JUNE 1959 / 50c

AIR FORCE

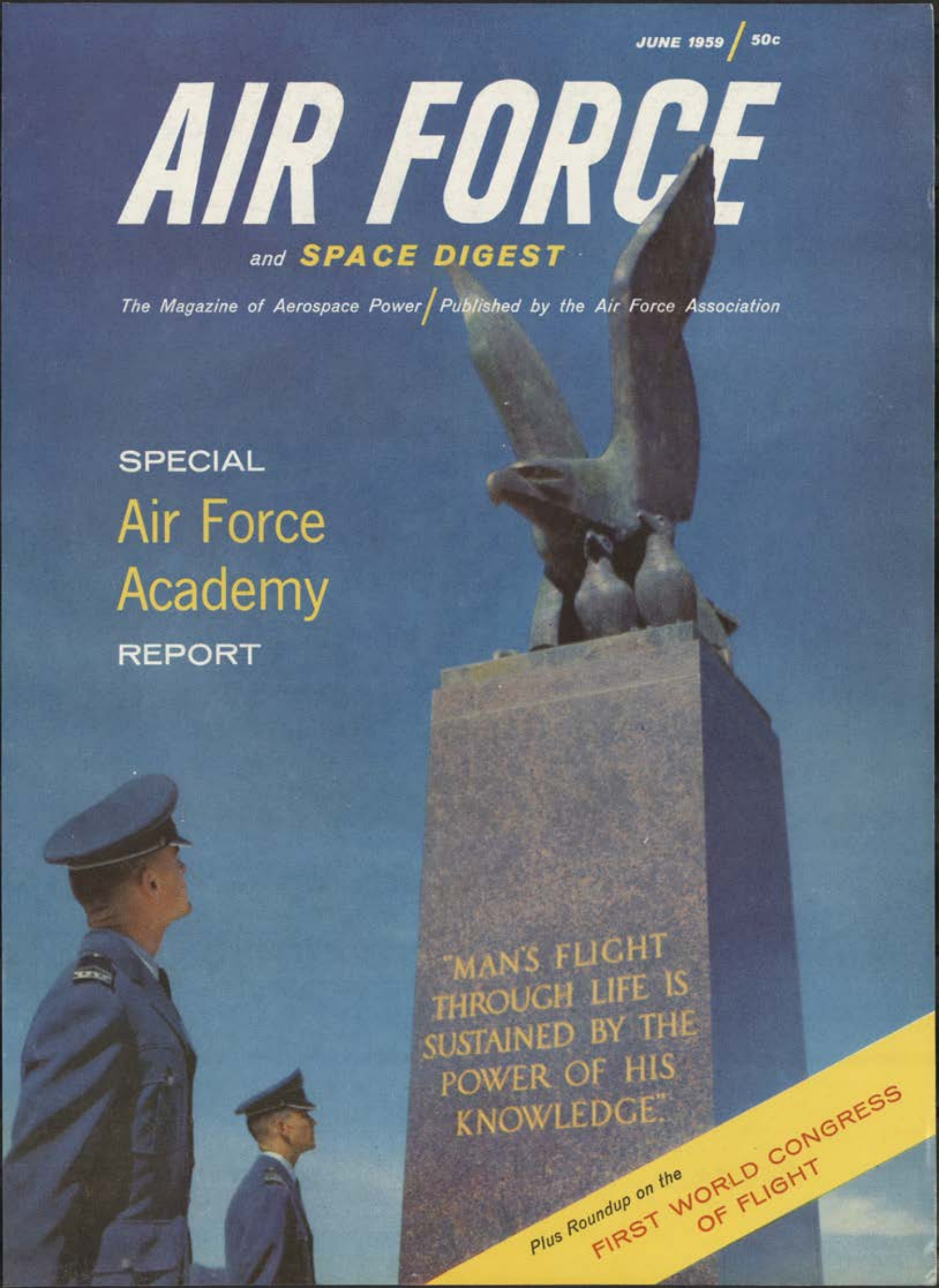
and SPACE DIGEST

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

SPECIAL

Air Force Academy

REPORT



Plus Roundup on the FIRST WORLD CONGRESS OF FLIGHT

THE KAMAN HUSKIE

This gas turbine powered helicopter has the stamina and brawn of its namesake, the Arctic Husky. An all-purpose aircraft, the Huskie in the role of the U. S. Air Force base rescue helicopter is ready to spring into action instantly. It's designed to be handled with mittens . . . not kid gloves.

Packing large cargo space within a compact frame, the Huskie is ready to support missile sites or carry troops, supplies and equipment with equal reliability. A direct descendant of the service-tested Kaman HOK and HUK, the H-43B Huskie proves its heritage.

PIONEERS IN TURBINE POWERED HELICOPTERS

THE KAMAN AIRCRAFT CORPORATION • BLOOMFIELD, CONNECTICUT

NUCLEAR DIVISION • ALBUQUERQUE, NEW MEXICO

Seventh in a series

DAGE CLOSED-CIRCUIT TELEVISION

The Dage camera in the F-102B chase plane provided "eyes" for thousands of spectators viewing the Air Force's World-Wide Weapons Meet.

The 10 lb. Dage camera, connected by closed-circuit to the home TV set, serves as a swimming pool monitor. It is available through Abercrombie & Fitch, New York, at $1495, including installation and one year's service.

To track a jet

or watch a child...

Another TRW product proving its value in military and commercial use

Not long ago a small closed-circuit television camera—weighing only 4 pounds and no bigger than a home movie camera—made television history. The Dage TV camera, carried in chase planes and located at strategic points on the vast gunnery range of the Air Force's Fighter Interceptor World-Wide Weapons Meet, recorded the supersonic flights of F-102s from scramble to kill. What it saw was transmitted back to TV screens in monitor stations.

In dramatic firsts like this, the Dage Television Division of Thompson Ramo Wooldridge Inc. is leading the closed-circuit TV field in number of installations and in technical achievements. Dage TV systems are being used to provide faster and more complete weather briefings for remote air bases, help control turnpike traffic, instruct salesmen, and aid in hospital education, surgical observation and consultation. Around the home, the Dage TV camera can be used in monitoring the swimming pool, watching the baby or the front door. Dage Television Division and its products are typical of the way Thompson Ramo Wooldridge serves its customers in meeting the demands of today's technology.

TRW

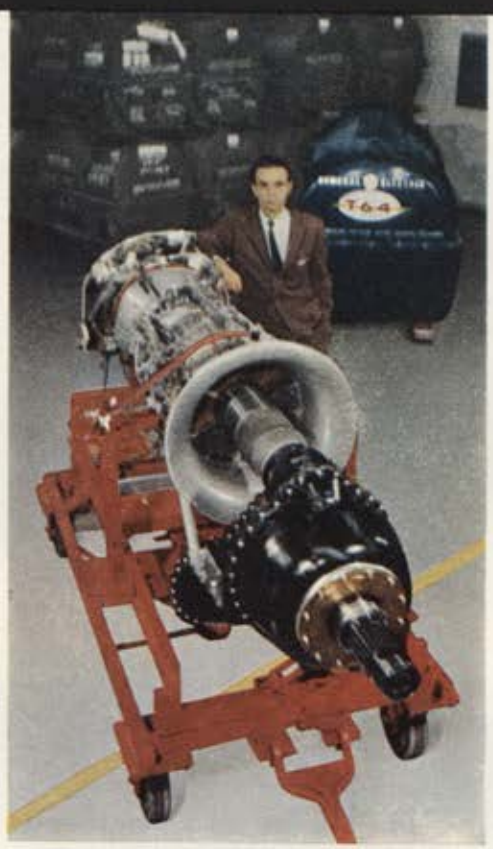
Thompson Ramo Wooldridge Inc.

Main offices • CLEVELAND 17, OHIO • LOS ANGELES 45, CALIFORNIA

GENERAL ELECTRIC

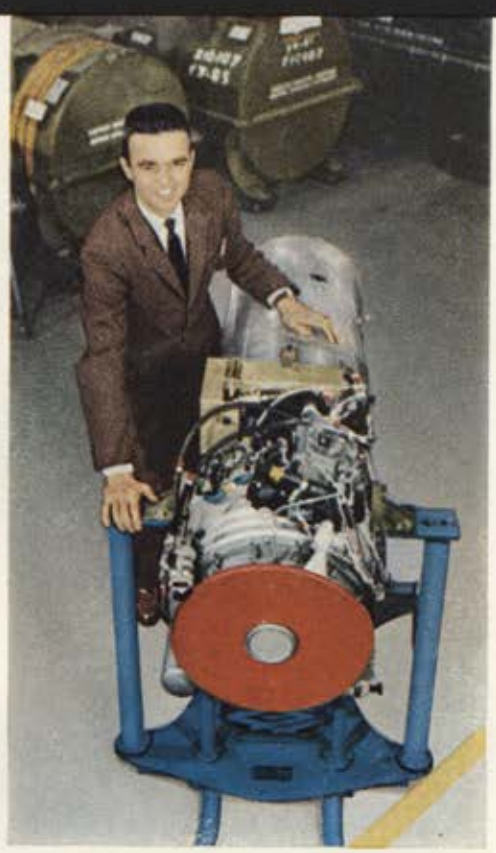
T58

The T58, now in production, delivers more power per pound of engine, consumes less fuel per hp-hr than any turboshaft flying today. Guaranteed at 1050 shp, 0.64 SFC, this 271-pound G-E helicopter powerplant has flight-proven its high performance, ruggedness, and reliability. Now on test is the 1250 shp first-step growth version.



T64

G.E.'s T64 is a turboprop/turboshaft engine in the 2600 horsepower class. A compact, versatile power package, it can be used in either fixed-wing or rotary-wing aircraft, or as a power source for advanced aircraft applications. Both configurations of the T64 are on test confirming their exceptional performance characteristics.

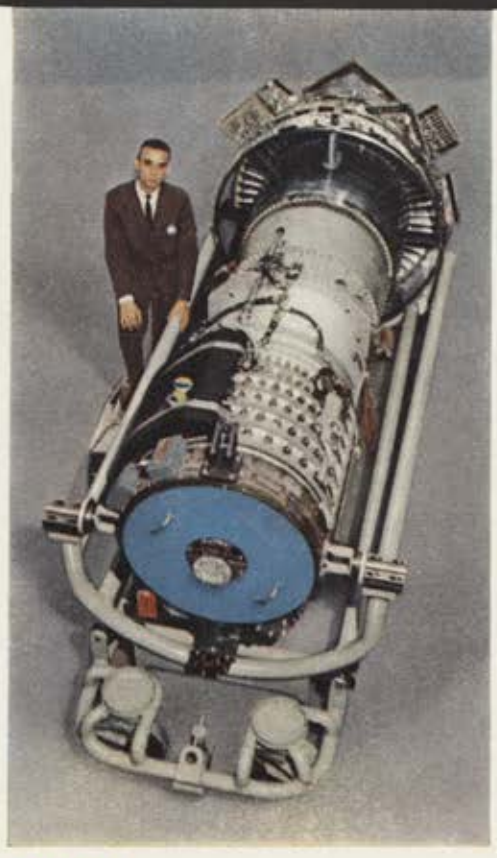


J85

The powerful, (2000-lb-thrust class), lightweight J85 turbojet introduces new levels of power and performance. Designed to provide dollar savings, performance advantages in missiles, drones, small and medium sized aircraft, the J85 is being flight tested in McDonnell's "Quail", North American's T-39, and Northrop's T-38.

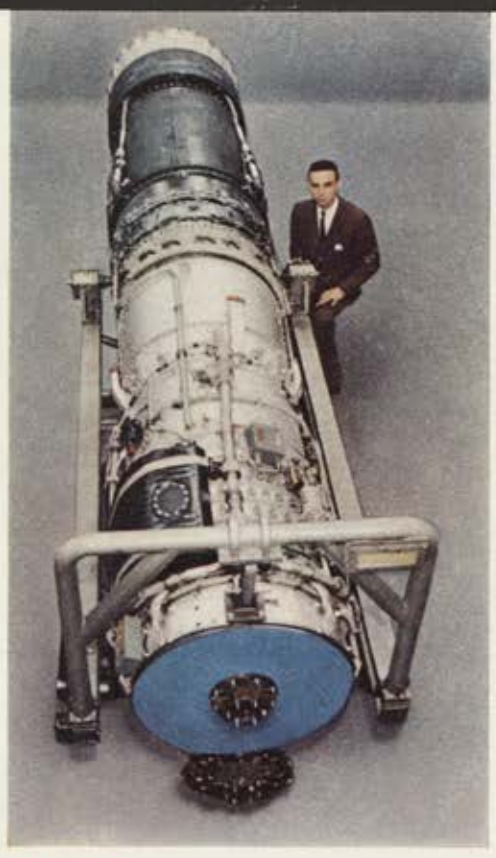
From Hover to Mach 3...more power, less weight

FLIGHT POWER SPECTRUM



TF35

The first successful U.S. turbofan engine. Designed for near-sonic military aircraft, the TF35 combines the proved J79 gas generator with an aft-fan, provides higher thrust at lower SFC. Its commercial version, the CJ-805-23, will power the Convair 600. New turbofan growth models being developed assure long service utilization.



J79

The 15,000-lb-thrust class J79 powers six Mach 2 air weapons, including the USAF F-104 Starfighter, world's record holder for speed, altitude, and time-to-climb. Also: USAF's B-58, Navy's F4H, A3J, F11F-1F, and Regulus II. With over 90% of U.S. Mach 2 flight time, the J79 has demonstrated its ruggedness and reliability.

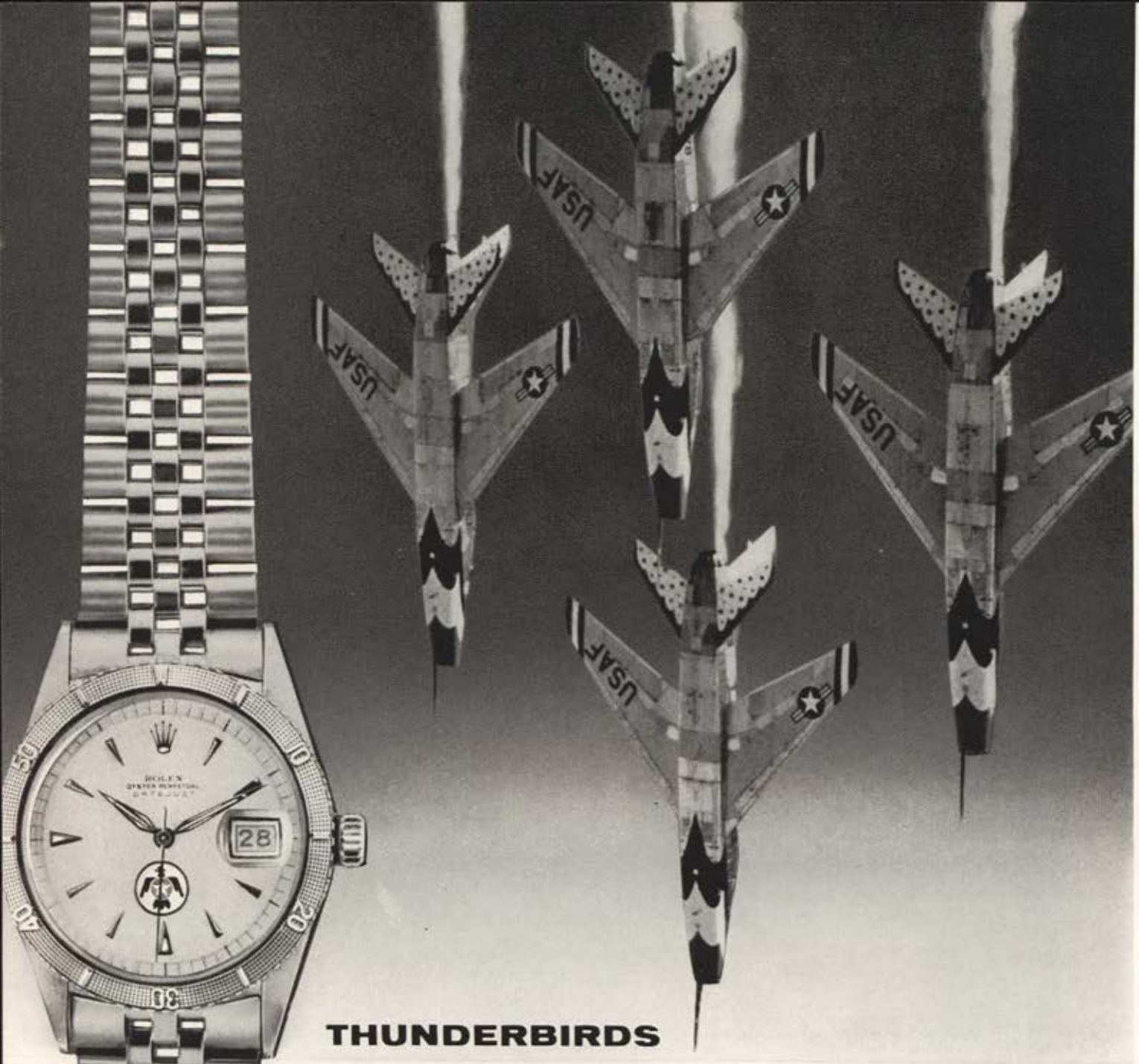
J93

General Electric's J93 Mach 3 turbojet —still highly classified—will power North American Aviation's F-108 long-range interceptor and B-70 intercontinental bomber. Along with other advanced turbojet engines currently undergoing development, the J93 typifies General Electric's continuous flight propulsion progress. 235-35

and reliable performance

Progress Is Our Most Important Product

GENERAL ELECTRIC



THUNDERBIRDS

World's first supersonic precision aerobatic team the U. S. Air Force Thunderbirds! Brilliant pilots, each is also a "scientist" with years of research to back his in-the-air mastery. Demonstrating the ultimate in precision maneuvers, with wing tips overlapping at "broom stick" clearance, their speeds range up to a spine-chilling 730 m.p.h. at the lowest altitudes. More than 21 million international spectators have seen their "Century Series" fighters go through their thrilling punishing paces . . . You've got to see them to believe them!

Like the aircraft of the famed "Thunderbirds," the Rolex Oyster Perpetual "Thunderbird" is an unerringly precision-dependable part of their equipment . . . You've got to see it to believe it!

THE THUNDERBIRD: Rolex DATEJUST. 18 K Gold case with "Turn-O-Graph" bezel. 25 Jewel chronometer, as identified by the Rolex Red Seal. Rotor-self-winding PERPETUAL movement, completely protected by the famous waterproof Rolex OYSTER case. New cyclops crystal magnifies date for easy readability. With strap, $550.00 F.T.I., bracelet extra.

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AIR FORCE

THE MAGAZINE OF AEROSPACE POWER

Volume 42, Number 6 • June 1959

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SPECIAL AIR FORCE ACADEMY REPORT

ROUNDUP ON THE FIRST WORLD CONGRESS OF FLIGHT

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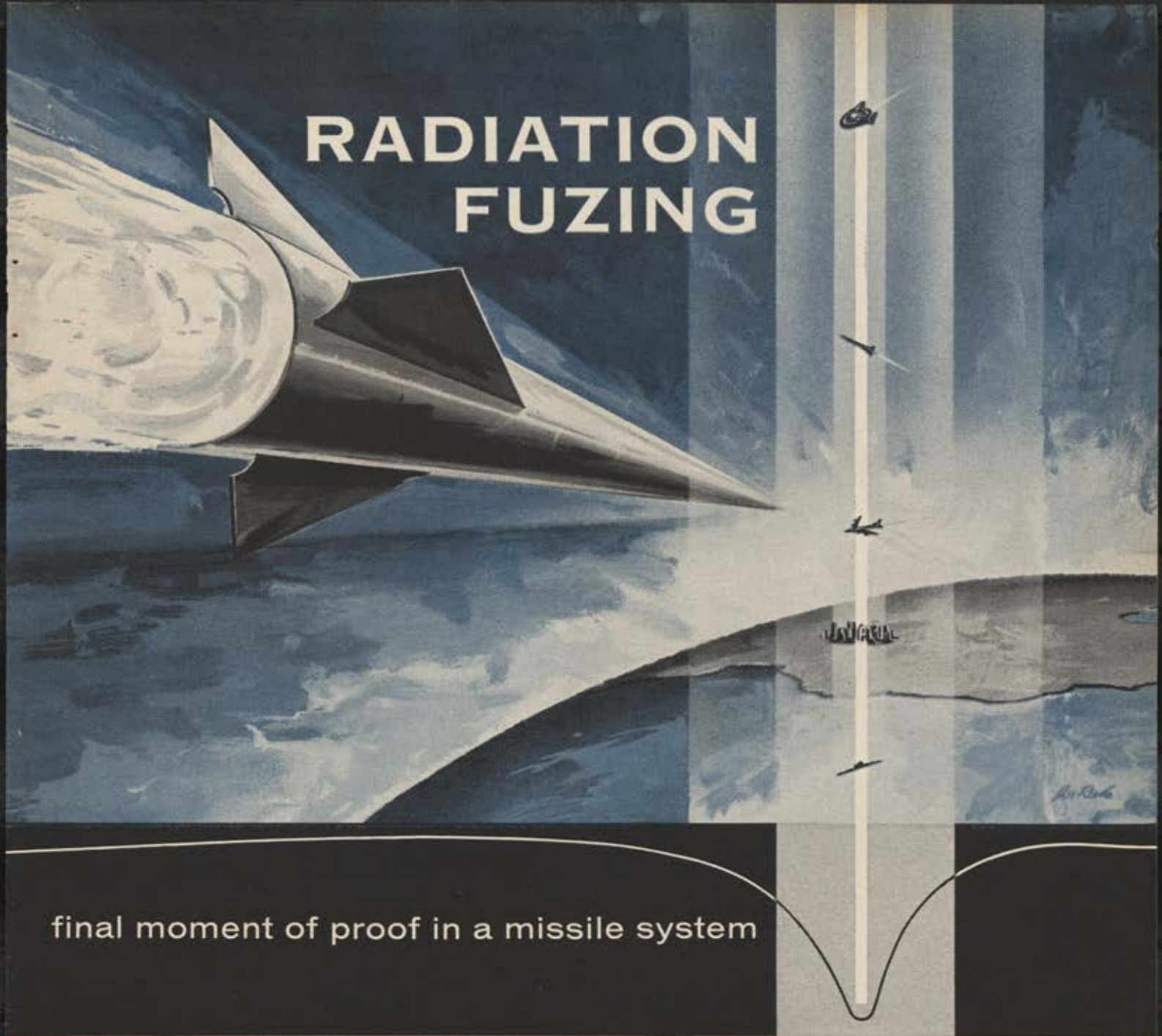

final moment of proof in a missile system

There are hundreds of moments of proof in the life-span of a missile system, but the final, and most dramatic, is that split-second when the radiation fuze fulfills the purpose of the mission. There may be no time for a "second shot".

The critical problems of high closing rates in air and space, of ground and submarine target discrimination and sensitivity, and of improved countermeasures in all areas, demand fuzing techniques which will not fail the technical integrity of the complete missile system. Such fuzes must be subminiaturized and ruggedized to provide absolute reliability and precision under re-entry and other extreme environmental conditions.

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A DEPARTMENT IN THE DEFENSE ELECTRONICS DIVISION

Avco / Crosley

An Editorial

Too Much Information . . . Not Enough Facts

John F. Loosbrock, Editor

WE HAVE just spent a couple of days leafing through an impressive 864-page volume which will never become a selection of the Book-of-the-Month Club. Nor will it ever be done as a motion picture or a television script. Its cover is the chaste khaki of the Government Printing Office, devoid of the half-clad, bosomy females which lead to commercial success on the newsstands of the nation.

Its title is something less than titillating—"Hearings Before the Subcommittee of the Committee on Appropriations, House of Representatives, Eighty-Sixth Congress, First Session, Subcommittee on Defense Appropriations, George H. Mahon, Texas, Chairman, Part 5, Procurement."

The authors' credits include a parade of seventy-three high-ranking military and civilian witnesses ranging from Adams, Brig. Gen. A. J., to Wood, Maj. Gen. R. J. All three military services and the Department of Defense are represented, and the subject matter ranges from a learned discussion of the philosophy of deterrence to the replacement cost of gloves.

This volume covers but *one* part of *one* group of hearings before *one* subcommittee of *one* committee of *one* of the Houses of Congress. And its size and scope point up in dramatic fashion just how the legislative portion of our decision-making process is being engulfed in a sea of facts, figures, conflicting opinions, as well as plain old gobbledygook.

One hardly can determine where one's sympathy lies. With the armies of generals and admirals which repeatedly storm Capitol Hill armed with flip-charts and view-graphs in support of what they firmly believe is the answer to this nation's salvation? Or with the embattled congressmen, who snipe back with the dramatically pointed finger and the trenchant phrase?

At the moment, our feelings, admittedly colored by reading miles of fine print, lean sympathetically toward the legislators. As sincere in their solicitude for the nation's welfare as is the parade of witnesses, they must search for truth in a welter of conflicting statistics, must make decisions in areas requiring high technical competence, while simultaneously keeping a wary eye on potential holes in home political fences.

Granted, many congressmen and senators have sat on these committees for years, and some of them are more expert in certain fields than the witnesses they are interrogating. But their time is limited, and the technical resources available to them are but a fraction of those at the disposal of the executive departments.

In the defense business this dilemma is becoming critical. Not only are billions of tax dollars involved, but continued existence of the nation may well be at stake.

The situation becomes even more critical as more and more responsibility for essentially operational decisions is being flung at Congress by the Executive branch while financial responsibility is more and more being withheld from, or wrested away from, Capitol Hill.

Thus, we are currently faced with a situation which finds the Administration warning against any breakthrough on budget ceilings while simultaneously asking Congress to make the operational choices between competing weapon systems in order that the financial ceiling may be maintained.

Not long ago, in a colloquy involving the Army's Nike concept of air defense versus the Air Force's Bomarc, the Secretary of Defense was asked flatly what decision was to be forthcoming from the Pentagon.

"Frankly," said Mr. McElroy, "we were hoping you'd hold our feet to the fire on this one."

In other words, Congress was being asked to accept responsibility for an essentially operational decision. Yet, when it does accept the responsibility and votes funds at variance with the Administration's requests, the money is quietly impounded or spent on other things.

A great part of the problem lies in our far from unified approach to defense. Under the present system Congress is denied the kind of information which it needs to make the kind of sagacious decisions expected of it.

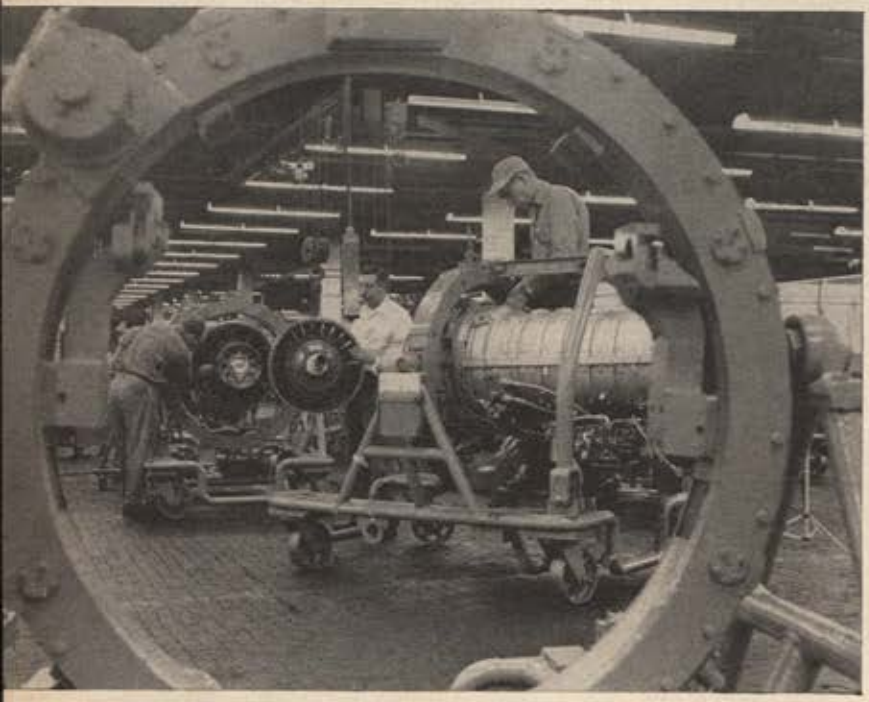
Each service, operating under over-all Defense Department financial ceilings, is still on its own on the Hill. The Navy may ask for a certain number of Polaris missiles, for example, and call rank after rank of expert Navy witnesses to justify its request. The Air Force will make an equally impressive case for its minimum number of Minutemen. But at no point does anyone stand up and say how many *fewer* Polarises will be needed if the Minutemen are voted or vice versa.

It is common to refer to our "unified" military forces as a team, made up of disparate elements each doing its own job. But a more nearly accurate analogy these days would be the kind of a team one would have if every man wanted to pitch, no one wanted to play right field, while the manager sat on his hands in the dugout.

If we were on Capitol Hill, we would explore the possibility of establishing our own sources of information and advice in technical defense matters, perhaps in the form of a nonprofit corporation of the RAND type. Perhaps such a group could not furnish us with all of the definitive answers, but it could serve the salutary purpose of providing reasonable and appropriate, sometimes embarrassing, questions.

If we are to decide these matters in the public arena, let us make sure that each side is equally armed.—END

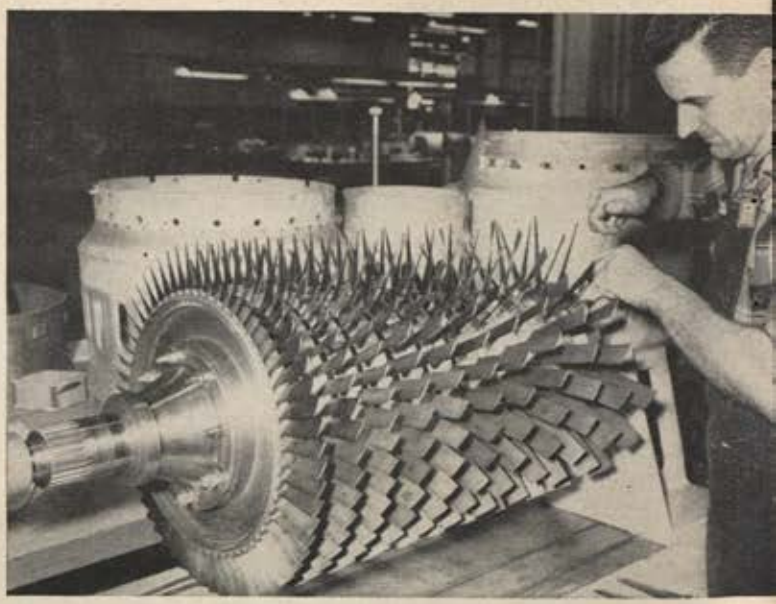
Why Westinghouse designs advanced propulsion systems more rapidly, meets all requirements on time



PRODUCTION POTENTIAL. The Aviation Gas Turbine Division at Kansas City has built more than 6,000 engines and associated spare parts. Engineering and Production experience with conventional gas turbine propulsion systems continues to be characterized by high-quality, on-schedule performance.

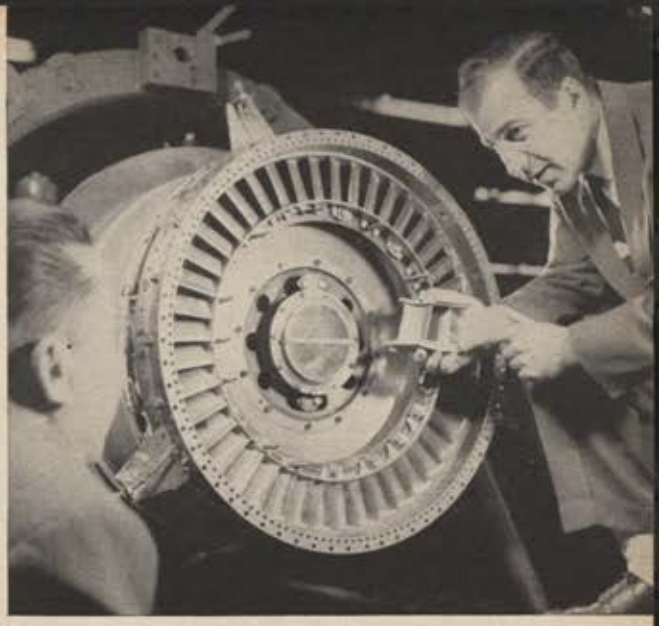
AUTOMATIC PRODUCTION TESTING, developed by Westinghouse, improves and speeds final pre-shipment testing. Test cell controls put engine through required tests automatically and record test results on the form prescribed for the engine log book.

FLIGHT TEST OPERATIONS. Following thorough component testing under simulated operating conditions in the Low and High Power Laboratories, Westinghouse engineers at the AGT Division's Flight Test Center at NAS Olathe, Kansas, test all propulsion systems under actual flight conditions.

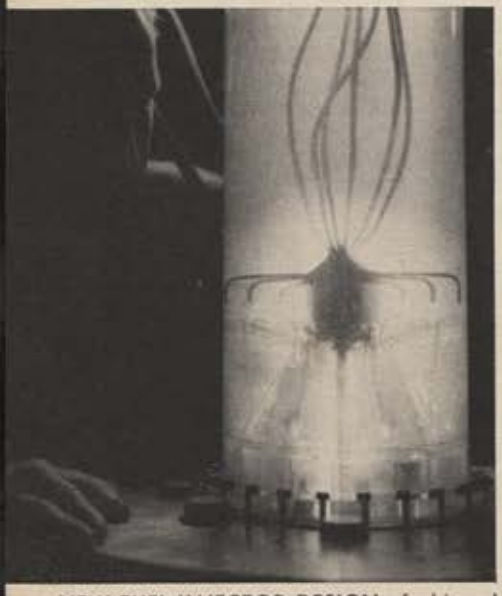


EXPERIMENTAL DEPARTMENT. This specialized factory-within-a-factory converts ideas into working prototypes. Independent engineering, tool design, progress and material control, permit self-sufficiency. Above, blades of a test cell bound compressor rotor are checked for proper balance.

ROLLS-ROYCE INFORMATION INTERCHANGE. A Rolls-Royce representative, resident at the AGT Division, here discusses new design concept with Westinghouse technical management. The Rolls-Royce-Westinghouse ten-year agreement permits faster jet engine design and production cycles.



AIR-COOLED TURBINE NOZZLES permit more efficient operations at higher temperatures. Design permits air to enter through wide slots on one side, pass through interior, and leave through smaller slots along blade's trailing edge. This cools the vane and lets turbine operate at higher temperatures.



NEW FUEL INJECTOR DESIGN—fashioned from inexpensive plastic—is tested with colored water and air bubble mixture in this flow analogy test rig to predetermine its performance characteristics. Test minimizes time-consuming and costly testing previously required with expensive handmade metal prototypes.

VIBRATION AND STRESS ANALYSIS data are obtained in hours instead of days with this special Westinghouse-developed Strain Gage Analyzer. From signals recorded on 14 channel magnetic tape, the analyzer plots multiple continuous curves visualizing vibration frequency and strain at varying engine speeds.

LINE-FLOW PRODUCTION. The 85-acre Kansas City plant of AGT is well adapted to line-flow production techniques. This system permits smoother and more efficient engine production . . . a characteristic of quality performance.

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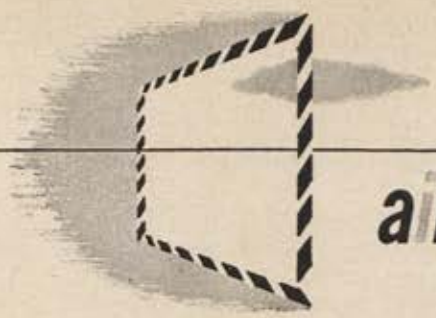
YOU CAN BE SURE... IF IT'S Westinghouse



air mail

Difference of Opinion

Gentlemen: Dr. Strausz-Hupé would like to change the Defense Department to the "aggression" department. This may appeal to certain European "geopoliticians," but it is hardly consistent with American tradition. Americans prefer democracy with its "illusions" to engaging in strategy to control the world and establishing a "new global order."

There is much that we can do in the economic, social, and cultural fields to improve our international position as well as maintaining our military preparedness.

Andrew L. Wallace
Swarthmore, Pa.

Gentlemen: I wish to thank AIR FORCE/SPACE DIGEST and Dr. Robert Strausz-Hupé for the very fine article in your April issue, "The Protracted Conflict." Dr. Strausz-Hupé makes what appears to me to be a very accurate appraisal. I believe it should be studied widely.

Matry G. Thomas
Detroit, Mich.

Source for Answers

Gentlemen: For the past six months I have been an exchange student at the UK Joint Services Staff College, which you might regard as Norfolk with a British accent.

During this time, as the USAF representative, I have been asked literally hundreds of questions. The obvious I could answer. I was struck by the answers to the less obvious, for these answers I invariably found (in some form) in AIR FORCE. My copies have been passed around until they are threadbare, if that is the word, and have been quoted as authoritative in the fields of performance, air logistics, personalities, hardware, and what have you. You can readily appreciate the regard in which, in this uncertain age of the deterrent, the UK forces view the USAF.

It has been my somewhat unhappy experience, especially in the field of complex issues, that customary news sources are either biased, incomplete, or erroneous, and fail to impart a complete and wholly accurate picture. More than once I have referred to current issues of AIR FORCE to sort out the true state of affairs.

In the library, small but good, I have found such things as the *Marine Corps Gazette, Infantry Journal,* and *AU Quarterly Review.* However, we—the USAF—seem not to be represented as I think we deserve. In my opinion AIR FORCE/SPACE DIGEST could represent us well, and I feel that the RAF personnel on the staff think so also....

Lt. Col. J. B. Townsend
APO, New York, N. Y.

Airlift Facts

Gentlemen: I wanted you to know how much I enjoyed Claude Witze's splendid article, "More Airlift Can Cut Our Bill for Defense" [April 1959].

This article expresses, in his usual very readable style, our exact philosophy on airlift. All of us here at MATS are delighted that the facts are appearing in such a widely read and respected medium....

I also noticed the very nice compliment paid on page 33 and agree wholeheartedly.

On behalf of the entire command, thank you for a powerful article....

Lt. Gen. William H. Tunner
Commander, MATS
Scott AFB, Ill.

That Troublesome 'S'

Gentlemen: I know nothing about publishing a magazine and certainly nothing about the responsibilties of a publisher to his advertisers. But since you correctly employ the term "weapon system" in your editorial texts, I wonder if you should not edit out the errors from the text material of your advertisers.

In the March 1959 issue, the term "weapons system" appears in the texts of three different advertisements. This is a pretty clear indication that those responsible have something less than a correct understanding of the scope and content of a weapon system....

Ralph R. Graichen
Santa Barbara, Calif.

● *This same question came up a couple of years ago, and we ran an excerpt from* The Inspector General Brief *in our July '57 issue. While we don't feel it is in our province to copy edit our advertisers, we can again run excerpts for all to see.*

"There still appears to be considerable misunderstanding within the USAF of the proper use of the term 'weapon system.' The Air Force is committed to the weapon system concept as a device of management.... In particular, those involved in any aspect of USAF development and procurement activities should appreciate the significance of 'weapon system'—as a term and as a concept.

"Occasionally, the expression weapons system is employed erroneously to denote a single 'weapon system,' or the entire inventory of weapon and support systems of a particular major air command.... The following definition should clarify the meaning:

"A weapon system is composed of equipment, skills, and techniques, the composite of which forms an instrument of combat, usually, but not necessarily, having an air vehicle as its major operational element. The complete weapon system includes all related equipment, materials, services, and personnel required solely for the operation of the air vehicle, or other major elements of the system, so that the instrument of combat becomes a self-sufficient unit of striking power in its intended operational environment....

"In Air Force terminology, there is no instance in which 'weapons system' may properly be employed."—THE EDITORS

Timely and Accurate

Gentlemen: Please accept my congratulations on your timely and factual article on housing which appeared in the March issue of AIR FORCE.

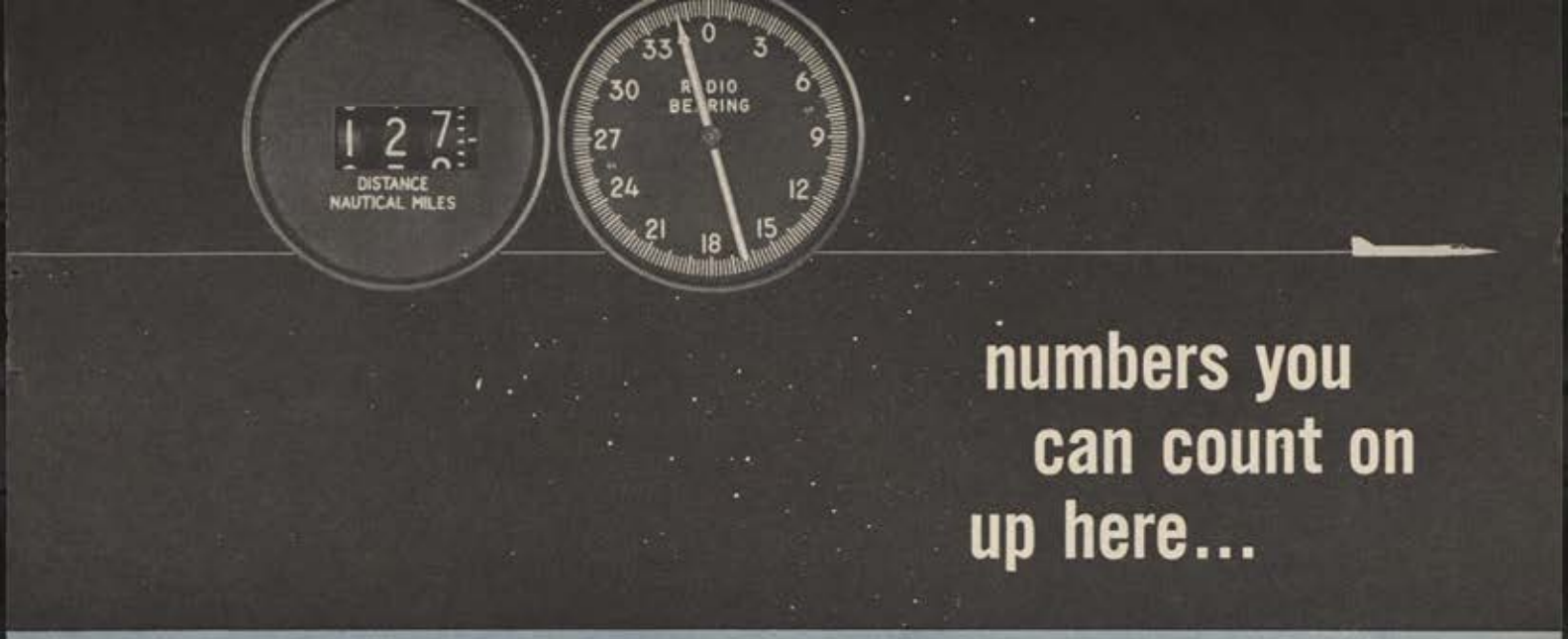
I was particularly impressed with your accuracy in estimating the magnitude of the problem and the logic of your recommended solutions.

Gen. Thomas S. Power
Commander in Chief, SAC
Offutt AFB, Neb.

Thor in Britain

Gentlemen: AIR FORCE readers from way back, the staff here was particularly interested in your Thor in the

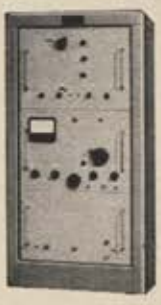
(Continued on page 15)



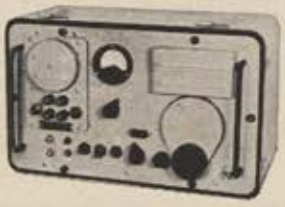
numbers you can count on up here...

because they're proved right down here!

Hoffman test equipment checks TACAN accuracy—on the bench or in the cockpit*



HLI-103 BEACON SIMULATOR duplicates all functions of the AN/URN-3 surface beacon. Tests ARN-21 for full azimuth and entire range, closure and departure speeds, surface beacon identity tone and decoding functions. For bench test or cockpit check. Available on 60-day delivery.



HLI-119 TACAN TEST INSTRUMENT. Portable unit tests *accuracy* of ARN-21 airborne TACAN in the cockpit of aircraft on the ramp or carrier deck. Checks accuracy of range and bearing at pre-set points and identification signals. Availability on request.

TACAN tells the pilot *which way* and *how far* to his base, station, or carrier in any kind of weather—a good reason why his AN/ARN-21 performance must be next to perfect.

To maintain the high degree of accuracy engineered into airborne TACAN equipment, Hoffman Laboratories has developed specialized test equipment to check function and accuracy on the *ground*—before a flight or after repair.

Compact and rugged Hoffman simulators can be carried and installed as standard test gear to every operating site or repair station—military, commercial, government or private installations. Write for further details.

**TACtical Air Navigation*

TRAINING SCHOOL Classes on use of Hoffman TACAN test equipment are now in progress at the Hoffman plant, and qualified field personnel are available to conduct class instruction at operating sites or bases.

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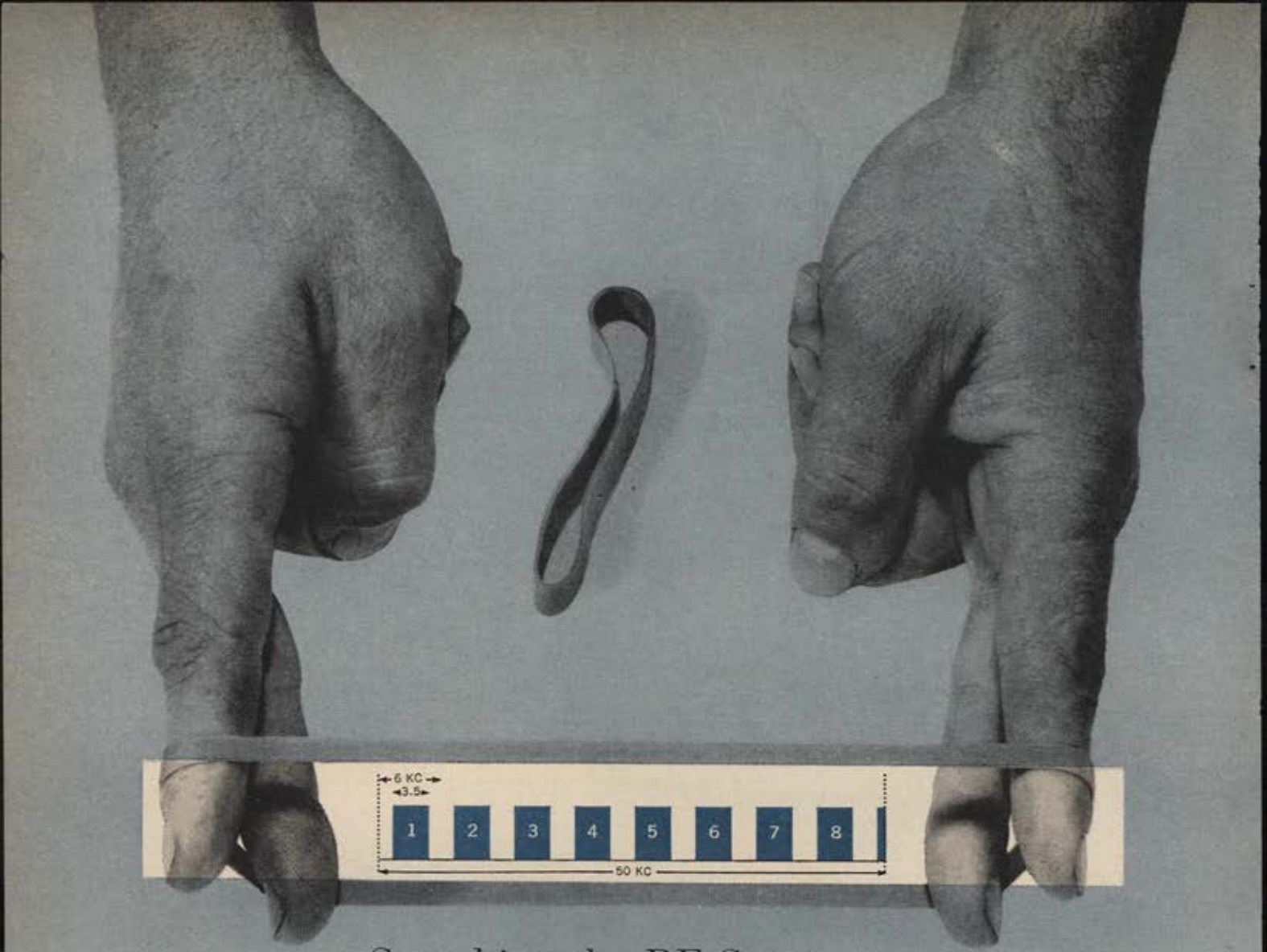
Significant developments at Hoffman have created positions for scientists and engineers of high calibre. Please address inquiries to Vice President, Engineering



Stretching the RF Spectrum... with Motorola SSB

Modern tactical needs for multi-channel voice and data transmission create serious communication problems within the limitations of the inflexible spectrum.

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UK coverage [May '59]. To quote our commander, Maj. Gen. W. H. Blanchard, "AIR FORCE has brought to its readers the story of ballistic missile development in the United States. Here is a story on what it takes to complete the final phase—deployment, installation, and training toward the operational status."

Lt. Col. John P. Spaulding
Hq., 7th Air Div. (SAC)
APO, New York

From an Ex-B-36 Crewman

Gentlemen: I have just finished reading your fine article entitled "B-36—Deterrence... Yesterday's and Tomorrow's" and I could hardly wait to sit down and write you to say how much I enjoyed the story, but most of all to say thanks. I doubt if the people in America ever realized what an important role the "Monsters" played in keeping this and all free countries safe from sudden attack. But maybe with the help of your fine article a few more people will come to realize the important part the now gone B-36 played in securing this goal.

It was every ton the aircraft you described, and then some. But I never knew that the first test model was equipped with twin tails, and I wonder if you might have a picture of this model that you could print. Also, is the C-99 still in use?

Al Hains
Los Angeles, Calif.

● *Original plans for the B-36 called for a twin-tail configuration. However, this evidently didn't get beyond the engineer's drawing board. Between the time of acceptance of the original design and construction of a prototype, the then Army Air Forces ordered a shift from twin- to single-tail configuration. Hence, no photographs.*

The C-99, cargo version of the '36, went out of service in November 1957 after ten years of honorable service. For a brief account of the merits of the C-99, see page 32 of our March '59 issue, "Logistics Without Wheelbarrows," excerpted from the late Maj. Gen. Clements McMullen's last letter to the editors of AIR FORCE/SPACE DIGEST.—THE EDITORS

A Japanese DC-5

Gentlemen: I have seen the correspondence regarding the Douglas DC-5 in your magazine [December 1958 and April 1959 "Air Mail"]. I can add that I have in my collection a photo of a DC-5 with Japanese markings. This was one of the DC-5 machines of KNILM, captured by the Japanese in the East Indies. It is not widely known that the Japanese air force flew with the Douglas DC-5!

Hugo Hooftman
Maarn, Holland

'Red Carpet' Transportation

Gentlemen: I have been impressed for a long time with the reports in AIR FORCE Magazine on the advanced status of civilian air transport in the Soviet Union. In publications dealing with railway development I find accounts of similar expansion. In both fields the Soviets are providing equipment and service of the highest order. This is in direct conflict with the impression generally conveyed to us that Soviet facilities are inferior and that the freedom of the citizenry under Communism is virtually nonexistent.

If it is true that Soviet citizens may not come and go as freely as the citizens of other countries, and if it is true that they earn barely enough for mere subsistence, for whom are these evidently superior, quite elegant air and rail facilities provided? Who rides? Who flies? And where and why?

Albert J. Franck
Mineola, L. I., N. Y.

● *For one thing, the vastness of the Soviet Union and the small investment in surface transportation facilities relative to those which the Western World has made over the years in rail and highway networks make it possible and necessary for the Soviet Union to place great dependence on air transport. As to the numbers of passengers involved, rail or airplane or other forms of public transport are about the only way to get around since there are few one-car garages in the Soviet Union, let alone the two-car variety now becoming quite common in the United States.*—THE EDITORS

Hobby for a Shut-In

Gentlemen: For a number of years now I have been corresponding with a collector of military insignia who lives in Sydney, Nova Scotia (6 McLean Court), and who is a cripple in a wheel chair. His name is Harold Dillon, and he has only his small insignia collection and a recently acquired TV set to keep him busy. He has 336 patches and fifty-six crests and would like to have more of the USAF World War II shoulder patches and regimentals. . . .

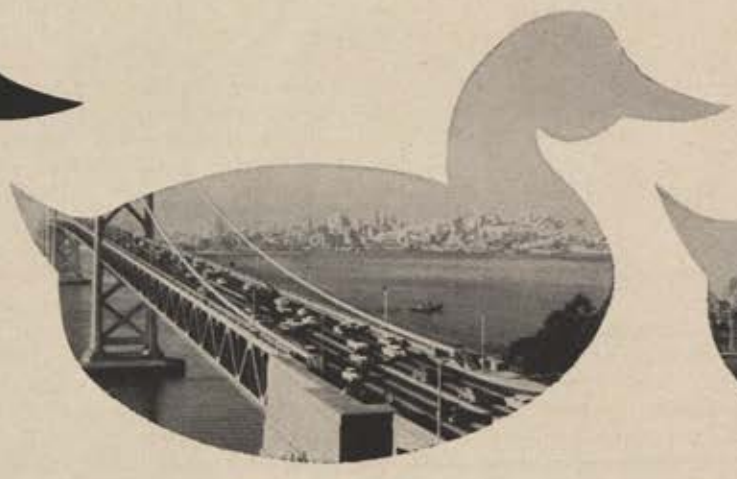
I know it would make him very happy to get not only the insignia but the mail, too.

Col. Robert F. Schirmer
Houghton, Mich.

Here are Grumman S2F Trackers on board aircraft carrier, mainstay of United States Navy HUK Group on Anti-Submarine Warfare maneuvers.

S2F starts search with electronic gear that can detect snorkel, periscope, or sub radar, even the submerged sub's disturbance of the earth's magnetic field.

Cities are Sitting Ducks



Coastal cities—of course. Midland cities, too. In fact, any city anywhere in the U. S. is a sitting duck target for missiles launched from subs.

One of the free world's greatest menaces is the submarine.

Best protection against this danger is the U. S. Navy—and its long-range anti-submarine task forces. Fixed-wing long-range aircraft, launched from task force carriers, patrol the high seas, probe their depths, screen their contents. They detect, identify and track. And, upon provocation, destroy. They help make the Navy our strongest defense against the threat of the submarine.

These anti-submarine warfare (ASW) aircraft are operational with the Navy throughout the world. Many are Grumman S2F Trackers. They carry the most advanced electronic detection gear plus the weapons that enable them to perform the complete search-attack assignment.

GRUMMAN AIRCRAFT ENGINEERING CORPORATION
Bethpage • Long Island • New York

Personnel of Combat Intelligence Center are receiving S2F Tracker report of contact and the dropping of detection devices to pinpoint submarine.

Grumman S2F Tracker is returning to aircraft carrier after "sinking" submarine in war games with depth charges and an ingenious homing torpedo.

AIRPOWER in the news

Claude Witze
SENIOR EDITOR

Time Marches On

Exactly a year ago, when the Defense Department Reorganization Bill of 1958 was up for debate, we could have profited a great deal from a crystal ball. If some of the events of this spring and some of the opinions that have been voiced had been available twelve months ago, it is entirely possible that the road to reorganization would have been shorter and straighter.

If you doubt this, go through the clippings on our editorial desks. They tell you there is a storm in the Pentagon over what is interpreted as an effort to have the Strategic Air Command swallow the Navy's Polaris IRBM weapon system. Somebody else wants to cut back SAC in order to modernize and increase the nation's ground forces. Another alarmist suspects that Gen. Earle E. Partridge, Commander of the North American Air Defense Command, is retiring on July 31 because of a policy dispute that has not been resolved in the Pentagon.

Before casting any brickbats in the direction of these issues, let every man stop and consider that these public defense questions can be symptomatic of our failure to get along with the job of true unification. When the reorganization plan of last year was first proposed, Gen. Thomas D. White, USAF Chief of Staff, was quoted as saying he liked the idea of the Secretary of Defense acting "to get things done" rather than acting as a monitor or referee. The Air Force Association, you may recall, said it favored the Reorganization Bill as a step in the right direction. At the same time it pointed to the original AFA recommendation that there must be a single service and a single promotion list, and said this remains the goal if unification is to mean what Webster intended it to mean.

Writing in this magazine a year ago, Peter Schenk, AFA President, said, "No one in his right mind expects this plan, or any plan, to be a substitute for weak or incompetent leadership. Organizational charts cannot replace either brains or guts. A bumbling Secretary of Defense will run a bumbling Department of Defense, no matter what the law might say."

So, here we are a year later; the law is in effect and we still are trying to unify, as one observer described it, by grafting twigs on the distant end of branches instead of getting at the root of the tree. There are simple examples like the continued failure to decide whether it is area defense or point defense that should get the priority. Should SAC have operational control—this does not mean that USAF would operate submarines—over the Polaris missile as a strategic weapon? There are more complicated ones, such as where the final authority should rest over components of the air defense system. Will we give it to the Continental Air Defense Command or North American Air Defense Command?

It seems reasonably clear that the continued existence of these problems indicates that reorganization, so far, has not accomplished very much. In fact, there is good ammunition here for protagonists of the theory that last year's bill created new sources of friction in place of old ones and that the rivalry will continue to live like a camel in the tent until we go all the way in shaking down the military organization.

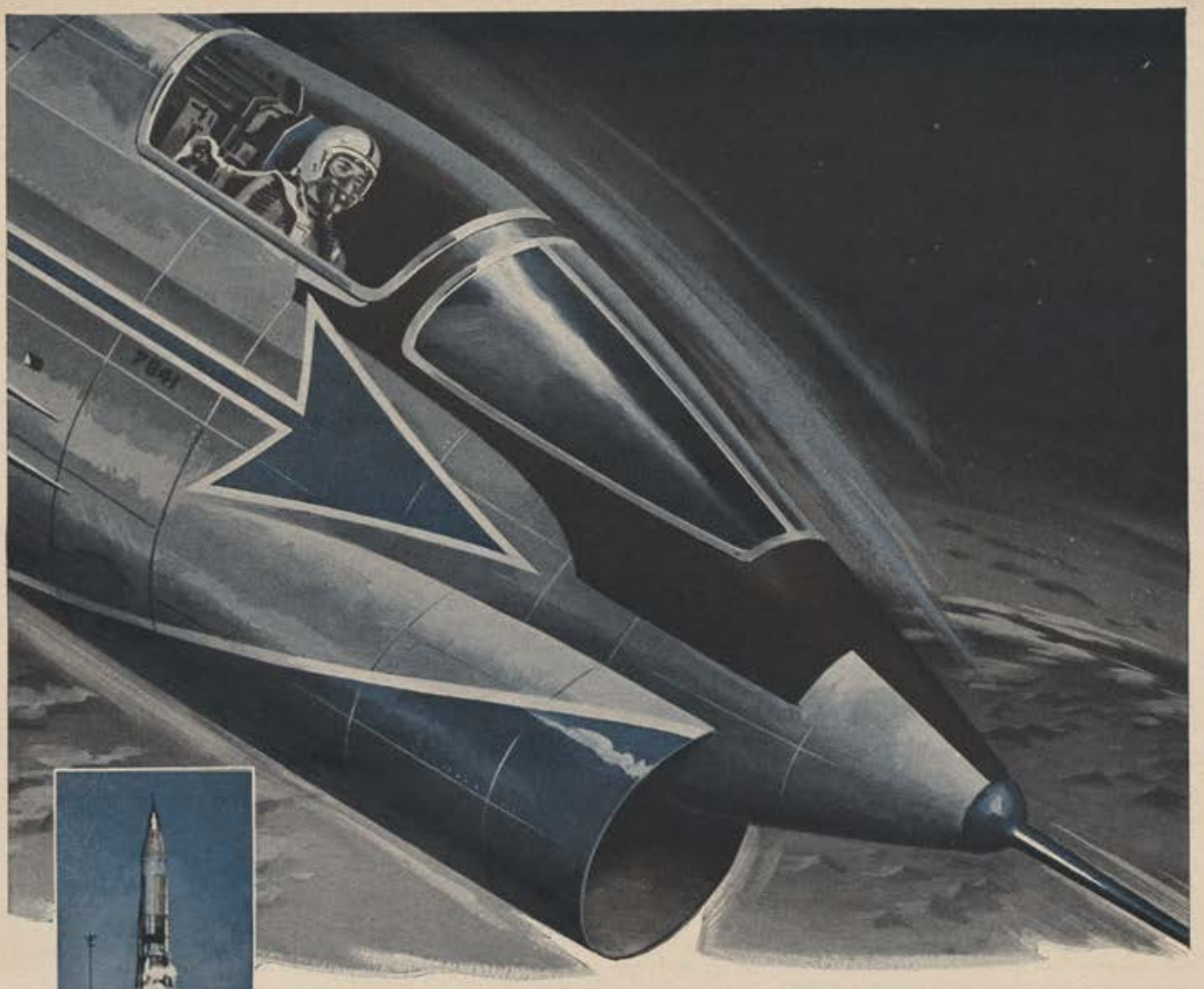
Take, for example, the recent statement of Army partisans that SAC has been overbuilt and most of its targets now are well within the capability of the fleet and the theater air forces. This is part of the effort mentioned in our editorial, "NATO, Sword and Shield," in the April issue of AIR FORCE Magazine. The entire validity of the sword-and-shield concept, Editor John F. Loosbrock wrote, has been challenged by those who want to enlarge their own "limited-war capability."

This is a good point at which to bring up a pet theory of this column that the Army would have been doing a wise thing if it had surrendered its entire ballistic missile setup at Huntsville, Ala., a few months ago when the National Aeronautics and Space Administration wanted to take it over. Indeed, looking back on that controversy, we can't remember that anyone thought they should keep it, except those in the command and the Secretary of the Army. And if reorganization means unification, and if unification were a fact, how could the Defense Department justify keeping the installation? It seems reasonable that stern and effective defense leadership would have insisted that the Army do something for the poor neglected GI, who needs better guns, better tanks, and other practical equipment.

At a recent hearing before the Senate Appropriations Committee we heard General White say that he "categorically disagrees" with his counterparts in the Army and Navy in their assertions that the Air Force is prepared to "overkill" the potential enemy. He pointed out that SAC, for instance, must have the power to retaliate in event of the worst possible eventuality—a surprise attack that could put a big chunk of the deterrent out of business. The very fact that members of the Joint Chiefs of Staff are forced to air their disagreements on such a fundamental and vital subject as the size of the deterrent force is another manifestation of a malignant situation. He never got an answer to his question, but Senator Stuart Symington, a former Air Force Secretary, wondered out loud and for the record: How in the world can the Department of Defense give policy clearance to speeches by top-ranking officers of the Army and Navy when they want to deprecate the value of SAC's arsenal?

Well, the answer probably is that we still do not have the type of military organization that we need. Congress certainly can't do anything about it this year, but it will find it pretty hard to overlook the necessity for further action. The headlines, the testimony up on Capitol Hill, the fact that the President now is reported under pressure to force a number of decisions, all make it increasingly obvious that we still aren't organized to do the job despite the ambitions of last year.

(Continued on page 21)



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Industry Takes the Platform

It has been evident for a number of years that a lot of people don't understand the weapon systems concept. Some of them are in the military services, where the problem in the early days was one of semantics. They just didn't know how to talk to each other and make themselves understood. More important was the fact that an awful lot of men in Congress, more remote from the runways and launching pads, have been in a state of confusion.

A major contribution, perhaps the biggest in the history of the weapon systems concept, is being made this year by the House Committee on Armed Services, which has a subcommittee under Rep. F. Edward Hebert (D-La.) conducting hearings on the subject. So far, such eminent industry leaders as J. L. Atwood, President of North American Aviation; Robert E. Gross, Chairman of the Board of Lockheed Aircraft; and a team from Boeing Airplane Company, headed by President William M. Allen, have appeared. They are conducting a worthwhile seminar on the subject. If the proper personages listen to the testimony, or read it later, there should be a precipitous drop in the number of stupid questions raised about weapon systems procurement.

Mr. Atwood was one of the lead-off witnesses and he gave an exposition on the subject that could well be made into a textbook. As chosen weapon system manager for the B-70 and F-108 programs, part of his three-day presentation was devoted to what North American has done to eliminate a lot of duplication and wasted weight factors as well as a spirited defense of the manned aircraft. Mr. Gross was more brief, but his story on the history of the Polaris missile ought to clear a lot of cobwebs out of the thinking on Capitol Hill, where small business finds a ready ear for its complaints.

We were most interested, however, in the papers presented by Boeing. Here is a company that is in a state of transition. Somewhat late in the development cycle, the B-52 was brought into the weapon system concept method of management and the same setup endured through the history of the Bomarc antiaircraft missile. With the advent of the Minuteman solid-fuel intercontinental missile, however, Boeing's weapon system management was replaced by that of USAF's Ballistic Missile Division, with an assist from Space Technology Laboratories.

What Boeing did in the case of Bomarc was to take full responsibility for the design, development, production, and delivery of all the elements of the defense system and use it to meet all USAF requirements. In the case of Minuteman, however, BMD is the executive agent responsible for the design and manufacture of the missile and all its ground equipment—right through to operation and maintenance. The Ballistic Missiles Center of the Air Materiel Command provides business management, Space Technology Laboratories furnishes systems engineering, design coordination, and technical direction. Boeing's role, in this case, is for weapon system integration, making sure the subsystems fit and that the total weapon system is tested out.

This evolution of the weapon system concept is more than an interesting phenomenon. It is a change filled with vast and possibly dire significance for the aircraft and related industries. Five years ago, when the weapon system concept still was news, USAF officials at Wright Field said they had turned to the idea because the management job was beyond the capabilities of USAF personnel.

"We simply didn't have enough systems engineers in the Air Force," an AMC officer said in 1954, explaining why

Wide World Photos, Inc.

Rep. Hebert (center) is briefed on a proposed space laboratory by J. R. Dempsey of Convair (right). On left is J. V. Naish, Convair President, who testified on the Atlas ICBM.

the management responsibility had been turned over to the prime contractors. There is plenty of evidence that USAF has more talent today, but the systems also have increased in complexity to the point where there are, in effect, prime contractors for subsystems, such as propulsion, guidance, reentry, and the airframe itself. What used to be the prime is being replaced by a team of primes with BMD providing the manager."

If we take a long look at this change in the trend it becomes reasonably clear that a fair number of companies have built up a weapon system management capability that can't be sold. Mr. Atwood's company, North American, has the two major contracts for the future, and there is no guarantee that his customer is going to need very many more primes in the sense that North American will serve on the B-70 and F-108 projects.

Tied in with this are some economic facts of life. Development time required for new weapon systems is increasing, not declining. At the same time, the part of the defense budget that must go into maintenance and operation is going up as the complexity and lethality of the weapons curtails the number of units.

It is not clear from the Hebert Committee testimony what the industry and the Air Force have in mind for the future, but it is evident that some companies will be forced to utilize the weapon system management capability they have built up in the area of subsystems rather than as prime contractors in the sense of that term in the pre-missile era.

J. V. Naish, President of the Convair Division of General Dynamics, gave some economic facts about the Atlas program—managed by BMD—that point up how important these changes are to industry. When he built airplanes, Mr. Naish said, he had one man in the engineering department to every seven in the factory. On Atlas the ratio was one to one. Of the total funds authorized for Atlas, exclusive of the money paid to STL, Convair gets only twenty-two percent.

The view of the industry probably was summed up most accurately for the Hebert group by President Allen of Boeing. He said:

"In the usual instance, no one company has the skills to produce or develop the entire system. Therefore it is necessary to bring together a group of companies who will contribute to the over-all result. That in my view can best be accomplished through the medium of a strong weapon system manager in the form of an experienced company."

(Continued on following page)

Donald A. Quarles, late Deputy Secretary of Defense. Formerly with the Western Electric Co., he had been in the Pentagon since 1953, took his first vacation early this year.

Donald Aubrey Quarles

It is too early, at this writing, to predict what administrative changes will come in the Pentagon as a result of the sudden death of Donald A. Quarles.

It must be pointed out that this wispy little man, who carried the work burden of a giant, was one of the most important people in the United States. He also was one of the most dedicated, ethical, and scholarly.

For a long time, starting with his years as Assistant Secretary of Defense for Research and Development (1953-1955), his opinions in the field of technology may have carried more weight than those of any other man. This endured, of course, during his term as Secretary of the Air Force (1955-1957) and reached a peak when he moved from that office to become Deputy Secretary of Defense.

There are a great many people who were mystified, more or less, by the fact that Mr. Quarles acquired with his reputation as a technological expert a parallel reputation for technological timidity. Yet it seems entirely reasonable, looking back on the years, that he was picked for promotion by Charles E. Wilson, who then ruled the military establishment with open scorn for any kind of research that couldn't be turned into a bang with minimum effort. "Don Quarles," Mr. Wilson said at the time of the first promotion, "is my kind of guy." He was proven correct, in the opinion of many critics.

There is some doubt that Mr. Quarles could have survived a test in the Senate if he had been nominated to replace Neil H. McElroy as Secretary of Defense. If he failed to realize this ambition, it would have been because he fell in political cross fire, not because he failed as a devoted public servant.

Congress Takes a Close Look

The budget fight is nearing a climax in this city, and a number of congressional committees are gearing up for a final showdown on the moot points. The Deputy Secretary of Defense, Mr. Quarles, passed away only a few hours before he was scheduled to appear before the Senate Committee on Appropriations. No doubt he would have faced a stern grilling on such items as the "missile gap" and the nuclear aircraft program.

The day before the demise of Mr. Quarles, USAF Secretary James H. Douglas and Gen. Thomas D. White, Chief of Staff, had their session with the upper chamber inquisition. The Secretary seized the opportunity to refute charges of Senator Symington that we have not been able to meet the promised schedule for having the Thor IRBM operational in Great Britain. Mr. Douglas said he had just visited the sites and that our deliveries of Thors are under way. He said they already have an "emergency capability" to launch, but that the time required to build and equip the bases has been longer than expected. He further made it clear that USAF has nothing to say about how long the British extend their training program and to what extent they use Thors for this purpose.

On another hot subject, that of the Bomarc air defense missile system, the Secretary said the first version should become operational late this year. On the Bomarc-B, a longer-range version, he said Mr. Quarles had set up a committee for technical evaluation, headed by Dr. Clifford C. Furnas, a former Assistant Secretary of Defense for Research and Development. He said the committee urged that there be more study of the mixed weapon system concept but also called for a stepped-up program on the Bomarc-B. He added that the Bomarc-B program in the proposed fiscal '60 budget is less than that recommended by Dr. Furnas and his group. He did not try to explain why the Furnas advice was not taken.

In the give-and-take of questions and answers it developed that the new budget would provide seventy B-52s, forty B-58s, and 128 F-105s. The number of manned aircraft, Mr. Douglas said, will continue to go down, a change in strength that we can afford in view of the missiles coming into inventory. Then he was questioned about the nuclear aircraft project and given, for exercise purposes, a narrow choice: If he could have more money than the $75 million in the budget for the nuclear airplane, would he prefer to apply it to that project or spend the money on more conventional manned aircraft of types already in production? His reply was that, ignoring the missile situation, he would prefer money for the nuclear airplane to money for more operational aircraft. In view of the pinch on maintenance and operation funds and the pressing necessity for faster action on nuclear power, his choice was easy to understand.

Mr. Douglas, incidentally, refused to confirm a report in the Washington *Post* that he is urging an increase in Atlas ICBM bases from the nine proposed in the budget to sixteen or seventeen. But he did declare, *not* admit, that he has made a recommendation for an increase in Atlas strength. His reason: "We recognize today that this ICBM will have more accuracy and reliability than we expected a year ago."

General White made an equally impressive presentation. He was at his best when he was challenged and was able to defend land bases, the manned aircraft weapon system, the size of SAC, and the capacity for airlift.

Believe it or not, he also had to defend USAF's rental of three limousines in Washington.—END


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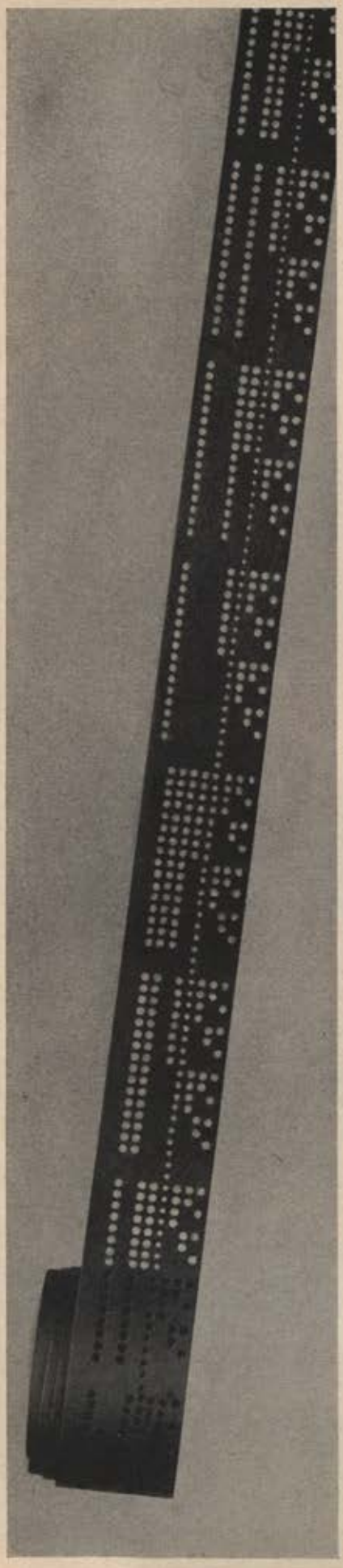

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This demands highly accurate surveillance and constant checks, achieved with an absolute minimum of equipment and personnel.

Programming and checkout equipment now being used is for the most part expensive and inflexible, with a low reliability factor. Logistics of coordination are puzzling and uncertain. Since thousands of conventional, mechanical relay switches are necessary, programmers are large and cumbersome; and any change in the logic of the missile system means that checkout equipment must be redesigned to conform.

Many of these problems are solved by Honeywell's Random Access Programmer, a distinct advance in the state of the art. It applies solid state techniques whereby tiny magnetic switches replace mechanical switches, making possible remarkable reductions in bulk and greatly increased signal speed, longevity and reliability.

MISSILE TEST ON TAPE

Pre-punched tape fed into compact random access programmer can monitor a missile continously through all phases of checkout and countdown procedures.

Random Access
Programmer Check
Out Equipment

automatic missile checkout

Solid state switching, random access and punched tape make the Honeywell programmer a fully automatic device that can be designed to monitor any missile throughout all phases of checkout and countdown procedures. The console contains comparator equipment that measures temperature, pressure, frequency, voltage, current, speed, time, weight, resolution and drift.

What's more, the Honeywell programmer is the only system which, when a malfunction occurs, sends a coded message to the operator pinpointing its location.

Advantages

Size. A conventional, mechanical switch with 1,024 switch points occupies 48 cubic feet. The same number of switch points in Honeywell's solid-state switch makes a package only *one-quarter* of one cubic foot.

Speed. Response steps up from milliseconds to microseconds. The new Honeywell Random Access Programmer is capable of a command rate of from 12 to 300 commands per second.

Long life. No moving parts, nothing to break, nothing to wear out. Mechanical and nuisance failures are virtually eliminated.

Flexibility. Because punched tape is the language of the system, even major modifications in the missile require merely a change of tape. No design changes in the checkout equipment are needed.

Malfunction Indication. During checkout and countdown the Honeywell device monitors the missile automatically through signals fed into it in a predetermined sequence. If a malfunction occurs, the device searches, finds and localizes it, then notifies the operator remotely by means of a coded signal. Meanwhile, the missile has been made safe. Repairs may be made quickly.

The new Compact Random-Access Programmer is essentially a data handling system. As such, it's a logical result of Honeywell's 15 years of experience in the accumulation, processing and presentation of data in practically every type of industry. The new device simply represents a wealth of competence turned to military application by the Missile Equipment Division of Honeywell's Military Products Group. It's logical, too, that the new equipment should have many points of technological superiority. For Honeywell development and production capability is devoted to producing a majority of the same missile systems and components that the programmer must check. Corporate-wide support is readily available from other divisions as needed—Datamatic, Seattle Development Laboratories, Aeronautical, Ordnance and Boston divisions, and others.

Since the corporation's business is *measurement* and *control*, the results of much research, development and production across a wide range of closely-related effort is incorporated in the work of Honeywell's Missile Equipment Division.

For a demonstration of solid state checkout—programming system, write Honeywell, Missile Equipment Division, Pottstown, Pa.

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The first astronauts have been chosen by the National Aeronautics and Space Administration, and Air Force pilots are among them. These men will blaze a trail into space. The first step will be soon — a boost into orbit, a capsule parachute journey back to earth. Next will come very high flights with controlled, glider-like landings. Then, one day, astronauts will pilot space cruisers throughout our solar system. Air Force, Navy and Marine pilots are taking the first step toward use of space in the NASA program, bringing the military pilot a giant stride forward in the evolution to spaceman.

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Index to Advertisers

Have You Registered? For AFA'S 1959 National Convention and Aerospace Panorama Miami Beach Florida September 3-4-5-6

Ocean waters, sandy beaches, fresh-water pools, and inland waterways await you at the AFA Convention in Miami Beach. Fourteen of AFA's twenty-one hotels lie between the Seville (foreground), where many AFA leaders will be staying, and the Eden Roc and Fontainebleau (top of photo).

THE HONORABLE JAMES H. DOUGLAS, Secretary of the Air Force, will address the Awards Luncheon on Saturday, September 5.

GENERAL THOMAS D. WHITE, Air Force Chief of Staff, will be the principal speaker at the Aerospace Banquet on September 4.

Top Air Force Leaders to Address AFA Convention...

The Program

WEDNESDAY—SEPTEMBER 2:
(For AFA Leaders only)

6:00 PM AFA Directors Meeting
8:00 PM AFA Leaders Meeting

• THURSDAY—SEPTEMBER 3:

9:00 AM Reserve Forces Seminar
12:00 N AFA Honors Luncheon
3:00 PM 1st AFA Business Session
7:00 PM Panorama Reception

• FRIDAY—SEPTEMBER 4:

9:00 AM 2d AFA Business Session
9:30 AM 1st Industry Briefing*
11:30 AM Industry Buffet Luncheon*
2:00 PM 3d AFA Business Session
2:30 PM 2d Industry Briefing*
7:30 PM Aerospace Banquet

• SATURDAY—SEPTEMBER 5:

9:00 AM Air Force Symposium
12:30 PM Awards Luncheon
7:00 PM Air Force Reunion

SUNDAY—SEPTEMBER 6:

1:00 PM Panorama Open

*Not included in registration fee—separate registration required. Note the two types of registration—TOTAL and BASIC. Basic is for persons who can attend for only one or two days.

THE Honorable James H. Douglas, Secretary of the Air Force, and General Thomas D. White, Chief of Staff, head the list of top Air Force leaders who will address the Air Force Association's 1959 National Convention and Aerospace Panorama in Miami Beach, September 3-6. Secretary Douglas will address the Awards Luncheon on Saturday, the fifth. General White will be the principal speaker at the Aerospace Banquet Friday evening, the fourth.

Lt. Gen. Bernard A. Schriever, newly appointed Commander of the Air Research and Development Command, and General Samuel E. Anderson, Commander of the Air Materiel Command, will participate in special briefings for industry on Friday, September 4. A seminar for members of the Air Force Reserve and Air National Guard will be held on Thursday, the third.

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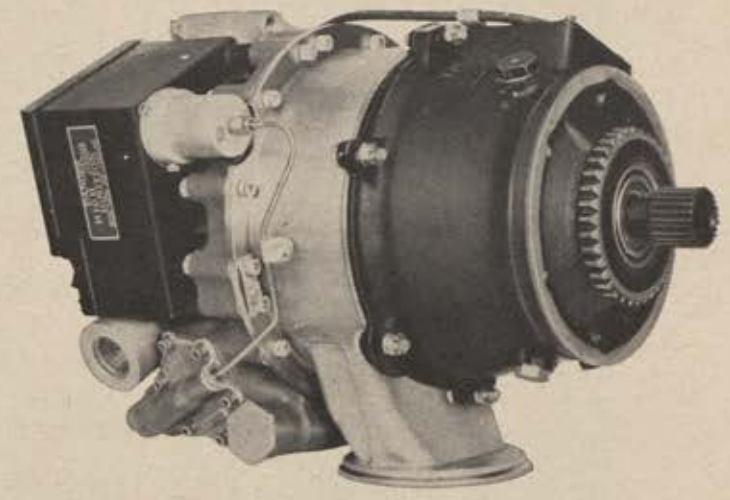

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Cadet Wing Color Guard, symbol of a vital military mission.

THE UNITED STATES AIR FORCE ACADEMY

SCHOOL OF THE SKY

Ed Mack Miller

■ AIR FORCE/SPACE DIGEST *this month salutes the Air Force Academy on the occasion of the graduation of its first class.*

We salute the Academy for its men and its mission, for its beauty and its hope, for its young achievements and its boundless promise. We salute the staff and the faculty members who have guided the Academy through its early years. Above all, we salute the Cadet Wing, the heart and soul of the Academy, which on June 3 sends forth 207 of its number to serve the Air Force and the nation.

The first Academy class has been outstanding scholastically and otherwise. The Academy organization, which began to take shape four years ago at Lowry Air Force Base, now is settling into well-appointed permanent quarters north of Colorado Springs—there to pursue its professional mission as generation follows generation. The Academy, the Air Force, and the nation will note the records of graduates with the passage of time—and there is no reason to suppose that these will be less than excellent.

Apart from all else, the Academy is a rare combination of natural wonderland and architectural genius that form an inspiring locale for our newest national institution.

To this institution—its past, present, and future—the Air Force Association and this magazine dedicate the fifty-odd pages that follow.

Air Force Association leaders, both national and local, will take part in Academy activities through the June Week lead-up to graduation and commissioning ceremonies. W. Thayer Tutt, AFA Regional Vice President for the Rocky Mountain area, was among the earliest advocates of building the Academy outside Colorado Springs. He also played a leading role in the formation of the Air Force Academy Foundation. Special mention for services on behalf of the Academy should also go to, among others, O. Donald Olson, until recently the Association's Colorado Springs Squadron Commander.

Colorado Air National Guard pilot Ed Mack Miller of Denver, a frequent contributor to this magazine, acted as a one-man, on-the-spot editorial bureau for this issue's extended Academy report.

—THE EDITORS

Come to fruition at last, the dream of American airmen since Kitty Hawk has been clothed with glass, marble, and aluminum in a Space Age city with an 'Alpine' backdrop that is—at once—both our nation's newest college and shrine —the US AIR FORCE ACADEMY . . .

SCHOOL OF THE SKY

JUNE 3, 1959, will be an historic date in our military history.

The sparkling new Air Force Academy, set like a freshly polished diamond against the green-velvet backdrop of the Colorado Rockies' Rampart Range, graduates its first class that day. It will also memorialize four of its main buildings.

With these events the Academy, both an outstanding center of liberal education and an institution with a vital military mission, will truly have come of age.

The list of those who fought for such an academy is long: men like Lt. Col. A. J. Hanlon, who only fifteen days after the signing of the World War I Armistice proposed an "Aeronautical Academy;" Barton K. Yount, H. A. Dargue, "Billy" Mitchell, Thomas DeWitt Milling, Mason D. Patrick—who fought the early Academy battles; and Henry H. "Hap" Arnold, Carl Spaatz, Hoyt S. Vandenberg, Stuart Symington, Thomas Finletter, Harold Talbott, Nathan Twining, Donald A. Quarles, James H. Douglas, Jr., and Thomas D. White, who kept the dream aglow until finally it was reality, clothed in glass, marble, and aluminum—and functioning to help keep America the greatest nation on the earth and above it.

The Academy's "June Week" will be many things to many men. A good number who helped create the Academy will participate in the week's events. Daily, from Friday, May 29, through Wednesday, June 3, the Academy's 17,900 acres of red earth, rugged pine, and scrub oak will be alive with tens of thousands of visitors come to view the vast and sprawling plant, the athletic events, and the Cadet Wing parades marking the graduation ceremonies. The Air Force's Thunderbirds aerial team will roar through its paces overhead.

Standing in the shadow of glistening, granite Pikes Peak and looking

Against a mountain backdrop, crowned by snow-capped Pikes Peak, the Academy nestles on its mesa, looks to years ahead.

out across the Academy site to the Black Forest and beyond to the rolling flatlands of eastern Colorado, many will share the satisfaction of a dream come true. It will be, as well, a time of new dreams.

Two hundred and seven Cadets are due to graduate on June 3. All but two will become Air Force second lieutenants. One Cadet has elected to become an officer in the US Marine Corps. One other will receive a Certificate of Graduation, but will return to civilian life because he is no longer able to meet the physical requirements for a commissioned officer. All but the latter will graduate with the aerial rating of navigator. Of these, 186 have elected to go into pilot training.

One of the new lieutenants, Bradley C. Hosmer, who was high man in competitive examinations for the Air Force Academy, Annapolis, and West Point the year he entered, will go to England for two years of graduate study as a Rhodes Scholar. Three will go on to advanced navigator training, and two will go directly to duty as navigators. Six go on to graduate study at MIT, Cal Tech, and Princeton, and five have been accepted for advanced technical training.

The four buildings will be christened in honor of four Air Force immortals. The Cadet Dining Hall will be named Mitchell Hall in memory of Brig. Gen. William Mitchell; the Cadet Social Center will become Arnold Hall, honoring the memory of General of the Air Force Henry H. Arnold; the Administration Building will be named Harmon Hall, in honor of the first Superintendent of the Academy, Lt. Gen. Hubert R. Harmon; and the Academic Building will be named Fairchild Hall, in commemoration of Gen. Muir S. Fairchild, first Commander of the Air University. Memorialization of the four buildings is sponsored by the Air Force Association.

The Air Force Association will make its annual trophy presentation to the Cadet Honor Squadron on May 29 during organizational awards ceremonies. AFA will take part in other events throughout the week. The Association's Board of Directors will attend the graduation. The Board meets in Colorado Springs June 3 and 4.

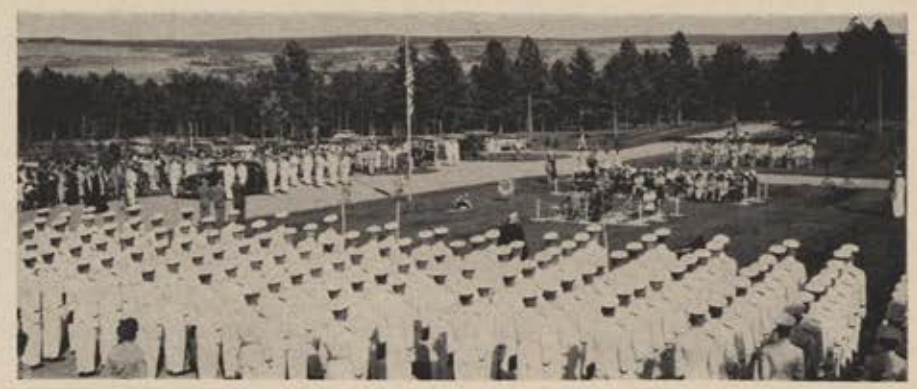
The long-sought Academy, examined in words and photographs on succeeding pages, took its first major step from the dream stage toward the splendor of its current reality just ten years ago. The nation's first Secretary of Defense, James V. Forrestal, appointed an Academy board to examine the matter in 1949, two years after establishment of the Air Force as a separate military service. Chairman of the board was Dr. Robert L. Stearns of the University of Colorado. His vice chairman was the then president of Columbia University, Gen. Dwight D. Eisenhower. The Superintendents of the US Military and Naval Academies were among distinguished educators comprising the rest of the group.

The board recommended the founding of an Air Force Academy without delay.

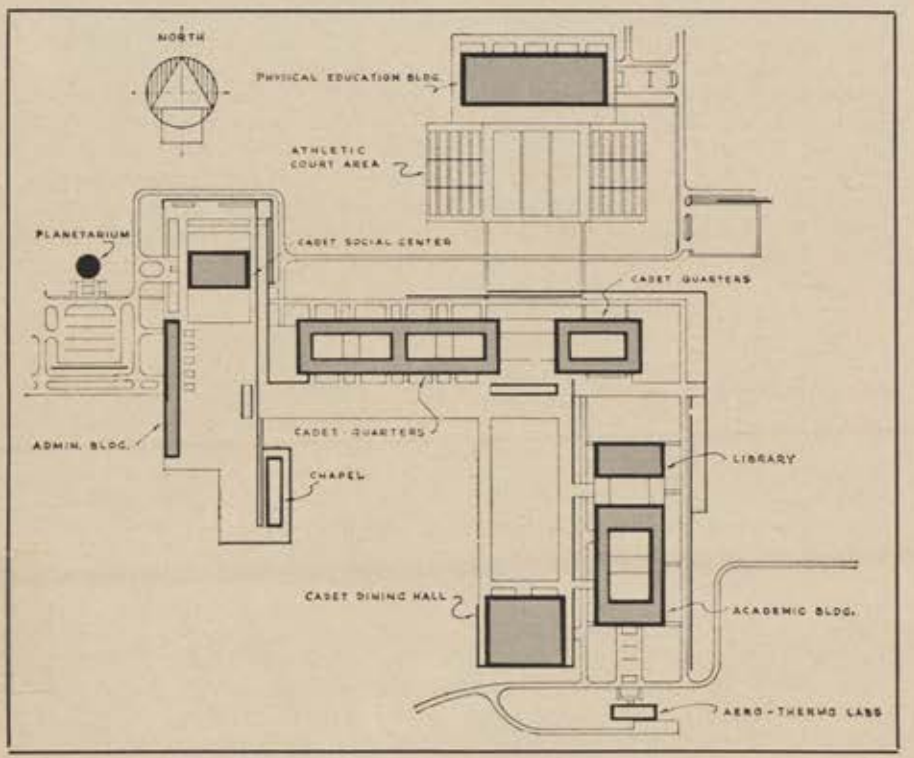
Late in 1949, following this finding, the Air Force appointed the late General Harmon as Special Assistant for Air Academy Matters. General Harmon, a West Point classmate of President Eisenhower, played a key role throughout the Academy developmental period. In 1954, he came out

(Continued on following page)

Early days at Lowry AFB temporary site. President Eisenhower, late Superintendent Harmon inspect the area.



A solemn moment in the history of the young Academy as military funeral for General Harmon marked the first burial on the grounds of the Air Force Academy.



Plan of the Cadet Quarters and Academic Area. Note the Planetarium at left. Architects of the Academy were Skidmore, Owings and Merrill firm of Chicago.

A contingent of fourth classmen in battle dress marches toward quarters building at Academy permanent site while upperclassmen look on from upper level. Cadet Wing moved into new buildings at Colorado Springs on August 29, 1958.

SCHOOL OF THE SKY — CONTINUED

of retirement at the personal urging of the President to become the first Superintendent. He retired again in 1956 and died the following year.

At about the same time that General Harmon became special assistant, first Secretary of the Air Force Stuart Symington named an Academy site selection committee headed by the former chief of the Army Air Forces, Gen. Carl "Tooey" Spaatz. General Harmon was also a member of this group. It examined some 350 sites, chose seven as the best of the lot, and turned a thick file of information over to the Air Force for possible future use. The present site was among the chosen seven.

The defense establishment's attention shifted abruptly to Korea before the selection report was in. In 1954, at the close of the Korean conflict, President Eisenhower and Congress turned back to the Air Force Academy. The Air Force Academy Act, providing for selection of a site and erection of the Academy, became law in April of that year. The effort to choose a site went into high gear.

Harold E. Talbott, then Secretary of the Air Force, appointed a second committee for the purpose. Its members included Generals Harmon and Spaatz once more. Charles A. Lindbergh, a Reserve brigadier general, was among others named for the final site deliberation. They picked up where the earlier group left off, specifying at the start that the decision was still "wide open."

By early June, 1954, the choice was narrowed to three possible sites: Alton, Ill., Lake Geneva, Wis., and Colorado Springs. On Thursday, June 24, 1954, Secretary Talbott called Governor Dan Thornton of Colorado to tell him that Colorado Springs would be the permanent home of the Air Force Academy.

Lowry AFB was subsequently named as the temporary home for the Academy, and Congress authorized remodeling of buildings there. General Harmon was selected as the first Superintendent and was directed to proceed with the Academy's establishment.

On Monday, July 11, 1955, under smiling Colorado skies, the nation dedicated its first new service academy in more than a century. In ceremonies attended by Secretary Talbott, General Harmon, Gen. Nathan F. Twining, who was then AF Chief of Staff, and many aviation notables, the first class was sworn in. The class, preparing for graduation at this writing, then numbered 306 Cadets.

One of the greatest building projects in the history of the nation swung into operation at the permanent site, some sixty miles away, while a new curriculum, a tradition, and a way of life came into being at Lowry.

The Academy builders at Colorado Springs moved at a prodigious clip. They were asked to have the permanent Academy ready for occupancy by the time the first class reached its final year. This took some doing. But the deadline was met.

On Friday, August 29, 1958, forty upperclassmen, the vanguard of the Wing, moved to their new quarters in the shadow of the Rampart Range.

Sadly enough, neither Secretary Talbott nor General Harmon lived to see that day. Their deaths came within four days of each other early in 1957. General Harmon's body was interred at the Academy shortly after his first Cadets moved in. His remains were transferred there, as he had requested, on September 28, 1958.

General Harmon was succeeded in 1956 by Maj. Gen. James E. Briggs,

the present Superintendent. Under its first two Superintendents, the Academy has developed a strong, broadly based curriculum to prepare Cadets to serve as professional officers in the Air Force. Cadet Wing organization and day-to-day Cadet life supplement course work and airborne training to this end.

The new visitor to the Academy is immediately impressed with its size and beauty. The site stretches for about 18,000 acres. The Rampart Range forms a rolling north-south wall to the west. The altitude of the reservation runs from 6,235 feet in the southeast portion to 7,900 feet in the lower slopes of the mountains. From the Great Plains to the east to the snow-covered Continental Divide, visible to the west, the Academy is surrounded by majestic natural beauty.

The size of the site provides the Academy room for expansion if Congress should so order. The Army and Navy, on the basis of experiences at their academies, initially recommended that the Air Force Academy be provided with adequate land to grow. The site's extent, in addition, would help keep the Cadet academic area free from noise created on the proposed Academy airstrip, which would be constructed on the other side of the reservation.

The site has an intriguing history. In sight of Cathedral Rock, at the northern edge of the Academy grounds, Cherokee and Arapaho Indians once went on the warpath against a small and crude fort built to protect early settlers. Here bands of vigilantes once rode. And, in a high valley just west of the site, stagecoach robbers once buried $63,000 of stolen money that has never been found.

Five finger-like ridges, or mesas, jut from the mountains. These form a pattern of ridges and valleys through the western portion of the Academy grounds. Monument Creek, running north and south, divides this more rugged western portion of the area from the flatland that comprises the eastern section.

The main Academy complex lies atop a broad mesa. Its buildings are placed around the Court of Honor, a plaza open to visitors, and a paved area on a lower level known to Cadets as the "battle area." Bordering these areas are plantings of periwinkles, crab apple, and honey locust trees.

On the west side is the "airborne" Administration Building; the concrete legs on which it stands, its dark-tinted windows, white marble, and aluminum trim strike a vivid contrast to the piney, craggy mountains behind. The buildings are all of modern de-

(Continued on page 40)

Cadet uniforms on display. Left to right: winter dress, formal dress, summer parade dress, winter parade dress, and summer khakis. All but last were designed by late moving-picture producer Cecil B. deMille at Air Force request.

The Air Force Academy Band plays a major role in Cadet life. It performs during drills, ceremonies, parades, sporting events, and will be active in June Week program.

Companion organization to the band, Cadet Chorale provides important extracurricular outlet for members. Academy slate of clubs, publications, and similar activities is long.

THE UNITED STATES AIR FORCE ACADEMY

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Maj. Gen. James E. Briggs

CADET AIRMANSHIP
Commandant of Cadets
Brig. Gen. Henry R. Sullivan

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Col. George B. Simler

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Col. Delmer J. Rogers

Assistant Chief of Staff
Col. James D. Hunter

Special Assistant to the Superintendent
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Director of Information Services
Col. Max B. Boyd

Director of Inspection
Lt. Col. John H. McCullough

DCS/Operations
Col. Jean H. Daugherty

Col. Evans G. Stephens (replaces Colonel Daugherty in June as DCS/O)

DCS/Personnel
Col. Evan F. Bourne, Jr.

DCS/Materiel
Col. Wingate B. Jones

DCS/Comptroller
Lt. Col. Daniel H. Bull

Cadet Registrar
Lt. Col. Virgil J. O'Connor

THE AIR FORCE CADET WING

Commander
USAFA Band
Capt. Carl W. Costenbader

Commander
7625th Support Group
Col. Jasper A. Westbrook

Commander
7625th Operations Squadron
Lt. Col. Robert E. Morrison

CADET EDUCATION
Dean of Faculty
Col. Robert F. McDermott

An *AIR FORCE* Photochart
(Corrected as of May 15, 1959)

CADET AIRMANSHIP STAFF

Deputy Commandant for Cadet Wing Command

Col. Benjamin B. Cassiday, Jr.

AOC, 1st Cadet Group
Maj. Everette L. Marcum

AOC, 2d Cadet Group
Maj. James E. Enos

AOC, 3d Cadet Group
Maj. Kenneth L. Tallman

AOC, 1st Cadet Squadron
Capt. Thomas F. Bullock

AOC, 2d Cadet Squadron
Capt. Rufus M. Monts, III

Col. Louis T. Seith (replaces Colonel Cassiday in June as Deputy Commandant)

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Capt. Frederick J. Hampton

AOC, 4th Cadet Squadron
Maj. Charles M. Hall (USA)

AOC, 5th Cadet Squadron
Capt. Billy J. Ellis

AOC, 6th Cadet Squadron
Capt. James G. Sandman

AOC, 7th Cadet Squadron
Maj. John D. Woodson

AOC — Air Officer Commanding

AOC, 8th Cadet Squadron
Capt. Paul M. Ingram

AOC, 9th Cadet Squadron
Maj. William A. Patch (USA)

AOC, 10th Cadet Squadron
Capt. Richard G. Carnright

AOC, 11th Cadet Squadron
Capt. William Banta (USMC)

AOC, 12th Cadet Squadron
Capt. Charles A. Gabriel

Deputy Commandant for Airmanship Studies
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Lt. Col. Louis J. Churchville

Director of Leadership Studies
Lt. Col. Gabriel D. Ofiesh

Director of Navigation
Col. Carl C. Barthel

Director of Physical Education
Lt. Col. Casimir J. Myslinski

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Director of Library
Lt. Col. George V. Fagan

Proud Cadets showed their stuff in Washington, D.C., as they paraded down Pennsylvania Avenue, Inauguration Day, 1957.

SCHOOL OF THE SKY — CONTINUED

sign, with the accent on space and light. Some external wall facings are done in bright red, blue, or yellow mosaic tiles.

On the north side of the "battle area," where Cadets drill, extends the impressive Cadet quarters building, which some Cadets call the "monstrous motel," "the factory," and "the Falcon Coop." Designed to accommodate the entire Cadet Wing of 2,520 men when the school reaches full strength, it has virtually all the facilities of a complete village.

Each Cadet room has a picture window with a view hard to duplicate. Two men share each room; each has a single bed, desk, lamp, chair, closet, wall bookcase, and chest of drawers.

The Academic and Library building, actually two large structures joined, stands on the east side of the broad court. Closer of the two to Cadet quarters is the impressive Library. Next is the superbly equipped Academic building—with its classrooms, offices, lecture halls, theaters, conference rooms, and laboratories.

On the south side of the court is the great Dining Hall, designed to seat 3,000 at a time. Two stories high, it is a gigantic room with no internal pillars or other obstructions. Its immense windows on all sides command a breath-taking panoramic view.

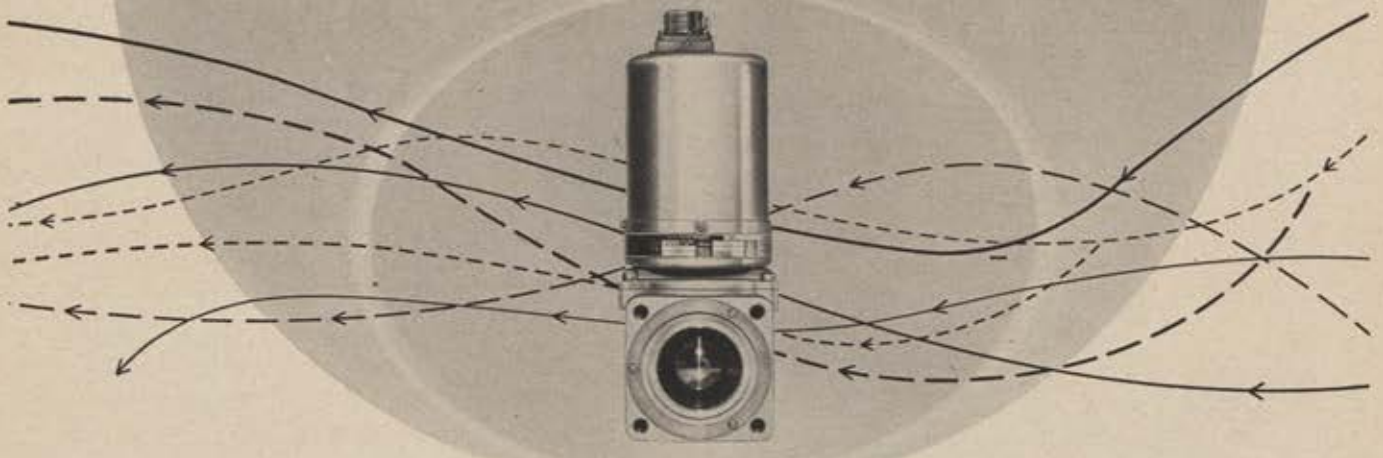
Also on the main mesa is the Cadet Social Center, near Cadet quarters. It contains an auditorium seating about 3,000, a ballroom, a lounge, and other facilities. The Academy Planetarium, at the northwest corner of the mesa, is believed to be one of the finest in the world. It has a 1,200-pound multiple projector that can produce more than 4,000 star patterns on the building's opaque aluminum dome.

The Academy Chapel is to be built on an area southwest of the Administration building. Its up-sweeping lines and spires will contrast effectively with the broad, flat-roofed Cadet-Academic area buildings. It will house special chapel sections for

(Continued on page 43)

A veteran flyer whose second love is writing, Ed Mack Miller, is presently an instructor pilot for United Air Lines and, as a Denverite, is a close neighbor of the Air Force Academy. Ed learned to fly back in 1940, and since then has chalked up a total of approximately 8,000 hours in the air. He has flown as spare pilot, narrator, and publicist for the Air National Guard's jet aerobatic team, the Minutemen, a stint he kept busy with from 1957 until last summer. A prolific writer, he is the author of more than 500 published articles and stories, and his newest book, Vigil Among the Stars, *has just been completed. In 1958, his collection of short stories,* Tales of a Flier's Faith, *was published by Doubleday. He is the former President of the Colorado Authors' League. Readers of* Air Force/Space Digest *will recall his byline on numerous articles which have appeared on these pages, among them a study of the Air Force's missile force at Vandenberg AFB., Calif., and a closeup picture—back in 1956—of the work of the Air Force's space medics at Randolph AFB, Tex. A family man, too, Ed is the father of eight youngsters.*

WHITTAKER SPHERICAL PLUG VALVES



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These compact valves afford split-second control in high pressure and cryogenic flow systems. Whittaker's spherical plug construction provides the efficiency of "straight-through flow" with negligible pressure drop—almost constant low operating torque regardless of pressure ... *for unlimited advantages of flow control!* Available in a wide range of sizes, each valve is designed to customer specifications—may be actuated manually, pneumatically, hydraulically, or electrically. Since 1955, Whittaker Spherical Plug Valves have been produced in quantity for both missile and aircraft applications—let Whittaker engineers help *you* with your design problem. Write, wire, or phone.

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In the 1960's the F-104 will still be the WORLD'S BEST TACTICAL FIGHTER

Lockheed's all-weather, multi-mission Starfighter is the world's outstanding fighter plane. Holder of the world's speed, altitude and seven time-to-climb records, the F-104 was recently purchased by West Germany for their own —and NATO'S—use as an intercepter, superiority fighter, fighter-bomber and advanced reconnaissance plane.

In addition to increased range and flexibility, the F-104 can be deployed to any combat area in the world within 24 hours. It is capable of delivering a wide variety of weapons, day or night, in any kind of weather. Despite this the F-104 is the most economical fighter plane currently available for U.S. defense needs, in terms of both initial purchase price and maintenance costs.

Never before has a single airplane done so many things so well. The F-104's performance and versatility are unmatched by any other operational aircraft, either flying today or programmed for the 1960-65 time period.

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Protestant, Catholic, and Jewish services.

North of the main Academy complex, in the northernmost valley on the site, are green athletic fields. These are used mainly for what the Cadets call "intramurder sports." On the edge of this valley is the Cadet Physical Education building, covering nearly 300,000 square feet and housing two swimming pools, twelve basketball courts, wrestling areas, twenty-four squash courts, pistol and rifle ranges, and ultramodern locker rooms.

Below the main buildings, the Academy highways drop into lovely Douglass Valley. Here one enters the Capehart housing area, which now includes an almost-complete elementary school. Pine Valley, the next south, has an elementary and a high school. The Academy hospital will be built in this vicinity under present plans.

The Academy Community Center is positioned on the next mesa south. It is complete with gas station, theater, ballroom, lounge, base exchange, library, hobby shop, barber shop, commissary, watch repair shop, a delicatessen, beauty shop, cafeteria, clubrooms, and youth clubs.

Housing units for staff and faculty are being finished quickly. Many Academy officers and airmen still live in Denver, commuting each day in car pools or on the "Green Worm," a German-built two-unit bus complete with a Pullman-type accordion link.

Although the Superintendent of the Academy is authorized to have a fitting house built at government expense, neither General Harmon nor the present Superintendent, Maj. Gen. James E. Briggs, exercised the option. The residence of the late A. E. Carlton, acquired when the Pine Valley land was purchased for the site, has served the purpose. The Spanish-style hacienda boasts an elevator, swimming pool, a tea house, a servants' wing, and morning room among other features. In it Mrs. Briggs had no trouble finding room to give a luncheon for 460 officers' wives. (A previous brunch for eighty was marred by discovery of a skunk in the swimming pool.) The building served for a time some years ago as a country club.

Hard study calls for good food, and chowtime in the Cadet Dining Hall keeps Cadets well fed on balanced meals. Hall will be named for Gen. Billy Mitchell.

Study, study, study is the only key to success at the Air Force Academy.

Congress appropriated $138.797 million for the Academy. Approximately $110 million of this work was in place by early this year.

A private nonprofit organization of friends of the Air Force Academy hopes to provide it with additional facilities for which no public funds are available. This group, the Air Force Academy Foundation, now has under construction a thirty-six hole golf course in the Douglass Valley section. Cost of the golf course and clubhouse are expected to total $500,000, all privately subscribed. The Academy will maintain the course.

The Foundation hopes to construct a $3 million stadium at the east end of the valley. The project, also to be financed solely with Foundation funds, was approved earlier this year by Air Force Secretary James H. Douglas.

The Superintendent has four top assistants *(see Photochart on pages 38-39)* to carry out the over-all Academy mission, each heading a major sector of the program. These are the Chief of Staff, the Dean of Faculty, the Commandant of Cadets, and the Director of Athletics.

Four academic divisions, each covering a field of learning, serve under the Dean of Faculty. The Commandant of Cadets sees to professional and military training. The Director of Athletics conducts the intercollegiate athletic program and assists in conduct of intramural and physical education activities. The Chief of Staff heads the several staff agencies that serve under the Superintendent.

On the following pages, these and other members of the Academy family tell the story of our nation's proud new school of the sky.—END

Lowry AFB: New Cadets arriving at Academy's first home.

Madrid, Spain: Summer training broadens Cadet horizons.

"This nation must continue to provide from the ranks of its youth a ready and confident group of men whose lifelong ambition is to lead in the air defense of this country and in the adventure of space pioneering as it pertains to national defense and advancement."

The Academy in the Aerospace Age

Maj. Gen. James E. Briggs
SUPERINTENDENT,
US AIR FORCE ACADEMY

EVER SINCE military and civilian educators began to plan for the Air Force Academy in 1948, the foremost question has been this: What does an Air Force officer need to know and be in an age of supersonic aircraft, long-range guided missiles, and nuclear weapons; in an era when man stands at the threshold of space; in a period of rapid social change and great political decisions?

The question is not an easy one to answer, yet the survival of the free world may well depend upon our answering it correctly. As Brig. Gen. Charles A. Lindbergh has said of the Academy:

"There are few, if any, places where influence exerted today can have more effect on the future of the country, of civilization, and of mankind."

The development of a curriculum suitable for Air Force officers in this explosive age is enormously difficult. Within a very few years we have witnessed the utilization of nuclear energy, the development of weapon systems with supersonic and hypersonic speeds, the introduction of long-range ballistic missiles, and the opening of the way to outer space.

What lies ahead in war or in peace no man can precisely predict, because no one knows the ultimate capacities of the sources of energy we have tapped. We only know that an unlimited future lies ahead and that our defenders must be alert to the latest implications of scientific developments and forever faithful to our ideals. We cannot exactly foresee what new forces leaders of the next decade may exploit for good or evil ends, but it seems safe to predict that the doors to knowledge which have been opened in the last twenty years will lead to others just as revolutionary.

In some quarters it is felt that all of our future officers should be scientists because of the growing importance of long-range ballistic missiles. This view is based on the theory that no one but scientists will be needed to devise the push buttons for operation of guided missiles. Obviously, we will need many scientists, in and out of uniform, to perfect the long-range missiles and to devise new weapon systems. But we will need more than scientists. We will also have great need for officers who possess the technical knowledge, the skill, and the adventurous spirit to pilot manned vehicles through air and space.

In the annual Wright Memorial Lecture to our Cadets last December, Gen. Curtis E. LeMay, Air Force Vice Chief of Staff, said: "How many of you have ever stopped to think of the heretofore unheard of things that could become the day-to-day problems which will face you during your career? Which one of you will have to tackle the problem of logistic support of a moon base? Who will be a satellite commander? Fantastic? Absolutely not. You men will have these and other problems just like them dropped right into your lap, and you must be prepared to handle them."

But our educational program must do even more than turn out men with knowledge of space weapons and vehicles. It must produce men who understand the society and economy which support the armed forces and the military organizations they may eventually command. Our young officers must be graduated with a basic knowledge of their economic, social, and political heritage. They need to be able to explain our defense requirements clearly to political leaders who have the responsibility for making great decisions for the employment of military power. They need to merit and obtain the cooperation of civilian populations at home and abroad.

If world conditions require the United States to maintain a powerful deterrent Air Force for years to come, Air Force commanders must manage that force economically to earn the taxpayers' continued support. On top of all these responsibilities, our air commanders must be able to lead other men, to plan and—if necessary—to execute military strategy and tactics.

Colorado Springs: Cadet Wing smartly crisscrosses parade ground of Academy's permanent site at foot of the Rockies.

In view of all these requirements of the aerospace age, the Air Force Academy did not establish its curriculum on a pattern of producing officers with superior knowledge in the military field alone. Military training became only a part of the curriculum; for it was determined that only a broad educational background would prepare future Air Force officers to meet the diversity of problems they will encounter. The central purpose of the curriculum became one of providing Cadets with the fundamentals of knowledge upon which future specialization will be provided through graduate education in the nation's leading civilian colleges and universities and through professional graduate programs of study in armed forces schools.

Based on this philosophy of education, our academic program has been built on a broad foundation of courses in the liberal arts and sciences. Upon this foundation the Academy has developed advanced academic courses to orient Cadets to the needs of their future profession. A curriculum enrichment program has evolved which enables Cadets to take elective courses and thereby to develop their full academic potential and to prepare themselves more fully for Air Force career specialties. The Academy's airmanship program has been carefully planned to give profession-oriented instruction in navigation, military and leadership studies, and physical education.

Our program is under constant evaluation and undergoes frequent revision. For example, the Academy added astronautics to the course of study following the swift advent of the space era. This year we have adopted new physical standards which permit some young men to enter the Academy without possessing the full physical requirements for pilot training. We desire that a majority of our graduates qualify as pilots. Yet we must consider that some of the nation's youths who rank the highest academically and display the greatest leadership ability do not meet the physical standards for pilot training, particularly the 20/20 visual qualification. It would be a loss to the Air Force and the nation not to educate those young men who may become outstanding in a critical nonflying career field such as scientific research and development.

The most foolish thing we could do would be to limit our preparation of the future officer to technical proficiency in the present tools at our disposal. We cannot anticipate the manual skills that will be involved in future weapons or vehicles any better than the Military Academy of 1914 could anticipate the skills that Maj. (later Gen.) Carl Spaatz would need in 1929 to keep the "Question Mark" in the air for over 150 hours. We can be grateful that when the time came to test the endurance of early aircraft engines there were men willing to do it.

When imagination and aggressive leadership of a Strategic Air Force in Europe were needed to crush the German war industry, General Spaatz was quite equal to the task. As first Chief of Staff of the United States Air Force in 1947, he set the course of air leadership that has been a critical factor in the continued survival of the free world. As a writer, editor, and adviser since retirement, he still evidences those qualities of leadership and devotion to duty that were cultivated as a Military Academy Cadet and practiced in peace and in war.

No, we cannot and do not pretend to prepare Air Force Cadets with all the technical skills they will need for aerospace operations in future years. There will be a time and place for that as each new vehicle or weapon comes into use. We can expect, however, that there will always be a call for the same qualities of leadership, dedication, and courage that have typified aviation adventurers of the past. We will prepare officers to answer that call. Our responsibility is to determine the essential core of knowledge and those skills of judgment and decision that must form the basis for effective future Air Force command. That, I believe, we are doing.

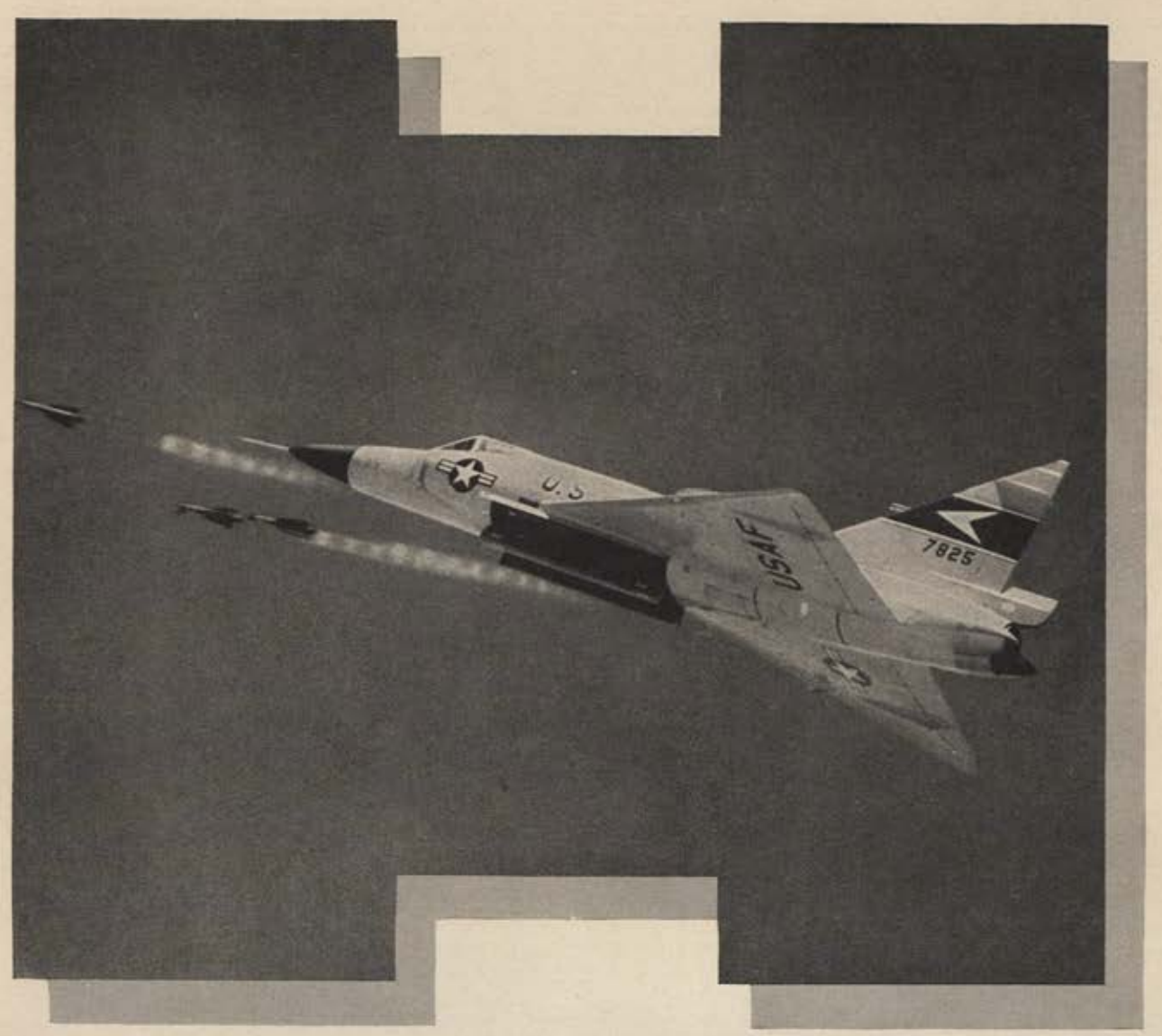
In addition, we are performing the primary task of the Academies as defined by the Service Academy Board: "To develop and strengthen a desire in each student for a life of service to the nation as a professional officer in the armed forces." Our faculty and staff are devoted to this task.

General Eisenhower once said: "My function and the ultimate function of the professional officer is to make himself unnecessary because the objective of the armed forces is peace, not war." But in the meantime—and "meantime" can be regrettably long—this nation must continue to provide from the ranks of its youth a ready and confident group of men whose lifelong ambition is to lead in the air defense of this country and in the adventure of space pioneering as it pertains to national defense and advancement.

To paraphrase John Stuart Mill, I hope that we will continue through the years to produce capable and sensible men. If we do that, I am confident that our graduates will go on to become the capable and sensible pilots, scientists, managers, and commanders we will need to defend the United States in the aerospace age.—END

Maj. Gen. James E. Briggs succeeded the late Lt. Gen. H. R. Harmon as Academy Superintendent in 1956. A 1928 West Point graduate who won his wings in 1930, General Briggs is a rated command pilot. During World War II, he served in Europe, later in Washington. He was Deputy Commander, FEAF Bomber Command, at the beginning of the Korean War.

Sharpening



the Falcon's claw

Faster flying, higher climbing, farther reaching... the new supersonic Falcon is today's best performing air-to-air missile.

The Super Falcon GAR-3, newest in the family of Falcon missiles, is powered by a new and longer-lived solid propellant rocket engine. It can climb far beyond the altitude capabilities of the interceptor and destroy an enemy H-bomber in any kind of weather.

Hughes Research & Development engineers, always moving forward, are also developing the GAR-9, a new atomic air-to-air missile. This missile will be used with the F-108, a fantastically swift, long range interceptor being built for the Air Defense Command.

The new atomic missile will be able to reach out over extremely long distances and destroy enemy bombers long before they reach their U.S. and Canadian targets.

At Hughes, advanced Research & Development is not confined to guided missiles. Investigations presently underway at the Hughes R&D Laboratories include advanced airborne systems, space vehicles, nuclear electronics, and subsurface electronics...just to name a few.

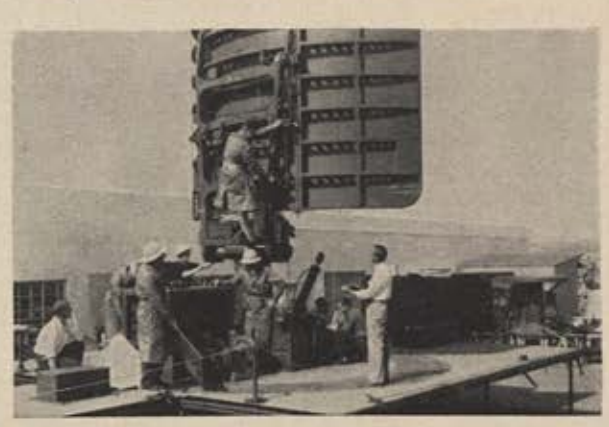
At Hughes, in Fullerton, engineers are engaged in the research, development and manufacture of advanced three-dimensional radar systems.

Throughout the Hughes organization, special emphasis is put on building reliability into every system to assure maximum utilization under the most severe conditions.

Advanced concepts...reliable hardware...these are the factors which have made Hughes one of the world's leading electronics producers.

Photo at left shows Convair F-102 firing salvo of Falcon GAR-1 air-to-air guided missiles.

Sophisticated Hughes Electronic Armament Systems control high-speed jet interceptors from take-off to touch down, and during all stages of the attack.



Ground Systems being developed at Hughes in Fullerton provide mobile three-dimensional radar protection and high-speed data handling.

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A Record of Achievement

Col. Robert F. McDermott
DEAN OF FACULTY
AND PROFESSOR OF ECONOMICS

Two Cadets study in their room. "During the last twelve months several events have occurred which attest to the content of the academic curriculum and the quality of instruction." Cadets spend at least an hour and a half preparing for each hour of classroom academic work.

THE ACADEMIC program of the Air Force Academy provides four years of undergraduate study in liberal arts, science, and engineering courses leading to a Bachelor of Science degree. The program includes a broad base of general education courses given during a Cadet's first two years at the Academy and more advanced courses oriented toward Air Force career fields given during the final two years. A total of 135 credit hours are included in the required academic curriculum. An additional five social science credit hours in psychology and management are taught in the airmanship curriculum.

The curriculum is carried out by four major academic divisions: Basic Sciences, Applied Sciences, Humanities, and Social Sciences—all within the purview of the Dean of Faculty. A general balance in required credit hours is maintained between the social sciences and the humanities and the basic and applied sciences.

During the first two years of teaching the Academy curriculum, the faculty realized that Cadets with marked aptitude and interest in certain fields were willing to go beyond minimum regular course requirements. After extensive study by faculty committees, a comprehensive program of curriculum enrichment was developed to fulfill this need. Cadets participate in this program by taking advanced placement, accelerated, and overload elective courses. Approximately one-half of all Cadets have taken enrichment courses during the past two years. Those who complete seventeen selected credit hours above the prescribed curriculum will receive a major in their chosen subject area. One of the purposes of the enrichment program is to prepare cadets more fully for graduate study in fields applicable to Air Force career specialties.

The present academic faculty is composed of 210 Air Force officers. As the Academy expands to full enrollment by 1963, the faculty strength will grow to approximately

On the double. Fourth classmen must move at double time in the Cadet area except under special conditions. Here two lowest classmen pick up the pace en route to class.

Left to right, Cadet Academic Building, the Library, and the eastern end of the Cadet dormitory. Branches of ponderosa pine tree frame buildings, mountain backdrop.

Architecture and academics: After-dark view from the inner court of Cadet dormitory is composed of dazzling checkerboard pattern of lights and darks, row on row of hard-working Cadets hitting the books to keep up with stiff tempo of liberal arts, science, engineering, enrichment courses that load curriculum.

330. The law establishing the Academy provided for twenty-one permanent professors; other appointments to the faculty are normally for four years. Qualifications for assignment to the faculty include a minimum of a master's degree and an above-average officer effectiveness report record.

All officers on the present faculty have a minimum of one of the following additional qualifications: professional experience related to their academic fields; outstanding operational experience in the Air Force; or a wealth of college-level teaching experience. The average teaching experience on the faculty is four years. All officers on the faculty are career Air Force officers—men who are eminently qualified to teach by what they are as well as by what they say.

The primary method of instruction at the Academy is the discussion-seminar type, calling for a maximum of daily participation on the part of the Cadets. Sections range from fourteen to sixteen Cadets and are arranged homogeneously in order of merit in each subject. Cadets are graded at least weekly on their oral and written recitations in each subject.

During the last twelve months several events have occurred which attest to the content of the academic curriculum and the quality of instruction.

In June 1958, the Class of 1960 took the standard college sophomore evaluation tests administered by the Educational Testing Service of Princeton, N. J. In this test of sophomores in seventy-three selected colleges and universities, the average Cadet surpassed ninety-one percent of the other sophomores in mathematics, ninety-one percent in science, ninety-two percent in social studies, eighty-five percent in reading, and seventy-five percent in writing.

In December 1958, at the completion of three and one-half rather than the normal four years, the Class of 1959 took the Graduate Records Examination, also administered by the Educational Testing Service. In this test of male students at twenty-one colleges and universities, the average Cadet surpassed eighty-three percent of the control group in natural sciences, eighty-two percent in social sciences, and sixty-nine percent in the humanities. Also in December 1958, Cadet Bradley C. Hosmer of Dunseith, N. D., was selected for a Rhodes Scholarship.

In April 1958 the only five Cadets of the Class of 1959 to apply for graduate training were accepted by three of the nation's leading graduate schools. Three members of last year's undefeated football team have been accepted for graduate training in astronautics at the Massachusetts Institute of Technology. They are our All-American tackle and team captain, Cadet Brock T. Strom of Ironwood, Mich.; Cadet Charles D. Zaleski of Carterville, Ill., a football guard; and Cadet Laurence J. Thomson of Billings, Mont., a fullback on the team. Cadet Gerald J. Garvey of Chicago, Ill., will pursue graduate study in international relations at Princeton University. Cadet Louis Kingsland, Jr., of Midland Park, N. J., will work for his master's degree in aeronautical engineering at California Institute of Technology.

And in April 1959, one year before the normal time of consideration, the Air Force Academy, in recognition of the above distinctive achievements, was recognized as an accredited institution of higher learning by the Commission on Colleges and Universities of the North Central Association of Colleges and Secondary Schools. The last sentence in the accreditation examiners' report pays this tribute to the Academy's curriculum and instruction: "Various standardized measures show clearly that standard achievement, compared to other selected colleges, is high, higher indeed than even the relatively excellent abilities of the student body would indicate."—END

Col. Robert F. McDermott, Dean of Faculty since 1956, has been a member of the faculty since the Academy's establishment in 1954. A 1943 West Point graduate, he holds a master's degree from the Harvard Graduate School of Business Administration. In World War II, he served in Europe. Colonel McDermott is a senior pilot.

Meeting

The Air Force Academy came into being in a period of swift technical transition in numerous fields. Nowhere was this more the case than in the field of flight. During the Academy career of its first class, the space/missile age suddenly was with us. Yet, with the dawn of this new era, earlier flight vehicles and weapons continued to form the bulk of the operational inventory. Their future life expectancy was unknown. How do you design a technical education to keep pace with developments in such a radically shifting world of technology? Top members of the Academy faculty live with this critical question. Here, in a panel discussion conducted for Air Force/Space Digest, *seven science and engineering professors at the Academy air their views on Cadet instruction within this context. The moderator was Professor Paul H. Dane, Colonel, USAF, Chairman of the Applied Sciences Division and Head of the Department of Thermodynamics.*

Three Cadets huddle with their officer instructor to solve a problem in mathematics, one of fundamental disciplines stressed at the Academy. Size of classes is held to a minimum to provide individual instruction such as this.

BASIC AND APPLIED SCIENCES

An instructor checks circuits in the Cadet electrical engineering laboratory.

the Challenges of A New Age of Technology

A Panel Discussion

Colonel Dane: Gentlemen, we're meeting here this morning for a very general discussion about the role of science and engineering training for career Air Force officers, particularly as it applies to what we are trying to do at the Air Force Academy. We have present this morning Col. Gerhardt C. Clementson, Professor of Aerodynamics; Col. James V. G. Wilson, Professor of Electrical Engineering; Col. Benjamin P. Blasingame, Professor of Astronautics; Col. Archie Higdon, Professor of Mechanics; Col. John W. Ault, Professor of Mathematics; Lt. Col. Bennett E. Robertson, Professor of Physics; and myself.

I think we should discuss just what a Cadet should receive in the way of scientific education for a career as an Air Force officer. We should bring out the reasoning behind our present curriculum and why we need specific areas of training.

In any science or engineering study you must start off with certain fundamentals. One of the first fundamentals, of course, is mathematics. Colonel Ault, would you care to say a few words about your feelings on the question of basic fundamentals that we must get across to our cadets?

Colonel Ault: Yes, I would like to say a word or two about that. Some people think that the only reason we teach mathematics is that Cadets need it in mechanics, in physics, and in all the other science courses. I think the study habits, the methods of attacking problems, and all those things that one can develop through the teaching of mathematics are just as important as the mechanical ability to take a square root on a slide rule, for example.

Colonel Dane: Then would you say that the most important thing you are trying to get these Cadets to do is to think logically, rather than just learn the specific mechanics of mathematics?

Colonel Ault: Well, "to think logically" is an abstract phrase that means many things to many people. But what I mean by "to think logically" is to approach a problem through the reasoning process. Back as sophomores in high school, most people learned to handle a plane geometry problem that way. They'd write down very clearly what was given, and they'd write down very clearly what it was they hoped to prove or to find out—and then they would proceed to try to use the given facts, and perhaps other things they could relate from what they had learned before, to achieve the desired solution. When people get to college many of them think this is old fashioned, a high-school approach to a problem. If we can convince our students that the logical method is the way to approach any problem in mathematics, mechanics, economics, personal problems of their family life, and their own checkbook, I think we will have done a big job.

Colonel Dane: Colonel Higdon, what do you feel about this need for stressing fundamentals in our science and engineering?

Colonel Higdon: Well, I feel that the mission of the Academy is to avoid specialization and to concentrate on teaching these young men to understand the fundamentals of science, the fundamentals of engineering, and exactly how to use them to build a career—a career which must be built, not in four years, but in thirty years. And that too early specialization is a dangerous thing. On the other hand, this foundation in science and engineering must be thoroughly firm and must consist of all the fundamental science that we can get across to these young men, because the way or areas in which they may specialize are largely unknown to us at this time. We cannot predict where the technology of the future will take us. And so we have to stay broad and adhere to fundamentals.

Colonel Dane: By not specializing, do you mean that we should be careful not to go beyond what is normally taught in an undergraduate engineering school?

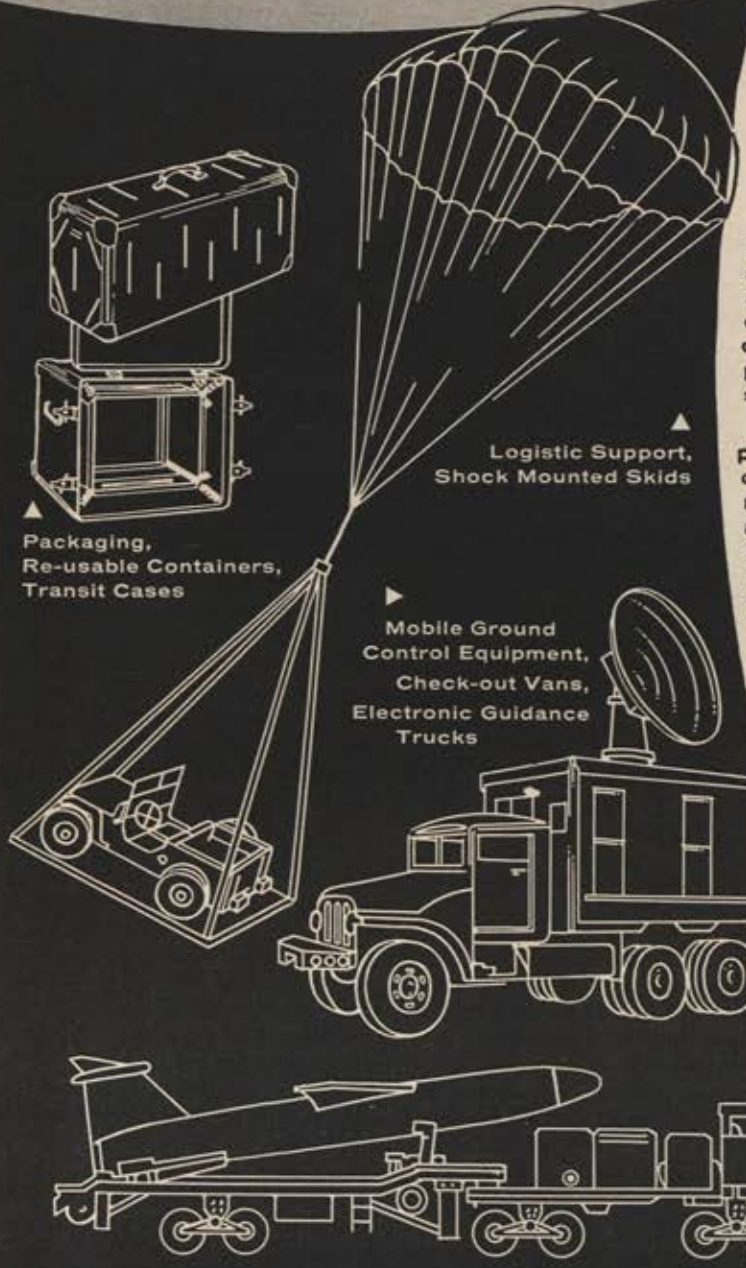
Colonel Hidgon: Well, I would say it in just a little different way. I would say that our curriculum is designed to provide adequate science and engineering training to enable our graduates to earn master's degrees in engineering at the leading civilian graduate colleges in two years.

(Continued on page 53)

Vibration and Shock

PROTECTION

for MISSILE GROUND SUPPORT EQUIPMENT



Logistic Support, Shock Mounted Skids

Packaging, Re-usable Containers, Transit Cases

Mobile Ground Control Equipment, Check-out Vans, Electronic Guidance Trucks

Transport Trailers, Launchers, Dollies

In the family of fine firms that serves the missile industry, there is one that is outstanding in its ability, attained through twenty-three years of experience, to assure performance and reliability for ground support equipment—Robinson Technical Products Inc., environmental control engineers.

Robinson all-metal mountings incorporate exclusive MET-L-FLEX resilient cushions. The non-linear spring rate and high inherent damping of these cushions make possible a variety of applications for the protection of ground support equipment from road shock and superimposed vibration during transit.

Typical of such successful production applications is a re-usable container incorporating a Robinson internal suspension system. This system, over a two year period, has demonstrated its effectiveness in protecting the inertial reference gyros of IRBM missiles during transportation from the laboratory to the launching site. Complementing this ground protection, twenty-four Robinson mounting systems protect the intricate mechanism of these missiles during launching and flight.

Through uncompromising loyalty to highest quality standards, reliability-minded missile experts are relying more and more on the *controlled environment* provided by Robinson MET-L-FLEX mountings.

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This means that we must complete the equivalent of three years of a typical engineering program—or, stated in another way, we must cover the engineering science, the mathematics, the physics, and the chemistry of an engineering program. But we should not attempt in our broad program, with its emphasis on fundamentals, to do much in the areas of engineering design and those things which an engineering student would do in his senior year—his year of specialization as a mechanical engineer, aeronautical engineer, etc.

Colonel Dane: Colonel Blasingame, do you agree with this approach to our training?

Colonel Blasingame: Yes, I do, and I think I can demonstrate how we in the astronautics department operate within this philosophy. We teach our course in astronautics as the basic physics of spaceflight. It is a study in the physics, the mathematics, and the thermodynamics underlying the design and operation of space vehicles. And it certainly is not a study in the design and utilization of existing space weapons.

We feel very strongly about teaching the fundamentals —and we credit ourselves with teaching just as much mathematics as Colonel Ault, or just as much mechanics as Colonel Higdon—maybe not as much, but certainly in the same way—and we draw upon and build upon the work that Cadets have had in other courses. We try to show that these courses have lasting utility beyond the time of exams. We try to show also that there are some common threads of human understanding in the sciences that run through all of these separate courses. We believe in teaching the Cadet to think across the board rather than in any one particular activity.

Colonel Dane: Colonel Wilson, you teach a great deal in the area of electronics, which is getting very close to the hardware. How do you feel about this question of teaching fundamentals?

Colonel Wilson: Well, here again, we're a firm supporter of fundamentals in that we do not attempt to teach any specific hardware. We're trying to teach the Cadets how to analyze a circuit—the many different ways a circuit can operate—and how you put the ohms together to make an amplifier, an oscillator, a modulator of these various building blocks that go into almost any type of electrical or electronic circuit, without tying it specifically to any particular hardware. These fundamentals are applicable to many, many pieces of hardware in the service right now, and these same techniques will probably be used in any future hardware that we can foresee. We're trying to teach these men how to analyze circuits and how to use these various components to do certain jobs. How they will apply them later on is something we cannot determine.

Colonel Dane: Colonel Clementson, what are your thoughts in this matter? Should we be teaching more fundamentals or more applications?

Colonel Clementson: I certainly agree with the teaching of fundamentals. However, I think about the only justification for the teaching of aerodynamics in a program such as we have here is the application of these fundamentals to a knowledge of the limitations and capabilities of weapon systems which we have in the field now or will have in the future. In aerodynamics we deal primarily with weapon systems which are airlift vehicles, whereas in astronautics they deal with weapon systems which are ballistic. We cover the fundamentals in fluid mechanics and basic aerodynamics in order to show the limitations and capabilities inherent in this phenomenon on the weapon systems.

Our course, I think, is different from most courses in aerodynamics. We approach it from the standpoint of the man in the cockpit, or I should say the operator, rather than the designer of the vehicle. We continually point out the things which the man in the field—the operator—can do to exploit the capabilities of a particular weapon system already committed to the field. We cover very little of the design aspect. We try to talk about general types of design rather than referring to specific aircraft. However, to illustrate particular ideas as we go along, we refer to current aircraft because there's a lot of motivational value in it.

Thermodynamics class. Cadets here include football end Jozwiak, second from right, and tackle Phillips, far left.

Colonel Blasingame: I would like to add something on this matter of design. I personally don't see a great conflict between the teaching of design, if it's taught in the right way, and the teaching of fundamentals. And I'd like to describe briefly how we do this in astronautics. We do use current developments, in the ballistic missile field, for example, to show reduction to practice of the theory they have learned. Now, the time spent on active discussion of these devices is, of course, very small. But we believe there is real motivational value in showing the students how you put this theory to work.

There's another aspect to this too, which I think transcends in importance all we have talked about here, and that is trying to touch the spark of creativity in all these young men. There's a tremendous amount of creativity and invention in the new devices and new weapons. How you reduce to practice this actual theory involves much more than just assembling in one place all the fundamental tools of science. There is much more to it than that.

Now, we sort of trick the Cadet into designing a ballistic missile. We do it this way: Before starting our course, we set up a general missile design, cut it into a series of pieces, and state each piece as a homework problem. Trajectory studies, for instance, wind up with Cadets actually calculating the trajectory for a specific missile. And, after they have finished their studies of propulsion systems, they design a propulsion system that will satisfy this same missile. And when they go on to the next step, in control systems, they finally outline the design of a control system to fit this same missile. Then, when the course is completed, they put their homework together, and they have unwittingly designed a complete ballistic missile. Now, I don't view this as a sin educationally.

Colonel Clementson: Along that same line, I'd like to add that it's rather a unique student that you can take all the way in pure theory. Most students need to have some physical models and examples to "hang their hat on" to illustrate the theory so that they can assimilate that portion and then go forward. So in practically all of our courses it is desirable to take specific examples to illustrate the theory and then generalize from these. The theory is more meaningful to the student that way.

Colonel Dane: Well, we do the same sort of thing in our thermodynamics course, in that we devote the first part to

(Continued on following page)

putting across the fundamental principles—and thermodynamics is really a very fundamental science in its own right. But once we cover the fundamentals, we then try to show the Cadet how the principles are applied to actual types of equipment, actual types of engines, actual propulsion systems, etc., so that he will be utilizing these basic principles in at least analyzing the performance and efficiencies of various types of engines. We do not get into the design of a piece of hardware, but we do give the students a feeling for analyzing the performance of various types of propulsion systems or engines, utilizing the principles which we have taught during the first part of the course.

Colonel Robertson, you haven't said anything about your ideas on this question of fundamentals versus applications. What do you think about it?

Colonel Robertson: When it comes to the question of theory versus application, you will find most physicists have a definite slant one way, although they are getting more "applied" all the time. I would like to describe the role of the physics department by first referring to one end-product we are trying to produce. We're attempting to develop an Air Force officer who will be able to cope successfully with the situation of the times in the thirty years of his career. We are teaching the natural philosophy and relating it to broad career applications to give our course transitional value. We are interested in getting the student familiar with the scientific method, in teaching him to organize a problem which will have applications to any of the other engineering fields.

We provide him with some of the broad concepts which lie beyond all physical laws. The officer will probably forget most of the facts we teach him, but if we can develop attitudes, appreciations, and habits in a young man that will enable him to work intelligently in science and with scientists, then we have achieved our purpose. For I think that every Air Force officer must necessarily be working with scientists or with the results of scientists' efforts, and he must have an understanding of what can and what cannot be done in science. If we leave with these men an appreciation of how the scientist naturally relates to the engineer, we will, I think, have resolved some problems that vex much older men than the Cadet.

Colonel Dane: Well, do you feel that teaching of the scientific method or the scientific approach fits in with what we said about trying to teach logical thinking?

Colonel Robertson: Right. Here's one of the first examples that we use in class: We tell the Cadets that throughout their Air Force careers they're going to get very familiar with an item called a "staff study." And a staff study requires the same type of approach as writing a technical report. First, know your problem. Once you have stated it so you can understand what you're trying to do, the problem is half licked. Then, assemble your facts, examine your criteria, use your intuition on the proposed solution, and go ahead. That's the way we define the scientific method. And that is what we try to teach.

Slide rule is prime aid to Cadets, who are required to take basic, applied sciences course load for four years.

Aerodynamic display in Academic Building attracts four Cadets, all members of the Academy's extracurricular Engineering Society. Exhibit shows airflow over wing.

Colonel Ault: It seems to me that the most important word that's been mentioned here is the word "hardware." Or call it "materiel," if you like. The complexity of the hardware—the aircraft, the radar, the A-bomb—is the thing that has forced the Air Force officer to try to understand scientific principles in greater detail.

I think this explains, too, why we teach fundamentals here. The fact is that the hardware is changing so rapidly that if we taught a particular piece of equipment it might be out of date in a year or perhaps less. Then we would have to start over and relearn another piece of equipment. Consequently, if we teach the fundamentals that will apply as far as we can tell (using our very best crystal ball) to all hardware in the next twenty years, we will have given the Cadets something lasting.

But the implications of hardware—the pressures, the complexities it puts on the Air Force officer—are also something we have to look at. In the first place, he has a job to do with the hardware, such as weapons to destroy certain targets. The officer has to write the military characteristics of the weapon that he wants built to do the job. If he doesn't know something about scientific principles, perhaps he'll ask for some Jules Verne sort of gadget for which no manufacturer can possibly come up with a design.

After the military specifications have been written, then somebody has to monitor the actual design of the thing and the manufacturing of it. Then the Air Force officer has to buy the product, and he can't afford to base acceptance on the word of someone who knows how to make the hardware but may not thoroughly appreciate how it's going to be used. And so the officer needs a lot more technical ability to request and buy this complicated equipment than he might have needed twenty years ago. And after it's in service, this hardware has to be maintained by technicians.

I think this is where the real revolution has come. The enlisted technicians of past years were brought up to a certain level of skills and technology. But, if we look at the enlisted men that the officer is supposed to direct at

(Continued on page 57)

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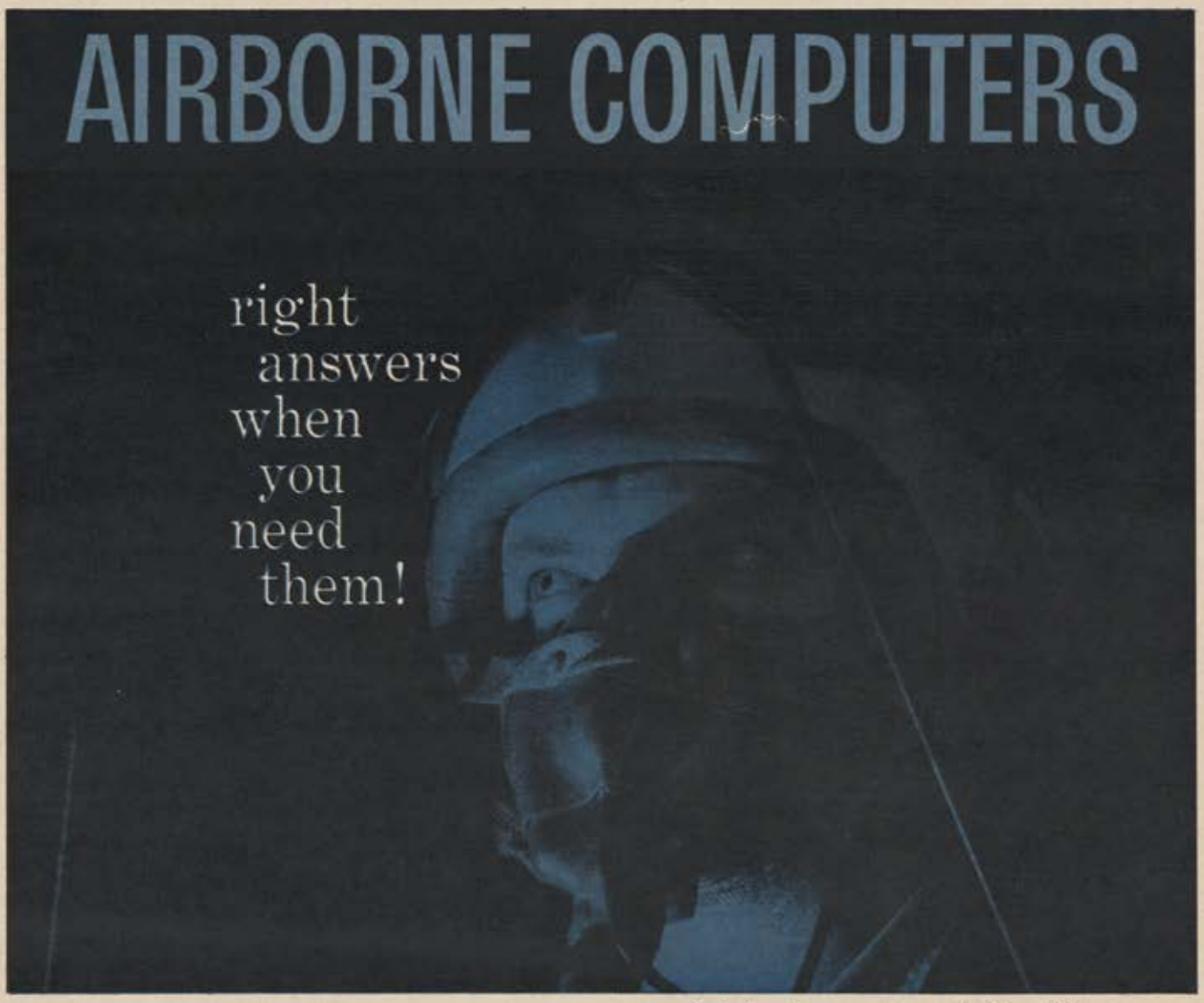

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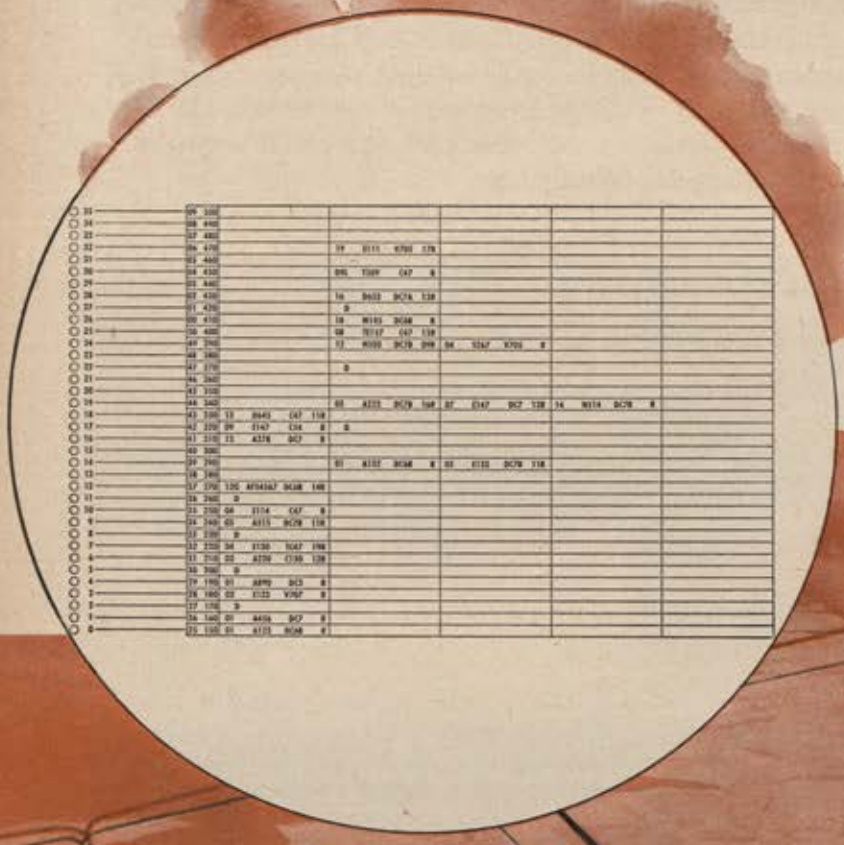

GPL's contracts for the FAA's experimental data processing central—the heart of tomorrow's air traffic control system—point up the diverse talents required of an effective systems manager.

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the present time, they're an entirely different "breed of cats." They have to come up to a very high level of technical capability. And if the officer doesn't have enough fundamental background to talk their language, he's not apt to rate highly in their estimation.

Now, I'm not saying that every officer should know how to fix every black box in every airplane. I think that is ridiculous, but if you command a man who knows how to fix a black box, you ought to be able to converse with him intelligently and understand his problems. Now I think this is the thing that we're shooting at. We talk about officers in the management business, but an officer in the present-day management business needs an excellent background or else he can't get along well in this business.

Colonel Dane: This leads rather naturally into another point I would like to throw out for a little discussion, and that is: In this age of rapidly changing technology and certainly rapid obsolescence of hardware, how thorough do we need to be in our curriculum? How much should we change our curriculum, if at all? Are we covering fundamentals of such a nature that they are all unchanging, or should we consider possible changes ahead of us in the world of technology that could force changes in our curriculum?

Colonel Blasingame: Well, I would make the observation that the thing on the horizon, the space vehicle, still follows the same orbit that Kepler deduced something over 300 years ago. And I think we just have to watch carefully to be sure that we teach these basic things properly so that they can be applied to the next new situation. Beyond this, I'd like to stress one further idea. I have a great belief in the cultural value of scientific education, which is somewhat of a revolutionary idea, I guess. I maintain that a study of the sciences is the only way that a man can get an exposure to the great heritage of human ideas that is ours to exploit today.

We try to teach our course so that the students actually realize there have been some unique individuals in the history of civilization who have made great discontinuities in human understanding, persons like Newton. We like to call the Cadets' attention to how far you can go with just the materials given us by Newton. To me, the cultural level of a civilization is measured by the intellectual content of that civilization, and a tremendous fraction of the intellectual content of our present-day civilization is basically scientific. I think it's only through recognition of this that we could really assess what is culture in today's civilization.

Colonel Higdon: I would like to add a word to what Colonel Blasingame has just said. I think if we will look to the past we will find that most people have thought of liberal arts as *the* broad education. Today one cannot be broadly educated without a considerable knowledge of the sciences. The Academy curriculum includes not only social sciences and humanities, but also the basic sciences and the engineering sciences. This is truly a broad education.

Colonel Dane: Gentlemen, I have a question I would like to direct to all of you as a matter of interest. There has been considerable publicity within the last two weeks about the selection of seven Astronauts who will be trained for the first manned flight into space. Has this incident created any additional interest in your students in the sciences or areas related to space travel or space research? Have you had any reaction from the students in regard to this?

Colonel Blasingame: Well, I could offer my own reaction. I had the privilege during the early part of this week of spending a day at the School of Aviation Medicine. I

Chemistry laboratory experiment. Permanent Academy home boasts outstanding physical plant for science studies.

was interested in the tests that the Department of Space Medicine has been making of people in the sealed-cabin environment, where they have stayed for seven days. This fall they will get a new cabin, I understand, and keep people confined there for thirty days. One of the very interesting facets of this was to see the higher-performance level which they can get out of an experienced pilot in that environment than they can get out of anybody else, even though the other individuals may be highly intelligent.

They have found, for example, that a SAC pilot in this sealed environment adjusts his whole routine of life to whatever schedule of hours on duty, hours off duty is demanded of him. And he'll adjust all his personal habits and fit in with the discipline required. In other words, if you look at the level of performance of a SAC pilot even after seven days in this sealed cabin, his performance level is still up as near to 100 percent as you can expect a human being to get. But, on the other hand, they have put some intelligent but never-disciplined individuals in that environment and they go absolutely to pieces. When the people conducting the tests flash on the warning light—and this means you've got to find your oxygen bottle and put the mask on your face—nondisciplined types scuffle around in all the debris they have left in the bottom of the cabin and spend about ten minutes finding the bottle.

A trained SAC man never shows any sign of this. He reaches down, and the bottle is in his hand. He disciplined himself to keep that where he's going to need it. And I think there's something to learn here, and that is that pilot training (which follows our program for most Academy graduates) is necessary discipline and training for the in-

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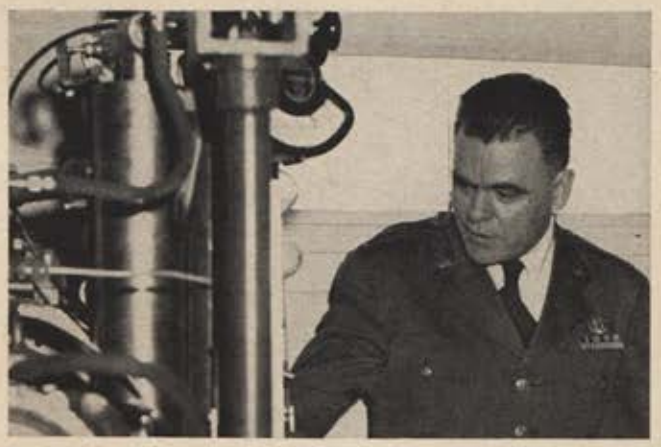
Aerodynamics class performs wind-tunnel experiment in Academy's impressive Aero-Thermo Laboratory facility.



Col. Paul H. Dane, Chairman of the Division of Applied Sciences, Professor and Head, Thermodynamics Department.

troduction of a young man to the operation of a space vehicle.

Colonel Dane: Do you feel the same type of mentality or personality is required, or at least most desirable, in training for possible future spaceflight as it is with the modern aircraft pilot?

Colonel Blasingame: There is no question about it in my mind. And I believe that a large fraction of our output will eventually find themselves in a space vehicle environment.

Colonel Dane: I would like to bring up the subject of how we can best develop the special talents and interests of our Cadets. We now offer them a wide choice of elective courses in areas of their particular interests. I would like to discuss how successful this has been, particularly in the science courses.

Colonel Higdon: The response to these electives has been tremendous. Many Cadets have the mental capacity and the learning rate to take two or three credit hours beyond the required nineteen each semester. Almost without exception, the Cadet with the capacity to do more than the required program has been ready, willing, and eager to take these extra courses.

Colonel Dane: Is this an indication that the majority of the Cadets are really motivated to get the most they can out of this school?

Colonel Higdon: I feel so.

Colonel Dane: What about the Cadets who participate strongly in extracurricular activities, such as athletics? Have we had good response from them on this enrichment program?

Colonel Higdon: Yes, we have many Cadets taking extra courses who participate on the first teams of the various sports. For instance, the captain of the football team has completed a major in engineering science, in addition to playing football for four years.

Colonel Dane: That is Mr. Strom.

Colonel Blasingame: I'd like to add that we're sending three football players to graduate school at MIT this fall: Strom, Zaleski, and Thomson. (We thought MIT needed some football players. We also think they are students who can handle the MIT course.)

Colonel Dane: I think this is certainly an indication that the enrichment program has been quite successful and worthwhile.

Colonel Clementson: I would like to point out that the enrichment plan is a way of taking a prescribed broad program and tailoring it to the interests of the individuals. Unfortunately, there are not many people whose interests are as broad as our basic curriculum. And, as a result, they tend to emphasize and do the best work in the subjects they're interested in and slack off on the ones they're not interested in.

The enrichment program makes it possible for us to be flexible and to cater more or less to their interests. If they have the capability, they can work at an accelerated rate in a course, or, if they've had the material before, they can then concentrate on the area of their particular interest. An example of this, I think, is the two Cadets who participated in our course in aircraft design this year. They went much further than just the engineering science major; they were willing to do work over and above two or three credit hours in addition to the prescribed program.

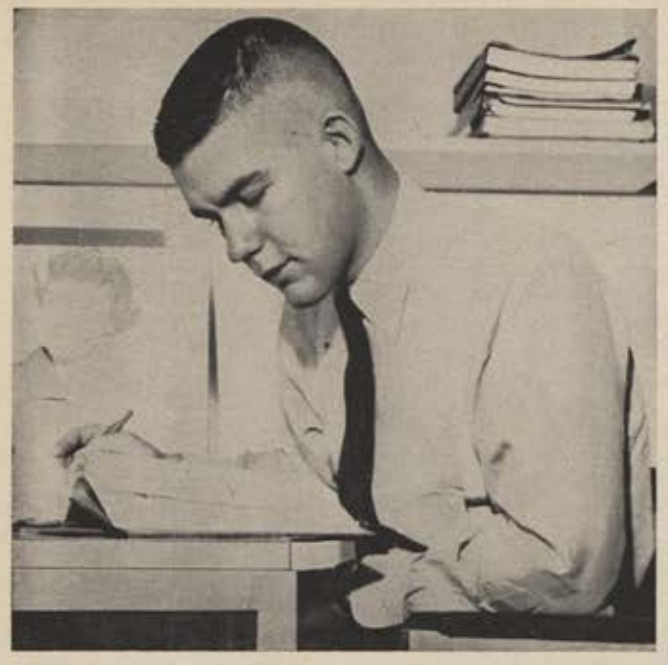
Mr. Kingsland and Mr. Johnson are the two Cadets I am talking about. They evolved a design of a jet transport which I personally believe is a very advanced design and fully equivalent to the type of design expected from a graduate student rather than an undergraduate student.

These are two exceptional students. But this does show the advantage of the enrichment program whereby, despite a rigid prescribed program, we can still stimulate students who have interests in a particular area—and satisfy those interests.

Colonel Dane: To summarize, then, our science and engineering curriculum definitely tends to stress the fundamental principles underlying each scientific area. We feel it is more important that the students obtain a good understanding of the fundamentals than that they have a working knowledge of specific military weapons or weapon systems. We bring in specific systems or pieces of hardware only as illustrative examples of the application of fundamental principles.

And yet, we all feel it is important that we provide some opportunity for our students to express or to follow up their own individual interests and capabilities. We do this by means of enrichment courses which we offer over and above the required curriculum, and so far we are well pleased with the response which the students have given to these courses.—END

COL. PAUL H. DANE, *Chairman of the Air Force Academy's Division of Applied Sciences, who conducted the above panel discussion, joined the Academy faculty in 1955 as Professor of Thermodynamics. Earlier he was assigned to the Advisory Group for Aeronautical Research and Development (AGARD), with NATO in Paris. He holds a B.S. degree and a degree in aeronautical engineering from California Institute of Technology.* COL. JOHN W. AULT, *Chairman of the Basic Sciences Division and Professor and Head of the Department of Mathematics, holds a B.S. degree from Bowling Green University and an M.A. from Ohio State University.* COL. BENJAMIN P. BLASINGAME, *Professor and Head of the Department of Astronautics, holds a B.S. from Pennsylvania State College and an Sc.D. from Massachusetts Institute of Technology.* COL. GERHARDT C. CLEMENTSON, *Professor and Head of the Department of Aerodynamics, has a B.S. from the US Military Academy, an S.M. from Cal Tech, and M.S.A.E. and Sc.D. degrees from MIT.* COL. ARCHIE HIGDON, *Professor and Head of the Department of Mechanics, has a B.S. from South Dakota State College and M.A. and Ph.D. degrees from Iowa State College.* LT. COL. BENNETT E. ROBERTSON, *Professor and Head of the Department of Physics, has a B.A. from the University of Oklahoma and a Ph.D. from Ohio State.* COL. JAMES V. G. WILSON, *Professor and Head of the Department of Electrical Engineering, has a B.S. from the US Military Academy and an M.S. from the University of Illinois.*



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THE ACADEMIC PROGRAM

HUMANITIES

Training the Whole Man

Col. Peter R. Moody
CHAIRMAN OF HUMANITIES DIVISION AND PROFESSOR OF ENGLISH

THE Air Force has set a high goal for its Academy: to produce not only a competent officer, knowledgeable in his trade, but also a broadly educated and intellectually mature man. This broad base of cultural education is furnished the Cadet by the Division of Humanities.

Division objectives are: (1) to teach the Cadet to appreciate and understand his heritage, history, values, and cultural achievements; (2) to develop his ability to think clearly, make sound judgments, and express himself effectively; and (3) to give the Cadet some degree of fluency in a foreign language. In meeting these objectives, the division teaches each Cadet prescribed courses in English, philosophy, history, and one of four foreign languages. These courses cover forty semester hours of the prescribed curriculum, spread throughout each of the four years which a Cadet spends at the Academy.

These break down as follows:

DIVISION OF HUMANITIES CURRICULUM

Fourth Class (Freshman) Year	*Fall Term*	*Spring Term*	*Hours*
Dept. of English	Composition, Speech	Literature	6
Dept. of History	World Civilization	US History	6
Third Class (Sophomore) Year			
Dept. of History	Recent World History	Military History	6
Second Class (Junior) Year			
Dept. of English	Problems in Philosophy	Literary Masterworks	6
First Class (Senior) Year			
Dept. of English	Literary Masterworks	Literary Masterworks	6
Dept. of Foreign Languages	French or Spanish or Russian or German		10

The primary concern of the first year of English is the teaching of composition. Major emphasis is laid on the development of a clear, forceful prose style. The Cadet writes approximately twenty short themes during the academic year and at least one long research paper. In the study of oral communication, each Cadet delivers some seven speeches of varying lengths, participates in group conferences, and plans and leads a conference. Finally, in addition, he furthers his reading capability and, at the same time, begins the study of literature by reading and analyzing a novel or several short stories.

So that the Cadet may learn to understand and enjoy literature, the English Department teaches three terms of literature, the spring term of the Cadet's third year and both terms of his first class year. By studying many of the literary masterworks of Western civilization, ranging from Homer's *Odyssey* to Faulkner's *The Sound and the Fury*, the Cadet both develops critical judgment and deepens his knowledge of mankind. Considerable attention is devoted to the study of Shakespeare. Masterworks of

(Continued on following page)

Language studies have high priority in humanities course. Here a small group learns Russian. Note class size, planned for maximum discussion. Cadets must take ten hours of a language—either Russian, French, German, or Spanish.

European continental literature are read in the best available translations.

Major emphasis in these three courses is on the study of literature, but training in written and oral communication also continues. The Cadet writes a number of critical papers and makes several speeches during these courses.

All departments cooperate with the English staff in maintaining a high standard of English usage. Any upperclass Cadet whose written or oral expression in any course falls below Academy standards is reported to the Dean. The Dean may then direct the Cadet to take a noncredit review course in English usage designed to bring the Cadet's power of expression to the proficiency required of an Air Force officer.

During his first academic term at the Academy, the Cadet's history course is principally concerned with the historical development of Western civilization from ancient times to 1900, with some treatment of Middle Eastern and Far Eastern civilizations. This course, in emphasizing the cultural elements and power structures of European civilization, provides the Cadet a broad background for his social and humanities studies.

During the next term the Cadet undertakes an American history course which surveys political, social, economic, cultural, and diplomatic developments from the colonial period to 1900. The growth of American democratic ideas and institutions is stressed.

The Cadet begins his sophomore year with a course in *Recent World History.* A study of leading historical issues since 1900 emphasizes international and internal forces which have tended to produce power blocs. Two important aspects of this course are an analysis of the causes of international tensions and a description of the steps by which the United States came to a position of leadership within the community of free nations.

The Cadet's final history course is *Military History.* This study includes the historical development and analysis of military principles, theory, trends, strategy, doctrine, weapons, organization, logistics, and tactics. Military affairs and civil-military relations are also covered. The Department of History emphasizes the history of air warfare as it has developed in this century.

During his senior year, each Cadet must take a ten-semester-hour course in a foreign language. The Cadet chooses his language—Russian, French, German, or Spanish. The objectives of the foreign language courses are to cultivate in Cadets a reasonable proficiency in understanding, speaking, reading, and writing a foreign language, and to introduce Cadets to the culture and customs of a foreign country.

Language classes employ the aural-oral instructional method. Instruction sections include no more than ten Cadets.

The over-all Academy policy of small sections allows full use of the instructor-led group-discussion method of teaching, with maximum participation by each Cadet. This is important in history and English classes where expression of ideas is encouraged; it is particularly valuable in

The arts are recognized, too. This drawing and sculpturing class is one of the enrichment courses offered on elective basis. By completing seventeen credit hours in such courses, Cadets may major in public affairs, sciences, and English.

foreign language classes where practice in the language is mandatory.

In the fall term of his third year at the Academy, the Cadet takes a three-semester-hour course in philosophy, *Problems of Philosophy.* He studies what men through the ages have written on such major questions as the nature of man, the nature of knowledge, and the nature of values. Discussions concerning man as an individual, social institutions, and the individual's place in society are based on readings from eminent philosophers.

What went before—history—may help forecast tomorrow. Cadets get a long look at ancient but interesting times.

The Division of Humanities makes extensive use of audio-visual teaching aids. The Department of Foreign Languages sponsors a series of foreign motion picture films. The Department of English finds that film versions of Shakespeare's plays and of certain novels and dramas are valuable in assisting the Cadets to enjoy and understand literature. It also encourages good Cadet writing by publishing twice a year *Chandelles,* a magazine of the best freshman writing, and *Wingover,* an upperclass magazine of essays.

From time to time each department in the division varies its routine instruction by inviting prominent figures to lecture to Cadets. The Department of English, for instance, has sponsored such guests as authors MacKinlay Kantor, S. I. Hayakawa, David Daiches, Paul Engle, and John Dos Passos.

The Division of Humanities has been particularly active in the enrichment program. Cadet response has been gratifying. The Department of History has taught such optional courses as *Russian History, History of the Far East, Latin-American History,* and *US Diplomatic History.* Some English offerings have been: *English Literature, American Literature, Modern Novel, Shakespeare, Modern Drama, Public Speaking, Fine Arts,* and *Ethics.* The Department of Foreign Languages is now teaching a course in German in addition to the regular course and may eventually offer literature courses in the languages of foreign nations.

Over-all, the Division of Humanities prepares the Cadet to fulfill his intellectual potential as a citizen and as a dedicated public servant in the Air Force—both through its general courses and through special courses designed to meet individual needs.—END

Col. Peter R. Moody is Professor of English at the Academy. A 1937 graduate of Wofford College, he is a member of the 1942 class at West Point and holds a master's degree from Duke University. He has taught at West Point and Duke. Before the Academy he was with the Military Assistance Advisory Group, Paris.

SOCIAL SCIENCES

People, Problems, Cultures

Col. Christopher H. Munch
CHAIRMAN OF SOCIAL SCIENCES DIVISION AND
PROFESSOR OF LAW

THE Division of Social Sciences at the Air Force Academy is comprised of the Departments of Economics, Geography, Law, and Political Science. The four departments provide integrated instruction in the social sciences.

The courses offered in social sciences support the general Academy mission of preparing the Cadet for future positions of leadership in the Air Force. Departmental and course objectives are based upon the conviction that an officer should understand the peoples, institutions, cultures, and environments of the world if he is to appreciate his role of service in foreign nations or among foreign peoples with whom he will associate throughout his career. His understanding must be based upon a solid foundation of American ideals and heritages and the nation's contemporary defense and foreign policy.

The prescribed social science course offerings total twenty-five semester hours. They are taught in the fourth, second, and first class years. Faculty members of the division with few exceptions possess graduate degrees in their fields and college-level teaching experience. Most have utilized their specialties in previous Air Force tours of

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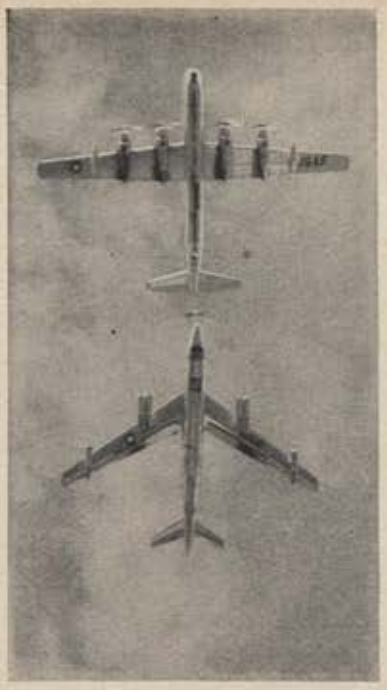
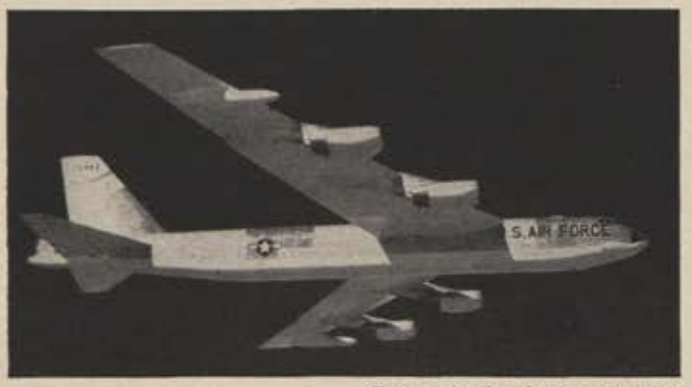
Geography, important in itself for an Air Force officer, is an integral part of the body of social science studies.



KC-97 refueling B-47 medium jet bomber

KC-135 tanker-transport



B-52 missile-platform bomber

BOMARC defense missile

The graduation of the United States Air Force Academy's first class is another important milestone in the history of the U.S. Air Force. Boeing salutes the members of this historic first graduating class.

BOEING

The eternal problem of the military Cadet, how to do several things at one time. After class hours, studying, keeping equipment in spit-and-polish shape, and getting ready for even busier tomorrows combine to make each day all too short.

PEOPLE, PROBLEMS, CULTURES

CONTINUED

duty. Classes within the division average fourteen Cadets.

The courses in economics point generally to a sharpening of the student's insight into major factors in this key area. The Department of Economics attempts to fulfill its function in a required course, *Economic Principles and Problems,* and two elective courses, *Comparative Economic Systems* and *Introduction to Investments.* The department plans a third elective course, *International Economics,* which it hopes to offer within the next year or two.

The required course, *Economic Principles and Problems,* presents a study of significant economic issues through which it analyzes modern capitalism, its problems, and its alternatives. The course then develops an understanding of the relationship between national security programs and the national economy and the side effects of international tensions upon the national economy.

The elective course in *Comparative Economic Systems* broadens the student's outlook by a study of the economic systems of the Soviet Union, Communist China, Yugoslavia, and Great Britain, as well as the economic aspects of a fascist system. During the study of these systems, an attempt is made to survey social, cultural, and psychological features of each system.

Cadet Bradley C. Hosmer, '59, who begins Rhodes Scholar studies at Oxford in the fall, with Col. R. F. McDermott, Dean of Faculty. Hosmer will study politics, economics. His father, a colonel at Lackland AFB, is a career officer.

Overseas classroom: Cadets in London visit Parliament, supplementing Academy study of our common-law heritage.

The second elective course, *Introduction to Investments,* covers techniques and standards of investment appraisals. It discusses investment problems, financial research, and the structure of an investment report.

The proposed third elective course, *International Economics,* would deal with theories of international trade. A study of underdeveloped economies would receive special emphasis along with United States commercial policy, investments, and development programs.

Courses offered in geography generally cover a basic knowledge of global geography as a foundation for the study of other social sciences. The first required course, *Elements of Cartography,* teaches the methods of earth representation, so that the student may interpret with some competence the natural and cultural detail on maps and photographs. Earth measurements, map mechanics, position reference systems, map projects, and aerial photography comprise the substantive coverages in this course. The second required course, *World Geography,* examines geographic causes for progress in some parts of the world and lack of progress in others.

The department offers two elective courses as well: *Advanced World Geography* and *Political Geography.* The first concentrates on geographic factors that influence the power of nations. The latter, a study of geopolitics, takes a long look at the impact of space achievements, present and future.

The Law Department offers one basic course, *An Introduction to Law,* designed to acquaint the student with the important precepts of our heritage from British common law, with emphasis on civil law fields most affecting the operation of government. The course also introduces the Cadet to the special fields of criminal law and evidence necessary to an understanding of the court-martial system administered by the armed forces on a worldwide basis, and international law as it affects the armed forces of the United States abroad. The course attempts to present to the student what the law is and how it functions as an element of our social order, and particularly as a factor in personal and official activities of members of the Air Force.

The department also offers an elective, *American Constitutional Law,* and, in conjunction with the Political Science Department, *International Law and Organizations.* The constitutional law offerings examine the historical background and case progress of American constitutional doctrine. The course emphasizes judicial powers as one of the moving forces in American economic, social, and political progress against a background of the legal theory of our government and individual constitutional guarantees.

The course in *International Law and Organizations* is a cooperative venture of both the Law and Political Science Departments. The course provides initially an understanding of the origins and evolution of international law and organized international collaboration.

The Social Sciences Division's program is rounded out by political science courses which cover generally the political institutions of the United States and foreign countries. Four courses are required in the political science sequence: *American National Government, Contemporary Foreign Governments, International Relations,* and *Defense Policies.*

The course in *American National Government* examines principles and basic institutions of the American federal system, including civil and political rights and the party system. This course is immediately followed by the *Contemporary Foreign Governments* course which analyzes the political systems of Great Britain, France, Germany, Russia, Japan, and India. Next is the *International Relations* sequence which covers the theory of interstate conflict and cooperation against the background of the basic government courses and United States foreign policy.

Last in the sequence is the *Defense Policies* course which delves into the problems of formulation of a defense policy by considering factors of national policy and objectives, technological advances in weapon systems, national resources, and modern military strategy. In addition to the required courses, the Cadet may take two elective courses: *Political Theory* and *Political Parties,* which cover, respectively, historical evolution of major trends and issues in political thought, and political parties in the organization and operation of the American system. Departmental participation in the *International Law and Organizations* course has been previously discussed.

In addition, two important extracurricular activities are sponsored by the department. The Cadet Forum presents a series of guest lectures on national or international affairs during the school year. The Air Force Academy Assembly provides a four-day meeting of undergraduates from over thirty colleges and universities in the Rocky Mountain area.

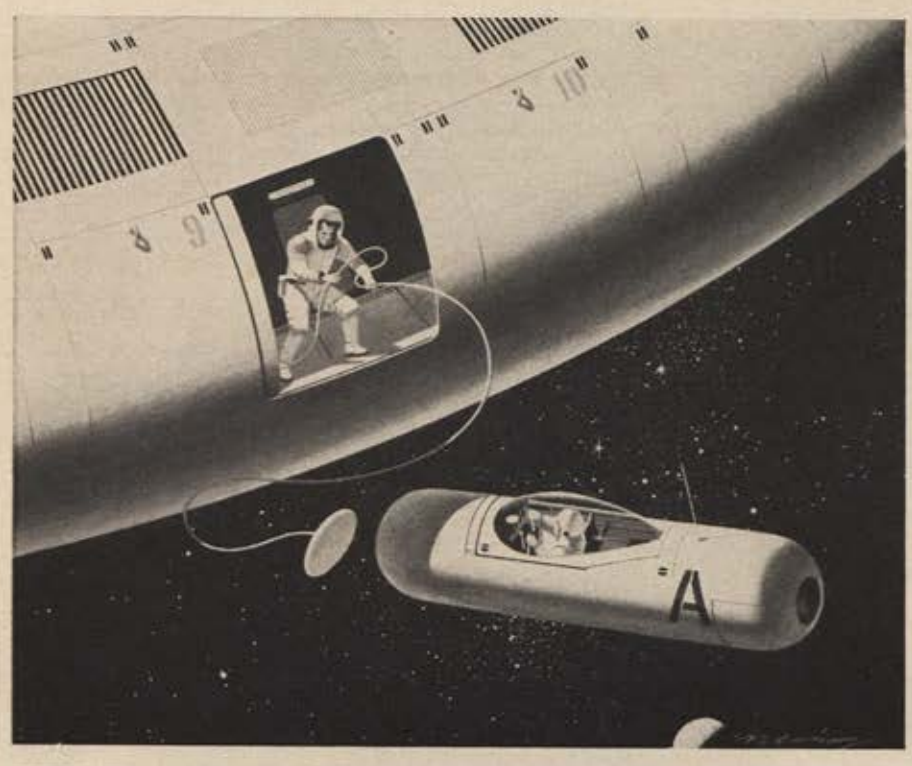
The Social Sciences Division and the Department of History offer a major in public affairs for the student who takes a sequence of elective courses plus the prescribed courses.

The four departments comprising the Social Sciences Division jointly participate in a senior seminar, *Problems in Public Affairs,* in which students perform supervised research, speak, and write on some major public issue.—END

Col. Christopher H. Munch, Professor of Law and Staff Judge Advocate at the Academy, is a 1943 graduate of West Point who received his Doctor of Laws degree from the University of Illinois in 1951. He served in Korea in 1951 and 1952 and subsequently in the Philippines, prior to his assignment in 1955 to the Air Force Academy.

COUNT DOWN!

for the conquest of space



WHAT KIND OF ENGINE FOR A SPACE-JEEP?

It takes a unique engine to jockey a space-jeep in for a landing on an orbiting space station—one that will give a space pilot instant control and precise maneuverability.

Such an engine is the fully controllable rocket engine—ideal for space travel yet as easy to operate as an automobile engine.

The rocket engines are ready now

Although the space-jeep is still a gleam in an engineer's eye, the controllable rocket engine is available now...and has immediate application for existing aircraft. The pilot of a plane with auxiliary rocket power can switch it on for sudden, swift acceleration at high altitudes . . . the aircraft's air-breathing turbojets supplying power for ordinary flight operations. This is the mixed-power theory. Since World War II several mixed-power concepts have been developed in foreign countries, including Russia, France and England.

Extra power for today's aircraft

Rocketdyne already has designed, tested, and manufactured rocket engines for mixed power applications. The AR-1 rocket engine is a liquid-propellant system, as are the large power plants for the Atlas, Thor, Jupiter, and Redstone ballistic missiles. The AR-1 passed stringent flight tests as a supplementary power plant on modern jet aircraft. Substantial improvements over normal near-sonic speed and 50,000-foot altitude capabilities were demonstrated in more than 100 test flights.

The AR-2, second in a series of four rocket-engine models developed by Rocketdyne, is a fully-throttleable engine that provides varied thrust. Using fuel from the airplane's tanks—which automatically ignites with hydrogen peroxide—these engines have full stop and restart capability.

More value for taxpayers' money

The auxiliary rocket engine gives present aircraft superperformance capabilities at a relatively low cost. It provides the increased speed and maneuverability that could spell the difference between the success or failure of an intercept mission. Almost any existing jet aircraft, as well as those now on the drawing board, can be adapted readily for AR engines.

Looking forward to tomorrow

Beyond a doubt, rocket power has a leading role in the Free World's future. Rocket-propelled airplanes, such as the X-15, will pave the way for man's entry into Outer Space. The multi-million-pound-thrust systems that are now under development at Rocketdyne will be man's means to explore interplanetary Space. But meanwhile, these rapid advances in rocketry can add great strength to America's present deterrent arsenal.

THE MEASURE OF ROCKET POWER

The liquid-propellant AR rocket engines are "static tested" at Rocketdyne's field laboratory to measure thrust and performance.

FIRST WITH POWER FOR OUTER SPACE

ROCKETDYNE

A DIVISION OF NORTH AMERICAN AVIATION, INC.

There is nothing more important than books. This Cadet has around him a world of ideas, in beautiful modern surroundings.

THE ACADEMIC PROGRAM—LIBRARY

'One of the Largest and Most Beautiful'

Lt. Col. George V. Fagan
DIRECTOR OF LIBRARY

ON January 5, 1959, the magnificent Library structure at the Air Force Academy opened for service. Housed in the academic building at the heart of the Cadet area, it is one of the largest and most beautiful military libraries in the world.

Few libraries have experienced an expansion rate equal to that of the Academy Library. When it opened at its temporary quarters at Lowry AFB, Denver, in 1955, the collection numbered fewer than 500 volumes. On April 1, 1959, Library holdings, including books, government documents, recordings, microfilms, and bound periodicals, totaled nearly 90,000. Ultimately, the Academy Library will contain a general collection of 250,000 items, including an extensive aeronautical collection.

During the 1957-58 academic year, more than 36,000 items were circulated. Registered borrowers totaled over 1,300. This amounts to a per capita use of 27.5. The average per capita use in colleges throughout the nation, according to published statistics, is 16.8.

The general book collection is composed of books in all areas of human activity. It contains standard books of general reference as well as those useful in the specific fields covered by the curriculum. In addition, the collection has an adequate stock of important general books, as well as those needed for proper instruction in each curricular field taught at the Academy. Books are also available for faculty and Cadet research. Nonfiction and fiction are included for recreational reading purposes.

The newspaper collection is among the largest found in any library in the United States. The Library subscribes to over seventy daily newspapers, which include leading journals from every state in the union. In addition, military newspapers and outstanding foreign newspapers, such as the *Times* of London and the Manchester *Guardian*, may be found. The Library has a complete file of the New York *Times* since 1913 on microfilm. This file is indispensable for research on current history. *Facts on File*, a weekly indexed summary of important news, is also available.

The Academy Library has been the recipient of outstanding aeronautical volumes donated by leading collectors from all over the United States. Some of this material is included in the main collection, while other is maintained in the special collection branch of the Library.

The special collection branch possesses a variety of materials. It includes clippings, biographical data on Academy personnel, Academy publications and archives, publications by and about Academy personnel, and the like. Access to this material is limited to authorized personnel.

The growing phonograph record collection of the Library emphasizes classical and semiclassical music. It also contains language records, poetry, dramatizations, and speeches of historical value. Record concerts are held on week ends in the music room of the fifth floor of the Library.

Maps and atlases comprise an important part of the Library. They include both American and foreign publications.

The aerospace room is located on the sixth floor of the Library. It contains current materials on airpower and is administered by the Airpower Fundamentals Division.

Other collections maintained by the Library include microfilms of military and civilian publications; microcard and microprint holdings; a vertical file of pamphlet series, brochures, data on various Air Force bases, and current small publications of the various service schools and academies; and visual materials directly related to the academic aspects of the curriculum or of historical value. A partial collection of UN documents is also available for use in connection with courses offered by the Social Sciences and Humanities Divisions, and technical report literature (RAND, NASA, etc.) is available for the use of the faculty in courses offered by the Basic and Applied Sciences Divisions. File copies are also maintained of Air Force bulletins, regulations, letters, and general orders,

(Continued on following page)

A view of the main reading room of the Library. Some 250,000 volumes are planned, with 80,000 already in the stacks.

and Air Force Cadet bulletins, regulations, manuals, and Wing orders, as well as those of the Academy itself.

By act of Congress, the Academy Library is a repository for government documents. These government publications provide a complete and thorough treatment of a wide range of subjects.

The Library receives, binds, and preserves a number of general periodicals as well as those in the scholarly fields covered by the curriculum. The Library is building up valuable files of the leading American and foreign military periodicals. Most of the periodicals are professional journals. Others are acquired for recreational purposes.

The Library places the thought and achievements of scholars and scientists through the ages at the disposal of faculty, Cadets, and a limited number of others.

In February, a community library, located in the community center about five miles from the Academy, was opened to meet the library needs of all Academy military personnel, their dependents, civilian personnel of the Academy, and other authorized users. During the first six weeks' operation, it circulated approximately 3,000 books and over 300 records. Attendance totaled more than 3,000. This library facility, with over 800 registered borrowers, is furnished all materials and services by the Director of the Academy Library.

The officially expressed mission of the Academy Library is to procure, organize, house, and maintain all library materials and provide all library services required by Cadets, faculty, and other authorized persons; to establish and maintain a special collection of unique and rare items pertinent to the growth and development of the Air Force and the Air Force Academy; and to create a reference and basic research collection in the fields of airpower and aeronautical history.

In other words, the Library and its staff have a king-size mission to perform. We feel we are off to a good start.—END

Book-toting Cadets walk down the striking modern marble staircase which connects the three floors of the library.

Lt. Col. George V. Fagan, Director of Library at the Academy, joined the Air Force in 1941 and served during World War II in Europe. He was recalled to active duty in 1951. He holds a B.S. from Temple University, a master's and Ph.D. from the University of Pennsylvania, and he has taught history at Temple and Annapolis.

Key factors in any weapon system

It takes more than a runway or a launching pad to get the new aircraft and missiles into the blue. The requirement for outstanding Air Force personnel is greater now than ever before, and promises to be even more demanding in the years to come. That's why the new Air Force Academy at Colorado Springs has such significance. Here, resourceful young men will be readied for the big jobs of the future. They will acquire that high degree of technical and executive skill which will allow them to handle tomorrow's problems relating to aircraft, missiles or space vehicles with competence and efficiency.

Douglas salutes the foresight of Air Force planners in setting up this fine facility. As an Air Force partner in the nation's security with such projects as THOR, C-133, RB-66 and GENIE, we assume responsibility for our products throughout their operational life. And we realize that their success depends largely on the capability of the personnel who utilize them. We send our best wishes to the men who teach and the men who learn at the new Air Force Academy.

DOUGLAS

The Armed Services' Partner in Defense

General Sullivan

The Commandant of Cadets, Brig. Gen. Henry R. Sullivan, Jr., supervises the entire Cadet airmanship program, including these areas:

- *Military and leadership instruction.*
- *Physical education.*
- *Training leading to an aeronautical rating as a navigator at graduation.*
- *The Cadet Effectiveness Rating System and the Code of Honor.*
- *Training and logistical support of the Cadet Wing.*
- *Personal, social, and moral welfare matters.*

This broad six-point mission is divided into two categories, each under an assistant to the Commandant of Cadets. The Deputy Commandant for Cadet Wing Command, Col. Benjamin B. Cassiday, Jr. (who this month will be replaced by Col. Louis T. Seith), oversees facets of the Academy regimen that fall under the formal designation, The Cadet Way of Life.

These activities are highlighted on this and the facing page by Colonel Cassiday.

The Deputy Commandant for Airmanship Studies, Col. H. L. Hogan, III, heads the instructional division responsible for a major share of the Cadet's professional training. Colonel Hogan's summary of airmanship studies begins on page 72.

In a dozen words, the motto on this striking monument *(see cover)* summarizes the Academy's philosophy. The sculpture, now on a pedestal north of the Cadet Dining Hall, was presented in December 1958 as a gift to the Academy by the personnel of Air Training Command who subscribed more than $25,000 for its execution. ATC's Lt. Col. Austin Miller wrote the inscription; sculptor was Carl Mose. The eagle represents the Air Force, the eaglets the Academy Cadets.

The Cadet Way of Life

Col. Benjamin B. Cassiday, Jr.

DEPUTY COMMANDANT
FOR CADET WING COMMAND

THE term "Cadet way of life" embraces all the activities, routines, and influences encompassed in the four-year environment of the Cadet which are not found in a civilian educational institution. It includes a rigorous daily schedule, a conformity to a rigid code of conduct, a gradual progression through the class system from led to leader, from virtually no privileges and maximum supervision to maximum privileges and minimum supervision, from self-responsibility only to broad responsbilities for management of the Cadet Wing.

A principal ingredient of the Cadet way of life is the class system which provides an increase in responsibility, authority, and privileges as Cadets progress through their four years at the Academy.

The fourth class year is the most rigorous that a Cadet spends at the Academy. The pressures involved in this training period test the ability of a Cadet to perform effectively under stress. If a young man is not capable of withstanding this stress, we want to know about it as soon as possible.

As a third classman, the Cadet's only authority over the fourth class is to ask certain questions and to make corrections when acting in positions of authority. The third classman's highest responsibility is as Cadet in Charge of Quarters, at which time he has many duties requiring action over the fourth class and even at times over the upper-classes. He exercises his authority over upperclassmen with great caution, however.

The Cadet lives by schedule. It teaches him the precision that will be a supreme asset to him as an Air Force officer.

Footwear so polished you can see your face in them is an old tradition at the new Academy. It is part of discipline.

The second classman assumes a good deal of responsibility. He has had enough experience to temper his enthusiasm and is therefore qualified to exert influence upon both underclasses. He supervises the compliance with fourth class customs and assumes certain noncommissioned officer positions in the chain of command.

The first classman assumes the position at the top of the Cadet Wing. His responsibility is considerable, and with it he has been given commensurate authority. The Cadet Wing staff (all first classmen under the supervision of the Commandant of Cadets) is responsible for the discipline, internal administration, training, and general efficiency of the Wing. All Cadets in the chain of command have specific responsibilities which are in keeping with their counterparts in the Air Force.

Should a Cadet fail to fulfill his responsibilities, he encounters another feature of the Cadet way of life—the disciplinary system.

Infractions of regulations vary from such relatively insignificant items as dust in rooms and shoes improperly shined to the serious matter of a Cadet failing to return to his place of duty on time. The more serious matters are thoroughly reviewed by a board of senior officers, and punishments are assigned subject to the approval of the Superintendent. If the infraction is sufficiently serious for the board to recommend dismissal, this proposal must be concurred in by the Secretary of the Air Force.

Demerits are awarded as grades in conduct, with the total number awarded determining a Cadet's standing in conduct. Demerit allowances are established for each class, and if a Cadet exceeds his allowances, he is considered deficient and must meet a board of senior officers.

Privileges, another feature of the Cadet way of life, are based upon the basic philosophy of attempting to minimize the transition from first classman to second lieutenant. For example, during the fourth class year, a Cadet has virtually no opportunity to leave the Academy other than on planned Cadet trips. This restriction is progressively lifted until, in the second semester of his first class year, the Cadet is treated much the same as a second lieutenant.

The Cadet way of life is not all work and no play. There is a strong need for the Cadet to relax and enjoy recreational activities during his leisure time. A variety of extracurricular activities is provided for the Cadets. For example, for the athletic-minded there are the Lacrosse Club, Mountaineering Club, Water Polo Club, and Judo Club. For the academic-minded we have the Forensic Association, Cadet Forum, Engineering Society, and Cadet Magazine. For the outdoor type there are the Fishing Club, Ski Club, and Gun Club. Cadets can pursue hobbies such as photography, model engineering, music, radio, chess. We even have a group that meets regularly to learn the fine points of bridge.

Fourth classmen are required to sit at attention during meals, another phase of traditional military Cadet life.

And, of course, among the most popular activities are those involving young ladies. On week ends, Cadets have dates who come from far and wide for dances, hiking, and picnicking, or to attend athletic events.

Another facet of the Cadet's life that will bear a lifetime influence on each graduate is the Cadet Honor Code. The Code was adopted by the first Cadet class and has since been administered by elected representatives of the Cadet Wing. The essence of the Code is contained in these words: "We will not lie, cheat or steal, nor tolerate among us one who does." The Cadets realize that this Code is a bond between them and the entire military heritage.

An unwavering adherence to the principles of personal integrity has traditionally characterized the professional officer. Because of the Honor Code, Academy professors feel no necessity to remain in classrooms while tests are being taken. The Code underlies every action of the Cadet's life and pledges him to immediate and unequivocal truth in every situation.—END

Col. Benjamin B. Cassiday, Jr., Deputy Commandant for Cadet Wing Command, will be replaced this month by Col. Louis T. Seith. Colonel Cassiday, a 1943 graduate of West Point, has been at the Academy since 1955. Born and raised in Honolulu, he flew combat in fighters in the ETO in World War II and again later in Korea.

The Professional Officer

Col. H. L. Hogan, III
DEPUTY COMMANDANT FOR
AIRMANSHIP STUDIES

THE Airmanship Studies Division, through its four instructional departments, presents a widely diversified program consisting of leadership studies, military studies, navigation training, and physical education.

Leadership studies treat the theoretical and practical aspects of the USAF and other services. Navigation training provides study and practice in the art of aerial navigation. Physical education prepares the Cadet for a physically active career.

The courses represent forty-eight semester hours of Cadet effort.

The chief of the Airmanship Studies Division is a member of the faculty council which considers all educational and instructional matters under the chairmanship of the Dean of Faculty. He is also a member of the curriculum committee of the Academy board, through which all airmanship and academic curriculum matters are referred to the Academy board. The four department directors—Col. C. C. Barthel, Director of Navigation; Lt. Col. G. D. Ofiesh, Director of Leadership Studies; Lt. Col. L. J. Churchville, Director of Military Studies; and Lt. Col. C. J. Myslinski, Director of Physical Education—are also

Wing experience, classroom instruction teach Cadets leadership. Below, Cadet officer lectures lower classman.

Cadets line up for inspection beside T-29 navigation training plane before taking off on indoctrination hop.

members of the faculty council. The chief of the division also serves on the Academy board.

The term "airmanship," as used in this case, refers to courses designed specifically to prepare the Cadet for his chosen career as a professional officer of the Air Force. Airmanship studies have a quite direct and immediate use to the graduate in discharging service duties.

To be an effective second lieutenant the graduate must be in good physical condition and have developed a habit of physical fitness, must have knowledge of the operational and logistical aspects of his service, and must be able to lead others.

Training to this end begins during the basic Cadet training program.

The objective of this training given Cadets in their initial preacademic summer at the Academy is to prepare them to take their place in the Cadet Wing. They must be taught how to wear the Cadet uniform and how to march. They study Air Force armament, Cadet regulations, and the Code of Honor. They are taught to obey instructions, for it is primarily through the application of external discipline that self-discipline is developed. They learn to follow before they can lead.

Two other departments of the Airmanship Studies Division also contribute to this initial summer's program. The Department of Physical Education conducts a rigorous conditioning program which provides an hour of body-building exercises and an hour of competitive sports every duty day.

Under the Department of Navigation, the Cadet begins another aspect of his professional education with an introduction to Air Force flying. This is designed to teach him the care and use of personal flying gear and emergency equipment of the two aircraft in which he flies during this course, the T-29 Flying Classroom and the T-33 jet trainer.

The Department of Military Studies, directed by Lt. Col. L. J. Churchville, not involved with basic Cadet training, first meets the Cadet during the fourth class academic year. A course devoted to the growth and development of the USAF is presented biweekly. The department continues its instruction through the next four years with detailed study of the combat and support commands of the USAF, the national security structure, USAF organization, other armed forces, career guidance, missiles, and airpower employment exercises.

The department sponsors four field trips, one each academic year. The first trip is to bases of combat commands, at present Hamilton, March, and George Air Force Bases, where, after preliminary study at the Academy, fourth class Cadets have an opportunity to become more familiar with the mission of each command at the squadron level. In addition to formal instruction at the combat bases, the Cadets have an opportunity to fly in the TF-102, F-100F, B-47, B-52, KC-135, and KC-97 aircraft.

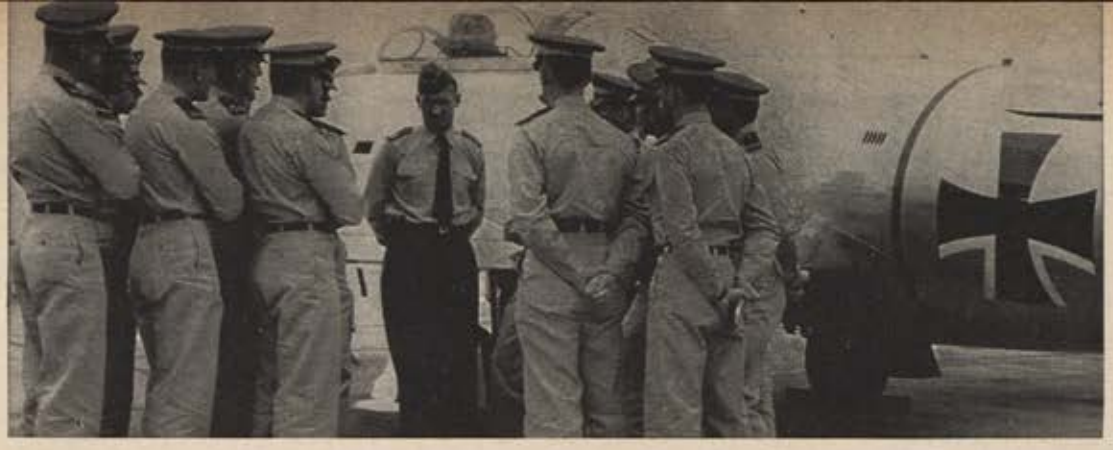
In the third class year, to give them a better appreciation of the logistics aspects of Air Force operations, Cadets visit Wright Air Development Center, Wright-Patterson AFB, Ohio, where they see some of the hardware on the drawing board and in the laboratories with which they may work after their graduation. They also go to Oklahoma City Air Materiel Area to study the huge Air Materiel Command complex there. On this trip Cadets also visit the Naval Air Station at Pensacola, Fla., taking a short cruise on an aircraft carrier and attending instruction on anti-submarine warfare and other naval activities. A visit to the Army Infantry Center at Fort Benning, Ga., brings the opportunity to witness ground firepower demonstrations and parachute training and to learn more about the role of the United States Army.

During their second class summer, Cadets are given the option of taking a trip to US and allied military establishments in Europe in lieu of their normal summer leave. On this trip Cadets see the USAF and other forces in action overseas through visits to US and foreign activities in England, France, Germany, and Spain.

In the first class year, academic classroom instruction in missiles is augmented by a visit to the Martin Company plant at Denver where the Titan ICBM is manufactured. The Cadets will also visit an operational missile unit in the

(Continued on following page)

Cockpit checkout precedes introductory flight in T-33 jet trainer. Cadets occasionally are taken up in jets.



Cadets hear lecture from West German Air Force officer during summer tour of overseas bases.

Colorado-Wyoming area when these facilities are completed.

To enrich Cadet interest in and knowledge of airpower, the Department of Military Studies frequently sponsors visits to the Academy by persons prominent in the field of contemporary airpower.

Thus, the military studies program is three-pronged, providing classroom instruction at the Academy, field study instruction at selected bases of the armed forces at home and abroad, and lectures by airpower leaders.

The mission of the Academy also dictates that everything possible be done to develop the leadership qualities of Cadets. During the basic Cadet training period this development is begun.

Cadets remain in a subordinate role for the remainder of their fourth class year. There is some opportunity for increased responsibility and leadership during the Cadet's second year at the Academy. In his second class year the Cadet is given additional responsibility and authority to develop his leadership abilities.

At this point the experience the Cadet has gained from two years of life in the Cadet Wing is reinforced with formal academic instruction presented by the Department of Leadership Studies. Instruction is given in psychology and management, the subjects which the Academy feels best treat the theoretical aspects of the highly complex study of leadership. The philosophy underlying this selection is the development of an awareness of the fundamental concepts of human behavior.

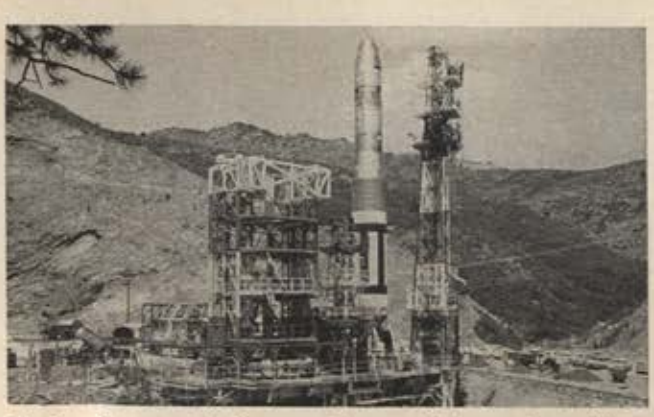
The first of these two courses, *The Psychology of Adjustment*, is designed to enable the Cadet to observe and understand human behavior with greater objectivity and accuracy. The course focuses upon human behavior, with all of its frustrations, conflicts, and readjustments. It is intended to provide a functional knowledge of how people deal with the problems and complications of everyday life.

Small arms practice: Cadets become familiar with Air Force armament during summer encampments at Academy.

Next, the second classman begins the study of management. The course is designed to integrate his previous study of psychology with the elements of service leadership. The course addresses itself primarily to the study of the most important aspect of management from a military viewpoint, the management of men. The course commences with a study of the principles of group behavior, progresses through a study of behavior of individuals and groups in Air Force situations, and then considers the Air Force administrative framework as it affects the decision-making process of Air Force managers.

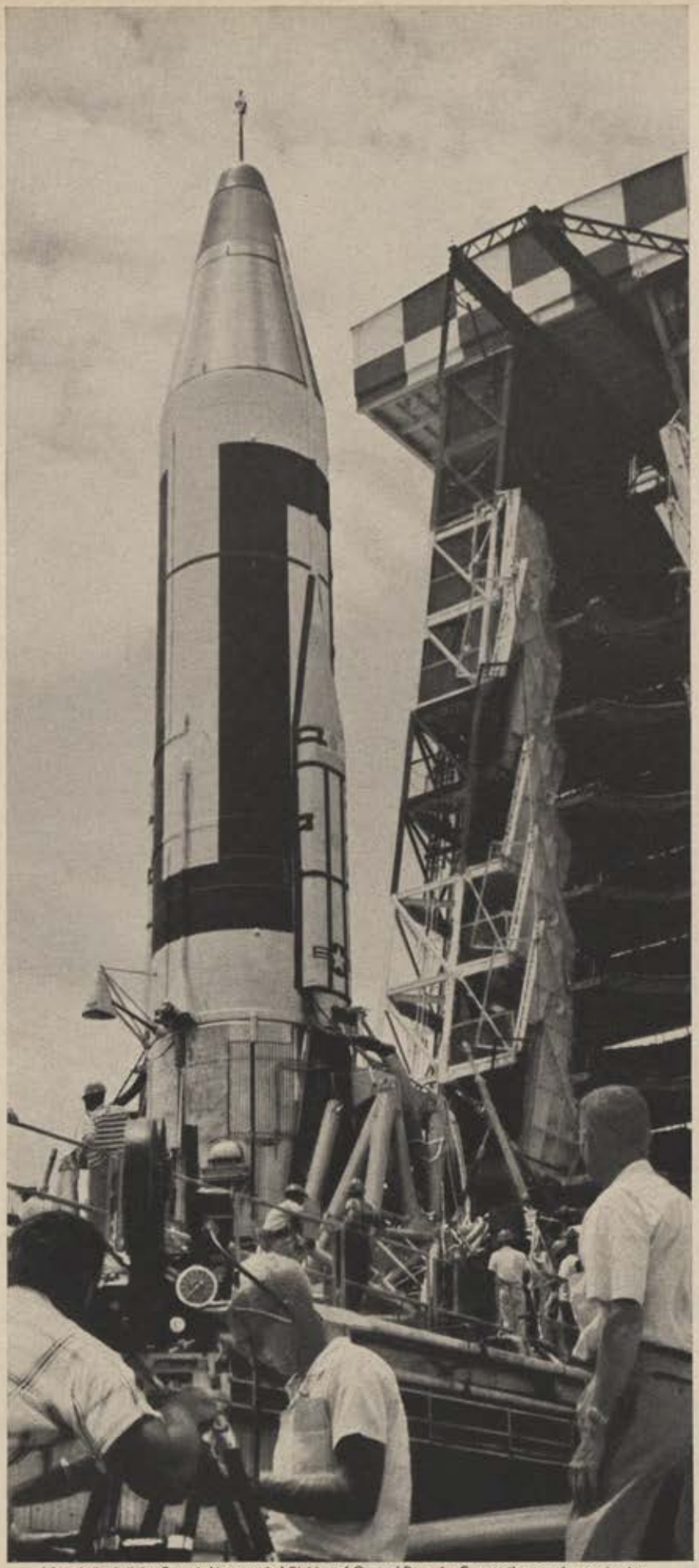
The Department of Leadership Studies also sponsors a two-week temporary-duty trip for each Cadet to an operational unit of one of the three combat commands —TAC, SAC, or ADC. Called "Operation Third Lieutenant," it gives each Cadet an opportunity to perform the duties of and to assume the status of a junior officer.

(Continued on page 77)



Martin Company's Denver plant, which produces Titan missile, is within easy field trip distance for Cadets.

Skull work with dead reckoning navigation trainer, a routine procedure before training flight aboard a T-29.



Atlas missile, built by Convair (Astronautics) Division of General Dynamics Corporation as prime contractor.

RCA ELECTRONICS CUTS DOWN THE COUNTDOWN

To our missile experts, "is it ready" is almost as important as "how far can it go." For retaliatory power, missile crews must be able to launch a maximum number of missiles in rapid fire order.

America's intercontinental ballistic missile, the Atlas, had already proved itself for distance—6,000 miles or more. But checkout and launching took several hours. So the next step in turning the missile into an operational weapon was to make it ready for quick action. RCA was selected to build an electronic system that would radically reduce the countdown time at the Atlas Operational Bases now under construction.

Now, in a matter of *minutes*, this elaborate electronic system can determine if any part needs attention—or signals that the missile will be ready to go.

This automatic checkout equipment and launch control system for the Atlas is one more of the many ways in which RCA Electronics works to strengthen our national defense.

RADIO CORPORATION OF AMERICA

RCA

BURROUGHS COMPUTATION GUIDES ATLAS INTO ORBIT

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He may have been in excellent shape when he entered the Academy, but he'll be in even better form when he leaves.

The dangers of hypoxia. Cadets in the altitude chamber learn high-altitude hazards at a simulated 35,000 feet.

After nine months of concentrated study, concurrent with the assumption by Cadets of minor leadership positions within the Cadet Wing, the second classman should have some insight into the complex subject of military leadership.

During his final year at the Academy the Cadet has ample opportunity to exercise leadership within the Wing. It is first classmen, primarily, who administer the basic Cadet training program.

The Cadet navigation program, presented by the Department of Navigation under Col. C. C. Barthel, provides 593 hours of classroom instruction and 171 hours in the air. It is a complete course with the same standards as the navigation training program of the Air Training Command and qualifies the Cadet as an aerial navigator. It is, in addition, good background for the study of missile operations.

Following his basic Cadet training introduction to flying, the Cadet receives eighteen hours of physiological indoctrination. Here he learns the physical characteristics of the atmosphere and their effects on airmen. He is given, as part of this course, a two-hour simulated flight in the altitude chamber. Emergency procedures learned in the previous summer course are practiced during a three-hour flight mission in a T-29 aircraft.

An additional eight hours of physiological instruction are given in the third class year. Then comes a two-week period spent at an Air Force Primary Pilot Training School of the Air Training Command. Cadets become familiar with the techniques and problems of piloting aircraft. Approximately eight hours of dual instruction are given in T-37 jet-type trainers. In addition to flying, the Cadet receives related ground schooling.

In the second class year formal navigation training begins. Continuing into the spring term with the study of fundamentals, Cadets learn about the history and basic problems of navigation, gaining a thorough background in fundamentals. Toward the end of the year, they progress to celestial navigation and flight plans. They then take up the theory of meteorology. Presentations in the Academy's planetarium are given to portray celestial-terrestrial relationships. Third classmen also fly several navigation missions of five hours each in the T-29.

The Cadet moves on to the use of radar navigational aids in conjunction with dead reckoning. Radar operating procedures and the problems of scope interpretation are practiced on ground radar trainers. Pressure pattern navigation comes next. Flights include practice of celestial and radar techniques.

In his final academic year at the Academy, the Cadet spends sixty airborne hours integrating all of the navigational techniques he has learned by flying simulated operational navigation missions, including overwater flights. In-flight requirements are progressively increased in stiffness throughout the term. Upon graduation each Cadet is a highly qualified rated Air Force navigator who has an immediate usefulness as a member of an aircrew and a good foundation for postgraduate study of a number of related aerial and technical areas.

An intensive physical education program in the form of sports instruction and intramurals is conducted by the Department of Physical Education, a part of the Airmanship Studies Division.

The Department of Physical Education, under the direction of Lt. Col. C. J. Myslinski, prepares the Cadet for a physically active career. The first objective is to condition him so that he will be able to cope with the many physical demands of Cadet life without undue strain.

Cadets receive instruction in the fundamentals of most sports including boxing, judo, gymnastics, and swimming, and participate in seasonal intramural sports. Individual grades are reviewed and Cadets of doubtful physical proficiency are given extra body-building training. Through the four years, each Cadet participates in intramurals two afternoons per week unless he is a member of an intercollegiate squad.

While the activities of the four airmanship departments are indeed diversified, they share the common aim of contributing to the immediate needs of first-rate young professional officers who are able to meet successfully the many challenges of their careers.—END

Col. H. L. Hogan, III, is Director of Military Studies at the Academy. His military service began in 1938 when he enlisted in the Army, in which he served for two years before entering West Point. He earned his pilot's wings while at West Point, from which he was graduated in 1943. He served in Italy during World War II.

Another phase of the stringent physical education program. Two Cadets vie in a wrestling match at the Academy gym.

On the following six pages are pictures of the 207 members of the first graduating class of the Air Force Academy. All photographs were taken by Tony Darnell, Newsfoto Publishing Co., San Angelo, Tex.

ADAMSON, HERBERT A.
Brigham City
Utah

AKERS, HOWARD T.
Los Angeles
Calif.

ANDERSON, DAVID D.
St. Johns
Mich.

ANDERSON, THOMAS I.
Montgomery
Ala.

ARCHINO, DAVID T.
Selbyville
Del.

AXLUND, ROGER C.
Sioux Falls
S. D.

BARNARD, ROBERT K.
Portland
Ore.

BARNWELL, ULES L., JR.
Greenville
S. C.

BARTHOLOMEW, JAMES O.
Burlington
Iowa

BECKEL, ROBERT D.
Walla Walla
Wash.

BENDER, CHARLES G., JR.
Marietta
Ga.

BIGELOW, RICHARD M.
El Paso
Tex.

BLACK, JON D.
Johnson City
Tenn.

BLACKWELL, JAMES R.
Providence
Ky.

BLAKE, ROBERT E.
Kelly AFB
Tex.

BOBKO, KAROL J.
Seaford
N. Y.

BOWEN, THOMAS G.
Decatur
Ga.

BROOKS, DON L.
Jefferson
Tex.

BROWN, JAMES W., III
Caruthers
Calif.

BROWNING, ROBERT L.
Clinton
Miss.

BRYAN, JACK B.
Felt
Okla.

BUCKLES, ROBERT C.
Fort Sam Houston
Tex.

BURCH, GEORGE W.
Silverdale
Wash.

BURGHARDT, STANLEY K.
Westbury
N. Y.

BURTON, JAMES G.
Normal
Ill.

BUSS, MARVIN W.
Clay Center
Kan.

CANTERBURY, HENRY D.
Huntsville
Ala.

CARNS, MICHAEL P. C.
(Parents
overseas)

CARPENTER, JAMES T.
Fredericktown
Ohio

CARR, RICHARD E.
East Hartford
Conn.

CHAPMAN, JAMES E.
East Point
Ga.

CHASE, DONALD T.
South Milwaukee
Wis.

CHEPOLIS, ROBERT J.
Pinebrook
N. J.

CLARK, GEORGE C.
Corpus Christi
Tex.

CONANT, ROGER G.
Skowhegan
Me.

FIRST GRADUATING CLASS

CONNALLY, JAMES W. (Parents overseas)

COOK, CURTIS G. Corning N. Y.

COTTON, LAWRENCE F. (Parents overseas)

COUNTS, ROGER L. Navarre Ohio

CULLER, HARRY H., JR. San Antonio Tex.

CWACH, EMIL E., JR. Yankton S. D.

DAVEY, JOHN M. North Kingstown R. I.

DAVIS, CHARLES R. Pico Calif.

DAVIS, HOWARD D. Leavenworth Kan.

DAVIS, WILLIAM S., III Demarest N. J.

DELLIGATTI, ROBERT Hialeah Fla.

DERRICKSON, THOMAS G., II Los Altos Calif.

DE SANTIS, JOSEPH G. Kearny N. J.

DOLAN, JOHN W. Northridge Calif.

DOREY, LEE R. Richmond Va.

DOUSKEY, PAUL T. New Milford Conn.

DWYER, ROBERT J. Elmira Heights N. Y.

ELSBERND, GERALD F. Calmar Iowa

ELSER, ARTHUR G. Centereach N. Y.

FAY, ROBERT H., JR. Quincy Mass.

FERRARI, CHARLES J. Jamaica Plain Mass.

FINNERAN, GERARD B. Larchmont N. Y.

FLETCHER, JAMES K. San Antonio Tex.

FORTNER, LARRY D. Dayton Ohio

FOX, RONALD C. Stockton Calif.

GAGLIARDI, ALBERT A., JR. Newport R. I.

GALIOS, STEPHEN E. Napa Calif.

GALLO, JON A. Sheppard AFB Tex.

GARBER, GARES, JR. Alexandria Va.

GARVEY, GERALD J. Chicago Ill.

GAUNT, JOHN J., JR. Little Rock Ark.

GIVENS, WALTER C. Pearisburg Va.

GOETZE, RICHARD B., JR. Cos Cob Conn.

GOLD, WILLIAM H. Natrona Heights Pa.

GOODRICH, DAVID M. San Antonio Tex.

GRAFFLIN,
DOUGLAS G., JR.
Chappaqua
N. Y.

GRIFFIN,
DAVID E.
White Oak
Tex.

GROARK,
DAVID H.
Philadelphia
Pa.

GULLEDGE,
JOHN F.
Sallisaw
Okla.

GUNTER,
JAMES P., JR.
Bon Air
Va.

HALBOWER,
HARLOW K.
Anthony
Kan.

HAMER,
STEPHEN A.
Hohokus
N. J.

HAMMOND,
FLAYE M., III
Rocky Mount
N. C.

HARDAGE,
DANIEL W.
Lindsay
Okla.

HARNITCHEK,
JOSEPH A.
Philadelphia
Pa.

HAYES,
JOHN G., JR.
San Mateo
Calif.

HAYES,
JOHN R., JR.
Shreveport
La.

HESTER,
FLOYD R.
Indianapolis
Ind.

HILBERT,
RICHARD M.
Larchmont
N. Y.

HOLMES,
RANSOM S., III
Westport
Conn.

HOSMER,
BRADLEY C.
Dunseith
N. D.

HOUSE,
THOMAS D., JR.
Decatur
Ga.

HOUSTON,
JOHN G.
Portland
Ore.

HOWELL,
JOHN M.
Fort Collins
Colo.

HUNDEMER,
JOHN R.
Dayton
Ky.

HUNT,
LEIGH H., JR.
Layton
Utah

HURLEY,
ROBERT L.
Long Beach
Calif.

HUTCHINSON,
JOHN F., JR.
Venice
Fla.

INNESS,
GEORGE R., JR.
Donaldsonville
La.

JAY,
JIMMIE L.
Sweetwater
Tex.

JEFFERSON,
WAYNE O., JR.
Washington
D. C.

JENNINGS,
ROBERT S. F.
Colonia
N. J.

JOHNSON,
HANSFORD T.
Aiken
S. C.

JOHNSON,
THEODORE B.
Corning
N. Y.

JOLLY,
LAWRENCE M.
Willits
Calif.

JOSEPHSON,
EDWARD H.
Concord
N. H.

JOZWIAK,
THOMAS J.
Detroit
Mich.

KAAKE,
CHARLES A., JR.
Imlay City
Mich.

KAY,
CONRAD M.
Taos
N. M.

KEEZELL,
NATHANIEL H., JR.
Harrisonburg
Va.

FIRST GRADUATING CLASS

KINGSLAND, LOUIS, JR.
Midland Park
N. J.

KOZELKA, ROBIN M.
Springfield
Ill.

KRUEGER, LORIN B., II
Trenton
N. J.

LANKENAU, EDWARD F., III
Oceanside
N. Y.

LANMAN, RONALD T.
Lexington
Ky.

LASEN, PAUL S.
Kansas City
Kan.

LEE, JOHN E.
Fayetteville
Ark.

LEE, RICHARD D.
Kalamazoo
Mich.

LENTZ, DANA C.
(Parents overseas)

LIVINGSTON, DONALD B.
Englewood
N. J.

LOFTON, CHARLES M., JR.
Newport
Ark.

LOVERIDGE, ROBERT T.
Dillon
Mont.

LOVRIEN, CLARK E., JR.
Milwaukee
Wis.

LOWE, ROBERT E.
Auburn
Mass.

LYNCH, EDWARD J.
Philadelphia
Pa.

MADONNA, DONALD E.
Denver
Colo.

MAHONY, LEONARD J., JR.
Elmhurst
N. Y.

MANTEI, JOHN E.
Marne
Mich.

MASON, RICHARD A.
Mt. Vernon
Mo.

MAY, CHARLES A., JR.
Silver Spring
Md.

McDONALD, GERALD B.
Dexter
N. Y.

McLAIN, WILLIAM L., JR.
Pittsburgh
Pa.

McMONIGAL, JAMES C.
Berlin
Wis.

MEIER, CHARLES H., JR.
Lynbrook
N. Y.

MELANCON, JOHN M.
Pineville
La.

MERZ, MELVIN J.
St. Louis
Mo.

MIHOLICK, JAMES I.
(Parents overseas)

MILLER, CRAIG V.
Humboldt
Iowa

MILLER, DONALD W.
Hamburg
N. Y.

MILLER, MAX I., JR.
Greensboro
N. C.

MILLIGAN, JOHN C.
Pittsburgh
Pa.

MILTNER, JOHN H.
Cadillac
Mich.

MITCHELL, JAY N.
Artesia
N. M.

MONTAVON, KENT
Denver
Colo.

MONTGOMERY, EDWIN J., JR.
Fair Oaks
Calif.

MORGAN,
JOSEPH D., III
Gainesville
Fla.

MURPHY,
MICHAEL C.
Bronx
N. Y.

MUSMAKER,
PATRICK L.
Greenfield
Iowa

OAKS,
ROBERT C.
Provo
Utah

OBERDIER,
LYN D.
Toledo
Ohio

OLSON,
JOHN A.
Helena
Mont.

OLSON,
NORRIS O.
Brocket
N. D.

O'NEIL,
JAMES F.
Flushing
N. Y.

PAGE,
WILLIAM E., JR.
Binghamton
N. Y.

PARKER,
BRIAN T.
Baltimore
Md.

PENN,
RICHARD L., JR.
Decatur
Ala.

PETERSON,
ROGER H.
Indianola
Iowa

PHILLIPS,
DAVID J.
Burbank
Calif.

PITTMAN,
WAYNE C., JR.
Otis AFB
Mass.

POLLARD,
MELVIN E.
Odessa
Tex.

PRESCOTT,
LEO L., JR.
Kinston
N. C.

QUIGLEY,
NORMAN P.
Buhl
Idaho

REARDON,
MICHAEL P.
North Scituate
Mass.

REED,
JAMES M., JR.
Ann Arbor
Mich.

REEVES,
JOHN M.
Valley Station
Ky.

RHODES,
JAMES M., JR.
(Parents
overseas)

RICHART,
DAVID K.
Richmond
Va.

RICHERS,
SHERWOOD A.
Bay City
Tex.

ROBERTS,
ROSCOE R., III
Fairborn
Ohio

RODGERS,
CHARLES S.
St. Paul
Minn.

ROSANE,
EDWIN L.
Pasco
Wash.

SCHAUM,
CRAIG O.
Willmar
Minn.

SCHEMENAUR,
ROGER E.
Bangor
Mich.

SCHMIDT,
KARL W.
Havertown
Pa.

SCHMIDT,
WALTER E.
Wauwatosa
Wis.

SEE,
DENNIS R.
Uniontown
Ky.

SEIZYS,
ANTHONY W.
Philadelphia
Pa.

SHAFER,
JONATHAN S.
Lake Forest
Ill.

SHAFFER,
JON G.
Brookville
Ohio

SHEARIN,
DAVID R.
Chattanooga
Tenn.

FIRST GRADUATING CLASS

SHUMATE, ARTHUR K.
St. Cloud
Fla.

SITEMAN, ROBERT H.
Los Angeles
Calif.

SMITH, JIMMIE L.
Waupaca
Wis.

SMITH, KENNETH R.
No. Hollywood, Calif.
& Midland, Tex.

SMOTHERMON, PHILIP R.
Pueblo
Colo.

STACK, THOMAS P.
(Parents
overseas)

STARRETT, SAMUEL D.
Indianapolis
Ind.

STEVENS, JOHN R.
Niagara Falls
N. Y.

STROM, BROCK T.
Ironwood
Mich.

TELFORD, WILLIAM D.
Brooklyn,
N. Y.

THOMAS, EUGENE A.
New Orleans
La.

THOMPSON, KENNETH R.
Bay Shore
N. Y.

THOMSON, LAURENCE J.
Billings
Mont.

TODD, HAROLD W., JR.
Kennett Square
Pa.

TONEY, WILLIAM M.
El Dorado
Ark.

TRACEY, RICHARD E.
Washington Court
House, Ohio

TRAIL, RICHARD L.
McCook
Neb.

ULMER, JOHN W., JR.
Houston
Tex.

VANCE, JAMES C.
Bazine
Kan.

VOSIKA, EUGENE L.
(Parents
overseas)

WARREN, JAMES E.
Blythe
Calif.

WATERS, ALBERT L.
Bridgeville
Del.

WEAVER, JAMES R.
Lima
Ohio

WELCH, JAMES C.
Speedwell
Tenn.

WEST, JAMES E.
Granite City
Ill.

WIDEMAN, HUBERT G., II
Perrysburg
Ohio

WILDER, ROBERT L.
Antwerp
N. Y.

WILLIAMS, ROBERT F.
Massillon
Ohio

WINTERS, CHARLES P.
Denver
Colo.

WOOD, DEAN C.
Newbury
Mass.

WYNN, FREDERICK B.
Jackson
Tenn.

ZALESKI, CHARLES D.
Carterville
Ill.

A Graduate Looks Back ...and Ahead

Cadet Richard D. Lee
CLASS OF 1959, US AIR FORCE ACADEMY

AS A MEMBER of the US Air Force Academy's first graduating class, I have been thinking back over the past four years a great deal in recent days. I have also been thinking about the future. So, I am sure, have my classmates.

I believe most of us feel that there are major challenges ahead of us. But then, there are a few behind us too—wrapped in memories of four busy years now drawing to a close.

On this point I am certain we all agree. Our fourth class year, the first at the Academy, was not an easy one. Fourth class years are not meant to be. Entering the Academy from civilian status was, in my experience, like plunging into a pool of ice water. Those early months are difficult to describe, in fact hard to remember in detail except as a period of suddenly experienced, tightly clamped discipline, rigorous academic, physical, and military training—and a dawning sense of self-discipline, honor, and accomplishment.

Lt. Gen. Hubert R. Harmon was our first Superintendent at Lowry AFB, Colo. The General was a great man. We came to love and respect him. He was deeply interested in the Academy and us as individuals. One time, on a Sunday afternoon, he walked from one end to the other of our dormitories to see for himself that we were well and having a day of rest. This was during a rough period of training. To a fourth classman who double-timed from 0555 on Monday morning until 1530 on Saturday afternoon, this sort of act—typical of General Harmon—meant a whole lot.

In the first few months of our life at the Academy we were given an Honor Code and system recast from those of West Point and Annapolis. We were told to take this code and system and live it and enforce it among ourselves. From this small beginning, the Cadet-administered Honor Code developed to what we have today, a practiced ideal of which we all are extremely proud.

In the first year, also, we began a broad and stiff curricu-

Part of the pressure. Back in 1955, specially chosen young USAF officers acted as upperclassmen, inspected Cadets.

European tour was profitable cultural experience. Cadets visited USAF bases, are shown here during time in Wiesbaden.

A leader of today with a leader of tomorrow. Cadet Lee chatted with newly appointed Commander, Air Research and Development Command, Lt. Gen. Bernard A. Schriever, when the former Ballistic Missile Division chief visited the Academy.

lum in mathematics, science, and liberal arts. This was to be the pattern throughout the rest of our academic career at the Academy. I believe we have touched upon nearly every field of academics. We have ranged from economics, English, and political science to the complex areas of astronautics and thermodynamics. We have been taught Air Force doctrine and have studied military history. I am not a specialist but have been exposed to a broad range of subjects. The Academy has succeeded, I would say, in giving us the "big picture."

Academy life has not been without its humor. The Superintendent arrived one morning to find an F-100 parked on the sidewalk in front of his office. Another bright morning found the Vice Commandant of Cadets trying to figure out how to get a T-6 from the quadrangle through a maze of telephone poles and dormitories back from whence it came. A Cadet helped solve the problem. One day the Air Training Officers found a howitzer on their front porch, muzzle toward the door.

Some of the high spots of our four Academy years came in summer training. During our second summer (our first was spent in Cadet basic training) we had two weeks of pilot indoctrination. This was an important step in our careers. Ten hours of indoctrination in T-34s and T-28s were just enough to whet our appetites. Then we spent quite a bit of time becoming acquainted with the Air Force and how it operates. We visited bases of various commands to learn about supply, base operations, and internal aspects of an Air Force base. We learned much about what is needed to keep aircraft in the air.

The next summer we were given the opportunity of seeing the Air Force in actual combat-ready operation in Europe. The trip was voluntary; each of us had to decide whether a month in Europe was worth giving up a month of seeing our families and friends on summer leave. I felt that the trip to Europe was one of the most valuable parts of my training at the Air Force Academy. This was our opportunity to see not only the Air Force in operation, but to meet European people. On returning to the States, we visited SAC, TAC, and ADC operational units within the continental United States. Here we learned more about the Air Force and how it is run.

Our final summer was devoted to helping run basic training for the incoming fourth class. This was the test of three years of leadership training.

While one-half of our class trained the "doolies" (or fourth classmen), the other half went on leave. We again were given the option of going abroad. This time sixty of us departed on a three-week tour of the Air Force in the Far East. We were warmly received by Japanese, Nationalist Chinese, and Filipino people as well as by Air Force personnel.

We returned to train the fourth class and move from Lowry to our permanent site north of Colorado Springs. Our initial impressions of the site were many and varied, but most of us seemed to feel that this beautiful, gigantic home of glass, stone, and aluminum was hard and cold. The first few times that we found ourselves lost in a labyrinth of halls and rooms, these feelings were reinforced. Only after nearly a full year of living here does it seem like a home. We have watched it grow, and have become a part of it and it a part of us.

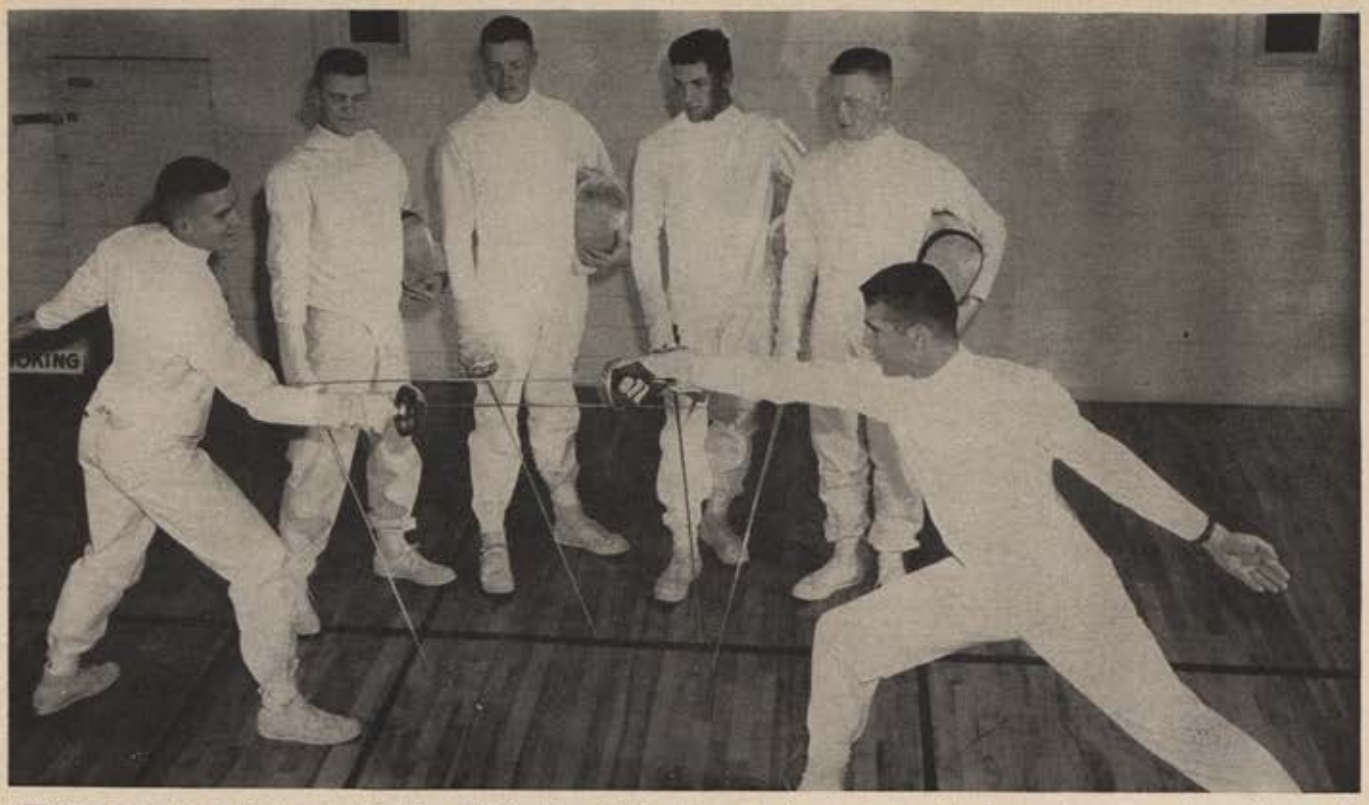
The year is finished now. Four years of training and experience are behind us. We have, of course, had our difficulties and suffered our doubts. We have lost about one-third of our class to them. Some left because of academics, some to get married, others because Air Force life was simply not their game.

Now, after four years of work, we will gain the rewards of our efforts. Upon graduation, we will receive bachelor of science degrees, navigators' wings, and shiny, new gold bars. Most of us will go to flight school.

After the training we have received, it is reasonable to expect that the service is going to look for a little extra from us. How much? Will we be able to perform up to expectations?

The Academy, as well as its early classes, will be on trial as we and other classes perform our Air Force duties. The proof of the Academy's worth will be found in the number of us dedicated to the service of our country. It will be found in the number of outstanding airmen and national leaders developed among Academy graduates. Or, in other words, the ultimate test of our great, new Academy lies in how well its graduates complete the mission set forth and begun in Cadet days. Now watch our smoke.—END

Cadet Lee, a member of the class of 1959, is the son of Mr. and Mrs. Charles H. Lamkin of Kalamazoo, Mich. After graduation, he reports to Moore AFB, Tex., for pilot training. While at the Academy, he served as news editor of the Talon, *the Cadet magazine. Prior to coming to the Academy, he attended Western Michigan College and Kalamazoo College. He has served as a first lieutenant in the Civil Air Patrol, and in high school he was active in extracurricular programs, with two letter years in football and track, and a stint on the sports staff of the school paper.*



"Winning teams against considerable odds": Few Cadets fence before entering Academy, but teams have done well.

THE ATHLETIC PROGRAM

Fields of Friendly Combat

Col. George B. Simler
DIRECTOR OF ATHLETICS

THE AIR Force Academy recognizes intercollegiate athletics as an integral part of the Cadet curriculum. There are three distinct and important phases of Cadet life: academic, military, and athletic. We consider that academics and military education, while decidedly more important, must be properly augmented by intercollegiate sports as well as physical education and intramural programs.

We also know that if the constructive character of athletics is to be maximized, it is essential that the Cadet athlete be representative of the student body to which he belongs. This requires that he fulfill academic and military requirements on the same basis as any other Cadet.

The mission of the Department of Athletics is to oversee the intercollegiate athletic program. In addition, it assists in the conduct of Cadet intramurals and physical education, and recreational, cadet welfare, and cultural activities designed to fulfill the over-all mission of the Academy.

Intercollegiate athletics help build *esprit de corps* for Cadet participants, Cadet spectators, and the Air Force in general. They supply an excellent rallying point for Cadet energies.

In view of the limitation of time available for practice and the heavy requirements of academics and military education, we cannot expect to lead the nation annually in all sports. However, we should be able to compete favorably across the board with most leading colleges and universities. We believe that athletics should be kept in proper perspective, but also should be encouraged to develop to a degree where the Academy can assume an above-average position in major national intercollegiate rankings.

The department is one of the four major staff offices that report directly to the Superintendent. Intercollegiate athletics at all four service academies are supported by non-appropriated funds; thus, like our sister academies, we have found it necessary to form an organization to carry out the business functions of an intercollegiate athletic program.

The Air Force Academy Athletic Association was established in October of 1954. It is designated by the Department of the Air Force as the "operating agency" through which the Superintendent of the United States Air Force Academy exercises control over the participation of Air Force Cadets in intercollegiate athletics. It consists of 17,000 members. An Air Force Academy Athletic Association executive council composed of the Commandant of Cadets, Dean of Faculty, Professor of Law, Academy Chief of Staff, and

(Continued on page 88)

Handicapped by service height limitation, Academy five wins more than it loses, produced an All-American star.

Gymnasts, in workout here, won team title at University of Colorado annual invitational meet late in February.

FAR RIGHT, rooters at Cotton Bowl: "*Elan vital* is the gift of the first four classes of the Academy to all future classes. . . ."

RIGHT, football coach Martin received fans' club trophy after the victorious 1958 season. The gridiron "success story" was written by "a host of authors."

BELOW, All-American Brock Strom (75) hits Texas Christian man with hard block to shake teammate loose in an exciting play of Cotton Bowl game.

Cadet Don Livingston, '59, crossing finish line first in three-way meet. Livingston was consistent winner.

Soccer is a popular sport at the Academy. Here team scrimmages with Rocky Mountain rival, Colorado College.

the Director of Athletics establishes the policies under which intercollegiate athletics are to be conducted. Council decisions are forwarded to the Superintendent for approval. The Director of Athletics is charged with implementing them.

Last fall, national attention focused on the Air Force Academy football squad. The team achieved an outstanding 9-0-1 season's record against such top teams as Iowa, Stanford, and Colorado. The "Fabulous Falcons"—so dubbed by sports writers and newscasters throughout the country—went on to play a scoreless tie with the Southwest Conference Champion, Texas Christian University, in the Cotton Bowl last New Year's Day.

Along the way, the Falcons held Iowa, top-ranked team in the nation, to a 13-13 tie. Iowa walked over California in the Rose Bowl. This game, in which the Academy scored a magnificent upset by tying tough Iowa, was the major highlight in a season of highlights that moved the Falcons into the national football picture for the first time.

The success story written on the football field in 1958 had a host of authors. The team members, of course, deserve the lion's share of the credit. Ben Martin, our new, youthful coach, is a man of considerable talent and dynamic personality. Last season was his first with us. A graduate of the US Naval Academy, he is a man of integrity who couples an understanding of Cadets with great leadership ability. He has had great impact on the Academy. Coach Martin's able staff also contributed a major share to the season's achievements.

While the 1958 Falcons may not be classed historically with the great Navy and Army elevens of 1926 and 1946 respectively, or the Four Horsemen and Seven Mules of Notre Dame, they will be remembered as the team which placed the Air Force Academy in its proper position on the national intercollegiate scene.

The Cadet Wing's support of the football team, notably against Iowa and Oklahoma State, when victory was snatched, 32-29, in the closing moments, is worthy of more than passing mention. This self-generated *élan vital* is the gift of the first four classes of the Academy to all future classes and to the entire United States Air Force. The *esprit de corps* thus demonstrated is today equal to that of the most venerable military schools in the world.

The Academy has been proudly represented on many other fields of athletic combat. Academics, in themselves, present a challenge worthy of most Cadets; add military studies and aerial training, and any Cadet is justified in feeling great personal pride in achieving the goal of graduation. However, the entire Wing has been aware of the necessity in these early years of the Academy for achievements over and above those that might be normally expected elsewhere.

In all varsity sports this desire for achievement has been prevalent and adequately demonstrated. To mention a few, we have had winning teams against considerable odds in basketball, fencing, track, soccer, and rifle, with the latter sport producing our first All-American. These successes can be basically attributed to personal desire and excellent coaching, but most of all to the will and determination of these first Cadets to make their mark for their young school.

Among the many individual Cadets who have contributed to the over-all success of the intercollegiate program are a few who deserve special mention. The first All-American at the Air Force Academy was Cadet Bob Siteman, named to the 1958 All-American Rifle Team. He was followed by Cadet Brock Strom (Football 1958) and Cadet Bob Beckel (Basketball 1959). Cadet Strom is also one of the outstanding students in the Class of 1959, and Cadet Beckel has served as Cadet Wing Commander.

Others will follow in their footsteps, and many outstanding athletes still in high school are looking forward to the opportunity of an Air Force career. The high school athlete, one should note, must meet requirements for entrance set up for all Cadets.

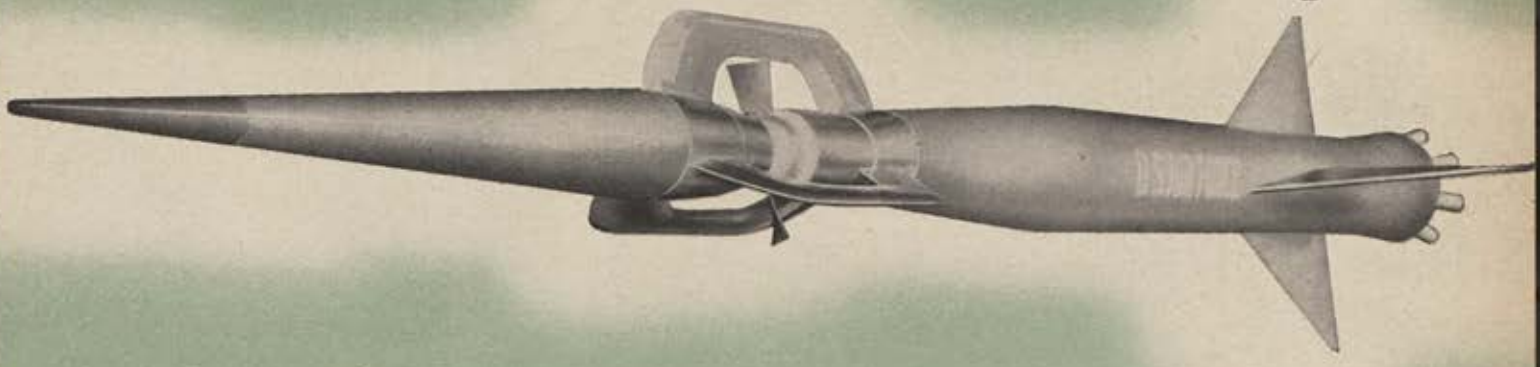
So far as the future is concerned, we plan to continue our rigorous fifteen-sport varsity program. We hope, in addition, to field at least two more teams in the near future in hockey and lacrosse. The total of seventeen intercollegiate teams is six more than the national average.

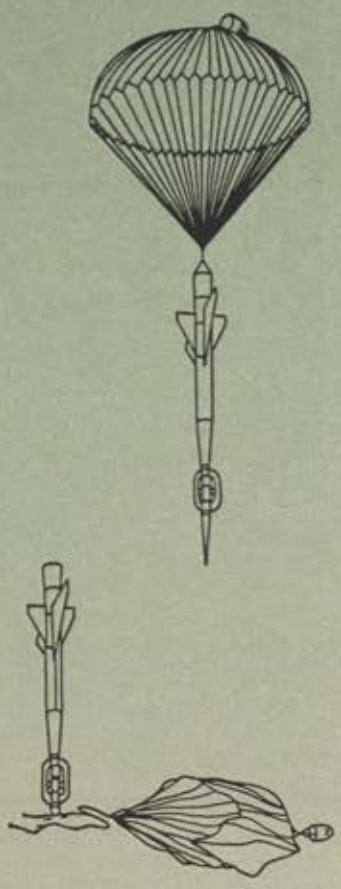
We strongly believe that this intercollegiate program, along with others in which the department assists, contributes substantially to the over-all development of the Air Force Cadet.—END

Col. George B. Simler, Director of Athletics, won his wings in 1942, after Aviation Cadet training. He had earlier served in the Navy. He served in Europe during the war, later taught Air Science at the University of Maryland. In 1953, he coached 86th Fighter Wing football team in Germany to a USAF European championship.

APGC..

– Symbol of teamwork with American Industry





The AIR PROVING GROUND CENTER, located at Eglin Air Force Base, Florida, is one of the test and development centers of the AIR RESEARCH AND DEVELOPMENT COMMAND of the USAF. As part of its overall mission, APGC is responsible for research, development, test, and evaluation of guns and other aircraft weapons, ammunition, rockets, bombs (except nuclear weapons), fire control components and systems. Typical of the development programs being conducted by APGC is the TDU-9/B supersonic tow target. This unique target, designed and produced by Hayes Aircraft Corporation, provides years-ahead capability to the Air Force in the training of personnel in missilery, rocketry, and modern gunnery.

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The TDU-9/B tow target development is one of several contracts which Hayes Aircraft Corporation has with the Air Proving Ground Center. As such, it is another fine example of the Air Force-Industry team working towards a more secure America.

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Torque Transmitter	CGC-8-A-7	26	100	.54	11.8	206	8.5	–	–	–	–	–	–	37	12	54 + j260	12 + j45	80 + j20	30	7
Control Transformer	CTC-8-A-1	–	–	–	–	–	–	11.8	.087	.21	23.5	411	9	143	24	210 + j690	28 + j114	250 + j73	30	7
Control Transformer	CTC-8-A-4	–	–	–	–	–	–	11.8	.030	.073	22.5	393	8.5	365	64	470 + j1770	81 + j330	590 + j190	30	7
Torque Receiver	CRC-8-A-1	26	100	.54	11.8	206	8.5	–	–	–	–	–	–	37	12	54 + j260	12 + j45	80 + j20	–	30 sp.
Electrical Resolver	CSC-8-A-1	26	.038	.39	10.8	189	20	11.8	.080	.25	23.5	411	11	230	27	270 + j630	39 + j142	340 + j67	30	7
Electrical Resolver	CSC-8-A-4	26	.038	.39	26	454	20	26	.030	.23	21.5	376	12	230	170	270 + j630	250 + j830	340 + j67	30	7
Torque Differential	CDC-8-A-1	–	–	–	–	–	–	11.8	087	.21	11.5	204	9	36	24	38 + j122	28 + j114	47 + j13	30	7
Vector Resolver	CVC-8-A-1	26	100	54	11.8	206	8.5	–	–	–	–	–	–	37	16.5	54 + j260	19 + j60	80 + j20	30	7

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THE RELIGIOUS PROGRAM

The Academy considers religion an important part of the life of the Cadet. Protestant, Roman Catholic, and Jewish services are held weekly. Attendance is compulsory until the final six months of Cadet life. Before each meal of the day at the Academy, Cadets pause together for a silent prayer.

Presiding over Academy religious life are Col. Charles I. Carpenter, Staff Chaplain, a Protestant, and Chaplain (Col.) Constantine E. Zielinski, a Roman Catholic. Services for Jewish Cadets are made available with the assistance of Temple Bethel, Colorado Springs.

Here Father Zielinski, speaking for the Academy's religious staff, discusses a military man's eternal faith in a world of change.

Religion touches numerous facets of Academy life. Here Roman Catholic Chaplain Zielinski performs ring-blessing ceremony for Cadets and their fiancees after Class of '59 received Academy first class ring in May of last year. Chaplains face heavy schedule of post-graduation weddings.

Eternal Faith in a World of Change

Chaplain (Col.) Constantine E. Zielinski
ROMAN CATHOLIC CADET CHAPLAIN, US AIR FORCE ACADEMY

CADETS at the US Air Force Academy belong to a generation privileged to witness the world's transition from an age that died to an age that was born. Their calling is to prepare for leadership in this new-born age.

The preatomic era is no more. Even the present atomic age has become overshadowed by the impact of the dawning space age. New frontiers of compelling challenge continue to open up in awesome sequence.

In a period of unprecedented scientific advances, one might well be tempted to conclude that change has become absolute. Yet, amid this ever-changing scene man remains substantially unchanged. True, his vision now touches upon horizons that a few short years ago belonged to the domain of pure fiction. However, the human mind, will, and heart behind that vision are ever the same.

Man still needs proper ideals as the motivating force of his life. Man still needs strength of character to achieve those ideals. No new technological advance can ever alter that fact. Without ideals human endeavor is doomed to the frustrating level of mere self-seeking. Without strength of character man drifts aimlessly without a rudder.

Life is motion. It cannot remain static. However, its direction depends upon man's own decision. On the one hand, he can bend the motion of life inwardly and thus make selfish interests his ultimate goal. Again, he can bend it outwardly—beyond mere self-interest—to the realm of ideals which, since they are greater than self, are capable of satisfying his noblest aspirations.

This latter approach to life is but another expression of

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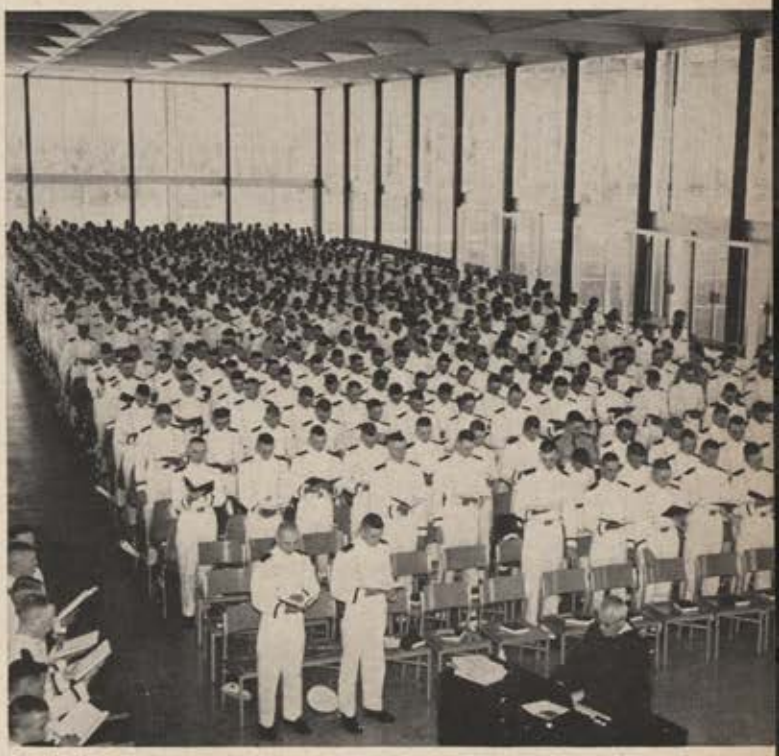

Protestant services in massive Academy Dining Hall. The seventeen-spire Academy Chapel, soon to be erected, will tower above other buildings in Cadet-academic complex.

Sunday school class on Academy grounds. A number of Cadets teach these classes besides attending services.

These two Cadets followed compulsory Sunday chapel by taking members of Sunday school group for nature walk.

Christianity's fundamental paradox: the finding of one's soul by the process of losing it. It is axiomatic that man becomes smaller to the degree that he concentrates on self-interest; greater to the degree that he rises above self. Call it morale, *esprit de corps*—whatever you will. The hard fact stands. Only by becoming bigger than self does one gain the full stature of manhood.

Religion plays an indispensable role. It gives man an anchor. It imparts essential purpose to life itself. It gives meaning to the challenges of sacrifice in the name of duty and honor by relating them to the unchanging values inherent in man's relationship with and responsibility to his Creator.

It is for these cogent reasons that the space age cannot afford to be less godly than the ages that preceded it. Divine and human values remain the same. Chapel spires will soon dominate the Cadet complex at the Air Force Academy, each spire a reminder that worthy aspirations must rise above petty self-interest.

Religion is the power that inculcates worthy ideals in the mind of man as a way of life. It generates strength necessary for character stability in the face of adversity. It enhances the spirit of sacrifice behind honor and duty with the assurance of a commensurate reward.

Just how practical a role religion plays in character formation is readily discernible at a military academy. Religion deals with values that are inner convictions of conscience. Once they are properly internalized, they stand on their own two feet and become a code of conduct quite apart from need for external supervision. To mention one such fundamental value, so essential in military life, let me cite respect for authority. A deeply ingrained conviction of conscience in this area goes far toward making a boy into a man of disciplined character, one who measures up to duty without need for the pressure of disciplining sanctions.

By their very nature military academies are long on external discipline, enforced by external punitive sanctions. This can readily result in the short-changing of internal convictions regarding basic values which must act as self-regulatory factors in human behavior. Whenever military life degenerates to the level of merely "beating the system," it becomes a tug of war between external discipline and disciplining sanctions. Tragically, many sound values fall to the wayside. "If I get caught, I get punished" would be a poor philosophy of life for a Cadet preparing for the responsibility of leadership.

Religion strives to help each individual better himself by means of self-control. The mechanism of conscience is set to work to keep behavior in line with ideals and responsibilities. The end product is an inner sense of discipline which becomes with the passage of time a self-regulatory habit, a way of life.

Self-discipline is the mark of the properly trained professional man, whether his profession be law, medicine, religion, or the military. To equip him with such professional integrity, based upon self-discipline, is the main goal of the institution dedicated to his training. After all, graduation is a transition from regulated, external discipline to the challenge of self-discipline—without which professional integrity cannot exist.

Why religion in a space age? The answer is evident. Man differs in a space age not one whit from man in any other age. His need for sound, moral values remains constant. His need for self-discipline becomes even greater. His need to live up to higher ideals becomes intensified. It is religion that undergirds these ideals, moral values, and stability of character, giving purpose to his life. To probe the vast expanse of the universe that once tumbled from the hands of the Creator is not man's most important task. That task is to live in the likeness of Him in whose image man was made.

Knowledge of this eternal truth underlies our religious program at the Academy.—END

Left, Academy Staff Chaplain (Col.) Charles I. Carpenter, who came on duty as the Protestant Cadets' spiritual leader in August 1958, after having served as Air Force Chief of Chaplains. He established the initial chaplaincy organization of the Army Air Corps at the start of the second world war.

Left, Roman Catholic Chaplain (Col.) Constantine E. Zielinski, author of the above testament of faith. He has been at the Academy since June 1955. Previously Father Zielinski served as Staff Chaplain, US Air Forces, Europe, where he was one of the founders of NATO's Joint Chaplain Consultative Congress.

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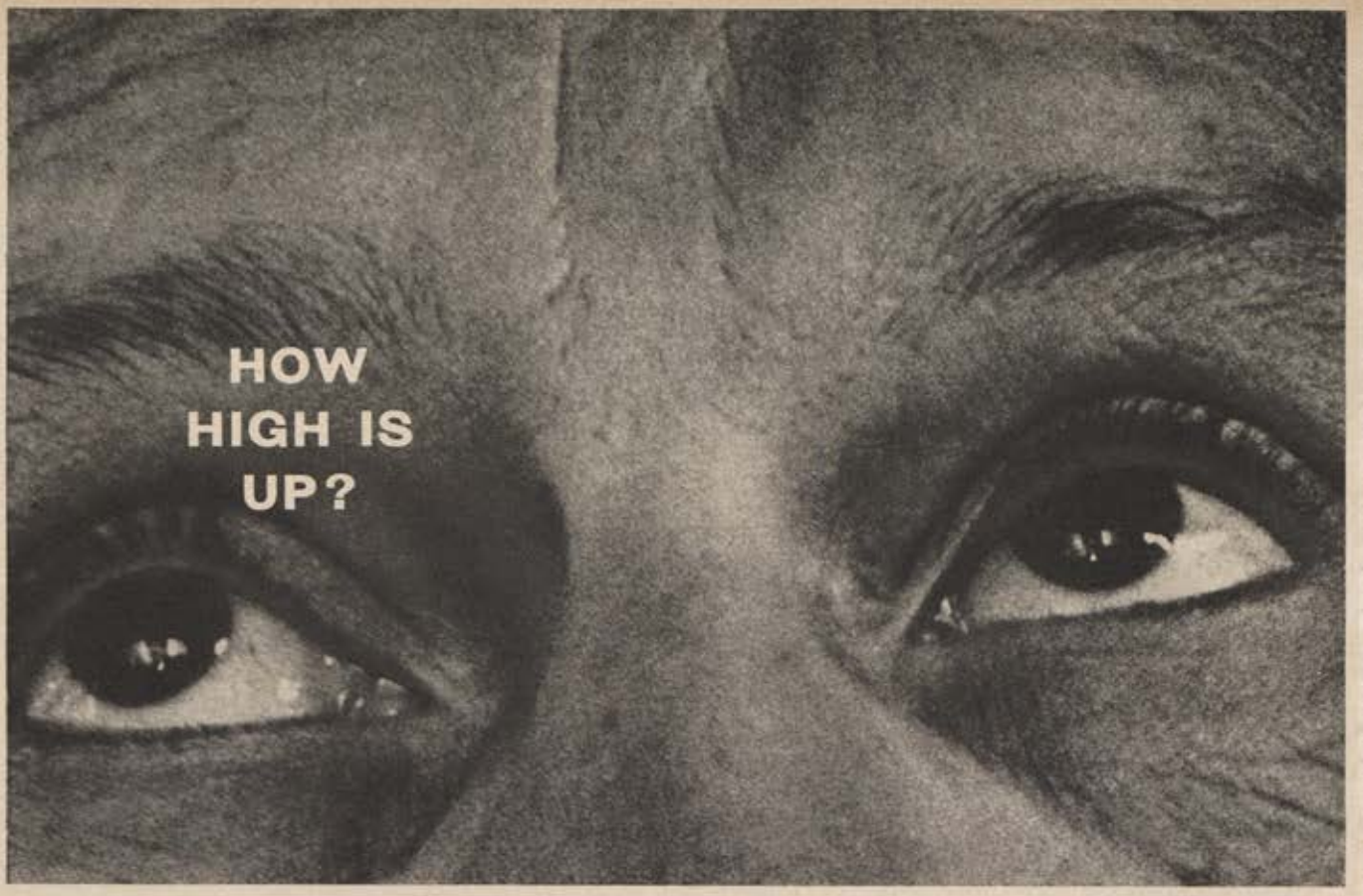

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Cadets and dates at Academy formal dance, high spot of school-year social program. The girls will go home alone.

THE SOCIAL PROGRAM

Hostess for the Cadet Wing

Ruth Whitaker

OFFICE OF THE REGISTRAR, US AIR FORCE ACADEMY

A LADY named Gail McComas holds a position at the Air Force Academy for which there is no civilian or military counterpart in the rest of the Air Force. She is the Cadet Wing Hostess, responsible for arranging social activities to provide the Cadets with diversion from their intensive schedule of classes and study.

Mrs. McComas organizes dances, keeps a "date list" for Cadets, purchases gifts for the Cadets' dates and mothers upon request, arranges teas, and—well, you get the idea.

One possible commentary on Mrs. McComas' effectiveness may appear in this statistic: Of the 207 Cadets in the Academy's first graduating class, ninety-three will be married immediately after commencement exercises or in the short period before they report to their first duty assignments. Mrs. McComas isn't solely responsible, it must be noted. But many of the couples actually did meet through the dating list, which she compiled from among women students at nearby schools, or at activities she set up.

However, statistics can't really tell the story. Mrs. McComas has been a genuine friend and social adviser to many, many Cadets since she came to the Academy in 1955 while it was still in temporary quarters at Lowry AFB. In that time she has virtually become an "institution" in an otherwise necessarily severe military atmosphere.

A minor incident illustrates the place she holds in the life of the Academy.

Some weeks ago, when this year's graduates acquired

(Continued on following page)

Mrs. McComas, capable, popular Cadet Wing Hostess who oversees social activities, performs a host of associated tasks for Cadets. The Beagle, a gift to "Mrs. Mac" from the 8th Cadet Squadron, answers to the name "Duchess."

Maj. Gen. and Mrs. James E. Briggs, the Academy Superintendent and his wife, attired for formal occasion. They have given a number of functions at their Academy home.

Cadet first classman and date at last year's Ring Dance. Ring's basic design represents Polaris, the North Star.

the long-awaited privilege of purchasing automobiles, I saw Mrs. McComas driving through the grounds in her quite attractive 1958 convertible. A first classman proudly drove up beside her in his new auto.

"Say, Mrs. Mac," he called, "where did you get that wreck? Why don't you buy a *new* car?" And he drove smartly off.

The occurrence seems small in itself. But the point is this: A Cadet would not be likely to indulge in this sort of banter with any other of his seniors at the Academy. Perhaps not even with the Wing Hostess if she weren't Mrs. McComas.

Mrs. McComas comes by her position at the Academy rightfully. Her husband, the late Col. Edward O. McComas, was commander of the 8th Fighter Group in Korea. He died of injuries sustained there in 1954, about a year before Mrs. McComas came to the Academy.

"When I came to work here," she recalled recently, "I was certain that this was what Ed would have wanted me to do. He was an enthusiastic advocate of the Academy. He was so very glad to learn that Congress had approved its creation. That was only about two months before his death."

Shortly after her arrival at Lowry in 1955, Mrs. McComas began working on one of her major contributions to Academy life, the date list. She contacted the deans of Loretta Heights Women's College, Colorado Women's College, and Denver University, asking them to send girls interested in dating Cadets to see her.

"Some lovely girls attended those affairs," she remembers. "I talked with each girl to ascertain her type and personality. Then I talked with the girls in groups and cautioned them against any illusions they might have about dating men in Cadet uniforms.

"'Dating Cadets won't be altogether glamorous,' I said. 'They're not permitted to have cars here, so you must come to the Academy for a social function and leave on your own. And you won't be able to date a Cadet more than twice a week, on Saturday night and Sunday afternoon, if that much, depending on whether he is maintaining his grades.'

"Those rules and limitations didn't bother the girls, though," Mrs. McComas told me. "Dating Cadets has become popular with the local coeds—in fact, so popular that enrollment at the two Denver girls' colleges has steadily increased since the Academy opened. The Cadets like to boast a little by saying they're responsible for the new dormitory that was built recently at Colorado Women's College."

I asked Mrs. Mac how new Cadets fare at their first major Academy dance. "Most of them are nervous and shy going through the receiving line," she said. "Cadets whose fathers are in the service are more at ease at first than those from civilian families. Military sons have usually attended social functions where protocol is followed. But, as time goes on, most of the Cadets develop considerable poise."

The Academy's hostess-with-the-mostest went on: "Some of the new Cadets are also a little awkward when greeting their mothers in front of other Cadets for the first time. When a mother tries to greet her son affectionately, one may hear something like: 'Mom, a Cadet isn't supposed to embrace in public.' But we assure the Cadets that Mom is special and an embrace is all right in her case. It's the girl friends of Cadets to whom our no-public-embrace rule applies."

The social program under Mrs. McComas operated without a real home until early last month when the new Cadet Social Center became operational with its first Cadet dance. Before that, the Dining Hall was used for dances, and Cadets picked up dates at a lounge in the Administration Building.

Erection of this lovely structure in the main complex of Cadet academic buildings points up the restricted but important role a well ordered social life has within the Academy scheme of things. We are fortunate in having Mrs. McComas to preside over this program.—END

Miss Whitaker has been Publications Editor in the Office of the Registrar at the Academy since 1956. She has a B.S. degree and an M.S. in government from North Texas State College, and did graduate work at Columbia University. Before joining the Academy staff, she was an information specialist at Perrin and Nellis Air Force Bases.

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The Falcon's Wing Tips

Some 200 mule deer live on the Academy site. Motorists must be alert for them day and night. The Academy has a committee on the preservation and control of its wildlife, which includes porcupines, skunks, coyotes, hawks, falcons, cougars, bears, and an occasional antelope. Hunting is strictly forbidden.

° ° °

The falcon was adopted as the mascot by members of the first Cadet class. To the Cadets, the falcon "symbolizes the courage and intensity of an Air Force pilot flying a supersonic aircraft in an attack on a target." The Cadet Wing has sixteen falconers who don't have to go far to catch a bird to train since Colorado is one of the nation's largest breeding areas of the prairie falcon. The original falcon mascot was named "Mach I." Falconry exhibitions are put on during football half-time interludes.

° ° °

In addition to his education, quarters, and medical and dental care, each Cadet receives $115.15 a month. Out of this he must buy books, clothes, and other personal items.

° ° °

From September through May, here is how a Cadet puts in his time. Classes run from 0800 to 1500, with a one-hour lunch break at noon. On Saturday, classes are held from 0800 to 1150. If the Cadet is not participating in intercollegiate athletics, intramural competition is mandatory on two afternoons a week after classes. On the other afternoons, he can study or take part in extracurricular activities—such as the monthly Cadet magazine, the *Talon*, or numerous clubs. Unless a special lecture is scheduled, he has forty-five minutes of free time after dinner. First class and second class students who have made the Superintendent's Merit List don't have to maintain a close evening schedule. Special emphasis is put on the gradual transition from Cadet to second lieutenant; consequently, in the last half of the final year the Cadet is allowed relative freedom after hours, as though he were a commissioned officer. But as a third or fourth classman the Cadet is required to be in his room or the library studying after 1915 on most nights. The Cadet, except under unusual circumstances, must be in bed with lights out at 2215 when Taps are sounded.

° ° °

The Academy was not designed as a flying school. Cadets are given an introduction to pilot training at flight schools in the summertime. They also spend 171 hours in the air in navigational training aircraft during their four years at the Academy. The original premise that all Cadets must try to become pilots is undergoing Academy reappraisal; however, pilot motivation is still the school philosophy, and almost all Cadets volunteer for further flight training at graduation. For a time soaring was a popular extracurricular sport at the Academy until high winds wrecked the Soaring Club's glider.

° ° °

The Academy's Protestant Chaplain, Col. Charles I. Carpenter, was formerly a major general and USAF Chief of Chaplains. As such, he participated in Academy dedication rites at Lowry AFB. Then he voluntarily reverted to colonel, highest rank authorized for an Academy chaplain, so he could assume his present post after completing his tour as Chief of Chaplains. He coaches fourth class baseball in addition to his other duties.

° ° °

Beginning in 1963, the Academy will graduate about 577 Cadets a year. At full strength, the Academy is authorized four Filipino students and twenty from Canada and other American countries. They will receive Graduation Certificates. Full enrollment will top 2,500.

° ° °

This past year's fourth classmen were an outstanding lot. The 453 Cadets who entered in the class amassed a total of 1,358 varsity letters in high school, 1,145 of them in major team sports. More than 100 were class presidents. Some eighty were members of honorary academic societies. An equal number had backgrounds that included these achievements: outstanding student or citizenship award, publications editor, or band or glee club member.

° ° °

Cadet Gregory Boyington, Jr., son of the famed Marine Congressional Medal of Honor winner in World War II, "Pappy" Boyington, is scheduled to graduate in 1960.

° ° °

According to General Briggs, Academy Superintendent, Cadet ingenuity—sometimes misguided—has never been at a loss. "A year or so ago," he says, "Radio Free Cadet appeared on the Academy air, convulsing the Cadet Wing with commentaries on Academy life and personalities. We never did locate the transmitter or the culprit, perhaps deliberately. We stopped the broadcasts by letting the Cadet Wing know the FCC penalties for illegal broadcasting."—END

HIGH STANDARDS

FOR ADMITTANCE

How the Academy Picks the Best

New Cadet stands at attention beside Academy Dining Hall.

THE AIR Force Academy picks only the best for its thoroughgoing four-year program of academic and professional training.

The Admissions Board weighs the academic achievements, qualities of leadership, physical condition, and moral character of candidates for admission, each of whom undergoes a battery of physical and mental tests.

Each year since it came into being the Academy has increased the size of its new incoming class. The first class, graduating this June 3, numbered 306 at admittance. The new class, now entering the Academy, numbers 712 Cadets. These were chosen from 6,724 nominees.

The goal has been to bring the Academy up to the full Cadet complement, some 2,500, by 1963. This would put it on a par with the authorized strength of the US Military and Naval Academies.

To wear the special shade of blue of an Air Force Academy Cadet, a young man must meet these requirements.

- He must be at least seventeen and not more than twenty-two years old on July 1 of the year of admission.
- He must be a citizen of the United States.
- He must be of good moral character.
- He must be unmarried and never have been married.

A young man must be nominated to take admission tests for the Academy. There are several types of nomination:

A total of 534 Cadet vacancies in each future class are to be filled by nominees of US Senators and members of the House of Representatives. Each legislator may nominate eleven candidates. He may submit their names to the Academy as a "principal" and ten "alternates" or as eleven equal candidates. Often the congressmen choose their nominees by their own competitive examination among young men who apply to them.

The Resident Commissioner of Puerto Rico, the Governor of the Panama Canal Zone, and the Commissioners of the District of Columbia nominate candidates for the Academy under the same procedure.

One vacancy is reserved for a nominee of the Vice President of the United States. He may nominate eleven candidates from the nation at large.

Twenty-two vacancies are allocated to the President of the United States, who in turn has reserved these vacancies for sons of members of the Regular components of the armed forces—in service, retired, or deceased, but not discharged before retirement.

Ten vacancies are reserved for sons of deceased veterans who were killed in action or died of wounds, injuries, or diseases incurred in active service during the first or second world wars or the Korean War. Applicants in this category write directly to the Director of Admissions at the Academy rather than to a nominating agency.

Twenty-three vacancies are reserved for members of the Regular Army and Regular Air Force, who apply to unit commanders.

Twenty-two vacancies are set aside for members of Reserve components of the Air Force and Army. Here again applicants seek nomination for the Academy through unit commanders.

Ten vacancies are to be open annually to honor graduates of military schools designated as "honor schools." Each such school may nominate three candidates to compete for admission to the Academy.

Sons of Congressional Medal of Honor winners may apply directly to the Academy for nomination. Vacancies in this category are not limited.

After nomination, all candidates take physical and mental examinations. These include:

- The Physical Aptitude Examination and the Air Force Officer Qualifying Test—both of which are given at Air Force examining centers over a period of three days.
- College Entrance Board Tests, given at College Board examining centers—completed in one day.
- The Air Force medical examination for flying training given at Air Force installations. This takes one or two days.

The physical standards are roughly the same as those for USAF flying training, including these requirements:

- Height—no less than five feet, four inches or more than six feet, six inches.
- Weight—not over 239 pounds and proportionate as to height.
- Vision—not less than 20/50, correctible to 20/20, with recognition of red and green necessary.

Waivers of minor physical defects may no longer be made where prospective Cadets are exceptionally well qualified academically, but do not meet the physical standards of the Air Force Academy.

One of the most important factors—leadership potential—is difficult to assess. The Air Force has found a high correlation between participation in athletics and other extracurricular activities and the qualities that make an outstanding officer. Backgrounds in high school athletics, student government, the Boy Scouts, and the Civil Air Patrol and like groups often indicate potentialities in this direction.

Selected Cadets agree to complete the full Academy course, enter flight training after graduation if so ordered, and serve on active duty for at least four years.—END

Is an Air Force career an intelligent financial investment?

Leslie Gould
Financial Editor
N.Y. Journal American

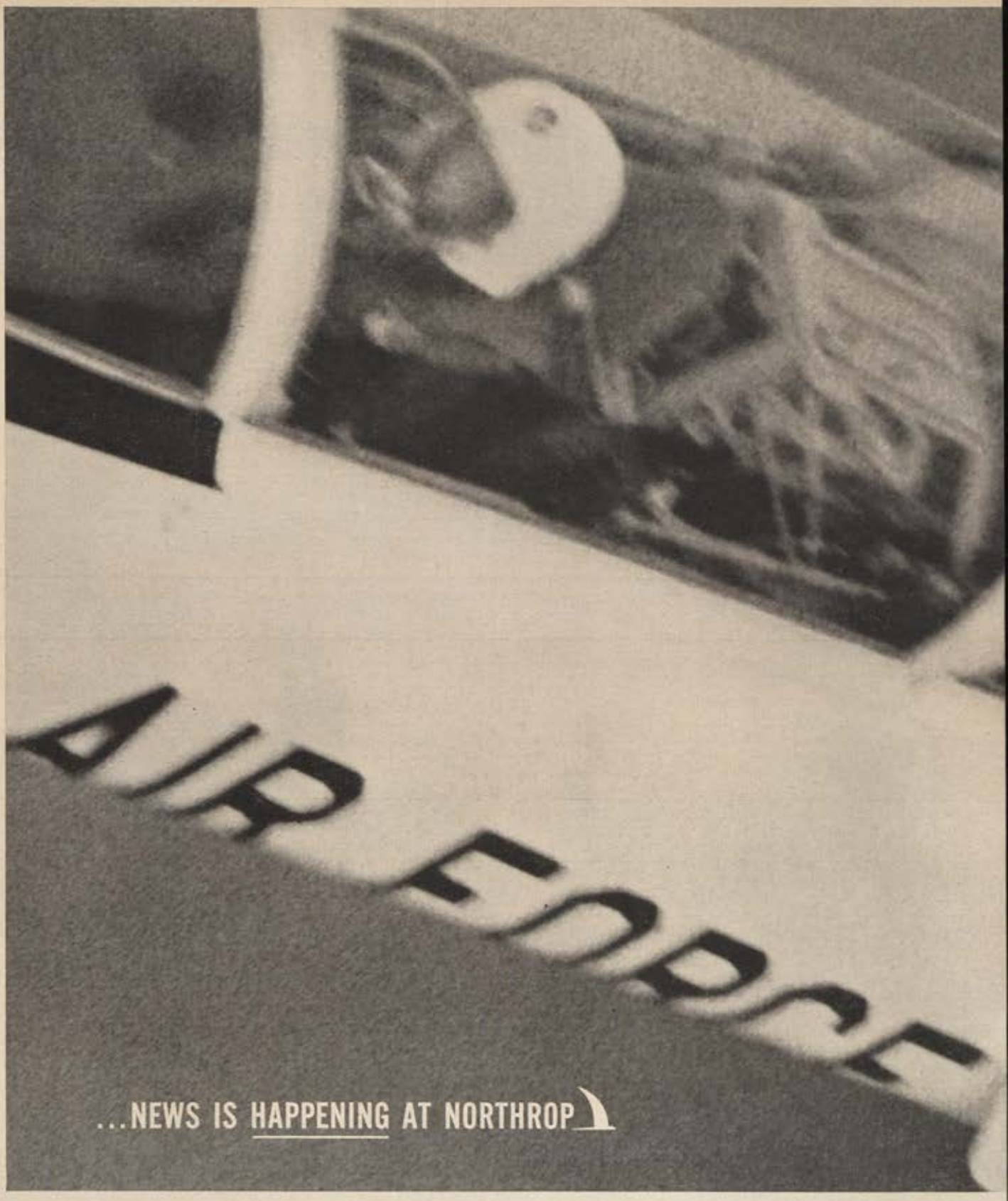
An observation directed to young Air Force officers

A very close parallel may be drawn between the nature of various investments and the career opportunities open to young men today. Like bonds, some careers are relatively stable, but appreciate very slowly. Others, like a "blue chip" common stock, have somewhat less stability, but offer a very sound, long-range growth potential. Thirdly, of course, there is the highly speculative stock (and career), with its immediate promise of extraordinary return—that may or may not be fulfilled or sustained.

Of these three categories, an Air Force career would seem most closely to approximate a "blue chip" stock. Whereas once the military was generally considered a sinecure, technological and scientific advances today demand a high degree of professionalism from the military's "stockholders." Absolute stability can no longer be assumed. At the same time, the real and monetary income of the trained Air Force officer continues to show growth potential, as evidenced by the recently adjusted pay scales.

Finally, the retirement income an Air Force officer may expect might well be likened, on an income basis, to a $100,000 investment portfolio—a financial situation that few people realize in their lifetimes.

Generally regarded, an Air Force career is a very intelligent financial investment.



AIRBORNE! FIRST LOW-COST SPACE AGE AIRCRAFT!

USAF-NORTHROP T-38 TALON ANSWERS AIR TRAINING COMMAND
NEED FOR A SAFE, ECONOMICAL TRAINER FOR SPACE AGE AIRMEN

NORTHROP'S T-38 achieves successful initial flight test at Edwards Air Force Base – offers USAF space age airmen supersonic training with twin-jet safety.

NORTRONICS

For U.S. Army's Hawk, Nortronics designs, produces airframe and all mechanical ground support as major subcontractor to Raytheon Co.

RADIOPLANE

Latest Radioplane answer to U.S. Armed Forces' drone needs is the supersonic, sophisticated USAF XQ-4 type target drone.

INTERNATIONAL

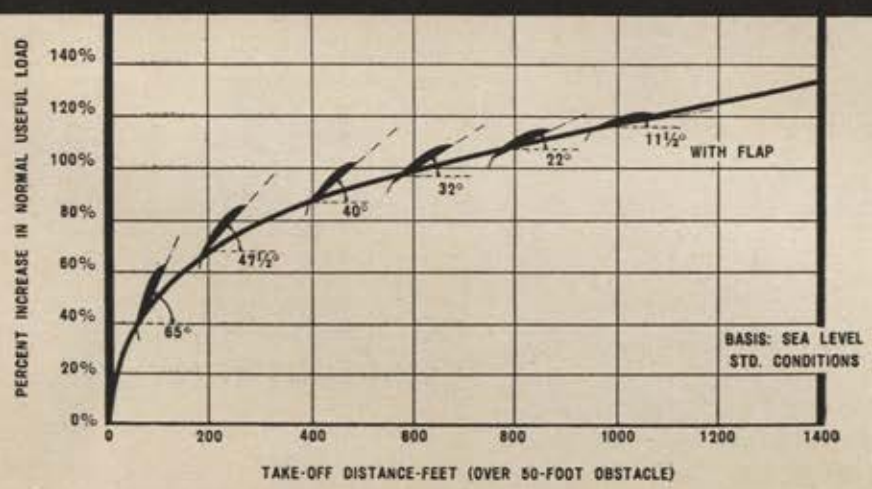
Northrop's N-156F multi-purpose fighter, a high-performance weapon system at minimum cost, now being developed under USAF contract.

NORAIR

The T-38 pioneers a new Northrop family of lightweight, low-cost manned aircraft. It is a breakthrough reflecting Northrop's constant use of all the tools of scientific management in finding lower-cost solutions to the pressing problems of present and future defense. Latest tool: the Norair-created Performance And Cost Evaluation Program called PACE.

NORTHROP CORPORATION

Beverly Hills, California



Increase in Useful Load of Tilt-Wing VTOL when operated as STOL.

Vertol's VTOL/STOL Aircraft

Built today....in preparation for tomorrow

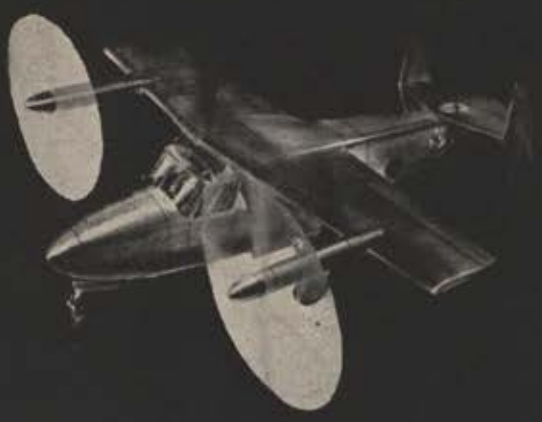
Vertol achieved a major breakthrough in aircraft development during 1958, when its Model 76 (Army VZ-2) became the world's first tilt-wing vertical take-off and landing (VTOL) research aircraft to successfully complete conversion flights. In extensive tests since the first conversion flights, this tilt-wing design concept has also shown its effectiveness as a short take-off and landing (STOL) aircraft. Because the Vertol tilt-wing design qualifies in this dual role as a VTOL/STOL vehicle, it has tremendous potentials for both military and commercial aviation.

As a next step, Vertol can now build an operational type aircraft incorporating the tilt-wing principle, to explore more practically – through evaluation – the mission usefulness of any VTOL/STOL type aircraft.

In anti-submarine work, this versatile VTOL/STOL vehicle offers high forward speed plus the hovering characteristics necessary for effective completion of all phases of such missions, thus replacing – with one aircraft – the several different types currently required. The broad capabilities of the Vertol tilt-wing design also include application as an air truck. In an STOL role, it can take off and land with substantially increased gross weights and payloads. This unique capacity, combined with VTOL performance, permits the user to "custom tailor" his take-offs to altitude, temperature, available runway and load.

This development of the tilt-wing is the latest example of the foresight and skill in research and development which Vertol has demonstrated over the past 15 years.

Engineers: Join Vertol's advanced engineering team



A tilt-wing aircraft
for operational evaluation of
VTOL/STOL mission usefulness.

In anti-submarine warfare,
the tilt-wing design offers fast
forward speed and hovering ability.

In its dual role as an STOL aircraft,
the tilt-wing design could be utilized
as a high load capacity air-truck.

VERTOL Aircraft Corporation

MORTON, PENNSYLVANIA

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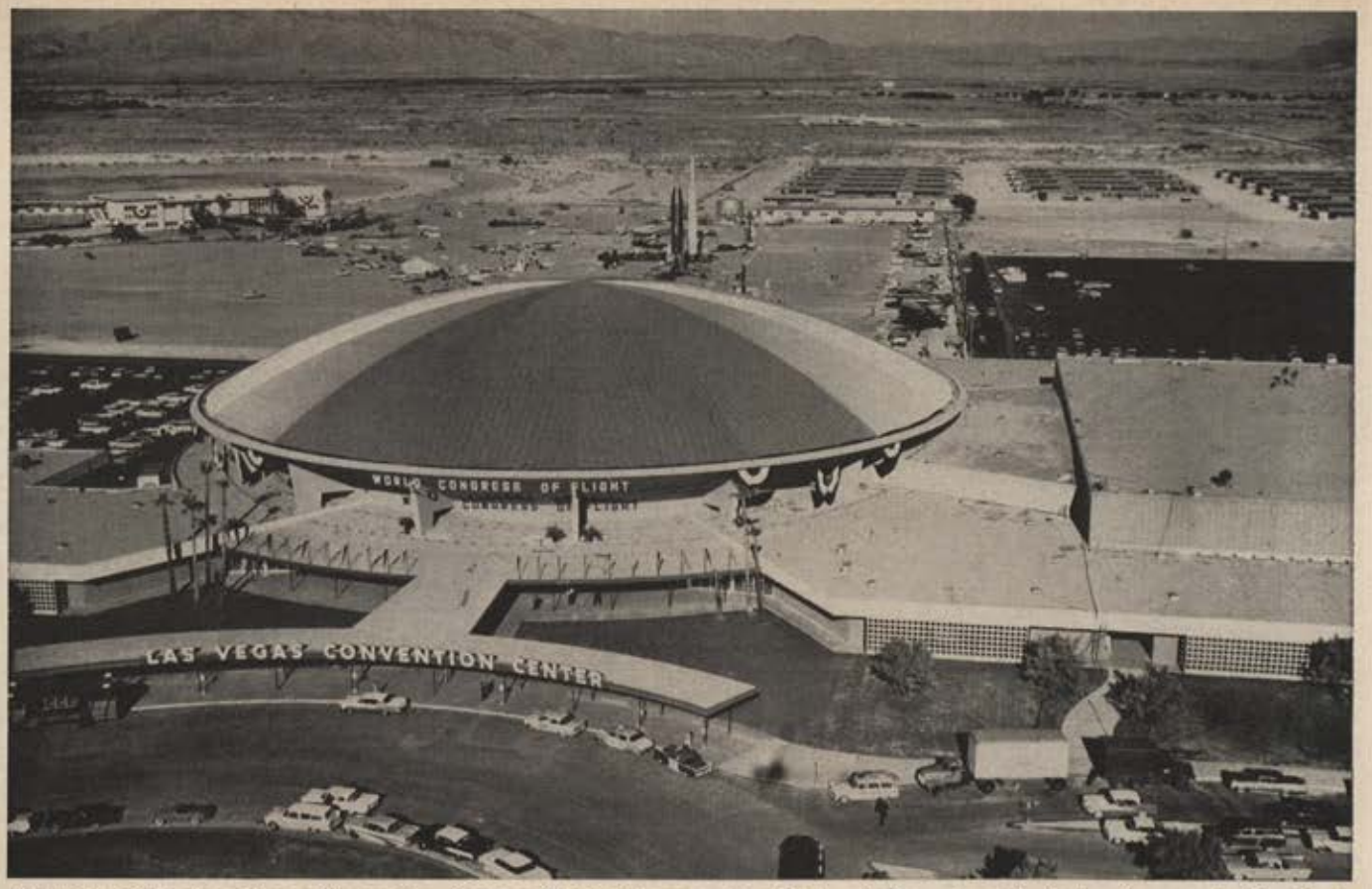


Air view of the Las Vegas Convention Center, World Congress site. Note missiles, aircraft display in area behind hall.

Ultramodern exhibits in the ultramodern hall. Broad aisles made it easy for delegates, public to view all the displays.

FIRST
WORLD CONGRESS
OF FLIGHT

PANOPLY OF AEROSPACE POWER

THE vast array of US and free world aerospace power—civil and military—was unfolded to the country and the world as the men and machines of the new age of transcontinental jets, supersonic military aircraft, missiles, and space vehicles gathered for the First World Congress of Flight at Las Vegas, Nev., April 12-19.

The week-long meeting, with a schedule of events that ranged from learned symposia on flight research problems to displays of the US civil jet fleet, and firepower and precision-flying demonstrations by US and allied jet teams, was the most comprehensive panoply of flight ever staged on the North American continent.

Some 5,674 registrants from all parts of the US and fifty other nations, including 215 company presidents, converged on Las Vegas for the World Congress. In addition to aerial demonstrations, they saw aerospace exhibits by a total of 217 American and foreign companies at the brand-new, giant Las Vegas Convention Center, at its nearby outdoor Stadium area, and at McCarran Field, the commercial airport for the Las Vegas area.

The World Congress story was relayed to the country by some 500 American and foreign newsmen who covered the meeting. A special NBC hour-long television "spectacular,"

(Continued on following page)

The civil jet fleet of the United States was displayed together for the first time at McCarran Field at the World Congress of Flight. From the top, Boeing 707, Douglas DC-8, Convair 880, and the jetprops Lockheed Electra and Fairchild F-27.

The public, including many people over from California, viewed missile and aircraft exhibition on grounds outside the Convention Center during the Congress.

sponsored by the General Motors Corporation, brought World Congress highlights to an estimated forty million televiewers across the country on the final day of the meeting. The television report was narrated by famed newscaster Bob Considine.

Sponsored by the Air Force Association, in cooperation with the Air Transport Association of America, the Electronic Industries Association, the Flight Safety Foundation, the National Aeronautic Association, the National Business Aircraft Association, and the Space Education Foundation, the World Congress was a team effort designed to mark the inauguration of the commercial jet age in America and, at the same time, to underscore the aerospace achievements of the free world and its determination to stay free through maximum deterrent aerospace power.

The theme of the World Congress was spelled out in the official welcome to delegates by World Congress General Chairman Edward P. "Ted" Curtis, former Special Assistant to the President for Aviation Facilities Planning. He told delegates:

"The distances you have traveled and the time consumed in such travel have for centuries been massive barriers in man's ceaseless quest to learn for himself what is 'on the other side of the mountain' and learn more about other men.

"In the search we have employed flight as a primary instrument for conquering time and distance, and along the way we have found need to pause and reflect on the problems at hand and the objectives ahead in our progressive development of travel above the surface of the earth.

"This development now leads us, for the first time, to the surface of other planets and beyond, to the 'other side' of new mountains, perhaps to other men. . . .

"We now pause, at a critical juncture in the Jet Age of Flight, to consider, as well, the Space Age that looms over the horizon, and ponder the new horizons it may bring.

Touring Exhibit Hall, from left: Cloyce J. Tippett, Lima, Peru (ICAO), Gen. Issa Stodakh, of Iran, and Brig. Gen. Joao Mendes de Silva, from Brazil.

Japanese delegation included Kikuji Sekiguchi, Tomijiro Moriya, Ryotaro Hikida, Eiyi Mega, Sunao Baba, all officials in aviation and transport in their homeland.

"At this point in history, between the advent of man-in-air and man-in-space, we . . . hope . . . that man's scientific climb over the mountains of time and distance may also be a climb away from human conflict and suffering. . . ."

Almost every aspect of flight, aircraft, missiles, spacecraft, was explored at the World Congress—not only the hardware of flight but also the impact of the aerospace age on education, public policies, and tomorrow's business.

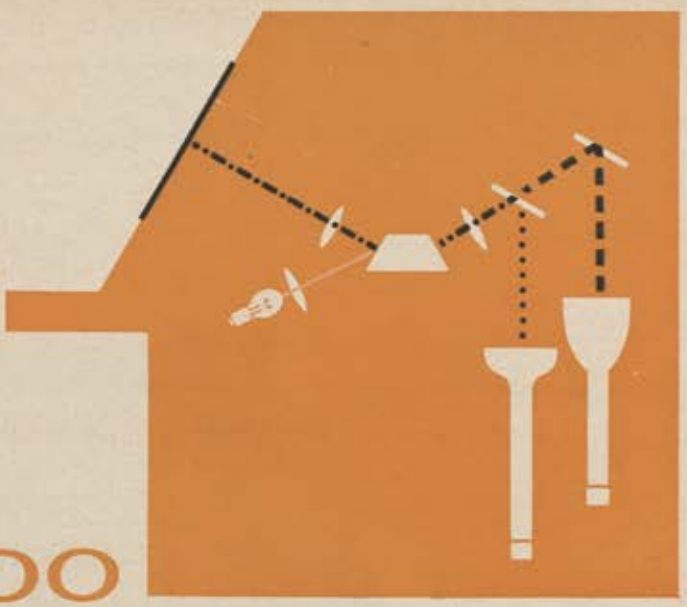
The Congress' opening event—after the special preview for newsmen—was the Air Force Association-sponsored Jet Age Conference *(see page 116)*, held Monday and Tuesday mornings and featuring a topflight panel of speakers including Sir William P. Hildred, Director-General of the International Air Transport Association; US Air Force Vice Chief of Staff, Gen. Curtis E. LeMay; and Federal Aviation Administrator, the Hon. Elwood R. Quesada. The Jet Age Conference, an annual AFA event on both national and regional levels, was the forerunner of the World Congress.

At NATO Banquet: Jacqueline Cochran, Korean AF's Lt. Gen. Chang Kyoo, RAF Air Vice Marshal G. A. Walker.

Also on opening day delegates saw air-ground demonstrations by America's civil jet fleet at nearby McCarran Field. On display were the giant Boeing 707, the Convair 880, the Douglas DC-8, and the Lockheed Electra and Fairchild F-27 jetprops. It was the first time the US jet fleet now

(Continued on page 111)

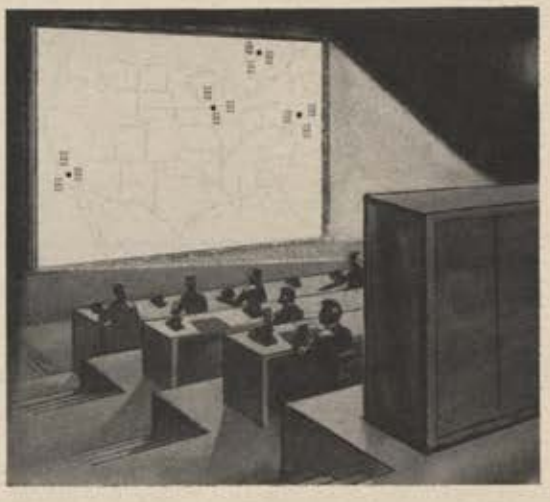
The McGraw-Hill Book Company of New York will publish as a hard-back book the proceedings of the World Congress of Flight. The Editors of AIR FORCE/SPACE DIGEST **will edit the book's contents, and publication is tentatively scheduled for early fall. The book will contain 600 or more pages of editorial matter plus sixteen pages of photographs. A retail price of $10 has been established tentatively, although the book will be available at a reduced price to World Congress of Flight delegates, exhibitors, members of the Air Force Association, and cooperating and participating organizations.—**THE EDITORS



S-C 2000

BRIGHT DISPLAYS FOR CONSOLE OR LARGE SCREEN PROJECTION

Bright, fail-safe, flicker-free display of alpha-numeric, symbolic and graphic data at high speed . . . simultaneously with PPI-type radar presentations . . . is now provided by S-C 2000 Bright Displays. Displayed data may be viewed in normal ambient light directly on the screen of the S-C 2000 console, or may be projected for group viewing on a large theatre-type screen. For air traffic control and military applications, maps may be displayed concurrently with radar targets and their identifying symbols, assisting the operator in geographic orientation. The fail-safe feature of S-C 2000 Bright Displays results from use of the xerographic process which allows the last frame displayed to be retained permanently, even in event of complete power failure. Send for more complete information concerning S-C 2000 Bright Displays. Ask for Bulletin 7-X. Write today: Stromberg-Carlson — San Diego, 1895 Hancock Street, San Diego 12, California.



See the S-C 2000 Bright Display demonstrator at the AFCEA Show, June 3-5, Washington, D.C.—Booth 89.

GENERAL DYNAMICS
STROMBERG-CARLSON DIVISION

Zippered nose cone cover foils moisture, dust, abrasion

To protect the polished finish of missile nose cones from assembly to countdown, B.F.Goodrich fabricated unique zippered "all-weather" Nose Cone Covers for Avco's Research and Advanced Development Division.

Made from neoprene coated nylon fabric, this shipping cover has non-rigid neoprene ribs and spacers that keep it from riding down on the cone. Special B.F.Goodrich Pressure Sealing Zippers provide easy access and removal—yet seal positively against dust, dirt, grime, damaging impact.

B.F.Goodrich was asked to engineer this special project because of its widely-known ability to manufacture coated fabrics to any shape or size—as in aircraft baggage panels. In addition, the space-saving B.F.Goodrich Zipper—used widely for air ducts, inspection ports, access doors, and aileron gap seals—withstands any pressure up to the maximum strength of the zipper itself. And it, too, can be fitted to complex contours.

Tricky sealing problems like this one are just part of the day's work at B.F.Goodrich. Next time you have such a problem and need an answer—fast—write or call *B.F.Goodrich Aviation Products, a division of The B.F.Goodrich Company, Dept. AF-69, Akron, Ohio.*

B.F.Goodrich ***aviation products***

entering service had ever been assembled in one place at one time.

Concurrently, on the first day and throughout the week, specialized briefings by exhibiting companies were held in the Convention Center auditorium that housed the indoor World Congress industrial and military displays. The interested specialist had his choice during the week of briefings on aerospace age products ranging from ultrasonic cleaners to high-visibility paint, from radio isotopes as a source of power to inertial guidance, today and tomorrow.

The second day of the Congress kept delegates and press busy with more air-ground demonstrations at the Stadium near the Convention Center. The versatility of the small aircraft that have revolutionized agriculture, short-range business transportation, and rescue and patrol in the air age was the theme of these demonstrations. Stadium viewers watched a program that included flights of aircraft ranging from cropdusters to a portable, inflatable rubber airplane, as well as helicopters and an automobile that can be converted into an airplane in a matter of minutes. A special feature was a series of precision flights by champion soarers. Marking the span of years from early post-Kitty Hawk days to now was the appearance of rebuilt versions of the old Bleriot and Sopwith Camel. And underscoring today's new age of rocketry was a demonstration of miniature rocket launchings by a carefully supervised group of teen-age space enthusiasts.

A highlight of the World Congress was the record-breaking flight in an Aero Commander 680-E by Oklahoma City's Jerrie Cobb. Miss Cobb completed a 1,242.7-mile closed-course flight from and back to Las Vegas in five hours, twenty-nine minutes, thirty-three and nine-tenths seconds, averaging 226.148 mph. She broke the Russian-held record, set in 1953.

Midweek of the Congress was dedicated to the free world's aerospace power. Delegates got up with the sun to travel some forty-seven miles from the desert metropolis to Nellis AFB Gunnery Range. There they watched a truly sensational air show and firepower demonstration. The air show featured, in addition to flights by the US Air Force Thunderbirds and the US Navy Blue Angels, precision demonstrations by jet teams of the Chinese Nationalist Air Force, the Italian Air Force, the Royal Netherlands Air Force, and the Royal Air Force. The crowd saw, among other demonstrations, USAF Tactical Air Command low-level delivery of simulated nuclear weapons, napalm fire bombing from the air, inflight refueling demonstrations, and inflight photo reconnaissance with special flash bombs that lit up even the bright daylight of the desert.

Under the tail of Fairchild's new F-27 jetprop transport, Secretary of the Air Force James H. Douglas, at right, chats with World Congress General Chairman Edward P. Curtis. In background, Maj. Gen. Stanley T. Wray, James H. Doolittle.

In the evening of the air show day, delegates convened in the enormous Convention Center banquet hall for the NATO Anniversary Banquet *(see page 127)* and heard an array of speakers headed by His Royal Highness the Prince of the Netherlands. Prince Bernhard, a pilot and strong believer in aerospace power deterrence, enunciated NATO's determination to stand fast against Soviet aggression.

During the afternoon of the salute-to-NATO day delegates had their choice of three significant symposia—one on efficient use of the airspace, one on aircraft and space communications, and one on international research—each featuring a topflight panel of speakers *(see pages 181-182)*.

Thursday was again a more-than-full day. Educators convened for the First World Forum of Aerospace Education Leaders *(see page 153)*, and symposia on flight safety, test piloting, air traffic control, advanced air navigational aids, and safety in private flying were held *(see pages 181-186)*.

Major event of the day was the Missile Management Conference *(see page 171)*, sponsored by the Air Force Association, keyed to asking and trying to get answers to the questions posed by the impact of missilry on industry.

Friday's program was the day-long Space Age Conference *(see page 138)*, last official event of the World Congress prior to the week-end viewing by the public of the exhibits and air-ground demonstrations. Thousands of Nevadans and Californians who drove in from Los Angeles trooped through the vast exhibit hall and saw the array of small aircraft and missiles on display in the outside areas.

The World Congress of Flight was a unique "first." For the thousands who attended and the millions who watched its highlights on television, the meeting provided a platform from which to examine the tomorrows of a new era in history.

The new age can move in either of two directions, peace or war, depending primarily on whether the world conflict between the democracies and the Sovietized part of the globe is settled peacefully or by all-out conflict.

The World Congress, through display, demonstration, and serious discussion, brought together, in a site blessed with the space to do the job, all the segments of the aerospace industry which has shrunk the world. To meet international tensions, this industry has also created the capability required by the military forces which have thus far deterred aggression in a nuclear age.

In one week, and in one place, delegates and the public had the opportunity to see this aerospace potential for peace and war. As they viewed exhibits, they saw towering ballistic missiles and contrasting civil jets, the X-15 and its pilots, and the capsule that will take an American Astronaut into orbit. Wings of peace shared billing with the military missiles, all part of the world of flight. All are machines, neutral creations of man's ingenuity. Their use is a decision for man.

The World Congress served another high function. As one speaker pointed

(Continued on following page)

Air Force Chief of Staff, Gen. Thomas D. White, and AFA President Peter J. Schenk view Army's Hawk missile display on exhibit grounds. The Hawk is designed to defend against enemy attackers flying at low altitude to escape detection, uses solid fuel propellant, is produced by Raytheon.

out during the Space Age Conference, the Russians have managed to convince too many people that theirs indeed may be the "wave of the future," that the Soviet advances in technology mark the beginning of the end of the "decadent" Western world. The World Congress helped tell a much truer story: that the free world is by no means about to throw in the towel, that its technological achievements continue to lead the world in many areas, and that its aerospace industry is fully conscious of the challenge of Red efforts to surpass the West.

The World Congress marked several "firsts":

- The first international aviation meeting to be held in the United States.
- The first cooperative effort of its kind, with more than fifty participating agencies and organizations.
- The first display of the American civil jet fleet.
- The first commercially sponsored national telecast of an aerospace meeting.
- The first meeting of its scope in a site which could handle the job, thanks to wide-open spaces and a compact, yet roomy and efficient exhibit area.
- The first nationwide organized meeting of educators for the express purpose of examining the educational implications of the aerospace age.

How did the World Congress idea get started?

Its genesis was in the Air Logistics Conference sponsored by the Air Force Association in December 1954, and it was a direct outgrowth of AFA's three Jet Age Conferences in Washington, D. C., in 1956, 1957, and 1958.

At the original 1954 meeting some 800 transportation leaders in government, industry, and the airlines gathered in Washington to explore the air logistics concept, the problems to be faced as air transport prepared to handle increasingly greater portions of the job of moving people and goods from point to point on a global scale.

The Air Logistics meeting, first of its kind, stimulated the highly successful Jet Age Conferences, which brought together civil and military leaders in aviation for more detailed examinations of the problems of the burgeoning Jet Age. Although there was timid opposition to public airing of such problems as sonic booms, mid-air collisions, and the like, public response to the Jet Age Conferences was highly encouraging.

With the advent of the Space Age and the expansion of the realm of flight beyond this world, it became apparent to AFA leaders and others that the spectrum of flight today needed an even greater platform.

Why not have a week-long meeting with maximum participation of other organizations, the military, and government, as well as representatives of free world allies? Planning and discussions culminated in the announcement of the World Congress plans at the 1958 AFA Convention at Dallas, Tex., last September. Months of hard work ensued, the concept took hold, the World Congress was on.

—WILLIAM LEAVITT

COMMITTEES AND ORGANIZATIONS WHO MADE THE WORLD CONGRESS POSSIBLE

Though it is impossible to list every one deserving thanks, the Air Force Association wishes to express its special appreciation to the following individuals, committeemen, committees, and organizations whose efforts helped assure the success of the World Congress of Flight:

EDWARD P. CURTIS, General Chairman for the World Congress.

These members of the Executive Committee and their organizations: JOSEPH B. BURNS, President, National Business Aircraft Association. JACQUELINE COCHRAN, President, Federation Aeronautique Internationale. DAVID R. HULL, President, Electronic Industries Association. THOMAS G. LANPHIER, JR., President, National Aeronautic Association. JEROME F. LEDERER, Managing Director, Flight Safety Foundation. FRANK PACE, JR., Chairman, American Council on NATO, Inc. ELWOOD R. QUESADA, Administrator, Federal Aviation Agency. DR. WAYNE O. REED, Deputy Commissioner, US Office of Education. PETER J. SCHENK, President, Air Force Association. DR. EDWARD TELLER, Director, Radiation Laboratory, University of California. STUART G. TIPTON, President, Air Transport Association of America. DR. THEODORE von KARMAN, Chairman, AGARD, NATO. GILL ROBB WILSON, Chairman, Space Education Foundation.

The membership of the Nevada Advisory Council, whose chairman is R. GUILD GRAY, Superintendent of Schools for Clark County, Nev.

These heads of the General Committees, who served under Chairman G. BARNEY RAWLINGS:

WILLIAM J. GRANT, Airlines Committee. L. E. TYSON, Airports Committee. JAMES A. MOSS, Arrangements Committee. GENE BROWN, Entertainment Committee. CLARENCE A. HECKETHORN, Information Committee. DR. QUINCY E. FORTIER, Medical Aid Committee. AL FREEMAN, Promotion Committee. HERBERT M. JONES, Reception Committee. WINDSOR C. DE CRANE, Registration Committee. REV. TALLY JARRETT, Religious Activities Committee. FRANK S. MIKULICH, Transportation Committee. WILLIAM M. BARLOW, Exhibits and Displays Committee.

The Military Project Officers:

BRIG. GEN. JAMES C. McGEHEE, USAF, Commander, Nellis AFB, Nev.; Military Host. MAJ. DAVID B. O'HARA, Hq. USAF; Department of Defense Project Officer. LT. COL. PAUL KLEPPINGER, Eglin AFB, Fla.; Military Operations Officer.

In addition, the World Congress of Flight is indebted to the following for their support:

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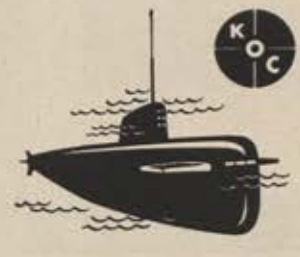

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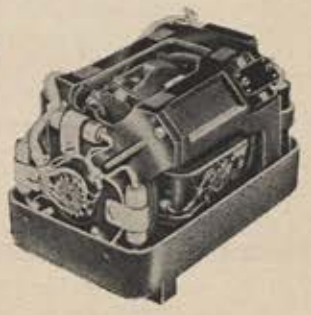

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Among the featured speakers at the Jet Age Conference was USAF Vice Chief of Staff Gen. Curtis E. LeMay. General LeMay stressed the fact that military necessity had led the way to the commercial jet revolution now under way.

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JET AGE CONFERENCE ...1959

THE New World, starting in 1959, is one of jet transportation for every man. And the World Congress of Flight, held in the same year, will go down in the history of aerospace progress as the one place where proper and complete emphasis was put on the problems that lie ahead. The job was done at the Jet Age Conference, an annual event sponsored by AFA and moved this year to Las Vegas, as a highlight of the Congress.

Led by Sir William P. Hildred, Director-General of the International Air Transport Association, six top-ranking speakers discussed all aspects of this important transitional period.

Sir William set the pace for the Jet Age Conference by admitting at the outset that fast-moving technology has outdated piston-driven equipment. "We can't expect much from it," he declared, in a day when people "here and in Western Europe have more money, more holidays, more mobility, and an increasing urge to travel."

IATA members know the operating cost of jets will be greater for each aircraft mile, but they hope it will be lower for each seat-mile and cargo ton-mile, Sir William said. He anticipated that the experience of this summer will show how well the airlines can meet this challenge in costs.

The way to meet the challenge, he indicated, is for the world's airlines to develop more traffic to fill the jets. In the passenger area he called for new efforts to stimulate the tourist market and said the present extra charge for riding in jet transports will be only a temporary measure.

Both fares and cargo rates must come down, the IATA chief said. He believes that air transportation, unlike surface methods, faces horizons that "grow broader every year." On the other hand, he warned the Jet Age Conference:

"We can cope with the jets; and the terminal facilities, the airports, the runways, and the navigation aids they require will come along in phase.

"But if manufacturers, inspired by the dedicated engineers in their project offices, suddenly throw at us a supersonic aircraft which can do 2,000 miles an hour before the rest of the system is in phase to accept it, we shall be getting into something like chaos.

"We must advance like an army in good order: the flanks and the center, the air cover and the logistics must maintain effective contact or the battle for greater efficiency and lower costs will be lost."

As a critic of the airlines—a role he claims is the prerogative of the professor—Dr. Paul W. Cherington of Harvard University lent support to some of Sir William's predictions. Dr. Cherington accused the airlines of some poor salesmanship and said most of them are starting too late to hunt down new markets. But he predicted that some time in 1961 there will be a wave of fare cuts, forced by the weaker carriers who will have to take drastic steps if they are to maintain load factors in the jet age.

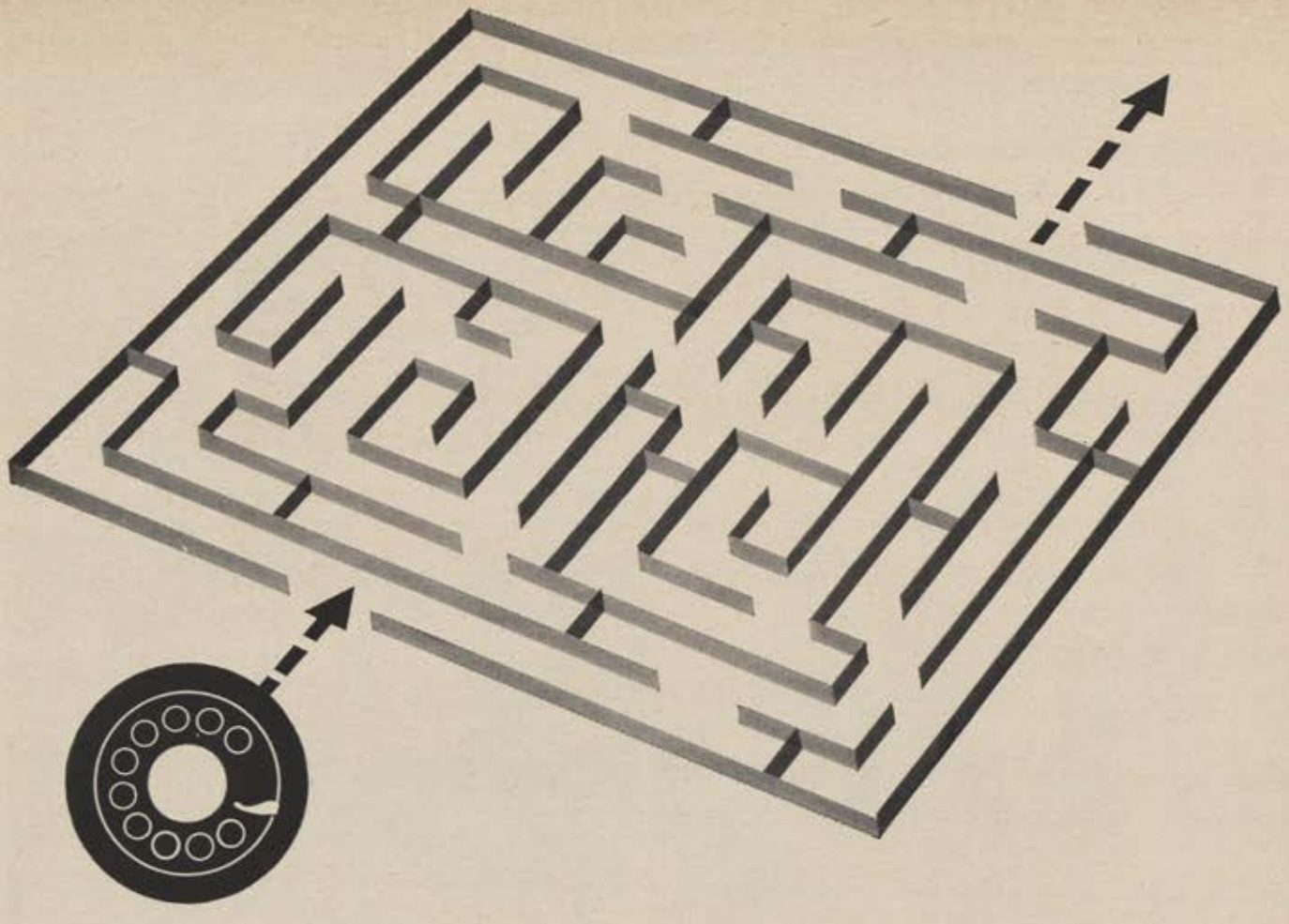
The Harvard expert was most vehement in his discussion of how the airlines handle passengers and baggage on the ground. He said ticketing methods are outmoded and too expensive and suggested that on many high-density routes reservations might be abolished.

For the future, he anticipates the airlines will have increasing difficulty when they look for financing and put part of the blame on the failure of the investment community to do a good job of analyzing the industry. *(See page 120 for the full text of Dr. Cherington's remarks.)*

Military spokesman at the Jet Age Conference was Gen. Curtis E. LeMay, USAF's Vice Chief of Staff. Pointing out that military necessity was the key factor in the development of jet transportation, the General said commercial jets will bring the airlines face to face with a number of problems previously peculiar to military operations. Basic are safety and the use of airspace in an era when approaching airplanes can come at each other with a closing speed of more than a thousand miles an hour.

General LeMay said positive control of all traffic at all

(Continued on page 119)



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Walter Binaghi, ICAO President; Edward P. Curtis, General Chairman; Stuart G. Tipton, ATA President, at Conference.

times is not possible under the present setup and with existing equipment. If such a program were attempted in 1959, he said, three out of four aircraft never would leave the ground because the system lacks capacity.

He gave it as his opinion that the key to effective traffic control in the jet age lies in the development of machinery that will provide quick decisions—"the speed at which decisions are made on the ground must match the speed of events that are taking place in the air." The General cited USAF's SAGE system, designed for control of air-defense interceptors, as the type of equipment that is needed.

General LeMay also told the conference that the sonic boom is a pressing problem with the Air Force as airplanes capable of supersonic speed in level flight come into the inventory. For the future, he said, the problem will get bigger, particularly when the airlines start using supersonic transports, already on the design boards of leading manufacturers.

At the second-day meeting of the Jet Age Conference the stage of Convention Hall was decorated with twenty-one flags of the nations of the Western Hemisphere. They marked Pan American Day at the World Congress of Flight.

Edward P. Curtis, General Chairman of the Congress, opened the day's sessions with a tribute to the Pan American nations and pointed out that Latin America is one area of the world where an air transportation system has been built without being tied to the patterns of surface transportation that penetrated the region in earlier years.

The military view was bolstered by another representative of the airline operators, Walter Binaghi, President of the International Civil Aviation Organization Council. He agreed that provision of facilities on the ground is lagging as the world's carriers start taking delivery on new jet planes. Mr. Binaghi said:

"The question to be answered is: Shall we achieve timely implementation? Or, in other words, will ground facilities be such as not to cause economic penalities to jet operations?

"There is no simple answer to this question. For each route the situation is different, depending on technical questions and the demand for air transportation. However, there will be many instances where the economy of operations will suffer unless more is done. . . .There are two major reasons for the existing deficiencies. One is the lack of trained personnel; the other is the lack of funds."

The ICAO official cited the jet age need for improved runways, approach lighting, telecommunications, positive air traffic control, and meteorology. He pointed to Latin America and disclosed that only six out of twenty-nine airports that will expect jet service are ready for the planes. Only two out of twelve instrument-landing systems have been implemented. Only five radio teletype circuits are functioning out of thirty-five in the program.

He reported that the operation of international airports now costs, on a global basis, about $80 million a year, and another $65 million goes into route facilities for international aviation. More money will be needed, he said, and it will not be easy to get. Some governments do not have more money; others do not put the demand for aviation facilities above the need for funds in other areas.

Mr. Binaghi made a plea for better planning in the future. Like Dr. Cherington, he sees a need for closer coordination among the manufacturers, the airlines, and the governments that must provide ground facilities.

From the world picture, the Jet Age Conference turned its attention to the smaller airlines serving several hundred cities in the United States. Joseph P. Adams, Executive Director of the Association of Local and Territorial Airlines and former member of the Civil Aeronautics Board, said the companies he represents expect their traffic volume to increase as the trunk carriers concentrate more on long-haul jet operations.

Mr. Adams made it clear that the local airlines expect to need continued financial assistance in order to provide more modern equipment, such as turboprop aircraft, for the cities that never will get their own direct jet service. He cited improved traffic figures that have resulted from introduction of the Fairchild F-27. Passengers per mile in some cases have increased as much as fifty percent with the new airplane.

Speaking for the new Federal Aviation Agency, E. R. "Pete" Quesada, the administrator, told the Jet Age Conference that he is about to start a new procedure for the allocation of airspace. He said he is not in favor of positive control for all planes in the air, and he is not in favor of anarchy but believes there is a middle ground where all flying interests can be well served.

He said the new procedure will provide for elimination of the Air Coordinating Committee, mainly because it has not been effective. So far as the military services are concerned, Mr. Quesada said they are cooperating in dealing with the problem of restricted areas which are essential for such things as air defense and experimental flying. He added that several of the large restricted areas have been examined closely by outside agencies and recommendations have been made regarding how they can be used.

The air traffic control system, now largely manual, is inadequate for the jet age, the FAA chief said, and studies are being made that look toward introduction of a semi-automatic system that will permit proper control of heavy and fast traffic.

The Jet Age Conference wound up with a closed-circuit television broadcast from the FAA exhibit in another part of the Las Vegas Convention Center. The broadcast described how air traffic controllers can use a computer and an approach-departure console equipped with radar to speed landing and takeoff of high-speed jet transports. One feature of the system is an air-ground-air communications setup that can compress two-minute messages into microseconds. —END

Delegates to Jet Age Conference gathered in flag-bedecked auditorium of brand-new Las Vegas Convention Center.

ECONOMICS OF THE JET AGE

Dr. Paul W. Cherington

PROFESSOR, SCHOOL OF BUSINESS ADMINISTRATION
HARVARD UNIVERSITY

THE TOPIC of Jet Age Economics is a big area. It is also one in which it is hard to discern the important threads and trends from those which seem awfully important today but won't seem so next year. Among the many topics that might be talked about, I have selected four which seem to involve some of the basic unresolved problems of the domestic airlines, their suppliers, their customers, and their regulators over the next few years. These four areas are: (1) Marketing; (2) The Scope of the Service; (3) The Economics of Scale; and (4) Financial and Human Resources. Alternative areas which might have been chosen include labor relations, competition, regulation, subsidies, the economics of sandwiches, and user charges of the Board's right to subpoena industry files.

The area of marketing is probably the most important single key to the future of airline economics in the jet age. Without the traffic to fill the new capacity which the jets provide and without fares adequate to cover costs and return a fair profit, the jet age will quickly deteriorate from being a splendid promise to a disaster. Certainly today airline traffic and revenues look a lot better than they did a year ago. Then traffic growth was virtually zero. Now it has resumed its upward trend and appears to be running about eleven percent. In the intervening year, also, the new jets have made their debut and, if load-factor information can be trusted, have received a most enthusiastic reception.

But although traffic and the marketing picture look much better today than they did last spring, they are still far from reassuring. The real test of whether there is enough traffic to fill the increased capacity of the jets will not come until sometime next year. Even with extensive retirements of piston aircraft in the next eighteen to twenty-four months, we should now be experiencing or have in sight much higher growth rates than eleven percent, unless we are willing to have load factors drop into the low fifties by 1961-62, or unless we are willing to see the return to fare cutting such as went on in the period of 1948-49.

In the past year only a handful of carriers have taken any aggressive action to identify new potential travel markets or to reexamine the ways in which they sell their product. Some are apparently satisfied with present growth; others argue that there is no use in talking about new markets for air travel because there just aren't enough rich people to go around. They apparently overlook the enormous travel potential which exists among families having incomes in excess of $8,000-$10,000 but who are now spending that income on other objects. Even a modest shift in the personal expenditure patterns of upper-income families to air travel would generate a substantial volume of traffic. But it will almost certainly not take place by itself. There is simply too much competition for the consumer's dollar. . . .

Because so little has been done in this area, I would venture to predict that sometime in 1961 we would begin to see an increasing number of reduced fare services and a rise in fare cutting. The basic cause will be the competitive frustration of some of the weaker carriers and the necessity of their maintaining utilization and load factors on the jets. Such a trend would not necessarily mean that the fare increases which took place in 1958 were a mistake. Rather it would mean that the carriers had been laggard in following up these increases with more aggressive and more imaginative marketing. The competitive picture arising out of the different delivery dates of the jets is now somewhat confused. But almost assuredly the future in the jet age belongs to those carriers who can prepare themselves for a marketing breakthrough, in terms of new market identification, new sales and advertising approaches, and new pricing *techniques*.

Current standards of airline flight service are, generally speaking, high and the carriers are to be complimented

(Continued on page 123)

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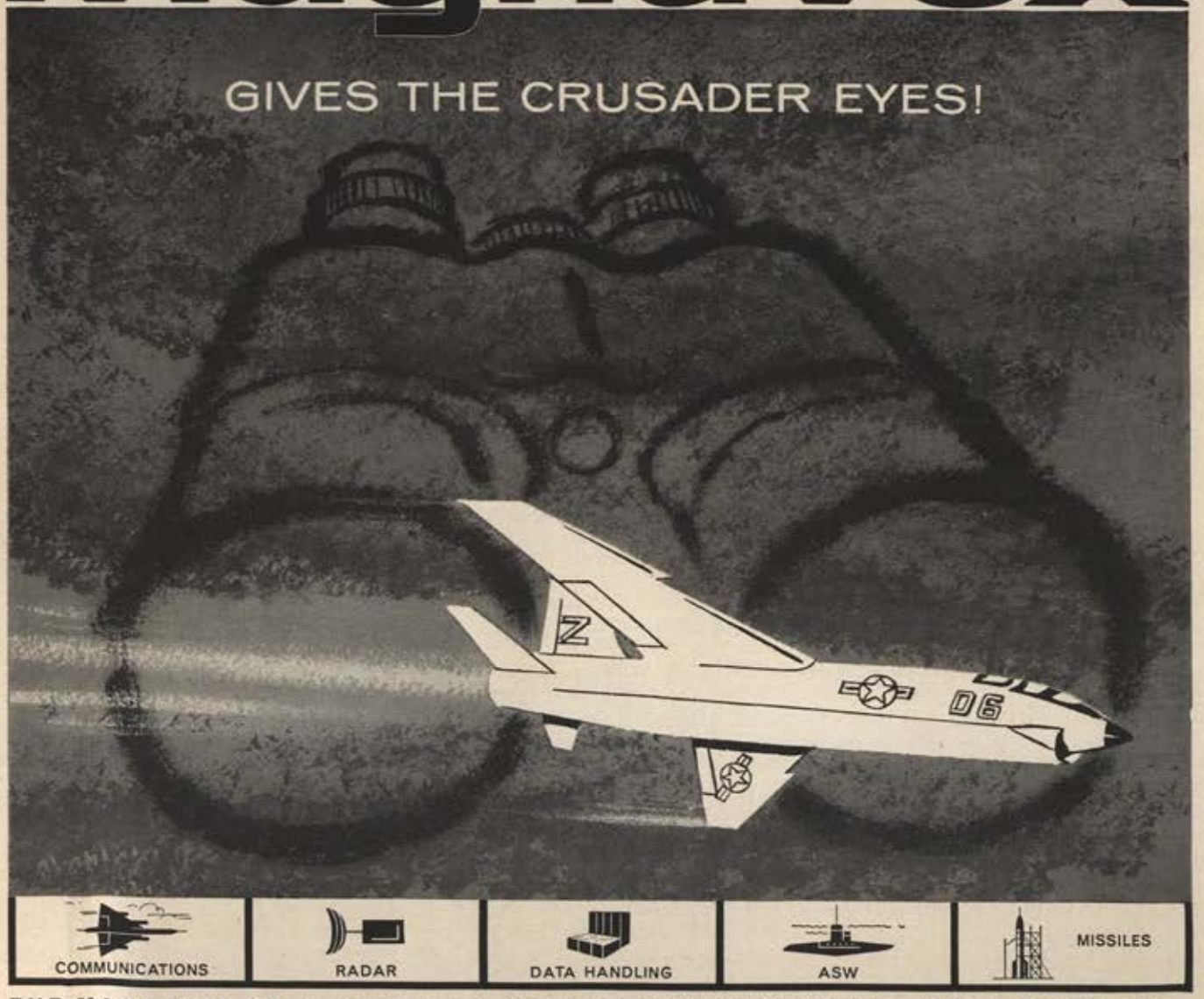

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for keeping them so. Unfortunately, the same cannot be said for ground services, and these are of growing importance in the jet age. This growing importance stems from the fact that, relatively, the length of the air journey will shrink and the length of time spent in being mishandled and abused on the ground will increase.

Actually I am not speaking so much of the physical facilities on the ground—bad as many of them are—as of the failure of the carriers to rethink their ground-service functions in terms of an over-all system of transportation designed to move a passenger from where he wants to start to where he wants to terminate with the least expenditure of time, effort, and insult.

Take, for example, the case of reservations. Its only purpose is to assure that you will be able to take an air trip at approximately the time you wish. As any reservations manager will tell you, the turnover in reservations is staggering. For every seat that is actually occupied somewhere between three and four reservations are necessary. The whole process of contacting the airline, waiting to get a reservation clerk because the lines are busy, accepting space that isn't really wanted, picking up tickets in advance, and the like is becoming a substantial barrier to air travel. It is also becoming increasingly expensive.

What is going on now is that the concept of reservations which originated in the DC-3 days is being put on electronic machines hooked up with an extremely expensive communications system.

I have proposed in the past and I propose again that the basic concept and need for reservations for most air trips be reexamined, looking to the possibility of a reservationless service, or one having an optional reservation for a flat charge of say $5. For many high-density routes where there are multiple schedules, such a system would seem to offer real possibilities. I was delighted to see that one of the local service lines plans to try out reservationless service. If reservations today are a headache for the carriers and the public, think of what they will be when traffic has doubled.

Much of the same sort of comments can be made about ticketing procedures. Since the introduction of the book ticket, no really significant advances have been made. As a result, lines at ticket offices are long and the employees more and more harassed and surly.

Problems and inefficiencies in the ground environment also show up in such things as the airport to downtown portion of the trip where the services become increasingly less attractive, not perhaps on an absolute basis but relative to service in the air. For example, according to the rules, it now takes as long to get from the west side terminal in New York to Newark as it takes to fly from Newark to Boston. The air speed is 184 miles an hour; ground transportation speed is approximately ten miles an hour. Another instance is the two hours and twenty minutes required for a legal connection time when the passenger transfers from La Guardia to Idlewild. For a passenger coming from Los Angeles and transferring at La Guardia for Albany, for example, this built-in waiting time now takes slightly longer than fifty percent of the inflight time from Los Angeles to New York.

The reintegration of these various functions, performed on the ground, into a more sensible system for getting the passenger from where he wants to start to where he wants to go, will require some major rethinking of the functions of airlines over the next few years. There are many sacred cows in this area. Some of them need to be kicked and some new and fresh ideas directed at the problem. Perhaps the solution is to have the airlines handle only the part of the passenger's trip from terminal gate to terminal gate. Perhaps the airline should broaden the scope of its service to include ground transportation and some new and better ways of handling tickets, reservations, baggage, and other appurtenances of an air journey.

There is a great deal of discussion about air traffic control. And certainly this is one of the major problems that the airlines and government face. I would submit that the problems attendant upon the ground environment and the scope of the service will come more and more to the fore in the years ahead as the jets take over. The real question is whether the airlines will be willing to face up to these problems. A closely related problem is whether regulatory authorities will recognize the need for some new solutions in this area and will cooperate by making it possible for the carriers to attract the required financial and other resources.

Several years ago the military began to turn increasingly toward a systems approach in the development of new weapons. Under this approach not only the weapon but its test and support equipment, its logistics support, and its personnel were looked at as a unity. It is high time that a similar approach be adopted for air transportation.

Over the past few years, the Civil Aeronautics Board has been pursuing a policy of building up the middle-sized and smaller carriers to a point where, it is hoped, they would be able to compete with the larger trunk lines. Whether this policy has been successful or not is largely a matter of opinion at the present time. But whether it has or not, there is every reason to believe that the scale of operations to which the policy was directed is about to change upward. In short, to be successful in the future may require a larger airline operating unit. There is some danger that the jets will make it impossible for some of the smaller trunk lines to compete effectively, even as enlarged by the Board.

Part of the reason for believing that the economical scale of operations for an airline is about to move upward lies, of course, in the jets themselves. By and large they are bigger airplanes and are much more productive in terms of seat-miles or ton-miles per hour. But there are other areas where the economical scale of operations may also be increasing: ground-handling equipment is one, advertising and sales promotions programs are another. Personnel is still a third—the ability to pay more for managerial talent without having it affect unit costs unduly.

Actually we know all too little about the economics of scale in airline operations. It is an area where there are many opinions and few firm facts. An examination of this question by the CAB might, I suggest, reveal more useful information than can be found in the files of the Air Transport Association.

My own guess, and it is no more than that, is that the optimum size of carrier operations and of carriers themselves is in the process of taking a sharp jump upward. Despite the flexibility that smaller organizations can frequently provide as against bigger ones, the economics of scale will probably require future air transport operations to be large. This is especially true if we peer into the future beyond 1965 and contemplate operations with supersonic aircraft having an initial unit cost of $20-$30 million plus elaborate ground-handling equipment.

The economics of scale can be expected to bring about some mergers among the trunk lines over the next few years, or at least pressure for mergers. While the regulatory process may tend to retard this movement for a time,

(Continued on following page)

it is not likely that it will stop the trend. Another reason for believing that mergers will be consummated in the face of a rising economical scale of operations lies in the aging of top airline management. The average age of trunk-line chief executives is fifty-eight. Seven of the twelve are fifty-nine or more. Only one is under fifty. Thus it may be easier for some of these gentlemen to face the possibility of merger with equanimity.

The probable reduction in the number of trunk lines and the emergence of larger operating systems thus becomes a part of the economics of the jet age.

If there is any validity to the trends mentioned thus far, the trunk airline industry over the next few years will be composed of larger units with more aggressive and systematic marketing programs and perhaps with different concepts of the system of air transportation. A final question involves whether the carriers will be able to attract the financial and human resources necessary to do their job. I purposely omit the question of whether the right kind of hardware would be available since it seems to belong more in the area of technology than in economics.

In the financial area there has been a good deal of recent concern as to whether the carriers would be able to finance even the first round of jet aircraft. I have expressed some doubt as to the financial ability of certain carriers in this regard. With economic recovery, the industry as a whole today seems to have largely met this hurdle, although some have not yet announced financing plans.

The cash throw-offs from the current airline investment will, as several people have already noted, provide very substantial sums available for new investment either in second-round jet equipment in the 1962-65 period or for supersonic equipment in the second half of the decade. The sizable investment represented by supersonic transports and the heavy technological risks involved would seem to preclude their introduction until 1966 or 1967 regardless of the theoretical availability of such an airplane.

It may well be that a large supersonic bomber, on which a transport version could be based, will be flying in the early 60s, but there is typically a considerable lag between successful first flights by military aircraft and the incorporation of related transports into regular scheduled service. In any event, the carriers in aggregate should be able, with reasonable earnings, to finance their aircraft equipment programs over the next few years without undue difficulty. This may not be true for all carriers and it would not be true for the industry if profits are unsatisfactory.

A reorientation of the carriers to an enlarged scope of service could drastically alter this picture. For example, if the airlines were to own a greater proportion of their terminals or ground facilities, if they were to enter the ground or intracity transportation business, or if they were to take other steps in this direction, their financial requirements could be sharply increased. In that event, the financial problem would again become a serious one for many of the carriers, particularly in view of the present general attitude of institutional lenders toward the industry.

Generally speaking, the image of the carriers which investors—large institutional investors—have is to the effect that the large ones are here to stay; some uncertainty as to the middle-sized carriers and real doubt about the smaller carriers. When coupled with the fact that within the financial community only a handful of individuals are really knowledgeable about airline economics and operations, the existing investor image poses a serious problem for the middle-sized and smaller carriers.

In part, the existing image which investors have can be traced to the carriers themselves who have frequently approached investors for money on poorly supported prospectuses and with a somewhat arrogant and truculent attitude. In part the fault lies with the financial community for failure to explore, on an independent basis, the economic facts concerning a rapidly growing new industry. Almost certainly the carriers both individually and as a group have a major educational job to do among institutional investors over the next few years.

Of perhaps greater concern than the carriers ability to attract the necessary financial resources for the jet age is their ability to attract the necessary human resources-management talent . . . in due course we are going to need some new talent at top levels. The average age of present trunk-line senior and executive vice presidents is fifty-five; and of twenty-six such individuals only two are under fifty. The average age of straight vice presidents varies widely among the trunk-line carriers. For one large carrier it is fifty-eight, and for another large one it is fifty-one. . . .

I have really not been able to say anything very harsh concerning the airlines. For the fact is that it is a good industry. Today it delivers a good product at a reasonable price. It is competitive; it is tolerably progressive in introducing new technological improvements. There is no question but that it has brought to the traveling public some notable improvements in the way of getting from one place to another quickly, safely, and with comfort. If I am critical of the industry, it is because I am ambitious for its future and because it is possible to see still further areas of utility. It is also possible to see some areas of jet age economics in which there appears to be less than the desired amount of attention and effort by airline management.

In an era when we seem to be in sharp competition with the Russians in everything from chess to Sputniks, we can be reasonably pleased with the present status of our airline industry. But to keep it ahead of the USSR and make the economics of the jet age attractive will require a great deal more work and a lot of imagination.—END

Dr. Paul W. Cherington currently is engaged in research work in aviation and air transportation in addition to teaching courses in transportation, marketing, and government and business. Dr. Cherington has been a consultant to the government, the Air Force, and commercial airlines. The above presentation is excerpted from Dr. Cherington's address in Las Vegas before the World Congress of Flight's Jet Age Conference on April 13.

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Interior view of mobile teleprinter center

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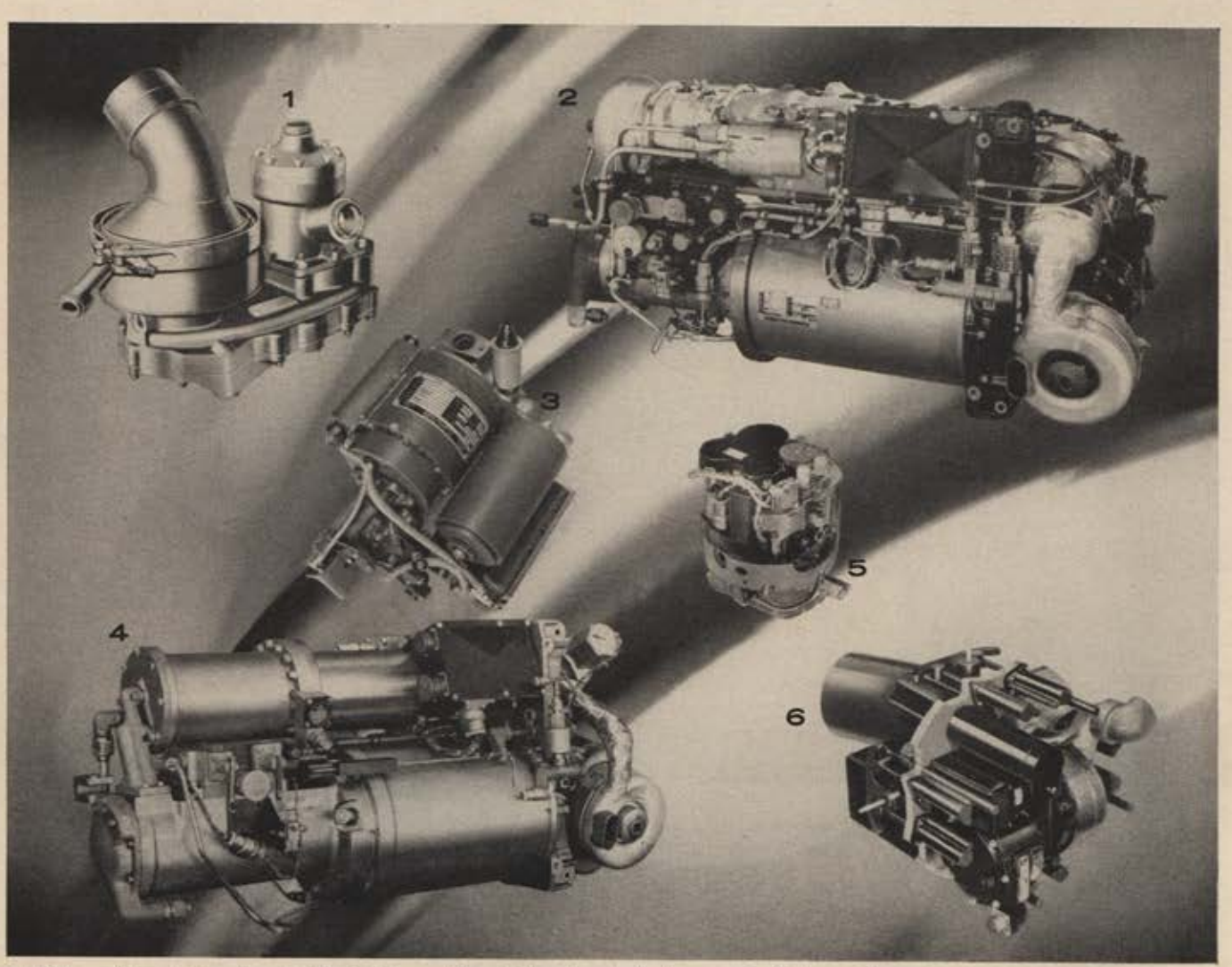

1. *Solid propellant—hydraulic output* 2. *Liquid propellant—hydraulic and electric output* 3. *Solid propellant—electric and mechanical drive output* 4. *Liquid propellant—hydraulic and electric output* 5. *Solid propellant—hydraulic and electric output* 6. *Solid propellant—hydraulic, electric and steering outputs*

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Strength of the free world alliance—represented by the caps of the men who lead military forces of NATO and other nations determined to stand firm against aggression. Caps were photographed as they awaited owners attending banquet.

FIRST WORLD CONGRESS OF FLIGHT

SALUTE TO NATO

NEARLY 3,000 persons, representing fifty-one nations, were present for the colorful banquet marking the tenth anniversary of NATO, held in Convention Hall midway during the World Congress of Flight.

The three-tier dais, surmounted by the NATO seal, held one of the most imposing groups of military, political, and scientific leaders ever assembled in tribute to the North Atlantic Treaty Organization. Guest of honor and keynote speaker was His Royal Highness the Prince of the Netherlands.

For many of the Congress delegates, particularly the Americans, Prince Bernhard's address was a highlight of the week.

The Prince made a strong point of the fact that NATO is not purely a military alliance and lent additional credence to the emphasis of the World Congress of Flight on the civil and political implications of the Aerospace Age.

This does not mean that the Prince passed over NATO's military import. He gave full credit to USAF's Strategic Air Command for maintaining the balance of power over the past ten years. And he expressed confidence that the NATO shield in Europe means that any aggressor must know he can gain no cheap victory.

The emphasis in this shield, the Prince declared, must be on airpower.

"There can be safety," he said, "only as long as the balance is maintained. The growing danger of surprise attack, combined with the physical impossibility to match the numbers of the Soviet armies, places the main accent on the effectiveness and state of readiness of our air forces. The striking power of NATO's air forces will need constant strengthening."

He said that because the threat of Soviet domination has broadened since 1949 it is a "healthy and growing economy" that is "the backbone of our defenses." The Prince acknowledged that the economic threat is most serious in the poorly developed countries and on the flanks of the alliance.

The Prince called on the NATO nations to realize that although they are militarily interdependent, national specialization is necessary in the pattern of their forces. He said the progress made toward a balanced collective force has been slow and will be speeded only if everyone accepts his share.

Dr. Theodore von Kármán, Chairman of the NATO Advisory Group for Aeronautical Research and Development, shared the speakers' rostrum with Prince Bernhard. He reviewed the history of AGARD and its contributions to aerospace technology.

Toastmaster for the NATO banquet was Maj. Gen. Frederick L. Anderson, USAF (Ret.), Deputy Chairman of the President's Committee to Study the US Military Assistance Program. The head table, representing all the major powers contributing to NATO, included Air Force Sec-

(Continued on following page)

Nearly 3,000 delegates and guests, representing fifty-one nations, attended banquet honoring a decade of NATO.

USAF Gen. Leon Johnson, Air Deputy to the Supreme Allied Commander, Europe, speaks to NATO Anniversary Banquet.

Dr. Theodore von Karman, chairman of NATO's aeronautical advisory group, discusses the joint areospace effort.

retary James H. Douglas and Gen. Thomas D. White, Chief of Staff. Others were:

Air Vice Marshal Walter C. Sheen, Commander of the Royal Air Force Staff, British Joint Services Mission, Washington, D. C.

Lt. Col. Joao de Paiva Brandao, Air Attaché, Portuguese Embassy, Washington, D. C.

Col. Ottar B. Engvik, Air Attaché, Norwegian Embassy, Washington, D. C., and Ottawa, Canada.

Maj. Gen. Duilio Fanali, Chief of Staff, Fifth Italian Air Force.

Maj. Gen. Spyros Diamantopoulous, Air Attaché with the NATO Standing Group, representing the Chief of Staff of the Royal Hellenic Air Force.

Lt. Gen. Josef Kamnhuber, Chief of Staff, German Air Force.

Maj. Gen. Jean Marie Bezy, Air Attaché, French Embassy, Washington, D. C.

Maj. Gen. Erik Rasmussen, Air Attaché, Danish Embassy, Washington, D. C., and Ottawa, Canada.

Air Vice Marshal Max M. Hendrick, NATO Standing Group, Royal Canadian Air Force.

Col. P. J. E. Janssens, Air Attaché, Netherlands Embassy, Washington, D. C.

Maj. L. F. Branders, Assistant Military, Naval, and Air Attaché, Belgian Embassy, Washington, D. C.

His Excellency R. S. S. Gunewardene, Ambassador of Ceylon.

Martin Mourik, 2d Secretary, Netherlands Embassy.

Lt. Gen. Louis Yen-chun, Deputy Chief of Staff for Operations, Chinese Air Force.

Air Marshal Mohammid Aghar Kahn, Chief of Staff, Pakistan Air Force.

Lt. Gen. Chang Kyoo Kim, Chief of Staff, Korean Air Force.

Brig. Gen. Julio N. Pereira, Portuguese Military Representative to NATO.

Rear Adm. James W. Boundy, Chief of Bureau of Supplies and Accounts, USN.

Maj. Gen. Rush B. Lincoln, Jr., Deputy Chief of Transportation, USA.

Edward P. Curtis, General Chairman of the World Congress of Flight, opened the banquet ceremonies by paying tribute to the people and aerobatic flying teams who contributed to the Las Vegas program.

Most thunderous applause went to the Thunder Tigers of the Chinese Nationalist Air Force. Also up for bows were the Red Devils of the Italian Air Force, the Dash Fours of the Royal Netherlands Air Force, the Blue Angels of the US Navy, and USAF's Thunderbirds.

All the teams had appeared earlier in the day at the air show held at Indian Springs.

In addition, Mr. Curtis introduced pilots from Great Britain, Canada, Belgium, France, Greece, West Germany, Denmark, and the United States who had taken part in a flying salute to NATO. Other flyers were present from the Air Forces of Spain, Pakistan, Saudi Arabia, the Philippines, Venezuela, and Colombia.

Mr. Curtis paid further tribute to:

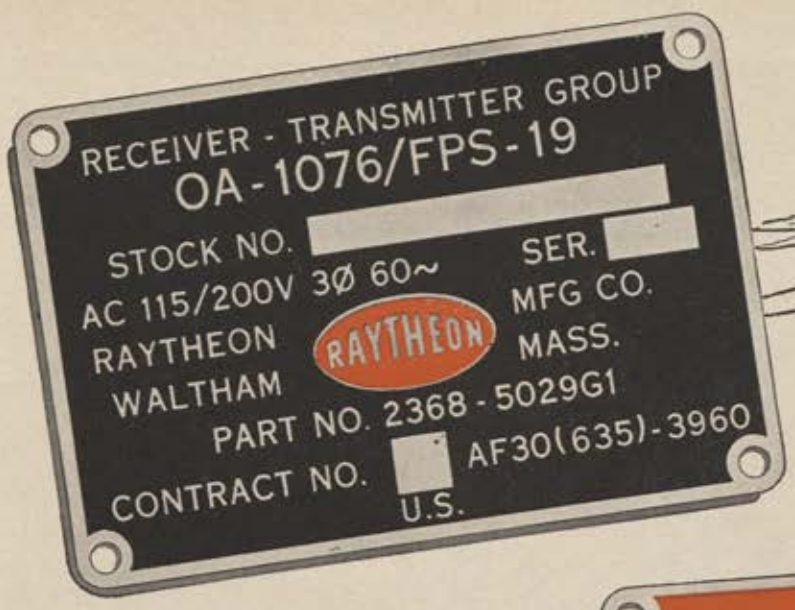
Air Vice Marshal George A. Walker, Royal Air Force, who led a flight of three Vulcan bombers from Great Britain to Las Vegas, and

Brig. Gen. James C. McGehee, Commander of Nellis Air Force Base and military host to the Congress, who was responsible for the air demonstrations.

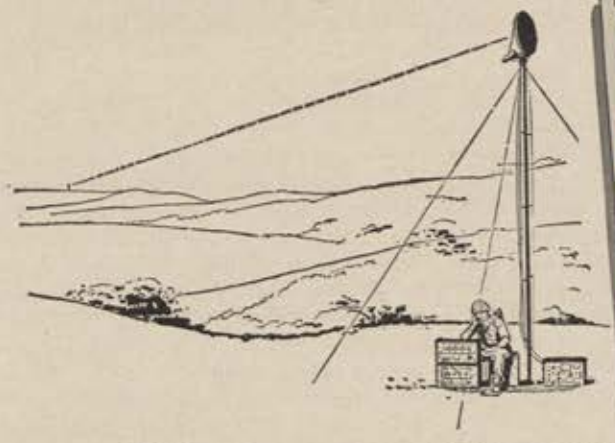
Members of the executive committee of the Congress of Flight also were at the head table, along with civic leaders from Las Vegas who worked on the program. In addition, there were Grant Sawyer, Governor of Nevada, and Alan Bible, senior Senator from the state.

Gen. Leon Johnson, USAF, Air Deputy to the Supreme Allied Commander, Europe, brought greetings from Gen. Lauris Norstad, SHAPE Commander.—END

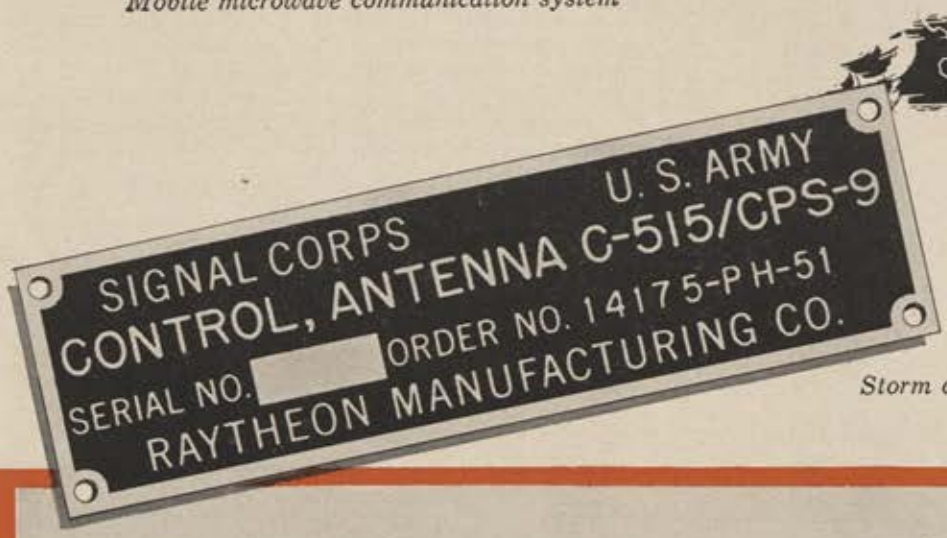
World Congress of Flight General Chairman Ted Curtis, left, chats with Bernhard, the Prince of the Netherlands, on banquet dais. The Prince gave major address of evening.



DEW line radar



Mobile microwave communication system



Storm detector radar

Electronic products of proven quality, efficiency and reliability for the Armed Forces

AT THE
WORLD CONGRESS OF FLIGHT

AIR SHOW—BEST YET!

For many of the thousands who attended the World Congress of Flight, the crowning event was the flying and firepower demonstration staged in the hot, dry air over the Nellis AFB Gunnery Range, some forty-seven miles out of Las Vegas.

Opening with a NATO salute fly-by of Republic F-84F Thunderstreaks, the air show featured demonstrations by the daredevil Thunder Tigers of the Chinese Nationalist Air Force, flying North American F-86 Sabrejets; the Red Devils of the Italian Air Force, flying F-84Fs; the Royal Air Force's Avro Vulcan bombers in a fly-by; and the Netherlands Air Force team in F-84Fs.

Flying aerobatics together for the first time were the USAF's Thunderbirds and the US Navy's Blue Angels.

Capping the show were demonstations of latest tactical bombing techniques by a TAC Republic F-105; inflight refueling demonstrations by TAC and SAC; air-to-air missile firings; high-speed aerial photography demonstrations; and napalm bombings—just part of the "best-air-show-yet" program.—END

At top of page, USAF's Thunderbirds do their stuff. Above, Chinese Air Force Thunder Tigers in action.

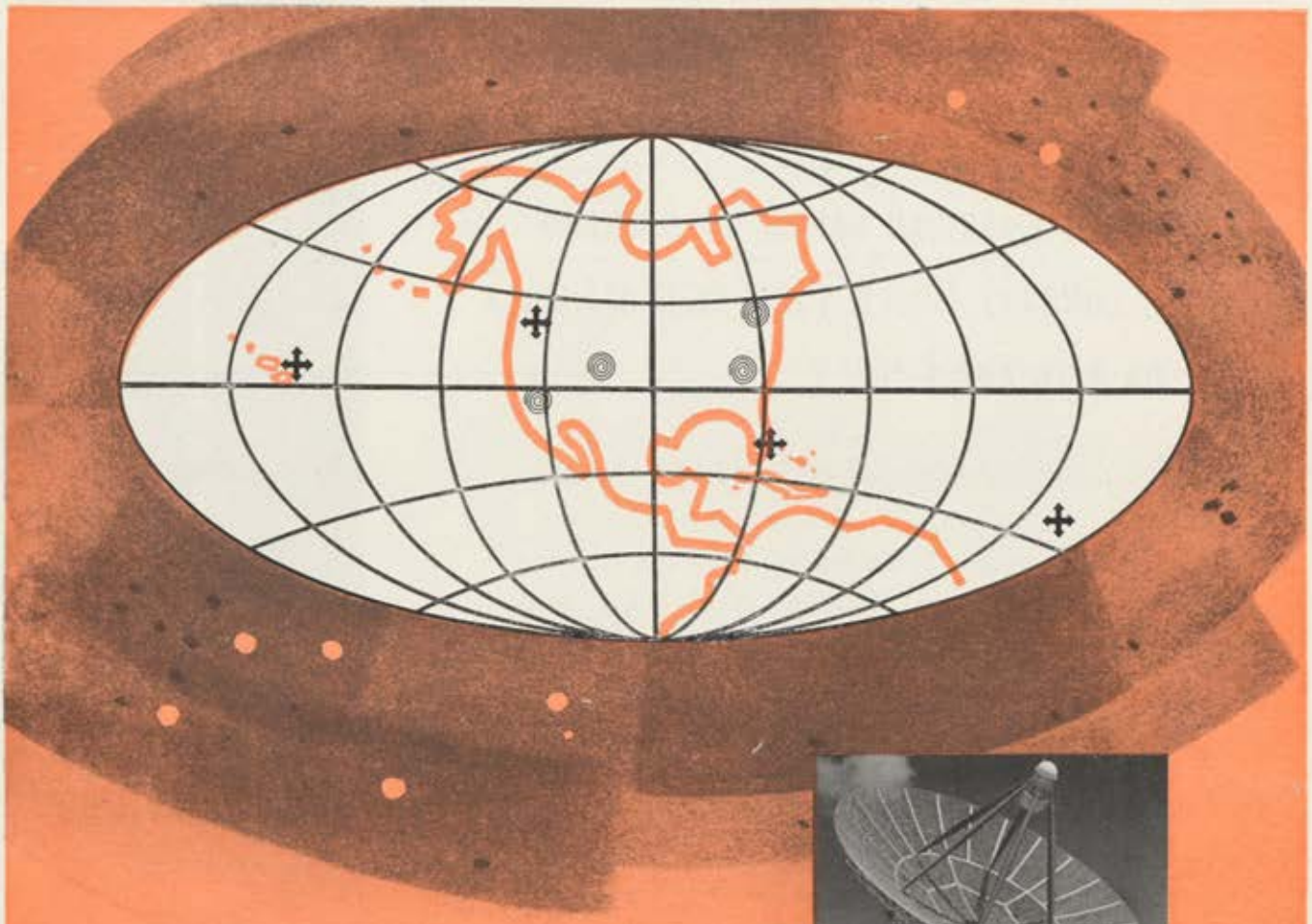
At right, SAC B-47 Stratojets in low-level fly-by. The live audience that witnessed the air show at the Gunnery Range was augmented later by millions who saw show highlights on General Motors-sponsored NBC television report.

Aerial demonstrations by allied jet teams were among the highlights of the air show. Above, the Italian Air Force's Red Devils, flying Republic F-84Fs streak across the desert sky. Other allied delegations included teams from Britain, the Netherlands, and Nationalist China. Foreign jet teams gathered at Las Vegas to help celebrate NATO's tenth anniversary.

The Royal Air Force's Avro Vulcans, part of the famed V-Force, on the ground prior to their takeoff for show flyover.

Throughout the show, stands were packed with the large crowds who traveled the long route from Las Vegas to the desert Gunnery Range for what veteran observers adjudged the best air show they had ever seen. Sunglasses and head coverings were uniform of the day to shield viewers from sun.

Talking things over before their aerial demonstration, members of the Royal Netherlands Air Force gather in front of their craft. The Hollanders flew F-84Fs, dazzled crowd with their skills, were later honored at NATO banquet, at which Prince Bernhard, a flyer himself, was the principal speaker.



Setting the stage for ever-deeper probes into space, protecting our borders against attack, a vast Radiation-built SPACE COMMUNICATIONS network extends from tropical Hawaii, far below our western horizon — spans the broad breadth of America, encircles half the Earth — and reaches bleak Ascension, far below our eastern horizon. Listening and tracking . . . this far-flung network lends an ever-alert ear to the sounds of space, friendly or foreboding.

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— proven high gain automatic-tracking telemetry antenna . . . recently recorded the Pioneer Lunar Probe into Space.

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NORTH AMERICAN NAMES SUNDSTRAND SECONDARY POWER SUBSYSTEM MANAGER ON B-70 AND F-108

Sundstrand Aviation is proud to be named a member of the North American weapon system team which will develop and produce a new concept in American air power —planes which will roam the skies at three times the speed of sound and feature the capabilities of both missiles and manned aircraft.

To meet its vast responsibility as a major system contractor for the B-70 Valkyrie intercontinental bomber and F-108 long-range interceptor, Sundstrand's system organization will include its own team of subcontractors—component suppliers and manufacturers whose reputation for technical skill, product development, quality, and reliability make them outstanding in their fields.

Utilizing the team concept with its subcontractors, Sundstrand provides the most efficient and effective means of accomplishing its assigned responsibility—development and production of reliable Secondary Power Systems for the B-70 and F-108.

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June • 1959

SPACE DIGEST

THE SPACE AGE IN PERSPECTIVE

ALPHA

A NEW NAME IN WORLD-WIDE SYSTEMS PROJECTS

To broaden and extend its systems projects services in keeping with the space age . . . Collins Radio Company has created Alpha Corporation . . . a wholly-owned subsidiary to be staffed initially with Collins specialists and executives.

For a number of years, Collins has been engaged in a concentrated program of design, engineering and installation of complex communication systems for both military and commercial uses. This program has resulted in the development of technical skills, management techniques and know-how representing a significant addition to the company's primary activity of developing and manufacturing individual units of electronic equipment. Alpha has been formed to expand upon Collins activities in this field.

Alpha, with its highly specialized systems management organization of designers, engineers, scientists and constructors, will produce complete, packaged commercial and government installations in this country and abroad . . . using the best available equipment from industry to deliver to its clients turn-key installations meeting the highest standards of dependability and quality . . . ready for operation.

Alpha will provide "on-the-job training" for customer engineers and technicians assigned to the installations . . . or furnish complete crews of skilled specialists to staff the finished projects.

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Alpha capabilities include technical systems management in all fields, with special emphasis on: • Space vehicle tracking and communication

Test range instrumentation and communications • Voice, teletype and data transmission • Aircraft modification and overhaul

Integrated shipborne, airborne, and ground communications • High capability remote control and switching

VOLUME 2, NUMBER 6 • JUNE 1959

SPACE DIGEST

• CONTENTS

From the Editors...

THE unsung contributor to almost any publication is the fellow known as the art director. Writers get bylines; the chap who creates the layouts and designs into which the copy is built usually has to content himself with his own pride in a job well done and the modest listing on the masthead, which people read perhaps once, but rarely on a regular basis.

AIR FORCE/SPACE DIGEST's Art Director, Jack MacLeod, is one of this highly creative breed. A few weeks ago he reported to the editorial staff that his design of the cover of SPACE DIGEST, which first appeared in our November '58 issue, had won a Distinctive Merit Award in the Tenth Annual Art Directors Show of Metropolitan Washington. The familiar cover was on proud display, at the Statler-Hilton Hotel in Washington, with the rest of the best in editorial and advertising art for 1958.

Seeing the original art again called to mind the sessions that went into its creation. We remember Jack asking: "How can we tell, in a single design, what we're trying to do in SPACE DIGEST?"

"Let's take the components of the space age," he said, "and put them together—simply—and attractively."

And he did. He mixed the feeling of motion, the infinity of space (at least to man), and the art of rocketry. We liked it, and so did his artistic colleagues, severe but honest judges.

Bold planning today can assure our survival in the days ahead . . .

SPACE AGE

WILL space exploration help solve the mystery of how life began?

Can the US meet the sinister challenge of Soviet science and propaganda?

What should private enterprise's role be in the highly expensive business of nonmilitary applications of space technology?

How do you go about selecting the men for a mission that is literally out of this world?

These were a few of the intriguing and significant questions explored by the topflight panel of scientific, military, and industrial experts at the day-long Space Age Conference that highlighted the astronautical portion of the World Congress of Flight. The Conference, sponsored by the Space Education Foundation, was held on the last day of the formal meetings of the World Congress.

The grim realities of today's space technology struggle seemed far off for a few refreshing moments during the opening session of the Conference as Dr. Edward Teller led a fascinated audience to the promised land of vast knowledge that space exploration may reveal.

All life on earth, the noted physicist said, is made up of the same building blocks. If we should find life beyond our own planet, Dr. Teller asked, will it too be made of the same components as on earth? Or are there other sets of ingredients that under the proper conditions can combine to form living and sentient beings?

Dr. Teller indicated his own strong faith that there is life on other worlds, and mused: "To assume that we alone are blessed or cursed with this phenomenon [of life] is . . . undemocratic."

Encountering and understanding extraterrestrial life may provide the answer to the very secret of life, Dr. Teller declared.

Living beings exist in a framework of time and space. Today's dominating theory of time and space is Einsteinian, and the keystone of the Einstein theory is the constancy of the speed of light —186,000 miles per second.

If we could blast a nuclear bomb at some vast distance from the earth—a hundred million miles out in space—it would send back to us at a single instant all the waves of the electromagnetic spectrum, including X-rays, visible light, infrared, ultraviolet, radio, and gamma rays. By charting the speed of the return of these waves, we could test the validity of the Einstein theory of relativity, Dr. Teller suggested. Dr. Teller's remark sent reporters to their phones. *(See page 144 for a summary of Dr. Teller's remarks to the Space Age Conference on April 17.)*

Having led his audience far out into space and time, Dr. Teller—who as Director of the University of California's Radiation Laboratory is deeply involved in today's problems—brought them back to earth. He closed his speech with a warning: History shows that those nations which led in the earth-bound age of exploration in the fifteenth and sixteenth centuries had the greatest influence on the development of today's world. The same will

CONFERENCE

WILLIAM LEAVITT
Associate Editor

be true of tomorrow's world. The leaders in space exploration will chart the future of this planet.

Opening speaker at the morning session of the Conference was Dr. James W. McRae, Vice President of the American Telephone & Telegraph Co., who spoke on the "Challenge of the Space Age."

Dr. McRae called for thoughtful analysis of the economic factors in space technology applications. Offering satellites as a new, potentially superior transoceanic communication method, Dr. McRae suggested that eventually the government must decide how such systems will be operated by private enterprise in view of the enormous expenses involved in construction, as well as changing military exigencies.

For commercial success such communication satellites must not only do a better job and handle more calls than the existing systems but must also be integrated with present systems as far as possible, Dr. McRae said.

From technological problems Dr. McRae moved on to some philosophical comments on the burgeoning space age. He stressed his view that the glamor of astronautics should not obscure earth-bound problems of population explosion, growing shortages of materials, rapid industrialization, and the increasing need for power to run the new technology.

These problems, Dr. McRae said, are all part of the over-all survival problem. The sooner we start thinking about solid answers to questions such as how much we want to spend on space technology, and what the government-industry relationship in the program ought to be, the sooner we will attain a realistic and balanced program for the new age, he said.

Dr. McRae was followed on the Conference program by Rear Adm. John E. Clark, Deputy Director of the Defense Department's Advanced Research Projects Agency. Admiral Clark outlined his agency's role in the development of military applications of space technology.

Commenting on the organization of the Soviet space effort, the Admiral said:

"The organizational makeup of the Soviet . . . program is not clear. The [respective roles] of the Soviet Academy of Sciences and of the Ministry of Defense have not been defined. This should in no way confuse our thinking as to the military input and output of Soviet space endeavors. We cannot compare the USSR's way of doing things with our own. At the very top of the Soviet hierarchy there is a group of dedicated Communists who can, under the best security system in the world, organize a program to whatever military and political ends the Kremlin deems necessary. . . ."

In contrast, the US, said Admiral Clark, has undertaken "independent but supporting civilian and military approaches to space."

Said the Admiral: "The duality of organization reflected by the National Aeronautics and Space Administration and the ARPA is a perfect response to the duality of American interest in space."

He pointed up the continuing key dilemma of US space technology planning with this observation:

"Our problem is really one of attaining the best possible organization. The history of American technological accomplishments, and the day-to-day progress evident on all sides, is eloquent testimony to the high level of scientific and engineering capability in this country. The problem of advancing and accelerating our technological position is not associated with a paucity of talent; the problem is how to organize it, how to bring the full weight of the potential to bear, eliminating power losses from duplication, from lack of complementary effort wherein the total is less than the sum of its parts."

Admiral Clark asserted that ARPA's effort (*See May* SPACE DIGEST) is to "mobilize great capability under the organizational discipline, priority, and long-range planning necessary to provide the breakthroughs of military space leadership."

On man's role in space he joined the ranks of those who see a continuing significant job for the human operator, even in a day of advancing automation:

"The greatest single advantage [of a man] is [his] ability to meet and cope with unforeseen situations. Such situations are the rule rather than the exception in combat. If active warfare ever pervades . . . space . . . a veritable bag of . . . tricks will be opened, the likes of which the world has never seen before. . . .

"To try to anticipate every one of these tricks . . . with automatic equipment seems not nearly so reasonable as to put a man into the spaceborne system—a man who can use his ability to think, to perceive, to discriminate, to identify, to make decisions and, acting like a servomechanism, to implement these decisions immediately in terms of the equipment that might be available to him."

On ARPA's project list, Admiral Clark reported, is a five-year research and development program for a number of sophisticated communication satellites which will be descendants of the US Air Force "talking" Atlas satellite of December 1958.

The satellites will be launched by IRBM boosters into 300- to 500-mile orbits and will have a communications capacity equivalent to twenty continuously available 100-words-per-minute teletype channels.

A later phase of this program, he said, will be the orbit-repeater system. This system will provide satellites capable of receiving and retransmitting messages instantaneously from 3,000- to 22,300-mile orbits.

Eventually, the Admiral said, a communication satellite will ride in a 22,300-mile equatorial orbit. Such a satellite would appear stationary from the earth since its orbit would take twenty-four hours to complete its path around the earth.

A system of three or four such satellites would amount to a great breakthrough in military communications, the Admiral said.

Other ARPA projects in space technology, as listed by Admiral Clark:

- With NASA, a general-purpose worldwide tracking and surveillance system.
- A satellite detection "fence"—creating a capability for detecting and predicting orbits of all space vehicles passing over the US.
- Mrs. V—a maneuverable, recoverable space vehicle. Information from the USAF-ARPA Discoverer series under way from Vandenberg AFB, Calif., is feeding into this program.
- Solid-fuel and exotic-propulsion systems.

Dr. Joseph M. Goldsen of RAND Corporation's Social Science Division pointed out to the Conference the importance of the impact on society of space attainments. He raised the question of US response to Soviet attempts to bully the world into believing that their space achievements mean that the Communists are indeed the "wave of the future."

"The Soviet Union never for a moment loses sight of the *political* utility of the space issue," Dr. Goldsen said.

The multipronged effort of the Soviet Union, in his view, is designed to:

- Convince the world that the Soviet Union is now the strongest military and scientific power.
- Convince the world that the Soviet Union desires nothing but peace, that its military power will be used only in the interests of peace and security against the aggressive designs of the West.
- Exploit the attainments of ICBMs and Sputniks in the service of the long-standing Soviet objectives to weaken and divide the free world

coalition by continuing to mix blandishments with threats as tactics of international blackmail.

Are the Russians succeeding in their campaign? Dr. Goldsen believes it is difficult to assess the long run effect of the Soviet campaign . . . "but it is probable that the Soviet Union has already scored impressive tactical gains on the political and psychological front, in addition to its technical and military gains."

Especially in the neutralistic countries and in underdeveloped areas, Dr. Goldsen said, the Soviet campaign has succeeded in part. As the doctor put it:

"It is likely, though unproved at present, that some influential people in small countries and in underdeveloped areas derived satisfaction from the failure of the United States to be the first to launch a satellite and from the current Soviet lead in space activities. These people may tend to view their nations as more like the Soviet Union than the United States in their standards of living. . . . To the extent that they regard the United States as linked with imperialism, colonialism, exploitation of their resources, racial superiority, and prejudice, they resent (as well as envy) the material success of the United States and its incredibly high standard of living. For the United States to have been first to launch an earth satellite, and to remain in the lead, would not have been so impressive . . . they expect America to perform such technological feats. They may interpret Soviet successes not only as confirmation of Soviet superiority in science, in economic development, and in military technology but also as evidence of the superiority of 'socialism' over capitalism. If such feelings gain sufficient strength, they will contribute to neutralist and pro-Soviet sentiments on other matters."

To counter the Soviet offensive, Dr. Goldsen called for a free world program to acquire military and technical superiority over the Soviet Union. He said also that the US must shatter hypocritical Soviet claims to world moral leadership through more effective propaganda efforts.

At the same time, he said, we must be prepared for probable new Soviet space successes, and temper our policies and statements in terms of such anticipated successes. Dr. Goldsen added that publicity in the US regarding America's activities in space should be considered "for its effects on other countries as well as for reasons of domestic public information."

As one way of making the Russians put up or shut up, Dr. Goldsen suggested that the US press the Soviets on the idea of nations filing flight plans and allowing inspection of space vehicle payloads to assure the world that the vehicles are harmless:

"If the Russians refuse such an agreement, might it not be to the advantage of the United States to go ahead anyway on a *unilateral* basis? Such an initiative might demonstrate unequivocally the peaceful intent of the United States in its . . . programs. The burden of proof of Soviet peaceful intentions would be thrown on them for a change by their refusal to do what [we] might already be doing."

A forum on "Man in Space"—the mission, the men—featuring three space scientists who played important roles in the selection of the seven-man Mercury Astronaut team (*See May* SPACE DIGEST) was the closing highlight of the Conference.

Project Mercury Director, NASA's Robert R. Gilruth, described the orbital mission as presently planned and announced that successful testing of the launch-pad escape system had been achieved.

Dr. W. Randolph Lovelace, II, Chairman of NASA's Committee on Life Sciences which planned the Astronaut selection program, described the intensive physical, psychological, and psychiatric testing methods used at his Lovelace Clinic at Albuquerque, N. M. It was there that Astronaut candidates were screened prior to being run through extensive space-stress simulation tests at the Air Force's Wright Aero Medical Laboratory at Wright-Patterson AFB, Ohio.

Closing speaker at the Conference was AF Lt. Col. William R. Turner, group leader of the NASA Astronaut selection team. Colonel Turner directed the space simulation testing of candidates at Wright-Patterson. He showed for the first time slides illustrating the rigorous Mercury Astronaut tests which ranged from partial immersion in freezing water to struggling with an "idiot" board on which the red light meant "go" and vice versa.

Of the candidates screened, Colonel Turner said all were "truly topnotch." He scotched the idea, which he said had been suggested in the press, that the selection program attempted to differentiate bunny rabbits from tigers.

"In fact, we were differentiating tigers," he said.

Moderators at the two sessions of the Conference were Col. John Paul Stapp, Chief of the Wright Aero Medical Laboratory and President of the American Rocket Society, and Andrew G. Haley, President of the International Astronautical Federation. Gill Robb Wilson, Chairman of the Board of Trustees of the Space Education Foundation and editor and publisher of *Flying* Magazine, gave the call to order.—END

Dramatic night photo of outside exhibit at World Congress reveals array of US aerospace craft and missilry. Left to right, the Snark missile; Thor-Able space probe, Discoverer nose cone, and the Atlas.

Aerospace Exhibits at the World Congress

SPACE SHOW IN THE

In the bright Nevada sun, the sleek black frame of the X-15, center, awaits the thousands of delegates and public who will view it during the World Congress. Test pilots for the X-15 attended the World Congress.

Giant Westinghouse paraballoon, Convair 880 displays were only part of the enormous indoor exhibit.

DESERT

THE vast new age of space is upon us, and shiny evidence of this significant fact was available at the enormous inside-outside exhibits at the World Congress of Flight.

Delegates and public braved the hot sun of Las Vegas to view such space age items as the ten-story-high USAF Atlas ICBM, whose double role in the new age as weapon and space vehicle has already made so many headlines. Also on display at Las Vegas were full-scale models of the X-15, the McDonnell space capsule designed for the Project Mercury orbiting-man program, and the Thor-Able space-probe vehicle.

Crowds at the Congress also saw probably the largest array of aerospace equipment ever assembled under one roof—Exhibit Hall.—END

Public lines up to view the innards of the giant Atlas. Frame was specially modified for display.

Are we alone in the Universe . . . ? And can Einstein's physics be proven?

THE AIMS OF SPACE EXPLORATION

DR. EDWARD TELLER

Director, Radiation Laboratory, University of California

NOBODY—and that includes me—can predict what space research will bring. Research has the particular quality of always bringing surprises. Therefore, the most you can possibly hope to predict, if you are good at predicting, is the next step, and usually you can't even predict that. The next step will be a surprise and will change our thinking so much that to further predict becomes entirely impossible. But we can be sure that space exploration is of extremely great importance for us and the next generation.

As we leave the earth, we can look down on our planet. Seeing it from our slightly elevated vantage point, we can find out things we did not know before. Meteorology is an excellent example. How will our weather appear when we examine it from the point of view of the angels? Our present-day meteorology is studied from a worm's-eye view. We painfully collect data first from the earth and then from very low-flying aircraft and balloons. We piece these data together and try to get the whole picture. But our "whole picture" is full of holes. Big areas in the Arctic region, over the ocean, and in many of the less advanced countries, are very sketchy.

A true meteorological satellite could do real service. It could look down, with television apparatus, on something like one-eighth of our globe at each instant, and see the phenomena in the Arctic region that bring rain to the temperate regions. Or it could report on the development of clouds driven and generated by the contact between the cold and the warm, moist air masses. Such knowledge will improve weather prediction, and might suggest new ideas which, in the uncertain future, could lead to the disquieting and dangerous possibility of eventual control, or partial control, of weather.

And what of the radiation zones surrounding the earth, which have been discovered by our satellites? This radiation is intense enough to interfere with the kind of "space platform" that we might want to establish—a manned station at elevations where the radiation zones have some practical importance. If we put people there, they would, according to our present knowledge, have to be appropriately shielded, and that would not be so easy. What do these radiation layers consist of? We do not yet know precisely. By and large these radiation zones consist of charged particles, perhaps electrons, perhaps hydrogen nuclei, we don't know which yet. Maybe both. These particles are bent around by the magnetic lines of force. They spiral around these magnetic lines of

force and run down from the North Pole to the South Pole in a fraction of a second and turn back again to the North Pole, staying essentially on the same longitude. But there is also a very slow drift of these particles so that they change their longitude, encircling the earth in an hour or less.

Where did the particles come from? We don't know. Probably the sun ejects streams of particles at the time of strong solar activity. With Project Argus, we made an actual stab at understanding these particles a little bit better. With nuclear explosions in space, we have created a tiny artificial layer of radiation. By doing something which is completely negligible as compared to the natural phenomena of the Van Allen layers, we have been able to watch charged particles do the kind of circling and drifting that I have just described. By a feeble imitation of a natural phenomenon we have contributed to the study of that natural phenomenon, and we have contributed to a slight extent to the natural radiation which surrounds us.

These explosions do contribute to our radiation background, but so little that the additions are barely discernible. Further nuclear explosions in deep space could provide us with some very interesting answers to scientific questions. One of these, which I heard from some of my friends, I should like to describe to you.

If we sent out into deep space a vehicle carrying a little nuclear explosive, and detonated it at a healthy distance of perhaps a hundred million miles, the explosion would send out the whole electromagnetic spectrum ranging from X-rays through visible light, through infrared to radar. All these radiations would be emitted at a very precise instant. The beginning of the emissions could be very sharply defined to an accuracy better than a microsecond—that is, better than a millionth of a second.

Let's see whether all these signals arrive back on earth at precisely the same time. This is what the wonderful branch of physics known as relativity tells us they should do. No matter whether it is X-ray or visible light or radar wave, light velocity is constant, according to Einstein. There is no deviation in vacuum of light velocity whatsoever in Einsteinian physics. We'll have the means to check this statement a thousand times more accurately than anybody has been able to check it before.

With such an experiment, we could make a sizable contribution to basic science. Incidentally, I do not think that the radar waves will come through with an honest-to-goodness light velocity. This is because these rays are very sensitive to even a few charged particles in space, and space is not empty. There are at least a few charged particles for every cubic inch in interplanetary space. Thus, measuring the velocities of these radar waves might be a good way to probe for the degree of emptiness of space.

Now what about the kind of space exploration which would involve manned travel? What will happen if we get to the moon, to the planets? What questions will we be asking, and what answers are we likely to get? Let's take the moon. I know I would very much like to know whether the moon has a magnetic field. I think it has none. Its density is less than that of the earth. It probably lacks a liquid-iron core, and probably a liquid-iron core is what produces our magnetic field. By going to the moon and making sure that it has no magnetic field, we will have an added piece of information about certain phenomena on earth.

And there are many other interesting things on the moon. Recently we were surprised by a report of volcanic eruption on the moon. Could it be true? What is the moon made of? Not only its surface but its interior. Is it correct, as many astronomers believe, that the craters of the moon are very old and have stood for possibly billions of years? What will happen when we put a seismograph on the moon? Are there any such things as moonquakes or rearrangements in the interior layers of the moon? Getting answers to these questions will teach us much about how the planetary system has developed, how our earth itself developed.

And what about Venus? We know that Venus has an opaque atmosphere, and we know nothing about its surface. Why is Venus' atmosphere so different from our own in spite of the fact that

the size of Venus and the size of the earth seem to be so entirely similar. Certainly to get to the surface of Venus would be a revealing achievement.

Mars, our other neighbor, is interesting for different reasons. Although it is much smaller than the earth, it has a similar atmosphere and there are suspicious signs of life. God knows now, and *we* may know sometime, whether those signs mean anything.

There are the other planets, such as Jupiter, which has enough gravitational pull to retain the lightest and most common of elements in the universe—hydrogen. Jupiter and Saturn have predominantly hydrogen atmospheres. Only deep inside them can you reach the other elements of which the earth is mostly composed. We are not likely to find life as we know it at the very low temperatures of the outer planets. We are more likely to find it on Mars or Venus.

What about the question of extraterrestial life? I believe there is life on other worlds. To imagine that we are the only place blessed or cursed with this phenomenon is a thoroughly undemocratic assumption. But if the billions of planetary systems in our own Milky Way and other galaxies are teeming with life, I would like to know why we haven't yet encountered our extraterrestial neighbors.

Travel to other star systems will of course be a formidable job. The nearest star is more than four light years away. Lacking a really good propellant—and considering that the best potential propellant foreseeable today is fusion—it will be difficult or almost impossible to travel such a distance at any speed greater than one twentieth the speed of light. The expedition, one way, to the next star would take probably at least eighty years. It is not an easy enterprise. The absence of any real flying saucers could be due to our extreme isolation. . . .

What will we find? I don't know. Strange things, to be sure. Let me suggest the strangest things we can expect to find. And the things to look for.

Life—even on this earth—is so full of surprising forms that, while life elsewhere will probably be quite different, it might not be more grotesque than life we already know. There is one way in which all life on earth is monotonously similar, uniform. The chemical composition of every living system, from man, through the insects, through the plants, through the microbes, through the very viruses, is made up of the same type of molecules, the proteins. There are other components, such as nucleic acids, but the basic composition of every living being on earth is the same.

Question: If we find any trace of life elsewhere, say on Mars, will it still have the same composition? And, if yes, why? And, if no, why? Either way, if we find anything lifelike, if we find any complicated or strange molecular arrangement in these places we visit, they may reveal an entirely new series of questions and a series of approaches which could give us a clue to the process of life.

We all know that, when Columbus set out for what turned out to be America, he did not start out with the purpose of finding this continent. What we are going to find in space will probably be different and much more interesting than what I have been talking about. Some of the information will be so interesting that probably at first it will not even be noticed. The most interesting and the most unexpected thing often fails to attract attention at the outset because we find only that for which we are prepared.

It is obvious that those countries which dominated the earlier exploration of our globe were the ones that had the real influence upon the fate of the world in our time. Similarly, whoever explores space first, whoever moves around in space with the greatest ease is likely to determine the fate and the direction of the world community tomorrow. For the free nations, which have entered into space exploration with some handicap, this is an extremely important thing to remember.

Space exploration is something that will affect us all. It is a venture which I think should be undertaken on an international basis. International cooperation has already proved extremely fruitful in the International Geophysical Year. I have but one criticism of that Year. It was too short; it lasted only eighteen months. With international cooperation, we shall not only find out for our enlightenment what is in space, but we will also obtain something else too—a knowledge of how to work together and live together.—END

A native of Hungary, Dr. Teller is one of the world's leading nuclear physicists. A veteran of the Manhattan Project, he directed development of the H-bomb. This article summarizes his remarks at the recent World Congress of Flight.

NEW DECISIONS FOR A *NEW* WORLD

DR. EDWARD DOLL
Vice President and Associate Director
Systems Engineering Division
Space Technology Laboratories

AS A nation we are not yet prepared philosophically to judge the importance of space technology as compared with other segments of science and engineering. There is no reservoir of common understanding of the military or economic or scientific values of accomplishing space missions. There is no general agreement on which particular projects will contribute the most to our military strength and national security, to scientific progress, or to the preservation of individual liberty and health and happiness. Yet, space technology is a field in which the major projects will become increasingly complex and expensive, and will increasingly tend to take on the character of national—and likely global—undertakings. And to further confuse the issue, an increasing number of alternate projects will become technically feasible.

With limited economic and intellectual resources, it is very important that we should distinguish between what is *possible* and what is *needed*—between what *can* be done and what *should* be done. Serious mistakes in judgment concerning either the selection or the timing or the magnitude of our space projects could have critical consequences.

Because of the overwhelming importance of maintaining our national security, the pace of future space development will almost certainly be closely linked to the military potential of space weapon systems. In this connection, one must consider both those military systems which have as their objective direct military action, such as retaliatory bombardment, and military systems which have as their objective indirect military action such as reconnaissance, communications, or early warning. Both direct and indirect military space systems merit careful consideration.

The intercontinental ballistic missile appears to be the most important space weapon system for direct military action for many years to come. It is clear that the ICBM has a large growth potential and that it is technically feasible to design ICBMs which are simpler, lighter, smaller, more reliable, more accurate, cheaper, easier to produce in quantity, more automatic, less vulnerable to enemy attack while still earth-bound, and harder to shoot down than those currently being tested. Such extensions appear able to meet foreseeable military requirements without encountering any fundamental scientific design limitations. Of course, the development of such advanced ballistic missiles will continue to require solutions of many difficult engineering problems.

Although other direct action space systems have been proposed, such as bombing stations on the moon and satellite stations similarly equipped, it does not appear that such systems would add as much to our war-deterring capability, during at least the next decade, as advanced ICBMs, advanced aircraft systems, or other advanced earth-bound military projects which could be developed with the same money and effort.

It is unlikely that the development of manned stations on the moon or like projects will be pursued in the foreseeable future under the forced draft of military necessity. It is more likely that space exploration of the moon and the near planets will be carried out, at least initially, for scientific purposes, and for those less tangible reasons of national and international prestige.

In contrast, the properties of earth satellites do offer a natural and significant potential for the accomplishment of military reconnaissance and for both military and commercial communications. Earth satellites equipped with photographic equip-

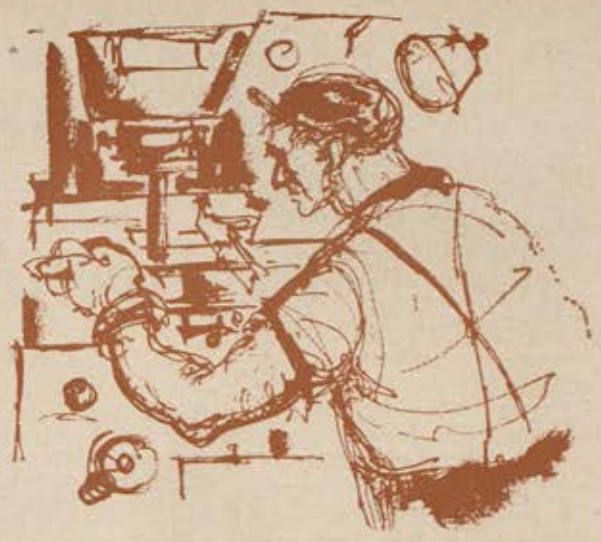
ment, television cameras, communication relay equipment, communication recording equipment, etc., may be expected to receive strong emphasis in military programs, and their development will most likely be paced by military requirements. The possibilities are many.

As an illustration of one important possibility for the use of earth satellites, let us first note that, as the altitude of an earth satellite is increased, the time taken for one revolution around the earth also increases. A satellite with a mean altitude of several hundred miles takes a time period of about an hour and a half to pass around the earth. The moon, which is a satellite with a mean altitude of about 240,000 miles, takes about twenty-eight days to orbit the earth. At the intermediate altitude of approximately 22,000 miles above the surface of the earth, the time period required for earth satellites to pass around the earth is exactly twenty-four hours. This means that an earth satellite at 22,000 miles' altitude, traveling in a plane passing through the earth's equator, and rotating in the same direction as the earth, will appear to an observer on the earth to be stationary in the sky. Such a stationary satellite can serve as a permanent relay station for both military and commercial communications.

The Atlas "talking" satellite, SCORE, while not a stationary twenty-four-hour satellite, did demonstrate the technique required for satellite relay communications. Other satellite systems with different orbits and different periods are of major future importance, whether for reconnaissance, early warning, or weather observation.

For most people, it is the manned exploration of space which excites the imagination. In some ways, the situation is similar to that found in the fifteenth and sixteenth centuries when it was first generally realized that new and unexplored continents of large size could be reached by sailing westward from Europe. Such sailing trips were certainly dangerous for the participants, and it was not clear what would be found at their destination. The travelers were out of communication with their home port for months and sometimes years, and it was something less than positive that they would return. It is worth noting that the voyage of Columbus was conducted under a government subsidy. It is likely that much of space exploration for years to come will be similarly sponsored.

Although it is not scientifically established that man will be able to survive extended spaceflight, it appears likely that he will be able to do so. This feeling is partly based on a small amount of experimental evidence gained in aircraft and balloon flights with men, in rocket flights with animals, and partly on the intuitive faith that the will and spirit of man will eventually enable him to explore and conquer space.



Up to this point I have confined my remarks to rather sober considerations of relatively plausible space ventures with particular emphasis on military applications. It might prove interesting to speculate a little more daringly on possible future space activities of more direct interest to the general public. Certainly there are some possible applications in which the newly acquired ballistic missile technologies can be used.

First, we may have cheaper intercontinental transportation at hypersonic speeds. Thus, one will be able to go from Los Angeles to Paris in an elapsed time of an hour. Cost should not be more than $100. A second probable embodiment consists of a worldwide communication and color TV system. In such a system suitable transmitting equipment would be housed in satellite vehicles. The orbits of these vehicles would then be arranged to place them over the continents which are to receive the broadcasts.

Observations taken from satellite stations can be used to provide a much more accurate set of weather predictions than we are currently able to make. It is conceivable that research directed toward the actual control of weather can be carried out with such a space satellite system.

Two things should be noted. First, all of the three applications just described can result from current technological developments. A variety of satellites and space probes have already been launched. Thus, with the possible exception of space-borne sources of electric power, no new component developments are needed to develop these devices (the electric power for use in space

vehicles can be obtained either from nuclear energy or from solar energy). In both cases working units are already in use in ground-based equipment.

The second interesting point with respect to the three developments I have just described is the fact that, although the essential technologies are a by-product of the ballistic missile development, the applications have tremendous potential for promoting peaceful understanding among the people and nations of the earth. For example, the suspicions, censorship, and out-of-date political procedures which now all too often hamper understanding between peoples might be subjected to tremendous pressures if the people of the world came into more frequent contact with each other through vacations in Paris, Moscow, Bombay or a day's shopping tour in Rome, or through a worldwide TV network.

Even worldwide TV commercials may have their place. Of course, there may exist a language problem. Nevertheless, I suspect that an international public which has learned to withstand the pressures of TV commercials would be less likely to succumb to misleading political propaganda.

These last applications of space technology which I have described have been designed to meet current human needs. At the same time that these applications are being developed, there will almost undoubtedly be carried out an extensive exploration of the solar system. Initially, these exploratory space vehicles will consist of instrument probes. These vehicles will be launched to different parts of the solar system. They will carry a complex set of instruments and sensory elements including television equipment.

Thus, the people on earth will be able to obtain close-up pictures and other measurements of all parts of the solar system. However, I think man has an adventurous nature. Pictures and thermometer readings will not be enough. Instead, ultimately there will be manned explorations of the various planets and their satellites.

The time required to travel to the more distant parts of the solar system will be measured in years or even decades for some time to come. Consequently, it will take a long period to complete the exploration of the solar system. However, it is interesting to project our technologies a little and try to see what may be done fifty or more years from now.

By that time we may have established fairly large colonies of people on the moon and on other bodies in the solar system. These colonies will be completely self-sustaining. Generation after generation will be born, live, and die within the colony. In short, such a colony would be a closed ecology.

A similar civilization could inhabit a synthetic planet. This would be a large space vehicle weighing millions of tons and carrying a population of several thousands of people. Such a spaceship could move in a permanent orbit about the sun, or, if desired, be attached as a satellite to one of the planets.

The description of an elaborate space vehicle of this type has been made for many years. I suggest that such vehicles may be possible and practical. Using a simple two-stage carrier vehicle, with both stages recoverable and therefore usable again and again, it will be possible to place a payload in satellite orbit around the earth at a cost of $1,000 a ton, or fifty cents a pound. Thus, a million-ton vehicle could be built from small segments, for example like the Pyramids, at a cost of some $1 billion.

In fifty years or so the per capita productivity of our population could grow to the point where a billion-dollar expenditure will be a comparatively trivial thing. Consequently, it could be possible and economically feasible to construct the synthetic planet type of space vehicle which I have described.

Interstellar flight is much more difficult than spaceflight within our solar system. The distances between stars are so great that travel times may be as long as several thousand years. However, it is not unreasonable to suggest that such flights may be attempted when large self-sustaining space vehicles are developed. The energy needed to maintain the life cycle of the inhabitants of such an interstellar vehicle could be obtained from a nuclear powerplant. Another method of coping with the tremendous travel time has often been

suggested. In the years to come it may be possible to modify human characteristics in a controlled manner. For example, it would be handy-dandy to have a population capable of long periods of hibernation available to populate an interstellar vehicle. It would also be most helpful if the average lifetime were increased, say to 5,000 years, rather than our present transitory existence.

Now having convinced you, I hope, that enormous space stations will be feasible within fifty or so years, I would like to suggest that probably they will not be built in the manner which I have described. Instead, I believe that during the next half century there will be made a large number of discoveries and that a number of new technologies will be developed. Using these new discoveries and new technologies, it will be possible to build the inhabited space vehicle in a much easier manner. Even more likely, however, is the fact that there will be many exciting embodiments and developments in the field of space technology in the years ahead, developments of which we are totally ignorant. Because of these impending future discoveries, these projections, which may seem startling today, are possibly very conservative.

Now let us summarize what appears to be the likely space market for the not-too-distant future.

Summarizing the problem of predicting the future in space technology, one must keep in mind that its rate of progress must depend not only on an estimate of technical feasibility, but also on an estimate of the national and international importance to be attached to these projects throughout the coming years. Partly for this reason, the pace in the future development of space technology will be closely linked to the military usefulness of space-weapon systems. The ICBM appears to be the most important space-weapon system for direct military action for many years to come. Earth satellites appear to offer a large potential for indirect military applications in reconnaissance, early warning, and communications.

In attempting to visualize future space developments, one must separate those future possibilities which depend only on continued engineering based on the scientific knowledge which is known today, and are therefore relatively predictable, from those possibilities which require new scientific discoveries, and are relatively unpredictable. Intermediate are those cases which require the reduction to practice of known scientific findings.

Those possibilities which can probably be accomplished without major new scientific knowledge include unmanned flights into various earth satellite orbits, to and around the moon, and to Mars and Venus, manned flights into earth satellite orbits, and manned flights for one to two men around the moon.

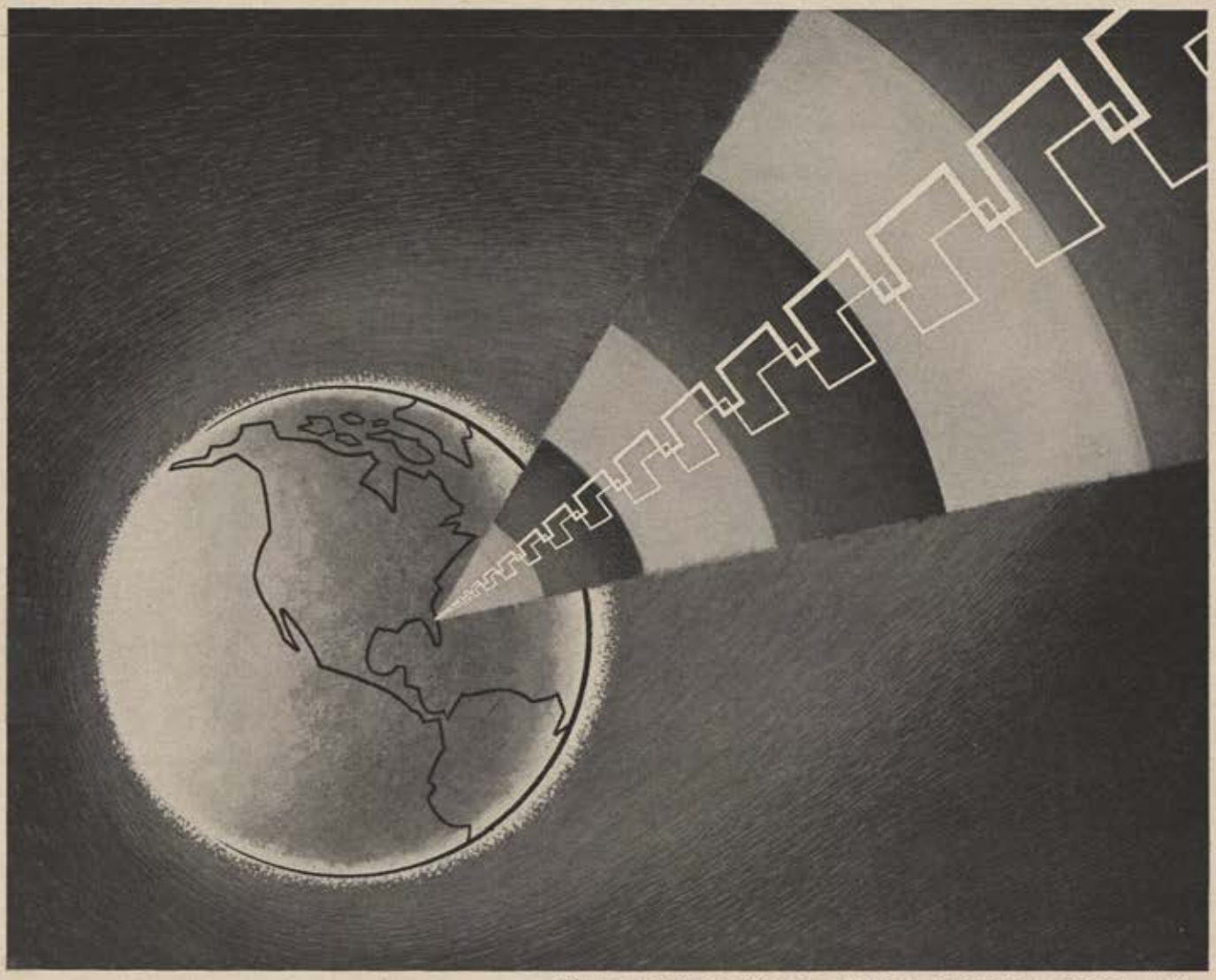
A manned lunar landing would require a vehicle considerably larger than the ICBM and would require extended engineering development. Major new *scientific* discoveries are necessary to make practical such missions as manned flights to Mars or Venus or the creation of a permanent, manned station on the moon. Consequently, extensive research into such unknown scientific areas must be anticipated. This extensive advanced research and development activity is a most important future space market.

Because both missiles and space systems will continue to be important to national security, many citizens must be provided with an understanding of the basic technical and nontechnical facts associated with these programs. This includes people in government, law, commerce, and general industry. This general public understanding is required if this country is to properly arrive at some of the difficult national decisions that lie ahead.

For instance, it is simply not clear today whether it is more important to place an additional vehicle in the vicinity of the moon or whether it is more important to spend the same money and effort on an irrigation project in the Sahara Desert. It is not clear that it is more important to conquer space than to conquer cancer, or that placing a man on the moon will be more important for the general welfare than learning how to make fresh water out of sea water. To make forward-looking and sensible judgments of this kind, we need wisdom along with imagination, uncommon—along with common—sense.—END

Dr. Doll is Vice President of Space Technology Laboratories, Associate Director of that company's Systems Engineering Division, and Program Director for the USAF's Atlas ICBM for his company. A veteran of two decades in technical development, he earned his Ph.D. at California Institute of Technology. This presentation was made at the World Congress of Flight on April 16.

SYLVANIA SYSTEMS . . . **IN COMMUNICATIONS**



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MEETING THE CHALLENGE

Educators Chart the Goals of an Aerospace Curriculum

THE men and women whose job it is to prepare today's youth for complex tomorrows got a firsthand look at the latest aerospace technical developments and spent three days exchanging ideas on aerospace education needs at the First World Forum of Aerospace Education Leaders, held in conjunction with the World Congress of Flight.

Sponsoring organizations for the meeting—a unique "first" for educators—were the Space Education Foundation and the Air Force Association. Chairman of the meeting was Dr. Frank E. Sorenson, Professor of Education at the University of Nebraska, and a long-time air education proponent. Dr. Sorenson is Chairman of the Aerospace Education Council of the Air Force Association.

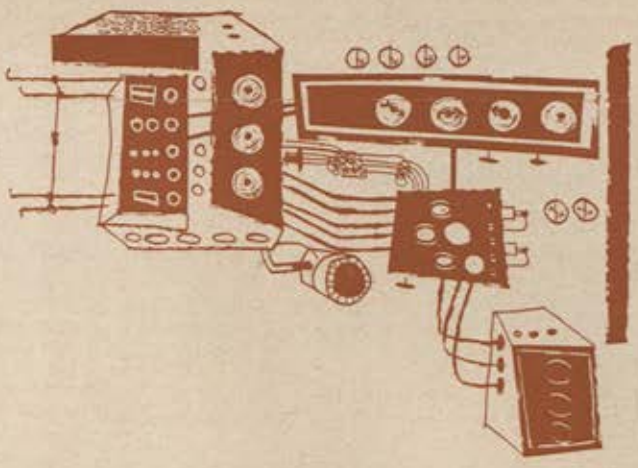
Cooperating organizations included the US Office of Education, the Federation Aeronautique Internationale, the University Aviation Association, the Civil Air Patrol, the Link Foundation, and the 3500th Recruiting Wing of the US Air Force.

The Forum, attended by approximately 300 state-level educational leaders, representing all parts of the US, and delegates from several overseas nations, was geared to providing:

- On-the-spot knowledge of the hardware of the new age and the men who design and operate the hardware.
- A focus for informal and formal discussions of the best approaches to aerospace education on all teaching levels.

Before beginning their formal sessions, the convening educators saw a live display of free world aerospace power at the air show held at nearby Nellis AFB Gunnery Range. The show featured precision aerobatic flying by US and allied jet teams, bombing simulations, and other displays, and was described by many of the veteran aviation reporters covering the World Congress as the best such demonstration they had ever seen.

After the air show the educators toured the aerospace exhibits at the Congress Convention Center, saw technological developments ranging from the latest jet engines to the X-15 aerospace craft, Atlas and Thor-Able space vehicles, and the



McDonnell space capsule that is expected to take the first American into orbit. Later they attended the NATO Anniversary Banquet and heard Prince Bernhard of the Netherlands spell out the free world's determination to meet—on all fronts—the challenge of Soviet aggression.

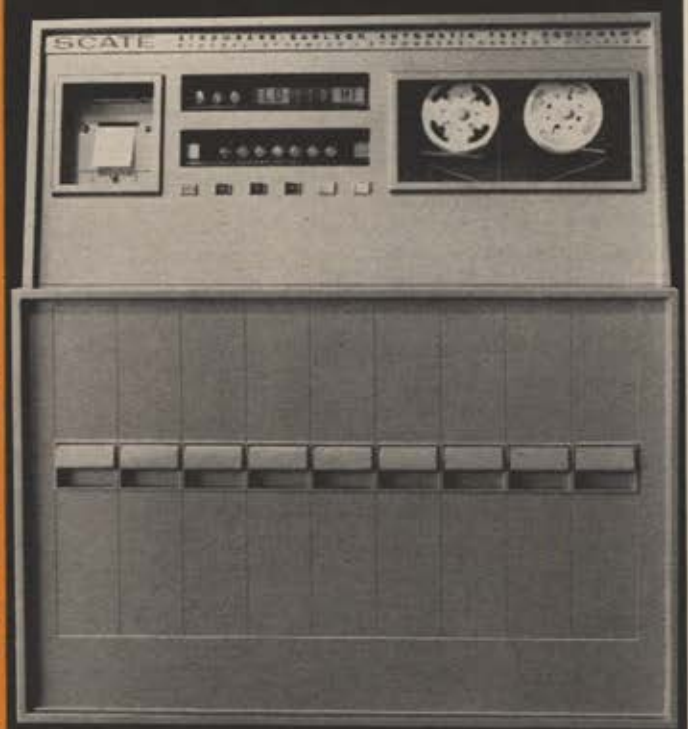
Toward the end of the week-long World Congress, the educators attended the full-day sessions of the World Congress Space Age Conference *(see page 138)* and heard presentations by top scientific, military, and industrial figures including physicist Dr. Edward Teller, who held out the prospect of finding the answer to the very secret of life as a potential payoff of exploration of the universe.

Opening formal session of the Forum was a morning panel on resources, chaired by James M. Trail, Chairman of the Board of Directors of the Air Force Association, and moderated by Samuel N. Stevens, Chairman of the Air Training Command Advisory Board. He is associated with Stevens, Thurow and Associates of Chicago.

Dr. Everett T. Welmers, Director of Long-Range Planning at the Lawrence D. Bell Research

At Aerospace Educators Forum, left to right: J. C. Marousek, Manager of Advertising and Public Relations, Rheem Mfg. Co.; Alexander Black, Vice President, Sales, Rheem; Gov. Ralph Brooks, Nebraska.

A TALENT FOR WEAPONS TEST EQUIPMENT



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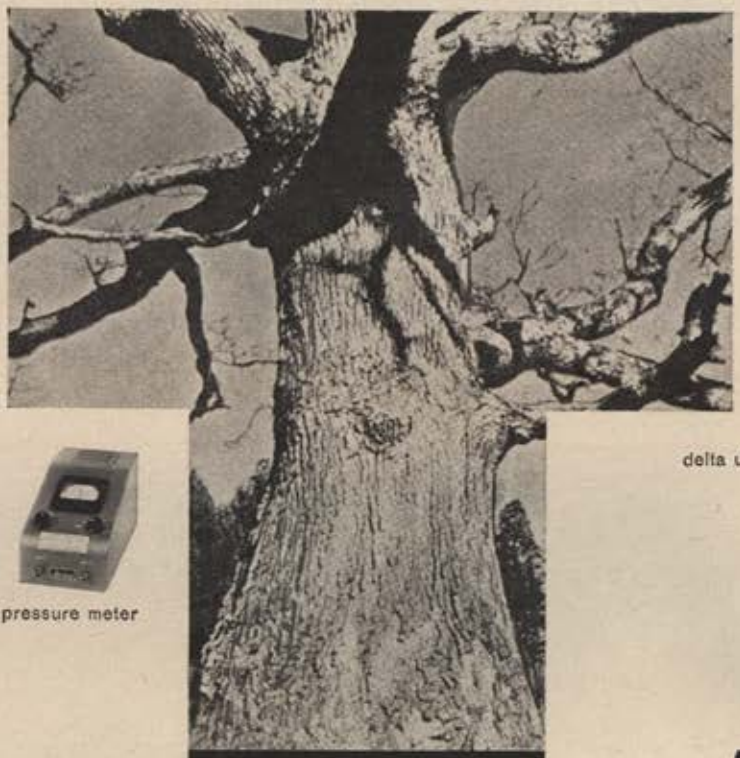

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Honored for his outstanding contributions to aerospace education was Dr. Frank E. Sorenson, right, shown receiving the W. A. Wheatley Trophy from United Air Lines' Ray Mertes. UAL sponsors the award.

Center, Bell Aircraft Corporation, provided the theme of the meeting with a keynote address, "Exploring the New Dimension."

Dr. Welmers told the assembled educators that their task is manifold and includes not only the preparation of the ordinary citizenry for understanding of their technological surroundings but also the nurturing of the first-rate scientific minds that must be spotted early in the educational process or lost forever.

Said Dr. Welmers:

"A considerable amount of discussion was generated by Sputniks . . . and the . . . progress of Russia during the last two years. Criticism was leveled at educators for their failure to produce scientific specialists in sufficient quantities and with outstanding capabilities. Whether much of the criticism was justified or not, there has been an awakening of consciousness toward the problem of properly educated, scientifically gifted individuals. . . . This is not a task which scientists can do alone or even a task for which they are best fitted."

Dr. Welmers summarized the problem facing educators, in terms of the gifted student and the "average" groups.

"Scientific specialists will be few, and methods of educating them may be peculiar. The mass of mankind must be educated for all the multitudinous activities of our modern life. Even though not a scientist, each individual will be living in a scientific world and should be educated to understand and appreciate it. . . . It is not expected that every teen-ager will understand Einstein. . . . A truly educated man must understand the world in which he lives, the role which science plays, and the relation he must have to it.

"There is an exciting new dimension—space—which mankind is beginning to explore," Dr. Welmers declared. "Only traces of its significance for man are beginning to be seen," he added, "but it has already created a revolution in his thinking. The age of space is now and will continue to be a dominant factor in civilization, one for which education and the educators must prepare this and coming generations."

A broad spectrum of current approaches to aerospace education was presented by Resources Panel speakers.

Lt. Gen. Frederic H. Smith, Jr., Commander, Air Training Command, led off the panel. He commended educators for their increasing interest in new approaches and called for even stronger efforts to prepare youth for tomorrow's aerospace assignment.

He described Air Force interest in and need for young people with good backgrounds in applied science. He said that with this scientific potential must come a breadth in the humanities that can help shape the "whole man" who understands the world in which he lives.

Brig. Gen. William J. Bell, Vice Commander, Air Force ROTC, indicated his general satisfaction with college preparatory courses, but said that

greater motivation toward interest in science and in future defense needs might be obtained through the use of AFROTC instructors and material in secondary schools, where their course of instruction seemed applicable.

The governmental role in aerospace education was outlined by Wayne O. Reed, Deputy Commissioner, US Office of Education. He described his office as a "catalytic agent" in the educational process—promoting and stimulating lines of research in educational methods, and providing general leadership.

Panel member Marilyn C. Link, of the General Precision Equipment Corporation, outlined some of industry's problems, particularly the competition among companies for scientific personnel and the problem of the newly hired technical person's desire to do things "their own way." This creates somewhat of a management problem of balancing the enthusiasm of younger personnel with the experience of older hands, she said.

The special skill needs of the military airman have to be developed "in house" by the Air Force, but on a solid, previously built foundation, according to Maj. Gen. Elvin S. Ligon, Commander of the 3500th Recruiting Wing, USAF. General Ligon reported to educators on the educational requirements for youths interested in an Air Force career.

Aerospace education has a new, vital job in supplying extension courses that will keep military Reservists "posted," Ward Stevenson, President of General Public Relations, Inc., told the educators. In an age where there is little potential time for emergency training, the Reservist himself and educators must help fill the gaps, he said.

An exciting motion-picture presentation on the US Air Force's hardware and human factors developments in space technology—"Reaching for the Stars"—capped the first formal session. Col. Carlo R. Tosti, Special Assistant to the Commander, ARDC, narrated the film and afterward answered questions for the educators.

Miss Barbara Timlake receives citation as Miss Aerospace Education in recognition of nationwide tour she made to encourage youngsters to prepare for the aerospace age through development of scientific skills. Nebraska State Education Association's Dr. Donald F. Kline makes the presentation.

Philco Ground-Space Communications System commands and tracks **DISCOVERER** satellite

DISCOVERER . . . the United States' newest earth satellite . . . is opening new vistas on the frontier of outer space. And Philco is proud to play an important role in this renowned achievement as a part of the Discoverer Team . . . in conjunction with the Lockheed Aircraft Corporation and the Air Force at the direction of the Advanced Research Projects Agency of the Department of Defense.

As the subcontractor for Discoverer's entire communications system, Philco designed and developed the vast complexity of ground-space communications, tracking, commanding and data gathering and processing systems.

The Philco-designed and equipped system observes and commands Discoverer through a series of five tracking and data collection stations in Alaska, California, Hawaii and a specially equipped ship at sea. Philco continues its participation in the Discoverer Program by assisting in the actual operation and maintenance of the communications and data handling network.

Philco's part in the Discoverer Program is typical of the many and diverse advanced research and development activities being conducted in our laboratories on the East and West Coasts where outstanding career opportunities abound for Engineers, Mathematicians, and Physicists.

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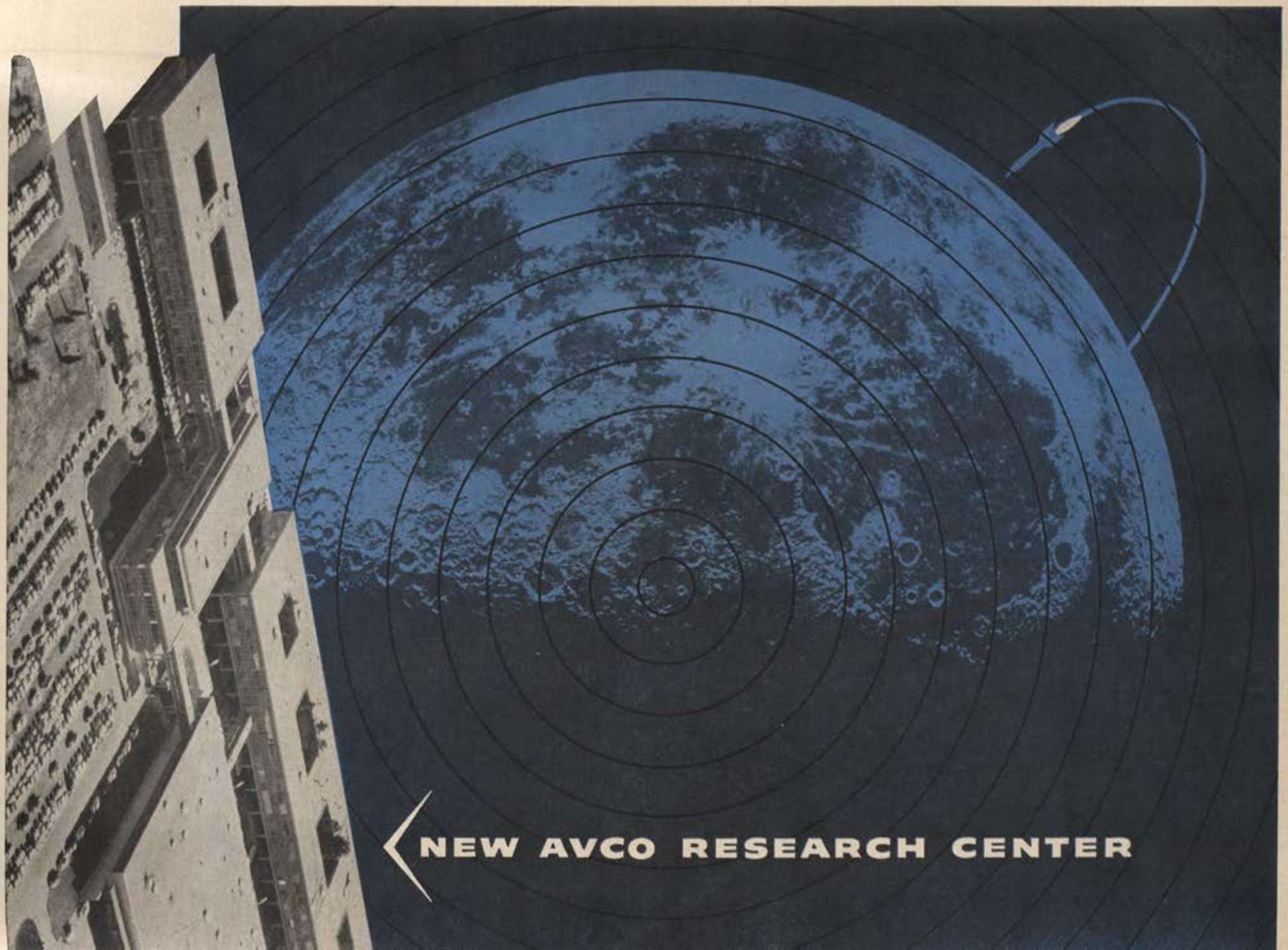
NEW AVCO RESEARCH CENTER

Space age research gets a new headquarters

One of the largest and best-equipped research facilities in the nation is the new 16-million-dollar Avco Research Center at Wilmington, Massachusetts. Here, research and development in space age technology is already being conducted in areas ranging from missile re-entry to satellite design. From work such as this—and equally important work at the nearby Avco Research Laboratory—will come further contributions to national security and the conquest of space!

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what is entropy?

Heat lost except at absolute zero?

A measure of disorder?

A statistical probability of state?

The gradient of a scalar?

Macrocosmic phenomenon or microcosmic, too?

The fundamental concept of entropy is involved in many phases of our technology. Hence we have a fundamental need to know everything we can about its significance. This knowledge is critical to our work of energy conversion.

Thus we probe and inquire, search without wearying – call upon the talents of General Motors Corporation, its Divisions, and other individuals and organizations – for a complete appreciation of all phases of scientific phenomena. By applying this systems engineering concept to new research projects, we increase the effectiveness with which we accomplish our mission – exploring the needs of advanced propulsion and weapons systems.

Energy conversion is our business

ALLISON

Division of General Motors,
Indianapolis, Indiana

Featured speaker at the Aerospace Awards Luncheon was Cal Tech's President, Dr. Lee DuBridge.

Following the formal session, the educators attended a luncheon at which guest speaker Dr. Lee DuBridge, President of the California Institute of Technology, discussed resources for the future in air and space.

Dr. DuBridge painted the vastness of the universe for the educator audience and cautioned that wise planning of practical approaches to space exploration is essential to avoid waste of resources.

He said that initially instruments would probe space but that it was inevitable that man himself would make the attempt to travel in space to see the cosmos for himself.

From the luncheon, educators returned to the second session of the Aerospace Education Symposium, chaired by Miss Jacqueline Cochran, President of the Federation Aeronautique Internationale. Moderator at the second session was Leo Black, Assistant Commissioner of Education for Colorado.

Afternoon and evening panelists included Philip Bacon, Associate Professor of Geography, Teachers College, Columbia University; William Hinkley, Superintendent of Schools, Aurora, Colo.; George S. James, Chairman of the Board, the Rocket Research Institute; Fred Miner, Aviation Education Specialist, Clover Park High School, Tacoma, Wash.; H. S. Seifert, Special Assistant for Professional Development, Space Technology Laboratories, Inc.; Byron F. Stetler, Superintendent of Public Instruction, Nevada; Ross Willmot, Secretary-General, International Society of Aviation Writers; and Gen. C. Sillevaerts, of the Federation Aeronautique Internationale.

The sessions included presentations on outstanding aerospace education projects on elementary, secondary, university, professional, and general-public levels.

The educators also attended a series of informal discussions keyed to special areas of interest. These included: implications of aerospace education to state school officials and educational association people, teachers' colleges, school superintendents, and parent-teacher associations.

Response (*see page 189*) to the Forum was strongly favorable.

How did the Forum idea develop?

In his report Forum Chairman Dr. Sorenson writes:

"Gill Robb Wilson [Chairman of the Board of the Space Education Foundation] . . . in 1956 . . . called attention to the great need to have an organized group of prominent educators closely associated with the Air Force Association and its partners in the aviation industry. . . .

"In the spring of 1958 state commissioners of education were invited to either attend or be represented at the [Air Force Association] Jet Age Conference held in Washington, D. C. The largest contingent was from Oklahoma.

"On May 1 [of 1958] the Oklahoma leaders sponsored a Space Age Conference for high-school youth. Six thousand students were thus brought closer to conditions which prevail today.

"On August 22, 1958, selected chief state school officials were invited to send official parties of state education leaders to the 1958 Convention and Airpower Panorama of the Air Force Association. Of the eighteen states contacted, twelve sent official parties to the Dallas meeting. The educators' response to this meeting was so enthusiastic that it was decided . . . that the Dallas plan should be expanded. . . ."

Reporting on the Forum, the Aerospace Education Council submitted these theses:

- Aerospace age education for children and youth should encompass the entire school system.
- Aerospace age education for teachers is as essential as it is for children and youth.
- The total aerospace facilities of the community should be utilized.
- No education program will be complete if it does not include the opportunity for those students especially motivated and qualified to learn to fly.—END

Speaking of SPACE

House Space Committee

We can have a worldwide communication satellite within four years to supplement existing communication systems that are barely adequate in peacetime and seriously limited in time of war.

This is one of the conclusions of the May 7 report of the House Committee on Science and Astronautics, "Satellites for World Communication," summing up recent testimony of key military and scientific witnesses.

Under the guidance of ARPA *(see page 139)*, Project Courier plans to place a satellite in orbit at about 500 miles. As it passes a ground station, it will pick up previously stored information, which it will transmit to other ground installations. An extremely high rate of transmission will give each Courier a traffic-handling capacity equal to twenty teletype channels operating at a hundred words a minute.

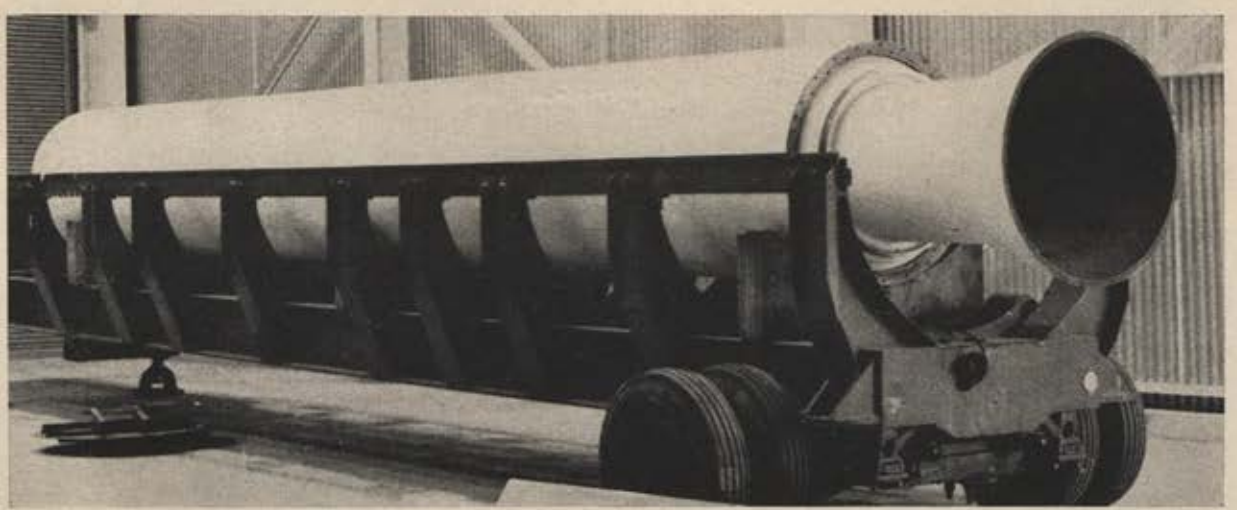
Other communications possibilities: a twenty-four-hour equatorial time repeater; a communications net between ground points in the US and aircraft in the polar regions; a network combining polar and equatorial-orbit satellites—possible within ten years.

"US Policy on the Control and Use of Outer Space," released by the House space committee to concur with the initial meetings of the UN space group (*see below*), summarizes US attitudes toward the need for space control and urges that the US assume leadership, specifically by indicating our willingness to negotiate with other countries and to exchange space science information.

Nose of 16,000-pound Discoverer II, ARPA satellite launched from Vandenberg AFB, April 13, into a near-polar orbit, to circle the earth every 94.2 minutes.

United Nations and Outer Space

"In no field of activity is cooperation among nations more appropriate or more necessary." Predicting that the world can expect great things from earth satellites in the near future if all nations cooper-



Solid-fuel rocket developed by Aerojet-General as the first stage of Project Scout, NASA's "poor man's rocket."

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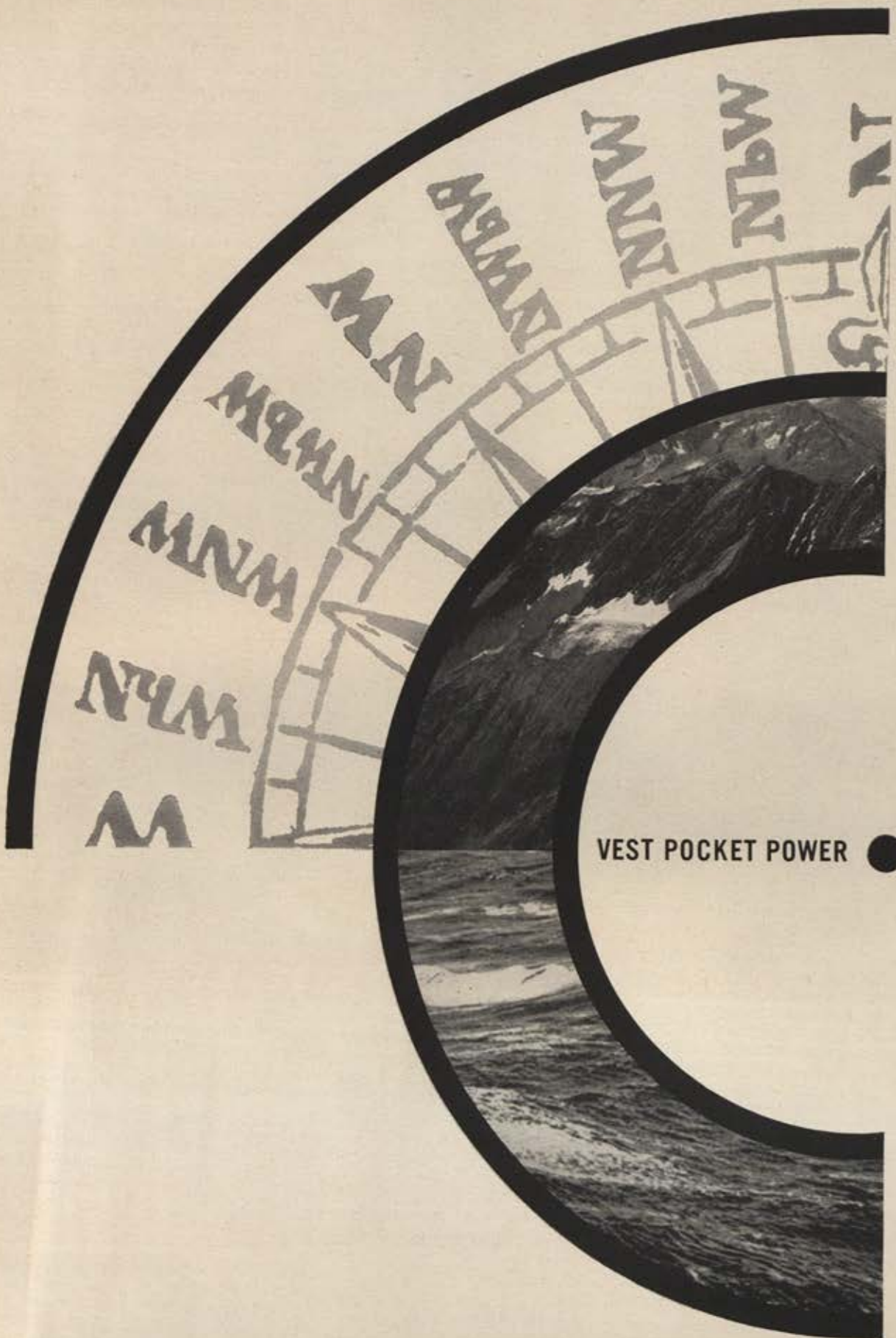

VEST POCKET POWER

SPEAKING OF SPACE

ate in peaceful space research and development, US delegate Henry Cabot Lodge spoke at the May organizational meeting of the Committee on the Peaceful Uses of Outer Space.

Dr. Hugh L. Dryden, Deputy Administrator of NASA, further suggested that the UN take the lead to establish a global effort to send manned spaceships to the moon or neighboring planets. "Such programs," he said, "become enterprises to warrant worldwide support and cooperation, particularly in research."

On the tricky legal aspects of damages caused by a satellite falling to earth, a problem we won't face in fact until reentry becomes a reality, Loftus E. Becker, legal adviser to the State Department, suggested that the real question is how to compel the responsible state to pay the damages. Legal relations between humans and possible "extraterrestrial life" are presently on the bottom of Mr. Becker's list of space problems.

The committee—which has been boycotted so far by the Soviet delegation, Poland, Czechoslovakia, India, and the United Arab Republic—will meet again this month.

Titan Number Four

The fourth Martin SM-68 Titan ICBM was launched from Cape Canaveral on May 4. Designed to evaluate the staging operations, this was the first test in which the rocket's two stages were separated, simulating the process that will occur in the operational Titan.

NASA Activities

Vega, a 295,000-pound rocket capable of putting a two-ton space laboratory carrying several men into a 300-mile orbit for several weeks, is expected to be ready for test flights by late 1960. Convair Division of General Dynamics Corporation, named NASA's prime contractor for Vega, is responsible for design, construction, and testing. A two-stage version will consist of a modified Atlas with a Vanguard booster. A storable liquid-fuel JPL third stage may be added to power a 750-pound payload on a planetary mission or to soft-land a man on the moon. Successor of Vega will be Nova, a 200-foot vehicle de-

Defense Secretary Neil H. McElroy, second from left, tours Aerojet-General, wearing a plastic shield against 15,000-degree heat. From right, RAdm William Raborn, USN; Brig. Gen. Carey Randall, USMC.

signed to carry two or three men on a round trip to the moon.

NASA's budget appropriation request for fiscal 1960: $485,300,000—$333,070,000 for research and development; $94,430,000 for salaries and expenses; $57,800,000 for construction and equipment.

Presumably coming under the last category will be the new NASA space projects center at Greenbelt, Md., named Goddard Space Flight Center after Robert H. Goddard, pioneer in rocket research.

The Venus probes planned by NASA for this month have been postponed because of engineering difficulties. Also postponed because of technical problems, the planned paddle-wheel satellite to test cosmic radiation.

Prime contractor for the Delta launching vehicle, a three-stage improvement of the Thor-Able, is Douglas Aircraft. NASA plans for Delta include launching equatorial satellites from the Atlantic Missile Range and polar-orbit experiments from the Pacific Missile Range.

Richard E. Horner, Assistant AF Secretary for R&D since February 1956, is the new NASA Associate Administrator, responsible for the general operation of NASA's programs.

Proud crew displays the first nose cone recovered after an intercontinental test flight of a Thor-Able, April 8, picked up in the South Atlantic near Ascension Island. Photo is retouched to conceal reentry ablation.

Satellite Catchers

Hawaii-based C-119s with especially equipped nose hooks may be playing catch with the Discoverer III capsule some time this month. At this writing, ARPA plans to send up four mice chosen from fifty space candidates under study at Holloman AFB, N. M. Packed neatly in the Discoverer III nose cone capsule, the mice are said to have about a hundred-to-one chance of getting back to the lab. The capsule, dangling from a parachute, may be caught in midair over the Pacific by a high-fielding C-119.

In the Battle for Man's Moon . . .

"In view of the great expense and difficulty . . . in firing rockets at the moon . . . attempts should be made when the moon is full. There would be a better chance of hitting this target than hitting the thin crescent. . . ." *From a letter to the Glasgow* Herald.

Moon Hot Inside

The classic concept of the moon as a cold, dead satellite of the earth is rapidly being refuted by advances in scientific observation. Dr. Harold C. Urey, Nobel prize-winning astronomer of the University of California, presented the new lunar theory to the April meeting of the National Academy of Sciences.

Gaseous activity in the lunar crater Alphonsus, first observed on October 26, 1956 at Mount Wilson as a "milky haze," was the subject of Russian astronomer Dr. N. A. Kozyrev's controversial analysis last year. Dr. Kozyrev's spectrographic studies of the region led to his observation, on November 3, 1958, of a half-hour-long eruption of gas from the crater-let atop the central mountain of Alphonsus.

Several subsequent observations have confirmed the evidence, and argue strongly, according to Dr. Urey, toward the theory of the moon as an active body with an extremely hot interior and an erupting, shifting surface.

—MICHAEL B. MILLER

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for NASA's
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The reality of McDonnell's manned satellite will be a great milestone in NASA's exploration of space. Collins Radio Company is extremely proud to participate in Project Mercury by supplying the complete electronic system. This consists of orbital radio voice communication, a command system for radio control, a telemetry data system, a Minitrack beacon system, a transponder beacon system for precision tracking, and a rescue radio voice and beacon system.
Other Collins space electronic projects include the communication-navigation system for the X-15, moon relay communication studies, and satellite tracking facilities.

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From an original painting for CECO by R. T. Handville

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CECO's product in the Huskie is one of a number of "unitized" control systems developed expressly for the fast-growing small engine field. In addition to controls for application in manned aircraft, other lightweight, compact CECO engine control systems have been developed for target drones and missiles, while still others are available for auxiliary power units in airborne and ground support systems.

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FIRST WORLD CONGRESS OF FLIGHT

MISSILE MANAGEMENT

A MAJOR innovation at the World Congress of Flight was a two-session conference on Missile Management, sponsored by the Air Force Association. The Missile Management Conference had its origin in AFA's now traditional Jet Age Conferences and is a logical outgrowth of the discussions held in previous years. Its being held as a separate meeting, as part of the World Congress, recognized the full maturity of industry's role, still changing fast, in the management of the missile program.

Significantly, AFA turned the chairmanship of the meeting over to David R. Hull, president of the Electronic Industries Association, and a large part of the program to presentations by representatives of Arthur D. Little, Inc., one of the nation's outstanding pioneers in industrial research and development.

The program ranged from industry problems with limited production—a characteristic of many missile programs—to automation and the effect of the new look in weaponry on the stock market.

Keynote for the sessions was set by Dr. Bruce S. Old, a Vice President of the Little Company, who showed that increasing industrial interest in basic research has resulted from recognition of what basic research means and how essential it is in modern industrial competition.

"To gain from basic research," he said, "you have to participate in it, not just sit on the sidelines. With the pace of science picking up the world over, one soon finds in many industries that he must be continually abreast of what is going on at the frontiers of science or lose ground in his competitive position."

How much basic research does a manufacturer need? The answer, according to Dr. Old, depends on the type and size of the company, the fields in which it operates, its future plans, and the competition.

He cited a survey of thirty-five companies which together provide about a quarter of all the basic research funds spent in the United States. In 1947 laboratories in technical industries spent about nine percent of their research and development on basic research. By 1957 this had increased to fifteen percent.

Reports from fourteen high-obsolescence-rate industries showed, in Dr. Old's study, that between 1947 and 1957 they tripled their expenditures for research and development and increased basic research by a factor of 4.5.

Dr. Old was critical of the military:

"How do the armed services compare with this trend in industry? If anything, their obsolescence rate is higher than industry and their fields of interest broader. Yet they do not appear to have had the same aggressive attitude toward basic research. . . . In general, one finds the armed services lagging on the low side of the current trend in high-obsolescence-rate industries. . . .

"To achieve rapid progress in a research program in so complex a field as national defense, each agency must have in its research and development program scientists actively participating in basic research in order to communicate rapidly with basic research on a worldwide basis and to pump into the program the knowledge and understanding coming from the frontiers of science.

"It is the realization of this important fact which has dictated the increasing investment by industry in basic research. Unnecessary duplication in basic research is seldom a factor."

The vital necessity for increased government participation in the research effort was emphasized by another Vice President of Arthur D. Little, William A. W. Krebs. His approach was that the research and development needed for modern weapons is so expensive and so risky that there is no possibility that public investment in this area can decline.

If industry takes proper advantage of this situation, Mr. Krebs argued, it can profit immensely in the field of civilian applications. He cited the history of the 500 largest corporations in the United States and implied that it shows "high-risk investment by government can lay down a cornerstone for growth that no investment banker, no matter how speculatively inclined, could dare provide."

The speaker said he could see in the environment of the World Congress of Flight, "ripening seeds of new enterprises which will add . . . to the strength and diversity of our economy." As examples of such experiences in the past he pointed to radar, atomic fission, and the diesel engine. For the future, he suggested, there is jet propulsion and the new era of space. He does not believe that our competition with Russia is the only motivation for continued public interest in research and development.

The role of industry, Mr. Krebs said, "is not that of the investor in any significant sense.

"Industry's function, rather, is to supply technical skills, plant, and equipment and the essential contribution of organization in being, including managerial experience and know-how."

But the industrial emphasis for the good of industry, he declared, must be on the conversion of what is learned from military—or government-sponsored—development that

(Continued on following page)

Dr. Bruce S. Old
Arthur D. Little, Inc.

Wm. A. W. Krebs
Arthur D. Little, Inc.

Henry F. Argento
Philco Corp.

Dr. J. Harrington
Arthur D. Little, Inc.

can be applied to the commercial market. He cited these motivations:

"A narrow product line of military hardware or a single customer—a government agency—provides a precarious perch. Even varied products marketed among a number of government agencies or subagencies leave the enterprise hostage to the fast, unpredictable swings and surges of budgets and political expediency. A broadened product line, balanced with items for the civilian market, can impart increased stability both to production planning and to income.

"The low-profit margins of government contracts, hemmed in by renegotiation, are traditional. While undoubtedly justified in most cases by their relatively low risk, and often low investment as well, such margins as a steady diet make thin enterprises.

"Not the least disadvantage is the limitation imposed on developing a proprietary technology within the restrictions of government patent policies, no matter how liberally administered."

On top of these reasons for turning swords into plowshares whenever possible, Mr. Krebs said the financial world will look with most favor on the firms that seize these advantages. Taking them, he said, is a good way to ensure that both skill and capital remain handy to industry.

Following this presentation on how industry can find advantages in capitalizing on the results of government-sponsored research and development, the Missile Management Conference was given an exposition on some of the hard facts about defense contracts. The speaker was Henry Argento, Vice President and General Manager of the Government & Industrial Division of Philco Corporation.

Mr. Argento spoke from wide experience with his subject, which was the problem of limited production. As the number of units ordered by defense customers has declined with the advent of missiles and more complex airplanes, he made it clear, problems in the factory have mounted. Almost all of them wind up with a bearing on costs.

In the area of quality control alone, Mr. Argento said, the cost per unit becomes exorbitant if the run is short. He cited the case of a complex product running at the rate of ten a month for a total sale of 112 pieces. The labor cost for quality control was $107 a unit. If the plant had been able to make 10,000 at a rate of 950 a month, this outlay would have been slashed to $28.50.

The limitation on defense production orders is traced to four main causes:

- Pilot production to test design and try out tooling for mobilization studies.
- Product will be made obsolete by new developments now under way.
- Production must be held down because of high complexity and costs.
- Multiple source procurement cuts production run for each of the suppliers.

Mr. Argento could find no argument with any of these reasons for limited production except the use of multiple sources when it would be more economical to have all of the units made on one assembly line. He suggested that more weight be given to the cost advantages of a single source. Also, "that the integrity of the prospective contractor in conscientiously applying his effort to achieve a minimum cost should not be so seriously and consistently held in doubt."

The speaker said limited production has its effects on facilities, cost accounting, material, manpower, and general efficiency. All of them, of course, are reflected in costs.

Another long look at production and the economics of manufacturing was taken by Dr. Joseph Harrington, Jr., of the Arthur D. Little organization, who discussed the effects of automation.

Dr. Harrington's presentation was a defense of automation and a plea for greater speed in its adoption. He tied this to current discussion about unemployment and showed that automation, far from causing joblessness, is one of the best cures for it.

He presented figures to show that an increase in wage rates, without a corresponding increase in productivity, always results in increased unemployment. At the same time, he said, rising wages act as an incentive to mechanization. He told the conference:

"The replacement of a manual operation by a machine operation requires an expenditure of capital for new equipment, and will yield a saving proportionate to the labor saving, plus material savings and other operational advantages.

"If the total savings over a reasonable period exceed the cost, then mechanization is justifiable. A reasonable period may be as little as one year, or as high as eight or ten years, according to the industry;... the greater the increase in the wage rates, the greater the savings available and the more costly the equipment which is justifiable....

"A rise in machine productivity (automation) prevents unemployment; it does not cause it. To put it another way, if machine productivity had not increased over the past decade, unemployment would be greater now than it is."

Dr. Harrington then gave a terse analysis of the present economic situation:

"Today people are baffled by an economy going at full tilt, a solid demand for goods and a near record level of unemployment. Now these idle people are not all unemployable; it's just that the marginal wage rates are too high. The answer is not to cut down the work week, because this would mean either spreading the same total wages over more people, or increasing marginal wage rates again, which is a step in the wrong direction.

"The answer is not the liquidation of the unemployed, because this is not Russia or ancient Rome. The answer is not to support these people out of tax funds, because this drains off capital which could be invested in productive

Dr. Edward Doll
STL

A. J. Catapano
Merrill Lynch

equipment. Obviously the answer is to get more productive machinery. This . . . will absorb employees and sustain higher wages."

The only catch to this, Dr. Harrington admitted, is that it costs money. He then presented figures to show that the amount of power that can be generated is a limiting factor, but suggested that the perfection of atomic sources may supply the answer. Material shortages were added to money and electricity as future problems. Then, Dr. Harrington commented:

"Here, then, is our dilemma. Science and engineering, sparked by sizable research and development contracts from the federal government in the interest of national defense, are moving ever more rapidly ahead.

"Technological know-how is surging forward, but the rate of its application to practice seems to be limited by a number of factors, particularly when viewed through the eyes of the classical economic theory.

"We want our leisure time, our high wages, our full employment; we want our standard of living to continue to rise; we want individual and national security. We want to have our cake and eat it."

Later, the speaker pointed out that the US industries with the greatest investment in automation produce more per unit of labor and have shown the greatest increase in employment. He cited steel, autos, and the telephone and chemical industries.

A by-product of this situation in these industries is that semiskilled labor is being displaced by skilled labor. This means, the speaker said, that in the long run automation is going to increase the burden on America's educational system and give unions a new responsibility to upgrade and retrain their members.

Here is Dr. Harrington's summary:

"There is no reason to think that the rate of advance in machine productivity will slacken in the near future. There are powerful motives behind the ceaseless efforts to achieve more and better mechanization.

"There are strong forces tending to increase marginal wage rates, which alone would tend to reduce employment. But they also tend to stimulate automation which in turn calls for the investment of capital. The investment of capital not only increases employment but its addition to the national income goes principally to labor in the form of higher wages.

"Lack of capital formation, as well as potential shortages of power and some materials, and acute shortage of competent technical manpower unfortunately limit the rate at which automation can go forward. Heroic and probably unconventional effort must be made to break through these roadblocks. Otherwise it will be many years, if ever, before we can satisfy the demand for automation stemming from our national desire for a rising standard of living and greater leisure time.

"We can take two important steps to ease the situation. We can exert every effort to train young men and women in science and engineering to meet the technical demands of mechanized civilization, and in liberal arts to meet the problems of personal and civic life in this increasingly complex world.

"Second, we can, by any method available, encourage savings and the formation of further capital.

"If we meet these challenges there is every reason to face the future with confidence."

Dr. Harrington's scholarly analysis of what industry will be doing in the future laid a perfect background for two major addresses delivered at the second session of the Missile Management Conference.

Because of their importance to the aerospace industry and all World of Congress of Flight delegates, the texts of both addresses are printed in this issue of AIR FORCE/SPACE DIGEST. They are:

- "The Space Market" by Dr. Edward Doll, Vice President and Associate Director, Systems Engineering Division of Space Technology Laboratories.

The text, printed on page 147, discusses the current ballistic missile program and reviews the facts as they relate to space vehicles. Dr. Doll then looks at the future and the problem of predicting trends. He offers personal comments on the evaluation of space possibilities.

- "The Changing Defense Industry from the Investors' Viewpoint" by A. J. Catapano of Merrill Lynch, Pierce, Fenner and Smith. His text is on page 174. It is a review of recent stock market trends with particular emphasis on the interest of investors in electronic opportunities.

A separate facet of the Missile Management Conference was a forum on Overseas Production under the Military Program. Leadoff speaker, who launched a session of give and take between top government and industry representatives on all aspects of the offshore procurement program, was Charles H. Shuff, Deputy Assistant Secretary of Defense for Military Assistance Programs.

With him on the platform for a panel discussion were the following:

- Brig. Gen. W. H. S. Wright, Chief, Mutual Security Division, Deputy Chief of Staff (Logistics), Department of the Army.
- Lewis S. Thompson, Special Assistant to the Secretary of the Air Force.
- Gen. Alden R. Crawford, Vice President of Republic Aviation Corp.
- Neal E. Firestone, General Manager, Production Engine Department, Flight Propulsion Division, General Electric Company.

Mr. Shuff acknowledged at the outset that the supply of money available for US assistance to our overseas allies is diminishing while the requirements for our weapons is increasing. For this reason, he said, programs are being developed to make greater use of the production resources of our allies. He cited the case of the Hawk missile as a weapon that will be turned out abroad under the Weapon Systems Production Program. This policy will be continued, he intimated, but it will call for "new ways and means of combining limited US and allied resources." The main effort here will be to increase the capabilities of the allied nations.

In the give and take of the question-and-answer period some of the more sensitive subjects involved in the military assistance program were aired. For example, in a discussion of the incentives left for American industry to take part in the program, Mr. Shuff said "the government isn't interested in having you lose money." On the other hand, he was not able to suggest a formula that will be used to determine what the incentive or profit basis will be.—END

DEFENSE INDUSTRY— THE INVESTORS' VIEWPOINT

A. J. Catapano

INDUSTRY SPECIALIST
MERRILL LYNCH, PIERCE, FENNER AND SMITH

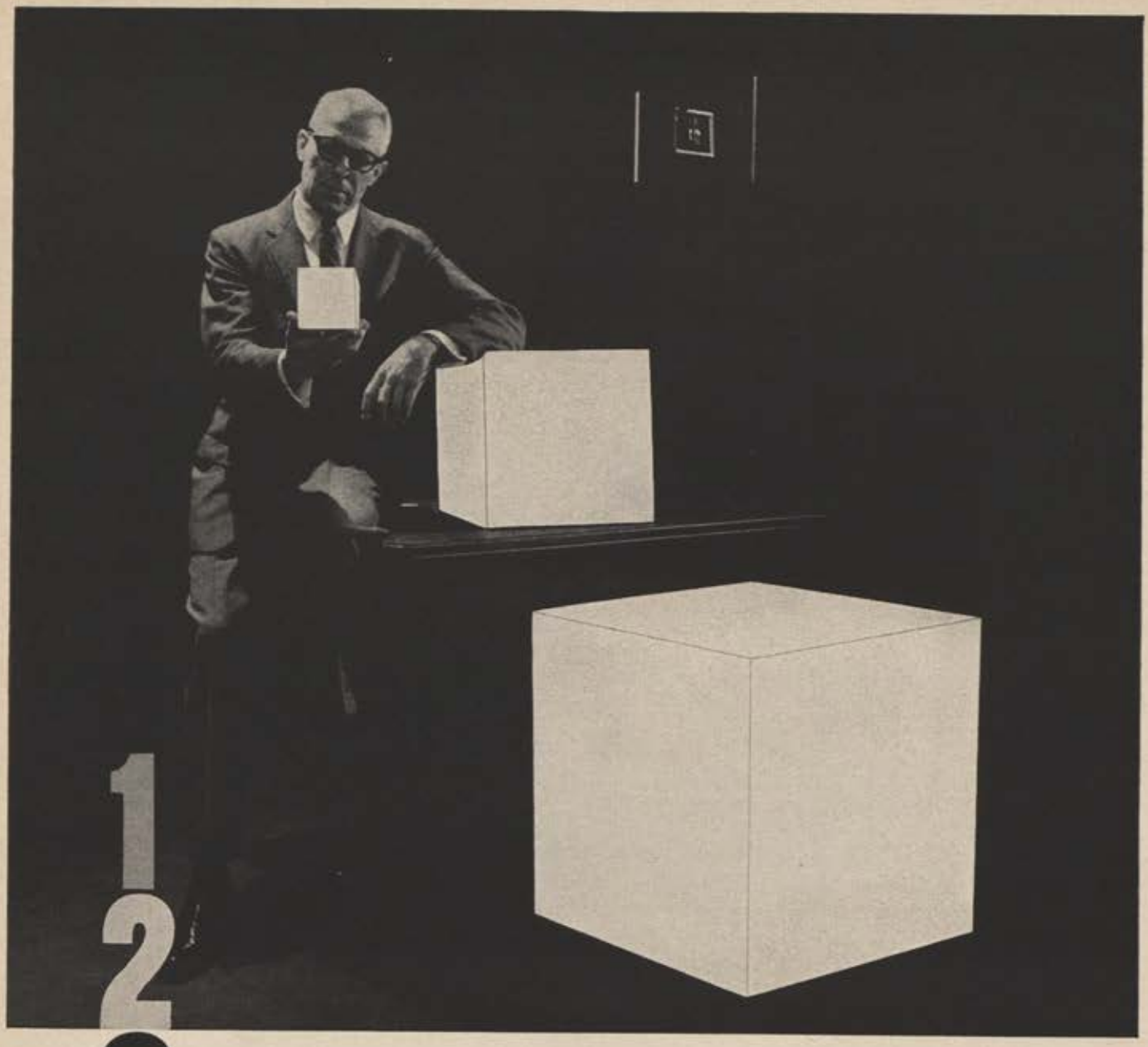
PRIOR to the Korean conflict, the financial community looked upon defense industry stocks with caution. Generally, investors felt that the industry was a "boom or bust" business and that securities in this field were only attractive when the defense cycle was favorable because the industry did not appear to offer the continuity of operations necessary for true investment purposes. Thus, most commitments were made for temporary speculation rather than long-term investment, and frequently these stocks were colorless performers. However, things have changed considerably. Lately, some of the defense stocks have been among the star performers in the booming stock market.

Since World War II and until recently, the securities of the aircraft producers were primarily regarded as defense stocks. For the most part, these companies were defense oriented. In war or peace they did most of their business with the government. But, with the start of the Missile/Space Age, the term defense now embraces electronics and propellant producers as well as the aircraft makers because of the former's increasing participation in the newer forms of armaments.

Defense securities were never really regarded as media for long-term investment. However, in 1950 as a result of the Korean conflict, investors began to change their attitude. Some people started to realize that both the Cold

(Continued on page 177)

The problems of industry in new age of missilry were explored at Missile Management Conference at World Congress.



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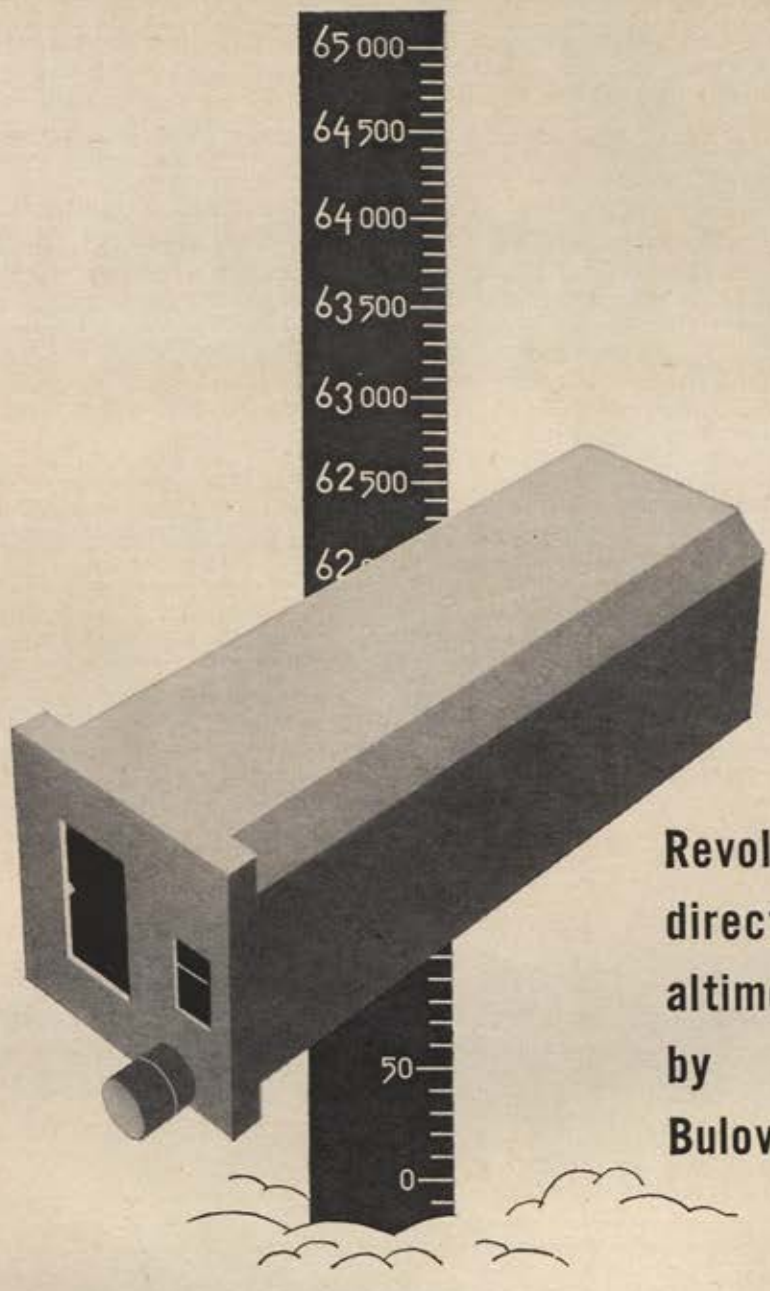

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War and a large defense bill were here to stay. For the first time, investors felt they could look at military shares on a long-term basis with some degree of confidence. This feeling was by no means widespread. There were still many who looked upon such companies with a critical eye. Nevertheless, there was a growing interest in this field and it began to be reflected in the market place.

During the Korean strife, the defense group kept pace with the rising level of the general market. Then in 1953, the group began a sensational move. This was due to two factors. One was the anticipation of the elimination of excess profits taxes which had an enormous impact on profits of these high-volume military suppliers, since most were paying the maximum seventy-two percent rate. The second was the expectation that industry operations would be maintained at relatively high levels even after the termination of hostilities in Korea.

Consequently, from mid-1953 to the end of 1956, the aircraft stocks were in a bull market of their own and outpaced the general market by more than 300 percent. Then suddenly the trend reversed itself. In early 1957, you might recall, defense spending plans were cut back, and later that year numerous programs were reduced or stretched out. The old cautious attitude about these equities reappeared and the group sold off rather sharply until October 4, 1957, when Russia successfully launched its first Sputnik.

This marked the beginning of another shift in investor sentiment toward military shares. The new Space Age has had a profound effect on stock-market values of certain defense suppliers. On an over-all basis, the rising prices of these securities confirmed the earlier reevaluation and even accelerated the movement. However, the market has made very significant distinctions between the various types of defense suppliers.

Investors have primarily been interested in the companies involved in rockets, missiles, and space vehicles and have generally ignored those involved mostly in manned-aircraft programs, despite the fact that many of these companies are still enjoying high-level sales and earnings. Thus, in terms of market performance, some defense shares have skyrocketed while others have not even kept pace with the over-all market.

Basically, the market has decided that the major beneficiaries of the Missile/Space Age will be the electronics and propellant companies. Stock prices of these firms have soared. In fact, since Sputnik, the defense electronics group, as measured by the Merrill Lynch price index of 540 stocks, has outpaced the general market by some 400 percent and has outperformed every other major group in the market.

Meanwhile, aircraft stocks have not gained as much from the surging investor interest in defense securities. As a group they have performed only slightly better than the general market and some of these issues have continued to decline even in the past eighteen months. Despite repeated assurances by the military that the inception of the Missile Age does not eliminate the need for manned aircraft, investors have chiefly emphasized those companies with strong positions in the missile field. Consequently, the others to whom manned aircraft programs are still of overriding importance have lagged far behind, current earning power notwithstanding.

The investment community seems to feel that the very high cost and enormous destructive power of the latest aircraft models have clearly eliminated the opportunity for long production runs, which were particularly profitable in their later stages of output due to steady increases in labor efficiency. While it is true that aircraft producers have most of the prime contracts in the current missile programs, competition for "primes" from nonaircraft companies on newer missile weapons is increasing. Moreover, aircraft companies still face the transition period from planes to missiles, and this could penalize earnings because of heavy research and development expenses, facility readjustments, and so forth. Also, at the present stage of the large missiles—ICBMs and IRBMs—there appears to be little prospect of very big volume production, although some later models may be built in quantity.

To get back to stock prices, some people ask why the electronics group has received so much attention over the last year or so. One factor—subtle but nevertheless significant—which contributed to the increased emphasis on defense electronics stocks in 1958 was the belief that these companies represented one area not likely to feel the effects of the recession. Sales and earnings for many of these firms made new highs for the year in sharp contrast to the substantial declines registered by the majority of companies operating in civilian sectors of the economy.

More important, however, I think that basically investors are anticipating substantial growth ahead. With the continuing shift from manned aircraft to missiles and the increasing emphasis on space vehicles, the electronics industry should continue to get a larger share of the defense budget. Thus, dollar volume in the electronics industry should continue to grow and could easily double by 1965, even if we assume only moderate increases in over-all defense spending. This is an impressive potential when compared with the expected over-all growth of the economy and even compares favorably with such long-established growth areas as the chemical and drug industries which are expected to expand by ten to fifteen percent annually.

Of course, certain fundamental distinctions must be made between growth in the defense industry and growth in civilian areas of the economy. Any defense endeavor inherently carries with it some degree of uncertainty because of the constant shifts in defense procurement, renegotiation problems, and the like. In a sense there is something essentially speculative about this industry. However, I think most people go along with the notion that the Cold War will not thaw out over the foreseeable future and that defense outlays will remain high. But, there are some who feel that there is always the possibility that over the longer pull there could be some reconciliation between the East and the West. Thus, they are still apprehensive about making long-term commitments in this industry because demand is so closely tied to world political factors.

While this viewpoint is well taken, it must be remembered that companies participating in the military field are gaining a tremendous amount of know-how in electronics technology and some are building up impressive technical and scientific organizations. Moreover, as you know, electronics involves a great deal of research and development work, and somewhere along the line these activities will result in ideas that have commercial applications. For example, radar, which was developed during the war, is now used extensively in nonmilitary applications. And, we certainly would not be traveling in commercial jet airliners were it not for the military research performed in this field.

Out of the billions of dollars being poured into military research and development, it is inevitable that many commercial applications will result. It seems to me that those companies which think and plan in terms of possible commercial adaptation of their research activities—regardless

(Continued on following page)

of how nebulous or premature this planning may now appear—will be the most successful over the longer term.

Anticipation has become the decided keynote in defense stock prices, particularly in the electronics and propellant shares. While it is true that earnings in many cases are already in an up trend, the share evaluations have accelerated much more rapidly than profits. For example, prices of the electronics group, which sold at levels fifteen times earnings before Sputnik, were twenty-five times earnings recently. Among certain individual issues, the multiplier has increased even more sharply. Obviously, it is quite an advantage for a growth industry to be recognized as such in the market place.

Relatively high prices facilitate financing, make acquisitions feasible, keep stockholders content, discourage raiders, solidify management reins, and help in recruitment. At the same time, such recognition also brings with it certain responsibilities. Many companies in this field will fulfill the hopes of today's investors.

But, the optimistic evaluations have been applied almost across the board—to small and large companies alike, to firms with broad and narrow product lines, to established strongly financed operations and to new small, untried enterprises, to companies with proven as well as untested managements, and finally to companies with large sophisticated research activities and to those which do hardly any research at all. And, strange as it may seem, in some cases, the only real tie to the electronics industry is the word "electronics" in the company's corporate title.

As for the future, in my opinion, maintenance of prices will depend upon operating performance and fulfilling the anticipations which established the current levels of prices. It seems unlikely that all companies will manage to do this. As you know, competition in this field is becoming intense and it will become even more so. Aircraft companies are expanding their electronics activities, and even firms outside the general field which previously did defense work only for patriotic reasons are now getting into the business to keep abreast of its fast-moving technological developments.

We will undoubtedly witness a shake-out over the next decade as weaker companies either disappear or become absorbed by the stronger ones. The result will be greater industry concentration with the emergence of several large industry leaders. This has been the typical pattern of evolution for all new industries in American history. I would like to add a qualification here, however. Since the industry is probably more dependent upon ideas and the human equation than any other industry in our history, the degree of concentration will perhaps be less than has been witnessed in most industries, with continuing opportunities existing for new, small, but soundly based enterprises.

How then does one go about making stock selections to participate in the growth of this field? This is difficult, particularly among electronics companies, because by nature the industry is not homogeneous. For example, two companies can be classified as electronics firms without making the some products and without competing with one another. Compare this if you will with the steel or machine-tool industries, where the economic factors which affect one company virtually affect all others in the industry to the same degree. We feel it is essential that the investment approach be extremely selective and that a stock be purchased not only on the basis of general industry trends but on the clear appreciation of the individual company. Among other things the following are some of the factors which guide us in our stock selection. We prefer to see:

(1) A rising trend of sales.

(2) Profit margins which are constant or rising. However, margins should not be unduly high because of possible repercussions of renegotiation.

(3) The product line should be diversified and represent growth segments of the industry.

(4) The company should have technical competence and give indications that it can do better than competitors.

(5) Annual research and development expenditures in relation to sales should be substantial. We prefer to see a situation where at least a good portion of these outlays are company sponsored because of the greater proprietary interest it derives from such activities. Nevertheless, large government-sponsored R&D programs can be extremely important as well.

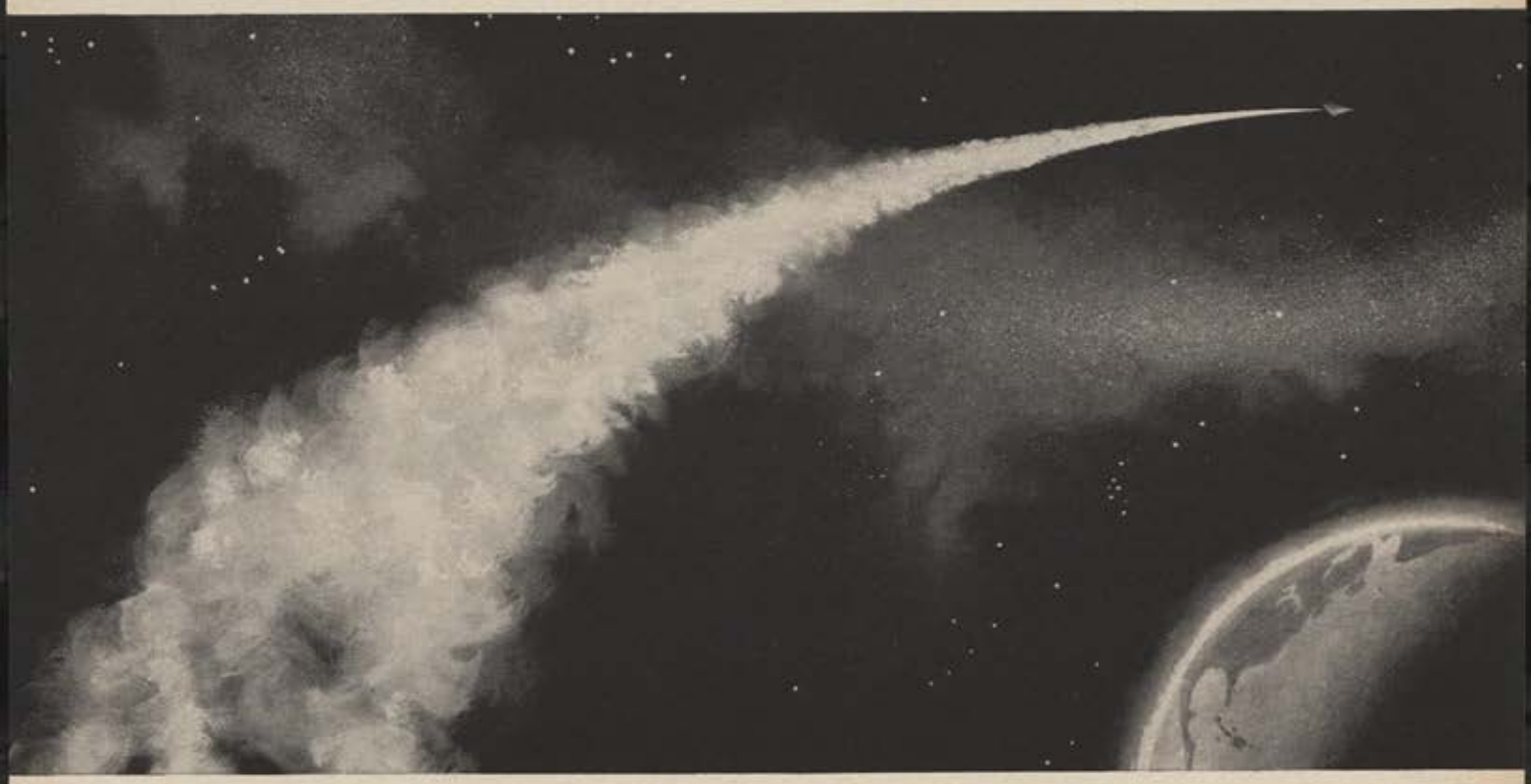
(6) The company should have adequate financial resources, and there should be no plans for common stock financing on the immediate horizon which would result in any serious dilution of stockholder interest.

(7) Management should have business experience and be expansion minded. We believe this to be even more important in the dynamic electronics industry than in most, for in this field it is certainly true that companies never stand still. They either go forward or they lose ground rapidly.

We feel that those companies which can fit the bill on all or most of these counts are most likely to succeed. For, as the industry grows, competition will increase, capital requirements will expand. More funds will be needed for plant and equipment and research development. Managements will be required to cope with financial problems as well as technical and scientific ones. They will also have to find and develop commercial markets for their new technology. Only those companies which can meet these challenges will retain the confidence of the investment community. And for those that do, the rewards will be indeed unlimited.—END

A. J. Catapano is an electronics industry specialist for the investment firm of Merrill Lynch, Pierce, Fenner and Smith. A native of New York City, he holds a B.S. in economics from the University of Miami and a master's degree in business administration from New York University. The above analysis was delivered to the World Congress of Flight's Missile Management Conference in Las Vegas, April 16.

DYNA-SOAR



Dyna-Soar (for dynamic soaring) is a joint project between the Air Force and the NASA, and is an attempt to solve the technical problems of manned flight in the sub-orbital regions. Advance knowledge on the project indicates how a boost-glide vehicle can operate from the outer fringes of the atmosphere where it can maneuver and be recovered undamaged. Studies show that by varying the original rocket boost, and thus the velocity, and with the control available to the pilot, the Dyna-Soar aircraft can circumnavigate the earth, followed by a normal and controlled landing. Boeing Airplane Company, one of the competing companies for the development contract for the complete boost-glide system, has delegated to RCA the responsibility for the development of important electronic components of Dyna-Soar.

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EFFICIENT USE OF AIRSPACE

A SYMPOSIUM on the Efficient Use of Airspace was sponsored by the National Pilots Association and moderated by its President, George E. Haddaway.

Participants were Brig. Gen. G. S. Cassady, Deputy Director, Bureau of Air Traffic Management, FAA; Charles W. Carmody, Chief, Airspace Utilization Division, FAA; Col. Joseph Ruebel, Directorate of Operations, Hq. USAF; J. R. Dettman, Western Region Manager, Air Transport Association; and Crocker Snow, Massachusetts Director of Aeronautics.

The airspace problem was tersely defined by Mr. Dettman: "The area of the United States is 3,022,387 square miles, and there is an equal area of airspace above it. This, at first, seems a rather large figure, and it is understandable why it was once considered limitless. The majority of our current transport aircraft will cover five miles of this airspace in a single minute. The new jet transports now being introduced into service will move twice as fast. Some military aircraft already in service can cross more than twenty miles of airspace in a minute. Consider that, at any given time, there may be thousands of planes in the controlled airspace moving toward every direction of the compass, and it can be seen why even three-million-plus square miles of airspace can take on the aspect of a Saturday night dance floor.

"Both the military and the civil users of airspace are individually clamoring for more airspace for their activities. Specifically, military requirements are for larger and larger reserved chunks of airspace for the accomplishment of their required activities. The civil users, on the other hand, are desperately in need of more usable airspace to accommodate the rapidly growing traffic between existing and new terminals. A look at any current aeronautical chart will disclose that the only available routes between many, many major terminals are by way of extremely circuitous routings. This not only wastes airspace, but increases the burden of operations costs unnecessarily and to an alarming degree. As a rough comparison, the direct operating cost per mile for the jet transports which are now being introduced is approximately three times that of the Douglas DC-3.

"It readily follows, then, that direct airways between terminals are not only highly essential from the standpoint of providing better service to the using public but are a matter of urgent requirement from the standpoint of sound operating economics. The introduction of jet transports also brings with it an additional instance of intolerable conflict between their operations and military activities, in that the operating altitudes of these new aircraft are critical."

EXPERIMENTAL TEST PILOTS

ONE of the most highly technical meetings of the World Congress was sponsored by the Society of Experimental Test Pilots and dealt with many aspects of their work and the problems met in flight testing new and radically different aircraft. Moderator of the two-session meeting was Al Blackburn, president of the society.

The morning session was devoted to a panel discussion on one of the newest topics in the field: flight testing of VTOL-STOL aircraft. Chairman of the panel was George L. Bright, X-18 project pilot with Hiller Aircraft Corporation. Other participants were:

Joseph A. Cannon, chief test pilot of Bell Aircraft Corporation; Lou Everett of Ryan Aeronautical Corporation; and Charles E. Myers of Convair Division of the General Dynamics Corporation.

At the afternoon meeting five papers were presented dealing with problems of interest to pilots and designers of transport-type aircraft. Lead-off man was the well known A. M. "Tex" Johnston, flight test manager of Boeing Airplane Company, who reported on his experiences flight testing jet-powered transports. Other speakers and their topics were:

Phil Prophett of Convair on "Stability Objectives for Jet Transports," William H. Magruder of Douglas Aircraft Corporation on "Flutter Phenomena on Jet Transports," H. R. Salmon of Lockheed Aircraft Corporation on "Powered vs. Manual Controls for Turboprop Airliners," and Brian Trubshaw of Vickers-Armstrong Aircraft on the "Icing Problems of Turbine-Powered Aircraft."

Mr. Salmon traced the history of Lockheed's experience with powered controls from the days of the P-38 fighter of World War II to today's 1,400-mph F-104. Other experience was gained from big transports like the Constellation and the Constitution.

He said the F-104 can be flown at a precise altitude without gaining or losing more than a few feet and emphasized that this is possible only because precision has been built into the control system.

In spite of this experience, Mr. Salmon said, there were skeptics who had to be shown that precise controls were necessary and possible when Lockheed was working on the design of its new turboprop transport, the Electra.

He drew a parallel between airplane and automobile, citing the widely accepted use of hydraulic controls on the nation's highways.

"When you think of reliability or precision," he told the symposium, "think of all the cars traveling at high speeds back and forth across the Los Angeles freeways—within inches of each other."

(Continued on following page)

AIRCRAFT AND SPACE COMMUNICATIONS

A SYMPOSIUM on Aircraft and Space Communications was sponsored by the Electronic Industries Association. The moderator was EIA's Military Engineering Coordinator, Capt. Henry Bernstein, USN (Ret.).

Papers were presented by D. M. Culler of the ITT Laboratories on "Satellite Communications"; Warren Bruene of Collins Radio Co., on "Airborne Single Side Band Communications"; Lloyd M. Luke of Stromberg-Carlson on "Air Traffic Control Data Link"; M. Berkowitz of General Electric Co., on "Space Cabin Communication System Design"; and Stanley Plass of Packard-Bell Electronics Corp., on "Preflight Radiation Test Equipment."

Mr. Culler described a globe-girdling system of communications that involves three satellites in orbit 22,300 miles from the earth. They would rotate at the same speed the earth moves on its axis, and for this reason each one would remain stationary with respect to a given point on the earth's surface. All but two percent of the earth's surface would be covered by such a system, he said.

The speaker suggested that ground relay stations might be located at Athens, Tokyo, and Houston, Tex., to provide worldwide coverage. With appropriate ground networks, he said, it would be possible to establish a worldwide dial telephone system. With one satellite over the Atlantic, the television stations of Europe and North America would be received on both continents and Africa and South America as well.

He further described the application in this manner:

"The first practical application of space systems will be the utilization of earth satellites as microwave links for global communications. Not only will this perhaps be the first practical reward of space research endeavors, but it also will provide a major step forward in the field of communications. At the present time, there is a tremendous need for broadband microwave coverage over large water masses where conventional microwave link structures are impossible.

"For example, in voice and teletype communications alone, it is estimated that overseas messages will increase seven times during the period of 1950 to 1970. Furthermore, present transoceanic cables do not provide sufficient bandwidth for television transmission, a medium of communication that on a global basis could develop a better understanding among countries and thereby be a major instrument of peace. . . .

"Imagine the impact of daily and instantaneous television programs from London, Paris, or New York, on the peoples of Africa, the Middle East, and the Orient."

INTERNATIONAL RESEARCH

USAF's Air Research and Development Command served as sponsor of a Symposium on International Research. The moderator was Brig. Gen. B. G. Holzman, Commander of the Air Force Office of Scientific Research.

The significance of the international effort to find new approaches that may be applicable to today's weapon systems was pointed up by the selection of both speakers and topics for their papers.

The introductory remarks on the basic research problem were given by Maj. Gen. John W. Sessums, Jr., of ARDC. He was followed by General Holzman who told about OSR's program.

For the European effort the mission and project activities of ARDC's European Office, located in Brussels, were described by Col. Nathan L. Krisberg, commander of that unit. He was assisted by Maj. Ralph O. Griffin, also of the European Office, who gave details on several projects now under way. They deal with man in space, space tracking, numerical weather prediction, and meteors.

Aeronautical research in Sweden was discussed by Dr. Bo K. O. Lundberg, Director of the Aeronautical Institute of Sweden.

Dr. Samuel S. Steinberg, Rector, Institute Technologicio de Aeronautics, Sao Paulo, Brazil, told the story of today's aeronautical research in South America.

From the Far East, Professor Itiro Tani of Tokyo's Aeronautical Research Institute, described the current state of aeronautical research in Japan.

Setting the pace for the meeting, General Sessums said:

"As we contemplate space travel far beyond the confines of the earth's atmosphere—perhaps to the moon and to other planets such as Mars and Venus—we realize that the bonds of international scientific cooperation will probably be drawn even closer. We are pleased, therefore, to share our thoughts on research with the representatives of the fifty different countries participating in this Congress.

"Research is the key to progress. It is shaping our lives and profoundly influencing the organized activities of nations around the globe. The relationship and interdependence between fundamental science and the Air Force are very close. Today's military forces are being equipped with the most complicated equipment ever operated by man.

"In fact, the scientist and the airman often use the same elaborate equipment. For example, radio telescopes can track missiles or reveal the nature of our universe; the cathode-ray tube in military radar equipment is the same as that used in the laboratory of a physicist. In short, military technology and basic science are intimately interrelated and interdependent."

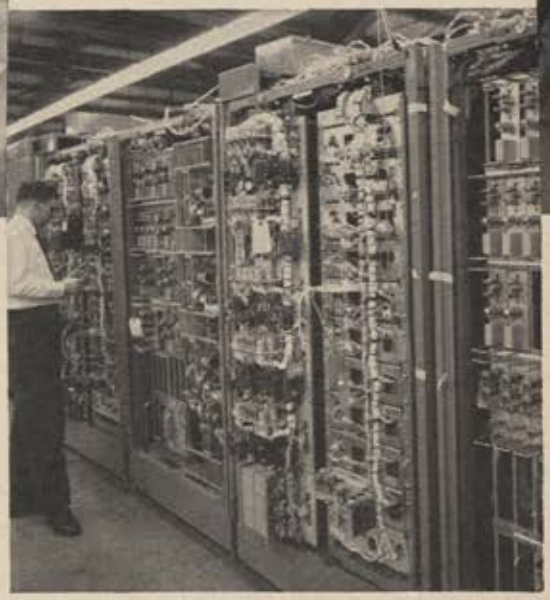
(Continued on page 185)

HERE'S PROOF:

North American Van Lines Carries High Value Products

Smoother and Safer

Raymond Jamieson, (center), Traffic Manager of Link Aviation, Inc., Binghamton, N. Y., discusses shipping with NAVL agent and representative. BELOW: Part of the complicated electronic equipment shipped in padded vans.



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"A $5,000 savings in cost in shipping by padded van over other methods is the bonus we get in delivering a typical flight simulator from Binghamton to the West Coast," says Mr. Jamieson. "With an insured actual value of up to $1,000,000, our primary concern is safe and careful handling. With North American Van Lines, we have never had a claim for damage."

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An Announcement

Military Products Division of AMERICAN-Standard

The new Military Products Division — with a background of twelve years experience as an integrated organization — will carry on and expand the work it formerly handled as a department of the Detroit Controls Division of American-Standard.*

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MILITARY PRODUCTS DIVISION

FLIGHT SAFETY; SAFETY FOR PRIVATE PILOTS

ALL USERS of airspace were represented at a double-session Symposium on Flight Safety. Sponsored by the Flight Safety Foundation, the meeting was moderated by the managing director of that organization, Jerome F. Lederer.

Speaking for the federal government were the Hon. James R. Durfee, Chairman of the Civil Aeronautics Board, and James T. Pyle, Deputy Director of the Federal Aviation Agency. Mr. Durfee discussed "Economics and Safety" and Mr. Pyle provided "A Digest of FAA Safety Projects."

The military representative on the main program was Maj. Gen. Joseph D. Caldara, USAF Director of Flight Safety Research, whose topic was "Aircraft Accident Prevention in the Jet Age."

The first three papers were discussed by a panel composed of Don Teel of U.S. Steel Corp., speaking for the corporation pilots; Col. James F. Wells, Director of Army Aircraft Accident Research; W. B. Becker, representing the Air Transport Association; and Clarence Sayen, President of the Air Line Pilots Association.

In the second half of the Flight Safety program, G. E. Rice, Manager of Commercial Jet-Assisted Takeoff Sales for Aerojet-General Corporation, delivered a paper on "Safety and Economic Aspects of Auxiliary Standby Power." A. Howard Hasbrook, Director of Aviation Crash Injury Research at Cornell University, spoke on "Greater Air Safety Through Crash Safety Design." "Safety Aspects of Russian Civil Aviation" were discussed by Harriett E. Porch of United Air Lines.

Keynote address for the Flight Safety Symposium was given by CAB Chairman Durfee who paid tribute to the World Congress of Flight as an ideal forum, making "a major contribution to the advance in air safety as well as a major contribution to the promotion of aviation."

Chairman Durfee put the emphasis on economy:

"Aviation is unique among industries, and indeed, among human enterprises, in the importance of safety. On the one hand, the safety of aviation is itself part and parcel of the product that aviation sells to the public. On the other hand, because of the new dimension in airspace in which it carries on its business, there is no such thing as an acceptable risk.

"In most other businesses, while safety is a factor affecting costs or even the reputation of the company, the product is usually saleable regardless of the business safety record. The economic success of aviation, on the other hand, rests primarily on public confidence in its safety record. . . .

"This relationship between economics and safety has been a basic postulate of government intervention in the industry. The Civil Aeronautics Act passed in 1938 had, as two of its basic assumptions, first, that the industry could not achieve a satisfactory safety record without a measure of economic stability; and conversely, that it could not achieve economic stability without improving its safety record and public confidence in the use of air transportation. These two interdependent assumptions are what we call the economics-safety equation. . . .

"You are all familiar, I know, with the groundings of certain aircraft types in the postwar transitional period of the late '40s. You will all recall that at roughly the same time as these groundings the air transport industry was overextended economically, with load factors and profits down. . . .

"No one, to my knowledge, has ever calculated the effect on the industry of the failures in safety during this period—even in terms of dollars lost. Certainly no one has ever assessed the damage done to the progress and development of the aviation industry in air transportation, manufacturing and, perhaps, most important of all, in maintaining our national defense posture. We can only guess at what might have been had the crisis never occurred.

"This crisis of the late '40s illustrates what I mean when I talk about the relationship between safety and economics. It suggests, even if it does not prove, the fundamental importance of safety not only to current airline earnings but to the long-term growth of air transportation, to the manufacturing industry, the national defense and, in short, the entire economy."

Following the Flight Safety Symposium, the Flight Safety Foundation was joined by the National Association of State Aviation Officials in the sponsorship of a two-hour Forum for Private Pilots. The subjects were "Integration of Instrument Familiarity (Altitude Control) in Flight Instruction," and the "Economy and Improved Safety of Such Programs."

Sitting on the panel, which was moderated again by Mr. Lederer, were Arthur E. Abney, Director of Aeronautics for the state of Illinois; George Stathers, Operations Specialist with the FAA; Leon Z. Seltzer, Professor of Aeronautical Engineering at the University of West Virginia; Dr. Charles M. Starr, Vice President of the Flying Physicians Association.

Also, James W. Osmun, Director of Aviation Weather Services, US Weather Bureau; Col. Joseph Duckworth, USAF (Ret.), Flight Training Consultant at Albion College; Dr. Leslie A. Bryan, Director of the Institute of Aviation, University of Illinois; Col. H. D. Edson, Acting Director of Army Aviation; and Lt. Col. Elmer P. Fleming, Jr., Office of the Deputy Chief of Staff for Military Operations of the Department of the Army.

(Continued on following page)

ADVANCED AIR TRAFFIC CONTROL

THE National Business Aircraft Association served as sponsor of the Symposium on Advanced Air Traffic Control Concepts, moderated by NBAA's President, Joseph B. Burns.

Speakers were Brig. Gen. G. S. Cassady of the Federal Aviation Agency, who discussed a control program based on the VORTAC system; Vernon I. Weihe of General Precision Equipment Corporation, who presented a paper on "Some Future Aspects of Air Traffic Control;" and John W. Grewell, also of FAA, who looked ahead for a study of what traffic control possibilities will develop for the year 2000.

Most of the discussion was centered around the use of automation and the computers that will be developed in years to come. Mr. Grewell, for example, anticipated that the airman's certificate in the year 2000 will be in the form of a card which can be inserted in a telephone to file a flight plan.

A plan filed this way, he predicted, may set a computer to work figuring out how the flight will be carried out, taking weather and other factors into consideration. It will perform the flight within the machine and pick out the best possible route. Then the machine will produce a chart that will give the necessary navigational information, the routes that will be used, the altitudes, times when the flight will be over key points en route, and other pertinent data.

Here is the rest of his "flight of the future":

"It is quite conceivable that this same chart may serve to set up the navigational equipment, to trigger required communications contacts, and to activate other automatic system functions as the actual flight is conducted. This will be true only if such activity will enhance accomplishment of the mission in question.

"The flight itself will be accomplished with a minimum burden on the humans involved, since the preflight preparation has been so comprehensive and thorough. The area navigation capability inherent in the system is obvious as we observe the lengthening line which marks our progress on the chart. Time and altitude indications which appear on our chart at intervals provide a check on the maintenance of schedule commitments. The appearance of these marks depict our progress and conformance to schedule. They also furnish proof that our communications system is automatically functioning within the air traffic system.

"Touching down at destination at the time allotted to us prior to takeoff, we may reflect that the operation was conducted in a most orderly manner. On the other hand, since the whole thing was entirely routine, we may go on our way without giving it a thought."

ADVANCED AIR NAVIGATION AIDS, SYSTEMS

NATIONAL Business Aircraft Association contributed to the World Congress of Flight program by sponsoring a Symposium on Advanced Air Navigational Aids and Systems. Moderator of the meeting was Joseph B. Burns, President of NBAA.

Three guidance systems were discussed in papers presented by outstanding experts in the field. They were Dr. Maurice A. Meyer of Laboratory for Electronics, Inc., who described the Doppler system; Capt. Harry A. Hall, USAF, a project officer from Wright Air Development Center, who discussed inertial systems; and Cmdr. Lyle C. Read, USNR, of Naval Research Laboratories, who talked on hyperbolic systems.

Dr. Meyer traced the history of the Doppler system back to 1842 and showed how the basic principle has been applied to a modern navigation system. He stressed that the system is self-contained and does not rely on ground facilities:

"The practical application of the Doppler principle to aircraft navigation has only been achieved in the last decade, since those electronic components necessary to construct a practicable system were developed only within that period. But these developments have come at a time when the advent of high-speed aircraft and ever increasing air traffic have made the requirement for accurate all-weather navigation and position-determination more acute than ever before."

Dr. Meyer went on to describe the Doppler system's abilities in detail and said that it, along with other devices now available, has many advantages for fixed and rotary-wing aircraft, both military and commercial.

"For the military," he said, "these systems offer precision, all-weather, automatic navigation in any part of the world—with consequent saving of fuel, and reduction of pilot/navigator fatigue. In addition, these systems provide instantaneous velocity data for such functions as bombing, flight control, fire control, and landing. For commercial aircraft, Doppler navigational systems would allow the pilot to limit his fuel reserve to a minimum, and thus increase his payload. In all probability, the precise position and velocity data will permit air traffic control to use smaller control blocks in high-density areas. Equally important, wind velocity and direction information are available to help the pilot select the optimum course, such as one taking advantage of the jet stream. Doppler systems are available now to provide these and other capabilities for modern aircraft navigation—capabilities which once could only exist in man's imagination."—END

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THE *IMPACT* OF THE World Congress of Flight

IN THE official program for the World Congress of Flight, the section describing the background for the Congress contained the following statement:

"The planning group early concluded that the day had passed when the success of an aviation show could be measured by the number of bodies passing through the gates. Thus, for the World Congress of Flight, modern communications bring the crowds to the show which by necessity must be held away from crowded areas. Further, television and other mass media coverage of the event will reach many millions of Americans who could never get close to an actual World Congress of Flight, no matter where held."

The results amply confirm this prediction. News coverage of the World Congress literally brought the world to Las Vegas.

Some of the statistics give you an idea. The News Room at Las Vegas registered 487 individuals—editors, writers, photographers, and radio and television people. Of these forty-five were from foreign countries. American newspapers and wire services accounted for 195, radio and television —both nets and local stations—for 150, while ninety-seven were covering for periodicals—weeklies and monthlies.

Apart from the millions of readers of newspapers serviced by the Associated Press and United Press International (both represented by their aviation editors), the largest single audience for World Congress coverage consisted of the estimated forty million Americans and Canadians who gathered in front of their television sets on Sunday, April 19, to view an hour-long television show, produced by the National Broadcasting Company and shown over its full network. The General Motors Corporation sponsored the telecast.

The NBC-GM show featured daring experimentation with the use of video tape, coupled with live telecasting, to bring the story of the World Congress—the story of the world of flight—into hundreds of thousands of living rooms.

Here is a sample of the television critics' reactions:

"Outstanding television entertainment. . . . A grand and glorious parade of aviation, the like of which has never been seen on television heretofore. . . ."

"A stunning demonstration . . . a roaring, whooshing, and decidedly awesome report on man's conquest of air and space."

"NBC's camera crew outdid itself. . . . Sensationally picturesque."

"Fascinating, exciting, beautifully impressive."

"A dip of the wings to NBC for an exceptional TV report from the World Congress of Flight."

"Quite an aeronautical spectacle."

Life Magazine, with its six million guaranteed circulation and estimated twenty million readers, gave the World Congress three and a half pages of photos and text, called it the "biggest display of aviation and space activities ever held. . . . Generals, pilots, and scientists found the Congress a convenient way to get together and talk about such subjects as space electronics and air safety. . . . The hit of the week was a military air show in which jets zoomed, bombed, and careened through the desert air without a single mishap."

Within the aviation family, high praise was bestowed by George Haddaway, veteran flyer and President of the National Pilots Association. He is also editor of *Flight* Magazine. Wrote Haddaway in his May issue:

"The first World Congress of Flight, a spectacular project of the Air Force Association . . . was a magnificent accomplishment.

"It was the most comprehensive and the only total US aviation show in history, and it effectively displayed every facet of American aeronautics from the lowliest putt-putt to the space capsules and rockets of the future. . . .

"Never before has there been such overwhelming evidence that US aviation wants, needs, and will support a practical, realistic, annual display equivalent to or even better than those held each year in England and France. . . .

"Perhaps the greatest payoff for aviation in the World Congress of Flight was the splendid press coverage. . . . It doesn't really matter where our annual showcase of aviation is located so long as it produces the kind of press, and radio and TV coverage enjoyed by the Las Vegas show.

"US aviation owes the AFA a debt of gratitude and a rousing vote of thanks for 'The Miracle at Las Vegas.'"

Another veteran of the aviation scene, as participant and observer, saw the World Congress as a "shot in the arm" for aviation. Editorializing in *Flying* Magazine, Gill Robb Wilson, its editor and publisher, said:

"In pertinent respects the Congress was a remarkable show. The industrial exhibition was the best portrayal of scientific and engineering achievement ever staged in this or any other country. The flight demonstrations . . . revealed airmanship and aircraft performance that testified to a new plateau of utility. Exceptionally productive from a long-range standpoint were the forum sessions of the educators who for the first time were attending an aviation event as a component part of the program and in representative numbers. . . .

"In retrospect, one can see numerous points at which the Congress might have been tightened up and streamlined. On the other hand, it is hard to imagine how a better program could have been originally planned and carried out. The chasm of ignorance existing between the several segments of aviation, civil and military, airlines and general aviation, big industry and grass-roots activity, is best symbolized by the Grand Canyon. It's colossal beyond belief. Organization of any such undertaking as the World Congress of Flight had to face this factor. It was remarkably well done, and the doing showed how sorely it was needed."

American Aviation Daily, in its "Trends and Forecasts" section on April 20, saw it this way:

"World Congress of Flight promises to become an annual event with more and more of an international flavor. Doubters generally believe that the

(Continued on following page)

IMPACT ——— CONTINUED

Congress met the objective of bringing various elements of industry, government, and international aviation together to discuss problems that are common to them all."

Editor LeRoy Whitman, of the respected *Army-Navy-Air Force Journal*, saw the World Congress as filling a real need. Whitman wrote, in the April 18 issue of the *Journal:*

"All the factors that comprise the airpower of the nation—defined by Gen. Curtis E. LeMay as 'science, industry, civil, and military'—combined to make the World Congress of Flight . . . a marked success. . . .

"Since the National Aircraft Shows were discontinued some years ago, the United States has had no single place where those interested in, and engaged in, keeping this nation in the forefront of aviation and space developments could gather and exchange ideas. England's Farnborough and France's Paris Air Shows now have no counterpart in this country.

"The World Congress of Flight not only has met that need, it has gone considerably further than the earlier shows in that it has embraced the other nations of the free world and has placed major emphasis on the grass roots of airpower—science and industry. . . .

"There is no doubt as to the success of this initial venture, and with this experience in back of the sponsors, one may be certain that future events would be even better."

Additional evidence as to the significance of the World Congress of Flight is the fact that the Air Force Association has reached an agreement with the McGraw-Hill Publishing Company of New York to publish the proceedings as a hard-back book. Publication is scheduled for late fall. Price is expected to be $10 for a 600-page book with sixteen pages of pictures. It will be made available at greatly reduced cost to members of AFA, cooperating and participating organizations, exhibitors, and members of the Airpower Book Club.

Letters from delegates have been pouring into World Congress of Flight headquarters at the Air Force Association. It is manifestly impossible to reproduce even parts of all of them, but the following excerpts represent a cross section of the response from the major categories represented at Las Vegas:

Foreign

"I thought the organization at Las Vegas for all events was splendid, and

I was particularly impressed with the flying demonstrations and the way in which the discussions were handled. The NATO Banquet was a most impressive occasion."—Commodore D. G. Goodwin, Royal Navy, British Joint Services Mission.

"All the organizations and executives who were responsible for the Congress deserve the highest commendation for a most successful venture. . . . I was honored indeed to be a part of such a successful and well conducted Congress."—Air Vice Marshal M. M. Hendrick, RCAF, Canadian Joint Staff.

"We were particularly impressed by the outstanding achievements reached during the various firepower and flying demonstrations. All of these cannot but reinforce confidence in NATO efficiency and collaboration of the West. The organization of each event and the manner in which it was conducted were absolutely perfect."—Maj. Michel de Villepin, French Air Force, Aide de Camp to the French representative to the North Atlantic Treaty Organization.

"Never in my thirty years of aeronautical life have I been able to participate in such a wonderful international gathering of leading aviation scientists and authorities. . . . The World Congress of Flight represents a remarkably effective contribution to the strengthening of Western nation friendship and reciprocal understanding in the field of aviation and knowledge of the vital problems related to the conquest of space."—Maj. Gen. Duilio S. Fanali, Commander, Air Training Command, Italian AF.

"I found the exhibits, demonstrations, and talks really interesting and instructive. . . . I thank those who were responsible for organizing such a magnificent international convention."—Brig. Raj Badra, Military and Naval Attaché, Embassy of India.

"My warmest congratulations for the huge success of the World Congress of Flight."—Lt. Col. Joao de Paiva Brandao, Military and Air Attaché, Embassy of Portugal.

"To my deepest regret I was unable to attend. Major Branders, who was sent in my stead, has given me a full report on this great event, its brilliant organization, and full success."—Maj. Gen. Baron A. Del Marmol, Military, Naval and Air Attaché, Embassy of Belgium.

"It was a thrill and pleasure to attend."—Brig. Gen. Julio Pereira, Chief, Portuguese Military Mission, Embassy of Portugal.

"My sincere congratulations for the extraordinary success achieved by the World Congress of Flight and for the superb organization of this event. . . . The benefits I derived from the personal professional point of view, as well as for the Argentine Air Force which I had the honor of representing, were many."—Col. Arnold C. Tesselhoff, Assistant Air Attaché, Embassy of Argentina.

"A very interesting and well organized show."—Col. W. Koch, Armed Force Attaché, Embassy of Switzerland.

Military

"Warm congratulations on the great success of the World Congress of Flight. It served a great need of American aviation and will have far-reaching effects. All involved have earned a hearty 'well done.'"—Gen. Thomas D. White, Chief of Staff, USAF.

"This occasion deserves the wide recognition which it has received from aviation interests throughout the world."—Gen. Curtis E. LeMay, Vice Chief of Staff, USAF.

"Please accept my thanks and my extreme awe at the terrific job done during and prior to the show. A statement overheard at Las Vegas aptly

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describes my sentiments. A man said, 'This group at AFA wouldn't accept that this job couldn't be done. They are like the bumblebee which can't fly but doesn't know it. They went ahead and did it anyway.' The Association has made another great step forward in selling airpower."—COL. RUSSELL W. TARVIN, USAF.

"AFA has scored another significant 'first' in aviation history."—COL. DANIEL K. PHIPPEN, USAF.

"The World Congress of Flight was a most impressive and precedent-making operation throughout. The meetings were interesting and the air shows of unusual significance."—MAJ. GEN. ROBERT E. L. EATON, USAF.

"It will surely be recorded as one of the most significant events in aviation history. The Air Force Association can be very proud to have been the sponsor of this unique activity."—JAMES H. DOUGLAS, Secretary of the Air Force.

"Let me be one of the thousands who want to congratulate you on the success of the World Congress of Flight. There never has been anything like it."—LT. GEN. WILLIAM E. HALL, USAF.

Others

"You should take particular pride in the Congress' unqualified success as attested by the plaudits of many of the participants and those in attendance. You deserve a twenty-one-gun salute for the magnificent job that was done in planning, coordinating, and directing this gigantic undertaking."—WILLIS G. LIPSCOMB, Vice President, Traffic and Sales, Pan-American World Airways System.

"The outstanding aviation safety record during the Congress was most gratifying."—C. A. LEFEVRE, Supervising Inspector, Region 4, Federal Aviation Agency.

"This was a difficult undertaking brilliantly executed, and the result was an outstanding success which is receiving well merited praise from all quarters. . . . As in any such tremendous effort, small mistakes will be made and misunderstandings will arise, but your splendid organization was successful in making no major error and no minor errors, so far as I know."—ANDREW G. HALEY, President, International Astronautical Federation.

"I should like to say how very much impressed I was by the scope of the Congress and by the magnificent organization and coordination throughout every phase of the arrangements.

Quite literally, there has never been anything like it!"—S. RALPH COHEN, Public Relations Officer, International Air Transport Association.

"We can only guess at the overwhelming amount of work which went into making it such a great success, but the smoothness with which the meetings and air shows were conducted gave ample evidence of careful planning."—LORETTA SLAVICK, Chairman, Public Relations, The Ninety-Nines, Inc.

"I knew it would go, but I didn't expect it to go over as such a terrific success."—J. GORDON BENNETT, Assistant to the Director, Federal Aviation Agency.

"I feel that the World Congress was one of the Air Force Association's finest hours and certainly carried out, on an international level, our purpose in being."—GEORGE HARDY, Central East Regional Vice President, Air Force Association.

"I found the program extremely interesting and most beneficial, and I hope this will be the first of many such meetings in the future."—ALYCE CANADY, Office of Senator Styles Bridges, New Hampshire.

"I have talked with all four of the young men who were there as representatives of the National Association of Rocketry. They have told me that the World Congress of Flight has meant more to them than any other meeting they have ever attended. It's rather early yet to determine what effect the WCF will have on their lives, but I am fairly certain now that they are bound for careers in the aviation or astronautical fields.

"I am sure that a great many people gained a very favorable impression about the aviation industry and, from our demonstrations, an appreciation that model rocketry can be safe, educational, and fun."—G. HARRY STINE, President, National Association of Rocketry.

"Never has an undertaking of this kind been put together under such time limitations and against such controversial odds. There was never a doubt in my mind that the World Congress would be anything less than a success."—DONALD W. DOUGLAS, JR., President of the Douglas Aircraft Company.

"You should be very pleased with the wonderful reception the WCF received, with glowing comments on the outstanding organization of the entire affair."—GLORIA W. HEATH, Executive Assistant to the Managing Director, Flight Safety Foundation.

"During the past ten years I have attended many industrial exhibitions, conventions, and the like but have yet to see anything comparable to the World Congress of Flight. From every aspect, all concerned deserve a complete 'well done' for planning and execution of the finest aviation show ever held."—D. L. CHADWICK, Vice President, J. E. Hensel & Associates, Inc.

"This was the best arranged and managed flight display I have ever seen. It was bright and extremely worthwhile and will show that the US is not only on the map, but in the skies all over the free world."—CHESTER G. MILLER, Director of Public Relations, Lear, Inc.

"The World Congress of Flight is now history. The vision and capability involved in bringing it about are remarkable. Nothing is more inspiring than the spectacle of such intelligent, well-directed strength."—SHIRLEY THOMAS, Annis & Thomas Productions, Inc.

"It was a tremendous convention—one of the finest I have attended in some twenty-five years of public life. I thoroughly enjoyed the show and regretted only that I didn't have time to do everything and hear everybody."—CLAIR ENGLE, US Senator, California.

(Continued on following page)

"The entire time was most profitable to me as I gained knowledge and experience which will be invaluable in my work. The personages assembled, the symposia, displays, conferences, and air demonstrations were absolutely outstanding in every respect."—COL. HARRISON THYNG, USAF, Planning Officer, Federal Aviation Agency.

"A well organized, aggressive congregation. . . . It's no mean feat, even for Americans, to do a job like this."—SIR WILLIAM HILDRED, Director-General, International Air Transport Association.

"A very fine demonstration of teamwork, energy, and foresight."—E. R. "PETE" QUESADA, Administrator, Federal Aviation Agency.

"By all odds the most critical message conveyed to me by the World Congress of Flight program had to do with the military applications of aerospace weapons. The Air Force's Atlas and Thor missiles, the X-15 experimental manned space vehicle, the space capsule, and other important items of aerospace hardware all underscored these three hard realities of our age: First, that modern aerospace weapons have a demonstrated ability to achieve decisive military results in a matter of hours. From this it follows that an overwhelming margin of superiority in aerospace power can produce a decisive strategic advantage. This forcefully underscores the imperative necessity for achieving and maintaining a clear-cut margin of US aerospace

supremacy. Further, it underscores the necessity for providing full and vigorous support of the development programs which are pacing the Air Force's logical expansion into the realm of aerospace operations."—CONGRESSMAN JAMES M. QUIGLEY, Pennsylvania.

"I consider my participation in the World Congress of Flight to have been a most valuable and memorable experience. I have benefited greatly from my discussion of the economic, military, and educational aspects of aerospace progress with many of the leading authorities on flight."—CONGRESSMAN MORGAN M. MOULDER, Missouri.

"I want to cite the tremendous value of this activity as a means of fostering cooperative effort on an international basis in solving many of the problems and exploiting many of the opportunities that are associated with the new and challenging field of aerospace operations."—CONGRESSMAN JAMES M. VAN PELT, Wisconsin.

"Certainly many of the answers arising from these deliberations will materially assist in charting the future course of our own national aerospace endeavors. The decisions relating to education will have an impact upon the young men and women of the free world countries for years to come. . . . There are a host of legislative proposals now under consideration on which the question of aerospace progress has an important bearing. These proposals cover such vitally important items as national security, civil aviation, and technical education. . . . Firsthand observations at a function such as the World Congress of Flight promise to be invaluable as a basis for subsequent evaluations and analyses of technical publications, committee reports."—CONGRESSMAN WALTER S. BARING, Nevada.

"The World Congress of Flight has concentrated the best brain power available in the fields of commercial aviation, education, and science on the foremost problems and opportunities which are presented by the accelerating pace of aerospace progress. The discussions among these experts will undoubtedly yield answers of immediate value. They will also provide an improved basis for cooperative effort in the solution of future problems."—SENATOR HOWARD W. CANNON, Nevada.

"Mr. Edward P. Curtis, the General Chairman, and the many individuals and agencies who worked with him to bring it about have earned an expression of national gratitude for the many important accomplishments that were realized through this first World Congress of Flight."—CONGRESSMAN IRWIN MITCHELL, Georgia.

Educators

Perhaps the most enthusiastic group of responses came from those educators who attended the Congress and participated in the Aerospace Education Symposium. Here is a sampling of the many letters received:

"I received a great deal of information. The forum was well conducted, the specialists were well chosen, and I hope I will be invited to participate again."—LESLIE A. HOLMES, President, Northern Illinois University.

"We shall try to see that the experience is reflected in needed adjustments in our school system."—SAMUEL M. JENNESS, Superintendent of Schools, Carroll County, Md.

"What we saw and heard makes it much more evident that we should interpret our personnel problems through closer liaison."—CARL A. MAGNUSON, Superintendent, Department of Education, Bristol, Conn.

"The World Congress was one of

(Continued on following page)

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1959 Air Force Association Convention & Panorama

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Others Sharing Room _____

Arrival Date and Hour _____ Departure Date _____

IMPACT — CONTINUED

the finest professional experiences I have ever had. . . . I am in hopes that my participation will help me to find new dimensions in curriculum."—RICHARD SCHUCHERT, Superintendent, Community Schools, Spirit Lake, Iowa.

"It was an excellent idea to invite educators because we must recognize the rate and scope of the change to aerospace. Our understanding of what space exploration means had much to do in determining the place of youth in this new wide world."—MRS. LOUISE OLSON, Laramie Public Schools, Laramie, Wyo.

"It was a good show and a worthwhile event."—FRANK D. PETERSON, Vice President, Business Administration, University of Kentucky.

"I must count it among the most fruitful educational ventures I have experienced. I only wish it were possible for everyone in the country who is engaged in educational leadership to have such an experience or the equivalent." — W. K. BEGGS, Dean, Teachers College, University of Nebraska.

"The World Congress was indeed a thought-provoking spectacle. It will help me to evaluate the strengths and weaknesses of the educational system as it exists in my state."—MRS. J. E. BETH, President, Kansas Congress of Parents and Teachers, Inc.

"I have made many meetings in my thirty years of school experience but never one that was so highly informative and interesting as the one in Las Vegas. . . . Nothing is more satisfying than to sit at Wisdom's feet, because we school men have to listen to so many people who aren't wise."—D. M. ALLEN, Superintendent of Public Schools, Canton, Mo.

"Much good comes from having the educational leaders of the states represented [at the World Congress]. For instance, we plan to build our Pre-Opening-of-School Workshop this fall around the idea of Aerospace Education. We hope to promote a sensitivity among our teachers and our community leaders to the meanings of technological advances to their lives in the immediate future in terms of social and economic considerations."—R. B. DOOLIN, Superintendent of Schools, North Kansas City, Mo.

"For me and the National Education Association *Journal* the meeting was most productive."—WALTER A. GRAVES, Senior Assistant Editor, NEA *Journal.*

"The educators present most certainly got much food for thought which will help them as they operate

(Continued on page 198)

AFA's FLIGHT PAY PROTECTION PLAN GIVES YOU...

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"I wish to take this opportunity to express my sincere appreciation for the expeditious manner in which you processed my recent claim for reimbursement under your Flight Pay Protection Plan. Being a recent addition to that unfortunate group of individuals who suddenly find themselves with their wings clipped by the Flight Surgeon with no prior warning symptoms, I can make one outstanding comment on your Flight Pay Insurance, I'm sho' glad I had it."

Linus L. Lee, Jr.
Capt, USAF

"The Air Force Association certainly deserves all the cheers in the world. The Flight Pay Protection Plan is, in my opinion, the finest thing that has happened in aviation since the invention of the propeller.

"For the professional military pilot, there can be no doubt that eventually the percentages will force him to be grounded some portion of his military career. When this grounding occurs, a real mental and financial problem emerges, regardless of the preparedness of the individual. Nothing can cure the mental let-down, but the strides AFA has made with the Flight Pay Protection Plan provides a very fine cushion for the financial problem.

"I would like to congratulate your staff on the very fine manner in which my case was handled. From the very beginning when I received notice from the flight surgeon, I was confident that the AFA was behind me. In fact, it was one of the few times in my career that I truly felt someone else was as interested in my problem as I was."

John E. Skaggs, Jr.
Major, USAF

"Most rated personnel always feel that these things always happen to the 'other guy' but it sometimes comes home to roost. Believe me the sudden stoppage on flight pay can be felt. The first couple of months are simple but the old 'nest egg' takes a beating. The cost is small for the protection offered, and that first check for $615 could and did fill the gap. The farsightedness and progressive endeavor of AFA in this behalf cannot be praised enough.

"It is my firm belief that this type of protection should be an integral part of every flying officer's personal program."

W. J. Sitzman, Jr.
Capt. USAF

"I wish to say that I have told many of my friends about the quick efficient service that I received upon filing my claim. The first check was received only one week after the necessary papers were mailed. I wish to thank you and say that I greatly appreciated this prompt service and generous cooperation."

Robert J. Wheeler
Capt, USAF

"I wish to take this opportunity to express my thanks and gratitude to your organization for offering Flight Pay Protection Insurance. The cost is so small and the protection so great that I can not see how anyone on flying status can afford to be without it. Needless to say, none of us should depend on our flight pay, but without it there is a very noticeable difference in our monthly take home pay."

JACK R. BONHAM
Captain, USAF

Write AFA FLIGHT PAY, Room 306
Mills Building, Washington, D. C.

IMPACT — CONTINUED

back in their respective areas."—CHARLES F. RITCH, JR., Commissioner of Education, State of New Hampshire.

"It was in the broadest sense most enlightening and educational. It would be a wonderful thing if all the educators could have seen the demonstrations and exhibits and could have heard the lectures."—J. F. INGRAM, State Supervisor, Trade and Industrial Education, State of Alabama.

"I was particularly grateful for the opportunity to discuss some of our space education problems with representatives from foreign countries. The whole effort gave each educator an opportunity to reassess the work which is being done in our public schools."—DOUGLAS A. CHANDLER, Superintendent of Schools, North Andover, Mass.

"It was one of the finest experiences I have ever had."—D. D. COOPER, Executive Secretary, Montana Education Association.

"Those of us from Pennsylvania who attended the meetings are now planning an initial program for Pennsylvania—a program which we hope will make some important contributions to education in this new age of space science."—PAUL H. MASONER, Dean, School of Education, University of Pittsburgh.

"The results of the stimulation that was received as to the necessity of educating for the future will be accentuated throughout our state as a result of our participation."—CHESTER H. BOWEN, Executive Secretary, Wyoming Education Association.

"One of the most instructional and interesting experiences which I have ever had."—THOMAS W. HOWIE, Superintendent of Schools, Wilmington, Del.

"The educational implications of such a conference seem so significant to me that I have made some suggestions for a program on space education at the fall meeting of the faculties of the five teachers colleges of Maryland."—EARL T. WILLIS, Dean of Instruction, State Teachers College, Salisbury, Md.

"Throughout the coming year I hope to bring the message that was received to the attention of many teachers, administrators, and school board members throughout the state."—OLIN W. STEAD, Assistant to the Superintendent of Public Instruction, State of Illinois.

"I can think of nothing which would serve to promote the development of course guides for future instructional programs of youth for the type of education which we must have in the

(Continued on page 200)

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IMPACT — CONTINUED

future which would, in any way, equal the opportunity to participate in the World Congress of Flight."—HUBERT WHEELER, Commissioner of Education, State of Missouri.

"One of the most impressive conferences that I have ever attended."—WALTER E. HESS, National Association of Secondary School Principals.

"This conference will do much to help educators realize the significance of including effective programs of aerospace education in their school programs."—WILHELMINA HILL, Specialist for Social Service, US Office of Education.

"One of the finest programs of its kind ever held."—F. B. DECKER, Commissioner of Education, State of Nebraska.

"I feel I am much better equipped to comment intelligently on the desirability of emphasizing air age education in our curricula."—J. C. WRIGHT, Superintendent of Public Instruction, State of Iowa.

"One of the greatest values was the opportunity to talk and plan with other educators concerning the impact of aviation and space developments on life today and tomorrow."—WILLIS C. BROWN, Specialist in Aviation Education, US Office of Education.

"It is difficult for you people who know so much about the space age ahead to realize just how little the average layman does know and understand. It was an eye-opener for me."—MRS. J. M. EWING, President, Mississippi Congress of Parents and Teachers.

"All of us came away with a much better appreciation of airpower concepts and of the very great problem facing us in adapting to the new world that airpower has brought to us."—DONALD G. WALLACE, Dean, College of Education, Drake University.

"It is a rare occurrence when educators, military personnel, and people from industry have an opportunity to sit down and talk about problems that are of real concern to all of us."—PHILLIP BACON, Associate Professor of Geography, Teachers College, Columbia University.

"This conference was of great value to me personally and I feel sure it will have its effects felt in the classrooms of Georgia."—HAL W. CLEMENTS, Director, Curriculum Development, Department of Education, State of Georgia.

There were many more, but this cross section indicates that the educational aspects of the World Congress of Flight alone were well worth the time and trouble.—END

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3rd year	$27,500
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