JANUARY 1969 / 60c

AIR FORCE

and SPACE DIGEST

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

C-9A Medevac Transports Join MAC's Mercy Fleet

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- The Growing Threat to NATO's Southern Flank
- Tactical Air Command: Facing a New Moment of Truth
- Special Reports on the National Laboratory for the Advancement of Education

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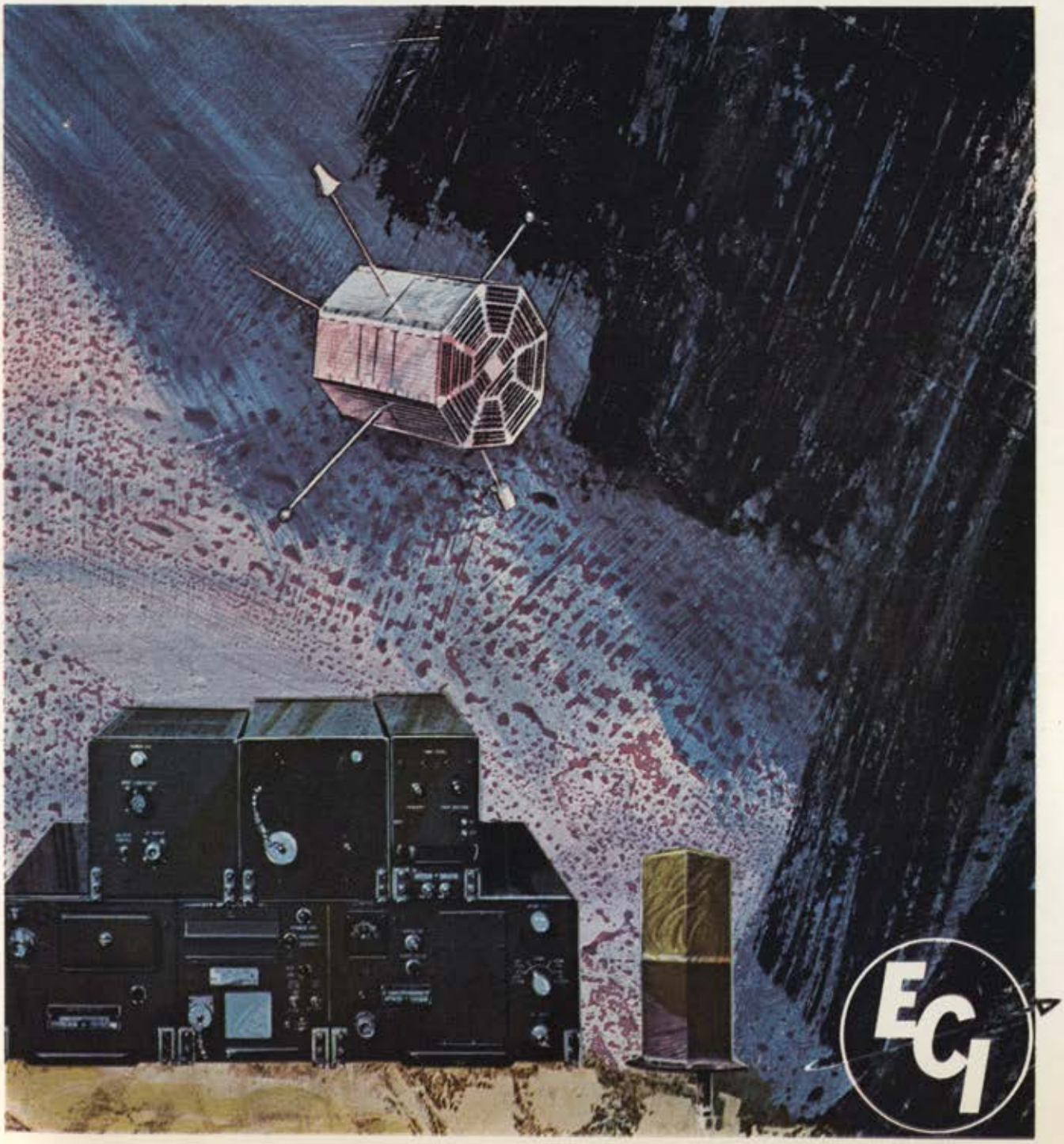

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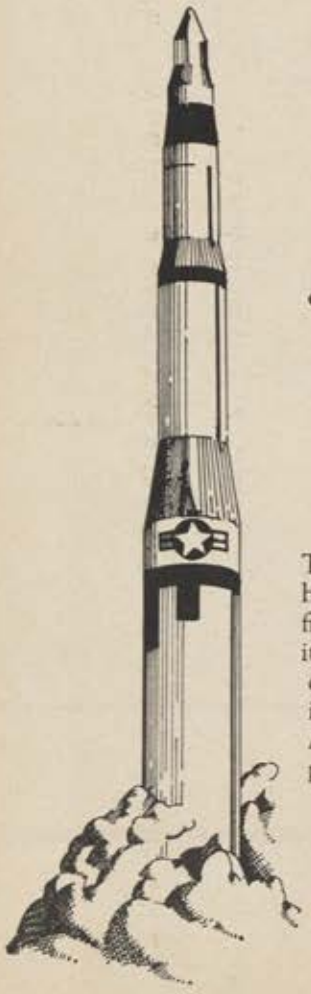

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the challenges we welcome

E. F. Buehring, President, LTV Electrosystems, Inc.

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BPA **AIR FORCE Magazine and SPACE DIGEST** are published monthly by the Air Force Association, 1750 Pennsylvania Ave., N.W., Washington, D. C. 20006 (phone Area Code 202, 298-9123).

PRINTED in USA, by McCall Corporation, Dayton, Ohio. Second-class postage paid at Dayton, Ohio. Composition by Sterling Graphic Arts, New York, N. Y. Photoengravings by Southern & Lanman, Inc., Washington, D. C.

ADVERTISING correspondence, plates, contracts, and related matter should be addressed to **AIR FORCE/SPACE DIGEST**, Advertising Hq., Suite 400, 1750 Pennsylvania Ave., N.W., Washington, D. C. 20006.

EDITORIAL correspondence and subscriptions should be addressed to Air Force Association, 1750 Pennsylvania Ave., N.W., Washington, D. C. 20006. Publisher assumes no responsibility for unsolicited material.

CHANGE OF ADDRESS: Send old and new addresses (including mailing label from this magazine), with ZIP code number, to Air Force Association, 1750 Pennsylvania Ave., N.W., Washington, D. C. 20006. Allow six weeks for change of address to become effective.

MEMBERSHIP RATE: $7 per year (includes $6 for one-year subscription to **AIR FORCE/SPACE DIGEST**). Subscription rate—$7 per year, $8 foreign. Single copy 60¢. Special issues (Spring and Fall Almanac Issues), $1.25 each.

UNDELIVERED COPIES: Send notice on Form 3579 to Air Force Association, 1750 Pennsylvania Ave., N.W., Washington, D. C. 20006.

AIR FORCE and SPACE DIGEST

The Magazine of Aerospace Power
Published by the Air Force Association

VOLUME 52, NUMBER 1 JANUARY 1969

SPACE DIGEST

DEPARTMENTS

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With a history of over 7,000 Hueys behind it, Bell's advanced HueyTug has the background and backbone of service and dependability unsurpassed.

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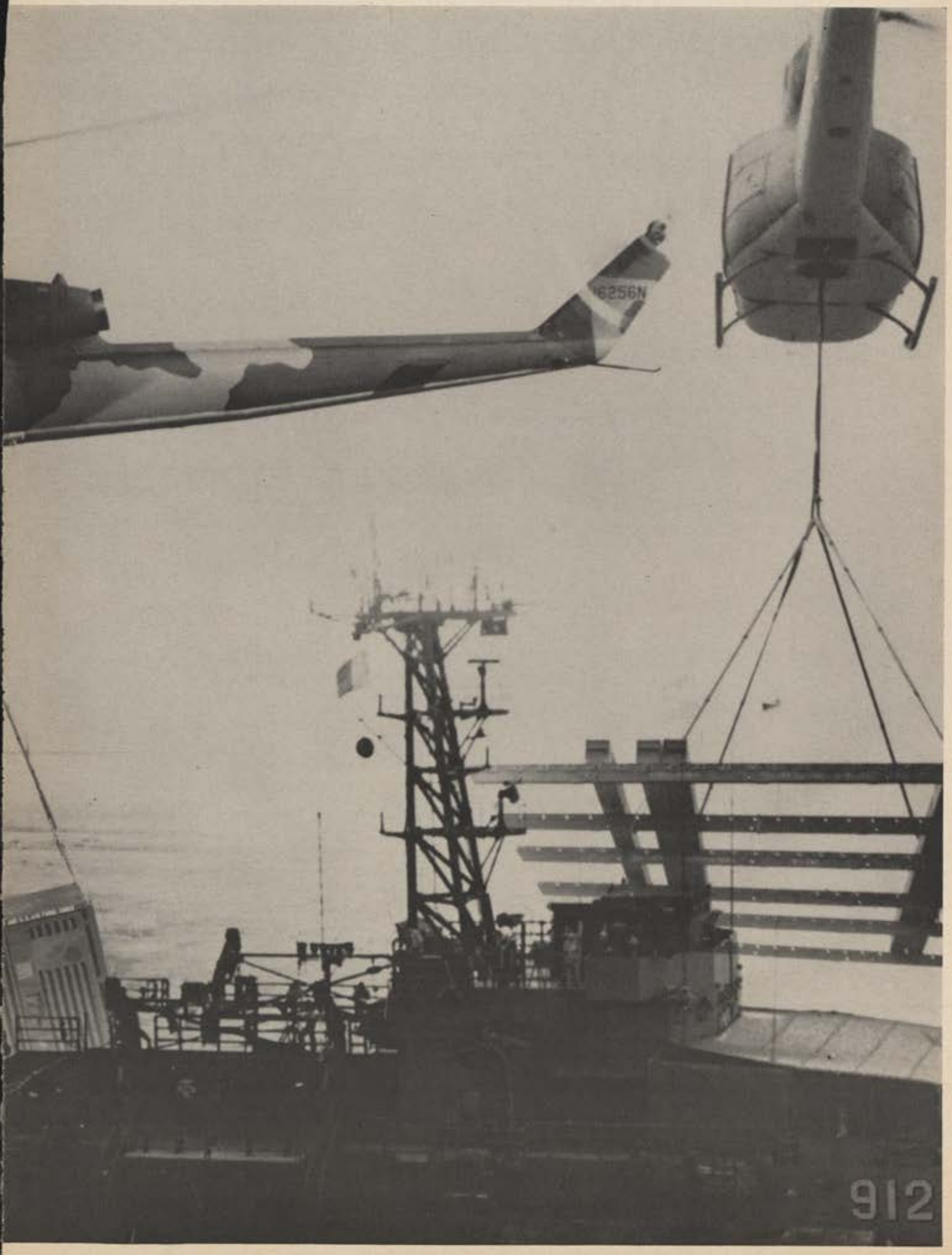
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AN INQUIRY INTO THE AMERICAN NATIONAL INTEREST

By Henry A. Kissinger

The following is from "Central Issues of American Foreign Policy," by Henry A. Kissinger, in Kermit Gordon, ed., Agenda for the Nation *(The Brookings Institution, 1968), pp. 610-614. Reprinted by permission of the publisher.*

President-elect Richard M. Nixon has named Dr. Kissinger as his Special Assistant for National Security Affairs.—THE EDITORS

WHEREVER we turn, . . . the central task of American foreign policy is to analyze anew the current international environment and to develop some concepts which will enable us to contribute to the emergence of a stable order.

First, we must recognize the existence of profound structural problems that are to a considerable extent independent of the intentions of the principal protagonists and that cannot be solved merely by good will. The vacuum in Central Europe and the decline of the Western European countries would have disturbed the world equilibrium regardless of the domestic structure of the Soviet Union. A strong China has historically tended to establish suzerainty over its neighbors; in fact, one special problem of dealing with China—communism apart—is that it has had no experience in conducting foreign policy with equals. China has been either dominant or subjected.

To understand the structural issue, it is necessary to undertake an inquiry, from which we have historically shied away, into the essence of our national interest and into the premises of our foreign policy. It is part of American folklore that, while other nations have interests, we have responsibilities; while other nations are concerned with equilibrium, we are concerned with the legal requirements of peace. We have a tendency to offer our altruism as a guarantee of our reliability: "We have no quarrel with the Communists," Secretary of State Rusk said on one occasion, "all of our quarrels are on behalf of other people."

Such an attitude makes it difficult to develop a conception of our role in the world. It inhibits other nations from gearing their policy to ours in a confident way—a "disinterested" policy is likely to be considered "unreliable." A mature conception of our interest in the world would obviously have to take into account the widespread interest in stability and peaceful change. It would deal with two fundamental questions: What is it in our interest to prevent? What should we seek to accomplish?

The answer to the first question is complicated anywhere it occurs since peace is indivisible. A corollary is the argument that we do not oppose the fact of particular changes but the method by which they are brought about. We find it hard to articulate a truly vital interest which we would defend however "legal" the challenge. This leads to an undifferentiated globalism and confusion about our purposes. The abstract concept of aggression causes us to multiply our commitments. But the denial that our interests are involved diminishes our staying power when we try to carry out these commitments.

Part of the reason for our difficulties is our reluctance to think in terms of power and equilibrium. In 1949, for example, a State Department memorandum justified NATO as follows: "[The treaty] obligates the parties to defend the purposes and principles of the United Nations, the freedom, common heritage, and civilization of the parties and their free institutions based upon the principles of democracy, individual liberty, and the role of law. It obligates them to act in defense of peace and security. It is directed against no one; it is directed solely against aggression. It seeks not to influence any shifting balance of power but to strengthen a balance of principle."

But principle, however lofty, must at some point be related to practice; historically, stability has always coincided with an equilibrium that made physical domination difficult. Interest is not necessarily amoral; moral consequences can spring from interested acts. Britain did not contribute any the less to international order for having a clear-cut concept of its interest which required it to prevent the domination of the Continent by a single power (no matter in what way it was threatened) and the control of the seas by anybody (even if the immediate intentions were not hostile). A new American administration confronts the challenge of relating our commitments to our interests and our obligations to our purposes.

The task of defining positive goals is more difficult but even more important. The first two decades after the end of the Second World War posed problems well suited to the American approach to international relations. Wherever we turned, massive dislocations required attention. Our pragmatic, ad hoc tendency was an advantage in a world clamoring for technical remedies. Our legal bent contributed to the development of many instruments of stability.

In the late sixties, the situation is more complex. The United States is no longer in a position to operate programs globally; it has to encourage them. It can no longer impose its preferred solution; it must seek to evoke it. In the forties and fifties, we offered remedies; in the late sixties and in the seventies our role will have to be to contribute to a structure that will foster the initiative of others. We are a superpower physically, but our designs can be meaningful only if they generate willing cooperation. We

can continue to contribute to defense and positive programs, but we must seek to encourage and not stifle a sense of local responsibility. Our contribution should not be the sole or principal effort, but it should make the difference between success and failure.

This task requires a different kind of creativity and another form of patience than we have displayed in the past. Enthusiasm, belief in progress, and the invincible conviction that American remedies can work everywhere must give way to an understanding of historical trends, an ordering of our preferences, and above all an understanding of the difference our preferences can in fact make.

The dilemma is that there can be no stability without equilibrium, but equally, equilibrium is not a purpose with which we can respond to the travail of our world. A sense of mission is clearly a legacy of American history; to most Americans, America has always stood for something other than its own grandeur. But a clearer understanding of America's interests and of the requirements of equilibrium can give perspective to our idealism and lead to humane and moderate objectives, especially in relation to political and social change. Thus our conception of world order must have deeper purposes than stability but greater restraints on our behavior than would result if it were approached only in a fit of enthusiasm.

Whether such a leap of the imagination is possible in the modern bureaucratic state remains to be seen. New administrations come to power convinced of the need for goals and for comprehensive concepts. Sooner, rather than later, they find themselves subjected to the pressures of the immediate and the particular. Part of the reason is the pragmatic, issue-oriented bias of our decision-makers. But the fundamental reason may be the pervasiveness of modern bureaucracy. What started out as an aid to decision-making has developed a momentum of its own. Increasingly, the policy-maker is more conscious of the pressures and the morale of his staff than of the purpose this staff is supposed to serve. The policy-maker becomes a referee among quasi-autonomous bureaucratic bodies. Success consists of moving the administrative machinery to the point of decision, leaving relatively little energy for analyzing the decision's merit. The modern bureaucratic state widens the range of technical choices while limiting the capacity to make them.

An even more serious problem is posed by the change of ethic of precisely the most idealistic element of American youth. The idealism of the fifties during the Kennedy era expressed itself in self-confident, often zealous institution building. Today, however, many in the younger generation consider the management of power irrelevant, perhaps even immoral. While the idea of service remains a potent influence, it does so largely with respect to problems which are clearly *not* connected with the strategic aspects of American foreign policy; the Peace Corps is a good example. The new ethic of freedom is not "civic"; it is indifferent or even hostile to systems and notions of order. Management is equated with manipulation. Structural designs are perceived as systems of "domination"—not of order. The generation which has come of age after the fifties has had Vietnam as its introduction to world politics. It has no memory of occasions when American-supported structural innovations were successful or of the motivations which prompted these enterprises.

Partly as a result of the generation gap, the American mood oscillates dangerously between being ashamed of power and expecting too much of it. The former attitude deprecates the use or possession of force; the latter is overly receptive to the possibilities of absolute action and overly indifferent to the likely consequences. The danger of a rejection of power is that it may result in a nihilistic perfectionism which disdains the gradual and seeks to destroy what does not conform to its notion of utopia. The danger of an overconcern with force is that policy-makers may respond to clamor by a series of spasmodic gestures and stylistic maneuvers and then recoil before their implications.

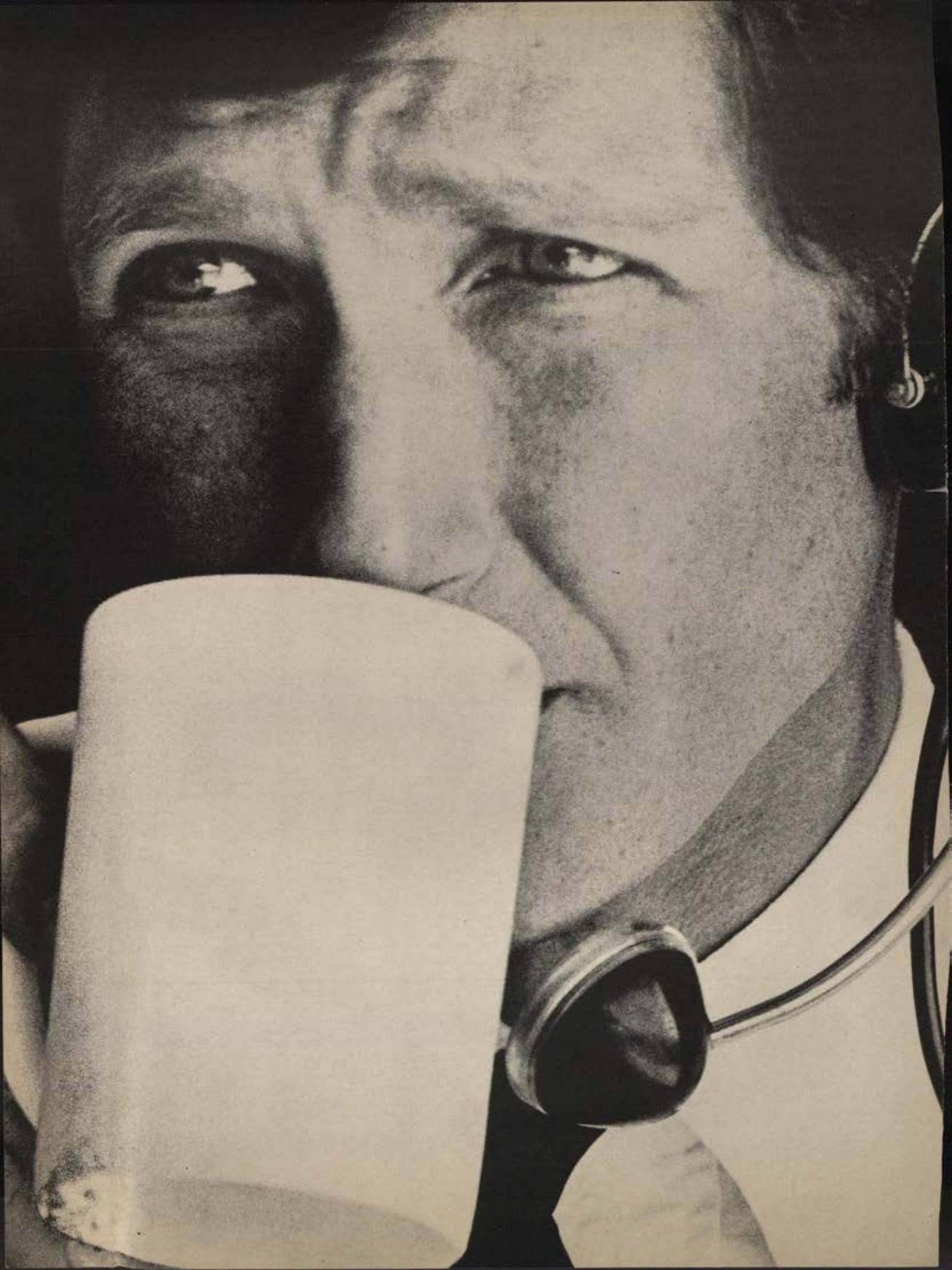
These essentially psychological problems cannot be overemphasized. It is the essence of a satisfied, advanced society that it puts a premium on operating within familiar procedures and concepts. It draws its motivation from the present, and it defines excellence by the ability to manipulate an established framework. But for the major part of humanity, the present becomes endurable only through a vision of the future. To most Americans—including most American leaders—the significant reality is what they see around them. But for most of the world—including many of the leaders of the new nations—the significant reality is what they wish to bring about. If we remain nothing but the managers of our physical patrimony, we will grow increasingly irrelevant. And since there can be no stability without us, the prospects of world order will decline.

We require a new burst of creativity, however, not so much for the sake of other countries as for our own people, especially the youth. The contemporary unrest is no doubt exploited by some whose purposes are all too clear. But that it is there to exploit is proof of a profound dissatisfaction with the merely managerial and consumer-oriented qualities of the modern state and with a world which seems to generate crises by inertia. The modern bureaucratic state, for all its panoply of strength, often finds itself shaken to its foundations by seemingly trivial causes. Its brittleness and the worldwide revolution of youth—especially in advanced countries and among the relatively affluent—suggest a spiritual void, an almost metaphysical boredom with a political environment that increasingly emphasizes bureaucratic challenges and is dedicated to no deeper purpose than material comfort.

Our unrest has no easy remedy. Nor is the solution to be found primarily in the realm of foreign policy. Yet a deeper nontechnical challenge would surely help us regain a sense of direction. The best and most prideful expressions of American purposes in the world have been those in which we acted in concert with others. Our influence in these situations has depended on achieving a reputation as a member of such a concert. To act consistently abroad we must be able to generate coalitions of shared purposes. Regional groupings supported by the United States will have to take over major responsibility for their immediate areas, with the United States being concerned more with the over-all framework of order than with the management of every regional enterprise.

In the best of circumstances, the next administration will be beset by crises. In almost every area of the world, we have been living off capital—warding off the immediate, rarely dealing with underlying problems. These difficulties are likely to multiply when it becomes apparent that one of the legacies of the war in Vietnam will be a strong American reluctance to risk overseas involvements.

A new administration has the right to ask for compassion and understanding from the American people. But it must found its claim not on pat technical answers to difficult issues; it must, above all, ask the right questions. It must recognize that, in the field of foreign policy, we will never be able to contribute to building a stable and creative world order unless we first form some conception of it.—END



Meet George Carver, tower controller. Right now there's a no ceiling condition. 150 foot RVR. And he's just assigned runway three-one to eight aircraft. They'll all land within one-and-a-half minutes.

Are you kidding, George?

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It's being tested on a Sikorsky CH-3 V/TOL flying test vehicle under Air Force sponsorship right now. And we're working up to further testing in an actual V/TOL aircraft.

The Path Guidance System's not limited to one-direction/one-glide slope. Multiple courses and artificial glide slopes are selected by tower control. These are numbered approach profiles selected from 360° which, on instruction, the pilot sets into an onboard real-time letdown computer. (We have them working up to thirty miles out now. The goal is a hundred.)

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AIRMAIL

Important Job Well Done

Gentlemen: Many thanks for your fine article on the operation of the USAF Military Personnel Center Casualty Division ["Casualty Reporting —A Hard Job That Gets Done," by William Leavitt, November '68 issue]. The people of the Casualty Division are doing a difficult and sensitive job —a job that is important to the Air Force.

Your informative article will certainly help get the word to Air Force members and families.

MAJ. GEN. ROBERT J. DIXON
Ass't. DCS/Personnel for Mil. Pers.
Randolph AFB, Tex.

Oldest Squadron

Gentlemen: Reference Capt. Joel T. Champion's letter which appears on page 10 of your issue of December 1968.

The 8th Bomb Squadron is not the "oldest squadron in the Air Force." That honor belongs to the 1st Aero Squadron (Observation), which was organized in 1913, has been on continuous active duty ever since, was the first aviation unit to reach France in World War I, and is now the 1st Strategic Reconnaissance Squadron.

I am not happy that, in the interest of historical accuracy, it is appropriate for me to point out the error in Captain Champion's excellent sketch of the 8th Tactical Bomb Squadron, for the Air Force needs more of the Captain's kind of interest and pride in its heritage—a heritage which is admirably exemplified by the long and distinguished career of the 8th.

ALBERT F. SIMPSON
Chief, USAF Historical Division
Hq. Aerospace Studies Inst. (AU)
Maxwell AFB, Ala.

Twenty-Fifth Anniversary

Gentlemen: Whether you are aware of it or not, the year 1969 becomes the Silver Anniversary date of the military helicopter in our country; and I believe that some USAF effort is being extended to commemorate the twenty-fifth anniversary of the USAF Helicopter School, which is now located at Sheppard Air Force Base, Tex. These past twenty-five years of laborious endeavor by the helicopter pilots and ground crews have now escalated the importance of the "agitated palm tree," the "flying washing machine," "Igor's nightmare," etc., that were flown by nothing less than daredevil pilots with two heads, five hands, three arms, and four legs at dizzying heights of up to a thousand feet and at terrifying speeds in excess of but not more than eighty knots. (You see, the machine was more out of control than not—most of the time!)

The role of the helicopter is now upon us. It can recover Apollo capsules, fly nonstop from New York to Paris, fire (with great accuracy) a multitude of lethal weapons, perform civil disaster relief work, and *many, many* other things that cannot be done by fixed-wing aircraft, wheeled vehicles (cars, trucks, trains), canoes, gliders, hiking boots, skis, roller skates, or *any other* means that man has yet devised to transport himself from point A to point B with precarious stops (for other conveyances) while en route. Only the chopper can do it—safely!

Recognition of USAF pilots and crews is noteworthy—a chopper pilot with a Medal of Honor, several with Air Force Crosses. Proportionately so, chopper pilots rate as many Silver Stars as do the men they expend themselves for—the fighter pilots. Distinguished Flying Crosses are sported by most rotor-motor pilots who have returned from SEA. Yes, the helicopter has grown up. It is doing a tremendous job, and it (and its crews) is now gathering plaudits for twenty-five years of total endeavor by only those people who believed in the machine and its capabilities all the way.

I believe the time is now ripe to further organize so that the full potential of future rotorcraft concepts (the rotorcraft of the 1975 and 1985 time frame) can be brought along in orderly and timely process. I believe that an Air Force Association of Helicopter Pilots and Helicopter Crewmen should be formed. The primary function of the Association would be an annual symposium tied in with the spring AFA meetings—and to provide unity, planning, and goals for the future.

Recently, it was reported in military trade journals, as well as your November 1968 issue of AIR FORCE/SPACE DIGEST, that Maj. Gen. Marion Carl, Adm. James Thatch, and Brig. Gen. Robin Olds all agree that the loop needs to be closed for what I could call, "What's wrong with today's fighter aircraft and their systems—or maybe I am using it the wrong way." Sounds like a title for a good war story, doesn't it? Since they speak, I feel, for all pilots, I would like to rewrite the last paragraph of your ["Aerospace World"] ending on page 35 of your November issue from a former USAF helicopter pilot's viewpoint.

"The Air Force Association of Helicopter Pilots and Crewmen agrees that there are 'too many echelons' between the pilot, the aircraft designer, the civil service engineers, analysts, planners, and approving authorities on what starts out as a good, clean design for a specific mission and tends to get all cluttered up by the time it comes off the production line, is in service, and several TOC kits and items have been installed and performance is degraded to a nonacceptable standard; and since it is in the inventory, we will use it anyway as an interim system. A new requirement and a new machine comes along and will slowly proceed through the same gate and down the same path . . . out the same gate to the end product that still falls short of doing the mission it was *originally* designed for. The Association blamed 'all of the experts' who have never faced enemy ground fire or tried to hover on a 12,000-foot mountain ridge in forty-five- to fifty-knot winds and in other trying situations in the air—besides making decisions that end up imposing needlessly high odds on Air Force chopper pilots during their combat tours and in performing the peacetime rescue and utility missions."

I believe that the year of the Silver Anniversary would be the year to form this association of dedicated, experienced people to further the aims of the only operational V/STOL machine that has laid the groundwork and will continue to lead the way in V/STOL operations, research, and

(Continued on page 15)

SCIENCE/SCOPE

The giant new Intelsat IV satellite ordered by Comsat Corp. for International Telecommunications Satellite Consortium from Hughes will have 25 times more communications capacity than any satellite now in operation. It will be able to handle 6,000 two-way telephone calls or 12 color TV broadcasts simultaneously. A unique feature will be Intelsat IV's ability to focus its power into two "spotlight" beams and point them at any selected areas.

The airborne radar system for the F-X fighter is being developed by Hughes under one of two $11-million contracts awarded by the U.S. Air Force. Winner of the competition will be selected after both radar prototypes have been flight tested and the results evaluated. The F-X will be the world's most advanced single-place, twin-engine air superiority fighter in the 1975 time period.

The U.S. Army TOW wire-guided anti-tank missile has been ordered into production under a $141-million contract awarded to Hughes. It is designed for use either as a man-carried tripod-mounted weapon or mounted on a variety of existing vehicles. It will also be launched from the Army's new Cheyenne helicopter. The Army recently demonstrated TOW to nearly 100 high-ranking military representatives of 11 foreign nations at Grafenwoehr, Germany.

A multiplexed passenger-entertainment system for the DC-10 is being built by Hughes under a $12-million contract from McDonnell Douglas. It will give the DC-10 passenger the choice of monaural or stereophonic high fidelity music or multilingual sound tracks for in-flight movies by pressing a button at his seat. Multiplexing will save miles of wiring and up to 400 pounds of weight.

Telecasts live and in 12 languages for Europe were relayed from the Olympics in Mexico by two Hughes-built satellites. NASA's ATS III and Comsat's Early Bird were used to transmit video and audio segments separately to two ground stations in Europe. The games reached Japanese viewers via microwave to a portable ground station installed by Hughes near San Jose, Calif., then via Intelsat II.

The 24-pound Manpack radio, built by Hughes and used by military forces in Vietnam, can communicate across vast distances with a power output of only 15 watts. Hughes engineers in California have had two-way communication with amateur radio stations more than 1500 miles away, and received from South America and Saigon.

Advanced materials technology research at Hughes has resulted in four processes for producing thermosetting polyferrocene resins suitable for laminate fabrication...a method of molding boron and graphite fibers into high-strength high-modulus composites for evaluation in spacecraft and missile components...new knowledge about color center formations, which could lead to extremely stable white thermal control coatings for spacecraft.

U.S. will be first to use laser rangefinders on tanks as the result of a $2.7 million contract awarded Hughes by the U.S. Army's Frankford Arsenal. Initial production order -- first for a completely militarized laser -- is for 243 rangefinders for the M-60 battle tank.

ECM

Electronic countermeasures—the hush-hush science everybody wants to know more about, and nobody talks about. What we *can* say is that Cubic already has many answers. Cubic's proven technical competence in receiver, transmitter and antenna systems readily applies to ECM.

Cubic can build the hardware on a quick-reaction schedule, as its record proves. Cubic has the testing facilities—and a staff of ECM engineers who are even now at work on a major ECM program under contract to NAVSHIPS. Put Cubic experience, supported by complete manufacturing operations to work on your ECM problem.

Write Cubic Corporation, Systems Division, Dept. H-101, 9233 Balboa, San Diego, Calif. 92123, or phone (714) 277-6780.

CUBIC CORPORATION

technological advances that are yet to be made in "the vertical way to go."

I believe that the voice of unity could be heard through such an association. I am interested in your reactions, as well as some of your readers' reactions. Any suggestions?

MAJ. CHARLES O. WEIR, USAF (RET.)
Granada Hills, Calif.

Chopper Typo

Gentlemen: In your November issue of AIR FORCE/SPACE DIGEST you had an article on helicopters entitled "A New Platform for the Hoist," page 95.

In this article you compared the HH-43C to the HH-53C. It was a very good article; however, in the picture in the lower right-hand corner you mistakenly labeled the front view of an HH-53C as an HH-43C.

As a pilot in the C-133A Cargomaster with a future Southeast Asia assignment to the HH-43, I ran across the error and am passing this on.

CAPT. JAMES H. BRITTINGHAM
Dover, Del.

• *The "HH-43C" designation was a typo our gimlet-eyed proofreaders slept through.*—THE EDITORS

UNIT REUNIONS

8th Tac Fighter Wing

The reunion of the 8th Tactical Fighter Wing will be held January 31–February 1, 1969, at the Sheraton-Park Hotel in Washington, D. C. For reservations or further information contact

Maj. James D. Covington
4315 Majestic Lane
Fairfax, Va. 22030

388th Bombardment Group (H)

An early reminder to our ex-combat buddies of our reunion this year with a trip to England. The 388th Bombardment Group (H), stationed at Knettishall, England, was a part of the 3d Air Division of the 8th Air Force. With this 3d Air Division, 45th Wing, were the 96th Bomb Group and the 452d Bomb Group. They are invited to join us. We will fly by jet from Detroit and New York in August. The event will feature sightseeing trips in London, a trip back to Thetford, Knettishall (base), and Bury St.-Edmonds, with a banquet dinner in Bury St.-Edmonds. For more information contact

Edward J. Huntzinger
388th Bombardment Group Assoc.
863 Maple St.
Perrysburg, Ohio 43551

468th Bomb Group (VH) and 58th Bomb Wing

Members of the 468th Bomb Group (VH) and fellow associates of the 58th Bomb Wing are invited to join us for our 13th Annual Reunion to be held Thursday, July 24, through Sunday, July 27, 1969, at the Charter House Hotel, 1700 South Harbor Blvd., Anaheim, Calif. To sustain the tradition of past reunions we suggest you bring albums, slides, motion picture films, etc., to help recall "a time that was not so long ago."

Chairman of the Reunion:
Malen Powell
840 Dean Dr.
Denver, Colo. 80233
or
Secretary:
Denny D. Pidhayny
1136 South Burnside Ave.
Los Angeles, Calif. 90019

"At this moment I couldn't care less who's first on the moon. . . ."

By Claude Witze
SENIOR EDITOR, AIR FORCE/SPACE DIGEST

About the Bombing Halt

WASHINGTON, D. C., DECEMBER 10

South Vietnam's Vice President Nguyen Cao Ky, who used to be an Air Force general himself, is settled in Paris today, and he expects to stay for a long time. If you need a reason for Ky's expectation of a long stay, the best place to get it is from the North Vietnamese.

The Hanoi radio is telling Communist forces in South Vietnam to get going. They are to put "great urgency" into the Viet Cong effort to "eliminate, liquidate, and wipe out" American and South Vietnamese officials. They are to step up the terrorist-guerrilla tactics.

Radio Hanoi gives top priority to "seeking out and destroying" American–South Vietnamese pacification teams working in rural areas in an attempt to win peasants and villagers over to the Saigon government.

Vice President Ky went to Paris, however, with more than Hanoi's radio messages as evidence that the North has no clear intention of stopping the war. He has pictorial evidence gathered by USAF photo-reconnaissance aircraft flying over North Vietnam. Since the halt of bombing in North Vietnam, the recce missions have been devoted entirely to a study of what the Communists are doing to prepare for peace, if that is what they expect, or for war.

All bombing of North Vietnam has been stopped since November 1, when President Johnson ordered this step in the belief, he said, that it "can lead to progress toward a peaceful settlement of the Vietnamese War."

What is shown by the November recce flights is that the North Vietnamese have been carrying out a vastly increased logistic and construction effort that will have utility only in continued hostilities.

Between the seventh and twenty-seventh of November, USAF's RF-4C Phantoms now are known to have recorded at least an hour and a half of photography over enemy territory. In that film, the pilots caught 8,200 trucks and 1,700 watercraft hauling military supplies south of the nineteenth parallel. There were thirteen truck movements for each minute of recce photo strip. The watercraft were not simply large numbers of sampans. They included tankers and freighters.

There are two pipelines under construction between the nineteenth parallel and the DMZ. These will be a vast improvement over the bicycle and the truck when the Communists again want to ship large quantities of petroleum into South Vietnam. They have not had pipelines before, and it was not until the bombing stopped that it was practical to attempt to install them.

In addition, the recce pictures show that all major railroad lines and marshaling yards have been repaired and put back in operation. Yards that last summer were wrecked and empty now are in full operation and packed with loaded cars, all of them en route South.

Bridges that were wrecked in photos taken last summer now have been replaced, some with redundant systems. In some cases, where the road is vital to Hanoi's war plans, a single bridge has been replaced with as many as three bridges, set some distance apart. Between there may be an "underwater bridge," which is a ford through the water for vehicles, one that is difficult to spot from the air.

Powerplants that were hit by bombs have been reconstructed and put back in operation. More than this, they now are surrounded by blast walls to protect them from attacks in the future.

In the Haiphong area, recce pictures of the docks and storage areas show they are busy with a steady flow of war materiel and supplies. Photos last summer indicated the Communists, under bombing attacks, had great difficulty moving their goods. Now the flow is unimpeded.

American observers say most of the materiel is massed in storage depots about fifty miles north of the DMZ. There is no way of knowing where it is headed. It is in the best possible position for fast movement directly into South Vietnam, or into Laos or Cambodia.

A final note on what the recce pilots see in North Vietnam, as it enjoys a respite: The SAM and antiaircraft sites in the Hanoi and Haiphong areas are being hardened. If Vice President Ky, the old Air Force general, is not optimistic about the outlook in Paris, he can be excused. Antiaircraft sites are hardened only when they are going to be used and may come under attack from the enemy.

First on the Team

The new Nixon cabinet, at this writing, has not been announced. But the selection of Henry Kissinger to be chief White House adviser on national security affairs is in the headlines, and there is a flood of speculation on the impact of this choice. Dr. Kissinger, of course, replaces Walt W. Rostow, who also comes from Massachusetts but is not being invited to return. Dr. Rostow, once on the faculty at MIT, is moving to Austin, Tex., and the academic atmosphere being bolstered there by his boss, Lyndon B. Johnson. MIT, according to sophisticated reports, is not prepared to welcome the professor back to its faculty.

Dr. Kissinger is a German-born scholar who has been head of the Harvard University International Seminar and its Defense Studies Program. Mr. Nixon said, in announcing the appointment, that Dr. Kissinger will overhaul the operations of the National Security Council and spend much of his time on long-range thinking and planning.

The Professor is not a stranger to USAF. He has been a guest lecturer at the Air War College at Maxwell AFB in Alabama, where his alacrity facing a barrage of questions has earned him a standing ovation.

Neither is Dr. Kissinger a stranger to Washington. A refugee from Hitler's Germany in 1938, he graduated from high school in New York in 1941 and then served in the US Army before going to Harvard, where he graduated *summa cum laude* and went on to take his doctorate.

He is credited with writing five books, the first of which was called *Nuclear Weapons and Foreign Policy*, and it was this volume that brought him to the attention of the politicians, including Richard Nixon.

Probably more important, however, is the fact that Dr.

President-elect Richard M. Nixon faces newsmen in New York with two of the earliest selections made for his official White House family. They are, on the left, Dr. Henry A. Kissinger and (right) Richard V. Allen. Both are specialists in European affairs and will serve the new Administration as national security experts.

—Wide World Photos

Kissinger has been associated for more than a decade with the Rockefeller brothers, who have funded studies in military technology and produced reports that urged the US to increase its defense expenditures. Out of this, Dr. Kissinger became an adviser on foreign affairs to Nelson Rockefeller.

It is interesting, in this connection, that Dr. Kissinger was at the GOP convention with Mr. Rockefeller, and there was credited with helping to keep the Vietnam War plank on the dovish side. The point is, he is not a jingoist and has served the Arms Control and Disarmament Agency in an advisory capacity, yet he also does not believe the Communists are getting mellow. The selection of Dr. Kissinger is in no way inconsistent with Mr. Nixon's declared intention of negotiating with ample muscle.

There is some apprehension in Washington that the choice of Dr. Kissinger means the White House interest in foreign affairs will be oriented toward Europe so strongly that our important interests in the Far East will be neglected. Mr. Nixon, indeed, has said he wants the Kissinger talent focused on the NATO problem in the sense that East-West relations are of top importance after the immediate problems of Vietnam and the Middle East.

Dr. Kissinger's most recent essay, part of a Brookings Institution study, is on pages 8 and 9 of this issue.

The new President also disclosed that Dr. Kissinger will have a young associate, Richard V. Allen, who has been on leave from the Hoover Institution on War, Revolution, and Peace at Stanford University. Mr. Allen had been acting during the campaign as director of foreign policy research for candidate Nixon.

Allen is described as an American who did his graduate studies in Europe and who has become an energetic and hardline-political philosopher.

During the campaign, he was interviewed by *U.S. News & World Report*, and put emphasis on the idea that, with Nixon, "NATO has a special place." That, Allen said, is because the new Administration is convinced "the main axis of activity still will be in Europe, the Middle East, and the Soviet Union."

Allen then spoke up with the kind of realism that Dr. Kissinger is reputed to applaud. He said that NATO must remain strong "as the basis for a détente with the Soviets." He continued:

"That is because it is a time-honored Soviet tactic to try to split the alliance by making bilateral deals with its members. The example of Soviet dickering with France illustrates that.

"We also must always negotiate from a position of strength. This does not mean we should be belligerent or truculent. We should not. But, until some of our basic differences with the Soviets are dampened down, we must have power from which to negotiate.

"This does not mean American power alone. It means Allied power. And there must be agreement on policy among the Allies—which means we must consult much more actively with our NATO partners than we have in the past. It also means our NATO partners must be given a stronger voice in making policy for the Alliance."

This approach, clearly in step with the Nixon preachments of 1968, must be taken, with Dr. Kissinger's essay, as the essence of the new Administration's attitude.

The magazine interview brought out some other firm views, including the idea that détente is a means, not an end. Détente, according to Allen, is used to relax tensions, so you can get down to the business of negotiating. What issues should have high priorities for an agenda of talks with the Russians? Allen says:

"From our side, and apart from Vietnam, two priority items are to cool down the Middle East and to head off an upward swing in the arms race between the Soviets and ourselves.

"There are areas of mutual interest where agreement would be good for both sides. Agreement to stop development of antiballistic missiles is one such issue. But while these negotiations proceed, we must continue our own efforts.

"What we should not do is repeat our recent experience which resulted in losing a year in lead-time development

(Continued on following page)

of the antiballistic missile in hopes that the Soviets would agree to stop doing what they already had started to do."

Then, he scoffed at the idea that parity can bring security, at least at this time.

"One reason is that there is no guarantee that the Soviet Union would stop with parity. They have developed a momentum in their arms buildup and in their research and development. You don't just shut off this kind of momentum. They have made basic decisions to push ahead, and it would take just as basic a decision to call off their effort.

"And, on our side, we must remember that it has been American military superiority which has kept the peace since the beginning of the Cold War. The unquestioned superiority of the United States has proved to be a most decisive deterrent to any potential aggressor."

Later, Allen called for a complete reevaluation of our potential enemy, a reexamination of both his intentions and capabilities. He denies that the Soviet Union and the United States are on a "convergence footing" and becoming more alike as time goes on.

Equally in error, he says, is the idea that world communism is united and monolithic. Also, that the Soviet aims are like those of old imperialist Russia. The Czars had limited ambitions, Allen says, but the Soviets do not.

The next twelve months under the Nixon Administration will show how far the new President and his crew can turn the American policy locomotive. As Allen himself points out, it is difficult to make radical changes, and each new Administration has to ride, for a long time, on rails that were laid by someone else. And, as always, there are the Communists. They made some decisions for the Democrats, you know, and they will now for the GOP.

Nixon on Security Issues

Five years ago, measuring the potential impact of Lyndon B. Johnson as President of the United States, we reported that his record in Congress showed "consistent concern with security problems." After all, LBJ had been in Congress since 1937, Representative and Senator, and his voting record in the Roosevelt, Truman, and Eisenhower Administrations was in support of the military requirement.

In addition, Senator Johnson had been a cutting critic during the Republican years, when he spoke up in favor of the manned bomber and warned that "control of space means control of the world." It was noted in these pages, however, that the "urgency and vehemence of [Mr. Johnson's] opinions were notably higher before the 1960 election." That was the year he was made Vice President on the Kennedy ticket.

Now there is another new President setting out to make good on his campaign promises, or to ignore them as the facts of life become evident in the White House. During the campaign, Richard M. Nixon made one speech on what he called "The Security Gap." He declared the "present state of our defenses is too close to the peril point, and our future prospects are in some respects downright alarming. We have a gravely serious security gap." He promised to bridge the gap before the early 1970s, when a "survival" gap looms on the Nixon charts.

It is possible to compile a long list of other statements on security issues that were made before Election Day. Some of them sound like promises:

- Nixon expects to have a defense budget of about $87 billion by 1972. This assumes peace in Vietnam. Non-Vietnam defense spending, it is anticipated, may climb up to sixty percent over the present level of about $48 billion.
- Purpose of the Nixon arms program will be to restore "clear-cut US superiority." This is a status the new President feels we had under Eisenhower, but have lost under Kennedy and Johnson.
- The new President fears that he may have to negotiate "from weakness rather than strength" some time in the next four years. The areas in which he looks for this strength are strategic nuclear capability, seapower, and tactical airpower. It is the Nixon contention that the Soviet Union is near parity with the US in the first two categories and has moved ahead in the third.
- First big increase in the Pentagon budget probably will be for research and development. Decisions on what to buy will come later, but there will be far fewer "studies" set up to delay essential decision-making.
- President-elect Nixon has endorsed the Sentinel ABM system and the idea that it is needed for protection against Russia. He also has argued that expansion of the system is not the start of a new arms race, but "a belated decision not to lose a race already in progress—a race in which the Soviets threaten to leave us behind."
- The question of the Advanced Manned Strategic Aircraft (AMSA) did not come up during the campaign, but the new Administration is expected to look with favor on the project. Certainly AMSA has been endorsed by the Joint Chiefs of Staff, and the weight of military opinion now appears on the upswing.
- Military space programs also did not provide any campaign material, but during the Eisenhower Administration it was Mr. Nixon who was most sensitive to the significance of Sputnik. He is expected to give greater emphasis to the USAF Manned Orbiting Laboratory (MOL) program. The GOP itself has criticized the lack of "positive direction and aggressive effort" in the MOL program.
- Closely related is the Nixon concern about Russian advances in military research and development. Mr. Nixon has observed that "Moscow now commands a full panoply of offensive and defensive strategic weapons, including an orbital nuclear delivery capability (FOBS); ever-improving tactical military equipment, communications facilities, surface naval and merchant vessels; and a large number of nuclear-powered, swift and quiet submarines. Together, these advances could, if we stand still, ultimately make the Soviet Union militarily dominant." The new President recognizes that the danger does not rest in the existing weaponry but in the possible breakthrough that can come from an aggressive R&D program.
- In a campaign speech in Texas, Mr. Nixon committed himself to continued procurement of the USAF F-111A, the fighter-bomber used by TAC.
- In another speech, he promised to replenish our stockpile of defense supplies and weapons, which he said has been seriously depleted by the war in Vietnam. If the war ends, it is estimated, it will take $10 billion a year for several years to restore the stockpiles.
- The new President is expected to restore the National Security Council to its place as an agency that gathers all the information needed to make a national security decision and meets with the President to discuss problems that go with keeping the peace. The NSC has all but disappeared since 1961, and Mr. Nixon believes this is responsible for a number of our reverses abroad since he last was in the government.
- In one speech, Mr. Nixon indicated he will cut back heavily on the role of the systems analysts, or "whiz kids," and their influence on decision-making. He said he intends to root out the approach "which for years in the Defense Department has led our policies and programs down the wrong roads."—End

AEROSPACE WORLD

WASHINGTON, D. C., DEC. 16

SRAM, the new short-range attack missile being developed by the Boeing Co. under direction of the Air Force's Aeronautical Systems Division, is already flying its first missions—inside the laboratory. To test the supersonic air-to-ground missile, engineers of Boeing's Systems Integration Laboratory have constructed an electronic B-52 and FB-111 that duplicate every electronic input furnished to the missile by the two aircraft, which eventually will be armed with SRAM's nuclear punch.

As the missile's subsystems were delivered by subcontractors to the Seattle laboratory, Boeing technicians utilized a building-block approach to check them circuit by circuit and then against each other until a complete missile was ready for static electronic flying.

The SRAM test program, which comes as close as possible to full operation of the missile under controlled conditions, also develops and tests computer instructions that will operate the weapon system.

Field testing of SRAM is set for sometime this year at the Air Force's Missile Development Center, Holloman AFB, N. M.

☆

A new, longer-range 747 superjet, designated 747B and capable of greater payloads, is being offered by the Boeing Co., according to J. E. Steiner, vice president for engineering and sales. It is meant to be primarily a freighter or a convertible passenger/cargo aircraft. According to Mr. Steiner, the commercial airlines' concern with retaining a substantial share of the military airlift augmentation business was a cardinal factor in design of the new model.

The 747B will have the same dimensions as the present 747, but its gross weight will be 775,000 pounds, compared to 710,000 pounds. This brings the new model close to the weight and payload characteristics of the L-500, commercial model of the C-5 Galaxy, offered by the Lockheed-Georgia Co. It will exceed the L-500's cruise speed by about fifty knots.

Boeing hopes to sell between 250 and 300 convertible/freighters by 1978. Many would be operated by US airlines and thus be available for the Civil Reserve Air Fleet, to augment military airlift capabilities in a national emergency.

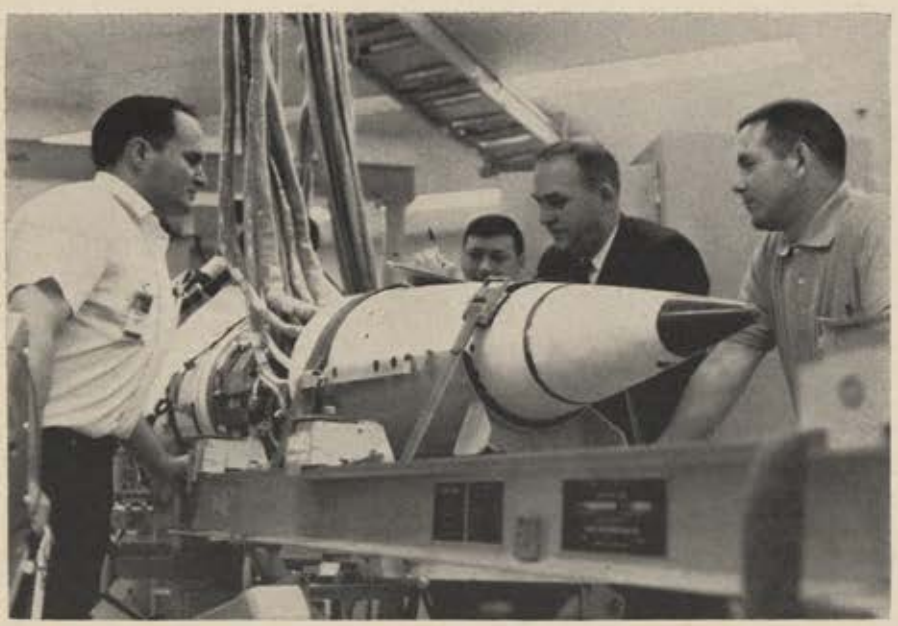
The 747B convertible and freighter airplanes will have mechanized cargo-handling systems on both the upper (main) deck and in the lower holds. The nose will swing up so pallets or eight-by-eight-foot containers in lengths up to forty feet can be loaded straight in on the motor-driven roller systems. Loading and unloading will be accomplished in thirty minutes. The 747B is designed to be compatible with military ground servicing equipment used for the C-5.

In addition to handling 463L military pallets, the plane will take present eight-by-eight-foot containers designed for other modes of transportation.

Lower holds also will have special contoured containers compatible with present military and commercial systems.

The 747B freighter, using containers on the lower deck and pallets

(Continued on following page)



New SRAM (short-range attack missile) being developed by the Boeing Co. is flying its first missions—inside the laboratory. To test SRAM, engineers of Boeing's Systems Integration Laboratory constructed an electronic B-52 and FB-111 duplicating every electronic input the aircraft will furnish the missile. B-52s and FB-111s will eventually be armed with SRAM's nuclear punch. The test program also develops computer instructions to operate the weapon system.

To standardize devices to rescue downed airmen, Aeronautical Systems Division, Wright-Patterson AFB, Ohio, is testing a rig of nylon tape sewn into AF flight suit with a loop on the chest that attaches to helicopter recovery cable.

Richard Evelyn Byrd

Amelia Earhart Putnam

John Arthur Macready

Igor Ivan Sikorsky

These portraits, done by Milton Caniff, are of aviation pioneers who because of their outstanding contributions to aviation were recently enshrined in the Aviation Hall of Fame in Dayton, Ohio.

on the upper, would carry about 260,000 pounds of payload 3,100 miles.

The 747B will cruise twenty miles an hour faster than the 707, will be quieter, and its takeoff field length and cruising altitude will compare favorably with the 707.

The 747B will use Pratt & Whitney JT9D-7W engines of 47,000 pounds of thrust, beginning in January 1972. Boeing 747Bs delivered in 1971 will use JT9D-3W engines of 45,000 pounds of thrust, also to be used on some later versions of the 710,000-pound airplane.

Development of the "B" model, according to Mr. Steiner, will cost about $100 million and includes a number of technological and aerodynamic refinements over the standard 747. The 747B, with spares, will cost about $21,750,000, or $800,000 more than the standard 747.

☆

At ceremonies held in Dayton, Ohio, December 17, four more illustrious aviation pioneers were enshrined in the Aviation Hall of Fame. Since 1962, in annual events, thirty individuals have been recognized by the Hall of Fame for their outstanding contributions to aviation. The latest four:

• Amelia Earhart Putnam, one of America's greatest women flyers, who during the 1920s and '30s became famous for her record-breaking long-distance and solo flights, for which she received the DFC from Congress, the first woman to be so honored. In 1937, she and her navigator, Fred J. Noonan, disappeared in the Pacific during an attempted around-the-world flight.

• Adm. Richard Byrd, who pioneered flights over both poles and led extensive explorations of the Antarctic. He died in Boston in 1957.

• Col. John Macready, USAF (Ret.), who in the 1920s and '30s pioneered high-altitude and endurance flights and helped develop aerial photography. Recalled to duty in the Army Air Corps in 1940, he remained in service until 1946. Now 80, he enjoys retirement at his ranch in Mariposa, Calif.

• Igor Sikorsky, whose career in aeronautics is legend. Although contributing to the fields of multiengine and transoceanic flying boats, he is best known for pioneering and developing modern helicopters, flown the world over. Retired, he lives in Connecticut.

☆

The Federal Aviation Administration has issued a Request for Proposals (RFP) for the collection and analysis of information on the various engineering, economic, and operational aspects of construction of airports on offshore water sites.

The FAA notes that although considerable data has been prepared on the subject in recent years, due to skyrocketing land costs, scarcity of suitable areas, and objections being raised to airport noise and other irritations, the agency recognizes the need for a more detailed analysis and correlation of the factors involved in offshore airport construction.

Methods thus far proposed include: floating airports; those built on fill; airports built on piles; or those built in polders (areas protected by dikes).

FAA, following evaluation of the submissions, will award a contract to assemble and summarize for a report

This renovated P-51 Mustang created considerable nostalgia recently during a demonstration flight at Andrews AFB, Md., part of an attempt by Cavalier Aircraft Corp., Sarasota, Fla., to persuade USAF that the World War II workhorse would be ideal for a close-support mission in counterinsurgency wars. The company hopes the Air Force will buy fifty of the Rolls-Royce-powered Mustangs.

the available data on the significant airport proposals.

☆

As this was written, the National Aeronautics and Space Administration had scheduled a Christmas-season Apollo-8 mission that was to take Astronauts Frank Borman, James Lovell, Jr., and William Anders into ten orbits around the moon. The flight is to test guidance, communications, and heat shielding of the Apollo-Saturn system and to obtain a man's-eye view, plus photos, of one or more potential landing sites for missions to come.

Equally important would be the return to earth and reentry via a narrow corridor Apollo-8 must arrive at to descend safely through earth's atmosphere.

If Apollo-8 is successful, NASA will push toward a series of successor flights: Apollo-9, to be manned by James McDivitt, David Scott, and Russell Schweickart, an earth-orbital mission hoped for in the spring for the first manned rendezvous of the mother ship and the lunar landing module, detached and then reunited; Apollo-10, in which two of a three-man crew (recently named as Thomas Stafford and Eugene Cernan, with John Young remaining aboard the mother ship) will detach the lunar landing module from the mother ship in lunar orbit, descend to within nine miles of the moon's surface, and then rendezvous with the mother craft; and, finally, the payoff flight, Apollo-11—from earth parking orbit to lunar orbit, descent by two crew members to the lunar surface, brief exploration of the surface, rendezvous of the mother ship and lunar landing module in lunar orbit, and return to earth. That could happen late in 1969 or early 1970.

But the "ifs" are plentiful, since each mission is dependent on its predecessor. As a further complication, the lunar landing module development program has been dogged with troubles and suffered another setback in December, when a lunar landing training vehicle crashed at Ellington AFB, Tex. NASA test pilot Joe Algranti survived.

As a happier footnote, Lt. Col. Donn Eisele was awarded astronaut wings in ceremonies at the Pentagon in November for his participation in the highly successful Apollo-7 flight.

☆

General Electric Co.'s CF6-6 turbofan engine for the McDonnell Douglas DC-10 superjet has completed its first series of developmental tests less than one month after first going on test. The engine, a derivative of the TF-39, powerplant for the C-5 Galaxy, attained a peak level of 45,750 pounds of thrust—5,750 pounds more than required by the performance guarantee.

The engine now is being prepared for a series of environmental tests at GE's outdoor test site near Peebles, Ohio.

GE also announced a growth version of this engine, designated CF6-10 and designed for the international model of the DC-10 (the dash 30). Its cruise thrust is a record-breaking 10,450 pounds, and its guaranteed takeoff thrust is 45,600 pounds. The engine, to become operationally available in August 1972, will not utilize water injection to achieve these high outputs, GE spokesmen said.

United Airlines is testing modified Pratt & Whitney JT8D-7 jet engines that reduce significantly the smoke in exhaust emissions. United has installed the engines on three of the tri-engine Boeing 727 jetliners in scheduled service, with two twin-engine 737s to be similarly outfitted. The engines, to be tested the length of a year for durability, contain redesigned combustion chambers and revised nozzles that spray fuel into the chambers. The effect is more complete mixture and burning, with the reduced emission of carbon particles. United said the development is important mostly for aesthetic reasons, since tests have shown that jet exhaust from aircraft contributes only minutely to air pollution.

☆

Boeing Co.'s Vertol Division has announced design plans for a heavy-lift helicopter (HLH) comparable in payload and size to the record-holding Soviet MI-6, the world's largest helicopter, which has lifted payloads in excess of 44,000 pounds.

The proposed HLH would have a maximum gross weight of 93,000 pounds and be able to fly a twenty-mile-radius sortie with a payload of 24.1 tons. Described as a multiservice helicopter for the 1975-to-1985 time period, the three-engine craft could be used for tactical, logistical (ship offloading, C-5 Galaxy offloading), construction, and downed aircraft retrieval missions.

A commercial version could accommodate between ninety and 100 passengers in short-haul intercity traffic.

Boeing officials stressed the HLH's capabilities in downed aircraft retrieval missions—a field having unique significance in Southeast Asia. As of October 1, 1968, Boeing reported, 5,300 aircraft representing $1.39 billion had been retrieved by helicopters in Southeast Asia.

☆

The Federal Aviation Administration has awarded a $2,093,000 contract to Raytheon Co. of Wayland,

(Continued on following page)

—Wide World Photos

President Johnson shakes hands with Apollo-7 commander Capt. Walter Schirra, Jr., as Apollo-7 and -8 astronauts autograph a document December 9 to hang in the White House Treaty Room. The ceremony took place before a dinner honoring former NASA Administrator James Webb and twenty-three Apollo astronauts. Seated from left are Walter Cunningham, lunar module pilot on Apollo-7; Lt. Col. Donn Eisele, Apollo-7 command module pilot; Schirra; Maj. William Anders, to be lunar module pilot on Apollo-8; Capt. James Lovell, Jr., Apollo-8 command pilot; and Col. Frank Borman, Apollo-8 commander. Standing are Charles Lindbergh, President and Mrs. Johnson, Webb, and the Vice President.

Mass., to modify seven military long-range radar antenna systems. Five will be for joint civil/military use and two for civilian use only.

The FPS-7 military radars will be adapted to meet special air traffic control requirements of the FAA in the automated National Airspace System, including a new antenna system, parametric amplifiers, and circular polarizers.

Radar antenna modifications will be made for civilian use only at Kirksville, Mo., and Waverly, Iowa; and for joint civil/military use at Tonopah, Nev.; Aiken, S. C.; Dauphin Island, Ala.; Kalispell, Mont.; and Osceola, Wis.

Modification installations will begin late next year.

☆

The sophisticated inertial guidance and navigation system designed to land an American on the moon has been adapted for the Boeing 747 superjet and other new commercial aircraft.

The system, known as the Carousel IV, was built by AC Electronics Division of General Motors Corp. at Milwaukee. Most versions of the 747 will carry three of the all-weather navigators as standard equipment. (Litton Industries has designed a similar system, the LTN-51 for the British-French Concorde.)

So far, flight tests of the Carousel IV have been conducted by Boeing, Pan American, Alitalia, Lufthansa, and BOAC.

The Carousel IV is accurate to within two nautical miles per hour of flight. Thus, in a ten-hour flight, the system would be well within a twenty-mile circle around its destination—sufficient to be within the normal radio and radar range of the terminal airport. The current Federal Aviation specifications call for ninety-five percent of flights to be accurate to within plus or minus twenty miles cross-track and twenty-five miles along track. Recent tests by Pan American, which has done most of the Carousel IV testing to date on its New York-

NEW BOOKS IN BRIEF

American Combat Planes, by Ray Wagner. When first published eight years ago, this book was hailed as a comprehensive reference work. The updated edition includes basic statistics and photographs of some 1,000 planes, with index. Doubleday, N. Y. 442 pages. $12.95.

Aviation and Space in the Modern World, by James V. Bernardo. A good nutshell summary of basic physics principles, navigation and weather, historical accomplishments, and social and economic influences in the aerospace field. With photos. Dutton, N. Y. 382 pages. $7.95.

Brassey's Annual, 1968. The seventy-ninth volume in this series, with its usual comprehensive reviews of military strategy by prominent defense authorities of the West. Praeger, N. Y. 360 pages. $16.50.

The Emotional Significance of Imaginary Beings, by Robert Plank. Having chosen an unusual subject, the author mainly considers "imaginary beings" concocted by horror stories and science fiction—and not the more sophisticated SF available, either. Chapters titled "Motives for Space Travel" and "Belief in Flying Saucers" end up as vehicles for some rather farfetched speculation. Charles C. Thomas, Springfield, Ill. 177 pages. $8.75.

Mass Behavior in Battle and Captivity: The Communist Soldier in the Korean War, ed. by Samuel M. Myers and Albert D. Biderman. The unusual sociopolitical behavior of Communist Chinese and Korean POWs prompted the US Army to sponsor, in 1953, research studies of their backgrounds. This volume presents detailed, well-organized information from that project. University of Chicago Press. 377 pages. $11.

Sea & Air: The Naval Environment, by Jerome Williams, John J. Higginson, and John D. Rohrbough. Oceanography and meteorology are integrated as closely as possible in this book, which treats both the atmosphere and the oceans as a single fluid environment. Many diagrams and some mathematical references are included. U.S. Naval Institute, Annapolis, Md. 340 pages. $11.50.

Squadron Shilling, by Arch Whitehouse. The latest novel from this one-time RFC fighter pilot describes more daring World War I exploits, culminating in a duel in the European skies between a Princeton graduate and his traitorous classmate. Doubleday, N. Y. 335 pages. $5.95.

Takeoff Into Greatness: How American Aviation Grew So Big So Fast, by Grover Loening. The author, shown posing with Orville Wright in one of the book's many photographs, has devoted two of the fourteen chapters to aviation since 1935. An armchair review of early highlights in flying by one of the true pioneers. Southgrove Book Agency, P. O. Box 5142, Miami, Fla. 256 pages. $4.95.

—Maria T. Estevez

CONTINUED

Dr. Abe Silverstein, a leader in the field of jet and rocket engine propulsion, was named winner of the 1968 Rockefeller Public Service Award for science, technology, and engineering. Dr. Silverstein was NASA's first director of spaceflight programs and currently is head of its Lewis Research Center in Cleveland. The awards are given to individuals involved in five broad fields of government service and each carries a cash grant of $10,000.

Rome route, have shown accuracies within the two-nautical-mile specification.

A pilot need only tell the Carousel system its starting point, destination, and as many as eight waypoints. The C-IV computer then calculates the shortest route from waypoint to waypoint and to final destination. Connected to the autopilot, C-IV actually steers the aircraft.

☆

In its campaign to keep the paperwork situation within bounds, the Air Force's Aerospace Defense Command has made two additional moves to automation—to handle air base activity data and airmen's personnel records.

The Air Force-wide data-processing system will assist base commanders with literally the mountain of data they must have on hand to manage the functioning of a modern base. Under this Base Level Data Automation Standardization Program, part of a major automation effort begun in 1962, nine ADC bases and 150 bases around the world will receive computers adjusted to data-processing workloads. Through use of a computer, decisions can be made utilizing the latest information, and data fed into it will be stored for rapid recall. Command headquarters at Ent AFB,

(Continued on following page)

Exploring gets air muscle, as large jet-powered Lockheed Hercules freighters, operated by Interior Airways and Alaska Airlines, haul up to 50,000 pounds in heavy equipment between Fairbanks, Alaska, and this site at Sagwon, in the Arctic Circle, where oil companies are probing for additional strikes. Geologists are aware that the region contains one of the last important known deposits of oil, and strenuous—and expensive—efforts are being made to find it.

Col. Ruth A. Lucas, first Negro WAF promoted to colonel, has her new insignia pinned on by Assistant Defense Secretaries Thomas D. Morris (left) and Alfred B. Fitt. Colonel Lucas is Education Programs Officer for the Office of Assistant Secretary of Defense (Manpower) in the Pentagon. She was born in Stamford, Conn., and entered the service through OCS upon graduation from Tuskegee Institute in 1942. She has an M.A. in Educational Psychology.

Colo., in April will be first to receive the equipment.

ADC also will go to a mechanized system of keeping airmen's records. For the first time, a full personnel record for all airmen will be maintained on magnetic tape at the Military Personnel Center at Randolph AFB, Tex.

With additional information available, more and more reassignment selections will be made at the center, and overseas consolidated base personnel offices no longer will have to submit assignment preferences for overseas returnees as was required in the past. Airmen will be able to review their assignment preferences during annual records review and during reassignment processing.

☆

New York Airways, Inc., has inaugurated in the Greater New York area its long-awaited first regularly scheduled air carrier STOL (short takeoff and landing) service. The operation employs eighteen-passenger deHavilland DHC-6 Twin Otter aircraft with a crew of three to serve between LaGuardia, Newark, and Kennedy Airports.

The Civil Aeronautics Board has approved scheduled helicopter service between downtown Washington, D. C., and National, Dulles, and Friendship Airports.

The CAB selected Washington Airways, Inc., from among five applicants to provide the new service for the capital area. The company is owned by nine commercial airlines, which must make up any operating losses over a five-year experimental period. Federal subsidies are barred under the CAB decision.

No Washington terminal was selected in the decision, but Union Station was considered the probable site. Operations could begin as early as January 21 under the CAB order, but even if the project proceeds full tilt a legal objection threatened by the Committee Against National, a group seeking to close National Airport, could cause a delay.

☆

Hughes Aircraft Co. has selected United Aircraft Corp.'s Hamilton Standard Division to build twenty-two monopropellant rocket engines for use on Comsat's new Intelsat IV series of advanced communications satellites. Deliveries will begin in mid-1969 to Hughes' Aerospace Group, El Segundo, Calif.

The rockets, using high-energy liquid hydrazine as the propellant, will develop five pounds of thrust each.

Each Intelsat IV satellite will be equipped with four thrusters designed for a seven-year operating life. The engines will be used for vehicle station acquisition, station keeping and changing, and attitude control during the satellites' stationary orbits.—END

INDEX TO ADVERTISERS

Sperry stability specified

Years of developmental work on VTOL stabilization projects for the Army and Navy, involving a dozen different aircraft, have led to the selection of Sperry to provide stability augmentation systems (SAS) for two major VTOL programs.

Lockheed-California has selected Sperry's single axis yaw SAS/heading hold system for the U. S. Army's AH-56A Cheyenne. This system provides extensive built-in test equipment, a "must" for efficient VTOL operation. Sperry equipment was also specified by Canadair for hover and transition flight in the CL-84 prototype and now in the three Canadian Armed Forces CX-84 aircraft. Three-axis systems being produced for this aircraft are fully fail operational in the pitch axis and fail safe in the yaw and roll axes.

Other funded development contracts and company-sponsored study in the VTOL areas includes work on automatic terrain following/avoidance and hover augmentation. In addition, Sperry's work on a versatile hybrid AFCS, full IFR AFCS and fly-by-wire AFCS for future VTOL aircraft will enable air frames and using agencies to continue specifying Sperry with confidence.

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AIR FORCE
JANUARY, 1969

The Tactical Air Command, whose role is to provide a reservoir of combat-ready airpower and personnel to meet worldwide challenges, finds itself at a crossroads. Stretched thin by commitments in Southeast Asia, potential trouble in Europe and the Middle East, and perhaps new brushfire wars, TAC now faces the prospect of a new Administration and its subsequent defense posture decisions. combat-ready airpower and personnel to meet worldwide challenges, "all across the board in both the strategic and tactical war fields," future Pentagon and congressional actions evolving under the new leadership are critical to . . .

TAC:
Facing a New Moment of Truth

By Claude Witze
SENIOR EDITOR, AIR FORCE/SPACE DIGEST

ONE day last spring, at a hearing conducted by the Senate Defense Appropriations Subcommittee, the US Air Force wound up its initial presentation by showing a film. Gen. J. P. McConnell, Chief of Staff, said the movie was a narrated description of USAF posture and that it portrayed the major weapon systems and their capabilities. The picture, of course, was classified.

When the showing was completed, Chairman Richard B. Russell said, "That was very spectacular. It did not, however, show any mistakes." To this, USAF Secretary Harold Brown volunteered his profound suspicion that the mistakes would come out in cross-examination. He was right, and has been proved so by Appropriations and Armed Services Committees on both sides of Capitol Hill.

If there is any one facet of American airpower that has taken more than its normal share of licks in this year's crop of congressional inquiries and reports, it is tactical air. It is a strange and totally unexpected by-product of the war in Vietnam that the Strategic Air Command is burning up its manpower and hardware carrying out a mission that is not prime to SAC. SAC is husband to our nuclear deterrent power; yet its B-52 bombers have been dropping millions of tons of iron on tactical targets. They have been doing an outstanding job, and there is unlimited testimony to this from our own Army and Marine Corps in addition to the suffering enemy.

The Tactical Air Command, with headquarters at Langley AFB, Va., has been doing equally good work, under more difficult circumstances and undergoing an almost ruthless examination of its stature, the foresight it has shown in selecting equipment, and its general ability to carry out its mission. With the advent of 1969 and Richard M. Nixon as Commander in Chief, it is inevitable that TAC faces a new and telling moment of truth.

In the discussion that follows, it is essential to keep in mind the fact that TAC does not fight wars. It is not an operational command. TAC is a reservoir of weapon systems and people, ready to fight, that can be tapped by unified and specified commands anywhere in the world. TAC is described as the focal point for the development of doctrine, techniques, and requirements. It is a producer, rather than a user —a producer of combat-ready airpower that can play a major role in the control of local aggression.

(Continued on following page)

Gen. William W. Momyer, Commander of Tactical Air Command, has at the top of his shopping list a new air superiority fighter he regards as "urgent."

There are TAC units in the United States, but the bulk of this force is working around the clock, and has been for the past few years, on the single job of satisfying the voracious appetite of the fighting units for equipment and trained men. At the moment, this hunger exists in the Pacific Air Forces (PACAF), which are fighting a war in Vietnam and protecting a volatile front in South Korea. Additionally, there are the US Air Forces in Europe (USAFE), which have tactical units in England, Germany, and Spain.

The tactical fighter squadrons committed to the replacement training (RTU) assignment have seen their burden rise precipitously. They provided 2,500 crews, mostly for Southeast Asia, in 1965, the year USAF really got off the ground in Vietnam. In 1968, the figure was 7,400 crews.

Adding to TAC's problem these days are the potential troubles looming in Europe as NATO seeks to rejuvenate its laggard columns, the tinder box of the Middle East, and the irritations of brushfire wars, which seem to be ingrained in the tactics of the non-Western world. There are four F-4 squadrons in the United States committed to NATO, and Defense Secretary Clark Clifford has said something about adding to this force, but TAC headquarters, visited a month ago, professed to have no details about a new and bigger commitment.

Until last July, the brushfire challenge was in the hands of the Special Air Warfare Center, established at Eglin AFB, Fla., in 1962. Now it has been rechristened. It is called the Special Operations Force, a name TAC believes more accurately describes the balanced capabilities built into the unit. Scattered Communist threats in various parts of the world have emphasized the menace of insurgency.

The newly named SOF is directly responsible to TAC, but serves as the focal point for all USAF developments in the fields of counterinsurgency, as well as unconventional and psychological warfare. Operational units assigned to SOF provide combat-ready personnel to assist unified commanders and instruct friendly foreign military personnel in special operations. The training is conducted in a dozen different types of aircraft, each chosen for some particular adaptability it has for a part of the mission. For the most part, they are propeller driven and easy to maintain. In addition to training our own rapid-reaction forces, SOF trains specialized crews in support of our effort in Southeast Asia.

On top of this, SOF has a chore that does not involve combat. This is what military men have learned to call "nation building." Air vehicles find plenty of utility in the program, which TAC describes as "an attempt to solve the social and economic problems that feed communism." SOF is creating mobile training teams that are tailored to help a friendly country requesting such assistance to prepare its own forces for special operations. Nation building, if we can refine the mission, is an elaborate civic action program, made more challenging in each individual case because there are essential differences in geography, politics, economics, and social and military factors.

THIS IS AWACS—THE ULTIMATE

From the beginning, which antedates the war in Vietnam by a couple of decades, there has been a running dispute between USAF's tactical forces and the US Army's ground commands about communications in a combat situation. Even by 1965, when USAF stopped being an "adviser" and became a belligerent in Southeast Asia, the complaints persisted. Joint operations never have been more essential or more sensitive. When the ground forces want air support, can they get it—and quickly?

The answer is yes. TAC's air control system (TACS) is admittedly complex, but it holds the operation together and makes it work. There are a number of components now in operation, and a new key system already is in development. Here is a rundown:

- **Tactical Air Control Center (TACC):** It coordinates and directs all tactical air operations. In South Vietnam it is located at Tan Son Nhut, outside Saigon, and controls both in-country and out-country air strikes. It publishes orders for preplanned air strikes, monitors all flights, and diverts aircraft when this is required.
- **Direct Air Support Center (DASC):** It coordinates with the Army corps commander and controls aircraft allocated to it by TACC.
- **Tactical Air Control Parties (TACP):** These are Forward Air Controllers (FACs) and their equipment at battalion, brigade, and division levels. TACP is the element that ties the Army commander into the system. In most cases, the vital link is the airborne FAC.
- **Air Base System (ABS):** Strike aircraft, crews, support facilities. It can launch and recover aircraft.
- **Radar Net (RN):** Control and reporting center, plus supporting radars. It regulates air traffic, provides control and surveillance for offensive and defensive air action.

TAC headquarters gives utmost urgency to the development of AWACS, shown here in artist's conception. AWACS will be used as an airborne command-and-control system for quick-reaction deployment and initial tactical operations. Backbone of the AWACS system would be its mobile communications capability.

Work must be done in pest control, aerial surveys, the development of airlines and communications networks. Medical education and aid are a must. If the effort fails to prevent insurgency, it must have the people prepared to fight insurgency.

All of this activity, plus the war and changing nature of the weapon systems, has fertilized TAC. It is growing fast, despite the burden of its chores and the paucity of its flying equipment. Headquarters at Langley provides this rundown on TAC's population and real estate in recent years:

Personnel Strength		*Number of Bases*	
Dec. 1961	52,125	July 1961	11
Dec. 1962	52,797	July 1962	12
Dec. 1963	68,529	Aug. 1963	14
Dec. 1964	79,460	July 1964	15
Jan. 1965	79,845	Sept. 1965	16
Dec. 1966	93,707	July 1966	19
Dec. 1967	100,623	July 1967	19
June 1968	114,607	July 1968	19

The fact that new weapon systems are going to demand more people to take care of them is best illustrated by toting the number of men required at a base serving as nest for a wing of fighter aircraft. TAC's manpower branch answered the request with the following set of comparative figures for a wing of F-100 fighters as contrasted with a wing of the newest F-111A fighters. The latter, of course, are highly complicated vehicles, full of advanced avionic equipment.

	Officers	*Airmen*	*Civilians*	*Total*
F-100	196	1672	7	1,875
F-111A	292	2611	7	2,910
Difference	+ 96	+ 939	no	+1,035

Senator Russell's observation that USAF's posture presentation put the best foot forward, as it should, was not based on any ignorance of our ability to meet future threats. The Senator, like many of his even more sophisticated colleagues, has expressed serious concern, and none of this has been louder than their apprehension over USAF's tactical air requirement in the years ahead.

As the new political administration takes over in Washington, TAC's major requirement is hardware, as it has been for many years. Aside from the oft-quoted appeals of TAC commanders, from Quesada, Lee, and Weyland, to Cannon, Everest, Sweeney, and Dissosway, the command still has a conglomerate and inadequate stable. In recent years, new attention has been fixed on the problem by the heavy strains of the war in Vietnam, the undefined threats in other theaters, the extent of our commitments, and the Senate Preparedness Investigating Subcommittee, headed by Senator John Stennis, who works in this capacity for Senator Russell.

In its most recent report on the subject, issued last October 4, the subcommittee points with alarm. It says clearly that this nation must be able to fight indefinitely in Asia and still be in a position to fight a large-scale NATO war in Europe. It says civilian

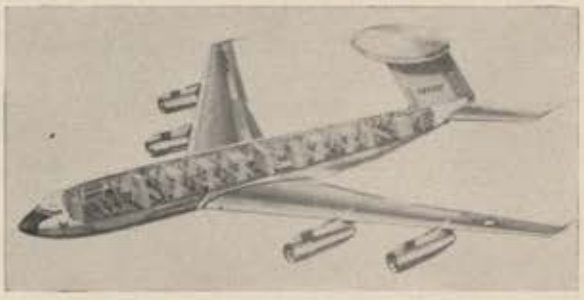
(Continued on following page)

COMMAND AND CONTROL SYSTEM FOR TAC

An Army ground commander at any level may request air support. Such a request goes from the TACP to the DASC at corps level. The request is monitored by TACPs at other command levels. If they want to, they can disapprove the request. They do not have to voice approval. Silence is like a green light. Silence also assures rapid response; it indicates approval and airborne planes can be on the target in less than five minutes. Ground-alert aircraft can be there in less than fifteen minutes. When a request is received, the DASC makes the choice; it can divert airborne pilots or call on the TACC to launch ground-alert planes. They will be vectored to the target by radar and turned over to the FAC, be he on the ground or in the air.

Can TAC improve on the system? The answer is yes. The first, and most immediate, approach is Program 407L, which provides mobility through an air-transportable tactical air control system that can be quickly put in place in a combat theater. The system will include operations shelters, communications, computers, and a new, lightweight three-dimensional radar. The radar can be lifted by a helicopter. It will weigh 7,000 pounds, compared to about 40,000 for current radar.

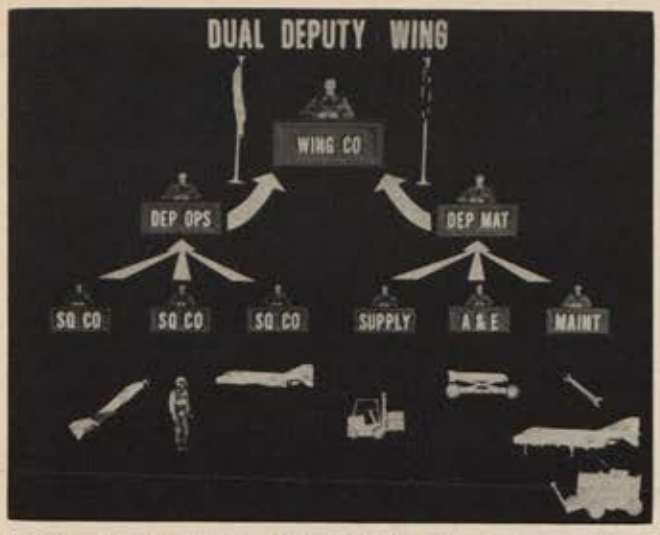
The ultimate solution, and a project that stands very near the top of TAC's shopping list, is the Airborne Warning and Control System (AWACS, pronounced AY-WAX). The basic vehicle will be either the Boeing 707 or the McDonnell Douglas DC-8. The entire system will be about ninety per-



Artist's concept shows compartmentalized aircraft that is intended as the basic vehicle of AWACS. The high-performance aircraft will be equipped with sensing, communications, display, and navigational devices.

cent common with the AWACS requirement of the Aerospace Defense Command. For TAC, it will be used as an airborne command and control system, ensuring the fastest deployment and readiness for combat. The advantage of AWACS over all ground-based systems will lie in improved low-altitude surveillance, improved command and control because of its mobility, and improved communications. Most important to TAC, AWACS will be able to direct and control both offensive and defensive weapons.

In the wars to come, says TAC, the survival of its command and control capability will be dependent on an airborne system. It can be achieved by the mid-1970s.



TAC has reorganized. As the charts above show, under the old concept there were deputy wing commanders for both materiel and operations. This meant that a squadron commander was a manager of pilots, lacking control over materiel and maintenance. This made it difficult to weld his men into an effective unit. Also, if he were suddenly sent into a theater of combat, his unit would be handicapped by lack of experience. This kind of centralized structure was not considered compatible with the requirement to rapidly deploy tailored forces and operate with them from austere environments. The new TAC wing (right) uses the tactical squadron as the basic unit. The commander now can deploy and fight with all the talent and equipment right on hand to support his operations in the field. Squadrons will be organized this way for work in peace or war. At the working level, it also means the aircrew members always will work for the same boss, at home or abroad.

officials believe we have the capability and that military officials do not. There is no better illustration of the standoff that exists between the policy-makers and the men with combat responsibility.

In its 1968 inquiry, the subcommittee cross-examined Lt. Gen. Joseph F. Carroll, Director of the Defense Intelligence Agency, as the initial witness. The transcript of his testimony never was published, because it was so solidly classified and packed with secret information about the size, nature, and composition of Communist tactical air forces. The subcommittee did publish, in addition to its own report, a censored volume of testimony taken from the Chief of Naval Operations, the Commandant of the Marine Corps, the USAF Chief of Staff, the TAC Commander, and the Assistant Secretary of Defense for Systems Analysis.

Chairman Stennis commented that he and his colleagues were impressed by the magnitude of the threat outlined by General Carroll. They were impressed by the new tactical planes unveiled recently by the Soviet Union and concluded that " the Soviets are challenging us all across the board in both the strategic and tactical war fields."

From other witnesses, including USAF Chief of Staff Gen. J. P. McConnell and Gen. Gabriel P. Disosway, then TAC Commander, the subcommittee got further evaluations of the Russian threat. Also, from military witnesses, the message came loud and clear that the American emphasis on preparations for conventional war, which burgeoned in the early 1960s, did not go unchallenged by the Soviets and their allies.

General McConnell, for example, said that by word and deed the Russians have made it clear they are accepting "the idea that a nonnuclear conflict between nuclear powers is a possibility in which tactical forces would play a major role." He said that in the past ten years the Soviets have put eleven new fighter models into their inventory. The United States has not matched it with six. Our six since 1957 have grown out of three basic types. The Russians have more than doubled that effort.

To the subcommittee, this threat is serious and failure to meet it can be fatal. The Senators and their staff found that the United States, including Navy and Marine components, has the same number of tactical aircraft it had in 1961. The US and its allies have parity in tactical aircraft with the Communist countries, but the Russians are ahead in the numbers of interceptor and air superiority aircraft. Our intelligence estimates that the Soviets would cut their inventory were wrong, and this mistake is not corrected by the fact that our airplanes are better than theirs.

Further, the subcommittee says, the qualitative advantage we claim for our air-to-ground tactical aircraft has led to another mistake. It has "erroneously been used by the Department of Defense to justify its conclusion that the United States has an over-all tactical air advantage over the Soviets." This ignores the essential ingredient of airpower, that is, the guarantee of air superiority, without which planes designed for the air-to-ground role will be ineffective.

The report leaves no doubt that the Senators consider it a mistake to lean almost entirely on new weapon systems that cannot defend themselves and expect them to operate in a hostile environment. The TAC inventory, even when it does include all of the planes now scheduled or planned—the A-4, A-6, A-7, A-37, F-105, F-111A—can operate only in a permissive theater—such as South Vietnam—or with what protection it can get from the F-4. The F-4 goes back to 1955, when it was first approved, and there is little doubt that the Russians have superior air-to-air systems.

General Carroll's testimony was not made public, but the report cites, from his accounts, the Russian Foxbat, holder of the world speed record, and speculates

that it is close to production status. The Soviet Union has introduced at least one new type of operational fighter every two years. There have been five models of the MIG-21 Fishbed, two models of the Fishpot, and one model each of Fitter, Firebar, Fiddler, and Flagon. We have the F-4 of 1955 vintage, and the F-106 used by the Aerospace Defense Command.

Another mistake, in the eyes of the Senators, lies in the fact that the US does not have a single STOL airplane even in contract definition. The Soviets are flying three supersonic models and also have one VTOL aircraft.

Faced with the subcommittee's recommendations, Gen. William W. Momyer, TAC's Commander, also puts the "urgent" label on the call for a new air superiority fighter. It is at the top of his shopping list. First called the FX, it now carries the designation ZF-15A, although TAC now is so familiar with the requirement and design possibility that the reference, in most conversation at the Langley headquarters, is simply the F-15. By the time this magazine is in print, two manufacturers probably will have been named to carry on the project. One will be a winner.

The subcommittee, in a second recommendation that no TAC commander can dispute, called on the Defense Department to study the mix of tactical aircraft performing air-to-ground missions as compared to aircraft with a primary air-to-air role. The Senators, reflecting Mr. Russell's curiosity about possible mistakes, want to know whether the balance is "correct and proper." The threat of a conventional war in some part of the world where the skies are more hazardous than they are in South Vietnam is a primary factor in this study.

Allied to this question in many ways is the stated USAF requirement for a new close-support aircraft, now designated the AX. The Senators, who want to avoid mistakes as well as uncover them, asked the Air Force and the Defense Department to restudy the project from the standpoint of its validity. If it is valid, they want to know whether we are procuring too many types of air-to-ground weapon systems at this time. At TAC, the impression is given that this airplane is on the shopping list, but not near the top.

The headquarters command gives far more urgency, second only to that given the ZF-15A, to the Airborne Warning and Control System (AWACS). Its mission is described on pages 28 and 29.

Other items that TAC requires include the Light Intratheater Transport (LIT), a reconnaissance version of the ZF-15A, and modernization of the C-130 TAC transport fleet. The latter is described by General Momyer as a program to improve the avionics equipment, the loading and drop systems, and more efficient power sources.

In any discussion of TAC equipment at this time, the subject of the much-maligned General Dynamics F-111A cannot be avoided. General Momyer says simply that TAC cannot continue to perform its mission without the airplane. Separated from the contentious atmosphere that has surrounded the Navy and SAC versions of the airplane, the F-111A remains the most advanced tactical weapon system in the Western world. In later versions, up to the F-111D, it will get better and there are no officers familiar with its introduction to TAC who feel that its early history, as hardware, differs from that of airplanes they have broken in during the years past.

There are details about the F-111A's performance that are highly classified. Many of them, in fact, are known to only a few members of Congress and to none of their constituents.

It will take action, both in Congress and in the Pentagon as it evolves under Republican leadership in 1969, to meet the needs of TAC and the Communist challenge. The next posture presentation and those to follow will not show any more mistakes than did the one Senator Russell commented about early in 1968. But it is possible, if we look far enough ahead, that there will be no mistakes to put on the screen.—End

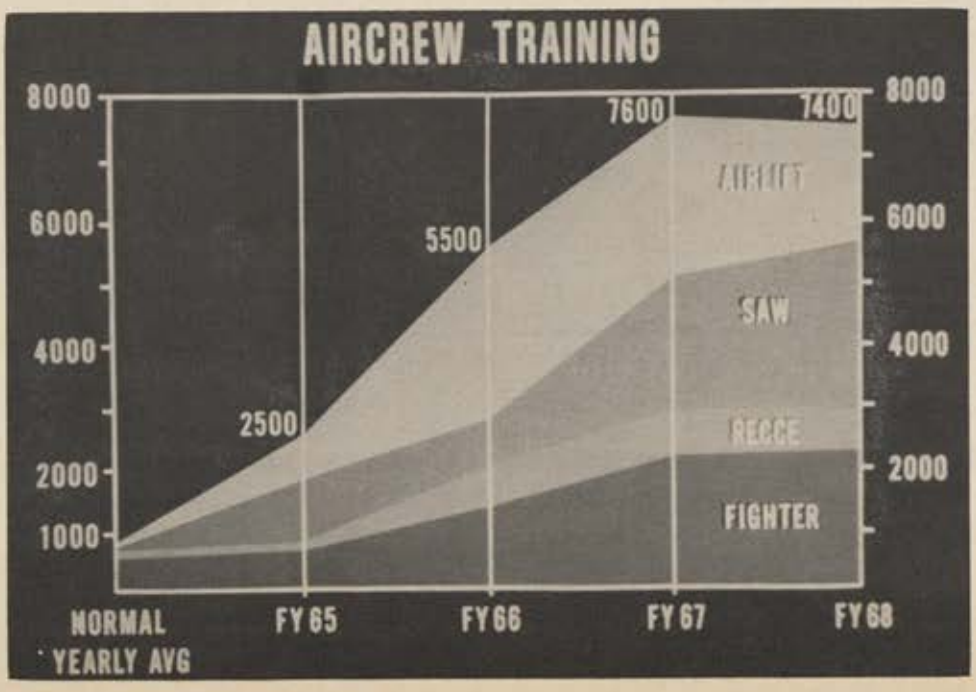


Chart shows how war in Vietnam has added to TAC's aircrew training burden. Notice major increases in Fighter and Special Air Warfare categories. Airways now are so crowded that TAC seeks establishment of a War Zone Training Range to escape handicaps imposed by civilian air traffic. TAC favors Wendover Dugway Complex in Utah, already partially owned by USAF, for this training facility.

An AIR FORCE Magazine Photo Feature . . .

Air Force Pilots

Maj. Gordon E. Williams is reflective as he listens to a briefing on the current Vietnamese order of battle. Two other Air Force officers also flew carrier missions.

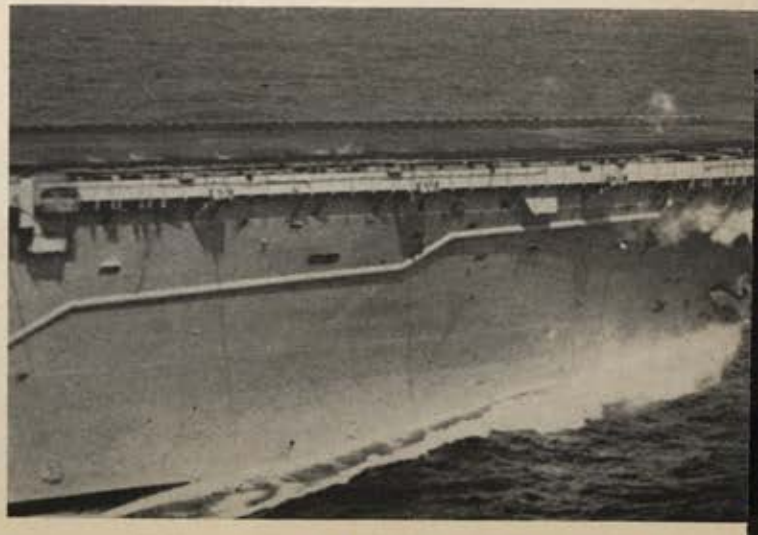
THE accompanying photos are remarkable because they portray Air Force personnel in an unusual role—conducting operations from an aircraft carrier. This photo sequence was taken last winter aboard the Navy's USS *Ranger*, in action off the coast of North Vietnam. On board, as working members of the sister service's Squadron VA-147, were three pilots, a maintenance officer, and twenty crewmen from the Tactical Air Command, all assigned to the mission under the code name Coronet Stallion.

Coronet Stallion was a familiarization exercise to speed the introduction of the LTV Aerospace Corp. A-7D into TAC. From the flight deck of the *Ranger*, the Air Force contingent flew regular combat missions in the Navy's version of the airplane, the Corsair II, or A-7 light attack bomber. USAF pilots flew nearly 200 sorties in the aircraft.

The A-7D, TAC's version of the Corsair II, is scheduled for initial delivery early this year. It will differ considerably from the aircraft flown off the *Ranger*, partly because it will incorporate 120 changes recommended in the Coronet Stallion report.

—CLAUDE WITZE

(More photos on the following pages)



An A-7 Corsair II is launched from the number one "cat" with a full bomb load for a North Vietnamese target as part of project Coronet Stallion to test the Corsair II.

In a unique display of interservice cooperation, a team of Air Force personnel, including three pilots, last winter found themselves aboard the aircraft carrier *Ranger* off the coast of North Vietnam. Also unusual was that their effort to help the Navy conduct air strikes against the North Vietnamese was only secondary. Their primary assignment, dubbed Coronet Stallion, was to evaluate the Navy's Corsair II for TAC.

Go To Sea in Carrier Tests of the A-7

An A-7 Corsair II clears the landing area after returning to the USS Ranger *from an armed reconnaissance mission over North Vietnam. Air Force pilots flew 200 sorties during evaluation testing of the Corsair II for TAC.*

During recovery of the force, maintenance and ordnance men prepare the aircraft for the next mission, less than an hour away. Assigned to Ranger *for the project were four Air Force officers and twenty enlisted technicians.*

Air Force Maj. Charles W. "Chuck" McClarren briefs Navy Lt. (j.g.) "Rusty" Scholl on the next mission. Air Force personnel were members of Squadron VA-147.

Sgt. Bob Groover inspects a radar component to be shipped to Aircraft Intermediate Maintenance Department for repair. AF technicians helped evaluate A-7.

Navy ordnance men fuze a load of MK-82 (500-lb.) bombs on an A-7, in preparation for an armed reconnaissance to be flown by one of Air Force pilots.

A-7 is taxied to the bow of the USS Ranger *for tie-down. During the tour, Squadron VA-147 flew about 1,500 sorties and delivered some 6,000,000 pounds of ordnance.*

After the force is recovered and tied down on the bow, the carrier turns out of the wind and races downwind on the back side of its "holding pattern" in Gulf of Tonkin. Pattern is repeated each hour and 45 minutes to stay on station.

Maj. Charles W. McClarren (center) talks over fuzing problem with Navy ordnance officer in preflight check.

Sergeant Groover teams up with Navy radarman to repair APQ-116 radar, part of A-7's electronic gear.

Hitching a ride at 130 knots.

1

2

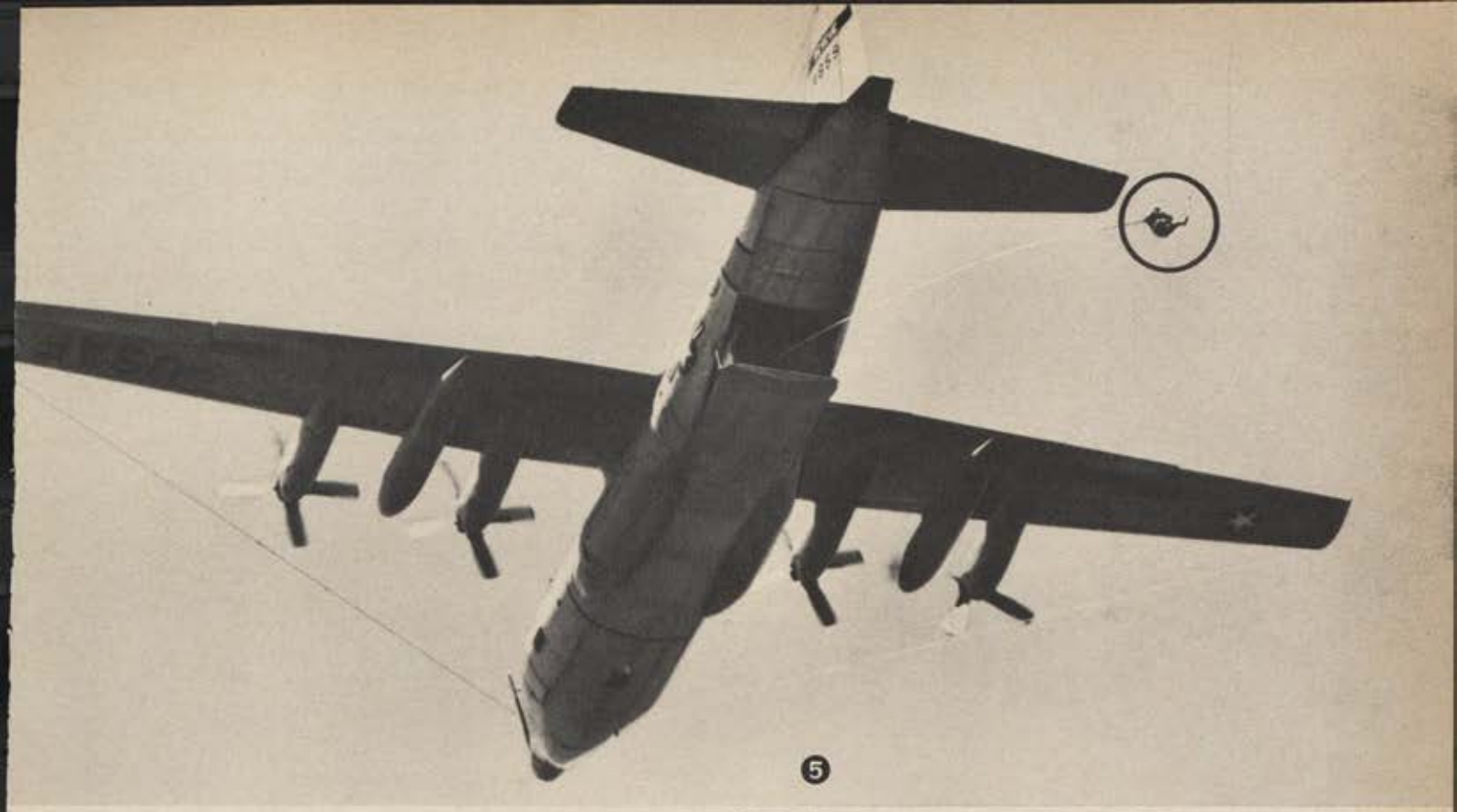
It's the new look in rescue: "fishing" upwards to catch a lift from an Air Force HC-130H Hercules passing nearly 500 feet overhead.

And that airman is safely up and headed home, lifted with less of a jolt than he'd feel in a parachute jump. With this advanced, man-rated surface-to-air technique, Hercules adds one more capability to Lockheed's list of successful responses to Air Force support requirements.

Hercules starts the operation by dropping a kit that can be rigged and readied in minutes. On a return pass, the plane snares the balloon-borne lift line in a nose-mounted yoke. Then, at the aircraft's open aft ramp, crewmen secure the trailing line, and winch it in.

This specialized Hercules is outfitted for making various high-speed pickups...searching for, finding, and retrieving personnel, space capsules and other objects in support of our worldwide aerospace missions. And doing it fast. It was a major link in the quick-reaction chain of rescue craft on the Mercury and Gemini projects. Today it backs up Apollo and the Manned Orbiting Laboratory programs, ready to haul in astronauts or other earth-aiming "packages." It can even catch on the fly, using highly efficient air-to-air retrieval gear.

The HC-130H, built by Lockheed-



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Georgia Company at Marietta, Georgia, carries rescue systems for searching and recovering over water, land, snow and ice—in daylight or darkness. And its more powerful engines—plus the addition of fuselage fuel tanks—give it approximately 12% greater range than other C-130 models, thereby extending the Air Force's worldwide search-and-recovery capabilities.

Hercules serves another way, too. With the addition of an in-flight refueling system for battle-zone rescue helicopters, it becomes the HC-130P. A number of these are in service today and their support is paying off regularly in Southeast Asia, as rescued Americans can testify.

The ability to understand present mission requirements and anticipate future ones, coupled with technological competence, enables Lockheed to respond dependably to the needs of the Air Force in a divided world.

LOCKHEED

LOCKHEED AIRCRAFT CORPORATION

An AIR FORCE Magazine Photo Feature

On these pages are photographs taken of the Air Force's first C-9A during its inaugural mission last fall. Twelve of the aircraft, designed specifically for an aeromedical airlift role, are on order and by summer should be helping in the swift and efficient transport of wounded and injured personnel to hospitals around the country as . . .

The C-9A Joins MAC's Mercy Fleet

Large red crosses on the vertical stabilizers of Air Force C-9A aeromedical airlift aircraft symbolize their task of transporting military personnel to hospitals within the US.

The C-9As are equipped with twenty-four-foot hydraulically operated ramps to permit litter or wheelchair patients easier boarding and unloading. Ambulatory patients board via a forward stairway or ventral stairway under the tail.

THE Air Force's Military Airlift Command expects that by summer all twelve of the C-9A aeromedical airlift transports on order from McDonnell Douglas Corp.'s Douglas Aircraft Co., Long Beach, Calif., will be in service in the US.

This will allow phase-out of the aging C-131s and C-118s presently flying continental aeromedical missions, and will upgrade sharply the capability of the 375th Aeromedical Airlift Wing, which will use the new aircraft.

Operations with the first of the twin-jet aircraft began this fall, carrying patients from Scott AFB in Illinois to Buckley Field, Colo., and to Travis AFB, Calif.

From Travis, forty-eight Pacific evacuees were flown to Kelly AFB, Tex., before returning to Scott. The entire mission took one day, and according to Col. Ralph E. Norton, wing operations officer and airplane commander on the inaugural flight, in half the time the older transports would have taken. The photos on these pages were taken on the first mercy mission of the new C-9A Nightingale.

The 550-mph C-9A, with a range of more than 2,000 statute miles, is adapted from the commercial Series DC-9-30 and incorporates innovations dictated by the experience of the 375th Aeromedical Wing.

The C-9A has among its features requirements for the exacting in-transit medical services that allow airborne care equivalent to that provided in a hospital ward. (*For more on the aircraft, see "Aeromedical Airlift Joins the Jet Age," by Irving Stone, AF/SD, March '68, page 102.*) Capacity of the aircraft is forty ambulatory patients, thirty to forty litter patients, or a combination of the two.

There is a possibility that eventually C-9As may be deployed by the Air Force in Europe and the Pacific.

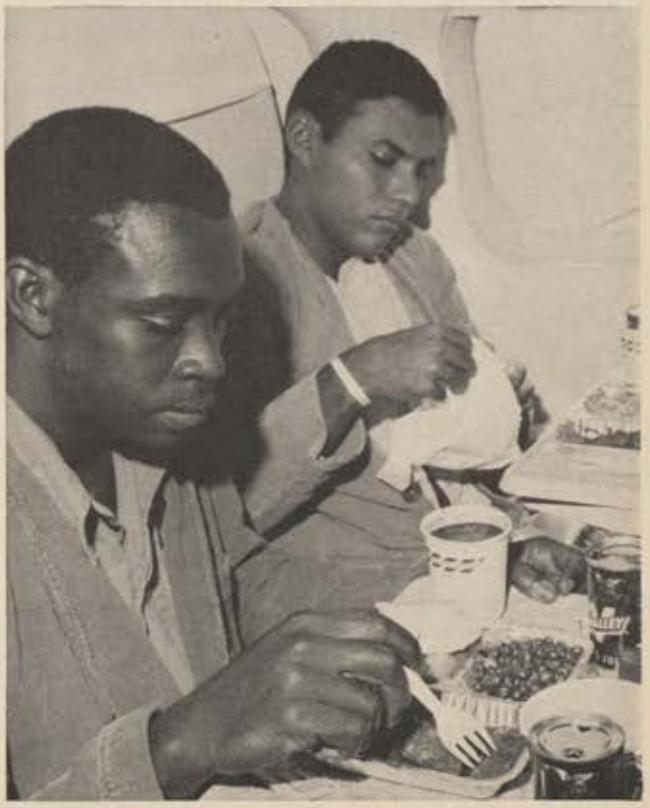
—WILLIAM SCHLITZ

The twin-jet will accommodate more than forty ambulatory patients, thirty to forty litter patients, or a combination of the two on a nonstop flight of up to 2,000 miles.

Many of the medical innovations of the C-9A were the result of the experience of the 375th Aeromedical Airlift Wing, the Military Airlift Command unit using the C-9As.

Injured airman takes things in stride as he adjusts to the rigors of aeromedical airlift during the inaugural flight of the first C-9A delivered to Air Force's MAC.

Equipment installed in the C-9A's cabin allows medical care equivalent to that provided in a hospital ward, benefiting airman patient and attending Air Force nurse.



To provide meals for patients aboard the aircraft, a main galley at aft end of cabin contains both a double oven and a refrigerator large enough to serve all patients.

In light of the Mediterranean's historic role as "soft underbelly" to "Fortress Europa," the growing boldness with which its waters are being used by the Russian navy takes on ominous significance. Although Soviet military power in the Med is of no immediate threat, and so far is overshadowed by the political implications of Russia's presence in strength there, a continued buildup could tip the balance of power in the area against NATO. It is essential to employ whatever measures are necessary to contain . . .

The Growing Threat to NATO's Southern Flank

By Stefan Geisenheyner

AIR FORCE/SPACE DIGEST EDITOR FOR EUROPE

ONCE again the Mediterranean has assumed its historic role as the "soft underbelly" of an impregnable "Fortress Europa." The lengthy and difficult-to-defend coastlines of the countries bordering the Mediterranean Sea from Gibraltar to Istanbul, combined with the frequently unstable political atmosphere around its shores, traditionally have made this area a potential danger for those faced with the task of defending Europe.

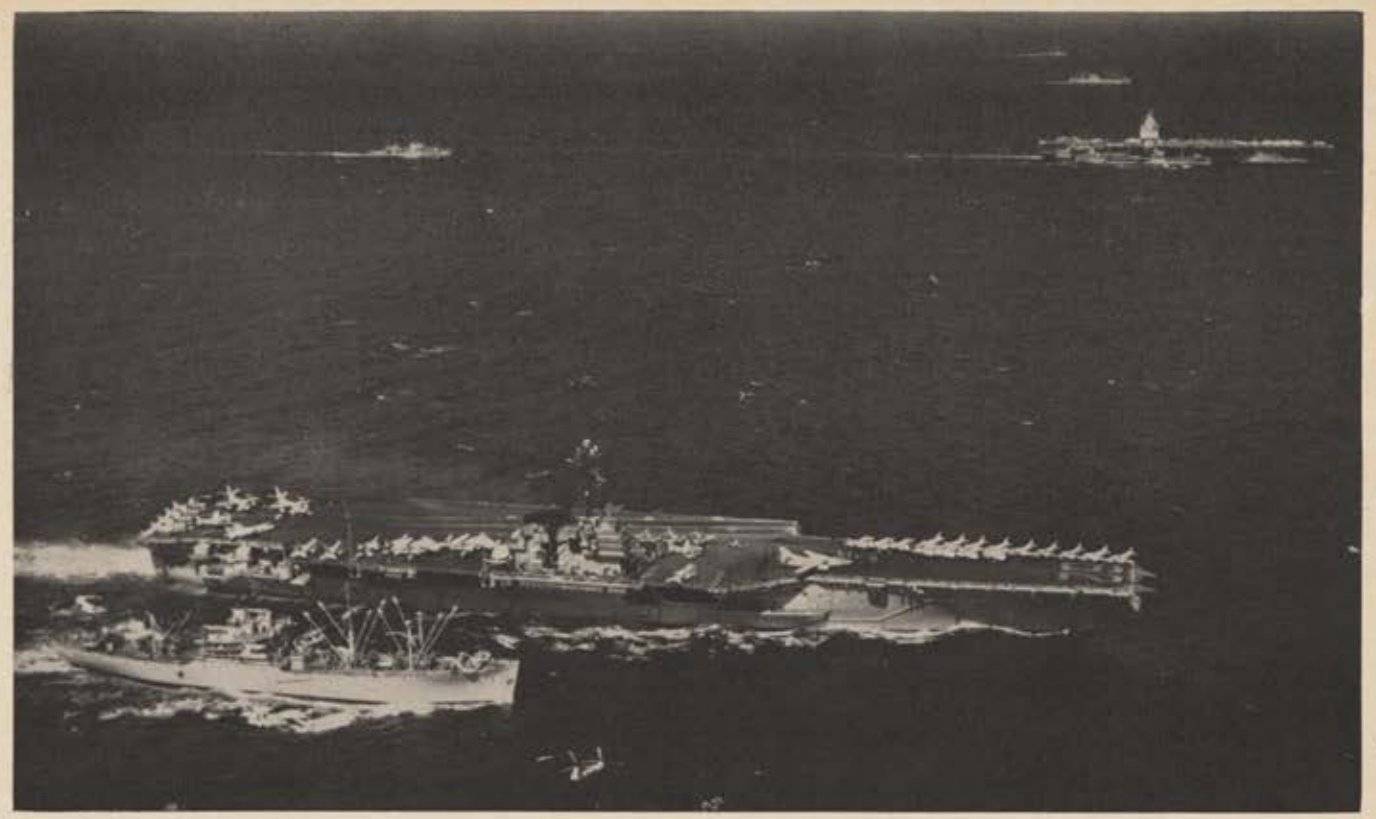
Since the North Atlantic Treaty Organization's inception in 1949, it has been confronted with this problem. To bolster its relatively spotty defenses in the region, NATO has a fast, mobile deterrent force, the US Sixth Fleet, that patrols the Mediterranean, serving both as a stabilizing factor and a barrier against Eastern expansionist policy.

Until recently the Mediterranean was considered relatively secure from a Communist threat. Of the nations concerned, Turkey, Greece, and Italy continue as members of NATO; France and Spain always have been sympathetic toward the Western cause; Yugoslavia has been neutral; Albania terminated its status as a Russian satellite long ago when it adopted the Maoist brand of communism; Israel has proved to be among the staunchest unofficial allies of NATO; and Libya and Tunisia, although antagonistic, remain neutral.

But Egypt, Syria, and Algeria have allied themselves with the USSR, and their harbors have been opened to Soviet fighting ships. Since Russian advisers are training the armed forces of these countries, Russia has established, for the first time in history, a secure base in the area.

As far as NATO was concerned, however, the sporadic visits of Soviet naval vessels and the military

Russian submarines based on the coast of North Africa are a potentially serious threat to the US 6th Fleet patrolling the Mediterranean. NATO recently has formed a new unit, Maritime Air Forces Mediterranean, to undertake surveillance of Soviet naval activities carried on in the area.



The US 6th Fleet with its two attack carriers is NATO's first line of defense against a Soviet push from the south of Europe. USS *Wrangel*, AE-12, rearms USS *Independence*, CVA-62, in the Atlantic Ocean. USS *Enterprise*, VCA(N) 65, can be seen in the background. The carriers are the backbone of a fast, mobile deterrent force that acts as a stabilizing factor.

ability of the Arabs, which even Russian training could not prop up, did not pose any serious danger.

At least this was the West's basic military position in the Mediterranean before the Arab-Israeli war of June 1967. With the brilliant tactical victory of Israel, the West apparently lost a strategic political battle. Both the military and the relatively strong pro-Western factions in the Arab governments were blamed for the disaster, and their subsequent removal opened the way for a strong influx of Soviet troops, ships, and aircraft. Only Western-oriented King Hussein of Jordan still hangs on to his shaky throne and refuses Eastern help. The tacit animosity of the Arab states toward the US and the West changed to belligerence, shifting the military balance in favor of Soviet expansion.

Land-Bound European Power

As a continental power, Russia's attempts to develop influence on the high seas had been doomed by geographical location. Its three major harbors, Leningrad, Murmansk, and Vladivostok, can be blockaded easily by an enemy, are icebound part of the year, or are too far from the nation's industrial centers. Thus, Russia's attempts to beat a naval power at sea warfare must necessarily fail despite the powerful fleets she might build. For example, Russia's disastrous war with Japan in 1904 and 1905 ended with the destruction of the Russian fleet in the Straits of Tsushima. Admiral Rozhdestvenski's fleet had sailed from the Baltic around the southern tip of Africa to Japan, and the lack of harbor and support facilities in the theater was the main factor for its subsequent defeat.

Russia's other single access to the open sea is via the Black Sea to the Mediterranean. However, the Black Sea had for centuries been a Russian inland lake because the Turkish straits guard that approach to the Mediterranean. Russia and Turkey have fought six wars, all basically for possession of this geographical feature. But with the help of other European nations, Turkey remained in control, and when Russia decided that its goal could not be reached militarily, a treaty was negotiated to give the USSR free passage through the Turkish straits.

The treaty also forbids any other power to send more than nine warships displacing a total of 15,000 tons at a time into the Black Sea. Foreign powers are allowed to have no more than 45,000 tons of warships and no submarines stationed there. The treaty was signed in 1936 in Montreux, Switzerland, as an international agreement.

With freedom of access assured, the USSR apparently has decided to step up its military activities in the Mediterranean as basic policy, but to what extent is undetermined. Thirty years ago, it would have been difficult to imagine that the Soviets would gain a firm foothold in the then wholly Western-controlled Mediterranean or that harbor facilities might become available to the Red fleet. Today more than fifty Soviet military ships, ranging from assault carriers to submarines, cruise in the area supported by their bases: Latakia in Syria, Alexandria and Port Said in Egypt, and Mers-el-Kebir in Algeria. The latter is a former French naval base offering some of the best maintenance and docking facilities in the world.

(*Continued on following page*)

The Mediterranean has assumed its traditional role as the "soft underbelly" of "Fortress Europa" with the buildup of substantial Soviet naval forces there. Thirty years ago it would have been difficult to imagine that the Russians would establish a firm foothold in what was a wholly Western-controlled theater. Thus far, however, NATO still has military supremacy.

Even before the Arab-Israeli war of 1967 all these harbors were open to the Red fleet for passing courtesy visits. But since the Israeli victory, with the Arabs firm allies who regard the Soviet Union as a protector, these facilities and many airfields now are being used extensively by the USSR. It is possible that, in case of renewed hostilities between the Arab states and Israel, Soviet ships based at Alexandria or Port Said would join the fight if these harbors were attacked.

The most troublesome element is that it would be almost impossible for Israel to distinguish between Soviet and Arab ships or airfields during an air strike, because the Russians and Arabs use the same type of ships, weapons, and aircraft.

With the appearance of Soviet naval power in the Mediterranean, Israel and NATO find themselves confronted with a situation that could develop into a major conflict.

Militarily, the situation remains fairly bright for the West. The Soviet fleet is small, and its combat value cannot be compared with that of the US Sixth Fleet and whatever additional naval power NATO has on hand. Furthermore, available land-based airpower is strong enough to counter any warlike Eastern move. The US fleet's two attack carriers and their supporting elements should constitute for the immediate future the dominant military factor in the region.

But this advantage is eroding fast. Soviet long-range bombers and missiles are being stationed in Egypt and also possibly in Algeria. Soviet-supplied fighter-bombers, which—according to Israeli sources—are in part flown by pilots of the Red Air Force, are stationed in Syria, Egypt, and Algeria, counterweighing the balance between NATO ship- and land-based airpower and the Soviet fleet. Thus, the days of unquestioned NATO air and naval superiority seem definitely on the wane, and NATO will have no course but to strengthen its airpower in the region to counteract a continued Soviet buildup.

Also of major concern to NATO is the potential threat to the fleet of Polaris submarines operating in the Mediterranean. It is known that Soviet surface vessels have been practicing submarine-detection work and are equipped with advanced detection equipment. The Polaris submarines take up stations in the area as deterrent to nuclear war and, if the Russians succeed in stripping them of their protective cover, much of their value would be lost.

New Arm for Surveillance

On November 21, 1968, NATO's newly formed Maritime Air Forces Mediterranean went operational in Naples. Its task is primarily surveillance of Russian ship movements, but it can be assumed that attack groups are or will be attached to it.

The US Sixteenth Air Force bases in Spain had been in the backwaters of world events for a long time. Now they have suddenly become very important for the defense of Europe. Since the US-Spanish contract to lease the bases is running out and now is being renegotiated, the new terms undoubtedly will be very tough, as Spain is aware of the absolute strategic necessity for the US and NATO to maintain bases covering the western Mediterranean. It can be assumed that the Western allies will pay a stiff price to bring the negotiations to a successful conclusion. Assuming this will be the case, the entire northern Mediterranean can be dominated almost absolutely by land-based airpower supplemented by the highly mobile Sixth Fleet. NATO has bases in Greece, Turkey, and Libya, and on Crete and Cyprus. Its air and naval bases on Sardinia are well located strategically, but the eastern part of the Mediterranean still lacks sufficient airpower.

Under pressure of all these rapidly developing events, the US State Department finally gave Israel long-awaited permission to buy fifty Phantom IIs, thus furnishing the West's best ally in the eastern Mediterranean with an effective medium-range strike force, which upon becoming operational will seriously impair the value of the Soviet naval bases in that region.

In view of the present military situation and under

the assumption that the Soviet fleet will not be strengthened substantially or will not be able to secure more bases in other parts of the Mediterranean, a balance of power is still in existence. However, such assumptions may be overly optimistic. To reach its goal of becoming the dominant factor in the Mediterranean and to force the Arab nations into a more moldable type of satellite status, the USSR can be expected to enlarge its fleet and must continue trying to establish new bases.

One prime target is Albania. This small country, located in the lower part of the Adriatic, offers good harbor facilities in an excellent strategic position. From there, the whole Adriatic and the traffic between Greece and Italy can be kept under surveillance. Missiles installed in Albania would be practically at Italy's doorstep. Fifteen years ago Albania left the camp of the USSR to join Red China, thus becoming the only supporter of Mao in Europe. Over the past ten years, Albania, with the help of its powerful radio station in Tirana, has become a serious nuisance to the Soviets. The station, broadcasting Maoist propaganda in a number of European and Arabic languages, is heard throughout the Balkans as well as in the Mideast and Europe, seriously hindering the effectiveness of Soviet propaganda efforts. It supported the Czechs during Russia's invasion last summer and so was quoted widely in the Western press.

Albania provides a staging area for Chinese ships and possibly submarines. All these factors combined disconcert Soviet efforts in the area, and retaliation certainly is being considered. And the foothold that the Chinese brand of communism has established in Europe obviously is against Russian interests. The arrival in the Mediterranean of a Red fleet assault helicopter carrier could possibly herald the beginning of a move against Albania where "true Communists" would ask for "liberation" from their Chinese overlords.

Russian Base on Malta?

Another possibility for a Russian base in the very center of the Mediterranean is the island of Malta. Several years ago Malta won its independence from the United Kingdom, an event that proved disastrous. The expected flood of tourists did not arrive and the Royal Navy, which for a century had given sustenance to the island by using it as a major naval base, withdrew. No new customers appeared, and the oversized docking and maintenance facilities remained idle. The occasional repair work to itinerant freighters on their way to the Far East simply could not sustain the labor forces or the island. With the Suez Canal closing during the Arab-Israeli war, even that trade stopped, and Malta now finds itself in a terrible quandary.

It is known that Soviet emissaries have contacted the Maltese government to sound out whether the island would be willing to offer its facilities to the Red fleet. Since the days when the Order of the Maltese Knights defended the island against the Turks, Malta always has been a strongly Catholic nation. There-

(*Continued on following page*)

Antisubmarine warfare operations are receiving greater emphasis in the Med. In the foreground is USS *Wasp*, patrolling with the USS *Robert L. Wilson* (DD847). Also of major concern is the potential threat to our fleet of Polaris submarines on station in the Mediterranean. If our subs lose their protective cover, much of their deterrent value would be gone.

British Lightning fighters intercepting a Soviet long-range reconnaissance aircraft over the Mediterranean. Confrontations of this nature take place regularly.

fore the likelihood that it would adopt Communist patrons is remote. But in view of Malta's growing desperation, the possibility that the Soviets might find a base there cannot be discounted. Such a development would be extremely serious since in effect it would collapse NATO's southern defense screen.

It is encouraging, therefore, that NATO's recent naval exercises in that region were directed from Malta, which has played a crucial role in many naval and air warfare situations in the Mediterranean. The exercise, called "Eden Apple," brought another pleasant surprise—although US, Greek, Italian, and British ships were scheduled to participate, the French Navy most unexpectedly also joined in. Though resigned from NATO, the French judged the strengthened Soviet presence in the area dangerous enough to order their ships to take part in the war game. This emphasizes more than anything else the potential seriousness of the situation developing in the Mediterranean.

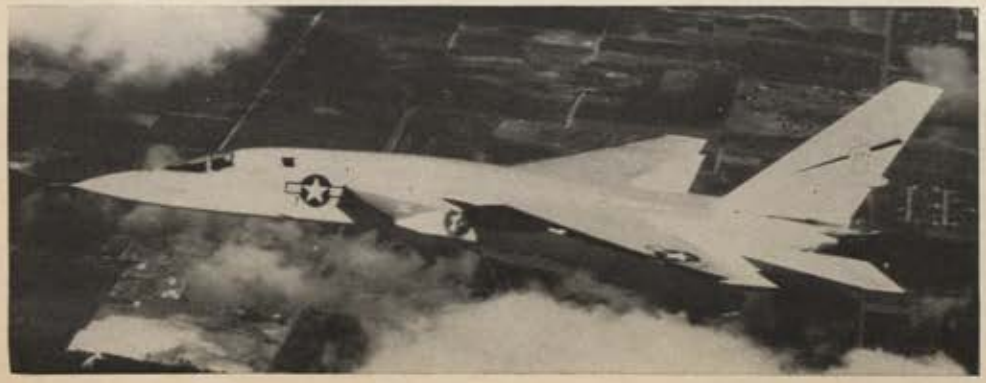
It seems only logical that to defend southern Europe the West has no alternative to strengthening its forces in the area regardless of political and economic differences among NATO nations. Two years ago, Adm. J. S. Thach (USN, Ret.), Commander in Chief, US Navy Europe in 1966-67, predicted the present situation during a discussion with AF/SD's Editor for Europe. He stated at the time that the two US attack carriers in the Mediterranean were not sufficient to counter the growing Soviet threat. The Admiral said he thought at least three carriers plus one ASW hunter-killer group and several more Marine battalions would be needed. Today certainly any planner or strategist for the Western bloc would consider even more naval power necessary to defend NATO's southern flank.

Most NATO allies today are doing their utmost to keep the south of Europe secure. Italy depends on the Mediterranean traffic and therefore has a well-trained and relatively large fleet under NATO command. The same is true of Turkey and Greece and, except for some reservations, with France. The once dominant power in the region, Britain, has withdrawn nearly all its forces. The remnants of what was once the most powerful fleet in the world, the Royal Navy, simply are not strong enough to participate to any useful extent in the Mediterranean's defense.

Crisis Has Not Been Reached

As stated previously, a crisis point in the military picture has not yet been reached. The Soviet fleet is still small and does not have sufficient bases. Politically, however, the Russian presence may have far-reaching effects. For the Communist parties of the nations bordering the Mediterranean, the mighty ships flying the Red flag with hammer and sickle give strong moral support. For example, the Soviet destroyer that anchored for a few days off Catania, Sicily, in October provided a big boost for the Communists during the local elections and did more for the party than had months of propaganda broadcasts. The effects of similar well-timed visits in crisis spots in the Arab nations can well be imagined, since the USSR thus demonstrates that it is on the scene and willing to support its allies militarily.

In any event, what was thought improbable until recently is fast becoming a reality: The USSR is growing into a major power in the Mediterranean. To what extent she intends to build her forces there and in what manner use them to back her policy decisions concerning the region is at this time problematical. However, the threat to NATO's southern flank is great enough to warrant whatever measures NATO must take to contain it.—END



RA-5Cs, like this of the US Navy, patrol the North African coastlines on ECM missions. They record the radar transmissions, monitor the voice frequencies, and keep tabs on the movements of the Soviet fleet.

A novel use of boundary-layer control promises to eliminate the hazards of engine failure during takeoff of multiengine aircraft. NASA tests confirm ten-year-old Martin Co. estimates for aircraft that will automatically trim themselves during power loss, providing the prospect, in the 1970s, of aircraft that . . .

You Can Fly Hands-Off With One Engine Out

By J. S. Butz, Jr.

TECHNICAL EDITOR, AIR FORCE/SPACE DIGEST

FOR the pilot, technology probably couldn't bestow a finer gift than a twin-engine airplane that could fly itself, "hands-off," with one engine out—an airplane in which engine failure on takeoff no longer presented the hazard of violent yawing and rolling motions.

It appears that during the 1970s this dream multiengine aircraft will become a reality even if the development pace today remains slow and deliberate. The first steps have been taken. A basic design was proposed about ten years ago by Hans Multhopp of Martin Marietta. Recently tests at NASA's Langley Research Center, by Richard J. Margason and Carl L. Gentry, resulted in the conclusion that this design was "promising," and that it could "produce the longitudinal and directional [and lateral] trim required for an engine-out situation with no control input by the pilot."

Privately, the NASA investigators estimate that the minimum flying speed of a counterinsurgency (COIN) aircraft in the OV-10A class could be reduced "possibly forty percent," or from sixty to seventy knots down to "about forty-five knots." This would mean a signifi-

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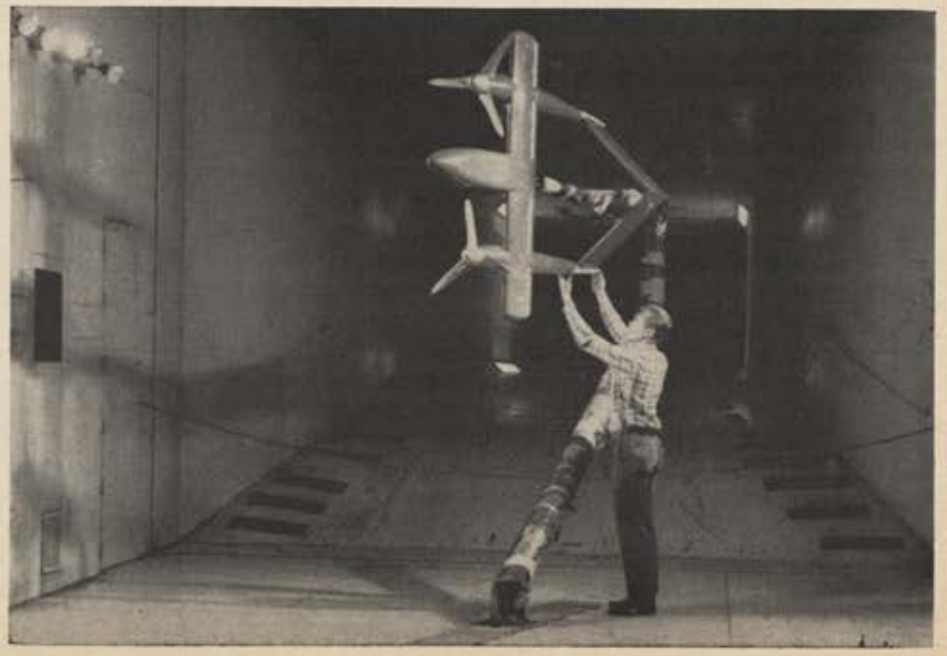
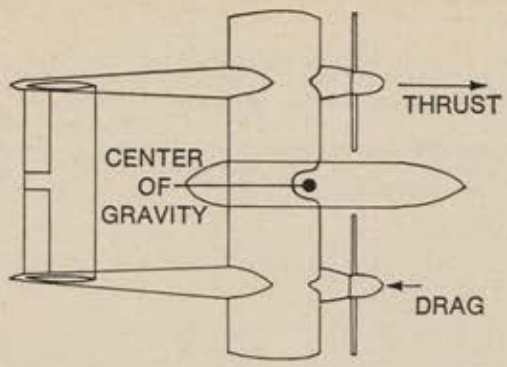
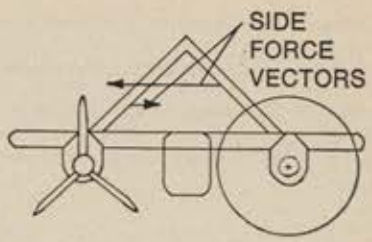
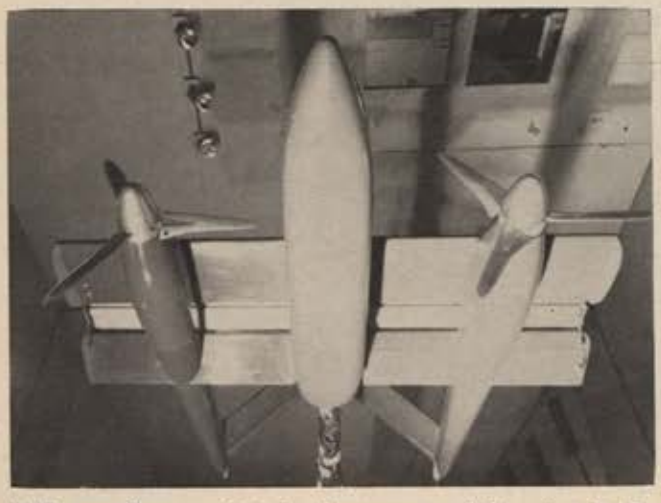


Recent wind-tunnel tests at NASA's Langley Research Center have revived interest in this unusual configuration devised by Hans Multhopp of Martin Marietta during the late 1950s. Engine air is exhausted over the lower surfaces of the inverted-V tail to increase available control forces. Each engine feeds air to the surface on its side. If the right engine fails, the side force on the right tail surface drops dramatically, and the force on the left surface automatically counteracts the aircraft's tendency to yaw to the right.

Yawing forces at work on the Multhopp design during engine failure are shown in the diagram at right. Full power on left engine and drag on right engine create strong movement to right. This can be counteracted by tailoring boundary-layer control for tail surfaces.







Full span flaps and total submergence of the wing in the propeller slipstream are features of the Multhopp design.

cant improvement in the STOL performance of the aircraft, with the ground run for both takeoff and landing probably cut in half. And the aircraft's inherent tendency to fly in a straight line, and to remain easily controllable in the engine-out condition, would be an incalculable boon to safety.

On the McDonnell Douglas/Breguet 941, which NASA engineers describe as an "excellent STOL aircraft," it is estimated that the minimum flying speed could be reduced some twenty percent, to fifty-five or sixty knots, using Multhopp's ideas. Slowing the airplane in this fashion would improve its STOL performance and make it even more useful in major terminal areas than present NASA/FAA tests indicate.

The key element in Multhopp's design is blowing-type boundary-layer control for the tail surfaces with the system being driven directly by the engine exhaust. Ducting of the boundary-layer-control system is arranged so that, in the event of engine failure, the blowing would stop on the side with the engine out and blowing would continue on the side with the engine operating. This would result in a very large side force on the tail. This force can be tailored to exactly balance the yawing moment resulting from the stopped engine.

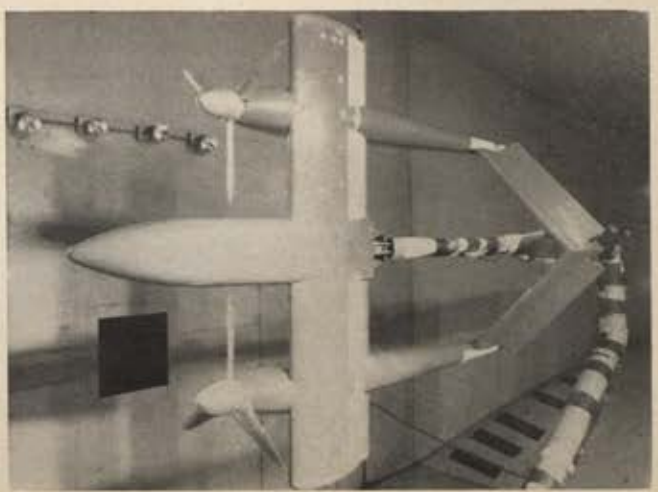
Consequently, the pilot would not have to counteract a strong yawing motion during an engine failure just after liftoff. The aircraft would hold its heading, and the primary indicators for the pilot would be reductions in lift and thrust.

NASA test data also show that the necessary lateral control for the engine-out situation could be provided with a spoiler to decrease lift over the wing which was still bathed in prop wash.

Multhopp's original design, which was the basis for Martin's entry in the Department of Defense's original counterinsurgency (COIN) aircraft competition, featured an unusual inverted-V tail mounted on twin-booms. However, the technique is applicable to any type of empennage, whether it is conventional or unconventional.

Little doubt about the feasibility of blowing boundary-layer-control systems lingers today. Thousands of them are in daily service aboard the McDonnell Douglas F-4, for example, increasing wing lift at low speeds by exhausting engine air over the flaps and out of the leading-edge slats. The weight penalty also is acceptable as shown by this McDonnell application and the Martin Co.'s mechanical tests of the system, conducted nearly a decade ago to gather supporting data for its entry in the COIN competition.

The recent NASA tests have provided a thorough independent check on the detailed stability and control problems of Multhopp's basic design. The very favorable results of these tests, plus the design's substantial safety and performance payoffs, undoubtedly will make it a strong influence on new civil and military aircraft construction, from the AX, advanced ground-support turboprop, to the executive twins of the 1970s.—End

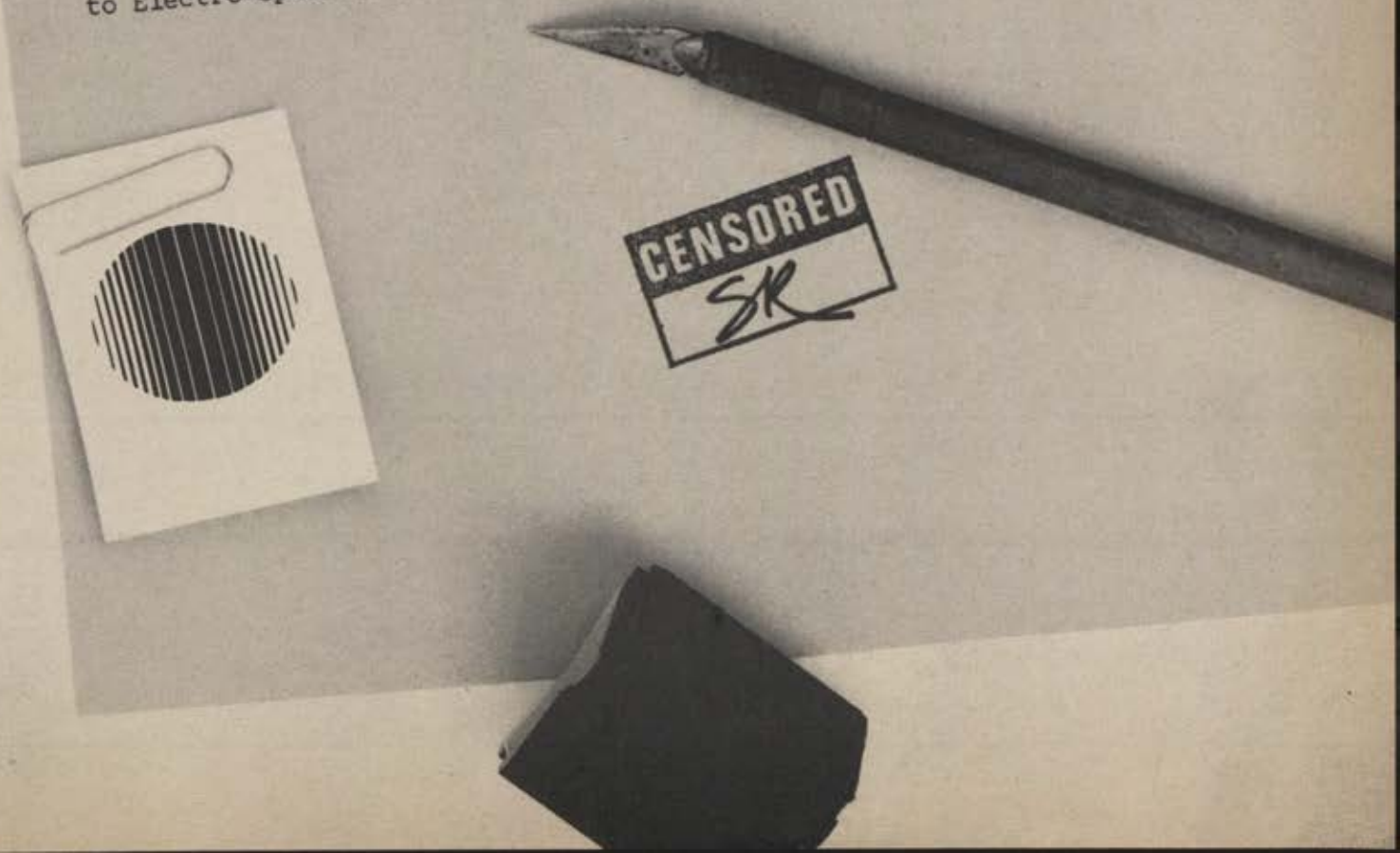


The inverted-V tail has important structural advantages, but Multhopp's idea can also be adapted to any empennage.

NOW, NEW FROM ELECTRO-OPTICAL SYSTEMS

The recent news that had, without question, developed new and has provided the military with Electro-Optical Systems, a Xerox company, has provided development is considered to be unusually countermeasures. The by various members of although these countermeasures are EOS provides manufacturing capability and total systems design for the entire project related to and other forms of countermeasures.

Do not write for further information on your company letterhead to Electro-Optical Systems, a Xerox company, Pasadena 91107.



As the air action in Southeast Asia has grown in volume and complexity, so has the problem of preparing the daily tactical strike orders—the "frags"—that largely direct that action. But the old techniques used to prepare frags were outmoded and slow, holdovers from World War II and Korea. Now in an advanced stage is a strenuous effort to propel frag preparation into the spage age. This is no small task, since to match modern air war capability with the limitations of a regional war is both intricate and essential. To accomplish this, the most advanced technology has been brought to the task . . .

How Computer Technology Is

THE techniques critical to tactical air strike force planning are undergoing what amounts to a technological overhaul. Until relatively recently such techniques had somewhat of a goose-quill pen and mounted courier air about them. Now it is essential that the strike force planning and scheduling techniques of World War II and Korea vintage be superseded by those that can match the instant and phased response requirements of limited war.

Consider the extensive detail in planning, scheduling, coordinating, and evaluating our tactical air operations in Southeast Asia. On a daily basis, hundreds of fighters, bombers, reconnaissance, rescue, and support aircraft sorties have to be intricately planned, executed, and recovered.

Ordnance and cargo must match targets and destination. Fuzing for each weapon must be properly set to achieve significant results. Air refueling times and places must be accurately set and adhered to or aircraft are lost just from lack of fuel. Runway capacity is limited, and with heavy traffic there must be a firm schedule since only a limited number of aircraft can take off or land in any time period. Rescue aircraft must be on station and ready when needed—not sooner or later.

This partial list contains some reasons why an operations officer with a scratch pad cannot properly plan and control the massive air operations in a combat theater. He needs assistance in the form of computer programming, fully automated data storage, and real-time communications and information transfer.

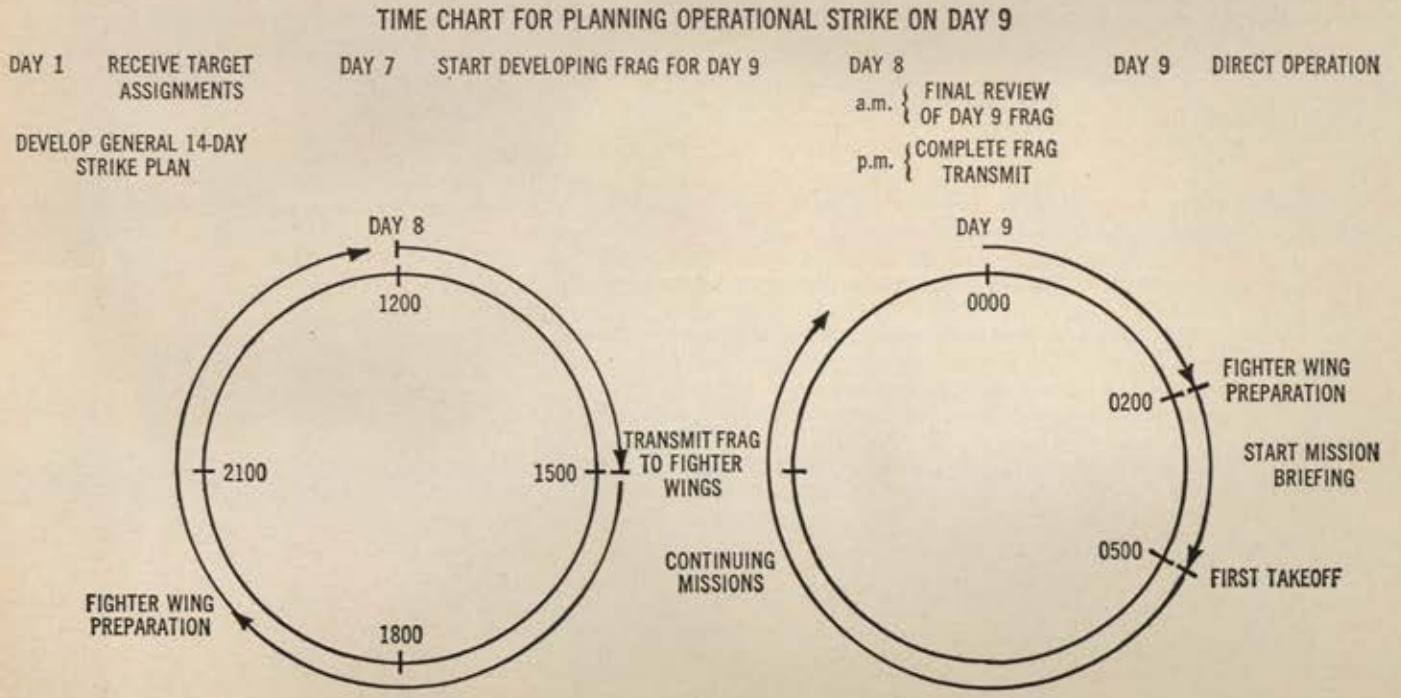


Figure 1. Tactical air strike force planning revolves around the all-important daily fragmentary (frag) order, usually prepared in the area command headquarters, the basis for flight plans, briefings, and other details of subordinate units.

By Lt. Col. Paul L. Gray, USAF

OPERATIONS ANALYST, COMBAT ANALYSIS DIVISION, HQ. USAF

Streamlining Frag Preparation

Work presently is under way in Southeast Asia to provide tactical air forces with the computer support that will optimize strike force planning. The intent of this article is to highlight this progress and to suggest other productive applications.

The Old Way

The most tangible product of tactical air strike force planning is the daily fragmentary (frag) order. This directive is normally prepared in the area command headquarters and covers all fighter wings assigned, listing all missions to be flown on a given day. In routine operations, it is usually transmitted to each wing by teletype twelve to fifteen hours before execution *(Figure 1)*. This permits each wing and its squadron to prepare flight plans, configure aircraft, and accomplish mission briefings.

The basis for the frag lies in the targets authorized for a given time span by higher headquarters. After receipt of specific targets, a general strike plan may be prepared for the coming week or two. In the past, the daily frag order preparation was started two days prior to implementation.

Key decisions made by the commander and his staff to initiate the frag include mainly target selection and general strike force composition. However, depending on circumstances, such items as time-over-target (TOT), ordnance, fuzing, ingress and egress routes, etc., may be specified directly rather than left to the discretion of the operational planners. In any event, the decision inputs were forwarded to the operations staff, where teams of operations officers worked in shifts to properly assemble and mesh strike forces for designated targets. At this point frag preparation began to lag because manual rather than machine techniques were used.

Starting with the designated target and forces specified, the frag planner proceeded to develop a strike force for a particular day's missions. Utilizing large worksheets, he computed times, speeds, and distances necessary to form and coordinate the strike force and support elements at given places, times, and altitudes.

In fact, all factors required to launch, assemble, schedule, and return the primary strike force of a hundred or more aircraft were taken into account, as well as types of aircraft involved. Also, in any given period, other missions using two or more aircraft were normally scheduled. Following is only a partial list of items that must be considered, calculated, and double checked for each mission:

(1) Time-over-target.
(2) Enemy defenses.
(3) Primary, first alternate, and second alternate targets.
(4) Air-to-air refueling times, positions, and altitudes.
(5) Ingress-egress routes.
(6) Ordnance and fuzing.
(7) Flight call signs.
(8) Prestrike and/or poststrike air-to-air refueling offloads.
(9) Target information/photos.
(10) Rendezvous, spacings, and maximum ranges.
(11) Special instructions.

The above factors were then to be coordinated so the entire strike force meshed with split-second timing and precision.

With the operations staff commencing this planning approximately forty-eight hours before transmittal, final review for a given day's operation was undertaken by a commander about twenty-four hours before transmittal. Any late changes in the order of battle were considered and incorporated in the planned frag. Changes often were made any time up to transmittal time—requiring only time to rearrange the frag and properly cross check it. For example, if a flight or target were added, air refueling, traffic flow, ordnance availability, rendezvous, etc., had to be checked across the force to ensure proper mesh and eliminate conflict.

However, when routine schedules became the exception—due to a rapidly changing order of battle—changes were made after transmittal time, or a new frag transmitted as late as five hours before execution. These actions strained the planning function and also imposed an extra load on the fighter

(Continued on following page)

wings. Obviously this increased the potential for accident and error. What was needed was a system that could provide the latest decision capability in conjunction with rapid and accurate transmission.

This latter factor, accuracy of transmission, has required considerable improvement. Frags ready for transmission were placed on a standard teletype circuit where paper tape was printed via a manual keyboard and the transmissions effected. Under this system, problems and delays resulted from typing errors, machine garbles, line outages, and competition with other message traffic priorities. The errors can prove disastrous. For example, assume the frag contained an air-to-air refueling rendezvous time for a flight of F-4s as 1105 hours. If the tanker frag should be misprinted as 1150 hours, the tanker would be on station at or slightly before this time, resulting in lost aircraft, or, at the least, unproductive sorties.

When a frag contained a garble, it may not have been serious. But any garble usually required an investigation, the least of which is a request for retransmission on already overloaded circuits. Obviously the time spent in clarification on both ends of the line was wasted.

A Better Way

To eliminate such archaic methods in strike force planning techniques, an extensive effort was undertaken to develop and institute machine programming to process the extensive detail involved in frag preparation. The primary gain made by shifting the out-of-date manual techniques to use of machines has resulted in time savings, increased accuracy, and greater operational planning flexibility. The extensive details of coordinating the strike force elements can be accomplished in minutes rather than in days, and accuracy improved considerably. A commander and his operations staff are being relieved of routine trivia in order to concentrate on special and more critical problems. Flexibility can be increased to where strike forces can respond to enemy tactics within hours rather than days.

Witness the increasing application of this concept in industrial processes, airlines, banking, etc., to perform tasks ranging from precision machine tooling and product assembly to airline flight planning. And these techniques are not something in the future; they are current and state of the art. Figure 2 depicts a flow chart for one possible "frag generator."

As an example, consider the standard planning factors such as fuel consumption, time to climb, cruising speed, and aircraft range. These factors can be readily placed in the computer data base. And when a strike frag is being prepared, the computer constructs the flight profile for the particular ordnance load, meshes takeoff, refueling and rendezvous times, etc., and signals if any phases are beyond limits. The frag generator also can print and transmit frags.

Consider how error-prone and time-consuming the old procedure was just for properly scheduling air-to-air refueling. For the hundred or more aircraft on a frag, each sortie had to be checked for proper coordination with each aircraft. Tanker flight times,

Frag orders are "unforgiving" about any transmission error concerning refueling rendezvous time and other technical details, but computer cross checks will nail mistakes.

rendezvous points, altitudes, and fuel off-loads had to match the corresponding factors for each F-4, F-105, EB-66, etc. An error or mismatch very easily could lead to lost missions and/or aircraft.

Use of the computer as a frag generator for the multitudes of computations and cross checks in preparing frags will decrease frag preparation from two days to two hours or less. This time gain allows a commander to delay until much later his final decision on a given day's strike activity. This, in turn, allows more time to consider the order of battle, and related decisions can be based on the latest reconnaissance, intelligence, and bomb damage assessment (BDA). In a rapidly changing tactical situation, setting an air operations battle plan only hours in advance rather than days is of considerable importance.

For instance, consider where a frag has been prepared and transmitted fourteen hours before first takeoff. If late intelligence identifies a major target that it is considered imperative to destroy, the old frag system would be of no use. Aircraft could be diverted if nearby, but confusion and loss of effectiveness are inherent in unplanned action. Under the new system, the new target and the desired strike forces are processed by a frag generator and an accurate and coordinated frag order is issued in a fraction of the time. At the operating level, the more precise planning is a great assist to the strike pilots.

Under combat conditions late changes in the battle plan happen quite frequently. A frag can be completely revised within its last twelve or twenty-four hours of preparation. Often this frag is transmitted to the wings behind schedule.

Since fighter squadrons have a great deal of work and planning to accomplish after receiving the frag, late receipt always creates some hardship. Flight crews need ample time to thoroughly plan each mission. Maintenance crews must load and check each aircraft.

Normally wings receive the frag between noon and mid-afternoon of the day before execution. But at times the frag may be received as late as midnight on the day of execution. When crews are briefed at 0200-0300 hours and aircraft are ready for takeoff after 0500 hours, late receipt can hinder mission results. The greatly increased speed of frag preparation by the

computer allows later decisions and fewer late transmittals.

Also, a central computer with direct printout or remote consoles at each fighter wing ensures accuracy of frag data. With consoles at each wing, frag printout at the same time it is produced on the central frag generator provides real-time receipt.

Concurrent with frag preparation is the necessity to enter certain information in a data bank for the computer (*see sample Data Base listed in Figure 2*). As mentioned, the planning factors and particular characteristics of each aircraft must be stored. This includes such items as cruise speed, time to climb, ordnance loadings, etc. Information on the number of operational aircraft and their base locations also must be on hand.

These and many similar bits of data then can be utilized in constructing the frag. They also will be available, on demand, for a commander and his staff. The final function these data items perform is to serve as a "red-flag" signal in the frag generator. Here they immediately alert the planner if he is calling for more aircraft than available, if he plans a target beyond the range of aircraft, or tries to use more ordnance than is on hand. This safety check provides a significant contribution to a smooth planning system.

One enviable prospect of computerizing daily frag preparation is the cost consideration. Computer facilities are available, in being, and on location. And "blue-suit" programming skills exist within the force. Therefore, few additional costs occur in changing from manual to machine operation. Actually, a team of three programmers already has converted about fifty percent of frag preparation from manual to machine operations.

The ability to quickly and accurately respond to changed battle conditions is another factor that must be inherent in the system. The ability to make changes, additions, deletions, new approaches, etc., is as vital as the original program capability. The small but expert staff of computer programmers and technicians represents the miniscule catalyst that is absolutely necessary for workable automated support. Only through them can a commander receive proper benefit from the computer technology. As conflict conditions change, so must a commander be able to adjust software components to meet his specific needs *(Figure 3)*.

The frag generator provides two distinct advantages in weaponeering. By inputting the most effective type of ordnance and fuzing for each target, as

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ORGANIZATION CHART ... THE NEED TO DEVELOP AN IN-HOUSE CAPABILITY IN COMPUTER OPERATIONS

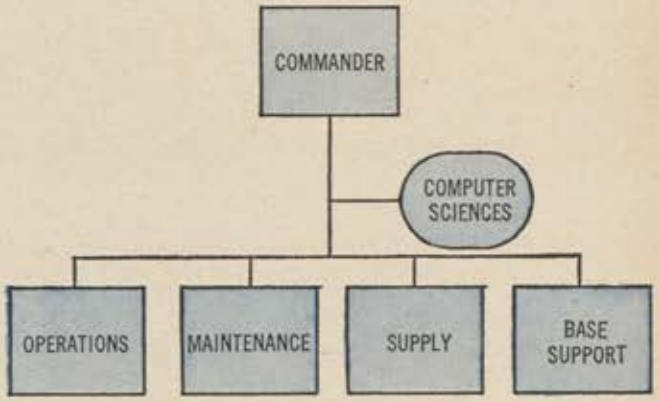


Figure 3. Automated, computer-oriented frag generator system depends on an expert staff of programmers that can change software components to meet changing tactical needs.

FLOW CHART FOR FRAG GENERATOR

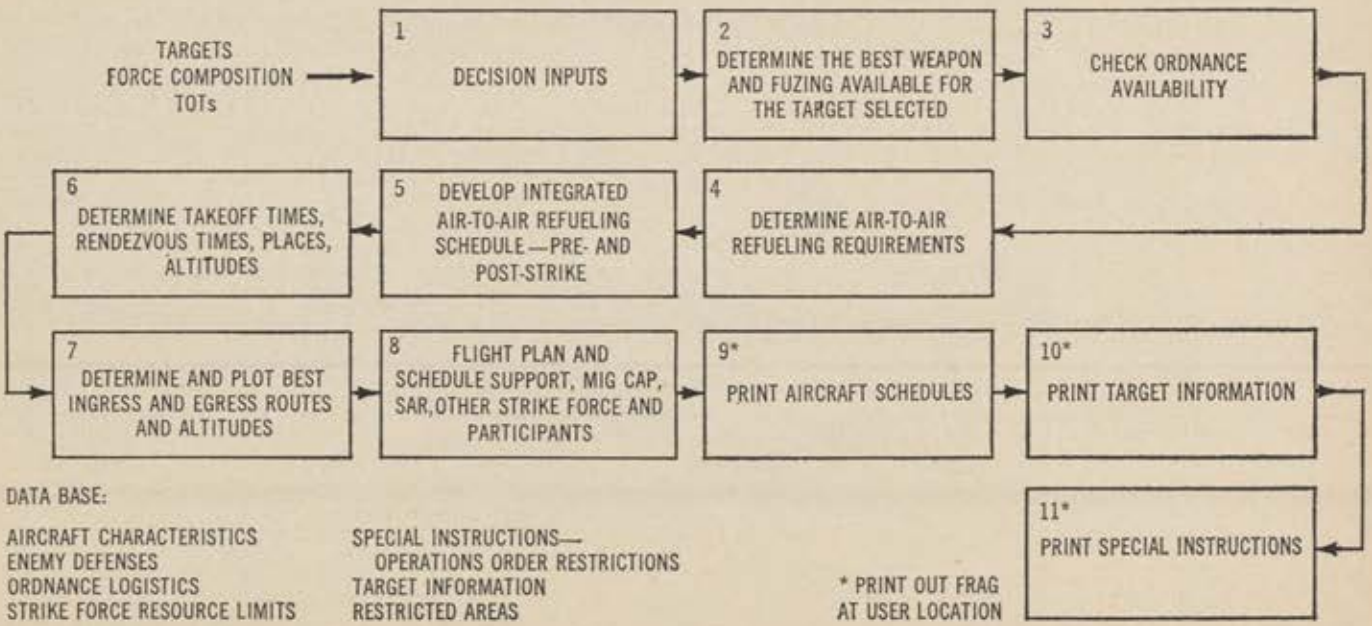


Figure 2. Flow chart for frag generator is premised on complete data bank inputs that would include planning factors and the particular characteristics of each participating aircraft, as well as base location, ordnance loading, and target data.

well as the second best, third best, etc., the programming easily can be structured to assign the optimum available ordnance to each mission. For example, assume a frag is being prepared and the target is an ammunition storage area. If a 750-pound bomb with delay fuzing is considered most effective and a 500-pound bomb with delay fuzing next, it is a minor matter for the frag generator to assign this ordnance depending on availability.

Further, if it is intended that Fighter Base A will fly the mission, but Base A lacks the 750-pound bombs while Base B has an overage, the frag program can signal this information to the planner who can then switch the mission assignment. In conjunction, a subroutine to tally and maintain an accounting of the total ordnance logistics situation can be established. For example, a commander can have available at any time a printout of the ordnance levels at each of his bases. Any shortages or overages can be observed readily. Through projected use rates and known pipeline quantities he also can estimate the future ordnance picture.

In the Future

The current effort to computerize frag order preparation is but the first step toward many different possibilities in automated support for combat operations. Of the following, some are being readied for installation and some may be included in the future. In any event, the forecast inevitably carries us closer to the much-touted "push-button warfare" setting.

• **Remote Display Terminals.** As new equipment is installed, it will have remote display terminals for direct input and output at selected locations. These terminals will be connected to the main computer and its program. Through them the user may make direct queries and receive, almost immediately, the desired information. For example, a strike commander may want to know what other forces are to fly into his strike area before and after his own force. By his query and subsequent readout, he can gain this information in minutes.

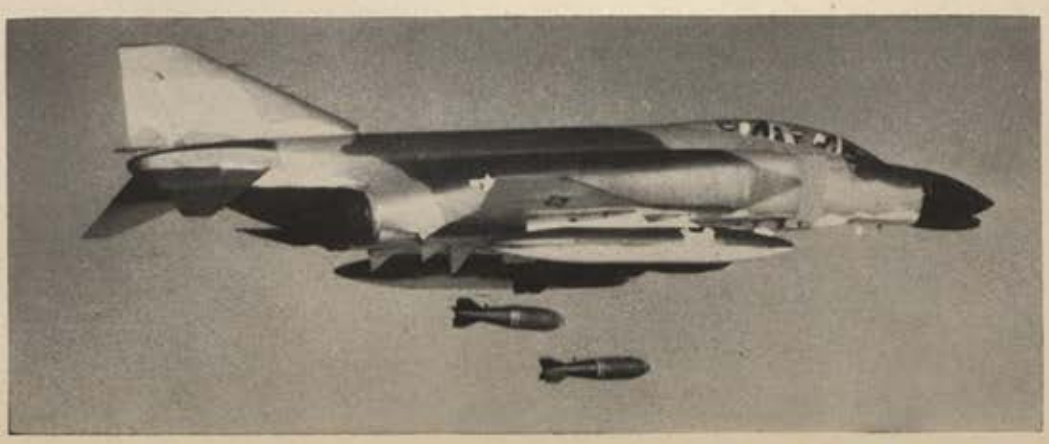
With an automated data base and a frag generator operational, more sophisticated planning and applications become possible. The true payoff in computerized strike force planning comes when a commander is able to utilize the mechanized system to direct and manipulate the strike forces at his disposal. The immediate gains of speed, accuracy, and flexibility are puny in respect to the optimization and the effective use of resources possible through expansion of the initial computer base.

Not only will a commander and his staff be able to input directly their decisions and changes, but also possible is the ability to test possible strike force options. Assume that, due to deteriorating weather conditions, it is considered necessary to strike two targets as soon as possible. By inputting desired damage levels and the numbers of strike aircraft and ordnance available within the given time frame, the commander can determine if enough resources are at hand to strike both targets simultaneously or if they must be struck in a priority order.

Any number of variations can be tested, such as the number of aircraft for a desired level of destruction; the amount of fuel to be consumed by one force compared to another; the differences in total sorties required by various types of aircraft to destroy a given target. The number and uses of the program are limited only by imagination and ingenuity.

• **Intelligence.** The establishment of a frag generator logically leads toward a real-time intelligence system. If data on enemy targets and bomb damage assessment are added to the data base, and updating provided, current information would be available by demand printout to all users and this same information for use in the frag generator program. One excellent use of this feature lies in recording enemy defenses. If only a simple list of automatic weapons concentrations, AAA, and SAM locations is maintained showing type, location, and last reported activity, it will be feasible for the frag generator program to plot ingress and egress flight routes through areas of minimum defenses (*see Figure 4*). The goal of minimum losses in heavily defended environments is obvious.

With such a real-time intelligence data system, it also would be much easier to keep track of target status. If an important target is being struck repeatedly, at some point it is not practical to send further strikes against it—the target will be out of commission. By keeping target information in the data base, and by daily input of BDA, the planner can readily assess when the desired degree of target destruction is obtained. For example, if a target such as a road is struck and cut, the enemy will often bypass it. If the planner is not aware of the road cut, he could



True payoff in computerized strike force planning comes when commander is able to utilize the mechanized system to direct and manipulate the strike force at his disposal in the most flexible and responsive manner, including testing out of strike force options.

PLOTTING INGRESS-EGRESS ROUTES THROUGH ENEMY DEFENSES
BY THE FRAG-GENERATOR PROGRAM

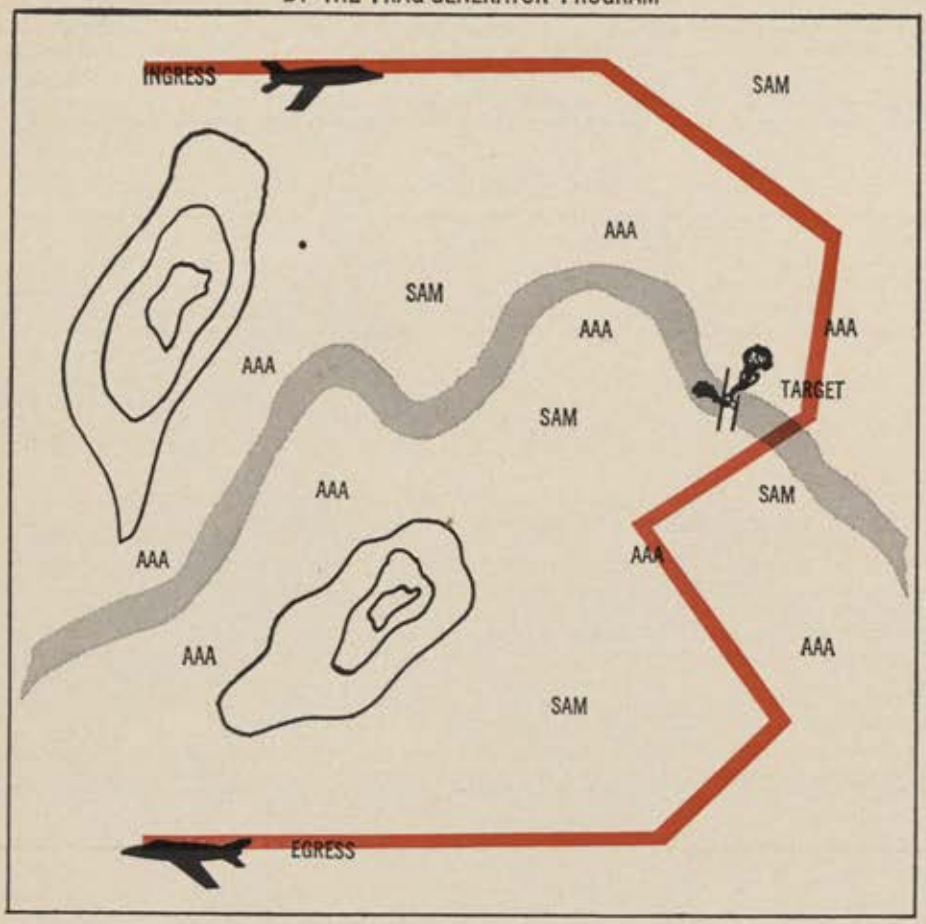


Figure 4. Plotting ingress and egress routes through enemy defenses presupposes real-time intelligence system that can plot routes along minimum defense paths. Inputs in the aggregate need not be more than a simple list of automatic weapons concentrations, and SAM and AAA locations. This information can be constantly updated with such additional data as the current activity of a given defense installation. Correlation between defense activities and target status is, of course, of further intelligence value.

frag a repeat strike on the road, whereas the bypass should be the target. The same conditions apply to bridges. The planner must have information available that the target is destroyed before he can frag the next priority target.

The concept of intelligence information in the data base linked to remote consoles at fighter wings is especially attractive. A flight leader could query the data base and receive a printout of the latest target information just prior to planning his mission, resulting in the most effective and precise strike results.

• **Rules of Engagement.** A similar by-product of automated data storage lies in the ability to store rules of engagement information. In current limited war operations where the level of escalation is stringently controlled, a welter of do's and don't's has evolved. Some targets are never to be struck, others only under certain conditions. Some areas are not to be flown over, others have altitude restrictions. Radio frequencies, procedures, and requirements are changed daily. With supersonic aircraft in a relatively small area, we may be approaching the limit of human perception in the number and type of restrictions that apply. A tremendous aid would be remote console use to obtain the latest rules of engagement for a particular area.

• **Airlift.** An allied function that is also very much in need of computer support is intratheater airlift. With the large numbers of transport aircraft, bases, and the amount of vital cargo, it is imperative that we utilize as near optimal scheduling as possible. Current efforts using a daily airlift frag generator based on linear programming and transportation model techniques may provide significant payoffs in allocating these resources.

• **Cost-Effectiveness.** If costing factors are added to the data base, it then becomes possible to compare costs and effectiveness. It may seem a bit remote to consider actual dollar costs in the daily combat scene, but a limited war of attrition demands that resources be used as effectively as possible. With such measuring tools, the planner can increase his own effectiveness in resource management. There, as options are tested to select the best effectiveness, he can also compare the costs of fuel, ordnance, attrition, time, etc., across his alternatives.

Within this setting, it is obvious that knowledge of limiting parameters is essential. Certainly, in planning any strike force, it is necessary to know exactly the proper amount of a given resource to use. Optimal use can very well depend upon maximum employment of the most effective weapon system. For example, often the most effective munition for a given target should be expended up to the limit of the logistics system. Or, for a certain target, no need exists to dispatch more than the strike aircraft required to achieve an expected level of destruction. In such cases, knowledge of the practical limits of strike force employment can be a vital asset.

(Continued on page 55)

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The number and uses of computer-based programs are limited only by the imagination and ingenuity of users and provide almost immediate test capability concerning optimum use of one aircraft type against another in such parameters as fuel consumption on a given mission. Commanders can readily establish sortie requirements to destroy given targets.

Going further into the problems of the operational planner management arena, computer services will permit finer discrimination through sensitivity analysis. For example, the cost and effectiveness of using one type of aircraft, ordnance, tactic, or technique compared to an alternative. This again is part and parcel of the war-of-attrition concept where the optimum use of each resource begs to be employed only for maximum payoff. Past successes of pure brawn and sheer force in combat should not necessarily be considered as the only way to win. Ingenuity, detailed planning, and optimal employment should be considered in every case. The optimum force necessary to do the exact task should be the guiding philosophy.

We must be prepared to employ our air forces in the most effective manner possible. We, as does the enemy, must pick and choose our engagements when we have all the advantages. In the war of attrition, the older concepts of "maximum effort" must be tempered with a finer judgment.

Conclusion

In this setting, the use of computer technology in scheduling, directing, and controlling the air strike force becomes imperative. There is a basic requirement for the speed, accuracy, and flexibility inherent in programming support. A commander needs the support necessary to make battle decisions at the latest practical time based on the most up-to-date information. The planner needs to be able to compare alternate courses of action, make simulated tests to prove and disprove options, and be able to assess costs and effectiveness of both potential and completed strike actions. An integrated and centralized computer system for command and control of combat operations is a very efficient instrument for effective strike force management.—END

Electronic countermeasure aircraft can be deployed more effectively through use of on-time intelligence concerning enemy's air defense installations and level of activity.

The author, Lt. Col. Paul L. Gray, is an Operations Analyst in the Combat Analysis Division, Operations Analysis, Hq. USAF. In November he delivered a speech on the subject of this article before a meeting of the Operations Research Society of America, held in Philadelphia, Pa. A native of Camp Crook, S. D., Colonel Gray is a graduate of Oklahoma State University and holds an M.B.A. degree from the University of Michigan. He entered the Air Force in 1950 and has served as a flight instructor in Training Command, as an F-86 pilot in TAC, and in flight test and aircraft maintenance at the AMC depot in Japan. He was an assistant professor in the AFROTC program at Colgate University in 1960-62, and in 1965 he was graduated from the Air Command and Staff School. In 1966-67 he served as a wing operations officer for F-105s in Thailand. He has written for publication in the Air University Quarterly Review. *This is his first article for* Air Force/Space Digest; *the views are his own and do not necessarily reflect those of DoD or the Air Force.*

The cloud of doubt blown up by Gordon Cooper's cloud of dust has settled. The astronaut's statement that during his twenty-two orbits in the final Mercury flight he saw such objects as houses, railroad tracks, and even a dust cloud produced by a moving vehicle, was treated with derision and disbelief in some quarters. And considerable data were on hand to "prove" that such sightings were impossible. However, a scientifically respectable report on the astronaut's claims apparently confirms that . . .

Man's Eye in the Sky Is Sharp Indeed

By J. S. Butz, Jr.

TECHNICAL EDITOR, AIR FORCE/SPACE DIGEST

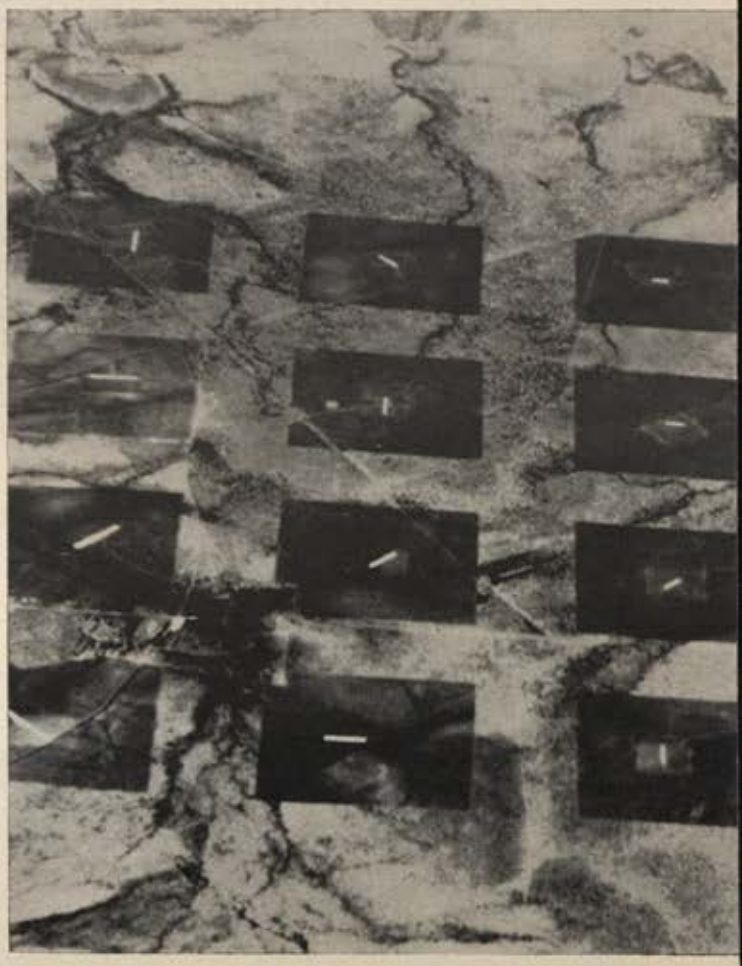
IT'S finally official. A scientifically acceptable report has been published backing up the astronauts' claims that they could see ships, trains, trucks, and houses from orbit when conditions were right.

The final report in the Gemini program visual-acuity experiment has been submitted to NASA by a group at the University of California, San Diego. The basic conclusion of this report is that humans can see small objects from much greater heights than was generally believed possible before the first spaceflight.

The new report, just published by S. Q. Duntley, R. W. Austin, J. L. Harris, and J. H. Taylor of the Visibility Laboratory, Scripps Institute of Oceanography, University of California, San Diego, marks the conclusion of a five-year effort to determine exactly what a man can see from orbit. Their study began at NASA's request shortly after the adverse and vociferous reaction to Maj. Gordon Cooper's statement that he saw trucks, houses, railroad tracks, and trains during his twenty-two orbits on the final flight in the Mercury program.

Both laymen and scientists expressed strong doubts about Astronaut Cooper's report, with the reaction running from complete rejection of his objectivity, to postulations of new "principles" applicable to man's behavior in orbit. Some prominent psychiatrists strongly suggested that weightlessness was causing the astronauts to hallucinate and that the space program was in for serious trouble.

Most of these doubts were the result of the rather wide understanding of the standard clinical wall chart (the Snellen chart) technique for determining visual acuity. This common eye chart test is based on the idea that a person has "perfect vision" if he can recognize letters that subtend one minute of arc (0.017



The big eye chart on the ground (above) was used to test the ability of astronauts to see from space. The white rectangles were 200 to 500 feet long, and the astronauts had to call out their orientation with respect to north.

The ability of men in space to observe orbiting spacecraft has proved to be significant. Their depth perception, estimation of closing rates, and ability to estimate relative orbital paths has been good. Even though man's senses are no match for rendezvous radar, it is believed that the astronauts could "eyeball" the terminal phase of a rendezvous if the radar/computer system failed. Photo shows December 1965 rendezvous of Gemini-6 and -7.

degrees). By identifying letters 0.07 inch high when standing twenty feet from the Snellen chart, a man qualifies for the 20/20 rating, or perfect vision. In other words, he has looked into a cone, the apex angle of which is 0.017 degrees, and he has recognized the object at the cone's base.

Applying this Snellen measure to the Mercury-9 flight with its orbital altitude of about 100 miles, most people who bothered to check came to the conclusion that Cooper could not possibly see an object that measured less than about 150 feet on a side. The very large difference between this calculated value and Cooper's report led to the uproar.

Cooper's reports certainly were enough to awaken very strong curiosity. First, he said that he saw a dust cloud from a vehicle moving along a dirt road paralleling the US-Mexican border near El Centro, Calif., and that he believed the vehicle at the head of this dust cloud was white. (It was later established that a dirt road did exist in this area and that it was traveled by Border Patrol officers in white International Scout vehicles.)

Second, Cooper reported seeing a large vehicle traveling on an east-west dirt road on a Tibetan plain about 16,000 feet high. (It was later calculated that there was a fifty percent probability that Cooper was correct in this sighting.)

Third, Major Cooper said he saw what he believed to be buildings with smoke coming from them on this same Tibetan plateau. (Using National Geographic photographs and other information on the area, the University of California investigators concluded that Cooper saw multifamily dwellings which measured some twenty-five feet on a side and had a very high contrast with the brown plain.)

The fourth specific sighting by Cooper was a railroad track in western China with a cloud of white smoke at one end which he interpreted to be coming from a moving train. (Later study led to the evaluation that such a track does exist and that there was a ninety percent chance that Cooper saw what he said he saw under the existing conditions.)

During most of the rest of his flight, poor atmospheric conditions prevented Cooper from seeing the ground clearly. However, astronauts on other flights reported somewhat similar sightings, including large ships in midocean. Soviet scientists at technical meetings also attributed such observations to their cosmonauts.

In their report, which ended with the conclusion that Cooper and the other space travelers were basically correct in their reports of observations, the University of California group offered several reasons for the common misconceptions about visual acuity in space.

A major reason is that the vision of most astronauts is considerably better than 20/20 on the Snellen chart. Cooper, for example, is 20/12, which means that he can see an object that is no bigger than 0.6 minutes of arc.

In addition there are numerous other measures of visual acuity. One which is crucial in observations from space concerns the fact that a man can see very thin wires if they stretch far enough across his field of view. It has been shown through measurements that men with good vision can detect wires down to 0.007 arc minutes in diameter, and that they can see dots no bigger than the wire if the dots are located at the end of the wire. This phenomenon is believed to be responsible for man's ability to identify roads, vehicles at the head of a dust cloud, and ships at the

(Continued on following page)

end of their wake from altitudes of 100 miles or better.

In addition to the size and shape of objects, the other major factors in eyeball observation from space have been found to be contrast and brightness. As would be expected, white objects have been far more visible against a black background than against a light one. Point sources of light also are highly visible, just as stars which subtend a very small arc angle are visible from the ground on a cloudless night.

To scientifically establish the capabilities of man during spaceflights up to fourteen days, NASA and the University of California group devised a visual acuity experiment, which was run during Gemini-6 and Gemini-7. First objective in this experiment was to determine if weightlessness or the other stresses of orbital flight had any effect on an individual's acuity. This was done by using a small, hand-held precision instrument resembling a pair of binoculars. A wide variety of test patterns with a wide variety of contrasts could be presented with this instrument. The crews of the two Gemini missions took the test dozens of times during their flights, and the resulting mass of data left no doubt that orbital flights up to fourteen days did not affect their vision in any way.

The second part of the Gemini visual-acuity experiment was much more difficult to conduct. It involved construction of an eye chart on the ground which could be read by the astronauts from orbit. This eye chart consisted of rectangular white bars located on background squares that ranged from white to black in tone to provide a variety of contrasts (*see photo, page 56*).

The white rectangular bars could have four orientations: north-south, east-west, northeast-southwest, or northwest-southeast, and these could be varied between orbital passes. It was up to the astronauts to call out these orientations as they orbited past the eye chart.

Only a small number of identifications on this eye chart were possible due to bad weather and the short time available to the astronauts to acquire and read the chart. However, these identifications established that the astronauts' visual acuity was similar to that measured with the hand-held vision tester and the sophisticated tests made under controlled conditions on the ground.

Certainly the data that were gathered leave no doubt that commonly held notions about man's visual acuity from orbit were grossly in error.—END

Gordon Cooper caused a major stir in the lay and scientific communities when, during the final Mercury flight, he reported seeing much smaller objects on the ground than any previous space flyer had. His sightings have now been confirmed.

Most US spacecraft crews, and probably crews of the USSR, have been treated to excellent views of Cape Kennedy (above) when the weather was right. The astronauts have reported seeing launch pads, roads, and even buildings.

Upper rocket stages, such as this Agena with malfunctioning nose shroud, have been used in successful station-keeping experiments. Astronauts tracked them with the aid of flashing lights and could maneuver near them with precision.

SPACE DIGEST

THE SPACE AGE IN PERSPECTIVE

Technology • Education • Science and Public Policy

Bringing America's Schools into the 20th Century . . . How You Can Help
A Special Message to Air Force Association Members

This January 1969 issue of SPACE DIGEST is devoted in its entirety to what took place on November 18, 19, and 20, 1968, at a remarkable conference sponsored in Washington, D.C., by the Air Force Association's Aerospace Education Foundation. The meeting, first of its kind in educational history, was called the National Laboratory for the Advancement of Education. Its purpose was to bring together educators, citizens, government officials, and industry representatives to explore and to see "live" the vast potential of space-age educational technology and innovational teaching techniques, geared to individualized instruction for every youngster, black and white, poor and affluent, urban and suburban, in our country.

The Air Force Association's continuing interest in education, expressed through its Aerospace Foundation's programs, is particularly appropriate to our organization. AFA has always taken the view that an enlightened citizenry is crucial to the strength and security of our nation. For an eloquent statement of why we are engaged in this vital undertaking, I commend you to the declaration (on one of the following pages) by Dr. Leon Lessinger, who has just completed a term as Aerospace Education Foundation president.

I hope every AFA member will study the following special report in depth. Once having done that, I earnestly urge every member to do what he can to see that the report is seen by local school board people, by teachers, by Parent-Teachers Associations, by his friends and neighbors.

Change and innovation—in the spirit of the aerospace world of which we as AFA members are especially active citizens—are vital to the cause of improving our schools and strengthening our society. If each of us will work to spread the word of what *is* being done, and what *can* be done, to bring our schools into the space age, then we will have made a major contribution to the future of our children and of our country.

Robert W. Smart

Robert W. Smart
President, Air Force Association

NOTE—Reprints of this special section on the National Laboratory for the Advancement of Education will be available shortly. Order from:

Aerospace Education Foundation
1750 Pennsylvania Ave., N.W. • Washington, D.C. 20006

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In its continuing search for new and action-oriented approaches to the infusion of innovative techniques and modern technology into America's schools, the Aerospace Education Foundation, AFA's educational affiliate, sponsored, in November 1968, a remarkable, first-of-its-kind, conference geared to the concept of individualized learning for our space-age children . . .

The National Laboratory for the Advancement of Education

A Special Report

BY WILLIAM LEAVITT

Senior Editor/Science and Education, AIR FORCE/SPACE DIGEST

THE time was the space age.

The scene was an aging red-brick elementary school in downtown Washington, D. C., a structure squeezed uncomfortably between an apartment building and the sleek new Washington Hilton Hotel.

The dialogue was between a bright-eyed little girl, a sixth-grade student in the school, and Dr. Robert Mager, Director of Research for the Aerospace Education Foundation, nationally recognized educational affiliate of the Air Force Association.

The girl asked Dr. Mager: "What happens after Wednesday? What happens when it's all over? Do we forget what we learned?"

Dr. Mager's answer expressed the candor an honest adult must show a child. He said: "I don't know."

Minutes before, the little girl and a number of her classmates had been briefed by Dr. Mager on a very special experience they would all be having for three days, at the hotel next door. They would be, Dr. Mager told them, guests and "stars" at an event the grown-ups called the National Laboratory for the Advancement of Education. At the Laboratory, they would attend a new kind of class where they would be learning in a new kind of way. The teachers would not lecture to them in the usual style and the children would not sit in the neat little rows they were accustomed to.

Instead, Dr. Mager went on, they would be grouped around comfortable tables or maybe even sit on the floor. Each child would work on his own "individualized" learning program, which the visiting teachers from Duluth, Minn., who would be their instructors, called "contracts." Each youngster would study at his own pace, using his "contract" as a kind of lesson guide that would lead him through a sequence of learning goals. The children would have full freedom to move about the classroom as they went about their lessons, and they would be able to choose from a wide array of audiovisual equipment, ranging from film projectors to tape recorders, to help them learn. They would operate the equipment themselves. Also, Dr. Mager said, the youngsters, if they chose to, could work with schoolmates on learning projects, and they could, whenever they wanted to, have a conference with the teachers. And very important, too, it would be up to *each child* to let the teacher know when he thought he was ready for a test on what he had learned.

The briefing at John Quincy Adams School was a small but significant part of the preparation for one of the most remarkable national educational meetings in recent history, the first National Laboratory for the Advancement of Education. The Laboratory was sponsored by AFA's Aerospace Education Foundation, in cooperation with the U.S. Office of Education and the District of Columbia public school system. Supporting organizations included the National Education Association, the U.S. Office of Economic Opportunity, the National Catholic Education Association, the National Aerospace Education Council, and the Education for the 70s Executive Committee. The meeting took place at the Washington Hilton Hotel on November 18-20.

The theme of the National Laboratory was "Individualized Education for the Inner City." The idea of the conference—attended by more than 1,600 representatives of the professional educational community, industry, and government, from all fifty states and the District of Columbia—was to present to a knowledgeable and national audience *live* demonstrations, using

It was standing room only during most of the formal panel sessions at the National Laboratory. Each morning a battery of educators and reactor-critics "told it like it is." In the evenings Lab participants returned to the Washington Hilton's conference hall to hear the day's panelists field critiques from the more than 1,600 people who attended the unique meeting.

—Photo by Robert deGast, Magnum

live students, of some of the most creative and innovative instructional techniques being used around the country. The participants ran the gamut from Air Force training and education specialists to public, parochial, and private school teachers and administrators. They had not only the opportunity to see live classroom demonstrations, but they also, in formal and informal seminars, were urged to comment on what they had seen, by means of a truly space-age communication technique called Tele-Critique.

Used for the first time at a national education conference, Tele-Critique worked this way: Anyone attending the National Laboratory could pick up a SAC-like red phone (they were scattered strategically around the Hilton Hotel) and feed his bouquets or brickbats into a master tape-recording unit. The recorded comments were analyzed by the Foundation staff virtually on receipt and then fired back at the battery of leading educators who appeared at the heavy schedule of panels each morning and evening during the three-day Laboratory meeting. There was a continuous exchange between conferees and speakers. It was a truly McLuhanesque space-age "real-time" media-oriented environment in which ideas freely circulated, and often collided.

In addition to the live classroom demonstrations, each of which ran three "shows" a day for three afternoons, and the morning seminars and evening "talk-back" sessions, National Laboratory participants had the chance to see, every day, films on educational innovations plus a striking array of educational "hardware" and "software" exhibits produced by the burgeoning educational-technology industry—including a number of major aerospace and systems technology firms—as well as USAF and various US government agencies (*for full list of exhibitors, see page 79*).

Laboratory participants heard a parade of speakers ranging from a dedicated high school teacher named Grace Turner, who has worked, often against overwhelming odds, for thirteen years in the Watts section of Los Angeles, to the Superintendent of Schools of Duluth, Minn., Dr. L. V. Rasmussen, the man who sparked the remarkable experiment in individualized instruction described elsewhere in this report and who is also the newly elected president of AFA's Aerospace Education Foundation.

The three-day theme of the formal morning seminars was "Individualized Learning for the Inner City." First-day speakers included Mrs. Turner; outgoing Aerospace Education Foundation president Dr. Leon Lessinger, now Associate Commissioner for Elementary and Secondary Education in the U.S. Office of Education, Washington, D. C. (who also served as National Laboratory general chairman); Dr. William R. Manning, Superintendent of Schools, District of Columbia; Dr. Robert F. Mager, of Mager Associates, educational consultants, Los Altos Hills, Calif., and Director of Research for the Aerospace Education Foundation; Elayne Kabakoff, a teacher at Woodland Avenue School in Hicksville, Long Island, N. Y.; Peter Wing, a high school student from Englewood, N. J.; Dr. Rasmussen; and Mrs. Carolyn B. Lewis, president of the Parent-Teachers Association at Syphax School, an inner-city school in Washington, D. C.

Keynoting the conference, Mrs. Turner told conferees that "our system of education has become disoriented chaos."

She declared that "we must reevaluate and reorient ourselves toward clearly defined goals. . . . We must define what is needed most to prepare our youth for positive contributions to society, to prepare them for financial independence. . . . We have passed children from one grade to another without cause. We have become so concerned with eliminating failure that we have limited learning. Our emphasis has been on memorization of words and concepts which mean nothing to the ghetto youngster. It should not surprise us that they are bored and uninterested."

The opening day's speakers picked up on Mrs. Turner's appeal, and each from his professional or citizen's vantage point addressed the theme of individualized

Toward total societal involvement in education . . .

Why the Aerospace Education Foundation?

BY DR. LEON LESSINGER
Associate Commissioner, Elementary and Secondary Education, U.S. Office of Education

The following is excerpted from remarks by Dr. Lessinger at the awards luncheon of the National Laboratory on November 19, 1968. Dr. Lessinger, 1967-68 President of the Foundation, was General Chairman of the Lab.

"Why the Aerospace Education Foundation?"

I have been asked that question many, many times. I asked it myself when I first was exposed to the Aerospace Education Foundation two years ago. I since have been involved in Foundation programs ranging in subject areas from driver safety education to vocational skill training, to educational technology, to values education, to this National Laboratory for the Advancement of Education.

Why this wide range of activity from an aerospace-oriented group? As an Advisory Committee member, as a trustee, and finally as President of the Foundation, I've gotten answers to this question. Let me cite them.

My military experience was Army—in World War II. I have had little background in the wild blue yonder. But I have learned that the world of aerospace is *far from that.*

People who work in the aerospace world are on the frontiers of technological advance. They think in terms of total objectives. They have pioneered the systems approach in getting big jobs accomplished. They are realistic about the present, but they think in futures. Research and development is not a fringe benefit for them, but a basic ingredient in their work. Change is not an emergency measure, but a way of life.

So it wasn't surprising that a decade or so ago educators began seeking out the leading aerospace organization in the country—the Air Force Association—as a way for them to get closer to the trends in our modern age.

Technological revolution was all around the educators, but it had not yet entered their classrooms. It isn't surprising that the Air Force Association, in response, formed the Aerospace Education Foundation, with a separate Board of Trustees and always with an educator as chief executive officer.

It's important to understand the role the Foundation has played in advancing educational research and development. A few years ago, when this was a major issue before the Congress, the Foundation was the *only* layman's organization invited to testify at hearings on educational research and development.

Foundation spokesmen pointed out to Congress, for the first time, the low status of educational research and development expenditures relative to R&D expenditures for health, Welfare, defense, agriculture, and so forth.

The Foundation was oriented to an aerospace world in which about twenty percent of the total annual investment was spent on futures, on innovation—contrasted with an educational world that invested *one-tenth of one percent* in futures—in research and development. This was the thrust of the Foundation's message to the Congress, and I have good evidence that this type of testimony, new to the committees of Congress, helped force a breakthrough in today's new approach to educational research and development.

Add to this the fact that in education, especially in the inner city, we have to play what football coaches call "catch-up ball." This means innovation, new approaches, especially in qualifying the disadvantaged to find jobs and a meaningful place in our society. Here the contributions of the United States Air Force in developing advanced teaching techniques, including its pioneering work in programmed instruction, provides a vast reservoir of experience and validated data.

A great part of the Foundation's total effort is devoted to the adaptation and transfer of this educational experience from military to civilian classrooms. It isn't surprising, therefore, that the Foundation should be supporting effective teaching practices in our public and private school systems or that it should be recognizing them, as never before, in this National Laboratory for the Advancement of Education.

The National Laboratory is a milestone in the history of the Aerospace Education Foundation. But I think of this event not as a climax, but as a beginning. Let me say why.

Sooner or later, and the sooner the better, *all* elements of society must become not merely supporters of, but active participants in, the educational process. This means, to begin with, a close working relationship between the educational community—especially the student—and industry and the professions, civic leaders and government, local, state, and national.

The Foundation already has established this working relationship. And the perennial barriers to action in advancing educational concepts and practices are, happily, missing in this organization. The Aerospace Education Foundation represents a new avenue toward the total involvement of our society in education. We can all be grateful for this leadership.—END

instruction as a positive approach to the educational ideal of one-teacher-to-one-student.

Superintendent Manning spoke of the hopes of the Washington, D.C., schools to implement individualized instruction on a city-wide basis. Miss Kabakoff reported on an individualized-instruction program in her school. Student Peter Wing spoke of the rewards he was receiving from a self-generated research program he was being encouraged to pursue at his high school. Dr. Rasmussen suggested how individualized instruction could respond positively to the many justified criticisms of militants and conservatives of the shortcomings of education. Mrs. Lewis, as a parent, spoke of how parents and teachers could, where there was the will, work together in the encouragement of children's innate urge to learn.

After giving their presentations, the first-day panel faced up to the comments and critiques of an array of "reaction-panelists" including Dr. C. Ray Carpenter, research professor of Psychology and Anthropology at Pennsylvania State University; Mrs. Elizabeth Koontz, president of the National Education Association; Dr. Ben Wallace, Superintendent of Schools, Mineola, N.Y.; and Dr. Charles H. Boehm, former Commissioner of Public Instruction, Commonwealth of Pennsylvania.

The seminar pattern was the same for the second and third mornings of the conference. The second morning session opened with an electronic puppet presentation produced by Air Force Col. and Mrs. Leo Beinhorn, dramatizing the plusses of individualized instruction. Second-day speakers were led by Doctor Mager. He sounded the warning that, although the National Laboratory—in its hopes to alleviate a crisis in the urban schools through the encouragement of individualized instruction—was concentrating on inner-city dilemmas, the same problems already were afflicting the suburban schools. He declared that rising costs, administrative rigidity, and taxpayer resistance to school funding were plaguing the suburbs too and that "today's urban disaster is but a prelude to tomorrow's suburban catastrophe."

"Making Individualized Instruction Work" was the second-day theme. Speakers included Thorwald Esbensen, Professor of Education at Florida State University, Tallahassee, and a veteran of the Duluth experiment. He reported in depth on the Duluth effort. Polo C'deBaca of Westinghouse Learning Corporation described a program developed by his company in which concentrated individualized instruction has successfully, on a money-back basis, sharply improved many youngsters' reading, mathematical, and other skills. Dr. Joseph Lipson, Professor of Science Education, Nova University, Ft. Lauderdale, Fla., spoke of the need to instill in teachers the insights and motivations required for the management of individualized instruction programs in the schools. Charles F. Adams, president of MIND, Inc., Greenwich, Conn., noted the increasing failure of public education to prepare youngsters for meaningful roles in society. He urged an infusion of proved training and education methods developed by business into the general education system in the US.

Following the pattern of the formal seminars, after making their presentation, the speakers fielded live critiques from an array of reactors including Benjamin Henley, Vice Superintendent of the Washington, D.C., schools; Mrs. Turner; Dr. Cleveland L. Dennard, president of the Washington, D.C., Technical Institute; and Dr. Robert Johns, President of Sacramento State College in California.

—Photo by Robert deGast, Magnum

Westinghouse Learning Corp.'s Polo C'deBaca, who reported on his company's remedial program in basic academic skills, chats with Lab participants after panel talks.

By the third morning of the conference, most Laboratory participants had viewed several of the live classroom demonstrations, seen several of the films in the Special Education Theater (an enormously popular feature of the educational-technology exhibit), had fed their comments into the Tele-Critique phones, and had attended the hot-and-heavy evening "talk-back" sessions.

Returning for the final, third-day morning sessions, devoted to the theme of moving ahead, they heard a new array of speakers who covered subjects ranging from the future of labor unions in education to the potential of high school work-study programs, and including such other subjects as the space-age comprehensive high school, the crisis in school facilities and logistics, and the vital question of how to instill a sense of social values in school children.

Featured speakers included Dr. Robert M. Morgan, Director of Educational Research and Technology, Florida State University; John A. Sessions of the Department of Education of the AFL-CIO and a member of the Washington, D.C., Board of Education; George Probst, Executive Director of the National Commission for Cooperative Education, New York City; David Bushnell, Director of the U.S. Office of Education's Division of Comprehensive and Vocational Education Research; Dr. Harold D. Gores, President of the Educational Facilities Laboratory, New York City; Dr. Sidney E. Simon, chairman of the college of education, Temple University, Philadelphia; Joshua L. Miner III, president of Outward Bound, Andover, Mass., a unique international character-building training program for young men; and Robert F. O'Neil of the Federal Aviation Administration.

The third-day panel faced, in their turn, a panel of educators-reactors that included Dr. Edward W. Brice of the U.S. Office of Education; Dr. Doris Kearns, Special

—Photo by Robert deGast, Magnum

Live feedback from participants—comments and criticisms for panelists to field—was received throughout the Lab by the use of unique SAC-like "Tele-Critique" telephones.

—Photo by Robert deGast, Magnum

These two tots have just had their introduction to the Responsive Environments Corp.'s "talking typewriter" in classroom demonstration sponsored by NY Board of Education.

Assistant to President Johnson; Dr. Gabriel D. Ofiesh, Director of the Center of Education Technology, Catholic University, Washington, D.C.; and Dr. Norman Boyan, Acting Associate Commissioner for Research, U.S. Office of Education.

Specially honored at the meeting was Marion B. Folsom, former Secretary of Health, Education and Welfare, who received an award for his major role in the enactment of the National Defense Education Act in 1958. He received the Air Force Association's Hoyt S. Vandenberg Trophy, with AFA President Robert W. Smart making the presentation.

But with all the homework the grown-ups attending the Laboratory had to do, just to keep up with the fast-paced live quality of each day's sessions, the emphasis throughout was on the prime purpose of the conference: the live demonstration of innovative teaching methods geared to individualized instruction in an era of incredibly rapid social and industrial change.

Each of the ten classroom demonstrations—honored with Aerospace Education Foundation Awards presented by Foundation Board Chairman Walter J. Hesse—told a different and exciting educational story. Patterson Cooperative High School, Dayton, Ohio, reported live and on film on its successful experiment with a school-industry work-study program. At Patterson, high school students sign up for a program of alternating periods of schooling and paid employment in jobs relevant to their academic studies. The program has worked so well that some 150 business firms in the Dayton area look to Patterson Cooperative High School for a large number of their workers.

San Francisco's GLIDE Urban Center, an exciting experiment in bridging the generation gap, focused, against a backdrop of psychedelic-style films, on animated dialogues between adult ministers and activist youth. The idea was to encourage understanding of the present traumas of youth in a world of instant information, a media-oriented world. How do you handle teen-age runaways? Can you "organize" street "gangs" for constructive community roles or sponsor hippie celebrations that appeal to rebellious young people and achieve positive results while at the same time earning and retaining the trust of the young? GLIDE's nonconformist approaches to such dilemmas were explored in depth.

For the first time, Duluth, Minnesota's exciting program in individualized instruction, now operational in seven schools, including an inner-city school in that midwestern city, was shown to a national audience. Duluth teachers, all veterans of the program, worked with students from the District of Columbia schools in a remarkable display of the effectiveness of individualized instruction at the elementary level. If the size of the crowds of Laboratory attendees who lined up daily for the Duluth demonstration was any indication, the Duluth classroom was the hit of the meeting.

Laboratory participants also had a chance to view some of the military's innovative achievements in individualized training and education. The US Air Force, author of many innovations in the field of programmed learning, showed airmen taking learner-centered instruction in such military career fields as medical technology, electronic maintenance, fuels handling, and administration. Shown in the Air Training Command classroom demonstration was a working multimedia programmed-instruction system that allows students to combine self-paced individual learning with group instruction.

"Learning to Learn" was the theme of the host public school system's live classroom demonstration. Washington, D.C.'s Tri-School District, located in the city's Southwest urban-renewal area, showed how children, from kindergarten through the sixth grade, can be motivated to learn through the discovery method in which they explore and progress, each at his own pace, aided by a combination of applied technology and effective teaching techniques. In the Tri-School demonstration, observers could watch the process of discovery as it happened, beginning with a tot exploring the alphabet on a specially designed typewriter, hitting the keys at random, and culminating with a group of youngsters working with a teacher and a viewgraph machine on improving their reading skills.

At the San Mateo, Calif., Union High School District classroom demonstration, the theme was a real-world problem for youth *and* adults: drugs. While high-schoolers borrowed from the D. C. school system partici-

—Photo by Robert deGast, Magnum

In addition to "Tele-Critique," Lab participants were encouraged to fill out evaluation sheets on the conference, to assist planners in programming successor Lab meetings.

pated in the class, the audience followed the action. Entitled "LSD: The Trip Back Home," the San Mateo demonstration took the students, seminar-style, via film and headphones, through a realistic, nonmoralistic, and objective visual presentation on the effects of drugs. This set the stage for reactions and views from the students. As observers entered the classroom, they were handed workbooks which guided them through the discussions as the instructor took the youngsters on their trip back "home" from the bizarre world of hallucinogens.

From Baltimore's inner city came a demonstration featuring twelve adult students, including several high-school dropouts, who were taking "second-chance" training to become electronic technicians—but with a "tell it like it is" motif. Combined with the occupational training was a course in simulated "slice of life" encounters with on-the-job problems. Guided by an instructor and using audio and video tapes, students saw potential work situations involving the bitter realities people often have to face on the job—prejudiced supervisors, envious fellow workers, and the like. As situations were projected, each student was asked for his response. They were often personal, very intense, and more than enough to stimulate excited discussions.

The idea of the Baltimore Radio Electronics Television School program, developed by MIND, Inc., was to make the point to student *and* viewer that skill training is not enough for occupational success, that understanding and the ability to handle the interpersonal relationships, to survive in what is often a jungle, is the real key to "making it." For some of the observers, the live dialogue was a revelation that brought home the realities of what life is like in the inner city.

Observers had the chance, too, to see live, from Brooklyn, N.Y., a demonstration of the New York City Board of Education's Responsive Environment Program, featuring a "talking typewriter" multimedia system developed by Responsive Environments Corp. The system reinforces reading and writing abilities at all grade levels, from kindergarten children to functionally illiterate adults. The REP demonstration showed both first graders and junior high schoolers being briefed on and using the "talking typewriter" with its interrelated network of typewriter, projector, viewer, speaker, and voice recorder. In concert, the hard- and software allowed the students to answer questions, project illustrations, and solve problems, each at his own pace.

New York Institute of Technology, Westbury, Long Island, a pioneer in the field of computer-managed instruction, devoted its demonstration to the theme of revolutionizing classroom management and school administration through cybernetics. As an example of computer-managed instruction in action, NYIT's demonstration showed a physics course featuring a student study booth with a video tape recorder and playback unit. The student in the carrel worked from scrambled texts with old-fashioned paper and pencil, but as he recorded his answers they were noted on IBM punch cards and checked for accuracy by the computer, which then printed out an analysis of his strengths and weaknesses. For the student, the computer served as an aid in the diagnosis of his individual progress. For the school administration, it helped provide not only a continuing and nearly "real-time" view of the student's progress but also guidelines for the improvement of instruction.

"New Styles of Teaching," the classroom demonstration by the Pennsylvania Advancement School, an unorthodox institution located in a midcity Philadelphia factory building, was in effect an instant teacher's workshop. The audience itself—after viewing a fast-paced minicinerama-style film depicting the techniques used at Pennsylvania Advancement to prepare teachers for dealing with underachievers—on short notice broke into small groups to exchange views on their own teaching experiences. These "instant dialogues," mostly among people who had never laid eyes on each other before, were so successful that people had to be urged to clear the room for the next influx of Laboratory attendees. As they left, you could hear them continuing their dialogues, talking of everything from unconscious racial bias to the pros and cons of psychodrama in the teaching process.

The National Laboratory for the Advancement of Education was something new in the way of educators' meetings. The newness was rooted in the idea of bringing together for meaningful dialogue, in one place and at one time, the many partners—teachers, administrators, governmental officials at all levels, military innovators, university researchers, and industry—in the endeavor of American education. The idea was not only to bring these many partners together to explore the crisis in American education and search for new ways to approach the ideal of one-teacher-to-one-student through the intelligent and humanistic use of modern technology buttressed by advanced educational philosophy. The purpose also was to show, in a variety of demonstrations, what some of the nation's most creative educational innovators around the country are doing and how they're doing it.

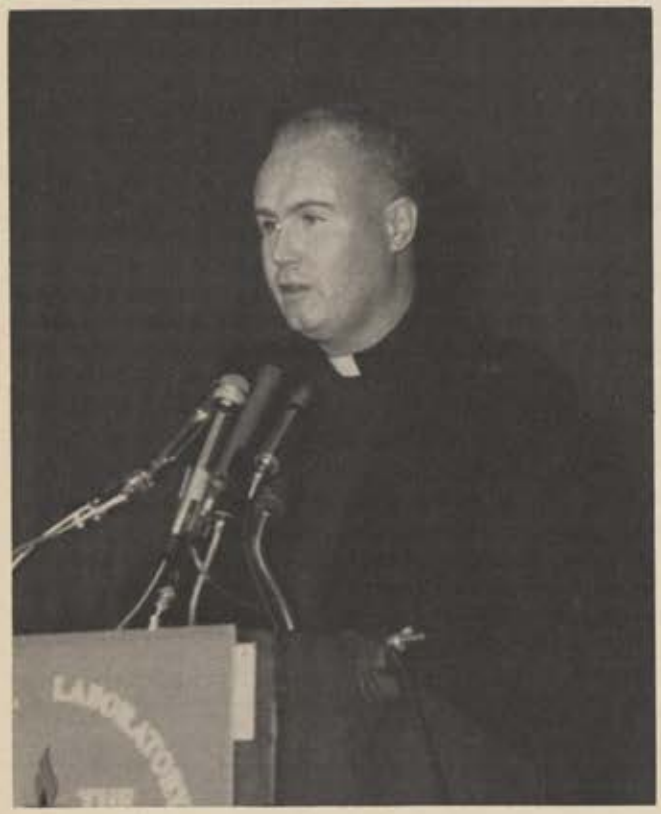
That was what the Laboratory was all about. The next one is scheduled for January 26, 27, and 28, 1970, in the capital, at the Washington Hilton.—END

We are living in a period marked by fantastic change and trauma, forcefully reported to us by the instantaneous communications media. The media, in turn, have created an electronic-information world in which our children have grown up and in which they—not we, the older heads—are natural citizens. Thus, the traditional approaches of spooning out information to the young as we think they are ready for it is no longer valid or workable. This situation demands an urgent emphasis, especially in education, on . . .

Changing Resistance to Change

BY THE REV. JOHN M. CULKIN, S.J.

Director, Center for Communications, Fordham University



Father Culkin is a noted Catholic educator who has specialized for a number of years on the impact of media on modern society, with a special emphasis on the visual media: films, instructional television, educational technology, and the arts. He received his doctorate from Harvard University and wrote his doctoral thesis on film study in the high school. This article is adapted from his presentation at the National Laboratory for the Advancement of Education, held in Washington in November 1968.

NO generation in the history of the world has ever been asked to change as fast as we have. This accelerated rate of change has created situations in which we all are trying to operate as best we can. Yet we are not helped very much by the experience and wisdom of the past.

One of the central causes of our dilemma and a matter which has a great deal to do with students has been the whole revolution in communications and transportation. I remember thinking about a year ago, when David Sarnoff of RCA was celebrating his sixtieth year in the communications business, that between the time he went to work as a fifth-story telegrapher for Marconi and the time he became chairman of the board of one of the largest communications enterprises of the world, the whole world of technical communications that we know had come into being.

I tried to imagine what it would be like in our current culture if we were to remove from the life of the student and his family and community all the technological communications equipment that has either been developed or proliferated since 1900.

Children in elementary school watch TV between twenty-five and thirty hours a week, high school students fifteen hours a week, adults fifteen to twenty hours a week. By the time a child starts school, he has already seen the faces of every kind of person in the world. Many of our children have gone through a *triple* assassination experience. They have visited every place in the world, seen all kinds of animals, seen the stupidities of the adult world. They have been exposed to a lot of nonsense, exposed to a lot of commercials. They have spent between 3,000 and 5,000 hours watching television by the time they get to the first grade.

Thus the old-fashioned analogies about the empty bucket or blank page which educators were supposed to fill are all gone.

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No generation in history has been asked to cope with change coming on at the accelerated rate we are experiencing now. For our youngsters' welfare, we must learn to cope with such change. Actually, it is they, not we, who are the natural citizens of the electronic world of instant communications. One of the important consequences is that we can no longer spoon out information to them as we decide they are ready for it.

If you take all these statistics and add them up, by the time the average student gets out of high school he has watched 15,000 hours of TV and gone to school for 11,000 hours. These figures almost double for some students in the inner city, where television is often one of the few ways they can amuse themselves or be educated.

So, if we take away TV, we take away the most important bit of technology in our culture today. If we take away radios, if we take away telephones, record players, all the fancy bits of journalism, if we eliminate the movies, and imagine what life would be like, we can begin to realize how in such a very brief time the whole media-environment has become interstitched into the fabric of our everyday life.

We must realize that every night there are some sixty or eighty million people who with great devotion follow the programs on TV. When we consider today's student, we have to think of him as a citizen of the electronic world, because he has been born into a world in which television has been added to the panoply of other communications devices.

The older generation was born into a world where there was no television. It grew up in that world. In today's communications-oriented world the *kids* are the natural citizens and *we* are the visitors to this electronic terrain. This really inverts the normal order of things as established before the media-world arrived.

Formerly, when school and church and family and government set down a kind of pace at which the young of the tribe were to receive their information, there was a pretty good chance of making it stick. There was a great deal of consensus within the community, and the intruders or rival communicators did not exist to the extent they do now.

We hear a lot of talk about the generation gap. One of the real problems today in dealing with young people —let us take teen-agers as a group—is that there is hardly any gap between the informational world of the adult and the informational world of the child. At one time, family, church, home, and government could pretty much cull the informational input into the life of a student. But that is no more.

There used to be a gap because the adults had possession—just to talk in very quantitative terms—of a great deal of information, and they yielded this information serially to students throughout the grades of school as they became ready to accept it.

Now, whatever the merits of that kind of world—and they were substantial—it no longer exists. We live in a free flow of information to which almost everybody has access. This is difficult to deal with.

Today's schools are faced with testing the relevance of what they are doing in the classroom against the relevance of what the student experiences outside the classroom. And there is more total information being pumped into the student's world *outside* the classroom than there is inside. Also, the degree of competency involved in the tasks and the information that the student perceives *outside* the classroom have changed. I have a friend in New York who is working on a one-minute commercial to sell soap. The budget just for the filming of that one-minute commercial is $150,000. That probably means it will be a one-minute commercial within a program which itself won't cost that much.

It also means that the students whose psychological intake systems are very much conditioned by what they perceive on television and on film and the radio will be seeing on Channel 2 programs that are produced with a great deal of technical competency, whatever the aim. Yet the next morning they may go to school and watch a program in instructional television that may, for a half-hour's worth, have cost on the average less than $300—$300 per half-hour for things that are very important against $150,000 per minute for a commercial.

The idea here is not just to throw more money into the educational pot and to forget the commercial world, but, in terms of the student, this *is* the kind of tech-

nical situation that he is accustomed to seeing. We have to find ways of dealing with such escalations of noise and excitement. Yet to the students with whom we deal and lots of other people, television has been so important that we can ill afford to go on muttering that "it is only entertainment" or issuing such clichés as "chewing gum for the eyes; it is not really important."

Television is enormously important. Even if none of us educators ever watched it, it still would be important because the people to whom we have dedicated our lives are students who are conditioned by the electronic world. They are the audience, and it is the audience that establishes the ground rules for communication.

If they speak in clichés, we'd better speak in clichés, and if they speak "kidese," we'd better speak "kidese," but not just to cozy up to them. Too many people these days merely say, "Just listen to the kids. The kids know where it's at."

That is not completely true. The kids have a *piece* of the action. They have some *insights* into what is happening, but I think what we have to do is establish the conditions for a fair game, where no longer will people be put in their place because of racial or economical *or* chronological reasons.

One of the things television has done is to make people participate nationally in what is going on. Ideas of what it means to be an American come through that television set night after night, ten feet away from the noses of the viewers. They want to be participants and contributors. Thus we have to seek new mechanisms and new devices to achieve that.

One seeks them with a great deal of courage and honesty. It is not going to be easy. When we talk about change, we are obviously talking about something very subjective. Some people think they are making major changes when they are only tidying up around the house. But as we think of change, we cannot merely rearrange elements within the structure of American education, as we have known it.

Much educational technology has lost out in the schools because it was stuffed into an environment completely intolerant of it. The archaic walls of the school cried out against technology's use and the people who tried to be most innovative. We tend to interpret the problem in very local terms. We tend to think that it is just the principal of a school or the superintendent who opposes change. But the fact is that real change will not come until we rethink the ground rules of a learner-centered educational system, realizing that the kid is at the heart of the matter, that learning is something the kids and people do for themselves, and that everything else in the environment of that very personal and private process that we call learning should be put in or taken out, depending on whether it helps or hinders the learning process for that kid.

We can ill afford the timetable of transitions that we followed in the past; again this is part of what is being set up in the environment by the media. People are intolerant of waiting a long time for things which in fact can often be made available to them right now.

Thus, I really feel that personal values, human values, interpersonal communication, and the reestablishment of the emotional element in the human fabric as a real part of what people should be involved in and what the school should be involved in are very important realities.

Probably the people who have the toughest sledding these days are those who sit on top of these structures that are left over from another time, another day. Very frequently they are being called upon to make increasingly numerical decisions in increasingly complicated matters about which they cannot hope to be completely competent.

We *do* have a great deal of understanding from people who frequently appear to us as obstacles. It is easy

By the time the average high-schooler completes secondary school, he has watched 15,000 hours of television but gone to school only 11,000 hours. The TV-watching totals for inner-city children are believed to be double because for so many of them TV is one of the few ways they can amuse themselves or become informed about the world around them. In view of this reality, we can no longer dismiss TV as a gadget. It is today's major educational influence.

Two-way adult-youth communication in the space and psychedelic age is vital. San Francisco's GLIDE, run by Revs. Ted McIlvenna, left, and Louis Durham, right, works hard at this task. GLIDE was one of the classroom demonstrations at the National Lab. The youngsters are Reverend Durham's sons, Bob and John.

enough to evaluate the student and respect his abilities. I think many people are going through hell these days because many *systematic* problems are falling onto them as *personal* problems. And very frequently they do not have the insight or the time to reflect on the huge scale of the problems.

We are in a very dynamic situation for which the ground rules are unclear and in which we are going to have to do a lot of swapping of information and attitudes. Many people in my own university do not know what is happening. They are very frightened by it. They say: "We've trained people and set up a sanction system of reward and punishment, inviting them to be a certain way, and then in a time of enormous change we reject them." I think there has to be enormous understanding and charity toward people suffering through today's upheavals. Merely to draw the battle lines does not help very much.

Actually, there is an awful lot that can be done by doing nothing. One favorite remark I use to encourage people who have dealings with other people, which means everybody, is the Latin *ne sim obex*, "May I not be an obstacle."

That is a pretty positive goal—to not let your own urge for either power or pleasure or prestige allow you to chop down one of your colleagues when he is about to do something you do not understand.

I think the time is passing when people have to understand everything. We can all get intellectual hernias if we try to get on top of everything that is happening in our culture. But if people in education won't say, "I will not be an obstacle," I think the schools are in real trouble. These are very tough days, and they are not going to get easier just by waiting them out. Yet after we get through our traumatic experiences, the world will be more fruitful for all of us.

We *can* learn a lot and be more productive ourselves, and we can make the students into better people than perhaps we have been.

In the schools there has been a lot of good will. The goals of education are hard enough to define. We are not paying those in the schools the kind of money that will attract the people we would like to have. I think it is important for us to look to the ground rules established for competency *outside* the schools. If the American airline industry were run with the degree of efficiency that American education displays, we would all be jogging to San Francisco.

We think of education as a local affair. Yet, if we could get some new understanding of these matters, we could operate more efficiently, using our energy for things on which it can best be used. I suggest that there should be, as there are in some places, satellite schools or school systems where not only the hardware and bricks and mortar involved in education are put together in new combinations, but also the people are trained over a long period to work together with these new forms.

We have so spoon-fed the student, we have so kept him in line with the sanctions of grades and the like, that we have not prepared him to be independent. We have not prepared our teachers to be independent either. Nor have we built any kind of staging process so people coming from a highly structured world into a more flexible environment will not get the bends.

We have to move faster than we have ever been asked to move before, for which our nervous systems are not prepared, because we were brought up to march to the beat of a different drummer.—END

The student has an obvious stake in education and is demanding an increased voice in its design and structure. One panelist during the National Laboratory was Peter Wing of New Jersey, who reported on his self-generated research.

Individualized instruction is geared to the advanced educational philosophy that considers each child a unique person, eager to learn. Wedded to useful modern media-tools, it can help mightily to upgrade America's schools and produce high-quality instruction. It can also provide an honest response to critics, across the spectrum, of education's current shortcomings . . .

Meeting the Critics' Demands for Quality Education—Through Individualized Instruction

BY DR. L. V. RASMUSSEN

Superintendent of Schools, Duluth, Minnesota, and President of the Aerospace Education Foundation

Dr. Rasmussen, Superintendent of Schools in Duluth, Minn., since 1962, played a major role in the implementation of the widely heralded program of individualized instruction now under way in his city, a program demonstrated "live" during the Aerospace Education Foundation's National Laboratory for the Advancement of Education. An experienced classroom teacher and administrator, he holds his doctorate from the University of Chicago. The above article is condensed from remarks delivered at the National Laboratory conference. Dr. Rasmussen was elected Aerospace Education Foundation president during the National Laboratory proceedings in Washington, D.C., last November.

INDIVIDUALIZED instruction means to me that each student progresses as rapidly as he can or as slowly as he must. But at all times he is learning those things most appropriate for himself as an individual.

Individualized instruction is not a product or a process. It is an ideal that I believe can be approached today through a combination of improved technology, improved psychological insight into the educational process, and improved public commitment to the importance of public education to the common good.

Improved technology means the teacher need no longer be the prime information source. The teacher can be free to manage the learning environment, to use professional skill in prescribing appropriate material and methods for individual students, to be an educational troubleshooter rather than an educational broadcaster.

The teacher is supplemented today by a wide variety of other media which can offer each student a multiplicity of approaches to the subject matter. This is a necessity in our electronic age with our preschool children conditioned by radio and television to respond to a far more dynamic kind of environment, an environment that transcends the printed page or even the very best talking a teacher can provide.

Let me talk a little about improved psychological insights. They have enabled us to see the importance of individual pacing. We know now that there is no one best way to learn, that one student's meat may be another student's poison. We have learned there is no sacred sequence for the presentation of curriculum units.

We have learned our main business is to teach learners to learn, to equip them for a lifetime of self-directed study.

Duluth teacher, Mrs. June Brieske, works with Washington, D. C., schoolchildren, who participated, during National Laboratory, in live demonstrations of the program of individualized instruction now operational in her city.

We have learned the value of letting a human being compete with himself.

We have learned that grades are, at best, a necessary evil and that we can eliminate the evil by eliminating the necessity for the traditional grading system.

We have learned that most youngsters are eager to learn unless their native impulses are somehow squelched by us.

We have learned that children, regardless of ethnic or cultural factors, come to us with wide differences in learning readiness and that we must meet that diversity with a corresponding flexibility.

As for improved public commitment, we can hope that it will give us at least two things: the willingness to accept change, and the finances with which to carry out the job. I think these things will come.

Individualized instruction is not the same as independent study; it is not the same as team teaching or modular scheduling. It includes aspects of all of these processes, but in addition it must include another special tool, and in Duluth we call this tool a "contract." Our contract is simply a clear statement of what the student is expected to learn, a list of alternate ways of approaching the learning, and a definition of the observable performance by which he will demonstrate that the learning has taken place.

Let me examine the values of individualization for the inner city as seen from the viewpoint of the administrator. To do this, I will resort to a simple rhetorical device.

Picture the inner-city school administrator as one of the partners in a dialogue. For the sake of this discussion, the administrator combines the functions of the superintendent with those of the whole central office staff and the school principal. Conceive of Mr. Administrator's problems as consisting entirely of responses to pressure.

The pressures come from a sequence of power groups. The spokesmen for these power groups, presented in sequence, are the other partners in this dialogue.

What Mr. Administrator will do, in my scenario, as he encounters each spokesman, is to offer individualized instruction as a *partial* solution to the problems presented or at the very least as a process that is consistent with the goals set forth by each of the adversaries.

Imagine the administrator as an animal in the blackboard jungle fending off attackers with the weapon of individualized instruction. Or, to use a somewhat more positive metaphor, imagine the administrator as a very harassed physician during a multiple epidemic who prescribes individualized instruction as a drug to a variety of afflicted patients. He makes no claim that it is a universal cure, but suggests that each individual patient will be helped a great deal and that the general health of the community will be improved enormously.

Let me begin with Mr. Black Power. He is a good man to begin with because he is so identifiable and because he expresses himself with such force and clarity. Let me generalize and incorporate his problems with those of other minority groups and call him Mr. Minority. He says this: "Look here, Mr. Administrator, I don't like anything about your schools. They are not fair to my kids. You don't teach about me, about my history, what I have contributed to my country. Your teachers talk a language my kids don't understand, and you are always pushing a book at them and that is not fair because we can't afford books at our house and they are not used to them.

"Some of my kids work. I have to keep on the move to keep my kids in school. If my kids miss school, nobody helps them catch up. My kids do not want to stay in school because the things you teach have nothing to do with their future. They drop out because you take a look at them and you attach a label to them, 'dropouts,' and they don't want a label. They want to be people."

Now let's try the administrator's answer. He says: "Let me tell you about individualized instruction; here is where it leads you. It is a method that says everybody is people. It respects the individual. It says 'get involved.' It says 'do your own thing.' It says 'learn how to learn so you can learn what you need to know.' We know your history is important, and with individualized instruction we can add important things, many important things, to the curriculum without taking two years to do it and appointing sixteen committees.

"Come around tomorrow at this time and I will show you a contract in Afro-American history. And I see what you mean about the books and the language; that is why we use movies and records and talking machines too. Your kid can choose what he understands best, choose the best way to learn, and if he has to be absent, it is not so bad because with an individualized instructional program it is easy to pick up where you left off.

"And if you move to a new school the teaching staff has the time and methods to find out about your child as an individual so that they can do their best to start him off on the right foot and keep him at the speed suiting him best.

"As for labels, we do not believe in them. Above all, individualized instruction says nobody is a loser."

That is part of the administrator's answer to Mr. Minority. The biggest drawback is that it is a longitudinal solution at best and a difficult one to demonstrate to people who are understandably very impatient. But if you can sell the idea you may win the support of a very important segment of the population.

Now let us talk to Mr. Parent. Since we just talked to Mr. Minority, this means Mr. Middle- and Upperclass Bourgeois Parent. Let us call him Mr. Taxpayer. He says something like this: "Look, your costs are going up ten to fifteen percent. Where is the money going? I am all for quality education, but what am I getting for my dollar? Don't give me any vague answers. I want specific information."

The administrator's answer: "With individual instruction we are adopting a systems approach to education. We don't know how much it will cost, but we expect the escalation to lead to the demand of the middle class for product evaluation and better cost accounting. At the same time, individualization and goal setting will be given highest priority.

"This priority on goals, this systems approach, will enable us to come up with firmer answers to the questions about costs and quality. Cost accounting in the procedures is built into the systems approach. Among its other virtues, individualized instruction is specific."

Mr. Taxpayer won't be completely satisfied with that or any other answer. But it will help administrators to get over a very important hurdle, the initial cost of an individualized instruction program. And initial costs are substantial—for the new hard- and software, for the brick and mortar modification, and for the in-service training. Perhaps that logically brings us to something called Mr. Federal Power. Now, needless to say, there is also a Mr. State Power around today, so let us combine all the branches of officialdom and just call them all Mr. Government. He has a lot to say to the administrator, but I will mention only those questions for which individualization, to some degree, offers answers.

Mr. Government says something like this: "I have been giving you a lot of money lately and all I've been getting is more of the same old thing. Now, how about something really creative, really new, and really exciting? Let us have something with a visible price tag on it. Let us have something that has a chance of being evaluated."

Yes, we know full well that Mr. Government is interested in assessments and that if we do not do it he may do it for us. But for the kind of reasons already offered, individualized instruction with its systems approach *is* a giant step forward for cost and quality accounting.

And it is really creative, really new and really exciting. Except for the small and happily successful beginning we made in Duluth with *our own* resources—resources very meager to start with—the second-stage effort for the dissemination of individualized instruction to the other schools was made possible with state and federal grants.

Now, the third stage which we are looking toward is individualization of our total system. This is going to take us a long time, and we will need the support of all the people we have been talking about.

That very definitely is going to include Mr. Gov-

In a a media-oriented world, kids know better than we think they do how to run gadgets that often faze adults. An important aspect of Duluth's individualized instruction concept is having the children operate the audiovisual equipment used extensively in the classroom. Above, under guidance of Duluth instructor Dale Koch, Washington, D. C., youngsters set up projector during National Laboratory classroom demonstration.

ernment. But the point is that in Duluth we have done a successful selling job thus far, which is the strongest possible evidence that individualized instruction is an allowable answer to the kind of questions that Government is asking today.

Let us talk to another power source. Student Power. We *have* been hearing what Mr. Student has to say. Without going into detail I can say that students already are on record in Duluth in favor of the independence and personal freedom of individualized programs.

At the secondary level we are working out additional answers for him, answers about his individual role in shaping curriculum, in forming school policy. Frankly, we do not want to move too fast in this area, but we do know the pressure is there and that among other things individualization will help equip tomorrow's students for the role they are already demanding today.

If it teaches anything, an individualized program teaches responsibility and, given a taste of participation, the student begins to see things from the teacher's point of view. This can be useful to all concerned.

This brings us to Teacher Power, which is real power today. We know what the teachers are demanding. Most of the current emphasis is on the dollar, but it is my hope that teachers also will demand increased responsibility for the end product.

At any rate, the administrator's answer includes this kind of comment to Mr. Teacher: "Okay, you want more money. You are getting more money, more power too, and we hope you are willing to earn your gains through increased responsibility and professional stature.

"Here is the greatest challenge teachers have been offered. It is called individualized instruction. It tells you to be a specialist in two or three areas of highly developed competence. It tells you to be a true professional, prescribing vital points in the program.

"To individuals, it offers you greater prestige than you have ever enjoyed because you will be a professional specialist with supporting staff, with the finest of modern technology at your disposal.

"It gives you the dignity you have always wanted because individualization operates in two directions. It gives greater individual opportunity to every student, but it permits the teacher to be an individual too.

"It gives the teacher his greatest opportunity in his try for true individual creativity."

I suppose I ought to introduce a final adversary, Mr. Establishment or Mr. Conservatism or Mr. Inertia. But I won't, because resistance to change is present in all the power representatives I have tried to personify, including those most strident in their demands for a change.

But if I were going to select a specific target in this context I might call him Mr. University, because that is where the forward thrust is, where individualization should be initially exercised, and that is where it is least in evidence.

Let me end at the beginning, reminding any administrator who cares to try it that the beginning of any individualization program must be small. A single classroom, a single school, a single creative teacher, or a team of enthusiastic volunteers is all that is needed to get going. A small beginning and much hard work offer a strong guarantee of initial success.

Having accomplished that, success with the second step of disseminating the program will depend largely on meeting the pressures I have tried to enumerate and in doing the selling job I tried to summarize. That is where we find ourselves now in Duluth, Minn.—in the final stage of bringing individualized instruction to the total school system. We will undoubtedly face a host of additional challenges. We are already. I could speculate about those challenges, but I prefer to speak only from our actual experiences of five years. Invite me back in a decade so I can tell you whether we made it for the total system.—END

The Duluth demonstration was the hit of the show, judging by the size of the National Lab crowds that lined up early to see it during the three days of the meeting. The midwestern city's program has earned nationwide acclaim.

The innovative spirit represented by such efforts as the Duluth program and other classroom demonstrations at the Laboratory was evident in the many industry and government educational displays during the meeting. Above, the display of New Dimensions in Education, Inc., Jericho, N. Y.

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A major feature of the Aerospace Education Foundation-sponsored National Laboratory for the Advancement of Education, held November 18 through 20 at the Washington Hilton Hotel, was an extensive array of displays by industry and government of innovational educational equipment, ranging from computer-assisted instructional systems to the latest in audiovisual systems designed for individualized instruction. A list of the National Laboratory exhibitors follows:

AMERICAN AIRLINES, INC.
New York, N. Y.

AUDIO VIDEO INDUSTRIES, INC.
Norwalk, Conn.

BAADER PLANETARIUM KG
Munich, West Germany

BELL & HOWELL CO.
Chicago, Ill.

BORG WARNER EDUCATIONAL SYSTEMS
Winnetka, Ill.

ROBERT J. BRADY CO.
Washington, D. C.

BURGESS PUBLISHING CO.
Frederick, Md.

CENTER FOR URBAN EDUCATION
New York, N. Y.

CENTRAL SCIENTIFIC CO.
Div. of Cenco Instruments Corp.
Chicago, Ill.

CESSNA AIRCRAFT CO.
Wichita, Kan.

CHESTER ELECTRONIC LABORATORIES, INC.
Chester, Conn.

CREATIVE PLAYTHINGS INC.
Cranbury, N. J.

EDUCATIONAL TEACHING AIDS DIV.
A. Daigger & Co.
Chicago, Ill.

ELDEN ENTERPRISES
Charleston, W. Va.

ENCYCLOPAEDIA BRITANNICA, INC.
Chicago, Ill.

ENTELEK INC.
Newburyport, Mass.

FAIRCHILD CAMERA & INSTRUMENT CORP.
Industrial Products Div.
Plainview, L. I., N. Y.

FEARON PUBLISHERS
Palo Alto, Calif.

HARCOURT, BRACE & WORLD, INC.
New York, N. Y.

HOUGHTON MIFFLIN CO.
Boston, Mass.

IMPERIAL PRODUCTIONS, INC.
Kankakee, Ill.

INTERACTIVE LEARNING SYSTEMS, INC.
Boston, Mass.

INTERNATIONAL COMMUNICATION FILMS
Santa Ana, Calif.

JAYARK INSTRUMENTS CORP.
New York, N. Y.

KEE, INC.
Baltimore, Md.

KEN COOK CO.
Milwaukee, Wis.

MIND, INC.
Greenwich, Conn.

THE NATIONAL CASH REGISTER CO.
Dayton, Ohio

NEW DIMENSIONS IN EDUCATION, INC.
Jericho, N. Y.

THE NEW YORK TIMES
Book & Educational Div.
New York, N. Y.

NORTH AMERICAN PHILIPS CO. (NORELCO)
New York, N. Y.

OLIVETTI UNDERWOOD CORP.
New York, N. Y.

PAN AMERICAN WORLD AIRWAYS
New York, N. Y.

PANASONIC VTR/CCTV
(Matsushita Electric Corp. of America)
Long Island City, N. Y.

QUALITY EDUCATIONAL DEVELOPMENT INC.
Washington, D. C.

RAYTHEON LEARNING SYSTEMS CO.
Boston, Mass.

REPUBLIC INDUSTRIAL EDUCATION INSTITUTE
Cleveland, Ohio

RESPONSIVE ENVIRONMENTS CORP.
Englewood Cliffs, N. J.

REVELL EDUCATIONAL SYSTEMS
Venice, Calif.

SCIENCE RESEARCH ASSOCIATES
Chicago, Ill.

SELF INSTRUCTIONAL DEVELOPMENT CORP. (SIDC)
Darien, Conn.

SOUND-CRAFT SYSTEMS, INC.
Morrilton, Ark.

TASCO SALES, INC.
Miami Beach, Fla.

TEXAS ALCOHOL, NARCOTICS EDUCATION, INC. (TANE)
Dallas, Tex.

UNIVAC DIV., SPERRY RAND CORP.
Philadelphia, Pa.

UNITED STATES R&D CORP.
Subsidiary: KBK Associates Inc.
New York, N. Y.

VICORE, INC.
Washington, D. C.

WANG LABORATORIES, INC.
Tewksbury, Mass.

JOHN WILEY & SONS, INC.
New York, N. Y.

THE WURLITZER CO.
DeKalb, Ill.

GOVERNMENT DISPLAYS

AIR FORCE ROTC
Maxwell AFB, Ala.

FEDERAL AVIATION ADMINISTRATION
Office of General Aviation Affairs
Washington, D. C.

OFFICE OF INSPECTOR GENERAL, USAF
Norton AFB, Calif.

LIBRARY OF CONGRESS
National Referral Center for Science and Technology
Washington, D. C.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
NASA Goddard Space Flight Center
Greenbelt, Md.

SOCIAL SECURITY ADMINISTRATION
Baltimore, Md.

USAF ORIENTATION GROUP
Wright-Patterson AFB, Ohio

USAF RECRUITING SERVICE
Randolph AFB, Tex.

AIR FORCE
JANUARY, 1969

Beyond the speed regime of present high-performance military and research aircraft is beckoning the new, unexplored world of hypersonic flight, which may one day combine in one manned craft the ability to fly either in space or in the atmosphere. But despite the substantial incentives and potential of hypersonic flight, the current level of research is lagging, and now is below that of the past few years. As a result, the National Aeronautics and Space Administration, the Air Force, and the aerospace industry consider it urgent that this country launch a follow-on program to the X-15 as a first step toward . . .

THE ULTIMATE IN HYPERSONIC FLIGHT— THE AEROSPACE PLANE

By Edgar E. Ulsamer
ASSOCIATE EDITOR, AIR FORCE/SPACE DIGEST

Lockheed-California Co. has studied various configurations of reusable air- and spacecraft for USAF's Flight Dynamics Laboratory, including arrowhead-shaped models shown here.

IN THE sixty-odd years between the inception of military aviation and the introduction of such 2,400-mile-per-hour aircraft as the YF-12A and the SR-71, aircraft speeds have approximately doubled every ten years. This trend now has tapered off, the only exception being the 4,500-mph dashes of the X-15 rocket-powered research vehicle. Last year's plans for a delta-wing X-15 configuration capable of prolonged Mach 8 performance, as well as its use as a testbed for supersonic combustion ramjet (scramjet) engines, have been scuttled. Research in the hypersonic flight regime has been slowed considerably.

Technological hurdles are not the problem. Rather, the obstacles are mainly financial and political. Dr. Antonio Ferri, aviation research pioneer and Director of New York University's Aerospace Laboratories, believes that a single breakthrough can provide hypersonic flight capability: "Funds!" The choice, he said, is between waiting "until Russia makes one [hypersonic vehicle] or we move ourselves." Soviet research in the hypersonic regime appears to be intensive. John Stack, a vice president of Fairchild Hiller Corp., who, as a former NASA executive was a principal mentor of the X-15 program, views as tragic the current "extreme lag" in hypersonic vehicle research in the United States. Such research is below the level of previous years.

The enigma, then, is why, in the face of reasonably provable technical feasibility, has aeronautical research into the next higher speed regime come to a virtual standstill?

Mr. Stack told AIR FORCE/SPACE DIGEST that one principal impediment is the "unilateral rocket orientation" of US space programs. The theoretical payload capabilities of airbreathing, reusable boosters are conceded to be at least four times those of the best rocket boosters on the basis of fuel expended. Yet little practical thought is being given to their use in present NASA programs, he claims. As Mr. Stack puts it, "Because of this total commitment to rockets, just suggesting that by going another route you might get 120,000 pounds into orbit instead of only 30,000 —and do it cheaper—goes over like swearing in Sunday school." As a result, he fears "now that we have all these big and fantastically expensive rockets, we will be conjuring up ways to use them in the post-Apollo programs."

There are exceptions. Speaking recently before the National Space Club in Washington, D.C., NASA's Associate Administrator for Manned Space Flight, Dr. George E. Mueller, said: "The uses of space have been limited in concept and extent by the high cost of putting a payload into orbit, and the inaccessibility of objects after they have been launched. Today we have in sight the technology necessary for reusable space vehicles." From this he concluded that "the next major thrust in space should be the development of an economical space vehicle for shuttling between earth and the installations, such as orbiting stations, which will be operating in space."

Explaining that initial orbiting costs were about $1 million per pound of payload, he predicted "a space shuttle that we can now foresee should evolve into a system that can deliver usable payload at a cost that might approach $5 per pound."

Dr. Mueller reported that "over the past several years, studies have progressed to the point where several promising concepts for an economical, reusable space vehicle already exist.

"It is reasonable to conclude," he said, "that a space shuttle development program, initiated now, could probably be brought to fruition before the end of the 1970s."

Airbreathing Boosters

John Stack maintains that rockets, in terms of cost-effectiveness, permit only "space exploration" while use of airbreathing, reusable boosters makes "space utilization" practical. He warns that the present approach ignores the "long-term requirements and therefore is likely to dead-end. . . . In the X-series of aircraft, X-1 and X-2, started shortly after World War II, we had no way to go supersonic without rockets. But no serious scientist associated with the program had any illusions about the fact that the rocket could provide the enduring, practical solution, and, of course, it didn't." The same wisdom, he suggests, should be applied to spaceflight where scramjets with vertical takeoff and conventional horizontal landing appear feasible.

The second reason for urgency in hypersonic flight research, obviously, is military utility. A number of applications have been suggested. Dr. Ferri envisions, for instance, an 8,000-mph strategic bomber, which, he says, would "free defense from the current 'Maginot-Line' inflexibility of intercontinental missiles." Equally effective could be a Mach 12 strategic long-range reconnaissance follow-on vehicle to the SR-71. It would be able to fly at 140,000 feet altitude, and defense experts predict it would be substantially less vulnerable to hostile action than mobile satellites.

Camera satellites, for example, are generally launched into polar orbits to take advantage of the earth's west-to-east rotation, and cover the entire globe in a day or less. Such an orbit can be easily plotted by a computer, and the satellite could be destroyed before it got over Soviet territory. In addition, present procedures rely heavily on midair recovery of film capsules ejected by the satellite on command from the ground. Both radio beacons and aluminum chaff are used to enable the recovery aircraft to locate the capsule, usually over the Pacific Ocean. In a hostile environment, this sort of procedure is obviously vulnerable. On the other hand, air recovery of actual film strips is necessary because of their far greater quality and resolution (up to 1,000 times better than that of television transmissions from space).

In contrast, a manned vehicle maneuvering in the atmosphere in a random fashion would be harder to track and intercept. In addition, the airbreathing vehicle's vision would be better than that of the satellite. There is good evidence that such a vehicle, if designed to be air-launched from a supersonic mothership, such as the XB-70 or the SST, could be oper-

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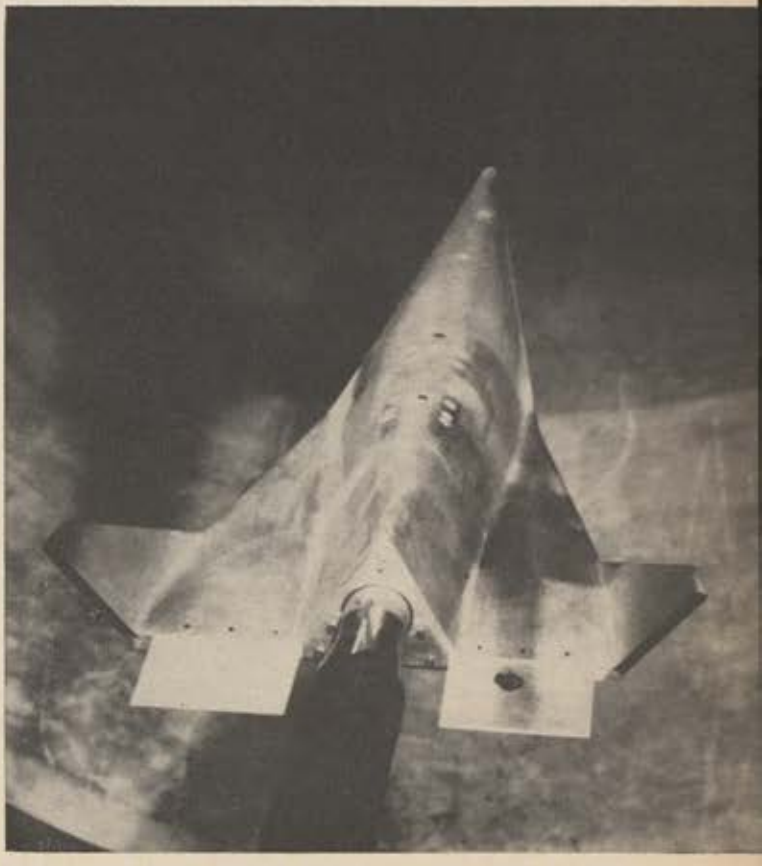
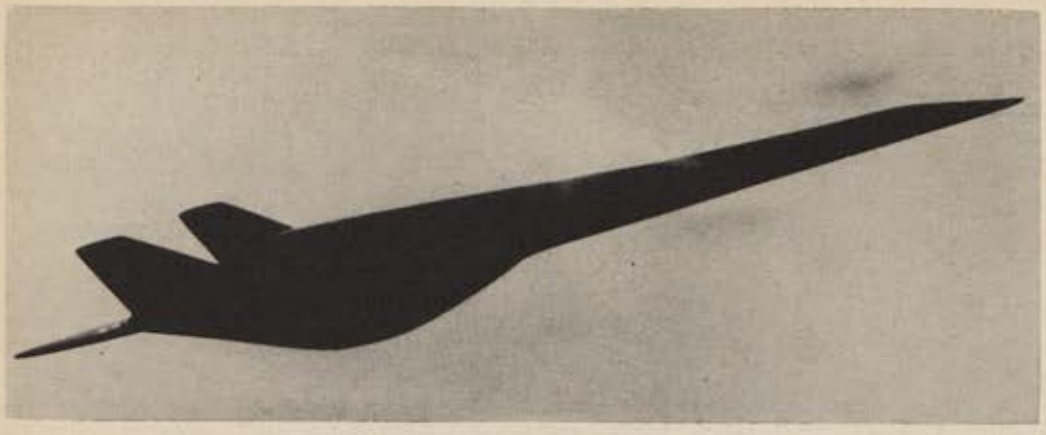


This scaled hypervelocity vehicle configuration is being tested in a wind tunnel at 20 times the speed of sound by Lockheed designers for USAF's Flight Dynamics Laboratory.



Highly maneuverable and reusable reentry vehicles like this USAF–Lockheed-California Co. preliminary design would have to cope with incinerating temperatures of reentry with only minor refurbishing, yet perform normal aircraft functions in terms of aerodynamic lift.

ational in less than ten years and at a cost roughly two and a half times that of the X-15 program, *i.e.*, less than $1 billion.

Mach 12 Research Vehicle

Mr. Stack, for one, counsels against continuing the X-15 program, which, he says, has run its natural course and was not meant to be patched up for Mach 8 flight and flight-testing scramjet engines. "We need to continue the pathfinder approach, perhaps the most effective and productive in the history of technology, inherent in the X-series of aircraft. The X-15 was invaluable, and it taught us what we need to know for the moment about the speed regime up to Mach 7.

"The next step hinges on our ability to solve the challenge of supersonic ramjet combustion with hydrogen as a fuel. As technology stands today, this should enable us to reach the Mach 12 range without generating major additional problems. It would seem obvious, therefore, that we need to build a follow-on vehicle to the X-15, designed right from the outset for such a mission."

NASA's Deputy Associate Administrator for Aeronautics, C. W. Harper, told AF/SD that the requirement to fully integrate powerplant and airframe for hypersonic flight ruled out the X-15 as a meaningful test-bed for hydrogen-fueled scramjet engines. In addition, a more extensive modification, involving a delta wing and other changes, appears so costly that the practical value "is debatable," he said.

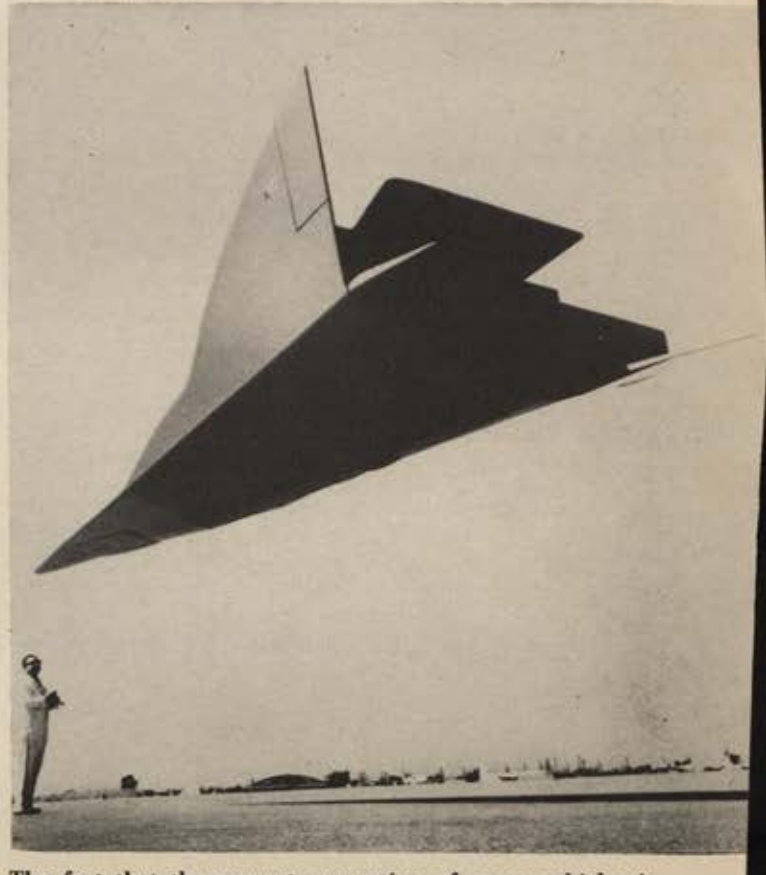
As a result, Mr. Harper said, NASA favors a program for an entirely new and optimized research vehicle, but he is less sanguine than Mr. Stack about the present state of metallurgy to meet all the structural requirements of a Mach 12 design.

A number of arguments for stepping up to the Mach 12 region are being advanced. Cruise range of a hypersonic vehicle is increased approximately fifty percent over Mach 6 at Mach 12, meaning more miles per pound of fuel at Mach 12 than at Mach 6, at the same total cost. On the other hand, aerothermal heating above Mach 12 would require materials and techniques not fully in hand at the present if the vehicle is to be reused.

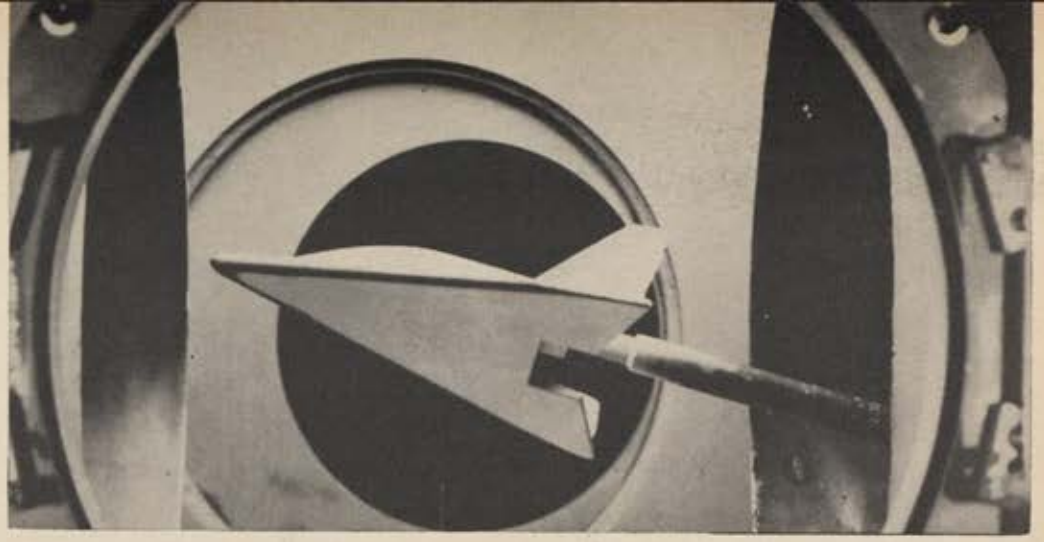
Centrifugal lift—the force which keeps spacecraft and satellites in orbit—becomes a significant factor in the Mach 12 region. At that speed it cuts the normal aerodynamic lifting-force requirement by one-third, a dividend that can be translated into commensurate range increases.

The Hypersonic Payoffs

The proponents of intensified R&D efforts into the closely related fields of hypersonic flight and reusable airbreathing boosters stress two formidable incentives. The engine efficiency of a hydrogen-fueled scramjet and the basic facts of aeronautical life are found in the flight efficiency equation laid down by the French engineer Louis Breguet some sixty years ago, the three components of which are speed, lift-



The fact that the present generation of space vehicles is not reusable sharply increases costs and, in the view of experts, has prevented massive, long-term use of space.



The policy of "unilateral rocket orientation" in the US space program has slowed down work on reusable airbreathing boosters despite widespread recognition that their payload capabilities are four times better than those of today's most advanced rockets.

to-drag ratio, and specific impulse of the engines. Dr. Raymond L. Bisplinghoff, head of MIT's Department of Aeronautics and Astronautics, and a former Associate Administrator of NASA, explained recently that hypersonic flight is "attractive to engineers" for three main reasons: because flight efficiency increases with speed; because the lift/drag ratio degrades only slightly from Mach 3.5 through the hypersonic regime; and because the fuel efficiency, or specific impulse (pounds of thrust per pound of fuel burned per second) of a hydrogen-fueled scramjet at Mach 12 equals that of a kerosene-fueled turbojet operating in the Mach 2 to Mach 3 region. (At Mach 5 the specific impulse of a scramjet burning hydrogen exceeds that of the best subsonic turbojet using conventional fuels, and is almost ten times that of a rocket. At Mach 12 the specific impulse is four times that of the rocket, and at orbital speed, Mach 25, still twice that of the rocket.)

Simplicity of the Scramjet

Other factors make the hydrogen-fueled scramjet attractive. It is relatively simple. Present-day jets require compressors of great weight and complexity to raise the pressure of the engine air to a level needed for combustion, as well as turbines. In both the ramjet and the scramjet, the raw air channeled to the diffuser generates the required pressure.

A sophisticated descendant of the World War II German V-1 "Buzz Bombs," the scramjet eliminates the excessive pressures and temperatures that are unavoidable if air entering the inlet at hypersonic speed has to be slowed to a subsonic flow by artificially inducing shockwaves. This is the basic difference between the ramjet and scramjet. As a result, scramjets can function from supersonic to orbital speeds and need less cooling, fewer movable parts, and are structurally simple. While scramjets, at least in theory, are able to function with other fuels, hydrogen is considered most desirable.

Most of the "proof-of-concept" demonstrations of scramjet technology to date have employed liquid hydrogen. The lightest of the elements, whose atom consists of only one proton and one electron, hydrogen offers low ignition temperatures, burns rapidly —even in a supersonic airflow—and provides high usable thrust at flight speeds reaching to more than Mach 25 (faster than 17,000 miles per hour).

Its energy content, the ability to generate heat per pound, is 2.8 times that of present-day hydrocarbon fuels. (Its drawback, however, is the fact that it is four times as bulky as present fuels with the same amount of energy, and, therefore, requires spacious onboard storage facilities.) It burns within a much shorter combustion zone than conventional fuels, and does so more easily, more reliably, and cleaner. Since its "residue" is only water and steam, engine maintenance and longevity should be advanced over propulsion systems employing hydrocarbon fuels.

The fact that liquid hydrogen requires cryogenic cooling is at once a blessing and a blemish. To retain its liquid state, hydrogen must be kept below its boiling point of —423 degrees Fahrenheit. This makes it a highly efficient heat sink for the very high skin and engine inlet temperatures encountered at hypersonic flight. Onboard storage, of course, necessitates elaborate insulation, which increases both weight and cost.

A typical Mach 12 vehicle encounters nose-cone temperatures—depending on angle of attack and altitude—of about 4,000 degrees Fahrenheit, and, equally critical, engine inlet temperatures of 2,400 degrees or above. Present structural materials cannot withstand these temperatures for long without deterioration. They need to be either insulated or cooled.

Coolant Value of Hydrogen

The coolant value of hydrogen is seven times that of conventional fuels, a fact that by itself may well spell the difference between practicability and impracticability of sustained hypersonic flight. Reentry vehicles manage to withstand the incinerating temperatures caused by skin friction during deceleration in the upper atmosphere largely through "ablation." This means that the metallic surfaces of the heat shield exposed to the high-heat pulse during the brief, critical period of reentry are covered by a protective substance, usually a plastic. This coating material changes from a solid to a gaseous state, a process called ablation, when exposed to high heat, and thus absorbs most of the heat which otherwise would be inflicted destructively on the metal surfaces of the craft.

In addition, the protective material between the ablating surface and the structure provides an insulating layer which slows down the transfer of heat

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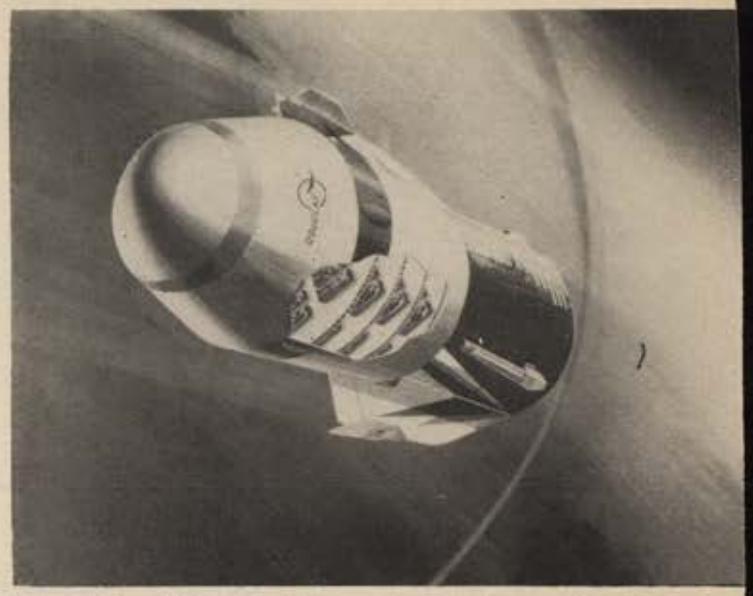
This Lockheed-California Co. artist's conception of a reusable aerospace transport shows two reusable stages, one performing boost and the other all orbiting functions.



The McDonnell Douglas "Pegasus" concept, shown here, is an orbital/global transport that would be able to carry 170 passengers to any spot on earth in 45 minutes or less.

not absorbed by the ablative action. The drawback of this technique is that the protective material is consumed in the ablative process and, therefore, works for only a limited time. For a reusable vehicle, it would, of course, require constant replacement. It is therefore of only limited use for a hypersonic vehicle.

Space vehicles reentering the atmosphere enjoy another advantage over a hypersonic cruise vehicle in terms of surface heating: They need not generate any lift. It is estimated that a reentry vehicle converts only two percent of its kinetic (motion) energy into surface heating, compared to five percent to fifteen percent for a lifting vehicle.

Hypersonic studies by Fairchild Hiller employ boron nitride, a relatively long-lived substance, to coat the nose cone. It would have to be replaced periodically. NASA research also envisions the use of refurbishable ceramics on the leading edges and other critically hot surface parts. These ceramics could be changed "like you change a tire," according to NASA's Harper. The remaining cooling functions, essentially in the engine and associated areas, are assigned to the hydrogen fuel.

Use of Liquid Hydrogen

Other industry and government studies take similar approaches. Liquid hydrogen would be injected at the hottest inlet points, helping to cool the engine walls and vaporize the hydrogen. This technique, also recommended by a McDonnell Douglas Corp. study, assures high cooling effectiveness by injecting and maintaining the fuel/coolant close to the engine wall. At the same time good combustion efficiency, according to the McDonnell Douglas study, "is achieved by injecting the fuel into the mainstream [of compressed supersonic air] to promote turbulence and mixing." (The external expansion of this self-igniting mixture provides the scramjet's propulsive force.) The feasibility of this technique has been demonstrated in wind-tunnel tests by the Marquardt Corp. and others.

The importance of hydrogen's role as an engine coolant was underscored by McDonnell Douglas' calculations indicating that, in the absence of hydrogen, the cooling requirements of a Mach 12 scramjet engine are "in the order of 150,000 BTUs per second, and, hence, would require 150 pounds of water or its equivalent for each second of cruise time." Such a weight penalty the study found "equivalent to about six times the cruise fuel load, and is completely unacceptable."

With the low density of the hydrogen calling for substantial interior tankage, a scramjet vehicle automatically benefits from its "deep-freeze" interior. As a result, an aluminum interior structure of conventional configuration appears possible for hypersonic cruise vehicles.

The cost of liquid hydrogen at the moment is high (about twenty-five cents per pound) for routine application in either the military or space field. But Mr. Harper predicts that nuclear powerplants could produce liquid hydrogen at a cost of five cents a pound. Or, it could be obtained from methane gas by a more conventional process for about ten cents per pound, if demand is great enough. A price reduction of this magnitude conceivably could lead toward the end of this century to hypersonic commercial vehicles of near global range, as a follow-on to the SSTs currently under development.

Other Propulsion Needed

The scramjet engine creates a basic problem for the designer: It can't get off the ground under its own power, and it cannot—within the present state of the art—function efficiently in the ramjet speed regime of Mach 3 to Mach 5. Short of air launches

from a supersonic "carrier vehicle," a hypersonic vehicle for either space or cruise application requires a secondary propulsion system. The "first-stage" propulsion unit can be either a conventional turbojet engine, or, as is favored for reusable space shuttles, a solid-propellant rocket system.

The alternatives for coping with requirements of the low hypersonic regime are not believed to require a special propulsion system. One is the so-called convertible or dual mode approach of operating the scramjet initially as a ramjet (subsonic combustion) until a Mach 5 or 6 level has been reached; the other approach, considered attainable in time by some researchers, is to upgrade supersonic-combustion performance at lower Mach speeds.

The Shape of Things to Come

To a larger measure, the shape of future hypersonic vehicles will, of course, be determined by the specific mission they are to fulfill and the materials to be used.

Certain features, according to present research, apply across the board. The liquid-hydrogen fuel necessitates substantial interior volume, which can best be met by a conic or elliptical shape. Further, the intensive interactions at hypersonic speed between airframe and propulsion system will require integration to a degree substantially above present aircraft. Two principal designs have emerged: the blended wing-body, and the all-body or lifting-body configuration.

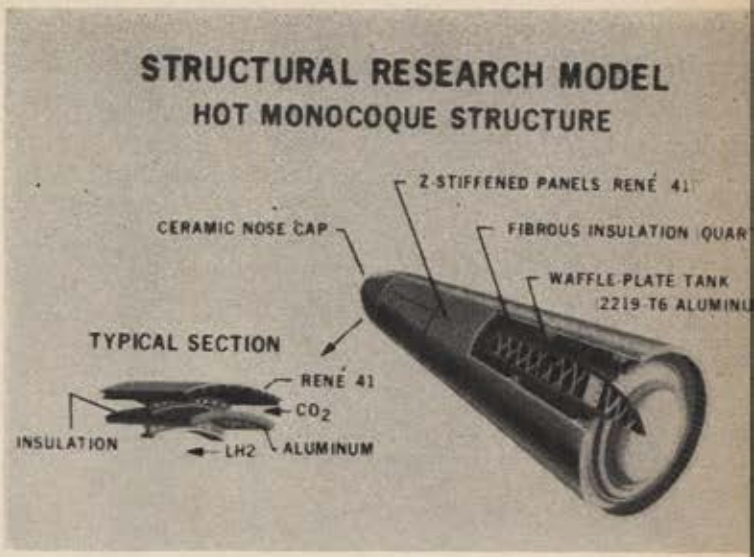
Research by the Air Force Flight Dynamics Laboratory indicates that significant weight savings could be achieved if the interior tankage can be made an integral part of the structure, that is, with the structure serving as the tank wall. The problem of "shrinkage" beyond permissible levels during the chill-down and hydrogen-filling phase caused by cryogenic process may, however, prove insoluble.

Engine location varies with different designs; the need to increase the capture (air intake) area over that of present aircraft and to use the aftbody as part of the exhaust nozzle is, however, common to all. Fairchild Hiller's design employs movable ramps around the engine core to regulate the ratio of air and hydrogen and to prevent overspeed once Mach 12 has been reached. The engines are located on the dart-shaped vehicle's underside.

Use of New Materials

A number of materials for use in a hypersonic vehicle are under consideration. The Fairchild Hiller approach centers on a structure of rené 41, a so-called superalloy already used to a significant degree in the hot sections of currently operational aircraft. Air Force research rates rené 41 as being able to withstand sustained temperatures of 1,500 degrees Fahrenheit without significant deterioration.

A refractory metal, columbium B-66, with oxidation-resistant coating would be used along the leading edges of the highly swept wing and tail section where higher temperatures will be encountered. Some researchers at the Air Force Flight Dynamics Laboratory favor coated tantalum over columbium for use in the hotter sections because its strength retention at temperatures above 2,700 degrees Fahrenheit is better.



NASA research has yielded a number of promising designs for hypersonic configurations, which would have structural capabilities needed for a reusable aerospace transport.

The engine cowl leading edges of the Fairchild Hiller design employ Hastelloy X, another superalloy of very high heat resistance.

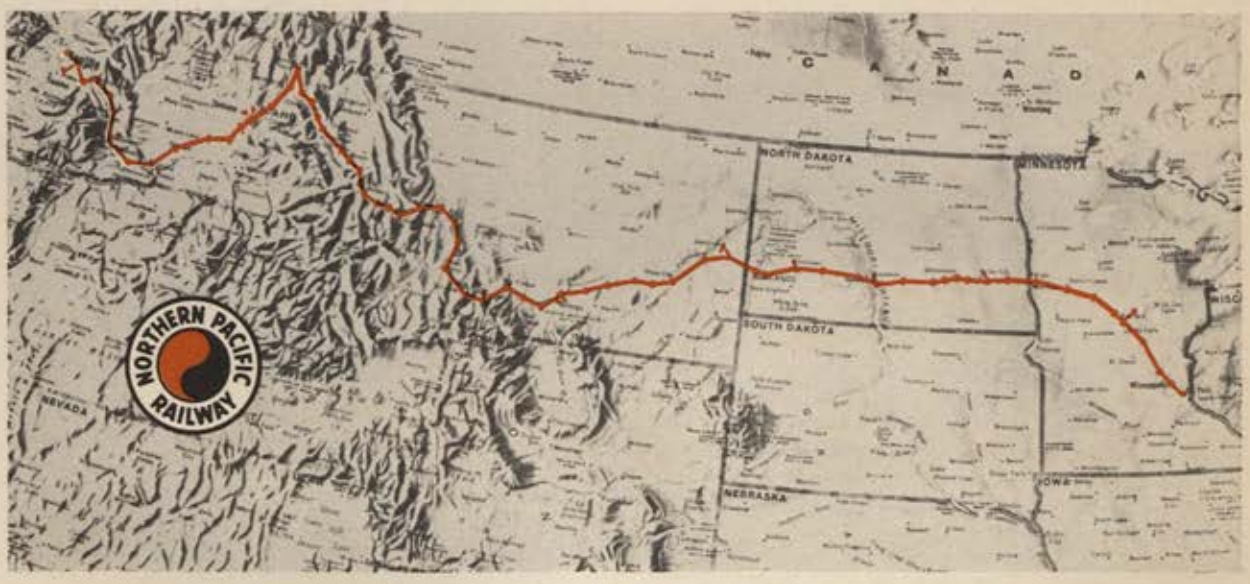
A number of other metallic materials are under examination and test for use in hypersonic vehicles. The requirement to withstand temperatures between 2,000 and 3,000 degrees Fahrenheit is, however, not easily met, either from an oxidation resistance or strength point of view, and all but the refractory metal appear to require protective coatings. This includes even dispersion strengthened nickel and nickel-based alloys, although some metallurgists foresee improvement potentials into the 2,500-degree area, without coating.

The degree of materials advances yet to be accomplished in order to permit sustained hypersonic flight obviously depends on the maintenance and time-between-overhaul requirements. With refurbishing permissible on a research or limited-use vehicle, the principal metallurgy is on hand, according to Mr. Stack. If the dispatch standards of present military or commercial aircraft are applied, this would not be the case.

Government and industry executives who favor intensified R&D efforts in hypersonic flight, including development of a suitable research vehicle, admit that only basic feasibility has been proved so far. The final proof of concept, as a NASA official put it, "is in the doing."

And he added that ultimately a merger of space and air, seemingly predestined by the word "aerospace," can and must take place. Its eventual attainment would be the aerospace plane, proposed early in this decade. "The stepping-stone to such an ultimate vehicle is the hypersonic aircraft, a fact that by itself might give the latter sufficient, vital justification for coming into being," he said.—End

the big systems by Collins



COMMUNICATION / COMPUTATION / CONTROL

THE BULLETIN BOARD

News and Comment about Air Force People . . .

By Jackson V. Rambeau
AFA DIRECTOR OF MILITARY RELATIONS

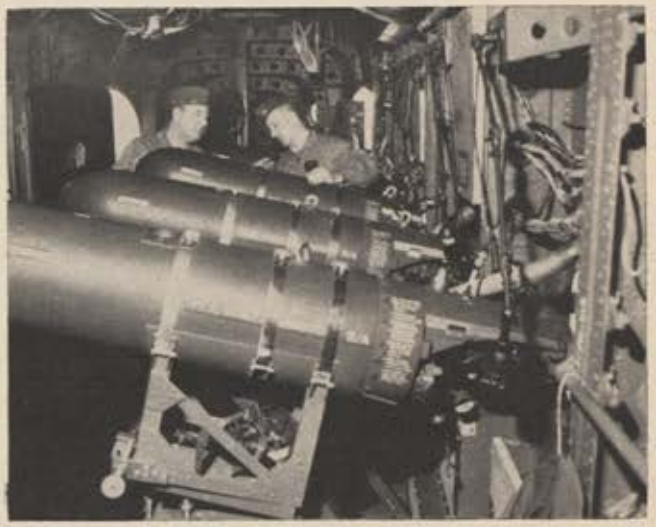
New DoD Plan for Job Assistance

Secretary of Defense Clark Clifford has asked that the armed forces develop a plan to help servicemen find meaningful civilian employment upon leaving the service. He has directed that a system be established under which servicemen and women scheduled to retire or otherwise leave active duty can register their skills and vocational preferences with a centralized DoD referral service. This service would match the registrants with nationwide public and private employers. Emphasis is to be on encouraging a match to positions having high social utility. A report on this project is expected shortly from DoD.

Junior Officers Council Member Honored

The 1969 edition of "Personalities of the South" includes David L. Hosley, aide-de-camp to Maj. Gen. Jack N. Donohew, Commandant of the Air War College. Captain Hosley has been decorated twenty-two times for service in South Vietnam, including four Distinguished Flying Crosses and seventeen Air Medals. In 1967, he was named one of the Outstanding Young Men of America by the Junior Chamber of Commerce. Captain Hosley has been designated to serve as a member of the AFA's Junior Officers Advisory Council. The Air Force Association salutes the captain on this new honor.

Air Force Sgt. Steve M. Northern of Riverside, Calif., racked up an enviable record during recently concluded service in Vietnam. Now only twenty-one years old, Sergeant Northern made fifty-one "combat saves"—more than any other person in aviation history. This record was established during the airman's two consecutive tours in Vietnam as a para-rescueman with the 3d Rescue and Recovery Group of the Military Airlift Command. Sergeant Northern has earned and been awarded two Silver Stars and the Purple Heart.



Col. James E. Pyle, 71st Special Operations Squadron Commander, briefs Lt. Col. William H. Horrell on firepower of the AC-119G, gunship version of Flying Boxcar. Since its call to active duty, the Reserve unit has trained in the gunship mission and expects to go to Vietnam shortly.

Air National Guard Council Meets

At its November meeting, the AFA Air National Guard Council met to hear DoD officials outline plans for a new Reserve Forces compensation and retirement system. Members of the Hubbell compensation study group elicited the Council's recommendations prior to sending the plan to the Secretary of Defense for final approval. Under the total salary concept for the active force, changes must be made in the drill pay compensation system. Traditionally, Reserve drill pay has been tied to active-duty base pay—one day of base pay for each drill period. As reported last month, the Hubbell group has considered two alternatives: either set aside the present base pay tables and retain them as the basis of drill pay, or establish a drill period as a percentage of the new full salary system.

It was the Council's consensus that Reserve drill pay should remain tied to active-duty compensation, and the Council therefore recommended that the present drill pay system be abolished if the Hubbell proposal is approved. Part of the new system most discussed was that pay for a drill period should be approximately seventy-five percent of a day's pay under the new plan. We believe that the Hubbell group will recommend this formula.

Admiral Hubbell's representatives also outlined a retirement system and survivors' benefit program for Reservists still in the working stage. The study group probably will recommend an improved Reserve retirement package to

1700 tandem miles of microwave in 85-station network

From St. Paul to Seattle. Across the plains . . . through the Badlands . . . over the Rockies . . . to the Pacific. More than 1700 tandem miles of microwave. Towers unbudged by 150 mph winds and two-inch radial ice. Facilities for up to 600 voice channels, teletype, high speed data, VHF mobile, and centralized traffic control. That's Northern Pacific Railway's new centrally-monitored space diversity microwave system, now setting new performance and reliability standards in long distance communications. Collins provided design and installation of the entire 85-station network — the equipment, buildings, towers, antennas, and roads — plus training of operation and maintenance personnel. It's another example of the big-system, turn-key capability Collins offers industry and the military.

COLLINS

Gen. John P. McConnell, Air Force Chief of Staff (left), is greeted upon his arrival at Don Muang Royal Thai Air Force Base by Air Chief Marshal Boon Choo Chandrubska, RTAF commander. The visit was part of a tour of AF units.

include a new vesting program. A Reservist, under this plan, for the first time would receive in a lump sum all contributions made to retirement if he left the program prior to retirement eligibility. The new survivors' benefit package would transfer a part of a Reservist's accrued benefits to surviving dependents if he should die after becoming eligible but before reaching age sixty.

AFA is working closely with several other interested associations and will present a united front when the new Congress convenes.

We are informed that the crucial pay tables, the missing element of the Hubbell proposal, will not be made public until presented to the Congress on January 6.

The Council also passed resolutions asking that the arbitrary ceiling on the military construction program be eliminated and that a priority system replace it. This was in response to the recent announced $10-million-per-year ceiling put on Air Guard military construction for the next five years. Presently the ANG has a $171 million backlog of construction projects.

The group also endorsed the recruitment of nonprior-service medical officers for Reserve Forces units, and early retirement for Reservists on a reduced annuity.

Manpower Council Hears Admiral Hubbell

At its late November meeting, AFA's Military Manpower Council heard many top officials report on various personnel problems affecting the services. This Council included both Army and Navy representatives. Projects 100,000 and Transition were covered in detail, as was the DoD job referral system now being planned.

The Council's principal consideration was the five-part Hubbell compensation proposal, namely: total salary system, new retirement system, Reserve compensation, disability retirement system, and survivors' benefits. The Council, after a two-hour presentation by Admiral Hubbell, enthusiastically endorsed the proposals in principle and urged the Admiral to continue his efforts to seek their enactment. The Council tempered its endorsement by deciding to forego, until it has inspected the final compensation tables, any request to AFA for action on the matter at its National Convention in March. As reported earlier, the pay tables are to be made public January 6. Further action by AFA's Manpower Council will be taken then.

In other actions, the Council passed a resolution calling for the exclusion of all pay of prisoners of war and their dependents from federal income taxes. It also endorsed separate legislation on survivors' benefits for retirees if the Hubbell proposal is not enacted by the Congress. The Fleet Reserve Association developed the legislation endorsed by the Council. And finally, the Council asked AFA to continue its efforts to get recomputation of retired pay, revisions to the dual compensation statutes, new per diem rates for both military and Civil Service, additional general officer spaces for all the services, an increase in military housing, legislation to permit crediting of certain nonactive duty Reserve time for enlisted personnel, and continued support for the Air Force Village Foundation.

Operation Patriotism

Brig. Gen. I. G. Brown, Assistant Chief for Air, National Guard Bureau, didn't realize a speech he gave at an Air National Guard Dining-In in Knoxville, Tenn., October 21, would have national impact. General Brown, speaking before the 134th Refueling Group, Tennessee ANG, cited witnessing lack of respect for the flag, particularly at sporting events throughout the country in the past few months. He also mentioned the apathy apparent when the National Anthem was played at these events. He challenged the Knoxville unit to do something to rectify this situation. Thus was born "Operation Patriotism." The unit got good response from city and county officials in Knoxville, school and business leaders, and fraternal organizations and University of Tennessee officials. The result, after excellent radio, newspaper, and TV coverage, was apparent at the next University of Tennessee football game.

Fifty-six NCOs then attending the ANG-NCO Academy in Knoxville were so impressed with "Operation Patriotism" that they unanimously voted to return to their respective states to initiate similar projects. The program is receiving nationwide publicity in civic and fraternal magazines.

Parting Shots

• The Air Force has notified Congress of the forthcoming inactivation of the 17th Military Airlift Squadron in the spring of 1969, and establishment of an Air Force Reserve, C-141 Associate Unit, during the summer of 1969, at Charleston AFB, S. C. The new Associate Unit, to be assigned for training and collocated with the 437th Military Airlift Wing, will utilize the same equipment and C-141 aircraft. Manpower authorization will include 413 drill pay spaces, of which 119 are civilian Air Reserve Technicians.

(Continued on following page)

—Wide World Photos

With his family looking on, Maj. William J. "Pete" Knight receives the Harmon International Aviator's Trophy on December 3 from President Johnson during a ceremony at the White House. Major Knight was awarded the citation for piloting performance while flying the X-15 rocket plane.

At AFA's Military Manpower Council meeting in Washington, November 22, are, from left: Rear Adm. Lester E. Hubbell, DoD Director of Compensation and Career Development; J. William Doolittle, ASAF (Manpower and Reserve Affairs); Council Chmn. Lt. Gen. William D. Eckert, USAF (Ret.); Lt. Gen. John W. Carpenter, DCS/Personnel.

Service organization leaders joined AFA's Air National Guard Council's recent meeting in Washington, D. C. From left: Brig. Gen. John L. Strauss (National Guard Assn.); Maj. Gen. Benjamin J. Webster (Council Chairman); Dr. Theodore C. Marrs (Deputy for Reserve Affairs in Office of AF Sec'y); Col. Arthur Brackett (Reserve Officer Assn.).

• Secretary of Defense Clark Clifford has appointed Dr. Hester Turner to a one-year term as Chairman of the Defense Advisory Committee on Women in the Services, beginning January 1. The Defense Advisory Committee on Women in the Services was established in 1951 by Gen. George C. Marshall, then Secretary of Defense. The Committee is composed of fifty prominent women from throughout the United States, selected on the basis of their outstanding reputation in civic or professional fields. Its purpose is to interpret to the public the need for and role of women in the services and to promote public acceptance of the military service as a career for women.

• Hq. AFROTC has announced that about sixty-five retired Air Force officers and sixty-five NCOs will be needed to fill instructor positions in the expanding Air Force Junior ROTC program. Positions will be available for the 1969-70 school year at leading secondary schools throughout the United States. Applications for instructor positions with the Air Force Junior ROTC should be made to AFROTC (ARTO-J), Maxwell AFB, Ala. 36112.

• Applications for Gen. Henry H. Arnold Education Fund scholarships now are being accepted by the Air Force Aid Society. Deadline for filing is January 31, 1969. High school seniors and college students may secure application forms by writing Air Force Aid Society, National Headquarters, Stop 102, Washington, D. C. 20333. Interested personnel should contact their local Air Force Aid Society officer for further details.

Air Force Col. Robert L. Stephens, Gilmer, Tex., is congratulated by Maj. Gen. J. C. Maxwell, director of the US SST program at the FAA, in Seattle, upon award of his second Legion of Merit and second Distinguished Flying Cross for work on SR-71/F-12 programs at Edwards AFB, Calif.

• Officer Training School output for FY '69 has increased by 700 to a total of 4,428. Until now, FY '69 nonrated entries have been limited to applicants with certain engineering skills, meteorologists, geodesists, WAF, AECP, and Bootstrap Commissioning Program candidates. With the 330 nonrated increase, the restriction on academic disciplines has been removed and all eligible college graduates can compete.

• A board is scheduled to convene at the USAF Military Personnel Center January 7, 1969, to select officers for promotion to major general and brigadier general in the Air Force Reserve. Eligible officers who desire to submit communications concerning any matter of record in the Armed Forces regarding themselves they consider important to their case should forward such to the President, Reserve General Officer Selection Board, Hq. USAF (AFPDG), Washington, D. C. 20330.

• On November 12, 1921, the first "air-to-air" refueling was made by Wesley May, with a five-gallon can of gasoline strapped to his back. He transferred from the wing of a Lincoln Standard, flown by Frank Hawks, to the wing skid of a JN-4 flown by Earl S. Daugherty, climbed to the engine, and poured the gas into the tank.

• Estimated first-year net tangible benefits from awardable civilian suggestions adopted in the Air Force during FY '68 exceeded $44 million. In addition, there were almost $12 million first-year benefits from suggestions submitted by employees who were ineligible for awards because their suggestions were considered to be within job responsibility.

• More than 85,000 senior members and cadets in 2,300 units throughout the US marked the 27th anniversary of the Civil Air Patrol with appropriate celebrations in December. An all-volunteer force, CAP flies humanitarian mercy missions, conducts air search and rescue, and helps educate the general public to the role of aviation and its impact on the nation. It is the official auxiliary of the United States Air Force. National Headquarters of Civil Air Patrol is located at Maxwell AFB, Ala. CAP senior members operate 4,600 light aircraft. Other members man a nationwide radio network of more than 21,000 stations.

• An increasing number of college graduates are expected to enlist in the Air Force during 1969, a result of changes in the Selective Service Act of 1967 and the decision to discontinue Selective Service deferments for graduate students, medical specialties excepted. This is

Maj. Gen. Hugh B. Manson, previously Commander of the Air Force Flight Test Center, Edwards AFB, Calif., and presently serving as Special Assistant to the Commander, Air Force Systems Command at Edwards, has announced his retirement effective January 31, 1969.

Gen. William S. Stone, air deputy to the Supreme Allied Commander in Europe and a former Air Force Academy Superintendent, died December 2 in Mons, Belgium, following an apparent heart attack. He was 58. General Stone was buried December 6 at the Air Force Academy.

bound to cause trouble for the Training Command in adapting courses on a speedup basis for these college graduates. It is also common knowledge that college graduates do not make the best airmen. If morale is to be maintained when these people arrive at operating bases, care must be taken to ensure the utilization of their capabilities. This problem is not confined to the Air Force, since thirty percent of 1969's draftees also will be college graduates.

• The Arnold Air Society holds a national conclave each year attended by Cadets and Angels from each local unit and by Air Force, aerospace, and education dignitaries. Here, members elect their national commander, enact legislation, and make plans for the coming year. The next conclave will be in New Orleans from March 30 to April 2. Society squadrons are located at over 165 leading colleges and universities across the nation. More than 6,000 AFROTC cadets are members. The Society is an AFA affiliate.

• The British Armed Services now are considering a "Hubbell-type" total salary compensation system. If accepted, such a plan can be put into effect administratively since no legislation is required. Canada already has adopted this type of system.

• Project Transition has been given considerable publicity inside and outside the services. Our firsthand look at the program on a big Air Force base indicates that there is little demand for the program among separating Air Force personnel. Less than one percent of the base population is taking advantage of the training offered under the plan.

• The closeness of the recent Presidential election emphasizes again the value of a single vote. With over seventy million votes cast, the President-elect received a majority of less than one-half million. The election also underlines the importance of the military vote, estimated to be nearly two million. According to pollsters, military people are more prone to vote Republican than Democratic. It well could be that the military vote decided the election in 1968.

• President-elect Nixon indicated during his campaign that he would try for an all-voluntary force after the end of the Vietnam War. It's interesting to note that less than one-quarter of those coming into the services annually are drafted. It should not be overlooked, however, that many "volunteers" are inspired to serve by the existence of the draft. All of the services do a good recruiting job; more than 8,000 full-time recruiters are in the field, and the programs they conduct cost over $100 million a year.

• As we went to press, AFA's Civilian Personnel Council was to meet in Washington with Civil Service Commission officials to receive a forecast on civilian personnel policies of the new Administration. A representative of the Bureau of the Budget also was to describe the impact that the congressionally imposed ceiling on civilian personnel was having on the various agencies. In one agency we recently visited, six attorneys and one secretary occupied a single office, which had been denied the authority to hire even one more typist. We wonder if the Congress can call this efficiency and good management.

SENIOR STAFF CHANGES

B/G William L. Clark, from Dep. Chief of Chaplains, Hq. USAF, to Cmd. Chaplain, USAFSO, Albrook AFB, C. Z. . . . **Mr. Frank A. Fishburne,** from Supervisory Budget Analyst to Chief, Financial Policy and Analysis Div., Office of the Comptroller, Hq. USAF . . . **Dr. Allen E. Fuhs,** from Naval Postgraduate School, Monterey, Calif., to Chief Scientist, AF Aero-Propulsion Lab., AFSC . . . **B/G William G. King, Jr.,** from Ass't DCS/Ops, AFSC, Andrews AFB, Md., to Ass't to Dir. of Special Projects, OSAF, with duty station Los Angeles, Calif. . . . **B/G Francis W. Nye,** Ass't to Dir. of Plans, Hq. USAF, assigned additional duty as Chmn., US Delegation, Inter-American Def. Board; Chmn., US Delegation, Joint Brazil-US Def. Commission; and Chmn., US Section, Joint Mexican-US Def. Commission, replacing M/G Richard A. Yudkin . . . **Dr. Robert E. Sievers,** from Research Chemist to Senior Scientist (Inorganic Chemistry), Aerospace Research Lab., OAR.

B/G Alton D. Slay, from Dir. of Ops, USAFE, to Cmdr., AF Flight Test Center, Edwards AFB, Calif., replacing M/G Hugh B. Manson . . . **B/G Robert V. Spencer,** from Cmdr., 8th Tactical Fighter Wing, Ubon RTAFB, Thailand, to DCS/Ops, Hq. PACAF, Hickam AFB, Hawaii . . . **M/G Richard A. Yudkin,** Dir. of Doctrine, Concepts, & Objectives, DCS/P&O, Hq. USAF, relieved of additional duty as Chmn., US Delegation, Inter-American Def. Board; Chmn., US Delegation, Joint Brazil-US Def. Commission; and Chmn., US Section, Joint Mexican-US Def. Commission.

RETIREMENTS: B/G Sterling P. **Bettinger,** B/G Hugh B. **Manson.**—END

LETTER FROM LOS ANGELES

By Irving Stone

WEST COAST EDITOR, AIR FORCE/SPACE DIGEST

Nine-Man Gemini Studied

A low-cost, modified Gemini spacecraft capable of carrying up to nine crew members is being analyzed by McDonnell Douglas Astronautics Co.'s Eastern Division, St. Louis, under a $436,000 preliminary effort sponsored by the National Aeronautics and Space Administration's Manned Spacecraft Center. The spacecraft would be used for low earth-orbital logistics missions. The study, scheduled for completion by July 1, 1969, will consider cargo and propulsion requirements, water- and land-letdown operations, and design features to permit the spacecraft to be refurbished for reuse.

The logistic spacecraft would have to be compatible with the Saturn launch vehicle's S-IVB top stage and with the Titan IIIM, launch vehicle for the Air Force's Manned Orbiting Laboratory.

The study will identify the developed cost, funding, schedules, facilities, and facility modification to assist NASA in planning future activities.

Mars Missions for 1971

Two Mariner spacecraft are planned to orbit Mars for three months after a six-month trip from earth. The launch period is programmed for May 1971, with arrival at Mars in November. NASA has established a program office that has assigned the project to California Institute of Technology's Jet Propulsion Laboratory.

Launch vehicle for the missions is projected to be the Atlas-Centaur booster. The Mariner spacecraft initially will weigh about 2,000 pounds, including 900 pounds of propellant and 125 pounds of scientific instrumentation. Data from the two spacecraft are expected to help establish touchdown sites for the first Mars landing mission, now scheduled for 1973.

One Mariner spacecraft is programmed to orbit Mars at an inclination of sixty degrees to the planet's equator to afford examination of seventy percent of the surface. The second spacecraft would be programmed for near-polar orbit (about eighty degrees inclination) to examine the polar caps and afford high-resolution coverage of selected areas. The higher-inclination orbit also would afford oblique views of broad areas of Mars and possibly permit an examination of the planet's two moons—Phobos and Deimos.

Triple-Launch Technique

Three Javelin III sounding rockets have been fired simultaneously from a single launcher at Army's White Sands Missile Range, N.M., by an Air Force crew from the USAF Missile Development Center's Directorate of Aircraft and Missile Test, Holloman AFB, N.M. The launch was in support of an Army project.

Two additional firing rails, angled to allow slightly different trajectories, were added to a single rail-launcher for the exercise. One rocket carried a payload of instruments to record meteorological data. The second and third were fitted with dummy ballast payloads of different weights to produce a staggered flight formation (*see photo*).

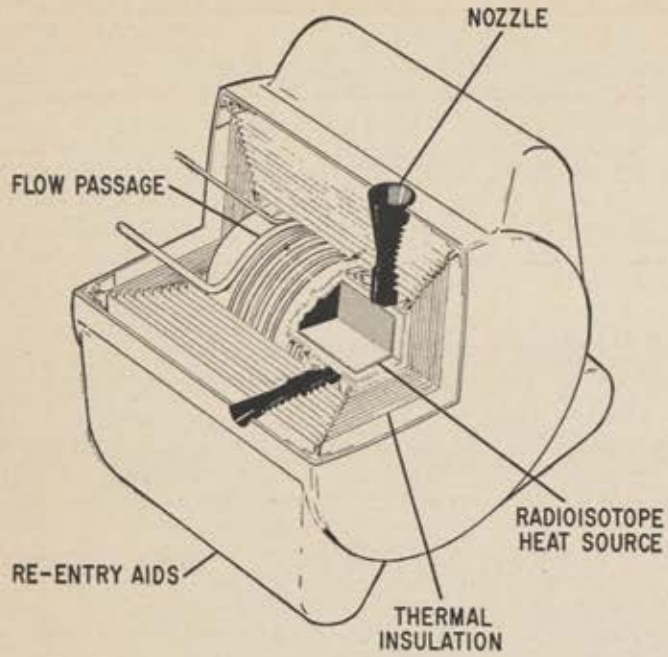
In biservice cooperative effort, this trio of Javelin III sounding rockets was recently launched in salvo at US Army's White Sands, N. M., Missile Range, by USAF crew from Holloman AFB, N. M. Trajectories of the rockets were varied.

Javelin III is powered by a single-stage solid-propellant motor produced by Lockheed Propulsion Co. It can loft a 120-pound payload to 150,000 feet.

More Power for MOL

USAF's Manned Orbiting Laboratory's electric-generating capacity will be upgraded with an advanced fuel cell design. Reevaluation of powerplant requirements resulted in a decision last July to boost fuel cell capability.

After a competition initiated by McDonnell Douglas Astronautics Co.'s Western Division, Huntington Beach, Calif. (contractor for MOL), Allis Chalmers, Milwaukee, Wis., was selected to develop the advanced fuel cell. Unsuccessful contenders were General Electric Co. and United Aircraft Corp.'s Pratt & Whitney Aircraft Division. Pratt & Whitney was contractor for MOL's original fuel cell design.



DART Configuration

TRW Systems DART (Decomposed Ammonia Radioisotope Thruster) was developed under USAF Rocket Propulsion Lab contract. Finlike projections distribute reentry heat.

Long Storage Life for Solids

Environmental testing at United Technology Center, Sunnyvale, Calif., indicates that the shelf life of large, solid-propellant booster rocket motors could be extended to ten and possibly twenty years.

Since mid-1961, UTC has conducted continual environmental testing of a 100-inch-diameter solid-propellant rocket motor containing fourteen tons of propellant—polybutadiene acrylic acid acrylonitril (PBAN).

The test motor segment has been exposed to weather conditions encompassing temperatures from twenty to 150 degrees Fahrenheit and a relative humidity range of thirty to 100 percent including rain, for 2,695 days, with no significant change in the propellant's properties. Stability has been established by tensile tests, burning measurements, and liner-propellant interface validations.

UTC produces the 120-inch-diameter rocket motors for the two five-segment strap-on units used on the Air Force Titan IIIC military space booster, and the company recently negotiated a contract with USAF's Space and Missile Systems Organization to produce the seven-segment strap-on units for the Titan IIIM booster scheduled to launch the Air Force's MOL.

Small Thrusters Tested

A radioisotope thruster being developed by TRW Systems Group, Redondo Beach, Calif., under a $470,000 contract from the Air Force Rocket Propulsion Laboratory, Edwards AFB, Calif., has been successfully ground-tested in a twenty-one-day run at the Atomic Energy Commission's Mound Laboratory, Ohio. This is to be followed by a year's test at operational temperatures, at the Mound Laboratory.

Applications for the radioisotope thruster are envisioned in reaction control systems and station-keeping equipment for future military spacecraft. Designated the Decomposed Ammonia Radioisotope Thruster (DART), the configuration includes an encapsulated radioisotope heat source, up to four nozzles with a separate flow tube for each, a passive thermal control, and a reentry module. Decay of the radioisotope provides energy to heat and decompose the ammonia for expansion through the nozzle. The unit is designed to operate in either a pulsed or continuous mode and produce more than 100 millipounds of thrust.

In the DART design, aerospace nuclear safety requirements, which have been observed stringently, require the containment of the isotope fuel under all credible accident possibilities, including reentry and impact.

In another effort funded by the Air Force Aero Propulsion Laboratory, Wright-Patterson AFB, Ohio, TRW Systems is working under an $840,000 contract to develop a flight model of a colloid microthruster; and under a $343,500 research contract to demonstrate colloid engine operations under specific thrust conditions.

The colloid engine microthruster is an electrostatic device that produces thrust by expelling charged multimolecular particles. TRW Systems' colloid microthruster already has completed test and measurement runs at 0.000007 pounds (seven micropounds) thrust. The unit weighs eight and three-quarter pounds, including a five-watt constant-current power device.

A 500-hour life test of the research model has produced an average performance level of thirty-two micropounds of thrust and a specific impulse of 1,200 seconds. Specific impulse is defined as the performance parameter of a rocket propellant, expressed in seconds, equal to the thrust in pounds divided by the propellant weight flow rate in pounds per second.

Colloid thrusters also are envisioned for service as station-keeping, attitude control, and maneuvering units, and are viewed as attractive for weight-limited or power-limited spacecraft.

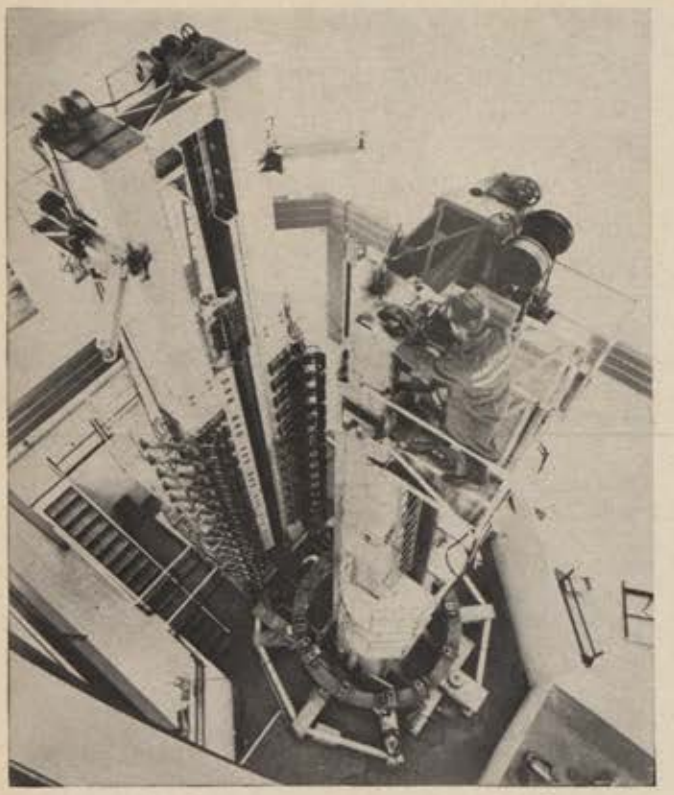
Pinpointing Downed Aircraft

The Federal Aviation Administration is considering rules that would require general aviation pilots to carry crash locator beacons on some flights. Currently no federal requirement for such devices exists. If a requirement were established, many such locators would be available from different manufacturers.

Effectiveness of one downed aircraft locator developed by Garrett Manufacturing, Ltd., Toronto, Canada, was

(Continued on following page)

Southwest Research Institute, San Antonio, Tex., researchers check spaceborne fire extinguisher they developed for Apollo program after device's return from Apollo-7 trip.



This 41-foot-high vertical welding facility will be used in the fabrication of fuel and oxidizer tanks for Titan III launch vehicles at Martin Marietta's Denver, Colo., Division. It will allow work on huge components of Titan III.

demonstrated in a Federal Aviation Administration–Civil Air Patrol search trial last November over northern California.

The locator, transmitting in a modulated tone over both VHF and UHF emergency bands, was placed in a simulated downed-aircraft tail section in the snowclad Trinity Mountains. The tail section was to serve as a visual target equivalent to an aircraft generally obscured by ground cover, with only the aft surfaces visible.

After receipt of a simulated distress call, two FAA DC-3 aircraft took off from the Red Bluff, Calif., FAA station for the search. Within thirty-two minutes the first of the two aircraft had picked up the downed aircraft locator signal, and minutes later located the "downed aircraft" even though heavy snowclouds made visual spotting impossible.

In FAA's nine-state western region, more than 4,500 hours were spent searching for downed aircraft in 1964, 4,900 hours in 1965, and 4,800 in 1966. In the ten years since 1957, thirty-one downed aircraft in the western region were never found.

Self-Eject Effort Renewed

The Air Force's extensively researched self-eject program—a drawn-out, stop-and-start effort—has been renewed again. This time, the primary responsibility will be limited to one of several competing prime contractors, with a propulsion contractor in a supporting role.

The self-eject concept is targeted for application to solid-propellant advanced ICBMs. The missile would be provided with a special propellant grain for initial burning to afford slow, progressively increasing acceleration during launch from a silo, to minimize noise and pressure effects in the hole.

The new effort, not necessarily an indication that the self-eject concept finally has been approved by USAF's Space and Missile Systems Organization planners, probably anticipates a year-long program involving firing of subscale solid-propellant configurations. The silo at Edwards AFB, Calif., is almost certain to be one test site.

Proposals for the new effort were submitted November 29. Contractor selection wasn't expected to be announced until early this month. Funding would be somewhere between $250,000 and $500,000.

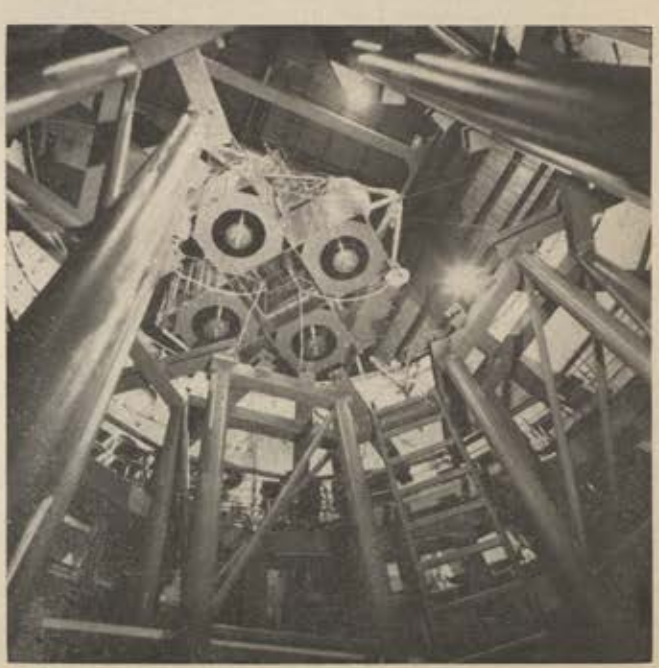
KC-135 Weightlessness Trials

The Air Force's KC-135 tanker aircraft is providing a space weightlessness environment for extensive zero-gravity experiments being performed in sectional mockups of NASA's Orbital Workshop program.

The zero-gravity flight program in the KC-135, begun last September, has afforded approximately two hours of weightless environment in seven flights consuming sixteen and one-half hours of flight time. Approximately fifteen more flights are scheduled in 1969. The flight tests are being conducted at Wright-Patterson AFB, Ohio. The Orbital Workshop mockup sections are installed in the KC-135 singly or in combination, depending on the particular zero-gravity experiment. The flight pattern includes a series of parabolic arcs between 24,000 and 34,000 feet to provide a thirty-second interval of weightlessness at the top of the arc.

The Orbital Workshop is to be a converted empty liquid-hydrogen tank of the Saturn S-IVB, built by McDonnell Douglas, to accommodate three crewmen. The tank measures twenty-one and one-half feet in diameter and is about thirty feet high.

The McDonnell Douglas Orbital Workshop mockup sections are used by space-suited personnel to determine their ability to perform tasks in hard-to-reach sections as the KC-135 flies through the pattern providing weightlessness. Five separate mockup sections are used for the task evaluations. They are constructed of fiberglass and aluminum and weigh as much as 835 pounds. The two largest sections are eleven by eight by five and one-half feet.—End



Wyle Laboratories, El Segundo, Calif., test-assembled Saturn V's major stages for Apollo in a record four months at Huntsville, Ala. Above, mated LM is hoisted for assembly.

You Are Cordially Invited to attend

The 23rd Annual AIR FORCE ASSOCIATION NATIONAL CONVENTION and AIR FORCE REUNION

Houston, Texas • March 18-21, 1969

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Until March 3, 1969

Tuesday, March 18

9:30 AM Board of Directors Meeting
2:00 PM Opening Ceremonies

Wednesday, March 19

9:00 AM 1st Business Session
12:00 N USAF Awards Luncheon
2:00 PM 2nd Business Session
6:00 PM Air Force Reunion Reception

Thursday, March 20

9:00 AM Aerospace Symposium
12:00 N The Chief's Luncheon
6:00 PM Reception for the Secretary and Chief of Staff

Friday, March 21

9:00 AM Air Reserve Forces Seminar
12:00 N The Secretary's Luncheon
7:00 PM American Fighter Pilots Association Banquet *

* Not an official part of AFA Convention program; not covered by Registration fee.

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THE FRESNO, CALIF., CHAPTER . . .
cited for consistent and effective programming in support of the mission of the Air Force Association.

The **Fresno Chapter's** annual Air Force Honors Night Banquet and Awards Ceremony, in observance of the 21st Anniversary of the Air Force and to pay tribute to the Tactical Air Command, also provided the occasion for the Chapter and local Air Force units to honor their "Outstanding Men of the Year."

Lt. Gen. Gordon Graham, Vice Commander of Tactical Air Command, was the honored guest and principal speaker, with **Jack Withers,** AFA National Director, doing an outstanding job as Master of Ceremonies.

The late **Sigmund Levy,** an Army Air Service pilot of World War I who was to have been honored on his eightieth birthday, was posthumously awarded an AFA citation "for his outstanding individual service to the USAF."

Other awards and citations went to members of the Air Force, Air Force Reserve, Air National Guard, Civil Air Patrol, Air Force ROTC, and the city of Fresno.

Distinguished guests included Congressman **B. F. Sisk;** State Assemblymen **George Zenovich** and **Ernest Mobley;** Fresno Mayor **Floyd Hyde;** County Board of Supervisors Chairman **Joseph Reich;** City Councilmen **Elvin Bell** and **Pat Camaroda;** Superior Court Judge **Milo Popovich; Jack Oliver,** President, Fresno City and County Chamber of Commerce.

During the Fresno, Calif., Chapter's recent Air Force Honors Night Banquet, Fresno Mayor Floyd Hyde, right, standing, presents a proclamation saluting the Tactical Air Command to Lt. Gen. Gordon Graham, Vice Commander of TAC and the guest speaker for the program. Seated at the head table are, from left: Jack Oliver, President, Fresno City and County Chamber of Commerce; Brig. Gen. Eugene Strickland, Vice Commander, Fourth Air Force; Congressman B. F. Sisk; AFA National Director Jack Withers, Master of Ceremonies; and Maj. Gen. R. G. Taylor, Commander of TAC's Tactical Fighter Weapons Center. Standing, far left, with his ever-present pipe, is Sam Boghosian, who was Program Chairman.

And, **Maj. Gen. R. G. Taylor,** Commander, Tactical Fighter Weapons Center (TAC); **Brig. Gen. George Edmonds,** Chief of Staff, California Air National Guard; **Brig. Gen. Eugene L. Strickland,** Vice Commander, Fourth AF (ADC); and California State AFA President **Dr. C. A. DeLaney.**

• • •

Exploring a new approach to the State Convention format, the **Ohio AFA's 1968 State Convention** was held in the beautiful new lodge at the Hueston Woods State Park near Oxford, Ohio, and was programmed as a "family weekend in nature's setting."

Delegates and their families—some twenty-five teen-agers and twenty-five children under the age of twelve—enjoyed a weekend intermixed with AFA business and use of the many and varied recreation facilities.

Jerrold W. Maben, Associate Professor of Education, and Director of the Science Education Center, University of Akron, was the featured speaker at the Convention banquet. Professor Maben, who recently returned from a trip to the South American country of Guyana (formerly British Guiana), where he met with education leaders of that country to discuss ways of improving their educational system, gave a very interesting and entertaining illustrated talk.

National Director **Jack Withers** served as Master of Ceremonies and

Gen. Arthur C. Agan, Commander of the Aerospace Defense Command, Ent AFB, Colo., here congratulates Washington State AFA President-elect Peter A. Tuohy following Mr. Tuohy's election at the State AFA's recent Convention, which was held in Tacoma. Waiting to congratulate Tuohy are, from left, Washington State AFA President Marvin Christman; Northwest Regional Vice President Warren B. Murphy; and, far right, Oregon State AFA President Clayton K. Gross. General Agan was the featured speaker at the Washington Convention banquet.

colors were posted by the AFJRROTC Color Guard from Pleasant View High School. During the program, **B. E. "Shorty" Fulton,** a former AFA National Director, received the State AFA's "Aerospace Power Award." **Michael G. Coleman,** Wright Memorial Chapter President, was designated Ohio AFA's "Man of the Year," and his wife Mary received the State AFA's "Patient Wife Award."

Delegates reelected **George Gardner** to serve another year as President of the State Organization.

Out-of-state AFAers included Great Lakes Regional Vice President **W. M. Whitney, Jr.;** and from the Claire Chennault Chapter of Detroit, Mich., President **Dorothy Whitney,** Secretary **Anne Boedigheimer,** and **Sandra Kendzierski.** AFA National Secretary **Glenn D. Mishler,** of Akron, also attended.

° ° °

The **Pennsylvania State AFA's 20th Annual Convention,** recently held at the Viking Motel in Pittsburgh, was hosted by the **Greater Pittsburgh Chapter. Mrs. Marie Fork** served as Convention Chairman.

The Convention opened with a gala "Hospitality Bash." The next day, after a short but effective business session at which delegates elected **Edmund J. Gagliardi** to succeed **George W. Crosby** as State President for 1969, delegates and convention registrants attended the USAF Academy/Pitt football game.

Lt. Gen. Thomas Moorman, Superintendent of the Air Force Academy, was the guest speaker that evening, and **David Kelly,** News Director, WIIC-TV, served as Toastmaster.

During the banquet program, **Brig. Gen. Richard B. Posey,** Deputy Adjutant General for Air and Chief of Staff, PAANG, was designated the Pennsylvania AFA's "Man of the Year." **Lt. Col. A. A. Milano,** Commander, Group 60, CAP, received the Greater Pittsburgh Chapter's "Aerospace Leadership Award," and State AFA's scholarships were presented to **Patricia Ann Smith** of Harrisburg and **Daniel J. Zdobinski** of Pittsburgh.

Distinguished guests included AFA National Directors **John Brosky** and **Carl Long;** Regional Vice President **James W. Wright;** New York State President **Charles Alexander;** New York State Vice President-elect **Gerald Hasler;** and New Jersey State Secretary **Lloyd G. Nelson.**

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Meeting in Fresno, Calif., delegates to the **California AFA's 20th Annual State Convention** elected **Robert Lawson** of Los Angeles to succeed **Dr. C. A. DeLaney** as State President for 1969; Dr. DeLaney was elected Chairman of the State Organization's Executive Committee. Others elected to office: **Eugene DeVisscher** and **Jack Sheldon,** Vice Presidents; **Robert Szabo,** Treasurer; and **Barbara Rowland,** Secretary.

At the Convention Awards Luncheon, awards were presented to winners of the state's aerospace design contest and to State AFA members who made significant contributions during the year.

Lt. Gen. John W. O'Neill, Commander, Space and Missile Systems Organization, was the featured speaker at the Awards Banquet, and **Maj.**

(Continued on following page)

In ceremonies recently in Madison, S. D., Senator Karl Mundt, at left in this photo, receives from Sioux Falls Chapter President John S. Davies a copy of the book *A History of the United States Air Force—1907-1957* and a subscription to AIR FORCE/SPACE DIGEST. Senator Mundt accepted the book and the subscription on behalf of the Karl Mundt Library at General Beadle State College.

At the Pennsylvania AFA Convention banquet, Carl J. Long, second from the left, AFA National Director and Chairman of the State AFA's Scholarship Committee, presents the State AFA's Scholarship Trophy to Cadet 2d Lt. Daniel J. Zdobinski, center, as the young man's proud parents, Mr. and Mrs. Joseph Zdobinski, left and second from right, look on. Also shown is Frank Fork, right, President, Greater Pittsburgh Chapter, sponsor of the North Hills Cadet Squadron 610 of the Civil Air Patrol unit, of which Cadet Zdobinski is a member.

William "Pete" Knight, astronaut and X-15 pilot who received the Harmon Trophy last month, served as Master of Ceremonies. AFA President **Robert W. Smart** made brief remarks.

During the program, National Director **Martin Ostrow** received the State AFA's "Man of the Year" award, and the **Santa Monica Chapter** was named "Chapter of the Year." **Col. Milton R. Graham,** CALANG, was named "Military Man of the Year." Los Angeles Chapter Secretary **Carolyn Hall** was named California AFA "Sweetheart of the Year."

Distinguished guests included **Brig. Gen. George Edmonds,** Chief of Staff, California Air National Guard; AFA President **Robert W. Smart;** National Directors **William Berkeley** and **Martin Ostrow;** and Far West Regional Vice President **Will Bergstrom.**

The Convention was hosted by the **Fresno Chapter,** and Chapter President **Bill Estep** served as Convention Chairman. The program included a Reunion Party and an AFA Workshop.

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AFA's **Santa Monica Chapter** recently held its annual program honoring the Civil Air Patrol. More than 100 CAP Cadets and Officers from throughout Southern California were guests of honor at the meeting.

Vera B. Wright, Chapter President, presided at the meeting. Sharing the podium as guest speakers were **Lt. Col. Jerome Holberg,** California ANG; **Maj. Lou Raines,** Director of Information, Edwards AFB; and **Lt. Col. Allen McGuire,** Director of Military Affairs for Hawaii.

Awards were presented to outstanding CAP Cadets **Rex Starr,** **Robert Westerman,** and **Byron Brammer;** and to "Senior Officers of the Year"—**Capt. Paul Crawford, Lt. Col. James Barnes,** and **1st Lt. Hugh Taylor.**

Shown at the Santa Monica Chapter program honoring the Civil Air Patrol are, from left, Col. Raymond Gaver, California State CAP; Mrs. Gill Robb Wilson; Lt. Col. Allen McGuire, Director of Military Affairs for Hawaii; Chapter President Vera B. Wright; Maj. Lou Raines, Director of Information, Edwards AFB, Calif.; Yolk Lew, Program Chairman; and Lt. Col. Jerry Hoberg, California ANG.

Distinguished guests included **Mrs. Gill Robb Wilson,** widow of the beloved founder of the CAP and former AFA National President; and **Col. Raymond Gaver,** California CAP Commander.

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More than 150 attended the testimonial dinner recently sponsored by AFA's **Front Range Chapter** of Denver, honoring **Maj. Gen. Joe C. Moffitt,** Colorado State Adjutant General.

It was appropriate that the dinner was held at the NCO Club at Lowry AFB because the General began his thirty-six-year military career as an enlisted man.

During the program, **Maj. Gen. I. G. Brown,** Assistant Chief for Air, National Guard Bureau, presented General Moffitt with the National Guard Bureau's Eagle Award; **Maj. Gen. James Cantwell,** President, National Guard Association, presented the General with the National Guard Association's Caricature Portrait Award. Colorado State AFA President **Gen. Robert Lee,** USAF (Ret.), presented him an AFA Citation; and Front Range Chapter Vice President **Noel A. Bullock** presented General Moffitt with the Chapter's Staffel Award. Highlight of the evening was reading of a congratulatory telegram from AFA President **Robert W. Smart.**

At the testimonial dinner held recently in his honor by AFA's Front Range Chapter, Denver, Colo., Maj. Gen. Joe C. Moffitt, right, Colorado State Adjutant General, receives the Chapter's Staffel Award from Chapter Vice President Noel A. Bullock. A telegram from AFA President Robert Smart was also read.

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COMING EVENTS . . . State Presidents' Orientation Meeting, Washington, D. C., January 9-10 . . . **Board of Directors** and **Nominating Committee** meetings, Washington, D. C., January 11 . . . **Iron Gate Chapter's** Annual Air Force Salute, Americana Hotel, New York City, February 21 . . . **AFA National Convention,** Houston, Tex., March 18-21.—DON STEELE

THIS IS AFA

The Air Force Association is an independent, nonprofit airpower organization with no personal, political, or commercial axes to grind; established January 26, 1946; incorporated February 4, 1946.

Objectives

• The Association provides an organization through which free men may unite to fulfill the responsibilities imposed by the impact of aerospace technology on modern society; to support armed strength adequate to maintain the security and peace of the United States and the free world; to educate themselves and the public at large in the development of adequate aerospace power for the betterment of all mankind; and to help develop friendly relations among free nations, based on respect for the principles of freedom and equal rights to all mankind.

Membership

Active Members: US citizens who support the aims and objectives of the Air Force Association, and who are not on active duty with any branch of the United States armed forces—$7 per year.

Service Members (non-voting, non-officeholding): US citizens on extended active duty with any branch of the United States armed forces—$7 per year.

Cadet Members (non-voting, non-officeholding): US citizens enrolled as Air Force ROTC Cadets, Civil Air Patrol Cadets, or Cadets of the United States Air Force Academy—$3.50 per year.

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State Contacts

Following each state contact's name and address are the names of the localities in which AFA Chapters are located. Information regarding these Chapters, or any place of AFA's activities within the state, may be obtained from the state contact.

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Bob Stevens'

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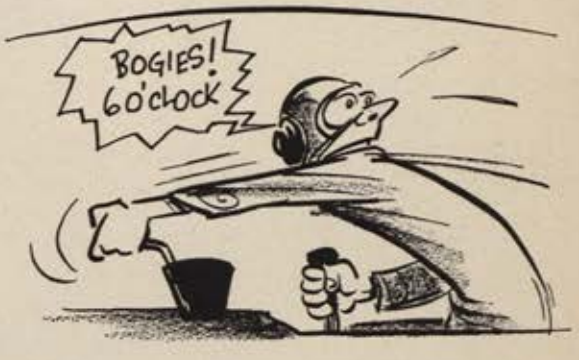
Here's the second entry in Bob Stevens' new illustrated dictionary for aviation buffs (the first entry appeared in AF/SD for September '68). Send in your favorite old AF term—it might be worth five bucks . . .

AIRMEN'S UNABRIDGED DICTIONARY

CLANK UP (verb) State of extreme agitation. Usually brought on by such statements as "overseas, special mission, check ride, the C.O. wants to see you..." etc.

THANKS TO ART LORD
WESTPORT, CONN.

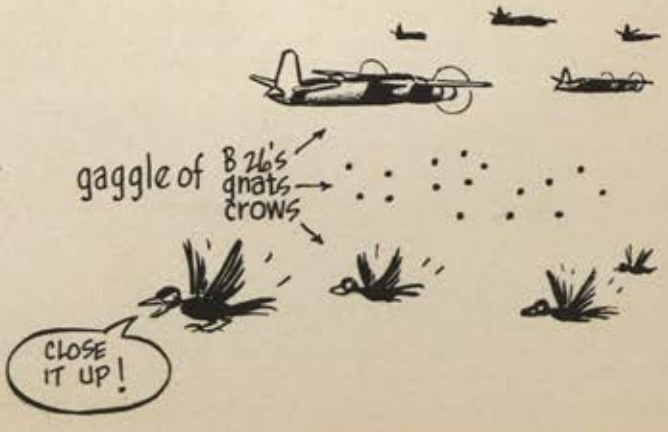
FIREWALL (verb and noun) (1) Act of pulling 65 in. of manifold pressure from an engine designed to give only 50. (2) section of the aircraft specially designed to allow all engine heat and smoke to fill the cockpit.



FIGMO (acronym) Quaint old Anglo-Saxon expression used by "short-timers" to tell the neophytes what to do. Stands for "_____, I Got My Orders". (no polite form)

THANKS TO CAPT. D. BREIDENBACH
TON SON NHUT AB VIETNAM.

GAGGLE (noun) A large number of anything headed in the same general direction in the same part of the sky. Often used to describe a USAAF tight formation.



Bob Stevens

Weather has no respect for national boundaries. Perhaps that's why international cooperation in forecasting has for a long time been a constant in an area fraught with inconsistency.

Cooperation is important, but it's not the only answer to more accurate and longer range forecasting. Computer technology is a key factor.

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These simulations are so complex, the elements so numerous that a 24-hour forecast for the northern hemisphere can take 10 hours of computing.

Despite this scientists are optimistic. In fact, current results indicate that reliable 14-day forecasts are a distinct future possibility. Also, the observational network must be expanded to the whole of the earth.

It will take some time, therefore, before two week forecasts become standard. Scientists estimate five to ten years.

But if it weren't for computers, it might take forever.

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Emil Szabo, production engineering manager at McDonnell Douglas in St. Louis, has been preparing his production teams by building the titanium structures for the Phantom while developing "evolutionary" titanium structures for its eventual successor. He says we're ready.

Q. Emil, you've been working with the Phantom since its inception. What changes in technology have occurred that now promise even more advanced aircraft?

A. In technology, "change" is seldom sudden, it's continuous. Change has been one of the keys to the Phantom's prolonged domination of fighter technology. We've changed to accommodate improved engines, new electronics. We've been increasing structural efficiency by fabricating selected components from titanium. With a new fighter we might see 50% or more of the structure fabricated of titanium alloys.

Q. By volume, titanium really isn't lightweight. Where do you get an advantage?

A. In the kind of performance we're planning, you have to consider the strength-to-weight ratio at "oven-hot" aircraft operating temperatures. Wherever elevated or prolonged temperatures are to be encountered, comparatively smaller or thinner titanium structures offer the strength you need. In addition, it has superior corrosion resistance and fatigue characteristics.

Q. You seem confident that a predominately titanium aircraft can now be built. What makes you sure this can be done at production rates?

A. For one thing, McDonnell Douglas is right now using more than two million pounds of titanium a year in airframe production. Our Phantoms are from 8-9% titanium alloy structures and they are surely coming off the line at a high rate. For another, there's our progress with numerically controlled (NC) machinery. We're tying the computer directly to the machine on the factory floor. We are continuously improving our skill at contouring. The objective is better material utilization. To that end, we analyze at the design level all available manufacturing techniques—chem milling, unitized structures, sculptured plates, weldment build-ups, one piece forgings, multipiece welded or bolted forgings, and heat treated components, selecting the best weight/cost way to shape each part.

Q. With the titanium production solutions in hand, are there other production problems you're investigating?

A. I don't want to give the impression that building airplanes with titanium alloys is a bed of roses. It's not. Titanium is still a relatively new material, but aerospace is beginning to make practical application of it in a major way. We're working hard on other new processes. Electron beam welding, diffusion bonding, new coating techniques, thin sheet fabrication, corrosion control, non-destructive testing . . . all deserve and are getting a lot of attention around here. And, there are other materials. Right now we're flying major load-bearing structures of boron filament and beryllium. We're bringing all these advanced processes to production status as fast as we can, while not neglecting to improve our application of aluminum alloy and non-metallic materials.

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