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AIR FORCE

and **SPACE DIGEST**

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

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USAF Major White's Walk in Space

—See Page 62





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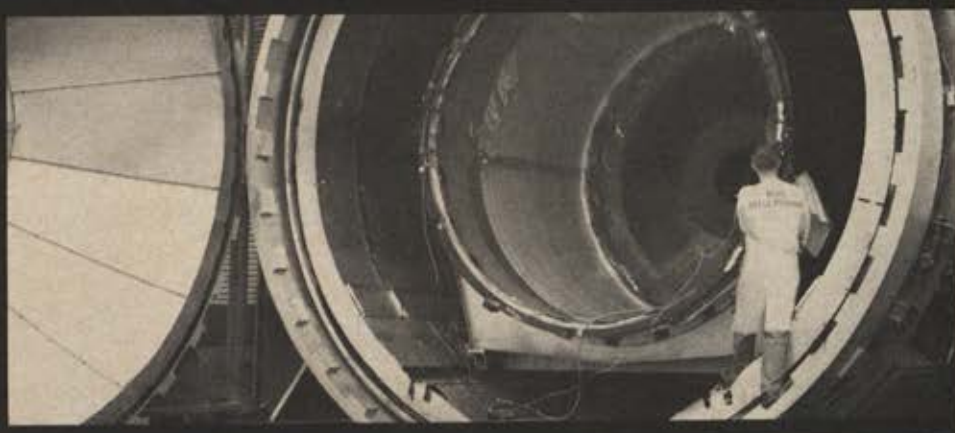
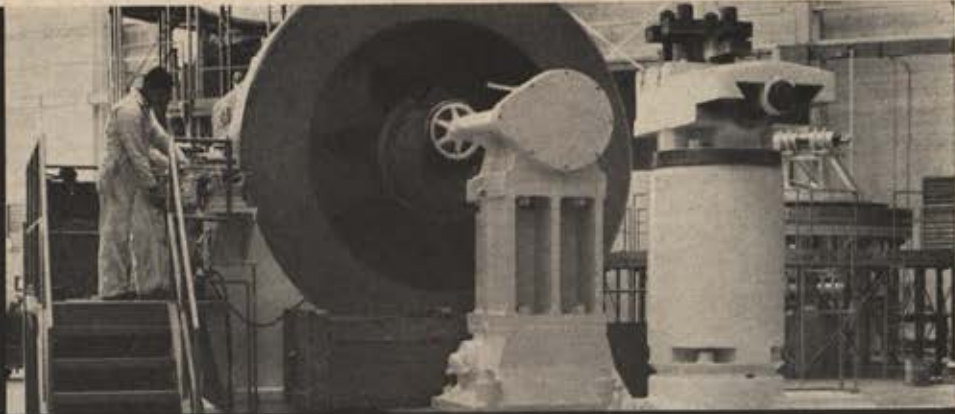
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For the full story on this and a variety of other nonmetallic fabrication capabilities, please contact: Marketing Manager, Dept. 61, Space Products Division, Rohr Corporation, Riverside, California.



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AIR FORCE



and SPACE DIGEST

The Magazine of Aerospace Power
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JULY 1965

VOLUME 48, NUMBER 7

Adequate Pay for Our Fighting Forces

A STATEMENT BY AFA, AUSA, AND THE NAVY LEAGUE

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The three major service associations warn that the problems of enlistment and retention of competent personnel, which plagues all the services, will not be solved until military incomes are at least comparable to civilian pay.

The New Soviet Missiles—Technological Storm Warning

or False Alarm? / BY J. S. BUTZ, JR.

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A close look at Russia's new strategic weapons is in order in view of the impressive missile arsenal displayed in the Soviet May 9 parade. The photos seem to contradict statements by Secretary McNamara that Russian solid-rocket-building capability is inferior to ours.

Defining the Government-Industry Relationship / BY J. L. ATWOOD

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A leading aerospace industrialist reasserts that the free-enterprise system is still the best method for finding solutions to problems. But a working partnership between government and industry is essential.

Containing Communist China / BY WILLIAM E. GRIFFITH

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The long-range Chinese goal is worldwide domination, and East Asia is her current prime target. A US withdrawal from Vietnam now could only be interpreted as a Communist victory... and encouragement for further aggression.

Aerospace Education Foundation Leaders Chosen / BY DON STEELE

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The AFA-affiliated Aerospace Education Foundation has a new and distinguished Board of Trustees.

SPACE DIGEST

The Prospects for US-European Space Cooperation

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Guidelines for space programs that may be suitable for US-European industrial efforts are proposed by this space-industry leader. Europe can gain operational experience by exploration of near space while US firms contribute in space systems management, he suggests.

Space Communications: Meeting the Needs of All

BY DALIMIL KYBAL

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As it progresses in space technology skills, Europe should concentrate on developing next-generation satellites as replacements for existing hardware, thus furthering truly global space communications.

The Flight of Gemini-4 / A SPACE DIGEST PHOTO FEATURE

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Spectacular photographs were made by Air Force Maj. Jim McDivitt of his colleague, Ed White, as White "walked" in space during the four-day Gemini manned spaceflight. The trip is recorded here from launch pad to postflight inspection of the capsule.

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US Rep. Chet Holifield's Military Operations Subcommittee recommends that the Air Force Manned Orbiting Laboratory (MOL) project be undertaken without further delay.

The Coming Revolution in Aeronautics / BY EDGAR E. ULSAMER

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Within our reach today is a new "golden age" in aviation. In a series of four AFA-sponsored Seminars, military, aeronautical, and materials-development experts examined the aviation challenge and stressed the wise and extensive use of technology in advancing aeronautics.

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Adequate Pay for Our Fighting Forces

Following are excerpts from the first joint statement made to Congress by the Air Force Association, the Association of the United States Army, and the Navy League of the United States. It was presented by AFA President Jess Larson on June 11 to the House Committee on Armed Services during hearings on the Rivers' and Administration's bills on military pay. As reported out of the Committee for House action, the bill contained all recommendations included in the joint statement.—THE EDITORS

APPEAR before you today as the designated spokesman of the Navy League, the Army Association, and the Air Force Association. . . .

Our joint statement today, therefore, represents the position of our joint membership—which totals 195,690 members—organized into a total of 628 chapters and councils located in every state of the union. . . .

All three of our organizations now have—and have had for years—a common objective of supporting those measures which will attract and retain competent personnel in the several services. In defining competent personnel, we mean personnel capable of operating and maintaining those types of highly technical weapons and equipment which your Committee recently authorized and which you estimate will cost approximately \$15 billion. This Committee already knows that low enlistments and declining reenlistments, together with the loss of commissioned personnel, indicate that the goal is not being achieved. But this is only a part of the problem. Quality is equally important. Will we have competent individuals and teams to operate exotic weapon systems in the years ahead? What this Committee does with military pay this year may well provide the answer. Two years from now—or even a year from now—may be a year too late. We believe that adequate pay is the first and major step in solving these problems. We believe it appropriate to comment on so-called fringe benefits generally understood to be enjoyed by the military. The value of these fringe benefits has decreased steadily over recent years while similar benefits in industry have been increasing, so that fringe benefits are no longer a significant factor, nor a realistic basis, for joining or remaining in the services.

The soldier, the sailor, the airman, the marine, and the military officer face the same financial difficulties as the industrial worker, the civil servant, or the business executive. In addition, the military man must shoulder the uncoupled "fringe penalties" related to abrupt disruption of family relationships, frequent changes of duty station, inadequate housing—to say nothing of the ever-present dangers of actual combat. We submit that no financial yardstick can be applied to the services of the squad or platoon leader in action, the pilots and crew members ashore or on ships when facing an enemy. But every effort should be made by this Committee to, at least, establish relative comparability between the financial standing of military men and civilian economy levels.

An interesting commentary on military and civilian pay appeared in the *Congressional Record* [on] 9 January 1958. . . . The author was Alain C. Enthoven, then a RAND Corporation economist and now Deputy Assistant Secretary of Defense (Comptroller). We think his remarks are even more pertinent today than when they were

written. He said: "Actually, considering the added demands and inconveniences of military life, it would not be at all surprising to find it necessary to offer many men more pay than they could earn as civilians in order to retain them. This is particularly true now that such large standing forces must be maintained."

Token or piecemeal increases will not solve the problem of attracting and retaining competent personnel. It is our consensus that the Administration's pay bill (H.R. 8714) is an example of the token increase to which we refer.

We have studied carefully the dissenting opinion on the Folsom Panel's pay recommendations submitted by our respected senior Army colleague, Gen. Omar N. Bradley. . . . We join in his dissenting opinion. On the retention problem, we can do no better than to repeat his conclusion: "Substantial increase in current pay at this time appears to be the simplest, most effective, and in the long run, cheapest solution if the services are to retain the hard-core professionals which the nation so desperately needs." We do not know what pay scale is necessary to attract and retain competent personnel, but we do believe that the Rivers Bill, H.R. 5725, is more likely to achieve the result. On this basis, these three Associations enthusiastically endorse H.R. 5725 to increase military pay now. We believe that the basis you have used in arriving at the pay schedule in your bill can be understood by the troops—and this is very important. . . . We are not persuaded that the 1963 pay bill brought to military personnel relative comparability with other sectors of the economy.

We also note with gratitude that the Committee again this year will include Reservists in the pay increase. We are mystified why the Administration again seeks to leave them out. We have been unable to find a logical explanation for this. We may need them sooner than we think.

We are happy to endorse that part of the Administration's bill which deals with the variable reenlistment bonus. This can be a worthwhile approach, and we ask that the Committee add this provision to its bill. Furthermore, we agree with previous witnesses from the Department of Defense that the present proficiency pay provisions be continued.

We wholeheartedly agree with the principle of an annual review of military pay and allowances. This principle appears to have the agreement of the Administration. Such review, if enacted into law, would assure military personnel that their futures are to be given appropriate consideration, and we urge the Committee to include such a provision in its bill.

In summary, we personally, and the members of our Associations, are convinced that this Committee will report out a bill which will meet the requirements for maintaining adequate fighting forces.—END



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Uneasy Peace

Gentlemen: Congratulations on Claude Witze's very excellent article ["Our Answer to Future Threats: Action or Reaction?"] in the May issue. He has done a fine job describing our enigma today in the face of Soviet technological progress. And, the recent May Day Soviet weapons disclosures further stress the point that the Soviet weaponeers are not resting on their oars. They are, as Malinovsky states, "standing guard vigilantly over the peace." But "peace" to the Marxists-Leninists is the struggle for Communist world domination.

COLONEL, USAF

Gentlemen: Congratulations on Claude Witze's fine article. . . . The thrust of the piece is so logical that I am amazed all do not grasp it and its implications. But many do not and, it would seem, the number is growing. . . .

RICHARD C. PEET
Washington, D. C.

Command Post

Gentlemen: Enjoyed greatly the April issue of AIR FORCE/SPACE DIGEST and perused Secretary Zuckert's article with considerable interest since command and control of the forces assigned to SAC is a matter of greatest import to us.

However, the supporting artwork needs updating. I am speaking of the shot of the SAC Command Post (page 68), which showed closed-circuit television used to "provide instantaneous

transmission of data to the White House and Pentagon."

I am sure you know that we pulled out that system a couple of years back and are currently using specially designed slide projectors as shown in the [accompanying] photo. . . . I call this to your attention because your magazine has high credibility among its readers, and I don't want people to believe we are still using the closed-circuit TV.

COL. DONALD C. FOSTER
Director of Information
Hq. SAC
Offutt AFB, Neb.

Hard Hitter

Gentlemen: . . . I have just finished reading William Leavitt's "Speaking of Space" in the May issue and am impelled to tell you how important I think it is.

I like all of Mr. Leavitt's stuff; it's extremely perceptive and well written. But in this case, he outdid himself. To me, and I am sure to all of your readers who have any background knowledge in the field, he laid in the golden spike with such precise sledgehammer blows that I must not only admire his acute perceptions and intellect but also have to give three-plus cheers for his capabilities as a writer, his style, . . . and ability to express a complex situation on several levels of meaning and innuendo. . . .

LLOYD MALLAN
New York, N. Y.



Slide projectors in SAC's underground command post at Offutt AFB are specially designed to give warning and provide global command and control over retaliatory forces in case of enemy attack.

Viable Honor Code

Gentlemen: Contrary to the paeans of praise in the "Airmail" column of your April issue, your [March] editorial "To 'Rat' or Not to 'Rat'" did not seem to me to touch the crux of the problem at all. That is simply whether it is logical to expect human beings to "rat" on their friends—is the code practical, realistic? I doubt it.

The very word "rat" indicates the common reputation of the man who tells. You mention the Mafia and their code of silence. But I think there have been more stool pigeons in the criminal world than there ever were at West Point—or in our Academy. How many Cadets do you suppose actually knew something dishonest was afoot? How many "ratted"? I would be deeply interested in the findings and action of the Cadet Honor Committee—but doubt that this will become public, even in your magazine.

I am not a philosopher and, therefore, have no way of knowing whether or when people should be morally called upon to tattle on their weak and sinful colleagues. But, as a practical matter, they just don't. I taught some years in AFROTC at [a university], where there is a code like ours, so I know whereof I speak.

Finally, you must have heard of the "WPPA" (the West Point Protective Association), a term derisively intended to indicate that Academy graduates cover up for each other all through their careers. Does the Honor Code on "ratting" extend only through graduation? The truth is, it isn't accepted or practiced at all.

No doubt it should be. I merely point out that it isn't—and isn't likely to be until Academy men become more than human. This to me is the important lesson in our scandal, completely ignored in your editorial.

LT. COL. EDWARD H. ROBINSON,
USAF (Ret.)
San Diego, Calif.

● The internal enforcement of a professional ethic by segments of our society is not unique. We expect doctors, lawyers, executives, public officials, and armed forces officers who
(Continued on following page)

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AIRMAIL

CONTINUED

observe a violation of the public trust by a contemporary to bring that contemporary to task. Similarly, Cadets have set a code for themselves which they internally police. This is not unique among students. Many universities have viable honor codes in which a no-toleration clause is a principal tenet. The fact that reader Robinson has in his experience observed men who did not live by such precepts does not invalidate the fact that many men do, or the fact that society expects certain segments to internally uphold a professional ethic.

To further support this view, we quote from "The Toleration Clause" in the White Report:

"The prohibition against 'toleration' which rounds out the Cadet Honor Code is its most exacting and difficult standard. Since 'honor' is not an exclusive value, a very real conflict may develop between personal friendship and a higher loyalty to the Cadet Wing which the Toleration Clause embodies. Here, too, however, the standard which Cadets exact of themselves, though far more rigorous, is not without roots in society at large.

"The moral courage of the crew member of a military or commercial aircraft who reports that a pilot has been drinking furnishes an example. The assistant who denounces a prosecutor for withholding evidence of a defendant's innocence is another illustration. In each of these instances, and many others, the public would condemn the individual for remaining silent. This is so because our commitments to society as such impose a higher loyalty than is demanded by those who would imperil it.

"Instances of this kind are reinforced and the ethical requirements are heightened when the individual is placed in a position of public trust. Examples include the officer in an Air Force research-and-development program charged with millions in public funds, who sees a fellow officer stealing; or an officer in a missile complex who condones a false report on the missiles' state of readiness; or a judge who knows that another judge has accepted a bribe; or a doctor who sees a colleague prescribe an illegal and dangerous drug.

"While these examples are extreme, they serve to highlight the fact that a public servant is always confronted by the obligation to put the welfare of the community foremost in his scale of loyalties. The Toleration Clause, in emphasizing that the Honor Code is a community possession of the Cadet Wing, is calculated to develop more

fully this awareness in each Cadet.

"In ordinary circumstances, each of us as an individual decides when he feels bound to report the misdeed of another. In their special circumstances, the Cadets have chosen as a group, through the Toleration Clause, to set a high standard, but one not out of line for a profession committed to public trust and mutual confidence. A military organization depends for its success upon a deep sense of personal responsibility by each member to the group at large. Each subordinate community in our society—university, profession, social club, or religious order—has this privilege, subject only to the legal restraints common to all. The high calling of the Air Force officer and the demands made by the profession of arms lend support to the choice which the Cadets have made.

"To suggest that such terms as 'squealer' or 'informer' are applicable is to indulge a misconception. It suggests that future Air Force officers have no higher duty than loyalty toward their personal friends even at the expense of loyalty to the Air Force or the nation it is dedicated to serve. Such epithets are rightly applied only to those narrow relations between man and man in which larger interests and commitments are not involved."—THE EDITORS

Entrenched

Gentlemen: Re the caption under the lower right-hand picture on page 64 of the May '65 AIR FORCE—someone is confused. In my experience, slit trenches were dug a respectable distance from domicile tents. However, trenches for drainage purposes, or just to keep the tent contents from washing away, were dug around tents. This was commonly called "ditching."

Referring to the caption on the cover, you do have a "fuzzy image" of that long-ago war.

Yours for more and better captioning.

E. W. GREGORY, II
Washington, D. C.

● At the risk of straddling the issue, may we point out that—in our World War II parlance at least—the slit trench was for protection against bombs, shells, and other scrap metal. The straddle trench, which Reader Gregory evidently had in mind, was for a nonrelated but equally elemental purpose and was usually placed not only a "respectable distance" from sleeping quarters but also preferably in a downwind direction.—THE EDITORS

Another RD and E capability report from ALLIS-CHALMERS

Fuel cell A-OK after 1,400 hours ... and still running!

An Allis-Chalmers 28-volt fuel-cell system has successfully operated for more than 1,400 hours — producing both electrical power and drinking water from hydrogen and oxygen. And it is continuing to rack up running time during performance testing in Milwaukee. Allis-Chalmers built this advanced system for NASA.

What's so important about 1,400 hours? A spacecraft could make nine round trips from earth to moon in 1,400 hours. Allis-Chalmers scientists and engineers feel this system's performance proves such fuel cells are suitable power sources for prolonged space missions — such as space stations in orbit 30 to 45 days.

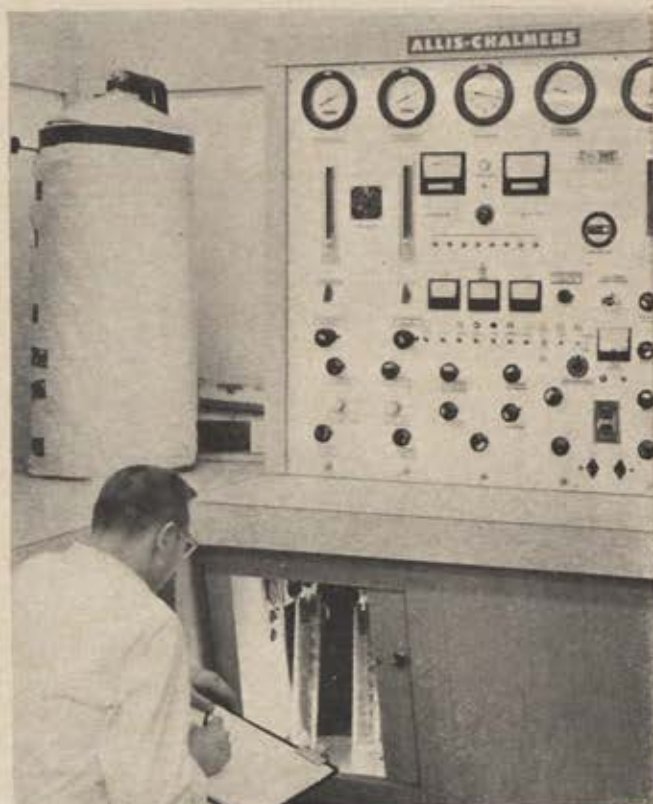
The Allis-Chalmers system converts chemical energy of hydrogen and oxygen directly into 28-volt electricity. During its initial 1,400-hour performance, it efficiently supplied power outputs ranging from 800 to 2,300 watts. Total energy delivered so far is 1,430 kilowatt-hours. Plenty of power for aerospace applications!

The system is producing $2\frac{1}{2}$ to 3 gallons of water per day, enough for two astronauts. Purity of the water is assured because a distillation process is used to remove moisture from the Allis-Chalmers system. A built-in capillary membrane (we don't need pumps) takes out the water in vapor form. Simply condense it, collect it, and drink it as needed.

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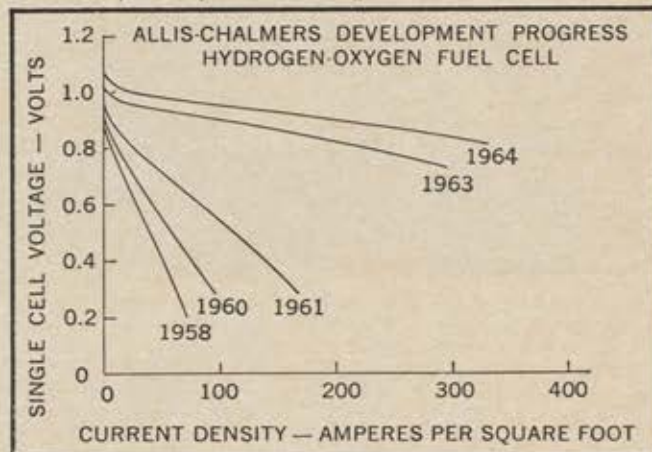
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Chart shows Allis-Chalmers fuel-cell technology has improved by an order of magnitude since 1958.





Letter from Europe

By Stefan Geisenheyner

AIR FORCE/SPACE DIGEST EDITOR FOR EUROPE

The German Aviation Industry

WIESBADEN, GERMANY

In nearly fifteen years of steady growth, West Germany and its industries have turned the country into one of the most prosperous nations on earth. More than a million foreign laborers—Italians, Greeks, Turks, Spaniards, and other nationals—have streamed into Germany, whose booming economy desperately needs labor of every type and description. The steel, automotive, chemical, and construction industries have experienced a steady growth rate which, even if it is not rising as fast today as in the "golden fifties," is on the upswing nevertheless.

The aerospace industries, however, have not shared in

this general economic growth, and as things stand today they may never become a really important factor in the industrial life of the nation. In fact, if the present trend continues, the German aviation industry will shortly be in a very serious condition indeed. The reasons are many and involved. Most of the official explanations are based on economic theorizing. The true reasons lie far deeper and include such intangibles as mass psychology and emotional factors.

During Hitler's Third Reich, the Germans were force-fed "air-mindedness." Slogans like "The German nation must become a nation of aviators," compulsory aircraft-building classes in the schools, and the glorification of World War I heroes—to name a few devices—were extremely successful. Aviation became the business of every German. The only discernible result of this campaign as seen by the average German, however, was the war, the bombings, and the destroyed cities. Thus aircraft, and rockets in particular, are considered evil, unnecessary, and dangerous; and an aviation industry is regarded as a warmongering enterprise.

Furthermore, the public mind does not distinguish between civilian and military projects and programs. German war experiences did not coincide with Hitler's claim that his aviation served peaceful purposes exclusively. As a result of this nonair-mindedness, any German government which today tried to allocate greater sums of money to its aviation industry would meet with fierce political



Development of the Entwicklungsring-Süd experimental VJ 101 VTOL aircraft was a truly international undertaking. Rolls-Royce was responsible for construction, development, and testing of wingtip-mounted engine pods, each of which contains two Rolls-Royce RB.145 engines. Funds for the development of the experimental aircraft came out of West Germany's military budget. Because of the German public's postwar attitudes, support for civil development is low.



Vereinigte Flugtechnische Werke (VFW) in Bremen is working on this design of a fast, commercial VTOL turboprop transport. Speeds of as much as 450 knots, carrying payloads of three to four tons over medium-range distances, are envisioned. The original studies for this project were financed by the German military, which apparently dropped the turboprop approach for a pure jet transport. VFW, largest German aero firm, is said to have only \$6 million to work with.



Above, the Heinkel He 211, which was a factory-funded design. If it had been built in quantity, it might have put West Germany in a position to market a fast feeder-line aircraft during an advantageous period. But because Heinkel, limited by its shortage of capital, was unable to put the aircraft into production, the sales opportunity was lost.

opposition. This stand on aviation, plus a host of minor and major financial considerations, has led to a paradox. It is ironic that Germany's aerospace industry now serves military purposes almost exclusively, that it was rebuilt largely with military funds, and that it has only one major customer—the Luftwaffe.

The explanation for this, in the light of the above-mentioned emotional revulsion toward aviation, is the German participation in the NATO treaty. Certain military obligations had to be fulfilled. Germany had to rebuild its Luftwaffe at a very fast rate. It was not feasible to buy all the necessary aircraft abroad since this would have endangered the favorable balance of export and import business. The only way open was to rebuild an aviation industry. Military requirements as to delivery dates and output led to the creation of an industry which turned out hundreds of F-104G fighter-bombers, C-91 close-support fighters, and transports, and which will in the near future begin the large-scale construction of military helicopters under license.

But after the main task of furnishing the Luftwaffe with combat aircraft was fulfilled, late in 1964, the industry

had insufficient follow-up orders available to keep itself going. This moment had been foreseen even during the inception of the new aviation industry in 1955, and the individual firms had proposed from the very beginning that military programs be supplemented with civilian projects. Many promising designs were submitted to the government for approval and—hopefully—for subsidy. But the government did not dare to show any interest.

The logical solution would have been for the firms to invest money themselves in new projects, to build and to market them, but they hadn't the money. The biggest German firm, VFW (Vereinigte Flugtechnische Werke), for instance, has available capital of only \$6 million. This is shared by five partners, consisting of a banking trust, a steel manufacturer, an American aviation enterprise, and two German aviation firms. The latter firms contributed \$1 million to the group. It is clear that one cannot embark on even a moderately ambitious aircraft program with only \$6 million of basic capital.

Furthermore, VFW and other German aviation firms are in debt to the German government for funds advanced to them in the late 1950s. Even though the payment of the debts is in the form of long-term and easy installments, it is quite an extra load. And there are other debts to pay which stem from the war years. To put it bluntly, the German aviation industry is living a hand-to-mouth existence. The government, the only financial source which could help, is not willing and cannot invest money on the needed scale. Thus the aerospace industry is hoping for a miracle to happen, either in the form of international cooperation or new requirements and orders in the military sector.

The hopes for international cooperation, which has its foundation in the very successful four-nation F-104G program, have been dashed time and again. The talks on French-German cooperation took concrete form in a few instances only and then on a military basis. The same holds true for German-American and German-British cooperation. The much desired coproduction program with other nations for a civilian aircraft type seems to be taking shape finally. The first groundwork is now being laid for a joint Dutch-German-British development and production of a short-haul jetliner. This may mark a turning point in inter-European coproduction ventures.

After much pressure, the German government in 1963 decided to assist with the development of several civilian
(Continued on following page)



This is the only jet aircraft which has been developed and produced in West Germany since the end of World War II, the HFB 320 Hansa, a light executive jet by Hamburger Flugzeugbau. HFB financed the project out of its own resources at first, until, in 1963, the government of the Federal Republic came through with some support. The funding problem is universal, an irony in the land that created the Luftwaffe.



One quite promising project of the aerospace industry in West Germany is this light jet transport, the VFW-614. The aircraft is expected to be of very rugged construction, which would give it needed advantages in underdeveloped areas of the world. Marketing research thus far suggests that more than 1,000 such aircraft might be sold. To date no funding from the government of West Germany has been forthcoming.



Germany's aerospace industry, ravaged by World War II, was very successful in rebuilding itself out of the ruins. Only four years after the beginning of the reconstruction, the industry was able to tackle production of the complex F-104G Starfighter weapon system. Whether by the time it is necessary to produce replacements for the F-104G there will be enough of a West German aerospace industry left to do the job is a moot question. Living from hand to mouth can lead to starvation; governmental capital infusions are needed.

aircraft types—one executive jet, two helicopter designs, one sports aircraft, a small STOL transport, plus the Dutch-German-British short-haul liner. To construct and develop these aircraft, the ridiculous sum of \$16 million was allocated, to be spent within five years. The German government is thus "helping" its industry to the tune of \$3.2 million per year. This sum is not large enough to live on nor small enough to die on, let alone allow the development of aircraft. Furthermore, the money is not a giveaway but has to be repaid from future profits. Another string attached to these loans is that they must not be used for more than sixty percent of the total development cost, the other forty percent to be borne by the company.

Under such circumstances, any competition on a worldwide basis is absurd and the aircraft manufacturer knows this. Whether the "government-subsidized" projects ever become a success remains to be seen.

On the military side, however, government funding is adequate and the results show what the new industry can do. Prototypes of excellent VTOL aircraft and helicopters are flying proof of the high technical standard reached during the past years. In the space field, too, Germany has made some outstanding contributions to the state of the art.

But an industry cannot live exclusively on research and development, well as it may be funded. Only a sizable production order can pull it out of the financial quagmire. Neither for the military nor for the space field are any bigger orders expected in the next three years. Stopgap orders, centering around a few hundred helicopters or a hundred transports, will not keep alive an industry which is geared to turn out complex weapon systems in great numbers as was the case with the F-104G. The picture can change rapidly, however, when the F-104G has to be replaced by a more modern VTOL aircraft. Whether at that future date there will be a German aviation industry in existence to build an F-104G replacement remains an open question.

The remedies for the financial instability of the German aviation industry are simple:

1. The government has to fund the research, development, and construction of a variety of promising aircraft designs which are salable on the civilian market the world

over. Several such projects are available and can reach the hardware stage in a relatively short time.

2. Firm requirements for future military aircraft have to be given to industry in order to enable it to do sound, long-range planning.

3. Participation in international aerospace programs has to be intensified and if the respective firms are not financially strong enough to deal properly with the foreign partners, the government must step in.

4. A publicity campaign must tell the German population that an aviation industry is necessary to ensure steadily continuing progress in every technical field.

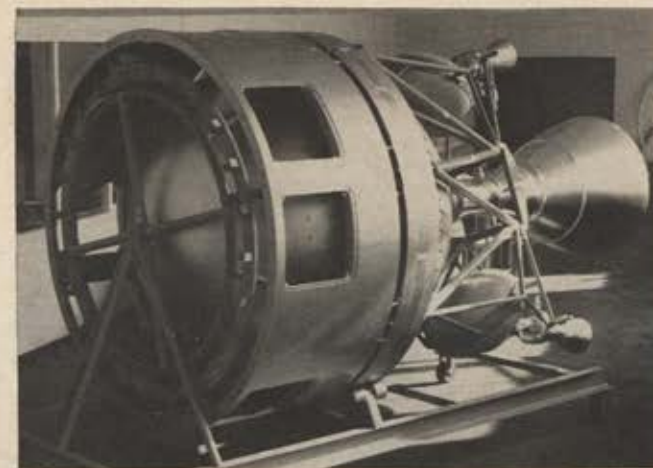
5. A master plan must be introduced on a fixed-time basis which takes all aspects of aerospace into account, which can be updated if technology overtakes it, and which has to be strictly adhered to by everyone concerned.

If these five points can be realized, the German aviation industry can survive its present-day difficulties. If nothing is done and the downhill trend continues, the end of an independent national German aviation industry is in sight.

—END



This is the Bolkow B.46 experimental helicopter currently in flight testing. Its designers indicate that through the use of a novel rotorblade arrangement, it is theoretically possible to attain speeds of up to 350 mph with the aircraft. The new rotor system being used in the B.46 was developed under a contract let by West Germany's Ministry of Defense.



There is international cooperation on the space side. Above, the third stage of the ELDO booster, being developed under the aegis of the European Launcher Development Organization in which several European countries are pooling their space capabilities. Germany is providing the third stage, and most of its aerospace firms are taking part in the project.

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Currently representing a five-airplane program, the XC-142A is scheduled to begin a rigid evaluation by a tri-service team in July. It is the world's largest flying V/STOL and the first of its kind to be developed by the United States for operational evaluation rather than the testing of a concept.

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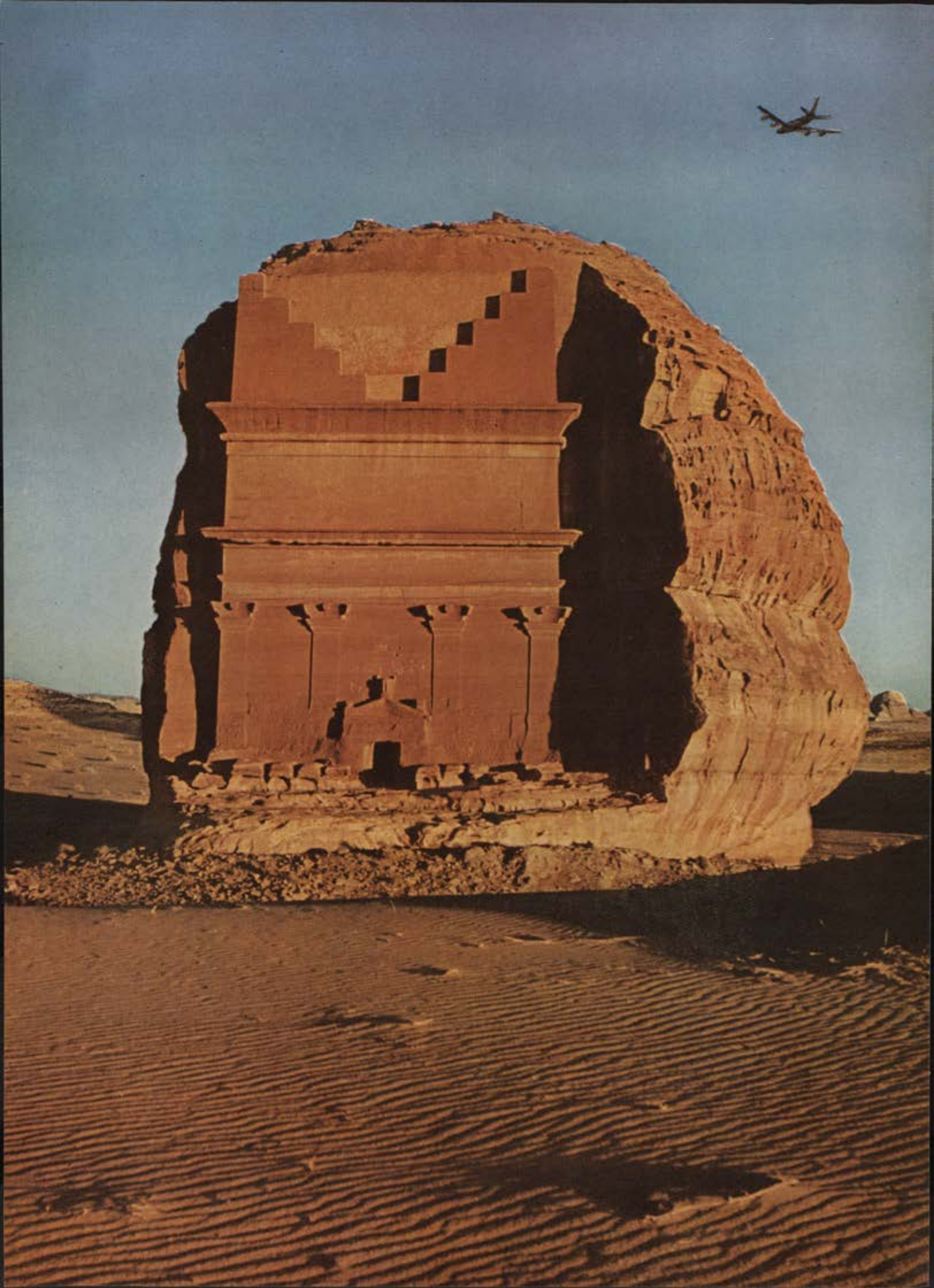
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AIRPOWER in the news

By Claude Witze

SENIOR EDITOR, AIR FORCE/SPACE DIGEST

Who's in Charge Here?

WASHINGTON, D.C., JUNE 10

At long last the General Accounting Office and its chief, the Comptroller General, are being put under public scrutiny. The almost unanimous complaints of defense contractors and defense procurement officials that have been welling up in the past few years have found an outlet.

They are being placed in the record by Congressman Chet Holifield, Democrat of California, and his Military Operations Subcommittee of the House Committee on Government Operations. It should be made clear at the outset that, contrary to some published reports, Mr. Holifield's Subcommittee has a clear right and responsibility to conduct an inquiry into GAO's conduct. This derives

former Treasurer of Columbia University, was appointed by President Eisenhower, and he cannot be removed by Congress or the White House.

Opening the GAO investigation a month ago, Mr. Holifield made it clear that both the Defense Department and the contractors feel that Mr. Campbell's operation is necessary but that it has screaming deficiencies. He said, "Resentment often arises over what the agencies believe to be invasion of their management prerogatives and reports which do not give a balanced account of their achievements as well as their deficiencies."

He added that contractors often believe that "the GAO reports invade their privacy, prematurely publicize issues still under administrative review, and place the companies in a derogatory position which they believe is unjustified.



Chet Holifield



Joseph Campbell



Paul R. Ignatius

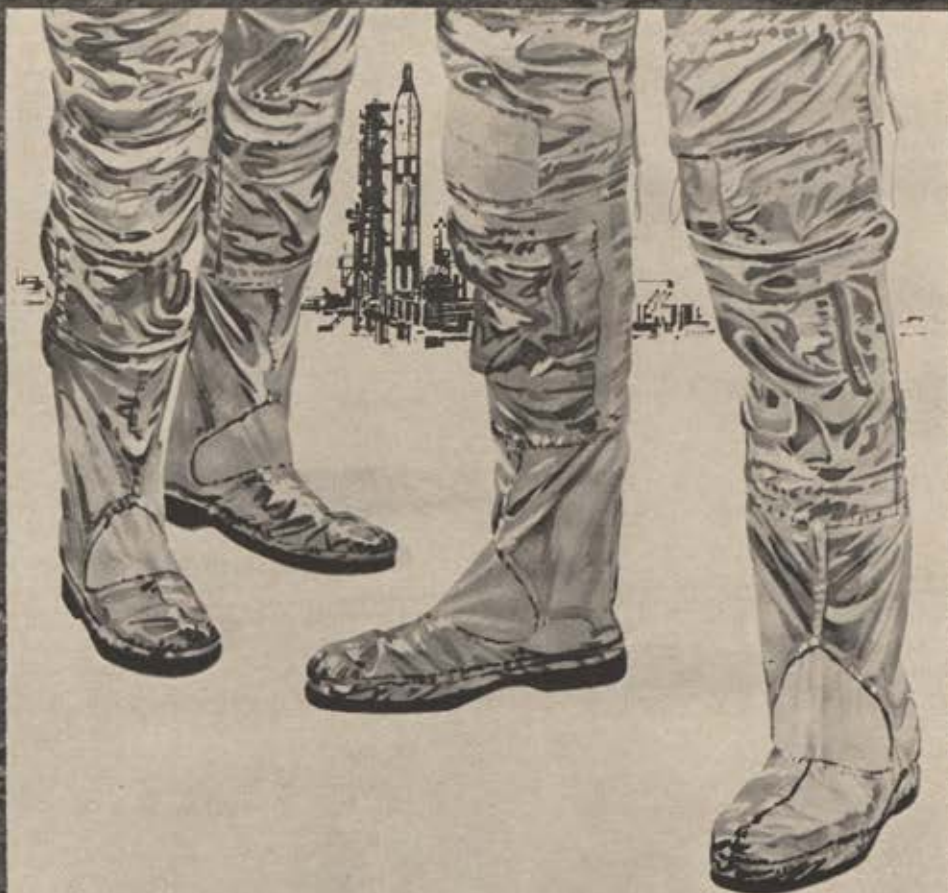
from (1) the fact that the parent committee is named by law as monitor of GAO operations and is given the duty of "receiving and examining reports of the Comptroller General of the United States and of submitting such recommendations to the House as it deems necessary or desirable in connection with the subject matter of such reports." And (2) in Fiscal 1964 alone, 164 GAO reports dealt with contracts in defense and related areas, which are the concern of Mr. Holifield's Subcommittee.

So far as the Comptroller General is concerned, he is authorized by law "to examine any books, documents, or records" of contractors and subcontractors "that directly pertain to and involve transactions relating to the contract or subcontract." This authority applies to negotiated contracts as distinguished from advertised contracts. The Comptroller General himself, who is Joseph Campbell, is appointed by the President, with the advice and consent of the Senate, for a term of fifteen years. Mr. Campbell,

The government agencies and the contractors both point to the fact that GAO reports often deal with matters and events which are years old, difficult to reconstruct, and occurring in situations and circumstances which hinders sight of perspective and understanding."

The Chairman said both industry and the Defense Department face "difficult and sometimes awkward situations created by the GAO audit reports" and that it is high time to air the complaints. To close observers, it has been clear for a long time that industry has felt that GAO goes out of its way to serve as judge and jury as well as prosecuting attorney, often in areas where it lacks competence. The buildup of Defense Department complaints against the agency is more recent. At the outset of his administration in the Pentagon, Defense Secretary Robert S. McNamara ordered the fullest cooperation with Mr. Campbell's efforts. That he has now retrenched was made evident by his rep-

(Continued on page 22)



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representative on the stand before the Holifield Subcommittee. The Defense Department witness was Paul R. Ignatius, Mr. McNamara's Assistant Secretary for Installations and Logistics. He is a man with experience in this area going back at least to World War II. He is one of the founders of Harbridge House, Inc., consultation experts on military procurement, and is considered an expert on management policy.

In an early observation before the committee, Mr. Ignatius cited the fast-growing interest of GAO in the Defense Department. The number of drafts and final reports on Defense functions jumped from 203 in 1962 to 544 in 1964. That is an increase of 168 percent and it seems to the Pentagon that this is not "a barometer of the number of deficiencies in procurement." Out of this mass of paper, Mr. Ignatius indicated that Mr. McNamara has learned that GAO, far from helping his procurement management, is hampering it.

Specifically, the Pentagon finds that GAO is damaging the integrity of its contracts, that it interferes with DoD pricing policies and presses for too much interference with the operations of government contractors.

GAO's frequent demand for voluntary refunds, which means refunds for which it makes no legal argument, is contrary to Defense Department policy. The Pentagon position, Mr. Ignatius testified, is that the government "is bound by the agreements which it enters into and that this must be the first and overriding consideration in any determination as to whether or not voluntary refunds should be sought." He cited cases in which GAO recommended voluntary refunds and the Pentagon did not seek them because the military departments signed the contracts "eyes open," knowing what they were doing and without being misled. In one example, where GAO recommended the withholding of payments to a contractor, Mr. Ignatius said, "Procurement of the unneeded spare parts was not the result of any failure on the part of the contractor, as contended in the report, but was due instead to the action of the government in accelerating deliveries and thereby disrupting the orderly process of spare parts provisioning."

Said the witness: "We believe that contractors should have reasonable assurance that they hold binding contracts with the government and that contracts entered into and performed in good faith will not thereafter be voided." And, later: "We must be careful to avoid actions that treat defense contracts as if they were fully binding on one party but not entirely binding on the other." Later testimony made it clear that the Pentagon and its contractors agree on this but that GAO feels no such compulsion. Charles I. Derr, a spokesman for the Machinery and Allied Products Institute, said that GAO auditors are not supposed to substitute for managers. Supporting Mr. Ignatius, Mr. Derr said that the contractor must now "be prepared to deal with the varied faces and moods of government as reflected by the contracting agency, the General Accounting Office, and in some cases the Department of Justice. He has every right to ask: Who's in charge here!"

On the subject of pricing, Mr. Ignatius recounted the Pentagon effort to get away from cost-plus-fixed-fee (CPFF) contracting and to "use contracts affording greater incentive for efficiency and economy." He said that CPFF now is used "only when no other form of contract is suitable," and that "the Department of Defense is currently using contract procedures that exploit the profit motive to the fullest. . . ." He said industry has cooperated and that the program is a success. At the same time, the witness said, "GAO has taken a position and made recommendations which, if we had followed them, would have seriously hampered our efforts to press for increased use

of the fixed-price approach." He added that "the most rigorous government surveillance and audit cannot take the place of the profit motive as a means of assuring effective cost control."

In the area of customer involvement in the contractor's internal affairs, Mr. Ignatius made a major issue out of GAO's insistence that prime contractors not be allowed to purchase components and assemblies, but that more of these items be supplied to the primes as government-furnished equipment (GFE). GAO charges that the profits and fees paid to primes for these purchases are "unnecessary costs." The witness pointed out that GFE already accounts for thirty to forty percent of many major contracts. But, he said, we can carry the idea too far, and we could run into some "very real dangers." Here is a list of factors that are not considered by GAO auditors:

- The criticality of the item to safety or military effectiveness.
- The stability of design.
- The effect on the prime contractor's performance responsibility.
- The effect on production schedules.
- The extra administrative costs to the government.

The GAO emphasis, of course, is on the fact that the prime makes a fee out of handling his own subcontracting. Mr. Ignatius replies that "the range of fee or profit allowed on purchased parts and components is lower than the range allowed for work done in the prime's own facilities. In addition, our profit policies provide that in instances where it is determined that the prime contractor has effectively transferred real cost risk to a subcontractor, the profit or fee allowed the prime will be appropriately adjusted. In short, the contractor's subcontracting program may have a significant impact on the degree of risk accepted by the prime or the technical contribution that the prime makes." Industry witnesses later expanded on this thesis.

GAO makes repeated recommendations that defense contractors should be given government-owned electronic data-processing equipment instead of being allowed to lease the devices. Here again, the Pentagon viewpoint is that this is a contractor responsibility and should be borne by the contractor. Such equipment is, of course, highly specialized, and becomes obsolete at great speed. This is why even nondefense industries lease instead of buy. But, to Mr. Ignatius, this issue with GAO is far deeper than that. He told the Holifield Subcommittee:

"We believe that the most effective way of assuring management decisions that are in the best interest of the government is not to increase government control and intervention but to use contracting techniques that provide maximum incentive for efficient and economical performance. . . . We believe it essential in a system of free enterprise that such decisions not be imposed by the government but that they be made by contractors, subject to government review."

A final issue between Defense and GAO is the recommendation of the auditors that contractors should buy routine housekeeping supplies, such as desks and other office requirements, from the government's General Services Administration instead of regular commercial outlets. Mr. Ignatius contends, in effect, that it is none of DoD's business where a contractor buys the things he needs to run his shop. GSA holds that "if the contractors elect not to use GSA sources and supplies, the allowable cost of such operating supplies charged to government contracts should be limited to the amount which would have been incurred if GSA procurement sources were utilized." To this, Mr. Ignatius replies that it is the contractor who has

responsibility for determining what he needs. On top of this, the government is inclined to encourage the purchase of such routine items from local commercial sources. The Defense Department, in fact, altered its regulations to let local military installations buy from local sources.

Robert H. Charles, Assistant Secretary of the Air Force for Installations and Logistics, gave strong support to Mr. Ignatius. Contract integrity, Mr. Charles indicated, is more important than large profit factors. He cited a case in which the profit was generous, but investigation "did not reveal any instance wherein the contractor had misrepresented prices or misled their customers. . . . There was no contractual basis for seeking a price adjustment. . . .

"The point is that we entered into a binding contract



Robert H. Charles, Assistant Secretary of the Air Force for Installations and Logistics, gave testimony which supported the theories of Mr. Ignatius.



H. M. Horner, Chairman of United Aircraft Corp., spoke out forcefully as an industry witness.

with our eyes open. The government, as well as the contractor, must respect its contractual obligations. We cannot, after the fact, treat a contract which we negotiated on a fixed-price basis as one entered into on some other basis. Like any party to a contract, we have to abide by the terms we agree to."

In the case of another GAO-chosen example, Mr. Charles reviewed the circumstances and said the GAO is suggesting "that when an improvement is made, the practices of the past should be reexamined to determine whether they resulted in any 'unnecessary' cost to the government which we should now try to recoup. To do so would, in our judgment, deter our contractors from introducing needed changes and improvements. Such a policy would have the effect of penalizing progress instead of encouraging it."

On the subject of GFE, Mr. Charles said the Air Force respects the prime contractor's responsibility for the quality and reliability of the end product. He said: "... when design or engineering effort by the prime contractor is required to develop, modify, or adapt a component for use in the end item, direct procurement by the government could result in relieving the prime contractor of his contractual responsibilities and denying the government one

of the major things it is paying for—the prime contractor's technical and management talents."

One of the most outspoken industry witnesses on this facet was H. M. Horner, Chairman of United Aircraft Corp. He said the GAO effort to force the military services to "break out" components is ill-advised. He said any substantial extension of the policy will "materially impair the quality and integrity of weapons and other military products and will substantially delay deliveries." These considerations appear to carry little weight with the GAO, which is entirely absorbed in the bookkeeping aspects and in the potential saving it professes to see.

"We are thoroughly convinced," Mr. Horner continued, "that if the true and complete costs to the government of procuring under a breakout system are computed and tabulated, they will not be less, and probably significantly more, than the cost of procuring through the end-item contractor, who provides, at no extra cost to the government, assurance of product integrity."

Mr. Horner, of all industry witnesses, made the strongest point of the GAO routine practice of loading its reports with derogatory adjectives that do not reflect fact, but the opinion of the auditors. He said GAO "pays little or no attention to the quality of the product delivered under the contracts it reviews nor to the effect on quality or delivery schedules which might result from yielding to its recommendations. The result is that a reading of GAO audit reports leads to a badly distorted impression that most military procurement is unsound. This distortion is accentuated by the GAO's practice of loading its reports with colorful language bordering on the sensational and apparently intended to appeal to the public press. . . ."

The witness said that seven final GAO reports concerning United Aircraft suggested there should be a refund that amounts to seven one-hundredths of one percent of total sales during the period to the government. And not any one of the reports, Mr. Horner said, "has claimed or could justifiably claim, any fraud, misrepresentation, or other wrongdoing on the part of the company." At the same time he offered an exhibit of newspaper clippings in which GAO reports had tagged United Aircraft with headline derogation. He said, "This sort of publicity, in addition to being unwarranted and inaccurate, hurts the morale in our plants and leads to higher costs which always accompany poor morale."

Space prohibits a full review of the industry viewpoints presented to the Subcommittee. Among the witnesses heard were Karl G. Harr, Jr., President of the Aerospace Industries Association; William H. Heflin, President of the Western Electronic Manufacturers Association; William H. Moore, Vice President of the Electronic Industries Association; Daniel J. Haughton, President of Lockheed Aircraft Corp.; Howard W. Neffner, Vice President of the Boeing Company; John F. Carr, Counsel of the Grumman Aircraft Engineering Corp.; and William T. Noll, Vice President of Honeywell, Inc.

The plea, in general, was for fair play. It was summarized by Grumman's Mr. Carr, who said:

"We recognize the necessity of [GAO's] role, but we wish they did not find it necessary to publicize their conclusions in such a provocative manner, that they would adopt a more objective approach to their studies, that they would not inject themselves so deeply into regular administrative channels, that they would look at contractor's actions in the context of the times in which the actions were taken, and that they would exercise greater selectivity in the choice of individual matters for study."

Other witnesses said the same thing but with much less delicacy. All wanted to know: Who's in charge here?—END

AEROSPACE WORLD

By Allan R. Scholin

ASSOCIATE EDITOR, AIR FORCE/SPACE DIGEST

WASHINGTON, D. C., JUNE 18

Four major Air Force commands will get new commanders this summer. Gen. Walter C. Sweeney, Jr., Commander of Tactical Air Command since 1961, is scheduled to retire July 31, to be succeeded by Gen. Gabriel P. Disosway, former TAC Vice Commander and now Commander of US Air Forces in Europe. General Disosway in turn will be replaced by Lt. Gen. Bruce K. Holloway, Deputy Commander in Chief of US Strike Command, who has been nominated for four-star rank.

Lt. Gen. K. B. Hobson, Vice Commander of Air Force Logistics Command, moves up to AFLC Commander and full general rank when Gen. Mark E. Bradley, Jr., retires on July 31.

Lt. Gen. Cecil H. Childre assumed

command of Continental Air Command June 16, upon retirement of Lt. Gen. E. J. Timberlake, who had led CONAC since July 1962.

New Commander of Air University, succeeding Lt. Gen. Ralph P. Swofford when he retires July 31, will be Maj. Gen. John W. Carpenter, III, nominated for promotion to lieutenant general. General Carpenter has been USAF's Assistant DCS/Plans and Operations for JCS. For details on these and other senior staff changes, see "The Bulletin Board," pages 80-83.

Military Air Transport Service will become the Military Airlift Command (MAC) on January 1. The name change, long advocated by Chairman L. Mendel Rivers of the House Armed Services Committee, was directed by Congress this spring.

Strap-on boosters of Titan III-C separate as first-stage engine ignites, in this artist's sketch depicting first Titan III-C launch at Cape Kennedy, Fla., June 18. Heaviest and most powerful rocket vehicle ever launched, it weighs 700 tons and generates 2,400,000 pounds of thrust. It is intended to become USAF's standard space-launch system, topped in power only by Saturn V.



The Gemini-4 flight marked a significant advance over earlier manned missions when its crew opened the capsule's hatch in space and Ed White ventured out for a twenty-one-minute stroll. (See "The Flight of Gemini-4," page 62.)

Until then, earlier US manned spaceflights were rated successful when astronauts went into orbit for scheduled periods and were recovered upon reentry.

From now on, our astronauts will be expected to perform successively more intricate tasks on each mission. The immediate objective is to perfect rendezvous techniques. Difficulties in this assignment were underlined in Gemini-4, when Jim McDivitt exhausted half of his thruster fuel in a futile attempt to fly in tandem with the Titan II's second-stage booster. Yet rendezvous is a vital step in gaining any real capability in space operations.

Gemini-5 is already being readied on the pad at Cape Kennedy for launch sometime in August. Its crew—USAF Lt. Col. Gordon Cooper and Navy Lt. Cmdr. Charles Conrad, Jr.—are not only programmed to add at least three more days to the McDivitt-White endurance mark, but will concentrate on practicing rendezvous maneuvers. If Colonel Cooper, who held the US endurance record of twenty-two orbits in Mercury-9 until it was surpassed by Gemini-4's sixty-two circuits, can guide his craft within a few feet of a pod previously ejected from the spacecraft, Conrad may leave the Gemini to make physical contact with it.

NASA has scheduled a total of twelve Gemini flights at approximately two-month intervals to explore various facets of manned flight and rendezvous techniques before moving on to the Apollo program in mid-1967. After the Saturn-Apollo hardware is tested in two or more unmanned flights, the

first three-man Apollo earth-orbital mission may take place in 1968.



The payoff on seven months of interplanetary flight for NASA's Mariner IV will occur July 14 when the spacecraft passes only 5,600 miles from Mars. During a twenty-four-minute period, as it closes in on Mars, Mariner IV's cameras are designed to take and record as many as twenty-one pictures of the Martian surface. It will then be 134,000,000 miles from the earth.

Unlike the almost instantaneous reception on earth of lunar photos taken by the three Rangers before they hit the moon, the transmission of Mariner IV's Mars photos will be a slow, complex procedure. It will take more than eight hours of continuous radio signals to transmit a single picture, or more than a week for all twenty-one. In that week, the earth will be moving away from Mariner IV at the rate of about 16,000 miles an hour.



Results of a series of exercises last year in which the Army and the Air Force demonstrated their respective concepts of battlefield support have apparently been decided in the Air Force's favor.

The Army will get one or more airborne divisions, Defense Secretary McNamara said on June 16. Such divisions will employ 434 aircraft, mainly helicopters. But earlier, in congressional hearings on military hardware, he said he had "overruled the Army in their requested purchase of . . . the Buffalo [CV-7A] as a successor to the Caribou [CV-2A], to carry on a transport function that I believe the Air Force can properly carry on with its C-130s and C-123s. . . . Similarly, I have refused the Army permission to buy the Mohawk [OV-1] and other aircraft in larger quantities which might be used for close air support."

Mr. McNamara said he considered helicopters "quite appropriate for Army use and for movement of Army troops." But, he added, "the danger is, I think, that the Army will move



Lt. Col. Robinson Risner, F-105 squadron commander in Vietnam, is awarded Air Force Cross, nation's second highest decoration for valor against an armed enemy, by Gen. J. P. McConnell, USAF Chief of Staff, in Pentagon ceremony.

beyond the procurement of aircraft directly related to its own mission and . . . into the procurement of aircraft to carry out functions such as close air support, or transport of large quantities of material, which functions the Air Force would be better prepared to carry out."

Elsewhere the Defense Secretary asserted recently that he wanted to "make it very clear that the fire cover for helicopters will be provided primarily by fixed-wing aircraft and only secondarily by helicopters. We will not have any conflict of roles or missions on this."



Gen. Thomas D. White, who retired as USAF Chief of Staff four years ago, presented his views on national security policy in mid-June before a Senate subcommittee on national security and international operations, headed by Sen. Henry M. Jackson of Washington.

"It seems to me that a great many Americans believe that an atomic war is impossible," General White declared. "We should, indeed, strive to make such a war or any war impossible. But let us be sure that the wish is not father to the thought. . . ."

"In my opinion, it is a fallacy to consider that the development of a particular weapon (the atomic weapon) has altered mankind. On the scale of biological time this seems to me to have no more validity than such an observation would have had when an

ancestor of Mao Tse-tung invented gunpowder."

General White indicated that President Johnson's recent decision to permit US forces in South Vietnam to conduct offensive operations on their own rather than as "advisers" to South Vietnamese forces is long overdue and should show favorable results.

"We probably have had, until quite recently, an example of foreign policy dictating, over a period of years, unsound strategy in Southeast Asia," he said. "On the other hand, and on a much smaller scale, the recent military operation in Santo Domingo seems to have been well-timed and fully coordinated."

General White pointed out that "our foreign policy-makers must understand, as never before, the capabilities and limitations of our armed forces. Likewise, the military command must not only understand thoroughly its missions in terms of foreign policy but it must also have opportunity to express the military viewpoint in policy decisions. . . ."

"It is not a requirement of good national security operations that national policy be always based on sound military strategy or tactics," he said. "Higher considerations sometimes, though rarely, should prevail. Nevertheless, it is palpably true that when sound policy and sound strategy coincide, results are likely to be optimum."

He pointed out that in the past eleven years the US has been involved in military crises in nine different areas of the world, each demanding different degrees of force or show of force.

"In almost every crisis—unseen, unheard, and unpublicized at the time in the US, but well known to the Russians—our strategic forces were on instant alert. . . . They served as a steel and atomic umbrella under which all other action could take place. . . ."

"We hear much about the inevitability of 'parity' of missile and bomber forces. 'Parity' or 'stalemate' could be
(Continued on page 28)

Crew members of Gemini-5, to be launched sometime in August on a week-long flight, are USAF Lt. Col. Gordon Cooper, far right, pilot, and Navy Lt. Cmdr. Charles Conrad, Jr., copilot. Until Gemini-4 mission, Cooper held US space endurance record with twenty-two orbits.





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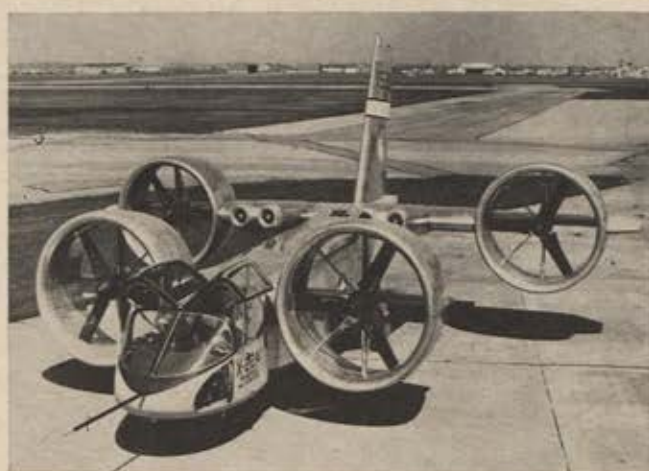
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NORTHROP



Winner of prolonged US Army competition for light observation helicopter is Hughes OH-6A, shown above, which beat out Hiller OH-5A in final field tests. Initial \$15 million contract calls for 714 aircraft, but orders may eventually total 4,000. Deliveries are to begin next summer.



Flight tests of the Bell X-22 experimental V/STOL aircraft will get under way this fall. The plane was rolled out at Niagara Falls, N. Y., plant late in May. Ducts and propellers swing ninety degrees, providing thrust for VTOL takeoff. Ducts serve as lifting surfaces in level flight.

only a transient state. Technology would be certain to upset it. The development of weapons in space or a positive defense against the ICBM might be examples of the kind of technological advances that could destroy any temporary balance in strategic forces. Research and development is, therefore, the cornerstone of national defense. It is vital that we hold the lead in military technology at whatever cost."



The government has wasted over a billion dollars on development of the XB-70, according to Secretary of Defense Robert S. McNamara. Total cost of the Valkyrie project through Fiscal Year 1966 will come to about \$1.5 billion. About twenty percent of information acquired from its construction and flight tests, McNamara said, might be useful in developing the US supersonic transport, but he insists the US is learning more about Mach 3 flight

from the YF-12A and SR-71 aircraft.

Not all aviation experts agree with McNamara that the XB-70 effort was largely wasted. North American, which built the Valkyrie, claims it could modify the XB-70 within a year into a flying testbed for a supersonic transport, providing space for nine passengers and a four-man crew. Another alternative is to build a third XB-70 with substantially greater passenger capacity which NAA engineers say could be flying by 1967, at least two years before the first US prototype SST.

The Air Force has requested funds for more R&D flights after the current test program runs out next year. One possible role is as mother plane for the X-15. Carried by the Valkyrie to 70,000 feet at Mach 3, the X-15 with a ramjet engine might be able to reach orbital velocity, becoming the first working prototype of an aerospace plane.

The second XB-70, rolled out in

May, is expected to make its first flight in August. It will have considerably longer range than the first Valkyrie, carrying five fuel tanks instead of four. The fifth tank, straddling the engine area, was sacrificed in the first B-70 because of problems in mating the wings and fuselage. This problem has been overcome in the second aircraft, adding 6,000 gallons to fuel load.



Bell's ducted-fan X-22 tri-service VTOL experimental aircraft is being readied for flight tests beginning this fall after rollout ceremonies at Bell's Niagara Falls, N. Y., plant late in May.

Developed under Navy sponsorship, the X-22 was built to explore mechanical and aerodynamic characteristics of the dual-tandem, ducted-propeller, V/STOL concept and to evaluate its military potential.

The circular ducts surrounding propellers seven feet in diameter serve as lifting surfaces during level flight and

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increase the static thrust of the propellers, thus permitting use of smaller and lighter propellers in relation to the aircraft's size and weight. Elevons mounted in the propeller slipstream provide more responsive control during hovering and transition than in other V/STOL configurations. Surrounding the propellers with ducts also minimizes danger to ground-crew personnel and protects propeller blades from foreign object damage.

The X-22 is 39.5 feet long and 19.75 feet high. Span over the front ducts is twenty-three feet and across the rear ducts 39.25 feet. Maximum takeoff weight in VTOL configuration is 17,600 pounds, sufficient to carry six passengers or 1,200 pounds of cargo plus the two-man crew.

Power is supplied by four General Electric T58-SD turboshaft engines rated at 1,250 shp each, interconnected through a system of shafts and gearboxes so that any one engine can turn all four propellers. Performance specifications require that the X-22 be able to take off with one engine out and cruise horizontally on two engines.

For vertical takeoff, the four ducted propellers are rotated to a position of ninety degrees vertical thrust. On reaching the desired cruising altitude, the pilot transitions to forward flight by gradually rotating the ducts to horizontal thrust position. To land, the pilot rotates the ducts to vertical thrust position and, hovering like a helicopter, gradually lowers the plane to the landing area.

The second of two X-22s in the \$27.5 million development program will be rolled out late this summer.

Next year, after manufacturer's flight tests, the planes will go to Patuxent Naval Air Station for operational tests, with Army and Air Force participating.



Development of the C-5A transport is being pushed with all possible speed because the Lockheed C-141 Star-Lifter is too small. This was brought out in Congress recently in a dialogue between Secretary McNamara and Sen. A. S. Mike Monroney of Oklahoma.

Senator Monroney said the C-141 needs a longer fuselage in order to make full use of its weight-lifting capacity. At present, he said, it can carry its maximum payload only in heavy-density cargo, such as ammunition. He suggested adding eighteen feet to the fuselage length, "a nine-foot plug in front and a nine-foot plug in back, that will give you the cubage you need."

Secretary McNamara said a proposal to redesign the C-141 had been considered shortly after he came to the Pentagon in 1961. Studies showed it could carry only fifty-five percent of its structural capacity in palletized cargo, he said. The whole aircraft "should have been designed differently, with larger entrance ports and with cubic content that would utilize its full weight-carrying capability." But tooling was already set up and any change at that time would have seriously delayed its introduction into the inventory. Instead, he said, DoD has decided to cut off C-141 production after equipping thirteen MATS groups, with C-5As to go to six more. Until the C-5As are ready, MATS will retain C-133s and C-124s to haul



NASA test pilot Milton Thompson tries out cockpit of Northrop M2-F2 lifting-body research vehicle, forerunner of aircraft which may return astronauts from orbiting spaceships. Thompson earlier flew M2 plywood prototype.

cargo that can't be accommodated in the C-141.



The latest of Paul Wilkinson's encyclopedic works on aircraft powerplants is now available. *Aircraft Engines of the World, 1964/1965*, the twenty-first volume of the series, follows the pattern of previous editions and contains detailed design information on the major gas turbine, piston, and rocket powerplants in use in the world's aircraft. More than 254 photographs illustrate the volume, which may be purchased for \$20 from Paul
(Continued on page 31)



Leroy Whitman, who edited *Journal of the Armed Forces* for thirty-five years before retiring last December, subsequently serving as editorial consultant to *AIR FORCE/SPACE DIGEST*, receives Certificate of Appreciation from Air Force Secretary Eugene Zuckert for his military news writing.



Ken Ellington, center, AFA National Director and newly appointed West Coast Manager of Aircraft Industries Association, talks with J. L. Atwood, Chairman and President of North American Aviation (see p. 40), at reception hosted by H. L. (Bud) Keeler, left, AFA's West Coast Manager.

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A Memorial Fund has been established in the name of Garrett W. Wesselink, US Air Force General Counsel, who died of a heart attack June 3. The fund will be turned over to Hope College, Holland, Mich., Mr. Wesselink's alma mater, for establishment of a memorial or scholarship in his name. Contributions should be sent to the Garrett W. Wesselink Memorial Fund, c/o Office of the General Counsel, US Air Force, Washington, D. C.



US Air Force bomber and interceptor crews are getting ready to test their combat skills in competitions scheduled for late summer and early fall.

SAC will conduct its 1965 version of the "world series of bombing" at Fairchild AFB, Wash., September 12 to 18. Forty-four SAC crews, one each from SAC B-47, B-52, and B-58 wings, will compete, along with four British RAF entries. Each crew will fly two round-robin missions calling for pinpoint navigation and low-altitude simulated bombing.

ADC will stage its biennial William Tell meet at Tyndall AFB, Fla., October 1 through 9. Teams representing Pacific Air Forces, US Air Forces in Europe, the Alaskan Air Command, Air National Guard, and ADC will fly F-101 Voodoos, F-102 Delta Daggers, F-104 Starfighters, or F-106 Delta Darts.

The familiar Ryan Firebee jet target drone will be joined this year by a new target, the Haynes supersonic tow target, measuring eight feet long and only eight inches in diameter. It is towed behind a Voodoo at speeds up to Mach 1.5.



If the USSR should come up with a plane to challenge the YF-12A's new world speed record of 2,062 mph, the US could apparently win it back easily with the SR-71. SAC crews operating the SR-71 from Beale AFB, Calif., are unofficially reported to be cruising at 2,400 mph over transcontinental ranges.

President Johnson said last July that the SR-71 is equipped with Pratt & Whitney J58 engines, which also power the YF-12A, but that the SR-71 is heavier and has longer range. If, as reports indicate, the SR-71 can fly substantially faster than the YF-12A, its engines are obviously more advanced than those in the interceptor version.—END



Snits & snails & puppy dog tails

He's a system. And if anybody wants to argue about that, they've got a battle on their hands. We've known for many, many years that a huge quantity of snits, a few snails and a couple of puppy dog tails will, naturally, result in a youthful system of terror, wholesale destruction, perversity, trickery and love. (We have a few words of a kind about the opposing system being composed of sugar and spice and everything nice, but that's not a discussion we feel valid to our point here.)

Despite all of this, the argument about what a system is and what a system isn't continues to rage unabated. Which leaves us at Hydro-Aire in a wild state of confusion. It would be silly of us to sit around telling *you* what a system is. You see, without a definition, Hydro-Aire is not particularly sure whether it is a component firm, a sub-system firm or a system firm. For instance, we say that we make the world's best braking system for aircraft. But some people say that the aircraft itself is the system which means that we make the best braking sub-system for aircraft. Or does it? Then we also make a new air vane hydraulic servo control system for an ordnance type missile. It includes a hydraulic piston type pump (driven by our own motor), fluid filters, relief valves, de-pressurizing valves, servo valves, dual piston actuators and accumulators. If this pump with its motor reacts to the air vane hydraulic servo control system, then, we suppose it is a pumping sub-system. Or if the missile is the system, then air vane hydraulic servo control is the sub-system and the pump with its motor is a component. But, we've got them all this time. Hydro-Aire supplies a cooling system for Apollo and Saturn C-V and LEM. We call them Liquid Coolant Pump Assemblies. How's that for avoiding the issue?

Let's face it. Whatever *you* call a system, is all right with us. The only real thing you have to be careful about is, if you call it a system, then you must think of Hydro-Aire as a systems firm. If you call it a component, we don't mind you thinking of Hydro-Aire as a component firm. What it boils down to is: whatever you call us, spell the name right. And send the order.

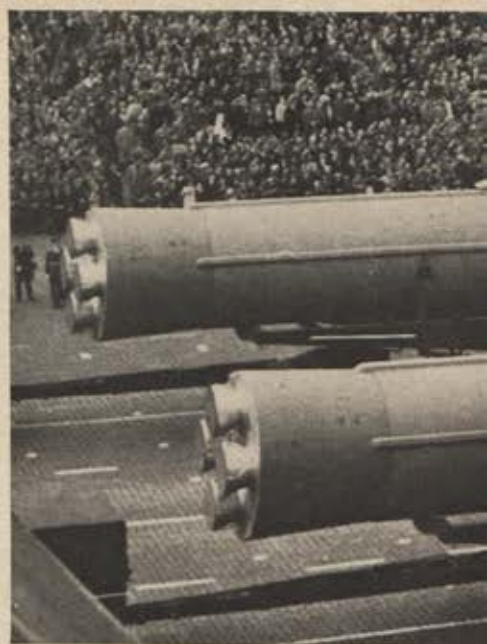
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In their May 9 parade in Moscow the Soviets cracked open the door on their long-range missile arsenal, which appears to contain two solid-fueled ICBMs and a pair of Polaris-type sub-launched weapons. These indicate—on the surface, at least—an impressive capability in the large, solid-rocket field. But shortly before the parade, US Defense Secretary McNamara stated categorically that the Russians have not been able to master the art of building large, high-performance solid rockets. This, if true, would give the US a vastly superior position in strategic armaments. In the face of these apparent contradictions, it behooves everyone interested in the US strategic-weapon position to take a closer look at that May 9 parade . . .



By J. S. Butz, Jr.

TECHNICAL EDITOR, AIR FORCE/SPACE DIGEST

THE NEW SOVIET MISSILES—



Two-stage, liquid-fueled ICBM code-named Fassim was shown for the first time last November and again in the May 9 parade. It is slightly larger than the US Atlas missile. Fassim is in the same family of missiles as the Sandal-Shyster (the Soviet equivalent of the US Redstone) and the Slean (the

Red Army's version of the Jupiter). A single rocket engine of approximately 400,000 pounds of thrust powers the first stage of Fassim. Some Western observers believe that four of these rockets, producing about 1.5 million pounds of thrust, power the first stage of the Vostok launch vehicle.

—Novosti Press Agency



Soviet ICBM, dubbed Big Brother by Western sources, was shown for the first time during May 9 parade in Red Square. It has approximately the same diameter and length as the USAF's Titan II rocket. However, Big Brother apparently is a three-stage, solid-fuel missile which uses 120-inch-

diameter motors, in the same class as the solid rockets employed in the first stage of the Titan III-C. Press releases indicated Big Brother launched Vostok and Voskhod, but this claim is highly suspect. A larger booster would be needed to put into orbit those 10,000-pound vehicles.

—Novosti Press Agency

Technological Storm Warning or False Alarm?

AN UNUSUAL opportunity to evaluate Soviet missile hardware was presented to the free world this spring. Russian news agencies have distributed unusually clear photographs (for them) of a series of previously secret intercontinental and mid-range missiles.

Examination of these photographs leads to a number of conclusions concerning Russian engineering and manufacturing prowess and the present Soviet strategic military posture. Some of these conclusions are disturbingly at odds with the situation as reported by top Department of Defense officials. Briefly the major conclusions are:

- The Soviet Union is intensely interested in large solid-rocket development and has been for many years. The success of the Soviet effort was demonstrated by parading two solid-fueled ICBMs on May 9 in Moscow. It was the initial showing for both. One is about the size of Minuteman I. The other closely approximates an ICBM that could be built from Titan III-type, 120-inch-diameter, solid rockets, which has been mentioned as a possibility for future development in the US. This rocket, code-named Big Brother, is about 100 feet long, ten feet in diameter, and should have "several times" the weight-lifting capacity of Minuteman II, according to US experts who have discussed solid-fueled ICBMs in the 120-inch class.

- Exhibition of these missiles raises serious questions about Secretary of Defense Robert S. McNamara's evaluation of Soviet strategic might. Mr. McNamara

has stated repeatedly, in congressional testimony and elsewhere, that the Russians have succeeded only in building liquid-fueled ICBMs and that this gives the US a major advantage. One of his most recent categorical expressions of this view was in an interview with *U.S. News & World Report* published last April 12, less than a month before the May Day parade. He said, "They [the Soviets] have no solid-propellant strategic ballistic missiles, for example. If our force were all liquid-propellant missiles, we'd feel severely handicapped."

- In the course of a massive and continuing effort to modernize its rocket forces since World War II, the Soviet Union has apparently followed the US pattern and has developed a large number of different missiles. In various parades of military might, the USSR has shown:

- Three intercontinental-range missiles, two solid fueled and one liquid fueled;
- One Jupiter-size, liquid-fueled, intermediate-range missile;
- One liquid-fueled rocket in the Redstone class;
- Two heavy, solid-fueled, intermediate-range missiles on tracked carriages in the mobile mid-range ballistic missile (MMRBM) class. This missile has been bypassed for development in the US even though strongly recommended by the Joint Chiefs.

In addition, the Soviets have shown two solid-fueled naval missiles, one of which resembles the earlier

(Continued on following page)

Polaris configurations, and more than a dozen types of heavy anti-aircraft and battlefield missiles, all highly mobile.

• More surprises are coming in Soviet rocketry. No rocket yet shown is capable of launching the heavy 10,000- to 15,000-pound Vostok and Voskhod vehicles which the Soviets have placed into orbit. The largest of these rockets shown to date, the Big Brother and Fassim, would need considerable modification in the form of strap-on solids or other thrust up-rating, to accelerate such large payloads to orbital speeds. At least one launch vehicle considerably larger than any shown has yet to be revealed by the Soviets.

Unfortunately, there is no wide agreement on these conclusions. The Soviets lifted their curtain of secrecy briefly, but the significance of the newly revealed systems has been obscured in a heavy fog of disagreement among Western press and official observers. The con-

fusion over Soviet capabilities is as great today as it was before the photographs were made available.

Even those readers of US and European newspapers and periodicals who are rocket experts are faced with an almost impossible job in evaluating the new Soviet hardware. Published reports have been contradictory in key respects.

This is a deplorable situation. More information must become available on the vital areas of advanced technology and strategic armaments. Secretary McNamara himself states that strategic nuclear superiority is the "absolute foundation" upon which all our military effectiveness rests. But it is not enough to say bluntly and without elaboration, as he did in the *U.S. News & World Report* interview, that our quantitative superiority in strategic weapons is three or four to one, and that in qualitative terms our superiority "far exceeds three or four to one."

The recent revelations in Soviet missilery raise the most basic doubts regarding such views. There are positive indications of a far more sophisticated Russian technology than has been conceded by US officials. If these indications are correct it would seem foolhardy to contend that the US has clearly outclassed Soviet Russia strategically, and will hold this lead for the foreseeable future because, as Mr. McNamara puts it, "There is no indication they are catching up or planning to catch up . . . there is no indication they are in a race at this time."

The newly revealed Soviet hardware definitely is worthy of more than cursory comment. If it truly signals US-Soviet parity in the design and manufacture of long-range military rockets, this fact is as important to the United States as what is going on in Vietnam or the Dominican Republic.

Obviously no observer can say with certainty just how good these missiles are. Photographs can't tell you what kind of propellant they burn, how much their cases weigh, how light and sturdy their nozzles are, and other key information. Such vital estimates must be made against a background of knowledge about the course of Western rocket development and by comparing major features of the Soviet missiles with known US hardware.

However, some pieces of this Soviet missile evaluation puzzle involve unclassified information—for instance, the heavy Soviet orbital payloads whose weights have been verified by US and English tracking stations. Another unclassified clue to Russian technical capability is the fact that their spacecraft often have had nearly identical orbits. This has led many Western observers to believe that in the difficult field of building guidance equipment the Soviets are in the same league with the United States.

Many parts of the puzzle can never be fitted together without a new approach to the release of information. For example, it has been widely published that the US has large radar sets near the Soviet borders and in the Pacific, which can track Soviet missiles during launch as well as during reentry. Such radar could easily tell a solid-fueled ICBM from one using liquid rockets because the solid vehicle would have to accelerate much



Little Sister, above, is judged by most Western observers to have approximately the same performance capabilities as the USAF ICBM Minuteman I. However, Secretary of Defense McNamara, on several occasions, has categorically denied the existence of Soviet solid-fueled strategic ballistic missiles. If the Little Sister is not a hoax, and if the configurations transported in the May 9 parade are not fakes, then the US has suffered a major intelligence defeat.



—Sovfoto

Long-range, solid-propellant naval missile, code-named Serb, is the second generation of submarine-launched ballistic missiles to be shown by Soviets. It resembles the first two versions of our Polaris. If the Serb has a range of 1,000 miles and a high accuracy, it has to make extensive use of advanced solid-rocket technology, including aluminized propellants, lightweight cases and nozzles, highly accurate guidance systems and steering mechanisms, and precise thrust termination. In many respects achieving high performance is more difficult in such small missiles than in large solid rockets.

more rapidly or its range/payload efficiency would quickly drop. At least, this is the pattern revealed by US development.

Quite naturally, the US government has been extremely close-mouthed about such tracking facilities and other capabilities for gathering intelligence data. However, Mr. McNamara must be considering the input from such facilities when he says flatly that the Soviets "have no solid-propellant strategic ballistic missiles." Maybe the whole May 9 parade was an elaborate Potemkin Village hoax.

A very real counter to this hoax idea are the many Soviet space accomplishments, which are verifiable, and Mr. McNamara's own assertion that the Russians have developed the capability to destroy the US, presumably with obsolete, liquid-fueled rockets that are overweight by modern standards.

The final question here concerns the difficulty of building solid-propellant rockets. Certainly, the US has enjoyed great success in developing advanced solid-fuel motors. The Minuteman and Polaris systems, which are to be the backbone of our strategic might for the indefinite future, have been built on this technology.

Very briefly, our advanced solids technology can be said to date from 1957-1958. At that time it became clear there were major performance improvements to be had by suspending very small flakes of aluminum and other light metals throughout a charge of elastomeric rubberlike petroleum fuel and ammonium perchlorate oxidizer, which has been in wide use around the world as a solid-rocket propellant. This aluminized propellant increased specific impulse fifteen to twenty percent, it suppressed combustion instability, and it

provided a "higher solids loading" which, in rocket-engineer terms, means it had increased density and burned hotter. All three of these improvements are important and they have made aluminized propellants a key element in the development of Minuteman and Polaris.

Perhaps the most important point about aluminized propellants in the context of this article is that they have never really been a secret. Their acceptance came rather gradually and was accompanied by extensive reporting in open technical literature on theoretical and experimental studies. Their worth was first proved in the US strategic weapon program. Experience there reinforced the contention of solid-rocket experts that aluminized propellants made it practical to build very large, very reliable, stable combustion, solid motors which could nearly match liquids in payload-carrying capacity.

It is well known that, with the exception of the Minuteman and Polaris programs, the US has been exceedingly slow in putting the "light-metal additive" propellant technology to work. At least three years of hard selling were required to get a large solid-rocket program going in the form of the 120-inch-diameter segmented motors slated for operational duty on the Titan III, and the 156-inch-diameter and 260-inch-diameter experimental motors being developed under joint NASA-DoD cognizance. Several 156-inch motors have been fired successfully and, with the exception of a 260-inch motor case fabrication problem, the program is on schedule. It appears that two 260-inch motors will be fired before the end of the year.

Other critical problems in solid-rocket construction
(Continued on following page)

involve the case, nozzle, thrust vector control for steering, and precise thrust termination for trajectory control. In case construction, the US has moved on from the type of steel proven through years of use in aircraft construction to high-strength steels with nearly twice the strength-to-weight ratio, and to even lighter cases made of materials such as titanium and glass fiber. Acceptable nozzles with three basic types of cooling—heat sink, gas film, and internal reservoir cooling—have been developed. A rather broad group of high-temperature materials suitable for the nozzle lining have been developed. Successful thrust vector control systems have been built using gimballed nozzles and the injection of high-pressure liquids into the nozzle flow. Terminating thrust precisely, with blow-out ports on the forward end of a motor, has become commonplace.

In short, the US has developed all of the elements of advanced solid-motor technology without a real hitch. And there can be no doubt that the US program has moved at an artificially slow pace. Few people in the rocket business would argue that this country couldn't have large solid rockets, of 120-inch diameter or bigger, in large-scale operation today if it had chosen to do so. Large solid rockets are easier to build in many respects than those of Minuteman size. For example, the critical nozzle heating problems are significantly reduced.

Looking over the requirements for developing large solid rockets, it is difficult to point to any part of the problem that the Russians could not have mastered if they had chosen to try. And, considering the slow pace of the US program, it certainly appears possible for the Russians to be ahead in this field, at least in the size of operational vehicles.

As mentioned previously, this sort of analysis has not been explored by most press commentators and

government officials. In general, Western response to this new opportunity to inspect Soviet hardware has been limited to straight reporting of Soviet announcements. The Pentagon has not commented on the quality of the Russian missiles.

On a more technical level, the aerospace trade magazines in the United States and Europe made contradictory estimates, not only of the technical excellence, but also of the basic mode of operation and the purpose of the newly revealed Soviet hardware. For example, one US aviation and space technology magazine described the missile code-named Fassim (page 32), first as a solid-propellant ICBM and then went on to call it a "storable-cryogenic-propellant" missile in succeeding weeks.

This same magazine called Big Brother (page 33) a liquid-fueled rocket and refuted Soviet press releases stating it was solid fueled. The main basis for this refutation was given as the lightweight construction of the Big Brother's transport trailer, which had only two axles and eight wheels. The magazine stated that the trailer "appeared too light to carry a solid-propellant missile of this class." The immediate question raised by such an analysis is whether or not the Soviets normally truck large, solid-propellant rockets loaded with propellant through crowded city streets, at speeds up to fifteen mph on trailers that obviously do not have special shock-absorbing mechanisms. Certainly the US does not transport loaded Minuteman and Polaris missiles in such a fashion.

In another paragraph, the magazine also raised the possibility of Big Brother's being a fraud. It said some Western observers doubted that the open truss structure connecting the stages could "stand bending moments in pitch-over." Another point given in support of this view was the jury-rigged appearance of



Soviets say that a major anti-ICBM rocket is transported in this container and also fired from it. If the Russians are making true progress in the difficult field of anti-ICBM development, they are mastering the art of building high-acceleration rockets and manufacturing fast-burning propellants, which are closely akin to explosives. Correspondents in Moscow have seen Soviet movies purporting to show the firing of these weapons.

—Sovfoto

the Big Brother trailer with a welded tube extension on its girder-type body.

An authoritative English aviation weekly did not express doubts of Russian statements that Big Brother was the rocket that had launched the Vostok and Voskhod spacecrafts. Most US publications took about the same position on this question. But the assertion is highly questionable, for Big Brother is in the size class of the Titan II missile, about 100 feet long and ten feet in diameter. The Titan II, which is generally regarded as being the most advanced operational US liquid-fueled rocket, can just put the Gemini spacecraft into orbit, and it weighs less than 8,000 pounds. If Big Brother can launch 10,000-pound vehicles such as the Vostok and Voskhod into low earth orbit, Soviet rocketry would be quite advanced over the US state of the art, and this fact would deserve explicit reporting and wide circulation.

In addition, the English magazine also said Big Brother's first stage "reportedly" was powered by four liquid-fueled, K-102 engines, each producing a take-off thrust of 300,000 pounds. This would be 1.2 million pounds total, nearly three times the first-stage thrust of the Titan II. Since Big Brother must be about the same weight as Titan II, assuming the Soviet missile actually is liquid fueled, Big Brother's acceleration during launch would have to be nearly three times that of the Titan II, a remote possibility for any booster used to launch a manned vehicle.

Quite different views were voiced by the expert observers who were interviewed for this article. This evidence, plus data on US rockets which most closely approximate the Soviet missiles and known data on Soviet missiles, is digested below.

Big Brother—100-110 feet long. About ten feet in diameter. Compares most closely in size to US Titan

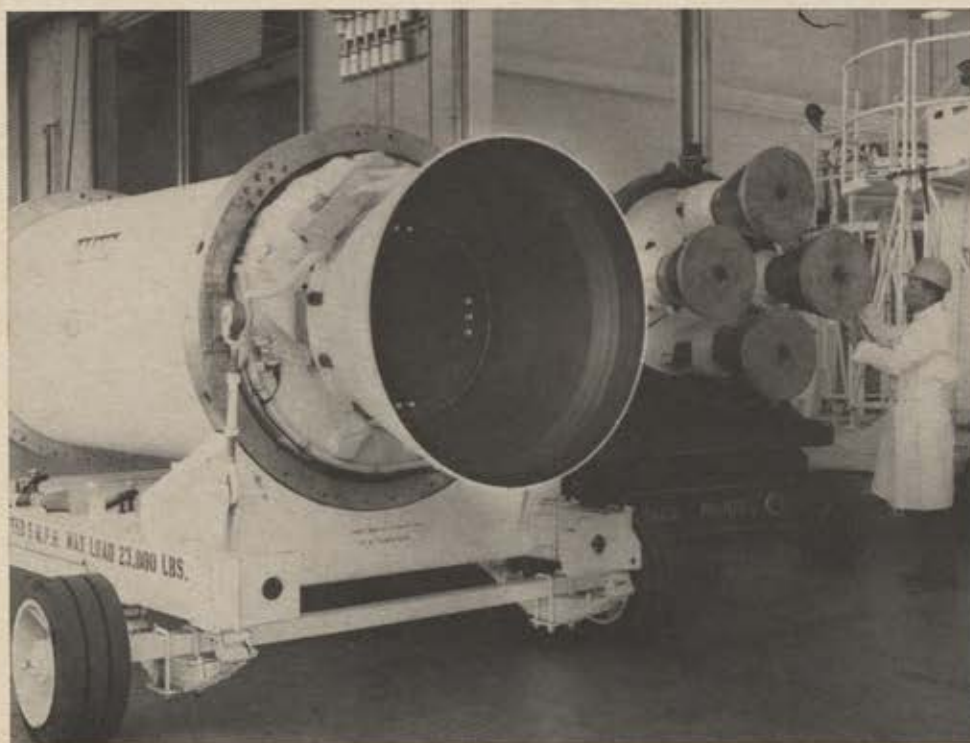
II, which is 103 feet long and is ten feet in diameter.

Most probably Big Brother is strictly an unmanned military rocket weighing more than 400,000 pounds with around one million pounds of thrust in the first stage. Photographs show it to have three powered stages giving strong indication that solid fuel is being used. Efficiency of liquid propellants is higher, and two stages are optimum for ICBM and orbital space-launcher roles. If Big Brother had three *liquid-fueled* stages, it probably would be a very old vehicle burning obsolete propellants.

First-stage motor has four nozzles to shorten stage length and ease high-temperature design problems. This follows US practice as used in Minuteman and Polaris, and Soviet techniques as revealed by Little Sister.

Second-stage motor has same diameter as first stage, using a single nozzle with very large exit diameter to improve performance at high altitudes. Major performance gains for Minuteman II (which Mr. McNamara says is four to eight times more effective than Minuteman I) are achieved by similar design, enlarging the second-stage motor to the same diameter as the first stage and replacing the older four-unit nozzle with a single nozzle. This second-stage configuration of Big Brother is regarded by some observers as a significant clue to Soviet state of the art. The length of its nozzle, for instance, is quite short and its diameter quite large, possibly indicating that it is of the expansion-deflection, or inverse-plug, type. In the US, such nozzles are considered to be quite advanced for, by shortening the nozzle length, they allow the designer to increase the length of the combustion chamber and to get more propellant into a stage of a given length.

Open truss, interstage structure appears to be heavy
(Continued on following page)



Most important improvement in the US Minuteman ICBM system is shown here. The Aerojet-General motor on the left powers the second stage of Minuteman II. It is about six feet in diameter, the same as the Minuteman first stage, and replaces the much smaller, four-nozzle motor at right, used on Minuteman I. Secretary McNamara says this new motor makes Minuteman II four to eight times more effective than Minuteman I. Some US observers believe the Big Brother second stage reflects a state of the art in the Minuteman II class.



—Sovfoto

A major new Soviet weapon in the mobile mid-range ballistic missile (MMRBM) class was shown for first time in the May 9 parade in Moscow. US Joint Chiefs have given high priority to the development of such a mobile weapon suitable for supplementing aircraft in strikes deep in the enemy's rear areas on a modern battlefield. This wheeled carriage is superior to a tracked vehicle, in the opinion of many US observers. This missile has code name Shaddock.

enough to bear flight loads. It is simple and would allow "fire-in-the-hole" staging of the type used on Titan II, whereby the second stage is ignited before the first stage drops off. In this case, neither the first nor second stages appears to have blow-out plugs on their forward ends to allow a reversal of thrust just prior to burnout. Probably staging is accomplished simply by igniting the stage ahead. Elimination of the blow-out plugs would save a little weight.

The large third stage presents many interesting possibilities for speculation in a period when US military rocket designers are concentrating on developing "shotgun" effects with multiple warheads and sophisticated penetration aids to fool ballistic missile defenses. The large volume available on this stage gives one Big Brother the potential of striking simultaneously several major targets scattered across an entire continent.

In pursuing the numbers game type of strategic analysis, one must consider the fact that, by conservative estimate, one ten-foot-diameter solid-fueled ICBM can carry three to four times the payload of a six-foot-diameter solid-fueled ICBM. That is, one Big Brother, if it is near the US state of the art, can do the work of at least three to four Minuteman IIs. For example, it could be highly misleading to draw a comfortable conclusion from a report stating that the US had four times the strength of the USSR in strategic weapons because we had 800 Minutemen and they had only 200 operational ICBMs. If these 200 Soviet ICBMs were Big Brother types, equipped with multiple warheads, the two forces would be essentially equal in military effectiveness.

Actual payload/range performance of any ICBM is critically dependent upon the specific impulse of the upper-stage propellants and the propellant loading fraction, or lightness, of the inert parts of all stages. On Big Brother the only clues to excellence in these departments are the relatively short length and semi-

submerged appearance of the second-stage nozzle and the monolithic design of the first stage. The one-piece case should be considerably lighter than the segmented case with its heavy joints, such as is used on the Titan III-C, 120-inch motors, which were designed to power launch vehicles of a variety of weights and were not optimized for one specific mission.

As far as the upper-stage propellants go, the Soviets are known to have conducted basic research on the use of beryllium rather than aluminum particles as a high-energy fuel additive. These beryllium propellants have been successfully developed in the US and are important features of the most advanced military rockets.

Little Sister—About sixty feet long and six feet in diameter. Compares most closely with USAF's Minuteman I, which is about fifty-six feet long and six feet in diameter (see photograph, page 34). This ICBM probably is an early relative of Big Brother, and is around three years old.

Fassim—Two-stage, liquid-fueled ICBM about eighty-five feet long with a first stage eleven to twelve feet in diameter. Total weight is around 275,000 pounds. The single first-stage engine delivers in the neighborhood of 400,000 pounds thrust, uses "jetavator" type paddles in the exhaust stream for thrust vector control. This vehicle and its powerplant are a direct outgrowth of the Sandal-Shyster and Slean development work. Probably four of the first-stage Fassim engines have been clustered to produce about 1.5 million pounds of thrust in the first stage of the Vostok and Voskhod launch vehicle, which has not yet been shown by the Soviets.

The closest US equivalent of Fassim is the one-and-one-half-stage Atlas booster, which is eighty-two feet long, ten feet in diameter, weighs 269,000 pounds, and has a thrust of 389,000 pounds from three engines.



—Novosti Press Agency

Iron Maiden was the code name given to this Russian MMRBM. It apparently is raised by hydraulic jacks mounted on the tracked carrier to a vertical position for firing. The cover houses a temperature-control system and an elaborate shock-absorbing system to protect the missile during transport in the field. The Iron Maiden and Shaddock (top of page) are the latest in a large family of battlefield missiles that make the Red Army the best equipped in the world.

Skean—An IRBM-class vehicle which probably can carry a heavy warhead more than 2,500 miles. It is about eighty-five feet in length, with a diameter of around nine feet and a launch weight in the neighborhood of 180,000 pounds. This rocket is somewhat heavier than US IRBMs, the Thor and Jupiter, both of which weighed 110,000 pounds and were powered by 150,000-pound-thrust engines. The Jupiter, for example, was sixty feet long and nine feet in diameter.

The Skean engine apparently is in the 250,000-pound-thrust class and uses "jetavators" for steering.

Sandal-Shyster—The Sandal is a Redstone-class rocket, which also has been produced in an up-rated configuration called the Shyster. Sandal is about seventy-five feet long with a diameter of something over six feet. It weighs around 80,000 pounds and is powered by a 110,000-pound-thrust engine. The Redstone, by comparison, is seventy feet long, a little under six feet in diameter, weighs 61,000 pounds, and is powered by a 78,000-pound-thrust rocket.

The Sandal dates from about 1950, and it probably can propel a heavy warhead nearly 1,000 miles. This would be about equal to Redstone performance, which always was heavily understated in US Army fact sheets.

A number of other relatively long-range missiles paraded by the Soviets are shown in the accompanying photographs. In addition, the Red Army is equipped with by far the widest variety of battlefield tactical missiles of any army.

Even the most cursory review of the known elements of this arsenal lead inevitably to four basic conclusions:

First, the development of rockets has received a high priority continuously in the Soviet Union for twenty years, since the end of World War II.

Second, the Soviet effort has been broadly based and produced several generations of vehicles with

increasing performance capability. The Russian engineering-industrial community has had an ample number of projects with which to gain experience. They have given a good account of themselves in the space race and the strategic missile race. There is no apparent reason for believing that this engineering-industrial community has to fake its position by showing false hardware in a Potemkin Village-type parade. There is no apparent reason for believing that this community is not capable of competing favorably on the newest frontiers of rocketry, including the development of multiple warheads, maneuverable warheads, decoy warheads, and the like as well as the development of vehicles which can take man to the surface of the moon.

Third, solid-propellant rocketry is playing a major role in current Soviet operations and in their future plans. Judging from the favorable experience of US industry in developing large solids, and the appearance of 120-inch Soviet motors, it is certainly possible, if not probable, that much larger solid rockets are available in Russia.

Fourth, US intelligence has suffered a major failure if the Soviet missiles in the May 9 parade were not fake. The top levels of the Defense Department have been operating on the assumption that the US is in an extremely favorable strategic military position, primarily because we are said to have a monopoly on large solid rockets.

If an assumption of such basic importance has proven to be absolutely incorrect, many other intelligence estimates and other assumptions of US superiority undoubtedly would become suspect. An early review of US intelligence and military planning operations by both the Congress and the Administration definitely is in order if the Soviets are operating large solid rockets.—END



Some of the older rockets in the May 9 parade are shown left. The Skean (foreground) is an IRBM weapon, somewhat larger than the US Jupiter and Thor. The four rockets in the background are of the class code-named Sandal-Shyster. They closely approximate the US Redstone. Fassim, Skean, and Sandal-Shyster apparently are powered by the same basic engine design, which was initiated more than fifteen years ago and has been up-rated several times.

—Sovfoto

The space program, with President Johnson's backing, is attaining an air of permanence, and there is no sign of significant cutback in defense as some have predicted. The government-industry partnership, which has brought us this far, has changed somewhat in the process but looks as though it will be enduring. It must be protected by both partners. Government must remember that the free-enterprise system is still the best method of finding solutions to problems and work to keep competition alive. And industry must keep in mind that government is its customer and treat it as such while maintaining independence . . .

J. L. Atwood,
President, North
American Aviation



Defining the

THE President of the United States has laid down a clear-cut space program for many years ahead. In his report to Congress on United States Aeronautics and Space Activities in 1964, he said: "We expect to explore the moon, not just visit it or photograph it. We plan to explore and chart planets as well. We shall expand our earth laboratories into space laboratories and extend our national strength into the space dimension."

While there has been a general presumption that the space effort will not end with the moon, and although the National Aeronautics and Space Administration has already begun the unmanned probe of the planets, we have not heretofore had from the President of the United States such a clear-cut declaration of our long-range space objectives. For this reason, President Johnson's statement may be comparable in importance to President Kennedy's original summons to the moon voyage four years ago. This public affirmation of the plans upon which NASA is already well launched helps to certify the permanence of the United States space commitment. We begin to be assured that the United States space program will be a continuing and integral part of the national purpose and the national economy.

It is to be noted that this commitment is made in the face of Soviet ambiguity as to its lunar plans. Less and less, the United States space program hinges upon a so-called race with the Soviet Union. More and more, it draws sustenance from our own well-based space objectives.

This joint space effort supplements the major peacetime partnership program between government and industry in the national defense effort. While this effort has been continuous through our history, its scale has fluctuated enormously in response to prevailing conditions of war or peace. Since the Korean War, however, national policy has called for a continuing high

level of defense procurement to maintain a strong national posture in the so-called cold war. Suggestions as to the impermanence of this defense program have so far proven wrong. Today the space program is added to this defense program; the United States government and industry are partners in planning and carrying out the most massive joint peacetime effort in their history.

The apparent permanency of this massive joint program brings up pressing questions of political and economic philosophy. Reconciling the American principle of private enterprise with the requirements of our national defense and space programs has become one of the major—though least-publicized—issues of our time. The question is, can a large portion of American industry depend for its major market on a single customer—the United States government—without losing its independence?

The solution to this question is up to industry fully as much as to government.

Consider briefly the specific American principle at issue. To us the concept of liberty has always included the right to make our living in any honest endeavor of our choice, to own property, and to enter the marketplace with labor, services, or goods to be sold for private gain.

In pursuit of these freedoms, and within a framework of law and order, we have built a dynamic economy unequalled in the history of the world. To maintain its vitality we have tried—not always successfully—to limit the government's role to that of umpire. This governmental role has been especially useful in helping to maintain the very life and breath of free enterprise—namely, competition and opportunity.

This same limitation of roles between business and government can be applied to preserve the aerospace industry's integrity in its close working relationship with the government. On the one hand, industry is the



Government-Industry Relationship

By J. L. Atwood

principal performer of research, development, and production work, although it is strongly supplemented in the research field by universities and certain other non-profit organizations. On the other hand, while government serves as the umpire—so to speak—of this private activity, its ability to judge effectively depends upon the vast body of knowledge it derives from that same private activity. This knowledge comes not only from technical advances in research-and-development programs, but also from company proposals for new business.

In fact, it is in competitive proposals that innovation often makes its appearance, and this innovation represents an asset to the government even if it is not followed by a contract. Moreover, some of the most valuable data available to the government come from unsolicited proposals, which contain creative ideas that might not otherwise find their way into the government's fund of knowledge. A significant percentage of industry proposals to the government for new business are unsolicited, and there are a number of additional concepts, discussed informally, that lead to solicited, competitive proposals. While only a fraction of these proposals are successful from an individual company's standpoint, each of them adds technical data—often of considerable importance—to the government's reservoir of knowledge.

In turn, the government is able to stand on this eminence of understanding and gain a visibility that would otherwise be impossible, and which no single contributor could ever attain. This visibility is used in planning defense and space needs, determining specific requirements, choosing between the manifold responses to those requirements, and monitoring the progress of defense and space programs.

These twin roles of government and industry, therefore, have at least two interlocking advantages. For

industry, there is the opportunity to provide many technical choices to any given problem through competitive proposals. For government, the accumulation of knowledge through these same proposals and through contract performance affords the best possible visibility from which to judge between competitive solutions.

If, hypothetically, there were only one industrial contractor as there is now only one customer, neither of these advantages would exist. But the individual work of many thousands of companies constitutes immeasurable strength both for the industry and the government.

Therefore, while every contractor goes through the disappointment of creating something that does not strike a ready response, he must recognize that the customer—with limited funds available—is constantly choosing between many innovations of which the single contractor is unaware.

And this accumulation of information and invention—applied or not—represents a corpus of technical knowledge that uniquely qualifies the customer—as no single participant could be qualified—to judge the competitive entries.

In any discussion on the division of roles between government and industry in this country, one must reckon with the impressive technical achievements of the Soviets in weaponry and in space. Without discounting these achievements, we may note that the more autocratic the government, the more short-term efficiency it can apparently achieve and the shorter the lead time of its priority programs. However, without the alternate approaches possible in a competitive system, the solutions are often less than optimum; this shortcoming has shown up rather pointedly in the lagging Soviet record in planetary shots to date. I believe that, in the over-all space program, our own approach

(Continued on following page)

will surpass that of the Soviets; the recent Gemini and Ranger missions lend support to the conjecture that we have already closed the gap substantially. In the long term, a government truly representative of the people, and a government-industry system yielding the best of many choices, must in the end prevail. We all know, from the relatively low percentage of company proposals that win competitions, that no one organization can have a monopoly on the best approach to anything. Superior strength must accrue to the system in which the judge is not one of the participants, and is, therefore, free to choose impartially from rival solutions, unhampered by any enchantment he might otherwise have with a solution of his own.

If the government's most effective role is that of umpire or judge, the next question is, how far should it go in overseeing the participants?

Let us begin by considering the government's basic



The US competitive system permits more alternatives than an autocratic system. The Gemini-Titan II shown in Martin Company plant is a good example. Many companies competed for various components to provide successful vehicle.

obligations. In the fields of national defense and space activity, it is charged with carrying out the policies and the objectives of the American people. More specifically, the Department of Defense and NASA must procure the best possible systems and equipment at the lowest possible cost, and often in the shortest possible time.

In a day when technological advance was relatively slow and new procurement was accomplished largely through shelf items and fixed-price contracts, government surveillance was largely limited to judging the performance of end items. The nation could generally afford two or three models by different manufacturers to fulfill the same function, and could then pick the best of these for follow-on production.

But with the steep acceleration of technology in the past fifteen years, new weapon and space systems have required such technical advances that research and development have constituted the major element in aerospace sales. And all of the nation's hopes have been riding on only one model for each particular function. The nation cannot afford to develop more than one

kind of Polaris submarine, any more than it can afford to develop more than one means of putting the first men on the moon.

For all these reasons, the government's interest in the day-to-day work of the contractors—as against reviewing only the results—has dramatically increased. Industry should recognize this legitimate interest.

Accompanying the rise of R&D, for example, has been a whole family of contract types. Since the fixed-price contract and its inherent profit incentives were not readily applied to research and development, the new contract types provided other incentives—still making the most of the competitive and profit motivations characteristic of private enterprise. This process of contract refinement continues—nourished by further suggestions from both government and industry.

Another milestone in the evolving relationship between government and industry is the establishment of weapon system contracting. With the need for closer integration of subsystems at the design and development stage, the day-to-day management of system development is usually delegated to a prime contractor or to several associate prime contractors. It is difficult to see how many of the systems developed in the last decade could have emerged with optimum performance without use of this management device.

More recently, the Defense Department has developed a system of contractor evaluation, largely for the purpose of rewarding efficiency and penalizing inefficiency in future competitions. While these requirements may sometimes seem onerous, it is difficult to criticize the intent of a system to recognize merit and stimulate maximum performance.

Industry can well take note that many, if not most, of these attempts to clarify the government-industry relationship were designed to strengthen that relationship, not destroy it. There is an enormous difference between the two intentions, and while we should welcome sincere efforts to improve the system, we are more than justified in resisting government restrictions that are unnecessary in carrying out its legitimate duties. In this close relationship between government and industry, the traditional role of umpire still serves as a valid yardstick in measuring the government's prerogatives.

It should be noted at this point that there is precedent for a far different government role in defense procurement. Almost from the beginning of the republic, federal arsenals were established for the manufacture of muskets and ammunition. Then and now, the Navy has made many of its own ships as well as ordnance. Generally, such government manufacture has involved the production of similar items over many years, with little need for new development. It is at the point where defense equipment requires innovation that arsenal manufacture becomes questionable. Such innovation is best accomplished when there is a choice of alternate solutions. When the umpire is also one of the players, his judgment may become less than objective.

Historically, attempts at government manufacture of
(Continued on page 45)



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military aircraft have either been sporadic or have gradually given way to private manufacture.

The point to be drawn is that private manufacture of defense and space systems and equipment must be earned by superior performance. It does not fall to American industry as a divine right. We may not expect to be mere order-takers from a generous Uncle Sam. And while we believe strongly in private enterprise as a keystone of the American economy, it does not occupy this position just because we say it does. Rather, it has won this position by past performance.



Attempts at government manufacture of aircraft have been unsuccessful. Many innovations in North American's B-70, above, may not have been attempted had the government tried to be the manufacturer, thereby stifling competition.

It can maintain this position by continuing that performance.

What is more, today the demands upon our performance have multiplied manifold over those that prevailed when the national policy of private aircraft manufacture was established. Soaring performance requirements have put a premium on technical capabilities and the management techniques for applying such capabilities. A few of these areas call for continued improvement.

- In the field of basic research, we must develop not only the most proficient scientific teams, but must improve our visibility of probable future requirements in order to channel their work.

- In applied research, our problem is not only to advance the state of the art, but to create faster means of communicating technical advances within the professional community.

- In the broad field of research and development, both the customer and the contractor must encourage creativity. A radical solution may sometimes be almost as easy to apply as the mere improvement of an old solution. One of the current examples of success in a novel approach is microminiaturization, which was conceived in joint research efforts by the government and industry and pursued in component development by several companies.

- Throughout the spectrum of contractor operations, we must look for even better means of assuring quality, value, and reliability. The industry has tried in every way to reduce these factors from qualitative

judgment to quantitative analysis. At the same time we have looked for new ways to encourage what has always been the real basis for quality—pride of workmanship on the part of each individual employee.

- In managing our programs, we should come to the realization that success is measured not alone in achieving the required performance levels, but also in the manner in which we meet cost and schedule estimates. While recognizing that research-and-development work can never be priced and scheduled with the precision of volume production work, it is time for us to acknowledge that weapon and space system contracting is no longer in its infancy. We have gained a vast working experience with our customers and with each other as contractor and subcontractor; together we have invented and applied advanced tools for management visibility and decision; we have developed and are still perfecting managerial techniques to match the complex technical and logistics tasks we face.

In all of these areas, it is a tribute to industry that great improvements have already been made. Yet few of us would assert that no more possibilities for improvement remain.

Let us remember that the two-sided relationship between industry and government is really one between supplier and customer. In such a relationship, it is the customer who has the most influence. Maintaining this relationship depends upon continual proof that private industry is a better source in providing defense and space systems than a government-owned industry. The customer, both civilian and military, is not generally hostile to private industry, but neither is it permanently committed in this field if the performance does not meet its needs. In short, we of industry can never be content to rest our case on economic doctrine. We must continually prove and re-prove our mettle through performance and results.

Thus, to the question of whether private industry engaged in defense and space activity can maintain its integrity, the immediate answer is that both industry and government have been working intensively on this problem for many years. They have applied an effort of the first magnitude and have gone far toward meeting the additional complications brought on by accelerated technological progress. They will continue to succeed in their effort if they both recognize that there is a vast difference between changes to improve the system of industrial procurement, on the one hand, and changes which would destroy such industrial procurement, on the other. It is my firm conviction that, insofar as we achieve the first and avoid the second, we will not only preserve the American freedoms that we cherish, but will also enhance our strength and security on this planet.—END

Mr. Atwood is Chairman, President, and a Director of North American Aviation, Inc. He has been with North American since 1934. He became president in 1948. That same year he was awarded the Presidential Certificate of Merit for his contributions to the war effort during World War II. This article is condensed from a speech to the Second Space Congress of the Canaveral Council of Technical Societies at Cocoa Beach, Fla., on April 7, 1965.

South Vietnam is far away, and the war there is dirty and bloody. But Communist China must be stopped somewhere, for her aim is worldwide domination, with East Asia as prime target. A US withdrawal from Vietnam could only be interpreted as a Communist victory—and an encouragement. So both the extremists who advocate full-scale invasion of Red China and those who want unqualified withdrawal from Vietnam are wrong. Our present policy is the only possible one—gradual escalation in Vietnam to discourage aggression and a long-range commitment toward . . .

Containing Communist China

By William E. Griffith

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HOW dangerous to us is China, and how may we best deal with it? We fought World War II in part to prevent a hostile major Asian power, Japan, from conquering East Asia and threatening us in the Western Pacific. We fought a limited war in Korea to prevent a similar threat. We are now confronted with another such challenge, this time by a China with an immense land army and the beginnings of an atomic capability which may eventually threaten our physical security.

Unlike imperial Japan, Communist China is socially revolutionary as well as anticolonialist, and its ambitions, although also centered in East Asia, are worldwide in scope. China centers its worldwide revolutionary drive in the nonwhite underdeveloped regions, but its propagandists are even at work to exploit its racist appeal within our own country, among the American Negroes. (The underdeveloped world is not alone a threat to us, because it is too weak; but if China should capture it, and also bring Japan into its orbit, our peril would be great.)

Mao's determination to displace Moscow at the head of a purified international Communist movement has been most successful in East Asia. The 1962 Chinese victory over India scared much of the rest of Southeast Asia into neutrality or a pro-Chinese position. Sukarno is increasingly allied with Peiping. India is weak and divided.

Long-range Chinese goals begin with expansion to the previous limits of imperial Chinese influence, including Southeast Asia, the Soviet maritime provinces, and Taiwan. These aims make China hostile to Russia and, unless we turn Taiwan and Southeast Asia over to them, to us. Chinese pressure now centers in South Vietnam and Laos, but China's revolutionary activity is not limited to East Asia. Peiping supports its Adriatic ally, Albania, the first East Asian foothold in Europe since the Mongols. It is splitting Communist parties throughout the world, including North and South America, where the Chinese support *Fidelista* activity against the pro-Soviet Latin-American Communist parties. In Africa the Chinese give radical anti-Western elements money, arms, and training. China

everywhere preaches and acts on Mao's doctrine that the United States cannot win in guerrilla warfare and will eventually have to abandon it.

Our strategic choice, therefore, is between two alternatives. The first to contain China within its present limits of geographic influence in order, through prolonged frustration, so to moderate its geographic ambitions and its atomic threat that we may eventually achieve with China something like our partial precarious *modus vivendi* with the Soviet Union. The second is to abandon, as gradually and with as much face-saving as possible, Southeast Asia and Taiwan but continue to defend India and Japan by our sea and airpower. Immediately, this means that we would leave Saigon.

South Vietnam is far away; the war there is dirty and bloody, and Americans have a deep revulsion, confirmed in the war with the Japanese in the Pacific and with the Chinese in Korea, against fighting fanatical troops in Asian jungle wars. Furthermore, the argument for abandonment goes, there is no viable anti-Communist, to say nothing of a democratic, government in South Vietnam; the Vietnamese are weary of the war, and its extension would only bring in millions of Chinese troops. Let us, therefore, leave Vietnam, and fight, if we must, where there are strong popular governments on our side—in Thailand, Malaysia, or even India or Japan.

Those who advocate the second alternative miss the main point: the nature and extent of Chinese ambitions. . . . China's rulers are totally hostile to the United States. Such men's appetites, history teaches, are whetted by victory, never satiated by their foes' concessions. Furthermore, the longer we wait effectively to contain them, the closer they come to effective atomic delivery capability. Today Mao and his associates are very confident. They beat us, they think, in the Korean War. They faced down the worst the Russians could do to them and still gained influence every year. They humiliatingly defeated India. They are the first Asian, colored, revolutionary power to explode an atom bomb. Their influence in Africa is rising rapidly. Finally, we have been steadily losing

and they have been gaining in South Vietnam. If they will not stop now, why should they stop if and when we leave Saigon? And why should anyone believe we would keep pledges to other Asian countries after we break them with Saigon? Thus everywhere time works for China and against us: The sooner we decide on containment, therefore, the better.

In Vietnam, as toward China altogether, we can expect little help from our allies. Britain is fully occupied in Malaysia, whose enemy, Indonesia, is moving closer to Peiping. France, convinced we will leave Saigon, favors neutralization—that is, saving as much face as possible while adjusting to Chinese victory. Germany and Japan are inactive. India, still suffering from the shock of the Chinese Himalayan victory, needs our aid. Whatever we decide needs to be done in East Asia, we must do ourselves. As for the Soviets in East Asia, the Sino-Soviet split has greatly reduced Soviet power and influence there. In areas where it cannot bring military power directly to bear, Moscow will therefore probably offer little more than verbal protests to American containment of Chinese expansionism, so long as we do not attempt to invade and occupy either North Vietnam or China.

South Vietnam is far from the most favorable terrain on which to contain China, but the alternatives—the loss of Southeast Asia to China, the encirclement of India, the threat even to Japan: in short, Asia's adjustment to our withdrawal and Chinese advance—would all be worse. Therefore, to hold South Vietnam is our most important present priority in containing China. Can we? And how?

Our objective should clearly be limited to holding South Vietnam and ending the guerrilla warfare there—specifically, to return to the 1959 *status quo* before Viet Cong guerrilla action became extensive; it should not include the overthrow of the North Vietnamese regime. We need not, and should not attempt to, achieve that. In South Vietnam the cards are still stacked against us, and our position there may well continue to worsen. We must intensify our efforts all the more. Furthermore, instability in Saigon is best remedied by demonstrated firmness on our part.

Peace in Korea on the basis of the *status quo ante*, let us remember, came from the credible American threat to Peiping that we would otherwise begin air strikes on Manchuria. The war in South Vietnam is different, but the principle is the same: We must borrow strength from our opponents' weakness—North Vietnam's vulnerability to air and sea attack. Furthermore, Ho Chi Minh, although under predominant Chinese influence, hardly wants to fall under total Chinese domination, which would be inevitable if he had to call in major Chinese forces to defend him and if our bombing destroyed the industrial capacity he has with such difficulty built up. Our leverage on North Vietnam is considerable, but only if our intentions as well as our capabilities are made clear to Hanoi.

Opponents of escalation reply that even if Hanoi wanted to, it probably could not stop the Viet Cong; most of the rebels' supplies come from South Vietnam itself. This is true, and Viet Cong troops are mostly nationalist and social revolutionary rather than Communist; but it is far more important, as the overwhelming weight of expert opinion holds, that the

Viet Cong are directed from and controlled by Hanoi. Ho Chi Minh called off the guerrilla war once, after the French left in 1954; he began it again in 1959; if he wishes, he can call it off again.

And what, opponents of escalation ask, of Chinese intervention? In the first place, Chinese policy is not high risk but low risk. As analysis of captured Chinese military documents has shown, Peiping is quite aware of the threat of American conventional and thermonuclear capacity, the more so since it can no longer depend on Soviet aid against us, and it has no intention of engaging us in these fields. Moreover, its advocacy and support of guerrilla warfare, in South Vietnam and elsewhere, are based on its assessment that we cannot win such a war and will withdraw rather than escalate it.

Moscow seems to believe, on the other hand, in the reality of our determination to escalate, and therefore believes the guerrilla warfare is too risky. It is of the utmost importance for us not only to prove the Chinese wrong, and thus contain them, but also to prove Moscow right, lest the Russians also renew their broad-scale support of guerrilla struggles.

Our best course in Vietnam is neither negotiation (which now, since Hanoi is winning, could mean only defeat) nor all-out attack; it is, rather, careful, graduated conversations and escalation. This seems to be the choice President Johnson has made. At each stage, we should privately convey to Hanoi, Peiping, and Moscow our goals and our methods. We should make clear to Hanoi and Peiping that we can and will continue to escalate, unless and until they are prepared to go back to the 1959 *status quo*, to the gradual destruction of North Vietnamese ports and then of industrial installations. More may be necessary—Chinese intervention would force us to consider extending our air strikes first to South China and then to their atomic potential; this possibility should be made clear to Red Chinese leaders. We should emphasize to the Russians our self-imposed limitation on our objectives and also make clear that while we want détente with them, as we hope eventually to obtain it with China, any substantial military intervention by them will risk the use of our ability to blockade not only Cuba but the Dardanelles and the Baltic Sea as well.

China's drive for power centers in the colored underdeveloped world. Peiping has especially great hopes in Africa and is investing much effort there. We must therefore move rapidly and intelligently to prevent the racist Chinese, as well as the Russians, from fishing too successfully in these waters.

This may seem a tough and dangerous policy. It is. But Demosthenes vainly warned the Athenians about Philip of Macedon: "If any man supposes this to be peace, which will enable Philip to master all else and attack you last, he is a madman." Appeasement now will mean not lasting peace but major war later.—END

The author, Dr. Griffith, is Research Associate for the Center for International Studies at the Massachusetts Institute of Technology and Director of its International Communism Project. His books include The Sino-Soviet Rift and Albania and the Sino-Soviet Rift. The above is excerpted with permission from an article, "Containing Communism: East and West," in The Atlantic Monthly magazine.



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A distinguished list of Air Force Association Board members have been elected to serve as trustees of the AFA-affiliated Aerospace Education Foundation. Chosen to serve with them are outstanding citizens, all leaders in their fields . . .

Aerospace Education Foundation Leaders Chosen

MEETING in Colorado Springs, Colo., on June 5, the Air Force Association Board of Directors elected twenty-eight of its members to serve on the Board of Trustees of the AFA-affiliated Aerospace Education Foundation.

The Foundation Board of Trustees also met in Colorado Springs on June 5, and elected a number of additional persons who are not AFA National Directors and who will serve, or will be invited to serve, on its Board of Trustees.

At its meeting, the Foundation Board reelected its Chairman **LAURENCE S. KUTER** of New York City, Vice President of Pan American Airways, former Commander in Chief of the North American Air Defense Command (NORAD), current member of AFA's Board of Directors, and recipient of an AFA Citation of Honor.

JOHN R. ALISON, Beverly Hills, Calif. Corporation executive. Former AFA President and Board Chairman. Permanent National Director. Incumbent.

JOSEPH E. ASSAF, Hyde Park, Mass. Chemical engineering technologist. Former Squadron, Wing Commander; Regional Vice President. Current National Director.

N. W. DEBERARDINIS, Shreveport, La. Newspaper executive. "AFA's Man of the Year" (1963). Former Squadron and Wing Commander. Current Regional Vice President. Incumbent.

JAMES H. DOOLITTLE, Redondo Beach, Calif. Industry executive. Air Age Award (Hoyt S. Vandenberg Trophy); Gold Life Member Card. Former AFA President. Permanent National Director. Incumbent.

KEN ELLINGTON, Los Angeles,

Calif. Industry executive. AFA Citation of Honor winner; World Congress of Flight Committee Chairman; former Squadron Commander. Current National Director. Incumbent.

JOE FOSS, New York, N. Y. AFL Commissioner. Former AFA President. Permanent National Director. Incumbent.

GEORGE D. HARDY, College Heights Estates, Md. Food brokerage executive. "AFA's Man of the Year" (1957); AFA Special Citation. Former Squadron and Wing Commander; Regional Vice President. Current National Secretary. Incumbent.

JOSEPH L. HODGES, South Boston, Va. Jewelry executive. Former Squadron and Wing Commander; Regional Vice President; National Committee member. Current National Director.



Laurence S. Kuter



Lindley J. Stiles

The Board reelected as President **LINDLEY J. STILES**, Madison, Wis., Dean of the School of Education at the University of Wisconsin and a recipient of AFA's Hoyt S. Vandenberg Trophy.

Secretary **JULIAN ROSENTHAL**, New York City attorney, former Chairman of the Board, permanent National Director, "AFA's Man of the Year" (1953), and recipient of a Gold Life Member Card and an AFA Special Citation, was reelected.

Also reelected was Treasurer **JACK B. GROSS** of Harrisburg, Pa., an investment executive, former AFA National Treasurer and Chairman of the Board, permanent National Director, "AFA's Man of the Year" (1958), and recipient of a Gold Life Member Card and an AFA Special Citation.

Additional AFA Board Members elected to serve on the Foundation Board of Trustees are:

ARTHUR F. KELLY, Los Angeles, Calif. Airline executive. Former Squadron Commander, Regional Vice President, AFA President. Permanent National Director. Incumbent.

JESS LARSON, Washington, D. C., Attorney. Former Chairman of AFA's Air Reserve Council. Current AFA President.

CARL J. LONG, Pittsburgh, Pa. Consulting electrical engineer. Former Squadron and Wing Commander; National Committee member. "AFA's Man of the Year" (1959). Current National Director. Incumbent.

W. RANDOLPH LOVELACE, II, M.D., Albuquerque, N. M. Surgeon and Director of the Lovelace Foundation. AFA's Science Trophy. Former AFA President, Foundation Board Chairman. Current Chair-
(Continued on following page)

man of the AFA Board. Incumbent.

HOWARD T. MARKEY, Chicago, Ill. Patent attorney. AFA Special Citation. Former Regional Vice President, AFA President, Chairman of the Board. Permanent National Director. Incumbent.

J. B. MONTGOMERY, Van Nuys, Calif. Industry executive. Former AFA President. Permanent National Director. Incumbent.

O. DON OLSON, Colorado Springs, Colo. Bank executive. Former Squadron and Wing Commander. "AFA's Man of the Year" (1960). Current National Director. Incumbent.

EARLE N. PARKER, Fort Worth, Tex. Industrialist. Former Wing Commander, Squadron Officer. Current National Director. Incumbent.

CHESS F. PIZAC, Bethesda, Md. Industry executive. Former Squadron Officer, National Committee Member, Regional Vice President. Current National Director. Incumbent.

PETER J. SCHENK, Arlington, Va. Corporation executive. AFA Special Citation. Former AFA President. Permanent National Director. Incumbent.

WILLIAM W. SPRUANCE, Wilmington, Del. Federal, state aviation official. Former Regional Vice President, National Committee member. Current National Director. Incumbent.

ARTHUR C. STORZ, Omaha, Neb. Brewing company executive. Former Squadron Commander, National Committee member. "AFA's Man of the Year" (1955), and recipient of a Gold Life Member Card, AFA Special Citations (3). Current National Director. Incumbent.

JAMES M. TRAIL, Boise, Idaho. Professional engineer. AFA Special Citation. Former Squadron and Wing Commander, Regional Vice President, Board Chairman. Permanent National Director.

NATHAN F. TWINING, Washington, D. C. Publishing corporation executive. H. H. Arnold Trophy. Former USAF Chief of Staff and Chairman, Joint Chiefs of Staff. Former National Committee member. Current National Director. Incumbent.

THOMAS D. WHITE, Washington, D. C. Military analyst. H. H. Arnold Trophy. Former USAF Chief of Staff. Former National Committee member. Current National Director. Incumbent.

GILL ROBB WILSON, Claremont, Calif. Publisher. Hoyt S. Vandenberg Trophy, recipient of a Gold Life Member Card. Former Squadron Commander, AFA President, Board Chairman, Foundation Chairman. Permanent National Director. Incumbent.

PAUL S. ZUCKERMAN, New York, N. Y. Investment broker. Former National Committee member. Current National Treasurer. Incumbent.

The following, who are not current AFA National Directors, were elected to serve on the Foundation Board of Trustees:

CHARLES H. BOEHM, Bogota, Colombia, S. A. Educator. Hoyt S. Vandenberg Trophy. Incumbent.

MILTON CANIFF, New York, N. Y. Cartoonist. Arts and Letters Trophy, AFA Citation of Honor. Current Chapter President. Incumbent.

B. J. CHANDLER, Evanston, Ill. Educator. Current Education Advisory Council Chairman. Incumbent.

JOSEPH V. CHARYK, Washington, D. C. Industry executive. Former Undersecretary of the Air Force. Incumbent.

ROBERT EWING, JR., Shreveport, La. Publisher. Incumbent.

ARTHUR GODFREY, New York, N. Y. Radio and television personality. Hoyt S. Vandenberg Trophy, AFA Citation of Honor. Former National Director. Incumbent.

MAX GOLDEN, New York, N. Y. Corporation executive. AFA Citation of Honor. Former Deputy Assistant Secretary of the Air Force; Air Force General Counsel. Incumbent.

JOHN A. HANNAH, East Lansing, Mich. President, Michigan State University. Former Assistant Secretary of Defense. Incumbent.

MAXWELL A. KRIENDLER, New York, N. Y. Food importer. Former Squadron Commander, National Committee member, National Director. "AFA's Man of the Year" (1964). Incumbent.

EARLE E. PARTRIDGE, Colorado Springs, Colo. Former Commander, Continental Air Defense Command. Incumbent.

COURTLAND S. PERKINS, Princeton, N. J. Educator. Incumbent.

SIMON RAMO, Canoga Park, Calif. Industry executive. AFA Special Citation. Incumbent.

EDWIN W. RAWLINGS, Excelsior, Minn. Former Commander, Air Materiel Command. AFA Citation of Honor. Incumbent.

SHERROD E. SKINNER, Detroit, Mich. Corporation executive. Incumbent.

H. GUYFORD STEVER, Pittsburgh, Pa. Educator. Former Air Force Chief Scientist. Incumbent.

EDWARD TELLER, Berkeley, Calif. Educator. Science Trophy, AFA Citation of Honor. Incumbent.

T. F. WALKOWICZ, New York, N. Y. Investment adviser. Former National Director. Incumbent.

The following have been elected and have been invited to serve on the Foundation Board of Trustees, but, as of this writing, had not accepted.

JOHN BADGER, SR., Altus, Okla. Industry executive and philanthropist. Community leader, supporter of Air Force and educational activities.

RAYMOND L. BISPLINGHOFF, Alexandria, Va. Associate Administrator, NASA. Former professor, MIT. Panelist, current AFA Seminar series.

JAMES C. FLETCHER, Salt Lake City, Utah. President, University of Utah. Physical scientist.

WALTER HESSE, Dallas, Tex. Industry executive. Current AFA Chapter President.

JAMES W. MULLEN, Richmond, Va. Industry executive. Panelist, current AFA Seminar series.

C. ROY SLEMON, Colorado Springs, Colo. Education administrator. Former Deputy Commander in Chief, NORAD. Director, Aerospace Education Center, Air Force Academy Foundation.

GEORGE L. WASHINGTON, Washington, D. C. Assistant to the President of Howard University. Aeronautical engineer. Former manager of Air Force Primary Flying School.

—DON STEELE

THE SPACE AGE IN PERSPECTIVE



SPACE

DIGEST

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The Prospects for US-European Space Cooperation

By Elmer P. Wheaton53

Europe's space effort should be a progressive technological advance including a thorough investigation of near space. US industry can be helpful to Europe in several ways, particularly in terms of existing American experience in the intricacies of complex systems management.

Space Communications: Meeting the Needs of All

By Dalimil Kybal60

European and American space communications requirements should be considered as part of a global system, in keeping with existing international agreements. As Europe's space skills develop, it should concentrate on developing "second-generation" communications satellite hardware.

Join the Air Force and See the World . . . The Flight of Gemini-4

A SPACE DIGEST Photo Feature62

It was the "saddest moment" of his life when USAF Maj. Edward White reentered the Gemini-4 capsule after his self-propelled "walk" in space. But to his command pilot, USAF Maj. James McDivitt, and millions following the flight from earth it was a giant step for the US space program.

Speaking of Space

By William Leavitt65

The Air Force MOL should get the green light soon, the sooner the better, urges Rep. Chet Holifield's Military Affairs Subcommittee. NASA need not worry about being preempted in space station developments. There's plenty for NASA to do getting to the moon.

How To Find Your Place In The Heavens.



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Europe's space effort should be based on a "progressive technological advance" that includes, in its earlier phases, a thorough investigation of near space. There are several approaches to US-European industry space cooperation for such a program, suggests a major US industrial space planner. Europe should take advantage of the existing experience of US industry in systems management . . .

Elmer P. Wheaton,
Vice President,
Lockheed Missiles
& Space Company.



The Prospects for US-European Space Cooperation

BY ELMER P. WHEATON

Last month's SPACE DIGEST featured the views of three important European representatives of Eurospace—the nonprofit European industrial-financial association dedicated to advancement of an all-European space program. This month we present the views of two prominent American space-industry specialists on the problems and prospects of European space efforts and possible US-European industrial cooperation in space technology. The following articles—by Elmer P. Wheaton, Vice President, Lockheed Missiles & Space Co., and Dalimil Kybal, Senior Consulting Scientist, Lockheed Missiles and Space Co.—are adapted from presentations at the recent Eurospace Conference—THE EDITORS

I WOULD not minimize Europe's ability to push ahead in space. I do believe, however, that the development of a sound foundation for very advanced space programs must be based on a progressive technological advance which encompasses, in the early phases, thorough investigation of near-earth space.

Perhaps we can define some specific guidance for space programs that may be suitable for US-European industrial efforts. Let me suggest four guiding principles which appear critical to any program.

- The program to be jointly undertaken should avoid unnecessary duplication of an existing program. The reason is obvious—we are not likely to be financed for unproductive undertakings.

- The project or program should contribute to a better understanding of the space environment. Space is still largely an unknown. We must be familiar with the space environment before many of our dreams and aspirations can be realized.

Even though various countries are actively exploring the environment, much more remains to be done and over an extended period of time.

- The program must provide a logical extension of our current space technology. In many respects our technology, including structures, power supplies, reliability, materials, etc., is very new and stretches the state of the art. Before we can achieve true space transportation, or comprehensive interplanetary flights—manned or unmanned—technology must undergo significant advancement.

- The program must not require such a substantial increase of knowledge in either the space environment or the space technology that it involves a high risk of failure. From experience we know that early flight failures quite often jeopardize the necessary public and, in turn, financial support essential to a visible program.

These objectives which are applicable to programs suitable for joint US-European industrial development are believed to be compatible with

the various desires of our respective governments.

In examining next the policies of our governments relative to cooperative space programs, we find that the United States, for its part, is on record as favoring cooperative efforts. Going back to 1958 when the National Space Act was enacted directing that NASA conduct international cooperative programs, Congress clearly indicated its desire that US space programs be carried out as openly as possible and that the competence of foreign scientists be used in achieving common goals.

It is entirely possible to have joint US and European industrial participation on European space projects not involving government-to-government agreements. If European governmental policy permits, and if Europe desires, this can be done, provided US industrial assistance is furnished *within* the framework of US government policy.

Industry Cooperative Modes

The participation of US companies in European space programs can be accomplished in several ways. The European governments or companies can buy certain developed equipment from US firms. US firms in conjunction with European firms can combine or establish new companies, or European firms can contract for technical services from US companies. The real reason today for joint US-European industrial cooperation is to facilitate the acquisition by Europe of the technical capability the United States has been fortunate enough to develop. As an aside, an objective appraisal forces us to recognize that "US cooperation" will often simply strengthen the European ability to compete more effectively with US firms.

We recognize, however, that a healthy and growing European space program can offer additional sales opportunities for US industry. Examining the alternatives, it is obvious that the purchase of complete US space systems hardware does not best fulfill Europe's aims, although there will be instances in which the purchase of components and equipment will be helpful to Europe. Also, the financial investment by US firms in European companies fails to adequately enhance Europe's space competence. The employment of US firms to work cooperatively with European industry offers the most logical means for the transfer of approved technical and management "know-how."

I will be specific as to what Europe can expect to derive from joint US-European industrial efforts.

These benefits include shortening of the learning process through undertaking space programs in which the US industry has gained significant experience and accessibility to space technology developed by the United States, often at great expense. The final advantage of this type of joint activity is that of further developing European techniques for managing and directing technically complex and industrially widespread space programs.

I am referring, of course, to the US systems management methods evolved as a result of experience indicating the necessity for central control and direction regarding performance requirements; design and development; schedule, cost, and other trade-offs; and test planning and operations. It is vitally important that Europe recognize the necessity of having a responsible and capable group in charge with authority to provide the decisions required in discharging these systems management responsibilities. In any space program, optimization is far more critical than it was in aircraft-development programs.

There are some important principles of prime interest to US industry in terms of direct company-to-company agreements:

- Space programs must serve scientific or commercial purposes. We limit the purposes to scientific and commercial, since joint military space programs can be realized only through government-to-government agreements.
- Even modest space program efforts will be expensive, necessitating government financing. US companies will want assurance that the required funds are available.
- Finally, the prestige to be gained from a space program is of secondary importance to us when compared with the acquisition of scientific knowledge and other useful data and with the development of advanced technology.

Scientific Areas

Although joint government space program activity is under way and most helpful to both Western Europe and the United States, there remain ample opportunities for Europe to conduct useful space investigation in a number of scientific areas.

Here are several:

- UPPER ATMOSPHERE: These investigations include atmospheric composition, density, and degree of ionization variations with time. Diurnal and seasonal effects would be observed over at least an eleven-year sun cycle for variations.

● **AURORA PHENOMENON:** This investigation ties in naturally with the current Scandinavian observational activities. Here long-term polar satellites could make a most useful scientific contribution in investigating polar-cap absorption, in which radio beams both entering and departing the polar areas at times are badly disturbed due to reflection or absorption.

● **EARTH RADIATION BELTS:** The radiation source and loss mechanism would be investigated.

● **SOLAR FLARES:** The study of conditions in the neighborhood of solar flares using spectroscopic instruments to investigate plasma behavior resulting from these flares.

● **EARTH'S MAGNETIC FIELD:** The purpose of these investigations would be to observe the changes of the earth's magnetic field with time as a result of the effects of solar-flare plasma and the solar wind impinging on the magnetic field. Information obtained from ground observations would be coordinated with that received from satellites orbiting above the ionosphere.

● **STELLAR ASTRONOMY:** The mission would be to observe the sun and stars in wavelength ranges not possible from the surface of the earth. Infrared instruments would be used to observe the cool bodies, and the high-temperature aspects of stars would be observed in the ultraviolet and soft X-ray wavelength regions.

There already are a number of investigations under way in the West in each of the scientific areas which have been suggested. However, these are scientific regions which will require extensive exploration over extended periods of time before reliable information is acquired. Further, this type of scientific exploration represents logical efforts suitable for countries operating with small space budgets and in the initial phases of space exploration.

These suggested areas can be investigated with relatively sophisticated instrumentation aboard small, rather simple spacecraft launched by comparatively inexpensive booster systems.

US industry, as does any industrial organization, wants to be associated with successful programs—not with programs which are too advanced and sophisticated to be realized. We know that programs which are well beyond the national competence level or state of the art have a way of encountering serious difficulties and are prone to lose public interest and funding support. I believe that the scientific areas which have been suggested are within reasonable reach of European countries and represent the type of space exploration which

Europe should initially emphasize. The intensive exploration of these areas can contribute substantial and useful knowledge to the West and are most apt to be of immediate interest to US firms.

Advanced Programs

As Europe gains additional experience in space operations and acquires the necessary research and development and tracking and data acquisition facilities, I visualize that its space activities will logically expand to more demanding and sophisticated space programs. I will suggest some areas for more distant European exploration.

They include:

● **ASTRONOMY:** Astronomical exploration requires large, complex, and expensive spacecraft, experiments, and booster systems. This type of program seems to be very ambitious for early European investigation and possibly should be preceded by the scientific programs I have already mentioned.

● **BIOASTRONAUTICS:** Extensive investigation in this area would seem to follow at a later date if it is keyed to Europe's manned spaceflight programs. Booster vehicles and other resources can be used to greater advantage in other space projects. Additionally, the United States, due to the pressure of its own manned space activity, will develop scientific information applicable to many of today's bioastronautics problems. Much of this information should become available to Europe, resulting in a saving of time and treasure.

● **UNMANNED INTERPLANETARY EXPLORATION:** This also could be a downstream program for Europe. It is exceedingly expensive since it requires large spacecraft and boosters and spacecraft filled with complex equipment and experiments. As an example of the cost, the US Voyager which is presently being actively studied for Mars exploration is estimated to require more than \$1 billion during a ten- to twelve-year development and operational program. Early opportunities for European cooperation in unmanned interplanetary exploration could lie, in my opinion, in the field of interplanetary instrumentation. One of the experiments presently under intensive study is the search for life on Mars.

● **LAUNCH VEHICLE DEVELOPMENT:** Even though Europe recognizes that booster development costs are large and that fund limitations may result in schedule stretchouts, it is reasonable to assume that the European launch vehicle programs will continue. At some point in the future Europe

will find it necessary to match its boosters with more accessible launch and tracking and data acquisition facilities which will be an additional and sizable inroad on capital.

From the European point of view, there may appear to be advantages in the joint US-European development of launch vehicles. A closer examination of this situation provides reasons for caution. New booster vehicles involve basic defense technology which necessitates that US industrial firms accede to the government's wishes in planning for the use of this sensitive technology. Joint launch vehicle development efforts can materialize only through government-to-government agreements which could be followed by US technical assistance programs.

There is little reason for optimism in contemplating any early joint US-European booster vehicle development program. On the other hand, we recognize that, through joint governmental agreements, NASA's announced policy provides that US booster support is and can continue to be made available to Europe in the areas of small- to medium-sized boosters and in launch services.

Working Satellites

There are three other space programs which should be recognized as having potential for European participation:

- At some time in the reasonably near future, Europe may find it advantageous to join with the United States in the development and operation of a Navigation Satellite system.
- Still another space program which Europe may want to undertake somewhat later is the Geodetic Satellite. Although the US government is performing geodetic surveys through the use of space vehicles, it may be that this activity will not satisfactorily provide for the specific plotting requirements of European countries.
- Also, Europe may recognize a need for Data Collection Satellites to be used in supplementing the meteorological data supplied by US weather satellites.

Summing up, Europe should:

- Emphasize the scientific exploration of space performed from a relatively near-earth orbit to gain further operational experience in space and to increase through self-participation its knowledge of the space environment. The areas which have been suggested for exploration are, I believe, the most suitable for this purpose. This exploration can be conducted through the use of small

spacecraft and booster vehicles which will tend to retain costs in alignment with European space budgets.

- Plan to accomplish booster development programs without direct US industrial participation in the absence of government-to-government agreements.

An area where US firms can provide a significant contribution to joint US-European industry programs is in space systems management. In broad terms, it is the over-all control of the program scope, the schedule, and costs. Specific inter-related functions include: writing systems specifications; systems design and engineering; systems integration; facilities programming; procurement, including components and subsystems; fabrication and assembly; quality control; integrated test planning; and logistics support, comprised of checkout and ground-handling equipment and spares and parts; launch operations planning and coordination; prelaunch checkout and launch support; data handling.

The United States in conducting its booster and space programs has learned a great deal about systems management, some of it after bitter experiences. European industry, through exposure to the full range of US systems management methods and procedures, may find it advantageous to draw on this experience.

Other areas where there are ample opportunities for joint industrial cooperation are in experiments and spacecraft.

In the area of experiments, US industry can provide technical advice during the process of their selection and design. This assistance may include supplemental background information about the space environment in which the instruments are to operate. In addition, US industry can provide advice on the compatibility of experiments with spacecraft materials and equipment. Finally, with the knowledge US companies have of American launch vehicles, and of their design and capabilities, significant help can be made available during the integration of the spacecraft and booster. Not to be overlooked are the contributions US firms can provide due to existing relationships with NASA and the US booster manufacturers.

As for how United States firms can assist European industry with the spacecraft, I am sure Europeans recognize that due to the extensive experience which US companies have had in designing, developing, and operating space systems, they are in a position to provide valuable and time-saving advice relative to spacecraft structures, space

power systems, telemetry, command and control systems, and spacecraft stabilization. Such assistance will be subject to the approval of the US government on a case-by-case basis.

Organizational Alternatives

What are some of the organizational alternatives available to Europe for joint US-European industrial efforts? There are four alternatives:

- A US industrial firm acting as contributor to a European company during conceptual study and preliminary design phases in which the European firm is seeking the support of its government, including project approval and initiation, for a systems hardware program.

- A European firm as prime contractor supported by European and US industrial companies operating in subcontracting roles.

- Conversely, a US company as prime contractor with subcontracting support from European and, possibly, other US firms.

- A European governmental agency as a systems manager supported by industrial firms from Europe and the United States discharging responsibilities as subcontractors. This is a normal consortium type of arrangement.

As to the first alternative—the participation of US firms in conceptual study and preliminary design—Europeans are offered opportunity to profit from the extensive and practical space experience residing in American firms. Taking part in this type of activity involves some significant risks for US firms. In the first place, normally this type of preliminary work is costly to the company performing it. Secondly, the program may not be implemented, and if it is, the contributing company may not be a winner. Finally, assuming the most favorable situation for the American company, wherein the hardware program is implemented by the responsible European government and won by the contributing US firm, the prospects for recovery of previous program-associated, company-funded expenses during extended production runs or through the sale of company-developed parts is minimal. Therefore, for the “conceptual study and preliminary design” type of assistance, Europe should recognize that contributing US firms must expect to be paid as contributions are made.

Examining the advantages and disadvantages of the second alternative, in which a European firm performs as prime contractor and as such is responsible for the systems management functions, the advantages are that this arrangement provides

major European identification with the space program and single responsibility to the accountable government agency. Problems may arise from not employing the more experienced systems management capabilities existing in United States' firms, and to some degree, from the lack of working experience between European companies and NASA and the US booster manufacturers. It is recognized that when Europe has its own booster vehicles, this last disadvantage will disappear.

Proceeding to the alternative in which a United States' industrial firm discharges the responsibilities of a prime contractor, among the advantages are single responsibility to the government agency directing the program. Also more experienced systems management capability is brought to bear on the program. And at least for the near term, there is the advantage of the US firm's knowledge of NASA and the launch vehicle manufacturer. Further, the extensive and practical experience in design, development, fabrication, test, and the operation of space systems can be used most effectively with a US firm performing as the prime contractor. The disadvantage is the reduction of European identification with the program.

The final alternative is one in which a European governmental agency performs systems management functions through coordinating the activities of a group of subcontractors from both Europe and the United States. Although this contractual arrangement provides maximum European identification with a space program, it, at the same time, imposes a complex and time-consuming coordination task on the responsible government agency. In examining the size and capabilities of the technical staffs existing in some European governmental agencies, Europeans may arrive at what appears to me to be an obvious conclusion—that, in general, from Europe's viewpoint, this alternative may be the least attractive of the four which I have presented. The United States government even with its much larger technical staffs has often turned to industry for the performance of the systems management responsibilities.—END



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**When LEM men
go down to the moon
in ships...**

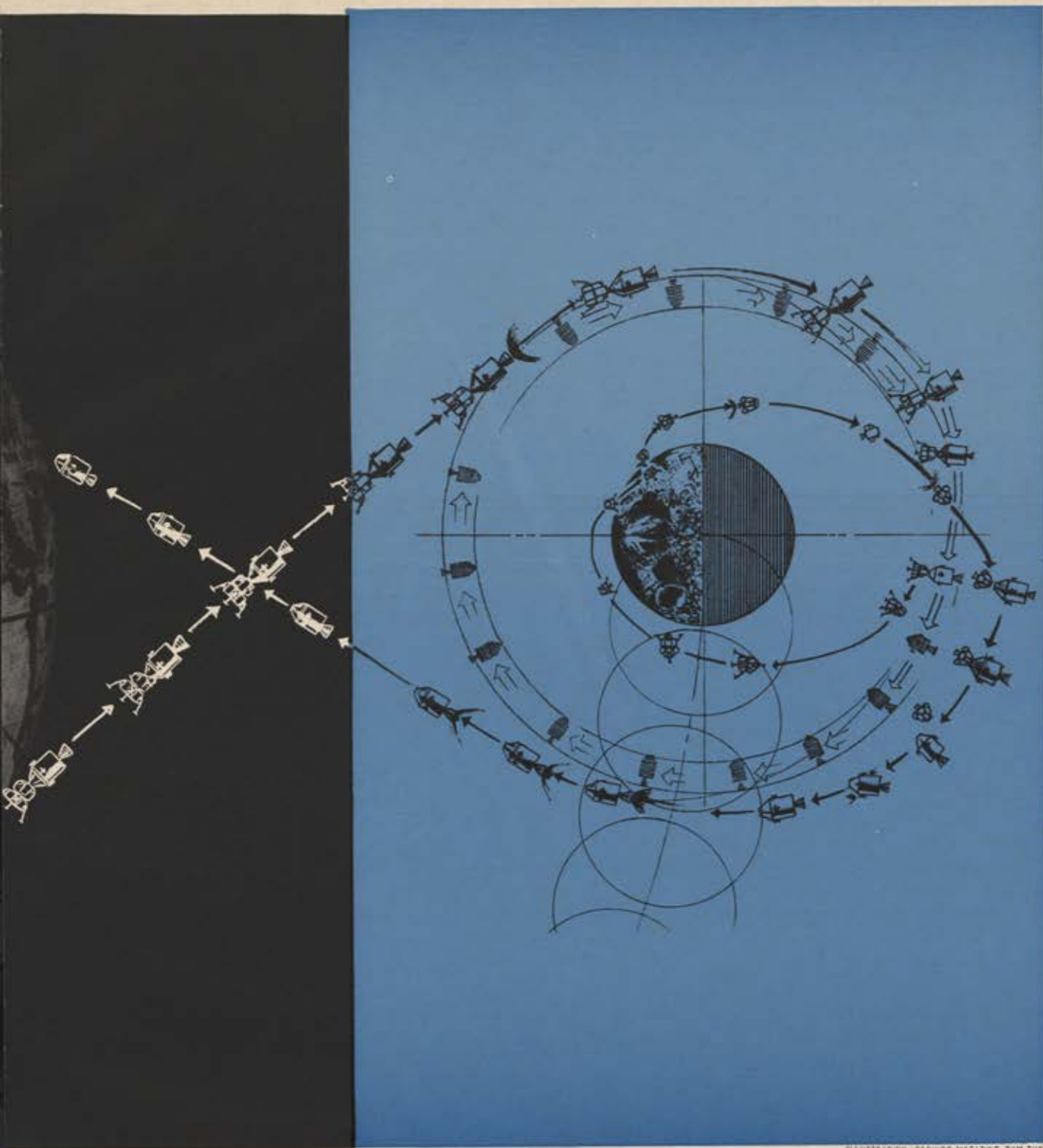


ILLUSTRATION: ESQUIRE MAGAZINE, TOM TURNER

TRW will help them get back. By 1970 two Apollonauts will descend onto the moon in their Lunar Excursion Module (LEM). A TRW advanced propulsion system will land them feather-soft. They will explore the lunar surface, then prepare for the long journey home. After lunar blast-off they will rendezvous with their return vehicle holding in orbit 80 miles out. During this lunar phase a lightweight

TRW-built "strapdown" inertial guidance system will enhance their safety. These major Apollo tasks have been assigned to TRW Space Technology Laboratories by the Grumman Aircraft Engineering Corporation. TRW will also provide mission planning and analysis for Project Apollo, as it has done for the Mercury and Gemini programs.

TRW SYSTEMS

Formerly TRW Space Technology Laboratories

Contrary to the views of those Europeans who tend to think of European and American space communications systems as separate entities, existing international agreements clearly call for a global system. Europe, as it develops space technology skills, ought to concentrate on developing next-generation satellites as replacements for existing hardware, in keeping with the competitive approaches contemplated in the international agreement . . .

Space Communications:

WHILE we understand and agree with the European desire to participate in the space segment of a communications satellite system, how this participation will take place raises difficult questions. I believe that one area of misunderstanding arises from the tendency to discuss European and American communications systems as if they were two separate, even insular, entities. This is just not so. The International Consortium, to which forty-five participating nations, including Vatican City, have subscribed, is indicative of the global aspects of communications via satellites. Further, the preamble of the Interim Arrangements of August 1964 for a global commercial communications satellite system issues a clarion call for the establishment of a *single global* communications satellite system at the earliest practicable date.

In furtherance of this purpose the first Early Bird is today in a synchronous position off the north coast of Brazil and could potentially communicate with four continents—Europe, Africa, South and Central America, and North America. From this initial coverage it is planned to achieve global coverage by late 1967.

A second difficulty appears to arise from the statement that Europe's interest differs from that of the US in terms of compass directions. I refer specifically to Dr. Erhard Löwe's identification (see *SPACE DIGEST*, June 1965) of European interest with north-south traffic lines, while America is said to be oriented in an east-to-west direction.

Projections of satellite communications traffic can be derived from long-distance communications, from world telephone distribution, or from the number of telephones in the world's principal cities. Obviously the absolute value of communications or telephones will increase with years, but

I believe that the relative percentage distribution will remain generally unchanged.

Let us first compare the north-south traffic for Europe and then for the United States. Europe will utilize only six percent of its own communications capacity to communicate with the African continent, whereas the United States will utilize between ten and fifteen percent of its capacity to communicate with areas south of its borders. If one assumes that Canada has similar communications interests to the south as the United States, then the over-all figure rises to twenty percent. Moreover, with respect to these cited percentage capacities, it should be noted that the US capacity appears to be almost double that attributed to the Western European countries.

While one could deduce from this elementary example that US interest along north-south lines is just as strong if not stronger than that of Europe, I do not believe that is the proper perspective in which to examine a potential communications satellite system. It seems to me more important to look at the major communications traffic lines between the various continents of the world, for it is this traffic capacity that will probably determine the design of the satellite communications system. About eighty percent of the world's communication capacity is concentrated in Western Europe and in the North American continents. While obviously this capacity is utilized to communicate to all parts of the world, Atlanticists, however, could suggest with some justification that this twenty-four-hour-day capability is one of the indisputable links binding the two continents.

Let me develop this point from a slightly different angle. To use an extreme case, let me hypothesize a satellite system specifically designed for communication with the African continent and

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Meeting the Needs of All

compare it with a global system. If my arithmetic is correct, it appears that the space segment for the former system could be of lower power and therefore more economical, since it would require at most a few tens of two-way voice-grade channels in contrast with the 240 two-way voice-grade circuits of the Early Bird, or the 800 to 1,200 circuits contemplated by the Consortium. Corresponding to this reduced channel capacity, it would be possible, according to principles of communication theory, to reduce the satellite transmitter power. But this approach would require that the same large, expensive antenna and receiving systems be used as those required for present east-west circuits. Therefore, another trade-off possibility might be much more attractive.

The same total satellite power needed for the east-west system would be available, but more power would be allocated per channel. This, in turn, would allow simpler and less expensive equipment at the ground terminals. Based on the number of channels needed, relative to that for an east-west system, power per channel could be increased by a factor of ten or more. Correspondingly, the antenna diameter required might be reduced from the twenty-five meters quoted by Dr. Löwe to eight meters, and the effective annual cost of the African or Central/South American installation would be reduced by a factor of about two below that of stations in England and Europe.

I chose this admittedly extreme example to show that Dr. Löwe's comments regarding diversity of interests between Europe and America might encourage development of an unbalanced satellite system in which the ground element could turn up to be far more expensive than necessary. A better solution would seem to be one which approaches the higher power outputs of the

space segment—in other words, a balanced *but single* global satellite system. In this regard stand-by satellites are of special interest, since these could be operated for the lower traffic volume characteristic of the previously discussed Europe-to-Africa communication.

My final point concerns another area of possible misunderstanding: Dr. Löwe's suggestion that Europe should expand "a worldwide communications satellite system by auxiliary systems made in Europe." I interpret this to refer to the European desire to participate in the *single global system*. The feasibility of such participation has already been formalized in Article X of the Interim Arrangements for a Global Commercial System which states "... When proposals or tenders are determined to be comparable in terms of quality, CIF price, and timely performance, the Committee and the Corporation as manager shall ... seek to ensure that contracts are so distributed that equipment is designed, developed, and procured in the States whose Governments are Parties to this Agreement in approximate proportion to the respective quotas of their corresponding signatories to the Special Agreement. ..."

One practical way to achieve such participation would be for the Europeans to concentrate on the next-generation satellites as replacements of the earlier and less sophisticated US satellites.—END



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The US space program took a giant step forward in June with the spectacular demonstration—by two Air Force majors on assignment to NASA—of long-term manned spaceflight. The Gemini-4 duo came back not much the worse for wear after four days of weightlessness, and one of them earned the honor of being the first US spaceman to “walk” in space and maneuver himself about, using a Buck Rogers-type oxygen gun. . . .

Join the Air Force and See the World . . . From Space The Flight of Gemini-4



The United States flags on their uniforms clearly visible, Majors McDivitt, left, and White walk the ramp to the elevator that will take them to the Gemini spacecraft for their historic four-day flight.

FOR USAF Maj. Edward White, II, crawling back into the Gemini-4 capsule after his spectacular self-propelled “walk” in space during the third orbit of the Gemini-4 mission on June 3, it was the “saddest moment” of his life.

But for his command pilot, USAF Maj. James McDivitt, and the millions on earth following the flight from the ground, it was a moment of sheer elation and pride. The planned, yet incredible, had been achieved. The fact that it followed by weeks a “first” step into the void by a Russian cosmonaut detracted scarcely at all from the US feat.

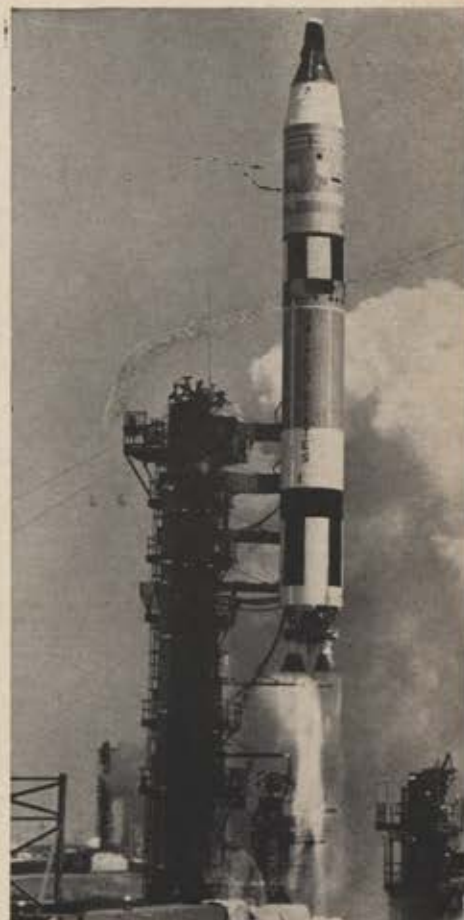
The Gemini-4 flight was by no means perfect. A scheduled rendezvous with the Titan II second stage failed, extravehicular activity had to be delayed from the second to the third orbit, and the onboard computer failed, forcing a Mercury-type, ballistic, nonlift reentry.

But after 1,600,000-plus miles of circumglobal flight, sixty-two revolutions of the earth, and more than ninety-seven hours in space, the duo returned to the “dry land” of the Navy’s carrier *Wasp*, not much the worse for wear. They had survived and functioned purposefully in space for several days at a time, and earned light-colonels’ leaves, too. Coming within weeks, longer missions.—W. L.



A few minutes before launch, and the two astronauts, Major McDivitt in foreground, and Major White, make last-minute checks with flight controllers before the hatches of Gemini capsule are finally closed.

Liftoff for Gemini-4. The Titan II, with precious cargo, leaves Pad 19 at Cape Kennedy, Fla., a little late but beautifully, at 10:16 a.m. on June 3.



Once this kind of picture was strictly science-fiction. Now it's for real on both sides of the Iron Curtain. Major White, attached to his golden tether, takes "walk" in space. Here he is still close to ship. Emergency oxygen chestpack supply is visible, front.



And here he has maneuvered himself away from the Gemini capsule, using the now-famous hand-held propulsion gun. All told, Major White spent twenty-one minutes outside. He ran out of hand-gun fuel but not out of enthusiasm. He hated to come back in.



The two astronauts, a bit haggard and both needing shaves after four days in a less than ideal and rather cramped environment, step off chopper that picked them up after splashdown and flew them to carrier Wasp. Major McDivitt, on deck, needs a shave the most.



The capsule came home to the Wasp separately. Here it is being hoisted gingerly aboard the Wasp as ship's personnel look on. At first glance, it looked none too much the worse for wear after its circumglobal trip of more than 1,600,000 miles and ninety-seven hours.

Technical personnel take a close look at the scorched bottom of the Gemini-4 capsule, confirming view that it took stresses of reentry excellently—so well in fact that it may be used again in Gemini testing program. Incoming G-loads on the capsule were somewhat higher than scheduled because reentry had to be done Mercury style, purely ballistically, due to failure of the onboard computer system.



Speaking of SPACE



BY WILLIAM LEAVITT
Associate Editor, AIR FORCE/SPACE DIGEST

Getting MOL Off the Pad

WASHINGTON, D. C., JUNE 14

Nearly lost in the excitement attending the successful Gemini-4 orbital flight and first American "walk in space" was a significant report on the US space effort released by Rep. Chet Holifield's Military Operations Subcommittee of the House Committee on Government Operations.

The 133-page document is a clearly written and incisive analysis of the problems and prospects of the US space program, with special emphasis on civil-military relationships. But it got short shrift in the daily press. Hopefully, it will get closer attention from decision-makers.

A major recommendation of the Holifield Subcommittee report is that the Air Force Manned Orbiting Laboratory (MOL) project be undertaken without further delay.

After reviewing the several agreements between NASA and DoD to cooperate in the formulation of manned orbital programs, and pointing out the historic lack of enthusiasm of DoD planners for manned military space efforts as well as "the fact that the Department of Defense cannot, as openly as NASA, publicize its space achievements and needs—a decided handicap," the report focuses on the MOL question directly:

"Is a manned orbital laboratory important for military purposes?" the report asks.

"The answer that came from the Department of Defense was affirmative but tentative. After cancellation of the Dyna-Soar orbital glider project in December 1963, Secretary McNamara announced plans for a military MOL. The importance of the MOL was explained in this way—that it was necessary to put men in space for an extended period and to conduct certain experiments in order to determine the military values of a manned space station. Significantly, this was a departure from earlier Defense pronouncements that the military had no clearly defined mission for

men in space. Now at least Secretary McNamara showed himself willing to investigate the subject seriously: The commitment still is confined to the study phases; however, no final decisions for full-scale developments have been made."

It should be pointed out here that by late June or early July it is reasonable to expect some kind of definitive announcement on MOL from DoD. By then the Defense Department and the Air Force should have completed their analyses of the industry design studies that have been under way for the past several months.

Logic would suggest that after a year and a half of MOL studies DoD will finally press ahead with a full-scale development. Knowledgeable Administration sources say that this will happen. But there is always the chance that out of all the study and negotiations between NASA and DoD will come, instead, an announcement that MOL is to be stillborn after all and that some hybrid program involving DoD and NASA will be substituted. Stranger things have happened.

The Holifield report addresses itself to the usefulness of an Air Force MOL project to NASA:

"Will a manned orbital station serve NASA's mission?" it asks. "There can be no doubt of it. The experiments to be conducted with a manned orbital station are, to a large extent, of considerable interest and importance to both the civilian and military agencies. Some experiments will have special military implications. Others will produce scientific and technical information which is indistinguishable in the military or civilian sense. . . . As knowledge is gained of the reactions and capabilities of men in the space environment, using their senses for observation and their brains for calculation and judgment, manipulating instruments, assembling and repairing structures and machines, inevitably the potentials for military applications will emerge even while the cause of science is advanced."

Recognizing this "mutuality of interest" and

Indecision and confusion have attended MOL planning, charges the Holifield Subcommittee report. Report urges MOL, shown in artist's sketch, be given a developmental go-ahead now.



the expected high cost of a manned orbital laboratory program, the report notes that both NASA and DoD have undertaken studies of design and management approaches to manned orbital laboratory programs, and that there have been "moves in some quarters to effect a 'merger' of requirements in a single program to serve both NASA and the Defense Department.

"NASA has projected its studies toward extensions of the Apollo project, sensitive to the need for developing new mission assignments before Apollo approaches the completion phase, and hopeful that Apollo hardware and design data can be exploited, with appropriate modifications, to save some time and money . . ."

On the other hand, the report observes that "DoD has lately given more emphasis to the 'operational' potentials of an MOL," apparently to buttress the case for a military program in contrast to the "scientific" aspects of the NASA effort.

"Although the Fiscal Year 1966 Defense budget carries \$150 million for a military MOL," the report says, "Secretary McNamara is withholding a final decision on MOL system design and hardware until program definition studies, contracted with four major companies, are completed and the results evaluated in conjunction with those derived from concurrent NASA studies."

The Holifield report agrees that a "soundly conceived program for a manned orbital laboratory with carefully devised experiments can serve both military and civil space requirements."

But, it asks, would such a single program *fully* serve both agencies' needs. And which agency's needs ought to have overriding priority? Which agency should manage the program and fund it? What hardware ought to be used?

"The inevitable answer to the first question, based on interagency experience in joint projects, is that compromises would have to be made in a single program. Cost, weight, and other constraints in spacecraft design would not permit both agencies to conduct all the experiments they desire in a single manned orbital station. The economies of a unified or joint program would have to be traded off against the limitations put on separate mission objectives and operating requirements.

"The answer to the second question [priority], in our judgment, points conclusively in the military direction," the reports says. "We reach this conclusion mainly on the conviction that the Soviet Union is substantially ahead of us in this field. The Voskhod, launched in October 1964, was in certain respects a manned orbiting space station. Three men were in orbit for twenty-four hours, and they conducted experiments which we have yet to do. For example, the Russian astronauts were not confined to oxygen suits in their spacecraft, and the Soviets have shown in other ways their technical mastery of the space environment."

[The report also cited the Soviet "walk in space" which has since been duplicated by US Astronaut Ed White in Gemini-4.]

As to which agency should run such a program and what hardware ought to be used, the report says: "It would be a serious mistake, in our judgment, for NASA to try to take on the complete management responsibility for a manned orbital laboratory with overriding military objectives. The paramount mission of NASA at this time is to land a man on the moon before the Russians do. The urgent need for an MOL is to catch up with the Russians in technology, which may have vital military significance. NASA should continue to concentrate on Apollo, and the Air Force should be commissioned without further delay to execute a full-scale MOL project incorporating Air Force and Navy experiments as well as those of NASA.

"The military MOL, under Air Force management . . . will energize and exercise Air Force resources for space management . . . which have not been fully effective under prevailing DoD policies to restrict new projects or extend unduly the preliminary study phases. These military and technical-support resources should not be allowed to deteriorate or be dissipated. They will be needed in the future, and their capabilities must be maintained for superior performance.

"The indications are," the report adds, "that the MOL under Air Force management will dictate the choice of the Titan III booster and the

modified Gemini spacecraft rather than the Saturn booster and the Apollo system configuration. Both the Apollo and Gemini vehicle configurations have certain technical limitations for an optimum program of experiments. . . . However, NASA is heavily involved in the Apollo program and sees a ready means to adapt the Apollo hardware for space stations . . . while the Air Force has studied modifications of NASA's Gemini spacecraft and wants to find more uses for the Titan III booster, a development project approaching \$1 billion in cost. The impetus and direction of Air Force development studies to date would seem to militate against a shift of the military MOL from the Titan III and Gemini to the Apollo systems."

NASA need not fear being squeezed out of other future space station developments just because MOL is an Air Force project, the report emphasizes. "Which agency is to undertake a large new project cannot be intelligently determined on jurisdictional grounds but on a case-by-case basis, depending on practical considerations of on-going tasks, budgetary constraints, and urgent needs. The future of space exploration will open up many requirements for manned orbiting space stations, and NASA will figure actively in developing new space projects. The imperative . . . now . . . is to cover the gap in military space exploration, which the MOL promises to do.

"The hesitancy, confusion, and delay afflicting the preliminary studies and planning for manned orbital laboratories or space stations cause the committee to emphasize . . . that planning for future space projects should not be on a hit-or-miss basis; that project development should not reflect merely the outcome of interagency struggles and maneuvers to preempt a given field.

"In our view," the report says, "a renewed effort should be made, under the leadership of the National Aeronautics and Space Council, to formulate a national space program which will take full account of military and civilian agency needs and ensure the effective use of all government resources. We foresee that NASA will continue to be the major space agency, but that military activities in space will increase as the technology progresses. . . ."

Don't Bug Us

It is scarcely too early to think about the dangers to life on earth from alien microorganisms that might be brought back to our planet by astronauts returning from exploration of the moon or Mars

or Venus. In fact, procedures to prevent such dangerous infection ought to be developed as soon as possible. The sooner the better.

This is the unnerving warning of a special panel of the National Academy of Sciences' Space Sciences Board. The Board provides counsel to NASA on the scientific aspects of the agency's spaceflight programs.

"While much thought and effort have been devoted to the detection of extraterrestrial life and to precautions against contaminating it by terrestrial organisms," the Academy report to NASA says, "much less concerted consideration has been given to the converse problem of back-contamination. . . ."

NASA has apparently played this report pretty close to its chest. The meeting at which the above conclusions were reached took place July 29-30, 1964. Only this month has its report been released.

Back-contamination may be defined as unwelcome invasion of earth by extraterrestrial bacteria or other forms of microscopic organic life. Such contamination could, in the NAS panel's view, have the most dire effects on human, animal, and plant life on this planet. Such harmful living material could be brought back by astronauts either inadvertently or in deliberately gathered soil samples.

Since present-day epidemic control depends mostly on the availability of specific pharmaceutical weapons, such as vaccines, designed to combat *known* earthly microorganisms, the NAS panel warns that fighting alien infections with conventional medical techniques could be extremely difficult.

The panel concedes that permanent prevention of the introduction of alien microorganisms—if they do exist and are transported earthward by



The moon may be even more inhospitable than it looks in this Ranger 9 closeup. The subsurface could harbor microorganisms, dangerous if carried to earth.

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spacecraft and astronauts—cannot be expected. Therefore, the objective must be to protect the earth from *immediate* infection until “the nature of the exotic organisms becomes familiar [and] devices such as vaccines or some means to destroy the microbes can be developed.”

The panel assumes the possibility of living, perhaps frozen, organisms in the subsurface of the moon. It also suggests that until a negative case is proved, we must also assume the existence of microorganism life on Mars and Venus—the planets we are most likely to explore in the foreseeable future.

As a first preventive step, the NAS panel proposes a three-week quarantine of astronauts and spacecraft, and those personnel who have had immediate contact with astronauts as they return from extraterrestrial exploration. At the same time, soil and other samples of extraterrestrial material containing alien microorganisms should be immediately examined. Also spacecraft, suits, and other equipment that *might* contain microorganisms should not be decontaminated until they have been thoroughly checked biologically.

The NAS panel points out that even microorganisms which in their original environments might not be harmful to earthly creatures might become quite nasty on a more hospitable earth. Such “nonpathogenic” organisms could dangerously preempt supplies of nutrients on which various forms of earth life depend.



“An organism innocuous when in the hostile environment of a planet might, when transported to the comparatively lush conditions of the earth, overgrow terrestrial life forms or alter the physical or chemical characteristics of the biosphere. For example, exotic soil mechanisms with unfamiliar metabolic capabilities conceivably could sequester a nutrient, such as fixed nitrogen, in a stable form which could not be attacked or utilized by terrestrial organisms. In time, the terrestrial flora would experience nitrogen starvation.” Another possibility is the combination of alien microorganisms with earthly microorganisms in the bodies of astronauts, causing disease or creating “carrier” conditions for transfer of disease to others.

Four primary potential sources of extraterrestrial contamination are listed by the NAS panel: samples deliberately collected on the moon or planets; materials unintentionally gathered; materials brought back on the astronauts’ persons; and materials brought back within the spacecraft.

Moon-mission returnees probably would not pick up back-contamination by planned samplings or even by pickup of surface dust that might stick to astronauts’ suits or equipment. Rather, the panel thinks, the danger would be from subsurface samples containing living organisms. These might be transported back to earth on the bodies of the astronauts. It would be advisable to compare carefully the astronauts’ bacterial balances before and after lunar flights. Mars and Venus represent even greater potential dangers, with Mars the more hazardous possibility.

The panel says, “The physical conditions, insofar as they are known, on Mars, Venus, and the moon, indicate that life could have developed on the Martian surface, the Venus cloud layer, or in the lunar subsurface. Evidence suggests that the probability of life on the moon is low, rather unlikely on Venus, but not unlikely on Mars. Conclusive answers may not be obtained for some time to come.

“In the interim, however, negative data will not prove that extraterrestrial life does not exist; they will merely mean that it has not been found,” the panel warns.

Therefore, NASA should prepare the necessary preventive program on the assumption that “extraterrestrial life and the concomitant possibility of back-contamination must be presumed to exist.

“To presume otherwise,” the panel warns, “could lead to inadequate planning of precautionary measures and failures to foresee a danger which might be avoided.”—END

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Within our reach today is a new "golden age" in aviation. That is the consensus among military, aeronautical, and materials-development experts. But there is also consensus that this potential—and all the benefits that this nation would derive from its realization—will not automatically fall into our lap. The story of the aeronautical challenge—pinpointed to the various sectors of technology involved and the socio-economic impact that would result—has been brought to important audiences in key regions of the nation. In a series of four Seminars, staged by AFA in cooperation with FAA, NASA, and the USAF, aerospace experts have examined all aspects of . . .

The Coming Revolution in Aeronautics

By Edgar E. Ulsamer

SPECIAL ASSISTANT TO THE EXECUTIVE DIRECTOR, AIR FORCE ASSOCIATION

THE Air Force Association's current Statement of Policy notes that while "to date, military requirements have provided the primary stimulus for public support of technological advance . . . new ways must be found to enlist public support for advanced technology."

With this policy objective in mind, the Air Force Association early this year launched a series of four regional seminars on "The Coming Revolution in Aeronautics." The locations and dates have been: East Coast—Garden City, Long Island, N. Y., February 23; West Coast—Los Angeles, April 7; Midwest—Chicago, April 20; Southwest—Dallas/Fort Worth, June 30 (*see box at right*).

The Seminar program has received the full cooperation of the Air Force Systems Command (AFSC), the National Aeronautics and Space Administration (NASA), and the Federal Aviation Agency (FAA). Each session featured briefings by AFA President Jess Larson and Past AFA President John R. Alison. Expert comment was furnished by distinguished panels, including FAA Administrator Najeeb E. Halaby; USAF Gen. B. A. Schriever, Commander, AFSC; Dr. Raymond L. Bisplinghoff, NASA's Associate Administrator for Advanced Research and Technology; and Dr. Alexander H. Flax, Assistant Secretary of the Air Force for Research and Development. Other participants were top industry executives, a leading scientist in materials development, and a top-rated aerospace industry marketing analyst. Luncheon speakers included Senator A. S. Mike Monroney (D-Okla.), Chairman of the Senate Aviation Subcommittee, and Austin J. Tobin, Chairman of the Port of New York Authority.

The main objective of the Seminars on "The Coming Revolution in Aeronautics" was to drive home to influential audiences the implications of new and revolutionary aeronautical technology. New structural materials coupled with dramatic advances in propulsion efficiency are making possible advances in airplane performance that are more significant than the transition from wood and canvas to aluminum, or from piston engines to jets.

The Seminars led off with discussions of the "birds-in-hand" aircraft which, dramatic as they may be, still draw on the old technology—the C-5A transport, the supersonic transport, and the new V/STOL vehicles. From here the discussions progressed into the new materials technology, the resulting aircraft, and their social and economic impact through lowered fares and cargo rates. A presentation on foreign technology as a serious economic threat, if the United States fails to capitalize on the technological revolution, formed an integral part of each conference. The climax of the Seminars came in round-table discussions of the philosophies behind research and development, the roles of government and industry in this area under the free-enterprise system, and the traditional pioneering function of the military in relation to commercial aviation.

In examining technology as the pacing factor of aeronautics and, in a broader sense, modern society itself, the programs achieved their ultimate purpose: To show that the US can only lose—economically, socially, and militarily—by allowing those to whom the *status quo* is a way of life to put artificial constraints on technology.

Further, technology was shown for what it is—an instrument for advancement that knows no loyalty, no geographic boundaries, but which willingly serves any master prepared to bear the expense of exploiting it.

The fact that AFA's Seminar series on "The Coming Revolution in Aeronautics" generated new, constructive thinking on the problem of research and development and alerted people of stature to the existence of a dilemma which begs solution is attested to by such comments as these:

Gen. Jimmy Doolittle, after attending the Los Angeles Seminar: "It was superb. Highly informative. Just right in tone. Achieved every objective."

Or, Senator Monroney, after acting as luncheon speaker and panelist: "I was not only proud to participate . . . I also learned a lot throughout the day."

In every case, care was taken to ensure a quality audi-

ence made up of members of the business community, financial analysts, bankers, and brokers, whose influence ranges wide in our society. In the following report, we attempt to present, in capsule form, the gist of the discussions in a highly successful and important AFA Seminar series.

The C-5A

Slated for test flight in 1968, the C-5A will be about 210 feet long, have a wingspan of 200 feet, weigh about 750,000 pounds, and carry payloads of up to 250,000 pounds. So far DoD has stated a need for fifty-eight of them. Four jet engines, each with about 40,000 pounds thrust, will give the C-5A a cruising speed roughly equal to today's commercial jets. A commercial version is expected to become operational in the early 1970s.

In a commercial version, the three companies competing for the C-5A—Boeing, Douglas, and Lockheed—see the possibility of accommodating as many as 1,000 passengers by using a three-deck configuration. Donald Douglas, Sr., says, "[The C-5A] should give the big luxury liners a run for their money. On a plane as big as that, all sorts of comforts can be added—and passengers will be flying across the ocean for perhaps less than \$100."

Recognizing the difficulty of finding 1,000 passengers for a given trip, transportation experts propose various combinations of passengers and cargo. Integrated, automated, and compatible cargo systems would link truck transport with the C-5A.

Air cargo's annual growth rate, averaging twenty-five percent over the past few years, plus the C-5A's potential for reducing the air ton-mile cost from 15¢ to 6¢, directly competitive with trucking costs, makes an all-cargo version of the C-5A highly attractive. One approach involves a piggyback operation, based on the C-5A's ability to be loaded directly through the end of its cargo compartment from two full-sized trailer trucks at the same time.

Maynard L. Pennell, a Boeing Vice President, said of the C-5A:

"Imagination and foresight are required to make full use of the opportunities offered [by this airplane]."

Vice President Leo J. Devlin, in charge of the Douglas C-5A program, struck a similar note: "... We firmly believe

(Continued on following page)



This artist's conception of Boeing's C-5A heavy logistics transport gives an idea of the magnitude of the aircraft. A commercial version, according to the designer, would not differ materially in outside appearance except that it would have three rows of windows extending the length of fuselage.

PARTICIPANTS AT AFA SEMINARS

GARDEN CITY, L. I., N. Y., FEBRUARY 23

Panel

Dr. Raymond L. Bisplinghoff, Associate Administrator for Advanced Research and Technology, NASA
Najeeb E. Halaby, Administrator, FAA
Gen. B. A. Schriever, Commander, Air Force Systems Command

Luncheon Speaker

Austin Tobin, Executive Director, Port of New York Authority

Industry Presentations

M. C. Haddon, Vice President, Lockheed-California Co.
Dr. James W. Mullen, II, President, Texaco Experiment Incorporated
Maynard L. Pennell, Vice President, Boeing Co.

Local Sponsor

The Long Island Association

LOS ANGELES, CALIF., APRIL 7

Panel

Dr. Raymond L. Bisplinghoff, Associate Administrator, NASA
Najeeb E. Halaby, Administrator, FAA
Gen. B. A. Schriever, Commander, AFSC

Luncheon Speaker

Sen. A. S. Mike Monroney (D.-Okla.)

Industry Presentations

Robert A. Bailey, Vice President, Lockheed-California Co.
Leo J. Devlin, Vice President, Douglas Aircraft Co.
Malcolm S. Harned, Vice President, Aircraft Div., Hughes Tool Co.
William E. Larned, Jr., President, DMS, Inc.
Dr. James W. Mullen, II, President, Texaco Experiment Incorporated.

Local Sponsors

The Los Angeles Chamber of Commerce
The Los Angeles Society of Financial Analysts

CHICAGO, ILL., APRIL 20

Panel

George P. Bates, Jr., Director of Aircraft Development, FAA
Dr. Alexander H. Flax, Assistant Secretary of the Air Force for Research and Development
Charles W. Harper, Director, Aeronautics Div., Office of Advanced Research and Technology, NASA

Luncheon Speaker

Gen. B. A. Schriever, Commander, AFSC

Industry Presentations

Robert A. Bailey, Vice President, Lockheed-California Co.
Charles M. Forsyth, Vice President, McDonnell Aircraft Corp.
William E. Larned, Jr., President, DMS, Inc.
T. R. May, Vice President, Lockheed-Georgia Co.
Dr. James W. Mullen, II, President, Texaco Experiment Incorporated.

Local Sponsor

The Chicago Association of Commerce and Industry

DALLAS-FORT WORTH, TEX., JUNE 30

(as scheduled at presstime)

Panel

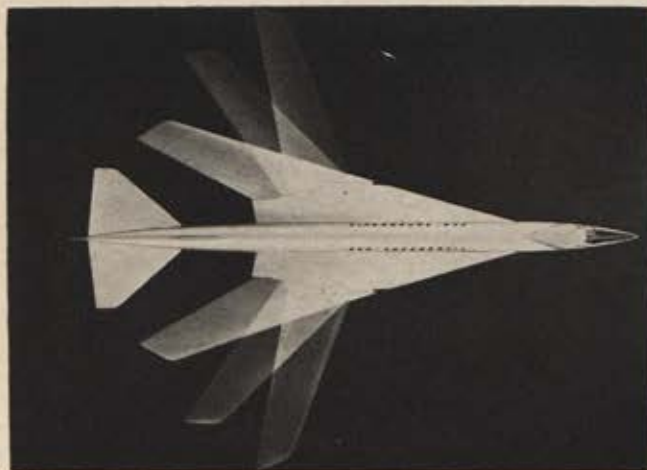
Dr. Raymond L. Bisplinghoff, Associate Administrator, NASA
Najeeb E. Halaby, Administrator, FAA
Gen. B. A. Schriever, Commander, AFSC

Luncheon Speaker

Sen. A. S. Mike Monroney (D.-Okla.)

Industry Presentations

William E. Larned, Jr., President, DMS, Inc.
Robert L. Lichten, Director, Advanced Engineering, Bell Helicopter Co.
Dr. James W. Mullen, II, President, Texaco Experiment Incorporated
J. L. Murray, Vice President, Douglas Aircraft Co.
Maynard L. Pennell, Vice President, Boeing Co.
Paul Thayer, President, LTV Aerospace Corp.



Boeing's bid for the SST centers on variable-sweep wing geometry shown here in a multiple exposure photo. Wings are positioned in nearly perpendicular fashion for takeoff and landing, swept back part way for transonic ascent and descent, swept back completely for supersonic cruise.

that the C-5A will bring new benefits for peace and prosperity for the world community by creating new dimensions in air transport during the last quarter of the twentieth century."

Charles W. Harper, Director of NASA's Aeronautics Division's Office of Advanced Research and Technology, remarked: "As far as the C-5A is concerned, it represents to NASA a very happy indication of greatly increased interest in aeronautics."

The Supersonic Transport

The SST proposed for the United States will carry 225 or more passengers across continents, or from continent to continent, at speeds approaching Mach 3, triple that of current operational transports. Economically, the SST represents a major challenge and opportunity. By 1980 the SST can mean \$10 billion to the national economy, more or less, depending, among other things, on whether the American version wins out over the slower, but presumably earlier available, British/French Concorde. Senator Monroney pointed out that the world market for SSTs over the next twenty-five years is estimated to reach 1,500, and that 375,000 jobs in this country could depend on the outcome of the competition.

FAA Administrator Halaby, citing recent design improvements, predicted that the American SST will carry



Lockheed's design for the SST relies on a double-delta, fixed-wing configuration to cope with aerodynamic requirements of supersonic flight, transonic transition, and take-off and landing. Careful contouring of wings is said to lower sonic boom potential while increasing lift-drag ratio.

40,000-pound payloads for up to 4,000 miles at about 2,000 mph, and at a seat-mile cost lower than that of the most economical jets now flying.

Boeing designers say they have improved the aerodynamic efficiency of their wind-tunnel SST model by ten percent, that a similar gain in engine efficiency has been achieved, and that these factors give the SST a seat-mile cost ten percent lower than that of the Boeing 707-320B on over-ocean ranges.

The idea of having both Boeing and Lockheed build actual SST prototypes has been proposed by Senator Monroney and is gaining support on Capitol Hill. These manufacturers have come up with two different solutions to the SST's requirement to cruise at 1,800 mph, yet operate efficiently in the low subsonic speed regime following take-off and during approach and landing. The Boeing design employs a variable-sweep wing similar to that of the F-111. Lockheed is committed to a double-delta, fixed-wing configuration much like that employed on the YF-12A. Each company is confident that its approach will meet the design objectives completely.

Government and aerospace industry officials generally expect the European Concorde to be operational at least two years before our SST. And Senator Monroney, whose Aviation Subcommittee rides close herd on SST developments, says he wouldn't be surprised to hear "any day now that Russia has taken to the air with an SST." He finds small comfort in the thought that the first Soviet SST will be slower than the American model; the Soviets are known to be working on follow-on SST designs in the Mach 3 speed regime.

Why is this nation taking, as Senator Monroney called it, the "calculated risk" of coming in third with its contender for the world's SST market? The director of NASA's Aeronautics Division, Charles W. Harper, points out that "... The reason we have striven for higher speeds than the Europeans is that efficiency continues to rise with Mach number. Somewhere around Mach 3 we begin to realize the limits of the technology we can get on at this point. It begins to get a little shaky beyond that, although our analyses show that at Mach 6 to 8 it looks as though very efficient flight can be achieved.

"For this reason this country decided against the lower efficiency of flight at the Mach 2 range that the Europeans have chosen—at greater economic risk—and instead settled for the higher technological risk of greater speed."

The Assistant Secretary of the Air Force for Research and Development, Dr. Alexander H. Flax, following a discussion on how easy it would be to put passenger seats into the B-70 and call it an SST, commented:

"We are attempting to build a transport which can earn a profit for a private operator. In the past, attempts to build aircraft that were uneconomical have been very unsuccessful. The first [British] Comets preceded US jet transports by several years. Aside from technological difficulties... they were also highly uneconomical on most route structures of interest to US carriers; and you may recall that none of them were bought."

Relating this thought to the Soviet SSTs, Dr. Flax labeled them "prestige items with little chance of being truly competitive."

V/STOL Aircraft

City-center-to-city-center transportation will be an expanding field for aeronautics in the next ten years.

Several American companies are well on the way toward designs which ultimately will carry sixty or more passengers



A commercial, stretched-out version of the tri-service XC-142A Ling-Temco-Vought V/STOL transport, shown here, would accommodate sixty passengers, according to LTV. Capable of hovering, and even backing up, the turboprop XC-142A has a top forward speed of 430 miles per hour.

and operate from landing pads no larger than a tennis court. Once these aircraft are operational and fitted into the over-all transportation system, they could bring about a rejuvenation of the downtown centers of larger cities, which currently are being strangled by traffic jams and inaccessibility. The United States currently spends about \$100 million annually on military V/STOL research and development. Europe's annual investment in vertical lift and descent aircraft is slightly higher. Soviet funding of V/STOL projects is sizable, and the USSR holds several world records in helicopter flight. However, no commercial V/STOL operations of consequence, outside of limited and subsidized helicopter service, exist today.

US manufacturers are on record to the effect that they can build commercially attractive and technologically sound vertical lift and descent aircraft.

Malcolm S. Harned, Vice President for Operations of the Hughes Tool Company's Aircraft Division, described at AFA's Los Angeles Seminar a 500-mph "Heliplane," employing a lightweight hot-cycle drive which could operate at twenty-five percent lower seat-mile cost than a conventional DC-3. The "Heliplane," Mr. Harned said, would be able to handle passenger service from downtown New York to downtown Washington in twenty-five minutes and from downtown Los Angeles to downtown San Francisco in

forty-five minutes, at fares below those of the present shuttle services.

M. C. Haddon, Vice President of Science and Engineering, Lockheed-California Company, told AFA's New York Seminar his company could institute right now a "rather methodical development program" which in five years or less would result in an operational sixty-passenger "Metroplane." Cruising at 375 mph, or faster if necessary, it would be competitive in price with current transportation media.

Ling-Temco-Vought's triservice XC-142A, a four-engine turboprop V/STOL capable of hovering and backing up as well as horizontal cruise at 400 mph, is being considered for adaptation to commercial uses. Its designers see no reason why it cannot become a sixty-passenger commercial vehicle capable of hauling ten-ton payloads more than 1,000 miles. It could operate in the VTOL mode in city-center terminals and in the fuel-saving STOL mode in suburbia.

NASA's Dr. Bisplinghoff has characterized the future of commercial V/STOL aircraft in these words: "... [it] will take aviation from the relatively specialized mode that it is today and make it one of the major transportation means in the country."

The Materials Breakthrough

The C-5A, the SST, and the V/STOL aircraft discussed above, exciting as they may be, are only preludes to the "Coming Revolution in Aeronautics." They make use of technology and materials that are currently available. The revolutionary quantum jump will come when new and truly revolutionary materials and propulsion systems are applied to new generations of advanced aircraft.

Basic, then, to the coming revolution in aeronautics is a group of new and exotic materials. They represent, in one major breakthrough, greater progress than the world has seen since the Bronze Age.

Weight is the key to efficient flight. And aviation has led the way in lightweight technology. The Wright brothers used wood and canvas. Lighter, stronger, stiffer aluminum took over in the 1930s. But speed brings increased heat, and in the Mach 3 range aluminum begins to soften. Titanium and stainless steel become the basic materials. But even these advanced metals cannot be classed as "revolutionary" in the aeronautical sense.

The really new breed of materials is something else
(Continued on following page)



This artist's conception shows Lockheed's sixty-passenger "Metroplane," which could be flying within the next five years. A winged rotorcraft, this vehicle is said to be capable of speeds up to 375 miles per hour. Following vertical takeoff, the aircraft would fold its rotorblades back for conventional winged flight. "Metroplane" would be more economical than present shuttle service.

THE COMING REVOLUTION IN AERONAUTICS

again. They fall into three basic groups. All are composites, comprised of two or more different materials, mixed or bonded together. What makes them revolutionary is their shared characteristics of light weight, great tensile strength, and high resistance to heat.

The first major category is the oxide-dispersed metals. Here the secret is the uniform mixture of minute foreign particles into layers of molecules of a base material. The result is reduced slippage and shear of one layer over another, similar to the effects of layers of sandpaper. These oxide-dispersed metals combine the desirable characteristics of their individual elements, characteristics which may not be obtainable from either separately. For example, a brittle material can be blended with one that melts easily, to make a composite that is flexible but which stands up at high temperature.

A second group of materials uses metallic and metalloid fibers—stronger, stiffer, and lighter than glass fibers. These fibers are embedded in a matrix material to form laminated composites, much as steel rods are used to reinforce concrete.

The Air Force has for some time been sponsoring development programs of a monofilament of boron, for use in laminated fiber materials. It has great potential for aeronautical applications. Fifteen percent lighter than aluminum, boron is six times stronger and six times stiffer. Boron

is stronger than steel, twice as stiff, and $3\frac{1}{2}$ times lighter. In hardness, boron ranks next to the diamond; it melts at $3,700^{\circ}\text{F.}$, compared with aluminum's melting point of $1,200^{\circ}\text{F.}$

Its combined qualities—weight, stiffness, strength, hardness, and high melting point—place boron far ahead of any other presently used aeronautical construction material. Boron's attractiveness is enhanced by the fact that its basic raw material, borax, is available in abundant quantities in the US.

Materials-development experts are convinced that the production cost of boron, currently conducted in a pilot operation, can be brought down to economically practical cost levels.

Boron is discussed here in some detail because it has already passed through its early research stages. But researchers are also exploring the possibilities of graphite, silicone carbide, beryllium, and others as filament material for laminates. There is evidence of equally interesting and attractive properties in these materials.

A third group of advanced materials is made up of organic and inorganic synthetic compounds known as the polymers. While they represent a separate approach to materials development, they are generally used as binders for the reinforcing of laminate materials.

Two of the polymers—PBI and PI—have shown remarkable versatility. They can be used as adhesives, they can serve as binders with laminates, or they can be made into fibers like nylon or other synthetics. As adhesives, PBI and PI give a fourfold increase in holding strength. As a binder for the new fibers, PBI and PI offer unprecedented advances in hardness, stiffness, and heat resistance. In fiber form, PBI and PI have no competition at temperatures of 700°F. and above.

Propulsion and Flight Dynamics

Engine efficiency is basic to aviation efficiency. In the jet engine, efficiency is equated with thrust-to-weight ratio and fuel consumption. Radical improvements depend on running the engines considerably hotter than is possible today. Theoretically, a $1,000^{\circ}\text{F.}$ increase in the temperature of turbine-inlet air will boost engine thrust by $2\frac{1}{2}$ times, requiring less fuel to produce a given amount of thrust over a given amount of time.

To date, the roadblock to higher operating temperatures has been the inability of available materials to withstand the required increase in heat. This barrier is now disappearing. A rise of several hundred degrees, to as much as $2,400^{\circ}\text{F.}$, is predicted for the next generation of jet engines. Here again, materials are the key as the new engines will employ dispersion-hardened high-temperature alloys, such as thorium-dispersed nickel, in their critical components.

Beyond this first increase, propulsion experts foresee the raising of turbine-inlet temperatures to $3,000^{\circ}\text{F.}$ or even $3,500^{\circ}\text{F.}$ within fifteen years.

Advanced composite materials and steadily improving turbine blade-cooling techniques, the latter keeping the blade temperatures several hundred degrees below that of the gas stream, are the factors that will lead to a breakthrough of this magnitude.

Engine designers predict, for instance, that within eight years and by applying only technology already available, the thrust-to-weight ratios of the engines used in commercial jet liners will double, from 5 to 1 to 10 to 1.

By 1980, the same designers foresee thrust-to-weight ratios in the order of 20 to 1. The impact on the economics and performance of aircraft of such an advance in engine



Miles of boron filaments are shown here at the Richmond, Va., pilot plant of Texaco Experiment Incorporated. Originally developed for the Air Force as a component for high-energy fuels, boron now is considered one of the most promising advanced materials for aeronautics. These reels are being shipped to other contractors for evaluation.

efficiency will be much greater than that of the changeover from piston engines to jets.

Adding to these performance gains in engines will be concurrent advances in aerodynamics and materials. A new field of aeronautical science—combining aerodynamics, materials, and propulsion—is emerging.

The "Cascading Effect"

The combined effects of the aeronautical improvements in various fields which can be foreseen, happily do not merely add up. They multiply. If improvements of forty percent in each of three areas—structures, aerodynamics, and propulsion—were designed into a future aircraft, the over-all efficiency gain of such an airplane would be an estimated 233 percent because of the "cascading effect."

Improved structural efficiency yields bonuses in aerodynamics. Increased aerodynamic efficiency leads to greater propulsion effectiveness. This in turn yields further gains in aerodynamics and structures, thereby closing the loop.

Tomorrow's Revolutionary Aircraft

Putting together all these advances into the 1980 counterpart of today's 707 or DC-8, we find an aircraft employing engines with a thrust-to-weight ratio of 20 to 1 or better. Its structure will be made of advanced composites with twice the strength-to-weight ratio of aluminum. Weighing no more than today's aircraft and consuming about the same amount of fuel, it will have triple the present payload and accommodate more than 400 passengers.

Applying a similar projection to a second-generation commercial C-5A of the same time period, this picture emerges: A 3-to-1 reduction in empty weight—from 300,000 to 100,000 pounds—results from the structural use of advanced composites, while the payload and passenger capacity remain unchanged. And while the first-generation C-5A would use 277,000 pounds of fuel over a maximum cruise range of 5,500 nautical miles, the second-generation version would require only 88,000 pounds for the same flight. Since empty weight directly affects an aircraft's purchase price, and fuel economy affects its operating costs, the possibilities for radically lowered air fares become obvious.

Similar advances are predicted for the V/STOL field in the 1980s. Lift-cruise, straight-cruise, and straight-lift engines, with thrust-to-weight ratios four times those of present levels, up to 40 to 1, are expected. The projected results will be increased payloads and possibly a whole new economic pattern for this type of flying.

With the productivity of aircraft closely linked to its speed, and since time is man's most perishable commodity, hypersonic commercial flight inexorably will follow supersonic flight.

President Johnson recently announced that models of hypersonic aircraft designed for speeds of 5,000 mph and more were being built. A panel of distinguished scientists, at the behest of the Air Force Systems Command, recently completed a detailed feasibility study of air-breathing aircraft capable of extreme hypersonic speed.

At AFA's Chicago Seminar, General Schriever commented on the findings: "The utilization of hydrogen fuel, with supersonic combustion, promises to give us an air-breathing vehicle that certainly can go at speeds of ten to twelve times the speed of sound, and possibly as high as twenty times the speed of sound. So I think we are in for a very dramatic increase in the velocity of manned vehicles with air-breathing types of propulsion."

Realization of these higher velocities, he added, would mean "that the aerospace plane concept becomes a reality."

And the earth-to-orbit vehicle, economically attractive as a recoverable booster for space launches, would for the first time make a single machine possible for air and space, giving new meaning to the term "aerospace."

Aeronautical Spinoff

Aeronautics is a generous science. Its technology and materials are adaptable to a wide range of industrial processes and products quite apart from aeronautics. It is a seedbed of ideas, knowledge, and techniques vital to an advancing society. Examples abound.

The aircraft production effort of World War I was the catalyst for the plywood industry, which last year grossed \$3 billion in domestic sales.

The US aluminum industry, with annual sales of more than \$1 billion, grew out of aeronautical requirements.

Military aviation during World War II gave rise to the plastics industry, which last year reached a sales volume of \$2.5 billion.

The new light and strong advanced composite materials, such as boron, are already being viewed longingly by non-aeronautical industries. Proposed uses include skyscrapers, large bridges, trucks, hydrofoils, air-cushion trains, ocean freighters, and sporting goods.

On the strictly consumer side, the greaseless frying pan and kitchenware that goes straight out of the refrigerator and into the oven owe their existence to aerospace developments. Precooked meals for bomber crews led to TV dinners. Electronics in general benefits greatly from aeronautics. The computer and its peripheral devices, from solid-state physics to information storage and retrieval, have been triggered and advanced by Air Force research and development.

Air Force avionics researchers only recently developed an "artron"—an artificial neuron or nerve cell. A number of these could learn to "remember" simple reactions and reflexes. A network of artrons could behave like a tiny portion of the brain, and even learn behavior patterns, or relearn them to correct its own mistakes.

The jet engine has found a number of nonaeronautical uses. Almost 1,500 engines are in stationary use at present, pumping oil through pipelines, powering compressors, and generating electricity. The annual world market for the sale of such gas-turbine installations is now said to have reached \$100 million. And the jet engine is also taking to the high seas, powering such vessels as the 350-foot Coast Guard cutter *Hamilton*.

Among the numerous benefits which modern medicine has derived from aerospace research is a device which enables doctors to interpret a patient's heartbeat. Another, the "cat eye," produces images a billion times brighter than the object it focuses on, giving a clear view of a patient's internal organs without the use of X-rays.

A Worldwide Competition

US preeminence in aviation is no automatic birthright. Structural aluminum started in World War I in Germany.

The sweptback wing originated in Germany.

The jet engine came into being in England in 1937 and in Germany in 1938.

Radar was invented in England.

Reporting on an inspection of the British and French
(Continued on following page)



—Wide World Photos

Three advanced Soviet helicopters are shown at Brussels airport on their way to the Paris Air Show. From left to right are the MI-6, the MI-8, and the MI-10. The MI-6 is the world's largest copter, able to carry sixty-five passengers or twelve tons of cargo. Mass production and an energetic export drive have been announced for the MI-6.

aircraft industries, FAA Administrator N. E. Halaby told AFA's Seminar in New York, "I think we can expect a real challenge." He stressed that those two countries are giving highest priority to the development of the powerplant and airframe market in the interest of "the prestige of France and the economic survival of Britain."

Senator Monroney, describing Free Europe as "fighting us tooth and nail in the competitive field of aviation," pointed out that European imports of US aviation products had slumped from \$86 million in 1961 to \$51 million in 1963.

The Senator pointed out that foreign competition offers such advantages as "lower prices because of government subsidies and lower labor costs" and "more generous long-term financing."

In regard to this country's cumulative \$21 billion balance of payments deficit, he said, the present annual export level of \$1.5 billion in military and over \$1 billion in civilian aircraft exports is "obviously crucial."

"If our dominance of the aviation manufacturing market were to slip, we would not only lose these exports, but we might find ourselves importing a similar amount from other nations. In the extremes, this could result in a net loss in excess of \$3.5 billion. A loss of this magnitude in our balance of trade would be a severe economic blow to the nation," the Senator warned.

And the Kremlin's economic and technical achievements cannot be overlooked. Soviet Russia is advanced in the use of dispersion-strengthened composite materials, including a dispersion-strengthened aluminum alloy. The Russians are moving ahead in the development of boron fibers and oxide-dispersed metals.

The Soviets either already have or are close to a jet engine in the 40,000- to 50,000-pound-thrust class.

Russia's new long-range commercial transport, the IL-62, seats 186 passengers, has a range of somewhere between 5,500 and 6,800 miles, and appears to be competitive in the international aviation market. Its designers are touting it as more economical than British VC-10.

Hard-sell tactics and attractive financing arrangements have already led some thirty nations to buy Soviet aircraft and helicopters.

To aggravate the picture, the Soviets are known to be

working on at least two long-range transports in the C-5A class and may possibly be the first to fly this type of aircraft.

Russia is experimenting with a helicopter capable of lifting 100,000 pounds, and with a tilt-wing vertical-lift aircraft designed to carry several hundred troops.

Mass production and a worldwide sales campaign of the Soviet MI-6 helicopter, holder of many world speed and altitude records and designed to carry sixty-five passengers or twelve tons of cargo, have been announced officially by Moscow.

In airline operations, the Minister of Soviet Civil Air Service estimates that Aeroflot will carry 42,000,000 passengers in 1965, roughly half the US volume, that 100 new routes will be added, and that four new international runs between Moscow and Africa will be opened.

Indicative of the new "business orientation" of Soviet airline operators is the fact that Aeroflot, once known for shoddy treatment of its passengers, now honors US credit cards.

Even Red China has climbed aboard the aviation bandwagon and recently signed an agreement with nineteen world airlines to accept and exchange tickets over its route structure, which now includes twenty-five terminals.

The Future

Progress in aeronautics depends largely on the economic health of the \$20 billion aerospace industry and its 1,300,000 employees.

Marketing expert William E. Larned, Jr., President of DMS, Inc., has predicted at AFA's Seminars a \$10 billion growth—two-thirds of it from aircraft production—in the US aerospace industry over the next decade.

Citing FAA figures, he foresees 1,085 jets in use by commercial airlines by 1970, compared to 432 today, and said that by 1975 "it is entirely possible that total civilian aircraft sales of the industry could be as much as four times that of today."

He pointed out that a comparable shift to commercial aviation products occurred in the 1950-1960 time period when civilian aircraft sales increased tenfold, while defense sales, dominant as they were, increased only sixfold.

Aerospace employment, according to Mr. Larned, can be expected to increase by at least a half million employees by 1975.

Mr. Larned tied his growth projections to the prediction that the industry's business environment over the next ten years will be marked by more stability and more adequate profits.

This conclusion he based on the growth element and on new government policies covering military aerospace such as predefinition to avoid costly cancellations, longer term contracts over the life cycle of a given program, a swing to incentive type contracts, and emphasis on value engineering and cost consciousness.

The Commercial Aviation Market

Market forecasting is at best a precarious art. But there is ample evidence that civil aviation will grow rapidly both in volume and revenue in the years ahead.

One underlying growth factor is the sheer number of people. By 1975, the Census Bureau says there will be 225,000,000 Americans—35,000,000 more than today. The labor force will be up by 18,000,000 and, if current trends continue, the 1975 American will be better educated and better paid and will travel more than his counterpart of today.



MEMO

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Government forecasts assume that, during the same period, the gross national product will grow from \$600 billion to \$900 billion. Disposable income is expected to increase by at least thirty percent. Longer vacations and shorter work weeks for more people round out the 1975 picture—more people, with more money, more time, and more desire to travel. A greatly stepped-up demand for aviation's service in the next decade and beyond seems inevitable.

At the same time, over the next ten years, the population explosion will add another billion people to the world population. And by the year 2000, statisticians foresee a total of 7,000,000,000 people—more than double today's total. In particular, the underdeveloped countries of the world, with no costly investments in highways and rail networks, can look to efficient air transportation to carry them into competitive economic positions.

In evaluating aviation's growth potential, current trends are illuminating. The year 1964 was the best the United States commercial air carriers have ever experienced, with aircraft operations up by ten percent. And this year looks even better. In Atlantic air freight alone, for example, a doubling over last year's level seems almost certain.

Authoritative forecasts predict these long-range growth rates:

- The Federal Aviation Agency expects an eighty percent increase in passenger-miles flown by US carriers by 1970.

- The Air Transport Association sees a 249 percent rise in air cargo volume within ten years. Individual carriers forecast even greater gains.

- Government studies indicate that commercial aviation in the United States by 1985 could reach a volume of twenty times the present level. Thus, if we are to avoid a traffic jam in the skies, new technology, in the form of greater speed and capacity, must be brought into play by then.

Still other factors point to continued growth in the civil aviation market.

One is the skimpy market penetration achieved by aviation thus far. Last year only one American in ten over the age of eighteen took a trip by air. And three out of four adults in this country have never flown in an airplane at all.

Worldwide, the potential for expanding the air-travel market is staggering. Only two percent of the world population has ever ridden in an airplane.

Today eighty percent of all air trips taken in the United States involve business people traveling for business reasons. The potential market explosion among people traveling for personal or vacation reasons is vast. A similar potential exists in medium- and lower-income groups, for the median income of today's US air traveler is high—\$15,000 a year. There are strong indications that some travelers in the lower-income groups, especially among younger people, are changing over to air.

Lastly, the average age of the American population is an important factor. Younger people are less afraid to fly than their elders. The average age of the US population is dropping, and soon more than fifty percent of all Americans will be less than twenty-six years old.

Market analysts agree that the cost of fares is important to the future of commercial aviation. Large segments of the aviation market are, in the language of the economists, "price elastic," meaning the lower the price the more people will travel.

A long-term research project, involving a number of airlines and the Port of New York Authority, came up with the findings that cutting air fares in half would bring 20,000,000 new customers into the air-travel market. A rate cut of this size would be out of the question at the moment, but a commercial version of the Air Force's C-5A heavy

logistics transport could well effect a reduction of almost this proportion.

Plateau or Revolution?

The revolution in aeronautics is not yet here. And it will not happen of its own accord. It will take the best efforts of the government and industry, and the support of the American public, to keep this nation on the road toward first-class achievements in aeronautics and the other areas of technology which determine the rate of progress of modern society.

There are clouds on the national horizon. General Schriever expressed concern at AFA's New York Seminar over how technology can be kept moving in the future: "I think it is fair to say that this rate of advance over the past twenty years has been largely stimulated by our defense needs. Should this urgency subside to some extent, I think that we have to be careful, as a nation, not to lose the momentum behind our technology... and this is what concerns me with respect to the future."

Senator Monroney, also with regard to the role of defense in advancing aeronautics, remarked:

"If the present Secretary of Defense has his way, we will have a supersonic passenger plane flying long before we have a supersonic capacity for carrying bomb loads in a potentially dangerous situation."

During the same Seminar he likened the DoD's refusal to proceed with a new manned bomber to the attitude of the Army's Bureau of Weapon and Fortifications fifty years ago when it refused to accept the Wrights' first airplane.

As the Senator put it: "It's ridiculous. We may soon be carrying bananas, lobsters, and passengers at Mach 3 and bombs at minus Mach 1."

On the question of the technological plateau, General Schriever, at AFA's Chicago Seminar, said that both military considerations and economic opportunities allow only one realistic, logical answer: There must be no plateau. "In this far-from-perfect world, where we face determined and dedicated opponents, we must possess the strength to maintain both peace and freedom. We can't turn back the clock. Nor can we stand still," he said.

Senator Monroney, in Los Angeles, gave this answer: "The future well-being of this nation—politically, economically, culturally, and in other ways—is bound up in how wisely and how extensively we utilize technology, in aeronautics as well as elsewhere. Technology knows neither geographical boundaries nor ideological loyalties. Like human ingenuity it knows no ceiling. If we shackle technology, somebody else will use it to soar high above our plateau. And I say, this we can't afford."

AFA's Seminars projected today's research findings into tomorrow's realities. They underscored the benefits this nation can derive from advanced aeronautical technology and they showed how these benefits cover the entire spectrum of the national interest. In so doing, they performed a crucial service. As General Schriever said recently, "We simply can't do enough to impress on the American public that a revolution in aeronautics is at hand."

The spark that has been kindled by AFA's Seminars on behalf of the commercial aspects of aviation will serve military aviation as well. Senator Monroney, in taking issue with DoD's neglect of funding for aeronautical projects, put it this way:

"Military and civilian aviation are Siamese twins—if you cut one, both bleed. And both must be nourished for either to be healthy." If, in that sense, the Seminars were "nourishment," they represent a project vital to the mission of AFA and the Air Force. Extensions of this program are now under consideration.—END



THE BULLETIN BOARD

News and Comment about Air Force People . . .

By Jackson V. Rambeau

AFA DIRECTOR OF MILITARY
AND INDUSTRIAL RELATIONS

The Pendulum Swings Back

A witness appearing before the House Armed Services Committee in its new hearing room in the Rayburn House Office Building is confronted, on the face of the rostrum behind which sit the Chairman and Committee members, with a plaque on which are inscribed pertinent excerpts of Article 1, Section 8, of the Constitution.

That section, to refresh your memory, enumerates certain powers of Congress, including the power "to raise and support armies . . . to provide and maintain a Navy; [and] to make rules for the government and regulation of the land and naval forces. . . ."

The plaque was mounted at the direction of the Chairman of the House Armed Services Committee, Rep. L. Mendel Rivers of South Carolina, who is leading a campaign to reassert congressional prerogatives which he says have been gradually taken over by the Executive Branch of the government.

One of the first to face the new plaque was Secretary of Defense Robert S. McNamara, a prime target in Mr. Rivers' campaign. Summoned as the first witness when the House Armed Services Committee opened hearings on military pay early in June, Secretary McNamara could do little but stare at the plaque while Mr. Rivers delivered a fifty-five-minute opening statement castigating the Administration's pay proposal.

How far Congress will go in seeking to regain its prerogatives is still uncertain, but there are numerous indications that Mr. Rivers' campaign is stirring the temper of some of its members.

Mr. Rivers' Committee wrote into the military construction bill this year—and the full House approved—a provision that no further military base closings will be made without specific approval of Congress.

The House Veterans Affairs Committee, chaired by Rep. Olin Teague of Texas, has voted to impose the same restrictions on closing of veterans' hospitals.

Rep. F. Edward Hébert of Louisiana, Chairman of the House Armed Services Subcommittee reviewing the Guard-Reserve merger, extracted a concession from Mr. McNamara that congressional action is needed before the merger can be effected (see next page).

In the Senate, Oklahoma's A. S. Mike Monroney, Chairman of the Post Office and Civil Service Committee, has advised the White House that he cannot support the Administration's proposal to establish a federal pay systems commission which would, in effect, take away from Congress the responsibility for fixing or amending federal pay scales. In this, he was joined by Mr. Rivers.

The Military Pay Wrangle

A military pay raise higher than that proposed by the Administration but somewhat below the 10.7 percent boost

advocated by Representative Rivers and thirty-three of his House Armed Services Committee members, will be passed by Congress late this summer. The reduced rate will be improved a little by making the raise effective on October 1, rather than January 1 as recommended by the DoD.

These are the conclusions that can be drawn as the Committee concluded hearings on military pay and submitted its bill for a vote of the full House.

The Air Force Association joined with the Association of the US Army and the Navy League in an unprecedented joint statement supporting the Rivers pay bill in hearings before his Committee on June 11 (see Editorial, page 8).

"All three of our organizations now have—and have had for years—a principal common objective of fostering means to attract and retain competent personnel in the several services," the statement, delivered by AFA President Jess Larson, declared.

"This Committee already knows that declining enlistments and low reenlistments, together with the loss of commissioned personnel, indicate that the goal is not being achieved. But this is only a part of the problem. Quality is equally important. Will we have competent individuals and teams to operate exotic weapon systems in the years ahead?"

"What this Committee does with military pay this year may well provide the answer. Two years from now—or even a year from now—may be a year too late. We believe that adequate pay is the first and major step in solving these problems."

The Administration's pay proposal, based on recommendations of the President's Special Panel on Federal Salaries headed by Marion B. Folsom, former Secretary of the Department of Health, Education, and Welfare, was expected to have little effect in modifying the Rivers bill in the House.

The legislation recommended by the Folsom panel actually includes three major elements—military pay, civil service pay, and a proposal to establish a Federal Salary Review Commission to recommend changes in government pay structures once each four years.

Of these elements, only the civil service pay proposal was expected to receive favorable consideration in the House. Congressman Rivers introduced the Administration's military pay bill on the House floor and immediately launched into bitter criticism of it, charging that it was designed more to refute his own pay bill than to improve the military pay structure.

The Administration proposal would also exclude Reserve Forces personnel not on active duty from sharing in the raise. Mr. Rivers pointed out that the panel "has provided no justification whatsoever for excluding this category of personnel from receiving increases in basic pay, and, therefore, I wish to assure you that these Reservists [in drill pay status] will be included in any pay adjustment reported by the Committee on Armed Services."

This was "noted with gratitude" in the statement by the three Associations. "We are mystified why the Administration again seeks to leave them out," Mr. Larson said. "We may need them sooner than we think."

Mr. Rivers also rejected the federal pay commission proposal. As proposed by the Folsom panel, the commission would be made up of ten civilians, not connected with the government, who would meet every four years to review pay scales in comparison with the civilian economy and submit their recommendations to the President. Upon approval by the President, he would notify Congress of his intention to effect the changes. Unless either House opposed his recommendations in the form of a resolution passed within sixty days, the new scales would take effect.

"Again we are confronted with the Executive Branch telling the Congress that it no longer has the capability of acting wisely, prudently, and expeditiously with regard to changes in the federal pay structure," Mr. Rivers declared. "In my opinion this recommendation constitutes a vote of 'no confidence' in the legislature of the United States."

Though the Administration may have found it difficult to modify the Rivers pay bill in the House, it is expected to exert considerably more pressure in the Senate when the bill arrives there. The pay scales are likely to be whittled down closer to the Folsom levels.

If, as is expected, the Senate bill is different from the House version, the final bill will be written by a small group of conferees from both House and Senate. Normally their product represents a compromise.

The travesty in the argument between the Administration and congressional critics is that the Service Secretaries and Chiefs of Staff, who are necessarily responsive to Secretary McNamara's views, are put in the position of insisting that Congress is trying to pay servicemen more than they are worth. You don't improve morale or retention that way. Thus, even though some level of pay raise will be passed, much of its value will already be negated by the pro and con arguments that precede it.

Breaking the Merger Impasse—Maybe

Action on the Defense Department's plan to merge the Army Reserve with the Army National Guard has been at a standstill since mid-May while Rep. F. Edward Hébert of Louisiana, Chairman of the House Armed Services Subcommittee which has been conducting hearings on it, recuperates from an operation. He has indicated, however, that he expects to resume hearings early in July.

Just before he entered the hospital, Mr. Hébert and Secretary McNamara staged a joint press conference at the Capitol in which the Defense Secretary acknowledged he cannot carry out the merger without congressional approval.



Gen. Gabriel Disosway, left, now USAFE Commander, will become Commander of Tactical Air Command on August 1. Succeeding him in Europe is Lt. Gen. Bruce K. Holloway, now Deputy CinC of USSTRICOM, nominated for four stars.



With his boss looking on, Col. Donald W. Paffel, chief military aide to Vice President Hubert H. Humphrey, receives Legion of Merit from Air Force Secretary Eugene M. Zuckert for initiative in congressional liaison duties before being selected for his present assignment early this year.

Characteristically, Mr. McNamara could not bring himself to bow to the will of Congress without some measure of whimsy. Among the legislative items he declared were necessary in connection with the merger was a request to establish National Guard units in the Virgin Islands.

But Mr. Hébert could afford to overlook this gesture.

"It is to be understood that the legislation which the Secretary proposes is not confined merely to that legislation but can be expanded or retracted," he said, with McNamara at his side.

"I want to call attention to the fact that the subcommittee has never taken a stand on the merger. It has only insisted that congressional procedure be adhered to—that the Department of Defense submit legislation in support of what it wants to put into effect, and the Committee will then consider the merger on its merits."

It should be noted that the House Appropriations Committee will also have a voice on merger plans, and at least one key member has indicated his opposition to it. After that, the Senate Armed Services and Appropriations Committee get their turn.

Council Favors Physician Draft

The drafting of physicians for military service should be continued, AFA's Medical Council recommended at its first 1965 meeting in Washington in May. The Council, led by Col. Maurice I. Marks, said the draft was essential because of the inability of the AF to attract sufficient volunteers.

(Continued on following page)



Lt. Gen. Kenneth Hobson, Vice Commander of AF Logistics Command, has been nominated for general to succeed Gen. Mark E. Bradley, Jr., as AFLC Commander. At right is Lt. Gen. Cecil H. Childre, named CONAC Commander.

Recognizing also the shortage of doctors in the Air Reserve Forces, the Council suggested that drafted physicians be offered an opportunity to volunteer for six years' service with a Reserve unit in lieu of two years active duty.

It endorsed the principle of incentive pay for medical and dental officers based on post-doctoral training and accomplishment and, noting that the promotion cycle for Air Force medical officers lags two years or more behind that of the other services, recommended enactment of H. R. 287, which would exclude medical and dental officers from provisions of the Officer Grade Limitation Act.



Gill Robb Wilson, who helped organize Air Force Association and served as President in 1956, received two honors in June, having airport in his home town of Parkersburg, W. Va., named for him and winning National Aeronautics Association's Frank G. Brewer Award for aerospace education.

Church Jobs for Retirees

Jobs are available for military retirees of all grades in church and church-related occupations, according to a survey made by Col. Matthew Thompson, USAF (Ret.), Administrative Assistant to the General Commission on Chaplains and Armed Forces Personnel.

Colonel Thompson emphasized that salaried positions are open for other than ministers or pastors in such varied fields as camp director, foreign mission worker, pilot, public relations, farm manager, dietitian, or hospital technician.

The program, endorsed by the Departments of Defense and Labor, is interdenominational. Inquiries should be addressed to the following: Protestant—General Commission on Chaplains and Armed Forces Personnel, 122 Maryland Ave., NE, Washington, D. C. 20002; Catholic—National Catholic Community Services, 1312 Massachusetts Ave., NW, Washington, D. C. 20005; Jewish—National Jewish Welfare Board, Director of Community Services, 145 E. 32d St., New York, N. Y. 10016.

SENIOR STAFF CHANGES... Maj. Gen. John H. Bell, from Chief, Air Section, Joint Brazil-US Military Cmd. and Chief, Air Section, MAAG, Brazil, to Dir. of Personnel Training and Education, DCS/Personnel, Washington, D. C. ... Maj. Gen. Robert W. Burns, from Cmdr., 73d Air Div., Tyndall AFB, Fla., to Chief, MAAG, Karachi, Pakistan ... Brig. Gen. Roland A. Campbell, from Cmdr., 72d Bomb Wg., Ramey AFB, P. R., to CinC SAC Rep. on Joint Strategic Target Planning Staff, Offutt AFB, Neb. ... Brig. Gen. Paul K. Carlton, from Cmdr., 305th Bomb Wg., SAC, Bunker Hill AFB, Ind., to Chief of Ops., Plans Div., Directorate of Ops., Hq. SAC, replacing Gen. William J. Crumm ... Maj. Gen. John W. Carpenter, III, from Asst. DCS/Plans and operations for JCS Matters, Hq. USAF, Washington, D. C., to Cmdr., Air University, Maxwell AFB, Ala., and nominated for promotion to lieutenant general ... Brig. Gen. Maurice F. Casey, from Dep. Dir., OI, Hq. USAF, Washington, D. C., to Cmdr., 1501st Air Transport Wg., MATS, Travis AFB, Calif., replacing Brig. Gen. James W. Chapman, Jr. ... Brig. Gen. James W. Chapman, Jr., from

Cmdr., 1501st Air Transport Wg., MATS, Travis AFB, Calif., to Cmdr., 1001st Air Base Wg., Hq. Cmd., Andrews AFB, Washington, D. C. ... Lt. Gen. Cecil H. Childre, from US Rep., CENTO, to Cmdr., CONAC, Robins AFB, Ga. ... Maj. Gen. Albert P. Clark, from Cmdr., 313th Air Div., PACAF, Kadena AB, Okinawa, to Vice Cmdr., TAC, Langley AFB, Va., and nominated for promotion to lieutenant general, replacing Lt. Gen. Charles B. Westover.

Brig. Gen. Thomas G. Corbin, from Dep. Dir. to Dir., Legislative Liaison, Hq. USAF, Washington, D. C., replacing Maj. Gen. Perry M. Hoisington, II ... Brig. Gen. Thomas H. Crouch, from Dir. of Medical Staffing and Education, TSG, Hq. USAF, Washington, D. C., to Cmdr., Wilford Hall USAF Hospital, ATC, Lackland AFB, Tex. ... Maj. Gen. William J. Crumm, from Chief, Ops., Plans Div., SAC, Offutt AFB, Neb., to Cmdr., 3d Air Div., Andersen AFB, Guam, replacing Brig. Gen. Harold W. Ohlke ... Maj. Gen. Richard D. Curtin, from Asst. to DCS/R&D, Hq. USAF, Washington, D. C., to Dep. Defense Adviser and Dep. Rep., North Atlantic-Mediterranean Area, Paris, France ... Brig. Gen. Howard A. Davis, from Dep. Dir. of Plans, SAC, Offutt AFB, Neb., to Dir. of Studies and Analysis, DCS/Plans and Ops., Hq. USAF, Washington, D. C.

Brig. Gen. Joseph R. Deluca, from Dep. Cmdr., Hq. OOAMA, AFLC, Hill AFB, Utah, to Dep. Dir. Supply, AFLC, Wright-Patterson AFB, Ohio ... Gen. Gabriel P. Disosway, from CinC, USAFE, to Cmdr., TAC, Langley AFB, Va., effective August 1 ... Brig. Gen. Richard H. Ellis, from Cmdr., 315th Air Div. (Combat Cargo), PACAF, Tachikawa AB, Japan, to Dep. Dir. for Plans and Policy, J-5, the Joint Staff JCS, Hq. USAF, Washington, D. C. ... Brig. Gen. Otto J. Glasser, from Vice Cmdr., Hq. ESD, AFSC, Hanscom Field, Mass., to Dep. Dir. of Operational Requirements and Development Plans, DCS/R&D, Hq. USAF, Washington, D. C. ... Brig. Gen. Donald W. Graham, from DCS/Materiel, MATS, to Cmdr., EASTAF, MATS, McGuire AFB, N. J., and nominated for promotion to major general, replacing Brig. Gen. Robert J. Goewey, who has retired ... Brig. Gen. William L. Hamrick, from Dep. Cmdr., San Bernardino AMA, Norton AFB, Calif., to Executive Dir., Technical and Logistics Services, DSA, Alexandria, Va. ... Maj. Gen. Bertram C. Harrison, from Dep. IG, Office TIG, Norton AFB, Calif., to Dir. of Manpower and Org., DCS/Programs and Requirements, Hq. USAF, Washington.

Lt. Gen. Kenneth B. Hobson, from Vice Cmdr., AFLC, to Cmdr., AFLC, Wright-Patterson AFB, Ohio, and nominated for promotion to general, replacing Gen. Mark E. Bradley, Jr., who is retiring ... Lt. Gen. Bruce K. Holloway, from Dep. CinC, USSTRICOM, MacDill AFB, Fla., to CinC, USAFE, and nominated for promotion to lieutenant general, replacing Gen. Gabriel P. Disosway ... Maj. Gen. Perry M. Hoisington, II, from Dir., Legislative Liaison, Hq. USAF, to Asst. to DCS/Personnel, Hq. USAF, Washington, D. C. ... Brig. Gen. Glenn A. Kent, from Military Asst. to Dep. Dir. of Defense Research and Engineering, DoD, to Dep. Dir. for Development Plans, Hq. USAF, Washington D. C. ... John A. Lang, Jr., Adminis-



First Air Force Outstanding Unit award to be received by Air Force Reserve unit is presented to 433d Troop Carrier Wing, Kelly AFB, Tex., by Lt. Gen. E. J. Timberlake, CONAC Commander, who retired June 15. At left is Col. Tom Marchbanks, 433d CO, and Capt. Frank Maxwell.

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trative Asst. to SAF, assigned additional duty as Special Asst. for Personnel, Manpower, and Reserve Forces, replacing Benjamin Fridge, who has resigned... Brig. Gen. Robert H. McCutcheon, from Dir. of Procurement Policy, ASD (Installations and Logistics), Washington, D. C., to Dir., Procurement and Production, Hq. AFLC, Wright-Patterson AFB, Ohio... Maj. Gen. James C. McGehee, from Dir. of Personnel Training and Education, DCS/Personnel, Hq. USAF, Washington, D. C., to Chief, MAAG, Rome, Italy... Brig. Gen. John L. Martin, Jr., from Vice Dir. of Special Projects, OSAF, and additional duty as Asst. Dep. Cmdr. for Satellite Programs, Space Systems Div., AFSC, El Segundo, Calif., to Dir. of Special Projects, with additional duty as Dep. Cmdr. for Satellite Programs... Maj. Gen. Gilbert L. Meyers, from Cmdr., Tactical Air Warfare Center, Eglin AFB, Fla., to Dep. Cmdr., 2d Air Div., PACAF, Saigon, Vietnam... Maj. Gen. Sam Maddux, Jr., from Cmdr., 13th AF, PACAF, Clark AB, P. I., to Vice CinC, PACAF, Hickam AFB, Hawaii, and nominated for promotion to lieutenant general... Brig. Gen. Howard W. Moore, from Cmdr., 19th Air Div., SAC, Carswell AFB, Tex., to Dep. Cmdr., Hq. OAMA, AFLC, Hill AFB, Utah, replacing Brig. Gen. Joseph R. Deluca... Maj. Gen. Joseph H. Moore, Cmdr., 2d Air Div., PACAF, assigned additional duty as Dep. Cmdr., Military Assistance Cmd., Vietnam, for Air Ops., and nominated for promotion to lieutenant general.

Maj. Gen. Lewis L. Mundell, from Dir. of Ops., AFLC, to Vice Cmdr., AFLC, Wright-Patterson AFB, Ohio, and nominated for promotion to lieutenant general, replacing Lt. Gen. Kenneth B. Hobson... Brig. Gen. Harold W. Ohlke, from Cmdr., 3d Air Div., SAC, Andersen AFB, Guam, to Cmdr., 42d Air Div., SAC, Blytheville AFB, Ark.... Brig. Gen. Robert L. Petit, from Dep. Dir. of Operational Requirements, Hq. USAF, to Asst. for AF Weapons Effectiveness Testing, Washington, D. C.... Birch Rivers, from Dir. of Civilian Personnel, USAFE, Wiesbaden, Germany, to Dir. of Civilian Personnel, Hq. AFLC, Wright-Patterson AFB, Ohio, replacing John E. Taylor, who moves to USAFE to replace Rivers... Maj. Gen. Frank E. Rouse, from Dir. of Logistics, J-4, USEUCOM, to Cmdr., San Antonio AMA, AFLC, Kelly AFB, Tex.... Maj. Gen. John

S. Samuel, from Dir. Special Studies Gp., Office USAF C/S, Hq. USAF, Washington, D. C., to Dep. Dir. of Plans, SAC, Offutt AFB, Neb.... Brig. Gen. George B. Simler, from Cmdr., 4520th Combat Crew Training Wg., Nellis AFB, Nev., to Dep. Cmdr. for Ops., 2d Air Div., Saigon, Vietnam... Brig. Gen. Benjamin A. Strickland, Jr., from Cmd. Surgeon, AFSC, Andrews AFB, Washington, D. C., and additional duty as Asst. for Bioastronautics, Office Dep. Cmdr. for Space, to Dir. of Professional Services, TSG, Hq. USAF, Washington, D. C.

Brig. Gen. Robert W. Strong, Jr., from Commandant of Cadets, USAF Academy, Colo., to Cmdr., 817th Air Division, SAC, Pease AFB, N. H., replacing Maj. Gen. John S. Samuel... Maj. Gen. Henry R. Sullivan, from SACEUR Rep. on Joint Strategic Target Planning Staff, Hq. SAC, to Deputy Cmdr., 2d AF, SAC, Barksdale AFB, La., replacing Maj. Gen. William E. Eubank, Jr., who will retire in August... Maj. Gen. Avelin P. Tacon, Jr., from Chief, JUSMAG, Republic of Philippines, to Asst. to Cmdr., 13th AF, PACAF, Clark AB, Philippines... Lt. Gen. Henry V. Vercellio, from Vice Cmdr., ADC, Ent AFB, Colo., to Dep. Cmdr., USSTRICOM, MacDill AFB, Fla., replacing Lt. Gen. Bruce K. Holloway... Brig. Gen. Don S. Wenger, from Dir. of Professional Services, TSG, Hq. USAF, Washington, D. C., to Cmd. Surgeon, Hq. AFSC, Andrews AFB, Washington D. C., replacing Brig. Gen. Benjamin A. Strickland, Jr.

Brig. Gen. James H. Weiner, from Asst. Dep. Dir., Defense Communications System, DCA, Washington, D. C., to C/S, DCA... Brig. Gen. William W. Wilcox, Dir. of Ops., Hq. 2d AF, SAC, Barksdale AFB, La., to Cmdr., 19th Air Div., SAC, Carswell AFB, Tex.... Lt. Gen. Charles B. Westover, from Vice Cmdr., TAC, Langley AFB, Va., to Vice Cmdr., ADC, Ent AFB, Colo., replacing Lt. Gen. Henry Vercellio... Nominated for promotion to general, Lt. Gen. Horace M. Wade, Cmdr., 8th AF, SAC.

RETIREMENTS... Maj. Gen. Kenneth P. Bergquist, Brig. Gen. Ernest H. Beverly, Brig. Gen. Willis F. Chapman, Maj. Gen. Lee W. Fulton, Maj. Gen. Robert E. Greer, Brig. Gen. Norman L. Peterson, Maj. Gen. Sory Smith, Maj. Gen. Robert M. Stillman, Brig. Gen. Robert H. Strauss, Lt. Gen. Ralph P. Swofford, Jr., Lt. Gen. Edward J. Timberlake.—END

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CHAPTER OF THE MONTH

Tacoma Chapter, Washington, cited for consistent and effective programming which has focused widespread community attention on the Air Force Association mission.

AFA's Tacoma, Wash., Chapter held its first annual Spring Formal Dinner Dance at the McChord AFB Officers' Open Mess on May 6.

Highlight of the evening was the presentation of a \$500 check to Dr. R. Franklin Thompson, President of the University of Puget Sound, to institute the Chapter's scholarship fund at the university. The scholarship fund was established to serve the needs of a deserving AFROTC cadet during his junior year (*see cut*).

The Chapter also presented honorary Chapter memberships to Brig. Gen. Byron Steger, Commanding General of Madigan General Hospital; RCAF Air Commodore George Elms, Vice Commander of NORAD; and Brig. Gen. Stanley Harding, Commander, Seventh Region, USAR.

As a part of its effort to keep youth abreast of developments in the field of aerospace, the Chapter recently presented AIR FORCE/SPACE DIGEST subscriptions to the libraries of several local high schools, colleges, and universities.

The Tacoma Chapter, which was chartered in October 1964, has already established itself as one of AFA's outstanding chapters.

The Niagara Frontier Chapter, Niagara Falls, N. Y., recently sponsored



Mr. Peter Tuohy, second from left, presents the Tacoma Chapter's \$500 AFROTC Scholarship check to Dr. R. Franklin Thompson, President of University of Puget Sound. Lt. Col. Carl Peterson, PAS at the university, left, and James H. March, Chapter President, look on.

a reception and dinner dance in honor of the commanding officers of Air Force installations and units in its area (*see cut*).

Chapter President William C. Rapp was host for the event, which was held at the Niagara Falls AFB Officers' Open Mess.

Master of Ceremonies Albert L. Cooper, Executive Director of the Buffalo Area Chamber of Commerce, introduced the following guests of honor: Col. Stanley Smith, 4621st Air Base Group (ADC); Col. Irving L. Leff, 431st Medical Service Squadron; Lt. Col. Salvatore Mauriello, 914th Troop Carrier Group; Col. John E.

Blewett, 107th Tactical Fighter Group (ANG); Col. Millson M. Bassett, 9306th AF Reserve Squadron; Lt. Col. Thomas Huddleston, Professor of Aerospace Studies; Maj. Leslie D. Keiser, 35th Air Defense Missile Squadron (ADC); and Maj. Harry C. Shaw, 763d Radar Squadron.

More than fifty of the city's most prominent citizens attended a recent dinner meeting of AFA's Anchorage, Alaska, Chapter.

Chuck Burnette, State Organizational Director, presented the Chapter's Outstanding Community Service Award to Lt. Col. Harry A. Wakefield,



Niagara Falls, N. Y., Frontier Chapter's distinguished dinner guests included, from left, Col. Millson M. Bassett, AFA's New York State President James Wright, Col. John E. Blewett, Maj. Leslie D. Keiser, and Father Harry Strassberger. Chapter President William C. Rapp is at the far right.



Chuck Burnette, right, presents the Anchorage Chapter's Outstanding Community Service Award to Colonel Wakefield as Lt. Gen. Raymond J. Reeves, left, Commander in Chief, Alaskan Command, and Maj. Gen. James C. Jensen, Commander, Alaskan Air Command, join the ceremony.

Chief of Public Affairs for the Alaskan Command (see cut).

During the meeting, John Stepp was elected Chapter President. Other officers elected were G. Ed Smith, Vice President; Ed O. Hansen, Treasurer; and Howard Groff, Secretary. The following council members were also elected: Neil Harper, Jim Dodson, Bob Hansen, Chuck Burnette, and John Norby.

The Front Range Chapter, Denver, Colo., had as its guest speaker Lt. Gen. Ira C. Eaker, USAF (Ret.), at a recent Awards Luncheon. More than 100 persons, including Chapter members, the press, area military leaders, and aerospace enthusiasts were in attendance. General Eaker spoke on "National Security."

Chapter President Barry Trader presented the Chapter's Aerospace Safety Award to Lt. Col. Burnice Terrell, Director of Emergency Service, Colorado Civil Air Patrol, for his development of the air search and ground rescue capability of the Colorado Wing (see cut).

Dr. James Allen, consultant to the Aerospace Education Foundation's Advisory Council and Professor of History at the University of Colorado, presented the Chapter's coveted Aerospace Education Award to William Pakalka, Colorado's most outstanding aerospace education student during the 1964-65 school year. The Martin Company's Aerospace Education Traveling Trophy was presented to Mr. Pakalka's school, Hinkley High School, as a result of his selection for the Chapter's award.

In addition to the above awards, certificates were presented to twelve area high school students for their ex-

Howard Ogle, President of AFA's European Organization, with Maj. Richard T. Schaller, Chief of Special Events Branch, Community Relations Division, Hq. USAFE. Major Schaller is called "AFA Pied Piper of Europe" as a result of his active participation in the organization of AFA Chapters.



cellent scholarship in the field of aerospace education.

AFA's California State Organization recently held its Seventeenth Annual Convention in Santa Monica at the Miramar Hotel.

Mayor Rex H. Minter proclaimed the two-day period as "Aerospace Power Days in Santa Monica" and called on the citizens of the city to attend and participate in the convention's informative discussions.

This year the convention program was again concerned with the challenge facing aerospace education, industry, travel-transportation, and national defense as we approach the 1970 time period.

The first day's program was directed to the challenge facing aerospace education. In the morning, an Aerospace Education Symposium featured the

Air Force Presentation Team from the Air University, commanded by Lt. Col. Richard B. Olney. An Educational Luncheon featured an address by Lt. Gen. James H. Briggs, USAF (Ret.), former Superintendent of the Air Force Academy.

"Scientific Literacy" was the title of the afternoon seminar, which featured as its moderator Dr. Alfred A. Artuso, Superintendent of Santa Monica schools. Panelists were Dr. Milton Pella, President of the National Association for Research in Science Teaching at the University of Wisconsin; Lawrence Vredevoe, Professor of School Administration at UCLA; Leonard J. Corti, Director of Administration, Guidance and Control Systems Division of Litton Industries; LeRoy Vaughn, Instructor of Science and Mathematics in the Santa Monica Unified School District; and William M. Jones, Instructor of Social Studies in the Santa Monica Unified School District. A Hawaiian Happy Hour completed the program for the day.

While most of the second day was directed to the challenge to industry, travel-transportation, and national defense, the program also included a Presidents' Breakfast and two business sessions.

The Industry/Military Luncheon featured an address by AFA President Jess Larson. Following the luncheon, a seminar entitled "The Coming Revolution in Aeronautics" was conducted by panelists President Larson, AFA's Past President John R. Alison, and James H. Straubel, Executive Director of AFA.

A Defense/Industry Reception preceded an Honor Awards Banquet. Highlight of the banquet was an address by Gen. William H. Blanchard, Vice Chief of Staff, USAF. The awards
(Continued on following page)



For his development of the air search and ground rescue capability of the Colorado CAP Wing, Lt. Col. Burnice Terrell, right, receives the Front Range Chapter's Aerospace Safety Award. Chapter President Barry Trader presented the plaque during the Chapter's recent Awards Luncheon in Denver.

Monsieur Louis Balsan, second from right, prominent French industrialist, receives the Chateauroux Chapter's first honorary membership award from Chapter President Wharton Cochran, left, as Brig. Gen. R. D. Forman, 322d Air Division (MATS) Commander, and Colonel Nye look on.



Walter Barrick, Virginia Organizational Director, presents the AFA charter to Fred Ergenbright, Chapter President, at Staunton, Va. Also participating are Rep. J. O. Marsh, Jr. (D.-Va.), right, and M. G. Manch, father of the late Lt. Col. Jack Manch, one of the famous Doolittle Raiders.



Newly elected California State Organization President Jack Withers, left, recipient of the Organization's Outstanding Service Award, with James Curnutt, named State Organizational Director.

were presented by State President Robert Vaughan.

Jack Withers, North American Aviation's newly appointed Corporate Manager at Vandenberg AFB, Calif., was elected President of the State Organization. James L. Curnutt received an award for community relations and was named State Organizational Director.

• • •

President Jess Larson recently announced appointments to several of AFA's National Committees. Mr. Larson will serve as Chairman of the Executive Committee with members George D. Hardy, Paul S. Zuckerman, Robert D. Campbell, Ken Ellington, Joseph L. Hodges, Martin M. Ostrow, Earle N. Parker, and ex officio members Jack B. Gross, Laurence S. Kuter, Julian B. Rosenthal, and Peter J. Schenk.

The Finance Committee will consist of Paul S. Zuckerman (Chairman), Jack B. Gross, George D. Hardy, Maxwell A. Kriendler, Don Olson, Chess F. Pizac, Peter J. Schenk, and Arthur C. Storz.

Members of the Organizational Advisory Council are Joe L. Shosid (Chairman), William R. Berkeley, Anthony Bour, Vito J. Castellano, N. W. deBerardinis, A. Paul Fonda, Dale J. Hendry, Joseph C. Jacobs, Glenn D. Mishler, Edward T. Nedder, Martin M. Ostrow, and A. P. Phillips, Jr.

Joe Foss, as Chairman of the Membership Committee, will work with Gen. Carl A. Spaatz, USAF (Ret.); Lt. Gen. James H. Doolittle, USAF (Ret.); James H. Douglas, Jr.; Gen. George C. Kenney, USAF (Ret.); Gen. Edwin W. Rawlings, USAF (Ret.); Gen. Nathan F. Twining, USAF (Ret.); and Gen. Thomas D. White, USAF (Ret.).

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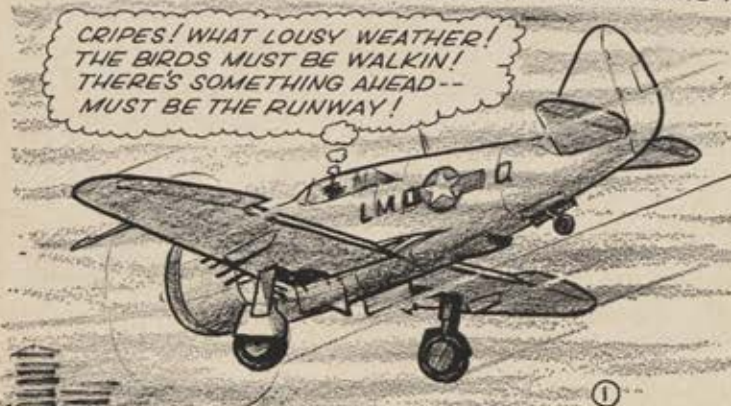
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CIVILIAN GROUP LIFE INSURANCE

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Double Indemnity is a unique feature of this plan, covering almost all accidental deaths, including death caused by aviation accident unless the insured is acting as pilot or crew member of the aircraft at the time of accident.

Coverage may be continued at low group rates to age 65, when it may be converted to any permanent plan of insurance then being offered by the Underwriter,

United of Omaha, regardless of the health of the insured person at that time. Conversion prior to age 65 is also guaranteed, at the option of the insured.

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The Family Plan provides insurance for each member of the family under one convenient policy. The wife of the policyholder is insured for 50% of his coverage.

Each child, regardless of the number of children in the family, is insured for 10% of the AFA member's coverage.

Insurance is also provided for nonreimbursed medical expenses of over \$50, up to a maximum of \$500. Under the Family Plan, *every* family member receives this valuable extra coverage.

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Grounded policyholders receive payments equal to 80% of their flight pay (tax free) for periods up to two

years if grounding is caused by aviation accident and for periods up to one year for groundings caused by illness. Because they are tax free, these payments are essentially the equivalent of full government flight pay, which is taxable income.

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Objectives

- To assist in obtaining and maintaining adequate airpower for national security and world peace • To keep AFA members and the public abreast of developments in the field of aviation.
- To preserve and foster the spirit of fellowship among former and present personnel of the United States Air Force.

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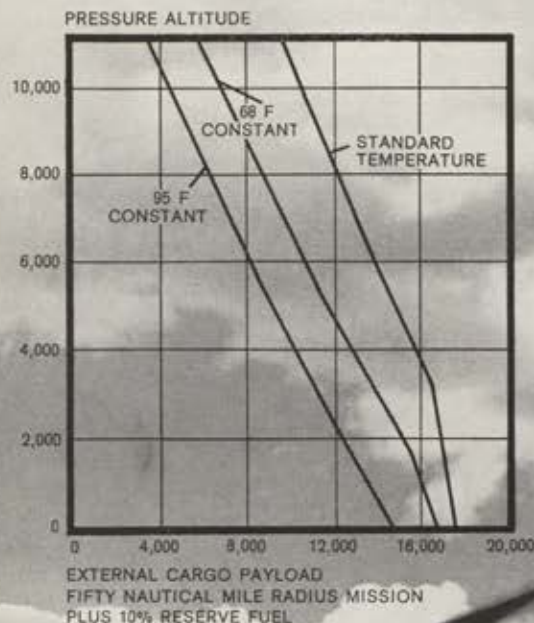
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