

MAY 1962 / 50¢

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



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... See page 33

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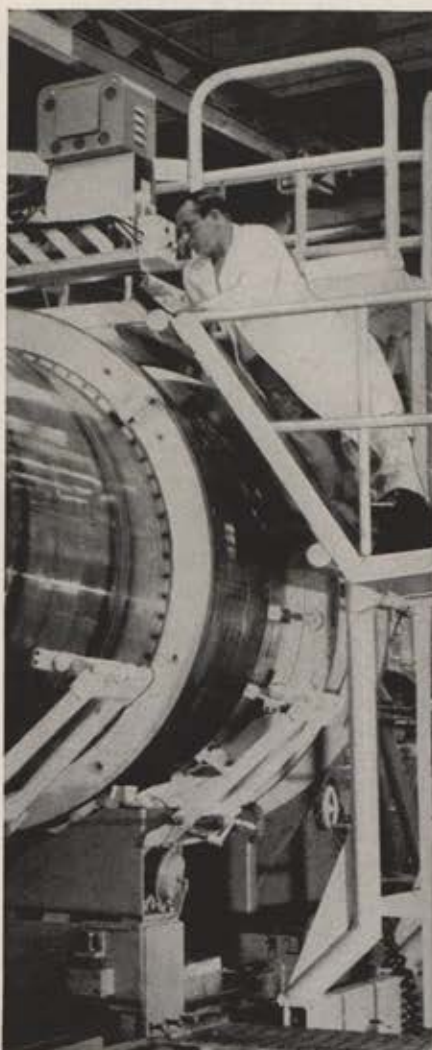
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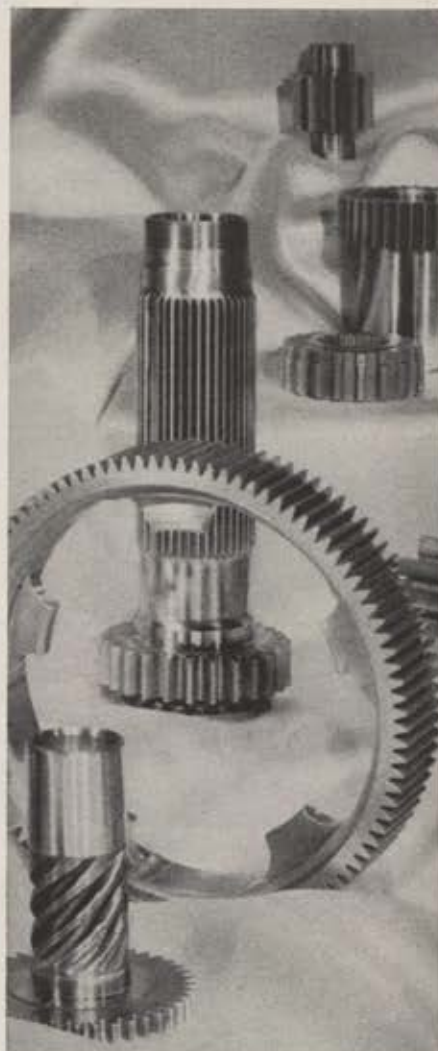
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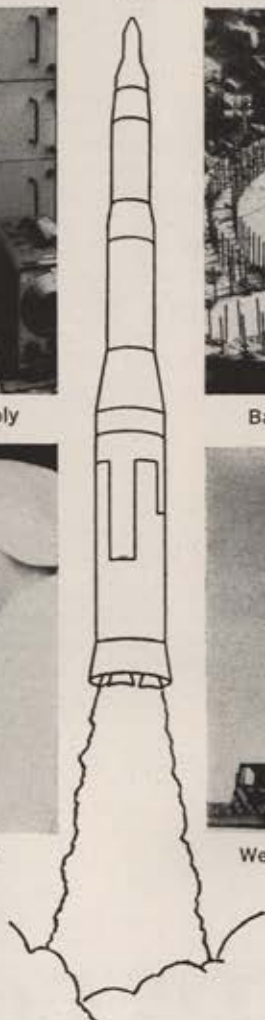


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AIR FORCE



The Magazine of Aerospace Power
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Peaceful cooperation in space is a laudable aim. It deserves earnest negotiations on both sides. But our Soviet friends really ought to have the courtesy to stop damning us for our "space bellicosity." If our military people are planning for security, that's their job.

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A Voice for Military Space

By Claude Witze

SENIOR EDITOR, AIR FORCE/SPACE DIGEST

IT IS a matter of record that in recent years Congress has been consistently more farsighted in assessing many military requirements than has the executive branch of the government. The most striking examples of this are in the area of weaponry, where the legislators have pressed hard for improvements in everything from the infantry rifle to the Polaris system, manned bombers, and military airlift. Because of the way the space age sneaked up on us, the Congress, it now is clear, organized its committee effort following a pattern in which insufficient attention was paid to the military requirement.

The House of Representatives has a Committee on Science and Astronautics, and the Senate has a comparable group on Aeronautical and Space Sciences. Quite properly these groups are concerned with the effort of the National Aeronautics and Space Administration, to the almost complete exclusion of military considerations. The House Committee on Armed Services and the Senate Armed Services Committee hear testimony from Defense Department and military witnesses. A proper part of this touches on the menace in space and what we should be doing, but the space-oriented testimony at this point in time tends to be submerged in discussions of more current weapon systems, personnel policies, the intricacies of procurement, and the generally wide range of topics that fall under the jurisdiction of these committees. The Armed Services groups have subcommittees to give special attention to some subjects. These include intelligence, the national stockpile, the NATO forces, conflicts of interest, real estate, housing, and the utilization of shipyards. In neither house does the Armed Services Committee have a subcommittee on military space. The result, inevitably, is that Congress, which itself wrote into the National Space Act of 1958 a demand that proper weight be given to the military potential, is focusing its attention on the peaceful program, at least from the important point of view of committee activity.

Some signs of this weakness have been called to the attention of the legislators. In March, to cite one weighty example, a subcommittee of the House Committee on Science and Astronautics, assigned to study the NASA manned spaceflight program, heard from two industry witnesses with scientific competence. They were Dr. George L. Haller, a Vice President of General Electric Co., and Dr. William O. Baker, Vice President for Research of Bell Telephone Laboratories. Both emphasized that Russia's peaceful applications of space technology are not a threat to this country. But, Dr. Haller said, the implications to our military survival "are almost obvious." Dr. Baker added that while international prestige is the "classic explanation" of why we have a space program (under NASA), "we can't forget the force factor, the naked power," and the capability of being able to do things in space that other nations cannot do. He said the Soviets are doing some things we are neglecting and that these have military applications. "This," he declared, "is the saddening, annoying, but literal fact at the moment."

The witnesses were in close agreement that we cannot afford to have space dominated by a hostile power. To this, Dr. Baker added the observation that technical knowledge about space in the United States is outpacing our planning and programming, particularly when it comes to using space technology for security or national defense purposes. He cited the requirement for facile and certain recovery of manned satellites on land and sea. And the necessity for a manned vehicle that can make an easy transition from suborbital to orbital rendezvous. Possibly more important is the knowledge needed to survive if an orbiting vehicle is under attack. To those who say there is no justified requirement for these things in any 1962 program, Dr. Baker points to the fact that he was working on ablative materials in the 1948-to-1951 period, when it had not been suggested that their application would be on nose cones and capsules. Yet, if his laboratory had not done this work, when there was no stated requirement, the entire missile program and development of recoverable satellites would have suffered. Our resources today, the witness said, "must include immediate research-and-development efforts directed toward the long-term acquisition of military capabilities . . . supplementary to and not in duplication of . . . the civilian space effort." Dr. Baker added that our national policy does not define the affirmative role of the military in space, but rather limits the military role. He pointed out, for example, that NASA has no interest in protecting Apollo from hostile action in space, an interest that would be paramount if the military probabilities were considered. He said the present NASA-Defense Department liaison has a good pattern, but so far there have been no orders given that will ensure proper attention to military needs.

None of this fell on deaf ears, and it is not our intent to so imply. But it did fall on the ears of a committee that is, quite naturally, primarily concerned with the civilian space program. It fell on the ears of a committee in which some members have consistently expressed serious concern about neglect of the military space program and duplication of military capabilities by the civilian program. But even these men, members of the House Committee on Science and Astronautics, face conflicts of interest, jurisdiction, and effectiveness if they pursue too determinedly a line of questioning that is centered on military topics. There is an eminent scientist of our acquaintance who believes that one day peace will be ensured on earth and that space will be given over to war. None of the existing committees on Capitol Hill are empowered or prepared to consider that possibility.

It may be that the ideal solution would be a joint House and Senate Committee, similar to the one that has handled our atomic-energy program. Certainly, if this is not possible, the House and Senate Armed Services Committees should prepare to give special attention to the military requirement in space with subcommittees devoted entirely to that subject. It would be in complete accord with their standing record for farsightedness in matters concerned with national security.—END



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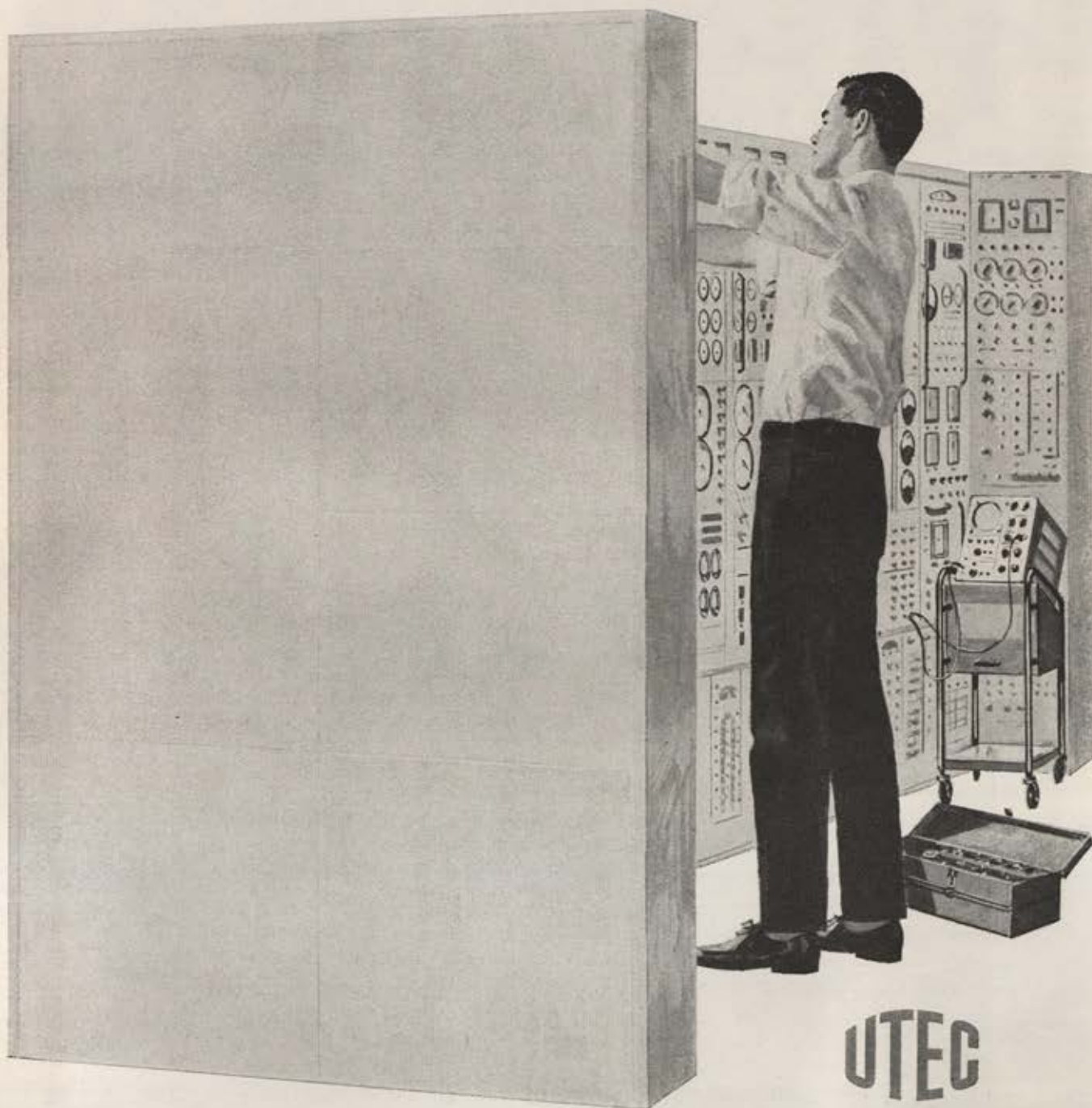
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Vostok Analysis

Gentlemen: I wish to congratulate your publication and [Technical Editor] J. S. Butz, Jr., on the excellent article on the implications of Vostok ["What Are the Lessons of Vostok?" March '62 issue]. To my knowledge this article is the most comprehensive analysis of the Vostok system to be made available to the general military and technical publics.

We quite often evaluate the Soviet space program and its underlying directions and technologies in an "ethnocentric" manner, tending to belittle, deride, and oversimplify their situation, leading to unrealistic conclusions dangerous to our national security, welfare, and prestige.

DON KARSHAN
New York, N.Y.

Scientists, Nonscientists, and Schisms

Gentlemen: In your March issue, Dr. D. Jerome Fisher comments on what is described as "the fundamental schism" between science and its search for truth and politics, "the act of the possible" ["The Dilemma in Communication—Scientists and Nonscientists"]. Dr. Fisher contrasts science's "rational search for truth," whose validity is established through experiment or experience with his portrait of government as a system based on "You scratch my back, I scratch yours," of deals and compromise. He suggests that because of this schism, scientists and nonscientists fail to understand one another in any fundamental way.

The article in your same issue "Science and Freedom," by Dr. Glenn T. Seaborg, indicates that this fundamental schism has not prevented a "significant integration of science into society" during the past two decades. "The consolidation of science into society," says Dr. Seaborg, "is striking in the field of governmental policy and international relations. . . ."

Interestingly, Dr. Fisher's emphasis is on the need for the nonscientists to rise to the level of the scientist in the search for truth. Dr. Seaborg, on the other hand, speaks of the need for the "return of science to the fold of humanism" and of scientists to relate

themselves to social objectives. He wonders whether the barriers between the "two cultures," of the scientist and the humanist, is not superficial.

The writer submits that politics and the social sciences are "scientific," even though their principles are not tested in the same formal ways as those of the physical sciences. The principle of compromise, deal, and reciprocal back-scratching which is too abhorrent to the mineralogist Dr. Fisher, is based on sound human experience and produces just as consistent results in human affairs as the electrolytic process in making aluminum.

How scientific has been the approach of the pragmatic politicians and statesmen Dr. Fisher turns up his nose at, is demonstrated in the way science and scientists have been brought into the highest circles of

government and policy and decision making.

Dr. Fisher apparently would like to see a common language shared by scientists and nonscientists. Is this a scientific expectation? Perhaps it would be more reasonable to expect not only that the nonscientist be educated to appreciate the spirit of science, as Dr. Fisher says, but also that scientists like Dr. Fisher learn to appreciate the "spirit" of politics and government.

ERNEST NEUFELD
Forest Hills, N.Y.

Airpower vs. Guerrilla War

Gentlemen: I enjoyed your editorial concerning airpower and guerrilla war in the March '62 issue of AIR FORCE/SPACE DIGEST, and cited it in the notes to a chapter of my dissertation dealing with the future of American participation in guerrilla warfare.

ROBERT M. LAWRENCE, Ass't Instructor
Department of Political Science
University of Kansas
Lawrence, Kan.

SAC Specialist

Gentlemen: I am the Information Specialist on SAC for Air Britain, the International Association of Aviation Enthusiasts, and would like to make this appeal to readers of AIR FORCE/SPACE DIGEST:

Will anyone who has unclassified material on any aspect of SAC from 1946-62 please communicate with me without delay. I am particularly anxious to contact past or present members of SAC. Magazines with pertinent articles would be most welcome. All replies will be answered.

A. C. E. NEWMAN
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Kent, England

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CORRECTION

The editorial, "The Education Bottleneck" (April 1962, p. 8), contained an error of fact which we would like to correct. In referring to the sum of \$900,000, sought by the Air Force to expand its program of advanced education and disapproved by the Department of Defense, we wrote, ". . . the Air Force has gone so far as to agree to take the program out of its hide, with no increase in requested funds or manning tables." The facts are that the Air Force is willing to take the program out of its hide as far as manpower spaces are concerned, but it does require the added funds to implement the program. A last-minute correction was telephoned to our printers, but it was too late to be included in all copies.

The principle expressed in the editorial, we submit, is valid. The monetary sum involved is small compared with the vital requirement to maintain an Air Force educationally in tune with the objectives of the present Administration.

—JOHN F. LOOSBROCK, Editor.



AIRPOWER in the news



By Claude Witze

SENIOR EDITOR, AIR FORCE/SPACE DIGEST

Only Some Figures Don't Lie

WASHINGTON, D. C.

According to this week's New York Stock Exchange tables, shares in Douglas Aircraft Company are selling for a bit more than \$27, only \$2 better than the year's low. It is about \$10 less than the 1962 high. Earnings per share in 1961, according to the company's annual report, were \$1.56, which was modest but a great deal better than the 1960 loss of \$5.09 per share. There was a three percent stock dividend paid this year, but the Douglas shareholders have cashed no checks, of recent record.

With this background on the company financial situation let us imagine that a security salesman offers Douglas stock as a sure winner and suggests that you invest in it heavily. The heart of his argument for this hefty transaction is that Douglas is a major contractor involved in the

the first to deny that they have intended to mislead anyone or that their interpretation of Nike contract statistics constitutes an accusation against the Douglas Company or the prime contractor, Western Electric. Mr. McClellan says his Committee, the public, and the government believe "profit rates which are fair should be paid to contractors."

Mr. McClellan recognizes that defense contracting is carried out under strict procurement regulations, that the contracts are monitored by military procurement experts with congressional watchdogs nipping at their heels, and that the Renegotiation Board is on hand with authority to correct any obvious excesses. His spotlight is on procurement practices, and he says that he expects constructive changes will result from the Committee's efforts. If there is any case the Committee has tried to prove so far, it is that systems management responsibility may be a burden that should be shouldered by the Army's in-house procurement



—Wide World Photos



—Wide World Photos

First industry witnesses before Senate probe of fees paid to missile makers were C. Raymond Smith (left), Vice President of Western Electric, and Donald W. Douglas, Jr., President of Douglas Aircraft Co. Both defended profits of less than eight percent on Nike-Hercules and -Ajax (center photo). Their firms provided engineering services for both these systems.

Army's Nike anti-aircraft missile program and is realizing a profit of 44.3 percent on its effort. Knowing, as you do, that the firm has not paid a cash dividend in three years and that the market value of the stock has slipped badly, you might be tempted to put in a query with the Securities and Exchange Commission and report what the stock salesman told you. If you did, we have been assured by a reputable Washington lawyer, the salesman would be "clobbered deadlier than a bomber hit on the nose by Ajax or Hercules." He would, in short, be accused by SEC of grossly misrepresenting the outlook for Douglas shareholders and forbidden to do business on the public mart. The public is protected from this kind of swindle by a law that had its origins in a previous Democratic Administration.

The suggestion that Douglas realized 44.3 percent profit on its Nike activity has appeared in headlines from coast to coast. The figure comes out of some arithmetic put together by the staff of the Permanent Subcommittee on Investigations of the Senate Committee on Government Operations. The Chairman is Senator John McClellan, a Democrat from Arkansas. Mr. McClellan and his staff are

experts. This would eliminate the necessity for rewarding contractors for this work at many points. But the system under which Nike was procured grew out of the customer's acknowledgement, back in the middle 1950s, that the Army lacked this capability.

Meanwhile the Committee staff is spreading on the record and in the nation's newspapers a grossly distorted impression of the profit margins realized by defense contractors. Prime contractor for the Nike-Ajax and Nike-Hercules is Western Electric Company, which is affiliated with Bell Telephone Laboratories. These two firms have complete responsibility for over-all system planning and performance, for the detailed specification and design of all elements of the system, and for management of the entire operation. The team constitutes one of the most reliable industrial components of the defense complex. Major second-tier subcontractor is Douglas Aircraft Company, which produces the actual weapon and is responsible for the design and development of the weapon and its supporting hardware. A third tier of contractors actually produced the ground-launcher loaders and the trailers for

(Continued on page 13)

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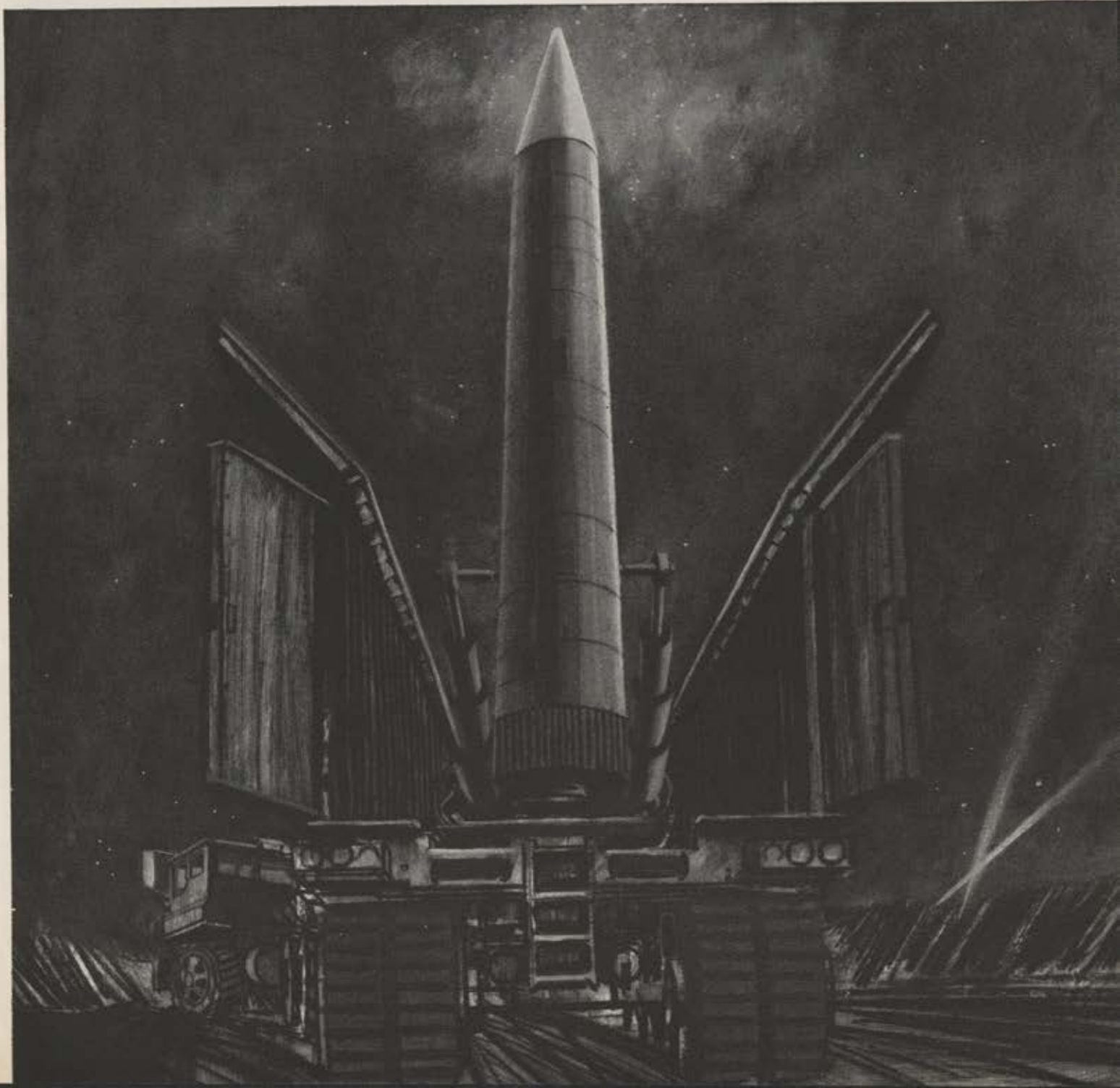


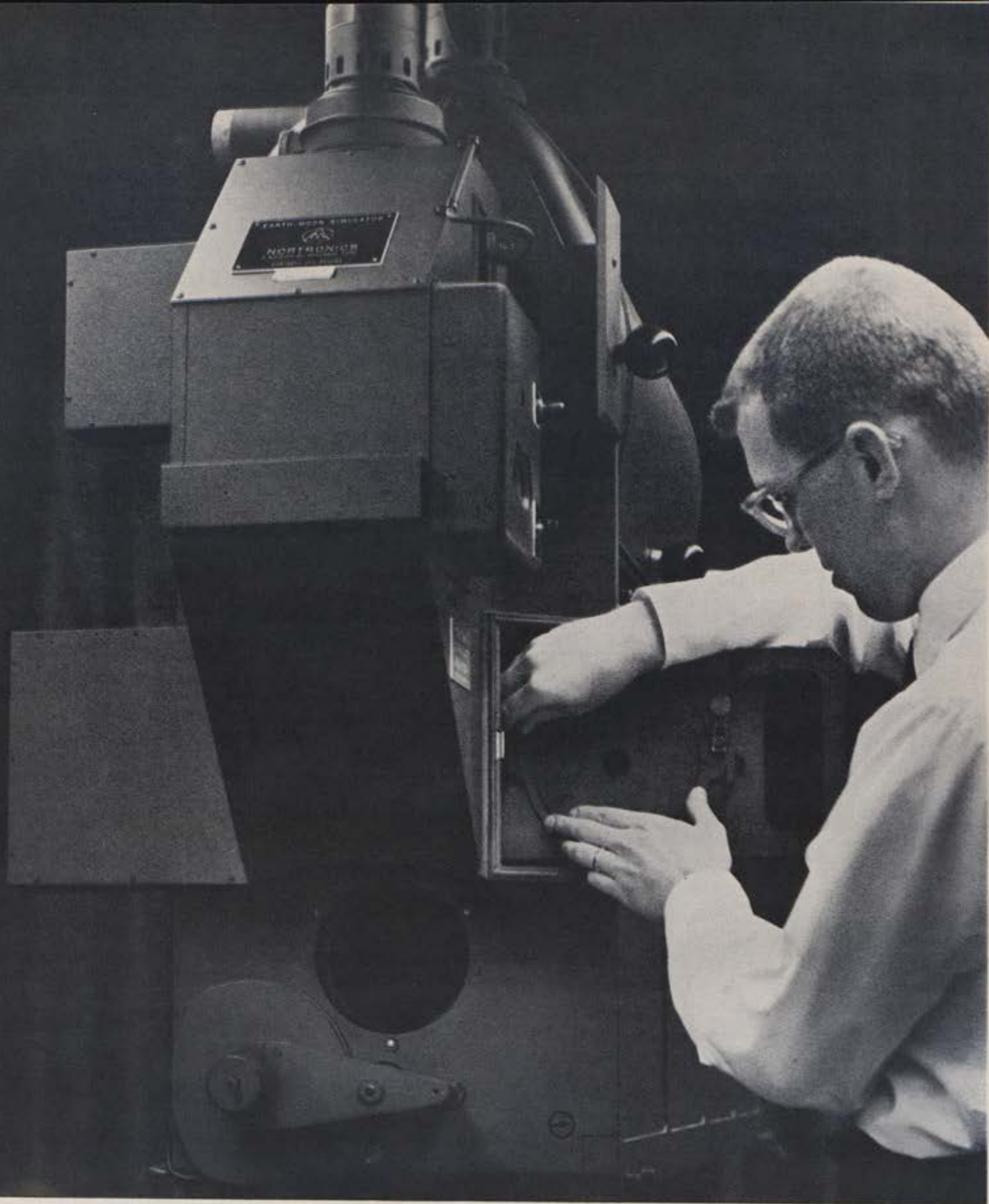
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The earth-moon simulator is not only an important research tool, but also a major step toward quality control in space systems. It was designed and built by the Nortronics Division of Northrop. It will be used by Caltech's Jet Propulsion Laboratory, contractor to the National Aeronautics and Space Administration. **NORTHROP**

moving the weapon. They were Consolidated Western Steel and the Fruehauf Trailer Co. In their work they were monitored by Douglas, which provided the design and specifications for what they were doing. Under terms of the contracts involved, Douglas and Western Electric were to be rewarded for their systems engineering and systems management efforts. This reward can be called profit or it can be called a fee, and there is nobody, not even on the McClellan Subcommittee, who argues directly that the contractor is not entitled to this reward.

The rub appeared when the Committee staff offered a presentation, digested in the table on this page, purporting to show that Western Electric did only about a quarter of the total job but took a profit of 7.9 percent on the total, which was equal to a profit of 31.3 percent on its "own effort." In the case of Douglas, the staff compilation argued that the aircraft company subcontracted and purchased 82.8 percent of its total assignment and did only 17.2 percent itself. Douglas took a fee or profit of 7.6 percent on the work for which it provided systems engineering and management. This fee was calculated by the Committee staff in relation to the 17.2 percent of the job done in the Douglas plant, to arrive at the conclusion, which made sensational headlines, that the aircraft company realized a profit of 44.3 percent on this part of the program. This is the figure, tolerated in the hearing room, that would send a securities broker to Coventry, if not jail, were he to use it to persuade a customer.

To take the Douglas case alone, the 82.8 percent of the work subcontracted or purchased presumably includes all raw material, such as forgings, in addition to the money paid to the trailer and launcher-loader manufacturers. This is a highly irregular method of auditing and succeeds in bringing the total Douglas subcontracting costs up to \$598.96 million. And the Douglas profit on this is shown as \$45.58 million. This profit or fee is, in reference to total cost, a respectable 7.6 percent. But, figured on the basis of the meager 17.2 percent of the total job done in the Douglas plant, it amounts to 44.3 percent profit, which is the figure that managed to hit the headlines, the radio, and television broadcasts. There was no effort by the Committee staff or the publicists, so long as they chose to use this method of auditing, to show that if Douglas made 44.3 percent profit on 17.2 percent of the work, then it should follow in another line on the table that Douglas made zero profit on 82.2 percent of the work which was subcontracted. It will be difficult for the McClellan Committee staff to deny its presentation, as filtered to the public through news media, was interpreted to mean that Douglas made 44.3 percent profit on 100 percent of the work. This is not true and would not have been promulgated if the staff had used conventional accounting methods in its presentation.

The comparable figures for Western Electric, fresh out of the McClellan staff's interpretative machine, resulted in a public impression that this corporation made a profit of 31.3 percent. The actual figure was 7.9 percent, which is not an unreasonable charge for the type of systems engineering involved in this new and complex weapon system. If the work were undertaken in-house by the government it would require a staff of thousands of engineers and technicians over the entire life of the project. These men would accomplish what Douglas did for 82.2 percent of its assignment and what Western Electric did for about seventy-five percent of its assignment.

With all due respect for Mr. McClellan's effort to separate his investigation from the aura left around his Committee from the days of Joe McCarthy and its reputation as the "rockets committee," there is no denying that

COMPARISON OF PROFITS BASED ON TOTAL COSTS OR TOTAL EFFORT

NIKE PRODUCTION

THIRD TIER	Fruehauf Trailer Co.	Consolidated Western Steel
Production Costs	\$46,889,345	\$137,978,000
G&A	2,440,910	8,245,000
Total Costs	\$49,330,255	\$146,223,000
Profit	4,519,072	9,285,000
Invoiced to Douglas	\$53,849,327	\$155,508,000

SECOND TIER

% of Contract			
82.8%	3d Tier Invoices to Douglas	\$495,970,000	Misc. 3d tier subcontractors & suppliers whose costs & profits were invoiced to Douglas Aircraft at \$286,612,673
17.2%	Work done by Douglas in-plant including G&A	102,990,000	
100.0%	Total Costs	\$598,960,000	7.6% on cost 44.3% on effort
	Douglas Profit	45,580,000	
	Invoiced to Western Electric *	\$644,540,000	

FIRST TIER

% of Contract			
74.9%	2d Tier Invoices to Western Electric	\$1,073,300,000	Misc. 2d tier subcontractors & suppliers whose costs & profits were invoiced to Western Electric at \$428,760,000
19.3%	Work by Western Electric in-house	276,900,000	
5.8%	Western Electric G&A	82,400,000	7.9% on costs 31.3% on effort
100.0%	Total Costs	\$1,432,600,000	
	Western Electric Profit	112,500,000	
	Invoiced to Army	\$1,545,100,000	

Unusual method of calculating fee or profit was used by McClellan Committee staff in this chart. Conclusion that Douglas made 44.3 and Western Electric 31.3 percent on Nike production contracts ignores management and engineering effort devoted to second- and third-tier output. This accounts for 74.9 and 82.8 percent respectively, of first- and second-tier contracts. Both firms argue conventional business auditing shows profit was not over 3.5 percent.

an injustice was done by his staff's approach. Dropping in the atmosphere created by the Eisenhower curse on the "industry-military complex," the injustice can be compounded, with ease, into a serious threat to our defense effort.

What Mr. McClellan has proved is that Western Electric and Douglas made a profit or fee of less than eight percent each for their design and management of the Nike-Ajax and -Hercules systems. They have not denied this and they are not ashamed of it. If there is a more economical way to achieve the same ends, government procurement authorities have not reported it.

Things Will Get Worse

Congress, at this writing, is acting on the fiscal 1963 defense appropriations bill. The House has approved expenditures of \$47.8 billion, including funds to accelerate the RS-70 program. Whether or not this will be done has not been made clear, pending further Air Force and Defense Department studies. It is clear that Robert S. McNamara,

(Continued on following page)

Secretary of Defense, remains less than enthusiastic about the RS-70 in spite of a couple of clashes with opinions on Capitol Hill. Following his collision with Rep. Carl Vinson and his subsequent caustic treatment of the Air Force and its Chief of Staff, Mr. McNamara, you will recall, promised there would be a "new study of the RS-70 program in the light of the recommendations and the representations of the Armed Services Committee."

Well, a few days later a "Pentagon spokesman" was pressed by reporters for details and came up with the news that the "new study" actually was an old one that was being continued. There was a pause of about forty-eight hours, and the Defense Secretary was reassuring Mr. Vinson that there was nothing routine about his new look. Mr. McNamara said he was "disturbed by reports that the study . . . pledged to Chairman Vinson . . ." was going to be some existing appraisal in new garb. Mr. Vinson, who had not displayed his teeth in public this time, said, "That closes that chapter."

Almost immediately Mr. McNamara started to write another one, over on the Senate side. The Defense Appropriations Subcommittee, headed by Senator A. Willis Robertson, had asked for an Air Force briefing to explain its convictions on the RS-70 program. When the witnesses appeared it seems that they carried a presentation that had been sterilized under the personal direction of the Secretary of Defense. This, Mr. Robertson announced with some heat, was not satisfactory. Before the day was over the Secretary of Defense paid a call on the chairman and assured him that the USAF argument for accelerated development would be made available.

If these incidents are not sufficient evidence of a new stern attitude toward the Pentagon management, we can turn back to Mr. Vinson again. Long an expert on how to pull a checkrein on the military organization, the Georgian has set up a two-man panel to take a look at some of DoD's managerial changes. Tagged by a wag as the "Special Committee to Annoy the Front Office," the Chairman is Rep. Porter Hardy, a Virginia Democrat and an expert for the assignment. Mr. Hardy has been the hot-foot operator for Mr. Vinson's group for many years. He has a talent for persistent questioning of witnesses and a tenacity for detail. Like Mr. McNamara, he has studied at the Harvard Graduate School of Business. On top of this he represents a district that includes Norfolk, home of an important Navy installation, and presumably the center of strong sentiment against unified defense agencies. And what is he to investigate? He says it is the Defense Department's tendency to "get into operational activities that normally have been carried out by the separate services." This is an issue close to Navy traditions. Mr. Hardy, who has been cited for his skill at "gumming up a witness," is familiar with Navy traditions and probably has some convictions about them that will come out as he conducts an inquiry into the new defense agencies that centralize control over supply, communications, intelligence, and atomic support. There has been speculation that Mr. McNamara is trying to unify the services activities without the special legislation required to unify the services themselves. Mr. Vinson, like the Navy, is a vigorous opponent of such a trend. Mr. Hardy will have plenty of support as he tills these green fields.

How to Get Discipline

The Senate Special Preparedness Subcommittee, chaired by Senator John Stennis and featuring the efforts of Senator Strom Thurmond to find martyrs in uniform, is putting

up a noble struggle against its handicaps. The biggest of these has been passed with the appearance of Edwin A. Walker, the retired Army general who has convinced himself and very few other people that he deserves a spot in history. By this time his rambling testimony, which reminded us of some speeches we have heard in London's Hyde Park, has been forgotten. It is too bad, as one commentator pointed out, that the conservative wing has to be represented by such a poor spokesman as Mr. Walker.

But there is another thing to regret about his wild pitches before the Stennis Committee. This is the possibility that some of his targets are vulnerable if the criticism is handled by more adept protagonists than Mr. Walker. Take, for example, the broad subject of "muzzling" and the more precise matter of operations in the Defense Department's Office of Security Review. The retired Army general and Mr. Thurmond, his friend on the Stennis Committee, have not recorded any substantial scores, largely because they are so inaccurate and so much more interested in the military role in the cold war than they are in achieving a proper organization to fight a hot one.

This situation was handled more adroitly by the House of Representatives in its action on the Defense Appropriations budget. On recommendation of the Committee on Appropriations, headed by Rep. George H. Mahon, the House voted to reduce the funds requested for security-review activity by \$66,000. The Committee said this was done because the function has "been handled at times in an inept manner." It added:

"Admittedly the problem of deleting from defense hearings statements which should not be printed is a very difficult one. Much prudence and judgment [are] required for proper handling of this matter. It is a job which must be well done.

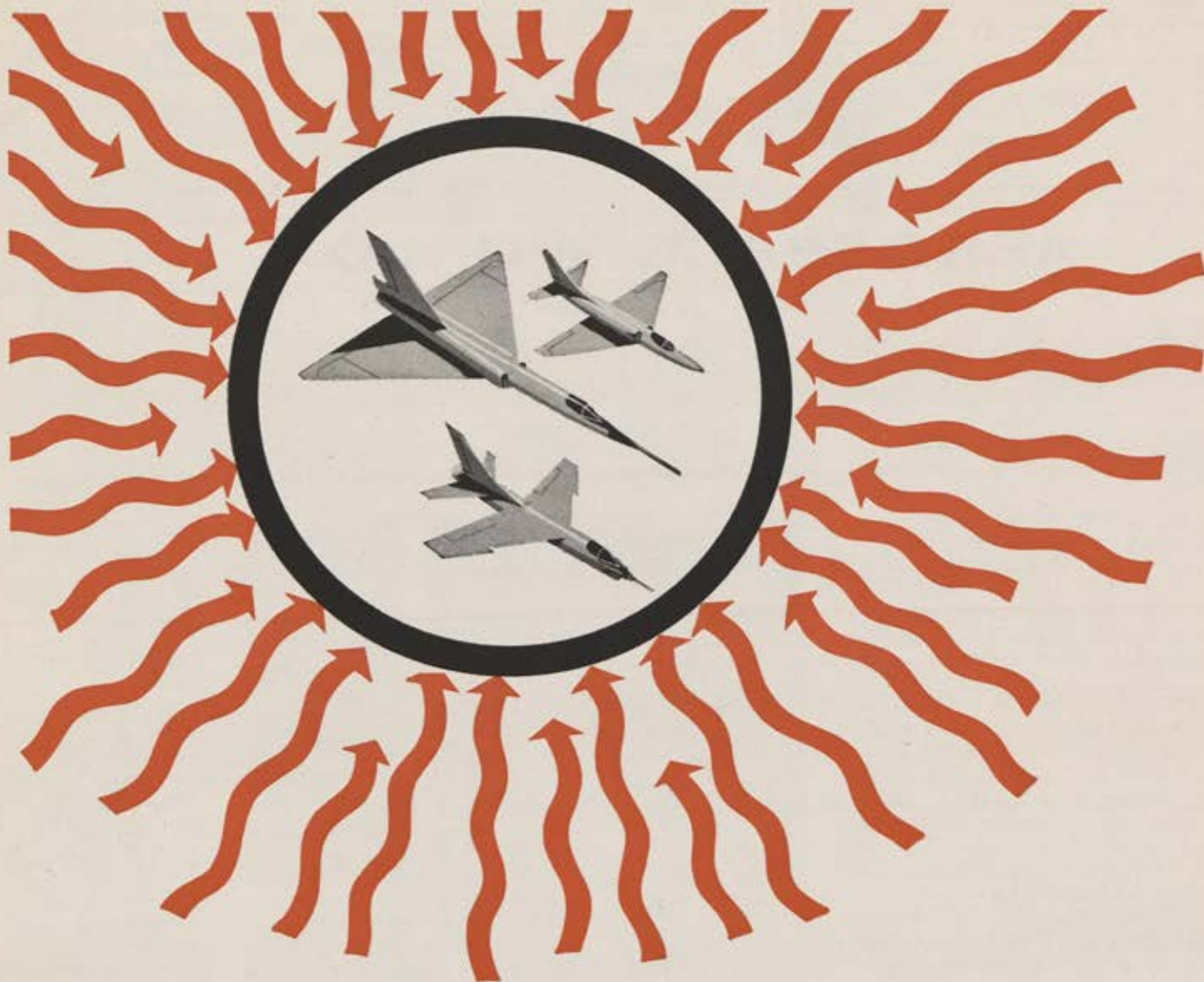
"Statements made by certain representatives of agencies have been deleted in some instances while statements of representatives of other agencies containing the same information have not been deleted from other portions of the record. A higher degree of judgment and management is required, and the Committee hopes a better job will be done next year in editing and deleting statements from the hearings than was done this year."

In the floor debate Rep. Gerald R. Ford, Jr., of Michigan, gave some of the specifics and said the Committee, of which he is a minority member, is disturbed by the inconsistencies displayed in security review.

"The Directorate of Security Review of the Department of Defense," Mr. Ford declared, "should be adequately manned by able, knowledgeable individuals, and they should be directed by persons who have no political axes to grind and who impress upon their staffs the need for objectivity and uniformity in their decisions."

This is a viewpoint shared by many men in uniform and hundreds of Defense Department contractors, who have to struggle from day to day with the whimsy that emanates from the security-review offices. It is significant that Mr. Ford openly disassociated himself from the Stennis Committee deliberations in this attack, suggesting that there is something seriously wrong but that the aura created by such enthusiasts as Senator Thurmond and Mr. Walker might even impede corrective action.

Mr. Ford said a great many ridiculous attempts at censorship are being made. When these attempts are challenged, he said, many of them are explained away as clerical errors or inadvertent deletions. He told the House that immediate steps should be taken to see that a proper job is done in the Public Affairs Office of the DoD, where "there have been enough excuses and alibis."—END



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AEROSPACE WORLD

By Allan R. Scholin

ASSOCIATE EDITOR, AIR FORCE/SPACE DIGEST

Initiation of our new series of nuclear tests by Joint Task Force 8 under Army Maj. Gen. Alfred D. Starbird late in April was ordered by President Kennedy after the Soviets indicated they were not impressed with his new proposals to the disarmament conference at Geneva (*see below*).

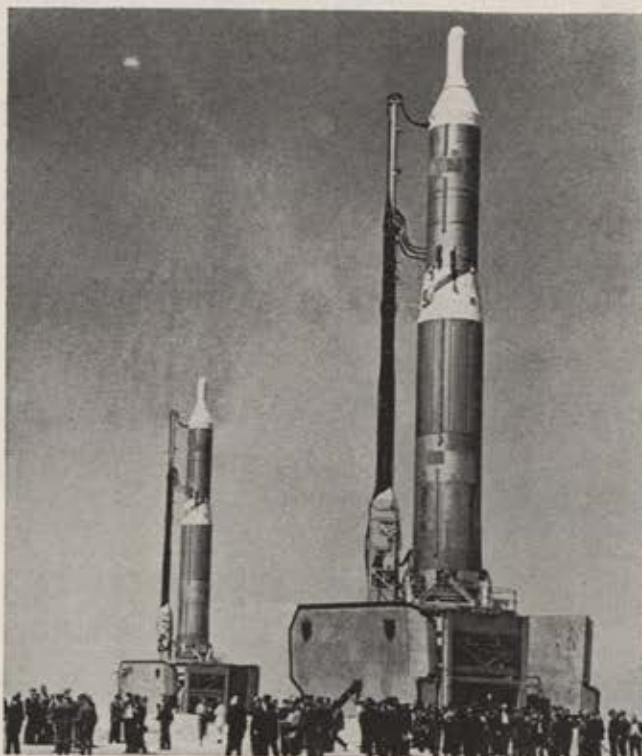
Before he announced we would go ahead with our tests, Mr. Kennedy had done everything possible to invite some indication, however faint, of Soviet interest in reaching a workable agreement on disarmament. But it became more and more clear that the Soviets never had any intention of taking the President up on his March 2 offer to call off the new series of atmospheric tests if the Russians would take some positive approach toward resolving the disarmament deadlock.

Undoubtedly the Soviets are even now preparing for still another test series of their own—and will claim our resumption of tests as an excuse.

General Starbird's task force includes almost 12,000 men, more than half of them Navy personnel, operating the many ships required to maintain communications and record test results within the broad test zones. The Air Force is contributing 1,700 men, the Army 600, and the Marines 100. Of some 2,800 civilians in the task force, 1,000 are technical specialists, and 1,800 are contractor support personnel.

There are two test zones—a rectangle of 600 by 800 miles surrounding Christmas Island, 1,200 miles south of Honolulu, and an 1,100-mile-diameter circle with Johnston Island as its center, 800 miles southwest of Honolulu.

The US schedule calls for thirty or more shots, including operational tests of our ballistic weapons—Atlas, Titan, Minuteman, Polaris, Redstone—and airborne weapons like the Hound Dog, Bullpup, and Skybolt.



—Wide World Photos

Also included are new devices conceived since our last test series, in 1958, which must be tested before further development is possible. These may include some theories of defense against missiles, such as detonations in space which might neutralize missile warheads.

Ballistic missiles will be fired into the test area over the Pacific Missile Range from California as well as from submarines and land-based sites in the Pacific. The Air Force, in addition to launching or dropping weapons, will engage in measuring radiation, taking air samplings, and tracing fallout patterns.

Fallout danger is expected to be extremely slight, amounting to only a small fraction of the normal radiation to which people are constantly sub-

jected. Moreover, prevailing winds in the test areas are expected to carry fallout in a belt around the equator rather than across the northern hemisphere as in the Soviet tests last fall.



The United States launched another attempt to break the deadlock in the seventeen-nation disarmament talks at Geneva with a detailed three-stage plan to reduce weapons of individual nations while building up a United Nations police force.

The plan was presented to the conference on April 18 by Chief US Delegate Arthur H. Dean.

President Kennedy commented on the plan at a press conference the same day. "This outline of a treaty (*Continued on page 19*)

USAF's first SAC operational Titan I missile squadron officially took over launch complex east of Denver, Colo., April 18. Two of nine operational missiles tower over crowd of dignitaries and press on hand for ceremony.

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represents the most comprehensive and specific series of proposals the United States or any other country has ever made on disarmament," he said.

The plan calls for a thirty percent reduction of weapons in three years, thirty-five percent more in the next three years. The third stage might take as long as fifteen years, ending in general and complete disarmament.

In Stage I the US and USSR would declare their major categories of nuclear and conventional weapons and dispose of one-third of them under supervision of an International Disarmament Organization.

Communist China, along with all other "militarily significant" states, would have to join in Stage II. New participants would cut their stocks by sixty-five percent in the three-year period to match reductions by the major powers. Then in Stage III "all states possessing armed forces and armaments" would have to sign.

In the first year of Stage II a UN police force would come into being, and be progressively strengthened as nations reduced their armaments.

President Kennedy indicated the United States has no illusions that the plan will be accepted in full, but, he said, "We are hopeful that through the give and take of the conference table this plan will have a constructive influence upon the negotiations now in progress."

Valerian Zorin, representing the USSR at Geneva, said he saw nothing new in the plan. "It comes down to the issue of verification of armaments," he said, "and the United States proposals for this are not acceptable."



—NASA photo

NASA's Neil A. Armstrong on April 20 flew X-15 No. 3 in test of self-adaptive control system sensing motions of airplane and automatically adapting vehicle to flight conditions.



Air Force Association Board of Directors got a briefing on US nuclear seapower and visited the Navy's atom-powered *Nautilus* submarine in mid-March at the New London, Conn., Naval Base. Briefing was arranged through courtesy of Navy League which invited AFA and Association of US Army representatives. AFA President Joe Foss, right foreground, Arthur Godfrey, were among the guests.

The USSR has been willing to agree to inspection only of weapons marked for destruction. Western powers insist that, to forestall cheating, there must also be inspection of weapons retained.

Until the Soviets agree to some reasonable method of on-the-spot checks, as the United States has fully offered, or until some other really foolproof technique can be uncovered to prevent cheating, a general and complete disarmament treaty is obviously well out of reach.



Until that distant day when disarmament may be achieved, the Air Force's primary concern is to improve its combat readiness. It passed an important milestone in that direction in mid-April when it opened shop at its first underground ICBM base near Denver, Colo.

Gen. Bernard A. Schriever, Commander of the USAF Systems Command, formally accepted (see cut, page 16) the complex of nine Titans in concrete silos from the contractor, the Martin Company, and turned it over to Gen. Thomas S. Power, SAC Commander in Chief, who in turn passed it on to his Fifteenth Air Force, headed by Lt. Gen. Archie J. Old, Jr.

Maj. Gen. Thomas P. Gerrity, who as Commander of USAF's Ballistic Systems Division is in charge of set-

ting up USAF's missile structure, called 1962 the "year of the payoff" in gaining operational ICBMs.

"We're going to more than triple the operational ICBM force this year," he declared, "and we'll triple it again in 1963."

The nine-missile Titan squadron joins seven Atlas squadrons already operational, bringing to sixty-three the total operational missiles in SAC. In contrast to the Titan missiles poised in 165-foot-deep silos, the first Atlas missiles are above ground or in shallow coffins.

By the end of the year, SAC is scheduled to acquire five more nine-Titan squadrons and six twelve-unit Atlas-F squadrons, all in hardened underground sites, for a total of 180 operational missiles. Next year SAC will add six squadrons of Titan II missiles, plus several hundred Minuteman missiles in sixty-unit squadrons.



The X-15 is being assigned new research missions beyond the earth's atmosphere that will add some thirty-five flights to its original schedule and may keep X-15s flying for at least two more years.

The new experiments include ultraviolet photography of the stars from altitudes above forty miles, measurement of micrometeorites and density

(Continued on following page)

of the atmosphere at various levels above 100,000 feet, evaluation of advanced vehicle systems and structural materials, and testing new control and reentry-computing devices.

In announcing the new programs April 13, NASA said modifications will soon be started on X-15s No. 2 and 3 to accommodate equipment needed for the experiments, some of which will be handled along with existing X-15 studies of such matters as aerodynamic heating, operational and control problems, biomedical data on pilots, hypersonic aerodynamics and structures, and exit and reentry problems.

NASA's announcement said X-15 No. 1 was not included at this time because of its planned attempt at a new altitude record above 250,000 feet, piloted by Joe Walker of NASA.

The star photography project will take advantage of the X-15's ability to get above the earth's atmosphere which obscures the stars' ultraviolet emissions. Two University of Wisconsin scientists, Drs. A. D. Code and T. E. Houck, who are directing the project for NASA, hope to test current theories on the origin and make-up of stars by acquiring a continuous simultaneous series of photographs in different ultraviolet wave lengths, taken as the X-15 arches over its long ballistic trajectory.

According to Paul Bikle, Director of NASA's Flight Research Center, about half of the X-15's original research mission has been completed. As of April 20, the three X-15s had made a total of fifty-one flights. On that

date, Neil A. Armstrong of NASA (see cut, page 19) flew the No. 3 airplane to an altitude of 207,000 feet and at a speed of 3,818 mph in testing a self-adaptive flight-control system which senses motions of the aircraft and automatically adapts to flight conditions.



The Department of Defense has selected eight pilots for the second class of USAF's Aerospace Research Pilots Course at Edwards AFB, Calif., to begin June 18. The first five-man class was graduated in December.

New students, all with engineering degrees, are Majors Byron F. Knolle and Donald M. Sorlie; Captains Charles C. Bock, Jr., Albert H. Crews, Jr., Robert H. McIntosh, Robert W. Smith, and William T. Twinting, and Navy Lt. Cmdr. Lloyd N. Hoover.

The course is intended to qualify them for military spacecraft projects—the X-15, Dyna-Soar, and follow-on programs.

Meanwhile, NASA has called for volunteers to fill five to ten more Astronaut slots. Their new pilots will support Project Mercury, will join the present Astronauts in piloting the two-man Gemini spacecraft, and may go on from there to become spacecraft commanders on Apollo.

Although the pilots selected for USAF's course meet NASA's qualifications, they are unlikely to apply for NASA slots because they are being trained for military programs to operate concurrently with NASA projects.



Standing proudly at new air terminal at Tulsa, Okla., is this heroic bronze, seven-foot-six-inch statue commemorating American World War II flyers. Entitled "Morning Mission," and executed by Robert Weinman, sculptor and air veteran, the statue is the gift to Tulsa of the mother of Tulsa newspaper publisher Richard L. Jones, Jr.

AWARDS . . . To Astronaut John H. Glenn, Jr., the Hubbard Medal, highest award of the National Geographic Society, for "extraordinary contributions to scientific knowledge of the world and beyond as a pioneer in exploring the ocean of space." . . . To Arthur C. Storz, Sr., of Omaha, Neb., life member of AFA, the USAF Exceptional Service Award, for "exceptionally meritorious service to the United States Air Force." The award was presented by USAF Chief of Staff Gen. Curtis E. LeMay (see cut at left). . . . To Maj. John J. Knight of Duluth, Minn., the American Legion's New York Aviator's Post Valor Award, for "a conspicuous act of valor or courage performed in aerial flight" in making supersonic penetrations of thunderstorms. . . . To Cols. Fratis L. Duff, Lawton, Okla., and David Gold, Schenectady, N. Y., Certificates of Achievement, top USAF award in medicine, for attainment of the highest level of professional achievement in their fields. . . . To the 3d Bombardment Wing, Yokota Air Base, Japan, the Daedalian Maintenance Trophy, highest USAF award (Continued on page 23)

Arthur C. Storz, AFA Board member, and Omaha, Neb., businessman and civic leader, received USAF's Exceptional Service Award from Chief of Staff, Gen. Curtis E. LeMay, in Pentagon ceremony on April 3.



—US Air Force photo

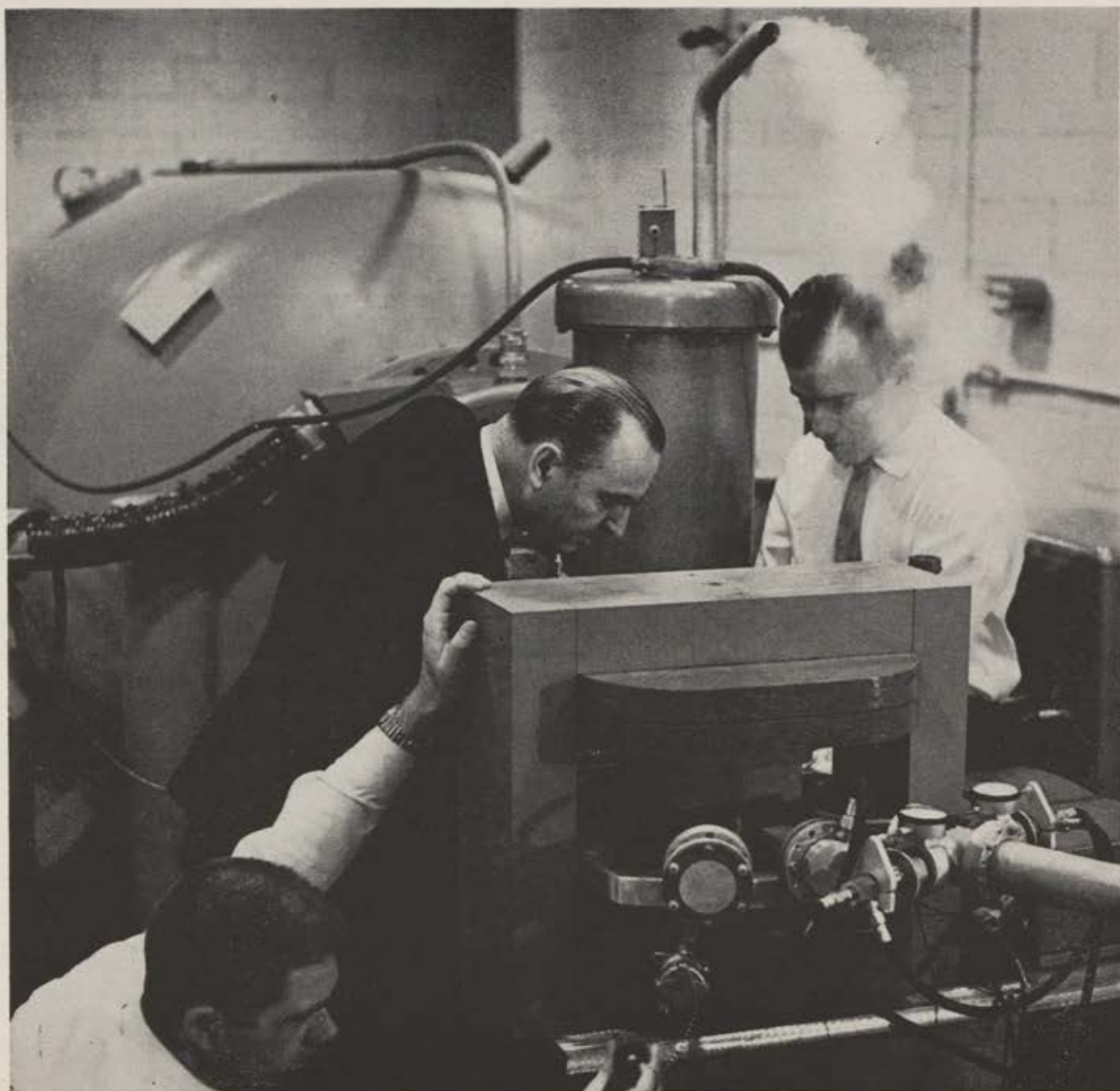
ANOTHER IN A SERIES DEPTH MANAGEMENT IN ACTION

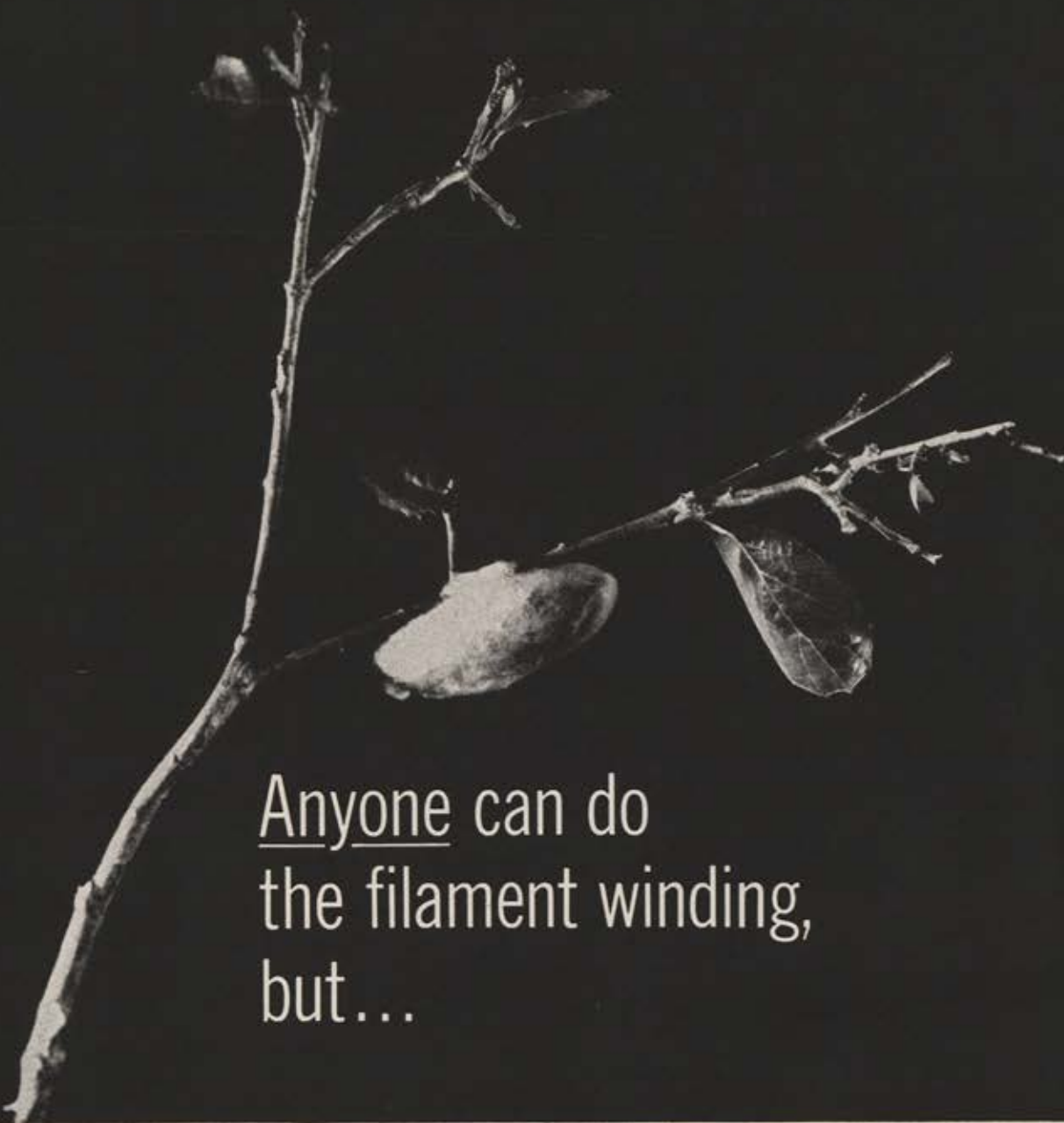
PROBING NEW WAYS TO PROTECT SPACEMEN

In a new, half-million dollar research center, LTV scientists are producing nuclear radiation equal in intensity to the powerful Van Allen belts through which space vehicles must navigate. This effect is created by a three-million electron volt "atom smasher" which is used in studying ways to protect men and materials from radioactivity. The new center also houses a plasma arc which produces temperatures twice as intense as those observed on the surface of the sun. Coupled with a precise optical spectrograph, this equipment gives LTV scientists one of the most advanced facilities of its type in the world. The man responsible for molding scientific activities into a pro-

gram that supports company product goals is Ray Blaylock — LTV vice president and technical director. A vital component in LTV's management in depth, Mr. Blaylock also heads the corporation's electronics division. His 33 years' experience includes key parts in developing the Navy's record-breaking *Crusader* aircraft, and in the engineering development of NASA's *Scout* — first U.S. solid-fuel rocket to orbit a satellite. This caliber of management, linked with proved technical competence in aerospace, electronics, communications and consumer products, enables LTV to make important contributions to the security, prestige and the well-being of our nation.

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U
A

for maintenance excellence. . . . To **Air Training Command**, Randolph AFB, Tex., the 1961 Tokyo Raiders Award, for outstanding command traffic safety.

Lt. Col. Robert A. Duffy of the Ballistic Systems Division, AFSC, is USAF's nominee for the 1962 Thurlow Navigation Award of the Institute of Navigation, for his work on guidance systems for the Atlas, Titan, and Minuteman missiles.



Kromas



Scholin

Brig. Gen. Joe Foss, AFA President, has announced the naming of two new members to AFA's headquarters staff in Washington. They are **Allan R. Scholin** and **Philip E. Kromas**, appointed Associate Editor and Art Director, respectively, of **AIR FORCE/SPACE DIGEST**. Scholin was recently released from active duty as an Air Force lieutenant colonel. Kromas, who has had fifteen years' experience in commercial art work, was an Air Force flight engineer and gunner in World War II (see cuts above).



President Kennedy recently sent messages of congratulation to three US Air Force Academy members who have been awarded Rhodes scholarships. They are **2d Lt. John D. Sullivan, Jr.**, a recent Academy graduate, and **Cadets David H. Roe** and **Robert H. Baxter**. Lieutenant Sullivan, incidentally, was nominated to the Academy by the President when Mr. Kennedy was a Senator.



People of a different sort also turned up in the news last month. **USAF Capt. Joseph P. Kauffman** of Rutland, Vt., was convicted of passing defense secrets to East German Communists and sentenced to twenty years at hard labor. Kauffman's attorney said his client had used bad judgment but was not a traitor. But the eight-man military court, headed by **Col. Edward S.**

Newberry of Bakersfield, Calif., found Kauffman guilty on four counts—conspiring to give defense information, agreeing to act as an espionage agent, failing to report contact with East German intelligence agents, and providing data on Sondrestrom Air Base in Greenland. His sentence is subject to review.

From Kazan, capital of the USSR's Tatar republic, came a report of the death of a former Soviet air lieutenant

general. His name was **Vassily Stalin**. In rosier days when his father ran the country, Vassily commanded an air brigade. When he died at forty he was back to the rank of major. Death, according to the report, came from a heart attack induced by chronic heavy drinking.



LAUNCHINGS. . . . USAF's new **Skybolt** ballistic missile was successfully tested in its first live airborne firing over the Atlantic Missile Range April 19. Objectives of the first launch, the Air Force said, were to test the missile's capability to pitch up into a ballistic trajectory after release from the aircraft and to obtain data on the Skybolt's motor and control system performance.

The first missile launching witnessed by an American President occurred March 23 at Vandenberg AFB, Calif., when President Kennedy saw an Atlas fired by a SAC crew. SAC promptly awarded the President a missileman's badge.

In contrast to this well publicized launching, the Pentagon has quietly embargoed information on military space shots. On April 9 USAF launched an **Atlas-Agena-B** from Pt. Arguello, Calif., reported only as "successful" with no indication of its purpose. When a **Thor-Agena-B** was launched from Vandenberg AFB on April 17, the Pentagon would only disclose that it had been launched,

with no further details on its mission or success.

The USSR on April 6 announced the launching of **Cosmos II**, second instrumented satellite in a series designed to explore conditions for prolonged spaceflight. (**Cosmos I** was placed in orbit March 16.) **Cosmos II** circles the earth each 102.5 minutes, with maximum altitude of 969 miles and minimum of 132.

Meanwhile, USAF launched a **Minuteman** on March 23 from an underground silo at Cape Canaveral to a target more than 4,000 miles down range. It was the seventh successful silo launching in a row for Minuteman.



STAFF CHANGES. . . . **Brig. Gen. Richard W. Fellows**, from Deputy Director, Maintenance Engineering, to Deputy Director, Plans and Programs, Hq. AFLC, Wright-Patterson AFB, Ohio, effective July 1. . . . **Brig. Gen. Robert W. Hall**, from Deputy Director of Plans, J-3, US European Command, to Commander, Air Photographic and Charting Service, MATS, Orlando AFB, Fla., effective July 1. . . . **Brig. Gen. Bertram C. Harrison**, from Deputy Commander, OCAMA, AFLC, Tinker AFB, Okla., to Director, Systems Inspection, TIC, Norton AFB, Calif. . . . **Maj. Gen. Victor R. Haugen**, from Assistant DCS/Research & Technology, Hq. USAF, Washington, D. C., to Chief, MAAG, Germany. . . . **Brig. Gen. Robert H. Herman**, from Deputy Commander, SBAMA, AFLC, Norton AFB, Calif., to Deputy Commander Defense Petroleum Supply Center, Defense Supply Agency, Washington, D. C. . . . **Brig. Gen. William G. Hipps**, from Director, Systems Inspection, TIC, Norton AFB, Calif., to Deputy for Plans, Hq. TAC, Langley AFB, Va. . . . **Brig. Gen. Edward J. Hopkins**, from Comptroller, Hq. AFLC, Wright-Patterson AFB, Ohio, to Director of Comptroller, Hq. SAC, Offutt AFB, Neb., effective July 25. . . . **Maj. Gen. George E. Price**, from Commander, AMFEA, AFLC, Europe, to Commander, SMAMA, AFLC, McClellan AFB, Calif., effective June 1. . . . **Maj. Gen. Turner C. Rogers**, from Chief, MAAG, Japan, to Assistant to DCS/Personnel, Hq. USAF, Washington, D. C. . . . **Brig. Gen. Avelin P. Tacon, Jr.**, from Deputy Commander, Twelfth AF, TAC, Waco, Tex., to Chief, JUSMAG, Republic of Philippines. . . . **Brig. Gen. John W. White**, from Commander, 3079th Aviation Depot Wing, AFLC, Wright-Patterson AFB, Ohio, to Commander, AFS-WC, Kirtland AFB, N. M.—END

Features of the



1962 AEROSPACE PANORAMA

*and the Air Force Association's Annual National Convention,
the largest defense meeting in the nation . . .*

LAS VEGAS, NEVADA — SEPTEMBER 19-23, 1962

FIFTEENTH ANNIVERSARY THEME

The fifteenth anniversary of the establishment of the Department of the Air Force will be themed at the Convention and in exhibits.

FIREPOWER DEMONSTRATION

Climax event of the program will be the Firepower Demonstration of the Air Force Tactical Fighter Weapons Meet, the only major air demonstration of the year in the US.

ATTENDANCE

Top management attendance of military and aerospace industry has grown steadily in quantity and quality, and is assured this year by advance reservations.

DEFENSE ORIENTATION CONFERENCE ASSOCIATION

The chief executives of 150 leading business and industrial organizations from across the nation comprise DOCA, which will hold its annual three-day conference during the Convention.

AEROSPACE MEDICAL ASSOCIATION

This organization of distinguished physicians, headed by Brig. Gen. Don Flickinger, USAF (Ret.), will hold meetings of its major committees at this time.

EXHIBITS

Already many top aerospace companies, ranging from prime contractors to component manufacturers, have reserved exhibit space in the Convention Center where the Air Force will stage its greatest exhibition.

US OFFICE OF EDUCATION

The US Office of Education will program educators from forty nations to the Convention for aerospace education seminars with 300 educators from throughout the country.

FACILITIES

Facilities are the best in the world, with auditorium, meeting rooms, and exhibit hall under one roof, concentrating Convention activities adjacent to the exhibit hall for repeated attendance. Las Vegas features a jet airport, military base, gunnery range, Convention Center, hotel facilities, excellent weather, in a concentrated area with no big-city jam.

CONVENTION PROGRAM EVENTS

Special events such as symposiums, luncheons, and meetings will be dovetailed with exhibit-hall hours to bring maximum attendance to the hall.

SPECIAL PROMOTIONS

Special promotions programs (direct mail, public relations) to all military and industry personnel in the area will bring users, customers, and suppliers to the exhibits.

OUTDOOR DISPLAYS

The Atlas, Minuteman, and Thor-Discoverer plus aircraft will be on display near the Convention Center.

RECEPTIONS

This year, for the first time, the General Officers' Reception (in conjunction with the annual Panorama Preview) and the reception for the Chief of Staff and the Secretary of the Air Force will be held in the exhibit hall.

THESE FEATURES ALREADY PLANNED, PLUS OTHERS TO COME, MAKE THE AEROSPACE PANORAMA A UNIQUE PLATFORM FOR PRIME CONTRACTORS, ASSOCIATE CONTRACTORS, AND SUBCONTRACTORS TO DISPLAY AND PERSONALIZE THEIR CAPABILITIES.

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175 VA STATIC INVERTER

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Voltage:	27.5 VDC $\pm$ 10% per MIL-STD-704
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Power:	175 VA single phase 0.5 lag to 1.0 power factor
Voltage:	115 V adjustable from 110 to 120 volts
Regulation:	1-volt change for any variation of load between zero and 110% of full load, and input voltage between 25 VDC and 30 VDC
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Distortion:	Less than 5% total harmonic
Efficiency:	80% at full load

250 VA STATIC INVERTER

Input	
Voltage:	27.5 VDC $\pm$ 10% per MIL-STD-704
Output	
Power:	250 VA single phase 0.6 lag to 1.0 power factor
Voltage:	115 V adjustable from 110 to 120 volts
Regulation:	0.7 volt for any variation of load between zero and 110% of full load, and input voltage between 25 VDC and 30 VDC
Frequency:	400 $\pm$.5 cps. Frequency changes less than 1.0 cps. for all environment, load and input voltage variation
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Efficiency:	80% at full load

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While we wait for distinct signs that we are in fact making progress toward disarmament, we must continue to make adequate preparations for free man's defense. To prevent a fatal technological surprise in the 1970s, those preparations must include capabilities in space . . .

THE ULTIMATE WEAPON IS FORESIGHT

By Gen. Curtis E. LeMay

CHIEF OF STAFF, UNITED STATES AIR FORCE

THE MILITARY point of view is a figure of speech often used to describe something that really doesn't exist in our country. The views of our military men differ just as much as do the views of congressmen from different districts, or clergymen of different faiths, or scientists of different backgrounds.

Like other responsible citizens, most military men try to study problems objectively and judge proposals honestly. But we use different background experience in the solution of our problems. We appreciate problems differently because of this difference in experience. And we don't always agree. So it seems to me wrong to suppose that some kind of thought control produces only one military viewpoint on our problems. There is no such thing in our country. There are many military viewpoints.

[What follows is] from my point of view as a military man. In our world that has witnessed great changes in the last few years, a military point of view must consider space as a new factor in our foreign affairs. I should therefore like to . . . discuss this new factor that will influence greatly our country's future. And I am going to describe my ideas that seem valid from my background in aviation and my experience with military problems.

The field of knowledge that is producing our capabilities in space today has its origin in the development of aviation. And the problems of space development are much the same as problems that confronted the growth of aviation. But our world has changed swiftly since World War II, and it is changing swiftly today. Now, we can no longer take long years to

recognize coming problems and more long years to theorize about their solution as we did with airpower in the 1920s and '30s. In today's world we have a hostile competitor for the solution of every problem—political, technical, and strategic. On the outcome of this competition depends our military security and our leadership of the free world.

Let me give you an example of the way we were slow to recognize coming problems. . . . Almost half a century ago Dr. Robert Goddard proved the validity of rocket propulsion principles in a vacuum. These are the principles applied today to launch intercontinental missiles, satellites into orbit, and interplanetary probes. They will be applied to launch our lunar expedition and return it to earth. They will probably be applied to control maneuverable vehicles in space some day.

But it took a long time for us to recognize the importance of Goddard's work, even though he continued this work until 1945. In 1929 he demonstrated the first successful liquid-fueled rocket flight at Auburn, Mass.

Many times during these years Dr. Goddard successfully demonstrated rocket-engine performance, and technical reports on his work were widely published by the Smithsonian Institution.

But it was after that, in 1936, that a representative of the Army Air Corps visited Goddard to assess officially the military value of his work. He reported that there was little military value in it, but that rockets would appear useful to drive turbines. And we did

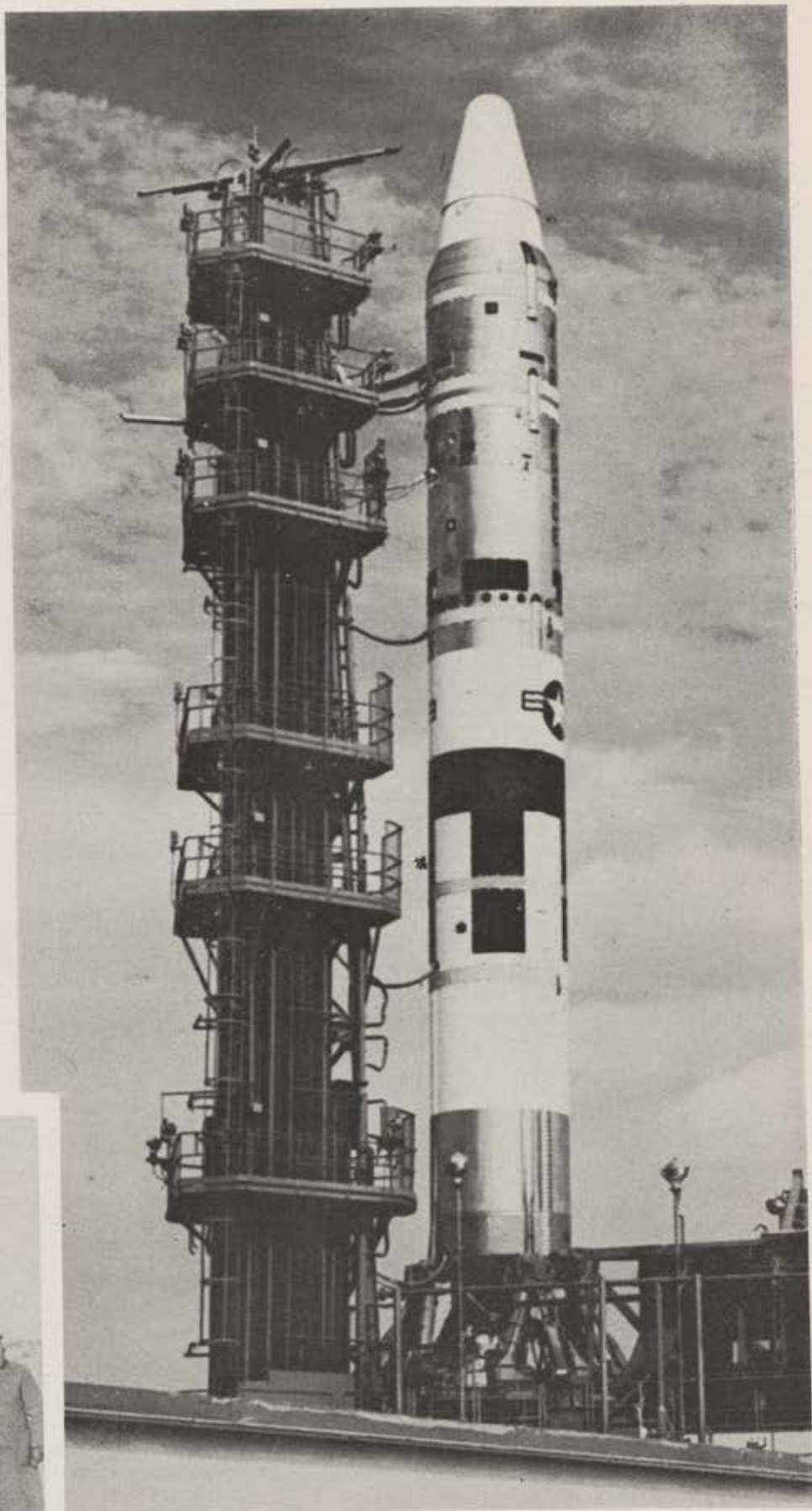
(Continued on page 28)

AIR FORCE

MAY 1962

THE LESSON OF THE PAST

In 1929 American rocket pioneer, Dr. Robert H. Goddard (below), demonstrated at Auburn, Mass., the feasibility of liquid-fueled rocketry. The importance of Dr. Goddard's work was largely unappreciated in the United States until after World War II. But not so in Germany—where the V-2 ballistic rocket was developed for operational use in World War II—or in Russia—where the first Soviet liquid-propelled rocket was successfully fired in 1934. Today, nearing operational readiness is the Titan II, our most powerful space weapon. Titan II is shown at right poised for take-off on a test flight from Cape Canaveral, Fla. The lesson of the past is clear: We must start now on the weapons of the future—knowing that the Soviets are moving at full speed for a decisive capability in space.



little to exploit Goddard's work until after World War II. We can't afford to make that kind of mistake today.

We were not only slow to recognize the value of Goddard's work. We were also slow to see that it was part of a growing problem.

Goddard's work was recognized in Germany and Russia as early as 1920. By 1923 a technical study of the rocket in a space environment was published in Germany. By 1929 the first of nine volumes of an encyclopedia on space travel was published in the Soviet Union. In 1930 the German Army, after reviewing the work of Goddard and others, decided to estab-

MILITARY SPACE SYSTEMS

There is much opposition to military space system developments:

- Some call it a needless extension of a nuclear arms race they think has gone too far already;
- Others ask—why take nuclear weaponry into space when it can work just as efficiently here on earth?

Both schools miss a basic point because they look on nuclear missiles as the ultimate weapon and military space operations as merely an outward extension of present-day strategy and technology. They must consider the important possibility that

- Future security may depend on weapon systems unlike any we know today, systems that might operate at the speed of light;
- Space deployment of such systems might enable neutralization of earth-based ICBM systems;
- With such capabilities an enemy could dominate the world;
- Our strategic philosophy must be geared to such future possibilities—to prevent fatal technological surprise in the 1970s.

lish a rocket program and to equip an artillery proving ground to develop military missiles. In 1934 the first Soviet liquid-propellant rocket was successfully fired.

In 1937 the German Army and Air Force opened the rocket research station at Peenemünde on the Baltic Sea. This is where they developed the V-1 and V-2 missiles of World War II. Those missiles lacked only nuclear warheads to make them effective strategic weapons. Also in 1937, the Soviet Union established rocket test centers at Kazan, Moscow, and Leningrad. And after the war, they captured and put to work in the Soviet Union a number of German personnel and missiles from the German arsenal at Peenemünde.

The strategic problem of intercontinental missiles

and space operations was impending when Germany and the Soviet Union decided to pursue the development of Goddard's knowledge. We might even say that the conditions for the strategic missile problem were established when Goddard acquired his knowledge of rocket propulsion. After all, in our society we can't keep men's minds under lock and key. Goddard's knowledge would be gained by those who wanted it. We cannot control what men will do with their knowledge. And problems arise not only from what men do with their knowledge; they also arise from what men fail to do.

I suppose World War II is one classic example of the kind of problem that can arise from what men fail to do. For a long time, we failed to stop Hitler at any point in his continual march of aggression. And finally he brought much of the world to ruin.

There were many reasons why no nation tried to stop Hitler before his march into Poland. And I don't wish to oversimplify the reasons. But one important reason was that no nation, or alliance of nations, outside of Germany had strategic capabilities in being that were clearly superior to the Germans'.

The weapons of all major powers were much alike—and the Germans' might have been a little better during the 1930s. No nation had the advantage of a breakthrough in new weapons and none held great quantities of arms, but Germany had the greatest quantity. No other nation wanted the burden of a large military establishment, but Germany developed one.

I think we could have obtained enough strategic advantage from the development of our technology to deter Hitler without large standing armies. Let me give you an example. In 1922 our National Bureau of Standards published one of the first studies of the jet-propulsion engine. Stanford Moss at General Electric had already developed the supercharger. This supercharger turbine technology was the essential basis for the design of a turbojet engine. Eight years later in 1930, Frank Whittle, a British Air Force officer, obtained British patents for turbojet engines. And so the stage was set for the American or British development of the jet engine. But it was the Germans who were the first to fly a jet airplane. They did it in 1939. It was several years later, during the war, that the British and we began to build jet airplanes. In the meantime, the Germans had them in operational squadrons.

We probably could have had them before Hitler. And if we had had them, Hitler would have had to reckon with their superior performance even if he did have a large air force.

Another example. After Marconi invented the radio he reported in 1922 that radar could be developed, and he described how it would work. It wasn't until thirteen years later that the development of radar was seriously considered in Britain. In the meantime, we had made some important observations and studies of radar in our own country. Again the stage was set. And when radar was finally developed, it was a real breakthrough that gave the British the margin they

needed to win the Battle of Britain in 1940. But we could have had radar much sooner and Hitler would have had to reckon with this too.

Of course this kind of strategic anticipation and development would have been called an arms race. But we might have deterred Hitler at least long enough for the rest of the world to organize its opposition to him. It would have been a struggle between laboratories and learning and men's minds instead of a ruinous war. We didn't make the choice for the development of arms in the 1930s and we probably could not have done so in the political climate of those years.

The choice between what our societies will do and what they will not do is always a political choice. And the process of choosing often takes years longer than the action itself after the choice has been made.

Twenty years after the Germans had bombed London from zeppelins and night-bomber aircraft in World War I, we had only thirteen B-17s. Later the B-17 was the mainstay of our bomber force in Europe in World War II.

Two years after we had thirteen B-17s that flew 140 miles an hour, the Germans flew the first jet aircraft. We could have had B-17s years earlier than that, and we tried to get them. But we spent those years in making a choice. Part of making the choice was listening to argument.

We heard arguments that Army bombers should not be designed to fly farther than 300 miles from our shoreline. And this argument came seventeen years after the old, early Army bombers under General Mitchell had sunk the captured German battleship *Ostfriesland*, the light cruiser *Frankfort*, and the destroyer *G-102*. And later, we sank the obsolete battleships *Alabama*, *Virginia*, and *New Jersey*. But still the argument was that bombers weren't supposed to fly more than 300 miles from our shores. Those years of choice were the years when bombs were falling regularly on Chinese cities and, in Spain, on Barcelona.

Most of us think of Lindbergh's flight from New York to Paris as the event that dramatized the new era of aviation. And yet, ten years after Lindbergh's flight, Pan American and Imperial Airways survey flights across the North Atlantic were the eleventh and twelfth successful nonstop transatlantic flights completed out of eighty-five attempts made up to that time. So we didn't develop aviation very rapidly after Lindbergh's flight.

We had to choose many times between what we would do and what we would not do in aviation. And there were all kinds of arguments about each choice. An aeronautical authority of his day said that airplanes would never fly faster than 440 miles per hour. There were other arguments that there was a maximum size and weight for airplanes and therefore a maximum range that airplanes could attain. Later there were arguments about the sound barrier—we could never fly faster than sound. And there was the argument about the heat barrier. All these arguments turned out to be wrong. But they prolonged the time it took to make our choice. But the political choice

between things we would do and things we would not do was determined by much more than these technical arguments. There were economic arguments—and there were philosophical arguments.

In the 1920s and 1930s when we were developing aviation we had also pursued a policy of disarmament—mainly naval disarmament. The public attitude was to support a policy of isolationism if possible and neutrality at most. The popular idea that our country should never become involved in what we called "Europe's wars" was a very powerful idea. And it certainly influenced the political choice between the development and deferment of new weapons.

Now we face the problem of choosing what we should do and what we should not do about the development of military capabilities in space. And there is technical argument, economic argument, and philosophical argument about our political choice.

The popular ideas accepted by the public today will probably influence the political way we choose our capabilities in space. The powerful ideas of today are not the neutrality and isolationism ideas of the 1920s and 1930s. The powerful ideas of today are new and peculiar to our time.

Not too many years ago, for example, the public was accustomed to the idea that the Defense Department would provide for our external security. The job of keeping America secure was the military's, under the direction of the President, and with appropriations voted by the Congress.

Today a new phenomenon has tended to disassociate this public image of security from the Defense Department. This phenomenon fogs the vision. It out-modes classical ways to deal with security problems. And it confuses our efforts to develop a workable national military strategy.

This phenomenon is a condition in which many people question whether "security" will in fact be provided by the armed forces if they are called on to perform.

Historically, the armed forces provide security by protecting lives and property from enemy forces. If the man on the street comes to believe that this type of protection will involve the destruction of the persons being protected as well as the aggressor, then to him, obviously, the cure has become as painful as the disease.

To a person who believes this, military action no longer promises the security traditionally sought from military forces.

It makes little or no difference that this image of modern war may not be valid. If it exists at all—and very few will question that it exists—then it serves to divorce security from military forces in the public mind.

This is the subject I want to deal with at this point. I feel this is vital background not only to the solution of modern military problems in space but to many other problems as well.

An ancient Greek once wrote that the art of war is, in the last resort, the art of keeping one's freedom
(Continued on following page)

THE ULTIMATE WEAPON IS FORESIGHT

of action. This thought has stood up through the ages and is pertinent here.

When all is said and done, we maintain military forces to give us freedom to exercise national power. Some of our new strategic literature tells us that our present posture gives the statesman too little freedom of action, too little room to maneuver. It says that today's nuclear posture doesn't lend itself to control, that limited actions won't remain limited. And it also says that missile forces don't give enough time for decision and negotiation.

I don't subscribe a hundred percent to all these ideas. I think there are many ways that you can maintain a nuclear posture and still have freedom of action. And I am certainly not suggesting that we stop building missile and manned weapon systems—they are going to be needed for some years to come. But I do recognize this:

Each dominant war system that has emerged in this century has tended to increase the danger attached to the exercise of national power and to complicate the statesman's job. Instead of making his work easier and giving him the variety of options he desires, these new weapons have closed in steadily on his maneuver room until today he senses he has none at all.

Seapower was an ideal tool for the diplomat. War and the threat of war were far removed from his shores and there was all kinds of time for decision. This offered the diplomat lots of maneuver room.

But each succeeding war system, built on an expanding technology, has cut into the statesman's art. Large land war systems, for example, resulted in wide damage, huge costs, and they couldn't always be controlled for the purpose of national power. The first World War was a good example of how such systems could expand war beyond control.

More recently, the jet bomber came on the scene to remove land and sea barriers. It offered almost unrestricted access to an enemy's forces. It reduced the time for decision. And, with its atomic payload, it increased the scope of destruction.

Finally, today, the ICBM has severely limited the statesman's maneuver room. In a word, then, security has declined and the exercise of national power has been restricted as technology has advanced.

Faced with this kind of dilemma, the statesman has tried to increase his maneuver room by other means. This search for security, excited by arguments over nuclear weapons, has taken two main directions in the last several years. One involves nuclear disarmament. The other addresses various ways to deter nuclear war. These are the powerful ideas of our time.

Most people recoil from the idea of building military space capabilities because they see this as a further cause for instability and a needless extension of a nuclear arms race that, in their view, has already gone too far.

When you lump their arguments together with those of the very logical and calm fellow who asks why try to deter nuclear war by taking the nuclear weapon into space—since we can already do an impressive job with it from here on earth—when you get the

total effect of these arguments, then you have a lot of tough opposition to military space systems. You have economic, technical, and philosophical opposition.

But there is one point which all of these ideas miss.

Their entire emphasis is on the nuclear weapon. Some of them favor nuclear disarmament or nuclear arms control. Others strive for nuclear deterrence. They all look on nuclear weapons as the last and final form of weapons that man will devise—and as weapons that will always determine the outcome of wars.

They look on space operations merely as an extension of the use of nuclear weapons.

This may not be the case at all.

Our national security in the future may depend on armaments far different from any we know today. And, believe me, they won't be ultimate weapons either.

Perhaps they will be weapons that enable us to neutralize earth-based ICBMs.

Perhaps they will be weapons that strike with the speed of light. That kind of speed makes the 15,000-mile-an-hour ICBM a relatively slow-moving target.

If a new generation of space weapons can neutralize an aggressor's ICBMs, then the world will enter a new era in warfare, or in the prevention of warfare.

What I am saying is that space capabilities may bring about the technological disarmament of nuclear weapons.

Let me give you one brief example of what I am talking about: Beam-directed energy weapons may be used in space. And the energy directed by these weapons could travel across space essentially with the speed of light. This would be an invaluable characteristic for the interception of ICBM warheads and their decoys.

We've looked into the phenomena associated with this kind of weapon. We have evidence from scientific papers they have published that the Soviets are also interested. And Khrushchev himself has boasted publicly about "fantastic weapons."

Suppose the Soviets were first to develop advanced weapons of this sort and to employ them aboard maneuvering spacecraft?

If they could neutralize our ICBMs with such a system, they could change the balance of decisive power in their favor.

If they could neutralize satellites and spacecraft with such a weapon, they could prevent us from developing an equal defense against their ICBMs.

And they could even prevent us from going into space for peaceful purposes.

I don't think it is an exaggeration to say that with such a capability an enemy would have the potential to dominate the world. He would have the military superiority essential to support all forms of aggressive policies to pursue his objectives.

Never before has there been so great a need to be certain of the steps we take to guarantee our security. For centuries, successful national military strategies have been based on principles of war learned in equally as many centuries of military experience. Those lessons came hard. And they came at

a great cost in lives and in gold and in national power.

When Nathan Bedford Forrest said that the secret of success in battle was "to get there first with the most men," he was recognizing principles of war that have been successful for more than 2,500 years. We ignore those lessons at our peril. Modern war is far too destructive to apply those principles exactly the way General Forrest would have applied them. Today, the desired way to apply those principles is by strategic anticipation and development. For if we are not the first with the most capability, we are very likely to be too late with too little.

In the past fifteen years it has been the Soviets who have been too late with too little:

- The atomic bomb canceled the advantages of Soviet capabilities for mass aggression at the end of World War II when the Soviets maintained extremely large military forces and began to build modern air forces.

- The development of our effective air defenses with nuclear weapons circumvented slower Soviet efforts to develop a long-range-bomber striking force.

- The rapid development of the B-47 jet bomber force in the Strategic Air Command frustrated Soviet intentions to control the aerospace in areas vital to our interests. It also countered their ability to employ their masses of men and aircraft in long wars of attrition. It forced them to build strong air defenses and, by diverting their resources, retarded the development of their strategic striking forces.

In the same manner, the rapid development of our missile-warning systems and second-generation ballistic missiles has frustrated Soviet efforts to seize a strategic advantage in this area with their ICBMs.

We have maneuvered our strategic advantage to counter the Soviets in each of these developments. But each time they have come closer to winning the contest for strategic advantage. The race for missile dominance has thus far been marked by an uncomfortably close margin and it has not been clear who enjoyed the margin. And it is a well-known fact that the Soviets now lead us in the field of booster thrust for both missile and space development.

One danger to our security will come from Soviet efforts to exploit this situation. Another and greater danger can come from our willingness to accept and perpetuate this *status quo*—either through fear of destabilizing this relationship, or through resigning ourselves to arguments that nothing can be done about it.

In this situation, one significant strategic requirement for both sides is to develop the capability to neutralize opposing ICBMs. But we could become preoccupied with the requirement stated this way.

We could become so preoccupied that we might overlook an equally important one—to retain forces that can control the aerospace. This includes the area from the earth's surface all the way up to and including what we now know as "outer space."

Controlling the aerospace from the earth's surface on out into space is going to take modern versions of missiles and manned aircraft, and it is going to take manned and unmanned spacecraft. It would do no

good to leapfrog into "outer space" without a simultaneous ability to control the lower aerospace.

I have said many times that I believe we should never replace tested and reliable weapons with new and unproven ones until we are sure the new one can either do a better job or a necessary job that cannot be done at all by the old systems. In short, I believe in having in-being protection along with progress.

Achieving that protection in being along with progress will require a great deal of wisdom and courage in the years immediately ahead. We will need in-being forces that can control each stratum of the aerospace. At the same time, we will have to plan for the future. The long lead times to develop modern weapon systems and the fact that those weapon systems could hand the developer a decisive advantage will demand that we handle our military resources with a balance far more delicate than ever before.

So when I call for the development of military space capabilities I am not forgetting that there is a simultaneous requirement to update our capabilities in the other strata of the aerospace.

Nevertheless, there is this fact of very long lead times between inception and a combat capability with modern weapons. This means that we have to start now on the systems of the future. I think we can start with what we know now.

Military space capabilities will eventually be the choice made by our political process. What we should do is to expedite the process by recognizing the advantages of developing military space systems as quickly as possible.

We can be reasonably sure of one thing. Whatever we do, the Soviets already have recognized the importance of these new developments and they are moving at full speed for a decisive capability in space.

If they are successful, they can deny space to us. I don't believe it is necessary to dwell any longer on the strategic consequences of such a situation.

All of us join in hoping we will make real progress toward disarmament and true peace. While we wait for distinct signs that we are in fact making progress toward disarmament, we must continue to make adequate preparations for free man's defense. To prevent a fatal technological surprise in the 1970s, those preparations must include capabilities in space—END

Gen. Curtis E. LeMay, Chief of Staff of the US Air Force, is probably the world's most noted airman. Prior to his present assignment, he served as Vice Chief of Staff and as Commander of the Strategic Air Command. A native of Columbus, Ohio, his service career dates back to 1929, when he completed flight training after receiving his B.S. in Engineering from Ohio State University. The above article is a slightly condensed version of an address by the General at Assumption College, Worcester, Mass., March 28.



PERFORMANCE REPORT

from ETS-HOKIN & GALVAN, INC.

MALMSTROM AFB MONTANA

(We call it "Project *I. F.")



Assignment: install 2000 miles of communication cable, underground, to activate Minuteman Guided Missile weapons for U.S.A.F. on a prime contract.

Tolerances: reliability of this installation determines the reliability of the entire weapons network. In addition, the complete system—including components—must withstand the impact of atomic attack.

Schedule: to be completed in less than two years from date of contract award.

Problems: terrain and weather! The Monarch Hills area of Montana is just about the most rugged in the world. The weather is "impossible". Four feet of snow is normal on September 30.

Progress: already finished in Monarch area! Job currently *ahead* of schedule.

Summation: we believe that one of the reasons we got this job was the "over-respect" of some contractors for the threats of "where and when" (*Monarch Hills in the winter*). When you have a job that takes skill *plus I. F.*, let us talk with you. We'd like to bid it.

*Intestinal Fortitude, of course.



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PERFORMANCE NOW FOR SPACE AGE DEMANDS

Anywhere, any time

- Provide mobile, integrated, flexible, readily available forces.
- Furnish highly trained combatant forces under JCS direction and a single responsible commander.
- Afford a display of force capability for cold-war operations.
- Reduce reaction time in dealing decisively with any type of aggression.
- Integrate Army's CONARC and USAF's TAC operations.
- Enhance joint planning and training.
- Develop joint doctrine in combined deployment of land and tactical air forces.

These are the jobs of the nation's newest unified command:

STRIKE

By Allan R. Scholin

ASSOCIATE EDITOR, AIR FORCE/SPACE DIGEST

MAINSTAY of the Saturday-night television gallery is a heroic character of the old west named Paladin, gifted with a pistol, who responds with finesse and devastating effect when summoned to contend with men of evil intent.

In modern dress, Paladin would fit right in with the men of the United States Strike Command, newest of the unified commands, with headquarters at MacDill AFB, Fla.

A primary mission of USSTRICOM-STRIKE for short—is to be prepared to respond swiftly, and with whatever degree of force may be necessary, to threats against the peace in any part of the free world.

To carry out its mission, STRIKE may call upon any or all combat-ready elements of the Tactical Air Command (TAC) and the Continental Army Command (CONARC), together with the airlift required to deposit the strike force promptly at the scene of trouble.

Commander in Chief of the US Strike Command—CINCSTRIKE—is Gen. Paul DeWitt Adams. A World War II Ranger in the Aleutians and Italy, a division commander in Korea, the man who led US forces ashore in Lebanon in 1958, and co-commander of several recent Army-Air Force joint exercises, fifty-five-year-old General Adams is well versed in the varied aspects of his job.

His Deputy Commander in Chief is Lt. Gen. Bruce K. Holloway, forty-nine, who flew for General Chenault in China and in 1946 commanded USAF's first jet fighter group. As Deputy Commander of TAC's Ninth Air Force in the mid-'50s, he contributed to development of new fighter concepts, and then as Director of Operational Requirements in the Pentagon guided development of the TFX.

STRIKE came into being on September 19 of last year when Secretary of Defense McNamara established the command's mission in response to President Ken-

nedy's concern over Communist "nibbling" aggression. General Adams was named Commander in Chief. Soon thereafter General Adams met in Washington with General Holloway and other key officers designated for the new command, including Maj. Gen. Clyde Box of TAC, now STRIKE's J-5, Plans, and Maj. Gen. Clifton F. von Kann, then chief of Army aviation and now J-3, Operations. By mid-December the command headquarters was fully manned, and General Adams declared it operational on December 28.

As an indication of the speed and urgency with



Tactical Air Commander, Gen. Walter C. Sweeney, Jr., left, and CINCSTRIKE, Army Gen. Paul D. Adams, during Operation Track Down, held this spring at Fort Hood, Tex.

which STRIKE was set up, none of the personnel assigned to its headquarters took any leave en route from their former stations. Nor did anyone get leave during the Christmas holidays.

"Never before," said General Adams recently, "has a command with the scope and responsibility of STRIKE been organized and started functioning in so short a period."

(Continued on following page)

The Joint Chiefs of Staff directive to General Adams listed two major mission elements—to provide general reserve combat-ready forces to reinforce other unified commands, and to plan and execute contingency operations as directed by the Joint Chiefs.

The United States now has seven unified commands. They are the Pacific, Alaskan, Caribbean, Atlantic, and European commands, North American Air Defense Command (NORAD), and now STRIKE.

The Lebanon crisis of 1958, in which General Adams played a key role, offers an example illustrating STRIKE's mission in more concrete terms. When it seemed that communism might capitalize on internal weaknesses in Lebanon to gain a foothold there, the President of Lebanon appealed to the United States for military support to maintain order. US forces based in Europe were hastily moved to Lebanon by air and ship, and the Communist threat was effectively dissipated. Meanwhile, however, the reassignment of US personnel from Europe to Lebanon weakened certain other of our positions, and command relationships of our forces in Lebanon were confused. In time, European positions were reinforced, command responsibilities were cleared up, and, in that instance, no harm was done.

But a familiar military tactic which has been practiced by the Communists in the past is to feint aggression in one part of the world, only to strike elsewhere when we are off balance. The mission of STRIKE, then, is to provide augmentation forces needed to meet any unexpected threat without weakening our prepared defenses.

If such a threat were to develop in a part of the world covered by one of our unified commands, STRIKE would furnish the theater commander the amount of augmentation forces he asked for, and they

would be deployed as the theater commander thought best.

If, however, the threat were to occur in an area outside the immediate jurisdiction of a theater commander, CINCSTRIKE might command the forces himself or through a task-force commander appointed by him.

With the advent of STRIKE, no chief of an individual service now exercises operational control over any of his combat-ready forces. In every instance where such forces might be employed, they would do so under control of one of the unified or specified commands.

When you are fighting a fire, it is important to act swiftly before the fire has a chance to spread. The same concept applies to brushfire wars. A small force arriving on the scene within twenty-four hours would be more effective than a much larger force arriving later.

STRIKE is geared for swift reaction. Not only does the command insist that its contingency forces be air-transportable—"if we can't fly it in," says General Adams, "we haven't got it"—but the force, including its commander and staff, is prepared to parachute into the trouble zone if necessary. General Adams is an experienced parachutist. General Holloway has just completed jump-school training and now wears the Army's Parachutist badge. A steady flow of USAF members of STRIKE is now going through the course at Fort Benning, Ga. STRIKE's Army personnel are, in virtually every instance, either qualified parachutists or Army pilots.

Despite its formidable title and high-ranking leadership, STRIKE's headquarters includes only 300 military personnel, half officers, half enlisted men, split almost fifty-fifty between Army and Air Force. At-

(Continued on page 38)



Here, in chart form, is the organizational structure of the new STRIKE Command, whose headquarters are at MacDill AFB, Fla. Six of the officers named are from USAF. They are General Holloway, General Zoller, General Box, Colonel Paulson, Colonel Cook, and Colonel Martin. The others are Army personnel. STRIKE headquarters totals about 300 military personnel, about half officers and half enlisted men. Of the 300, about half are Army and the others are USAF.

This test-stand for large solid motors is one of the many giant-size facilities we're now building to help make our organization a second-to-none solid rocket center. The test bay is notched into one of the rugged canyons in our new 9,000-acre production and testing facility. It can handle solid rockets up to 2,000,000-lb. thrust in either horizontal or vertical position. It will be used first to test the 120-inch solid motor we are developing under research contract to the Air Force. ■ In another recent contract, Lockheed Propulsion Company was selected by North American Aviation and NASA to design and build the solid escape motor for the Apollo spacecraft.

LOCKHEED PROPULSION COMPANY

REDLANDS, CALIFORNIA • A SUBSIDIARY OF LOCKHEED AIRCRAFT CORPORATION

A large, cylindrical solid rocket motor is being moved by a complex test stand system within a deep, rugged canyon. The motor is positioned horizontally and is supported by a series of cables and pulleys. The test stand itself is a large, dark structure with multiple support points. The canyon walls are steep and rocky, and the overall scene is illuminated with a warm, orange-brown light, suggesting a sunset or sunrise. The text "NEW TEST BAY FOR 2-MILLION-POUND SOLID MOTORS" is overlaid on the image in a bold, white, sans-serif font.

**NEW TEST BAY FOR
2-MILLION-POUND
SOLID MOTORS**

TAC pilots soon will be flying the F-110, latest in the Century series and USAF version of the Navy's crack F4H Phantom II, a plane that is breaking records these days with the same ease that it breaks the sound barrier . . .

F-110

USAF'S NEW TACTICAL FIGHTER



TACTICAL Air Command pilots soon will be flying one of the hottest machines that fifty-plus years of airplane building have been able to produce. TAC Commander Gen. Walter C. Sweeney, Jr., had only praise for the aircraft after he flew one recently from Langley AFB, Va., out to Nellis AFB, Nev., for evaluation tests. The plane, the McDonnell-built F-110, shown in full color on the front cover of *AIR FORCE/SPACE DIGEST* this month, will also be an important part of the weapons package of the new US Strike Command, headquartered at MacDill AFB, Fla., near Tampa (*see accompanying article*).

Designated the F-110 for USAF use, or RF-110 in its reconnaissance configuration, the plane earned its earlier laurels as the Navy's crack supersonic jet fighter, the F4H Phantom II. As the F4H, the plane now holds six official world's records, has eight others pending certification by the Fédération Aéronautique Internationale—the record-governing international body of which the NAA is the US member.

For one of the records now waiting certification the F4H roared from a dead stop to an altitude of seven and one-half miles in only one minute, seventeen seconds. This and the other time-to-climb records were set at the Brunswick, Maine, Naval Air Station, where the Phantom II also:

- Flew to 9,842.5 ft. (3,000 meters) in 34.523 seconds;
- Flew to 19,685 ft. (6,000 meters) in 48.787 seconds;

- Flew to 29,527.5 ft. (9,000 meters) in 61.629 seconds;
- Flew to 49,212.5 ft. (15,000 meters) in 114.548 seconds.

More recently the Phantom II racked up a second series of time-to-climb records, between March 31 and April 12 at Point Mugu, Calif., Naval Air Station when the plane:

- Flew to 65,620 ft. (20,000 meters) in 178.5 seconds;
- Flew to 82,025 ft. (25,000 meters) in 230.44 seconds;
- Flew to 98,425 ft. (30,000 meters) in 371.43 seconds. This is traveling from a dead stop (though with the aircraft at full throttle on the ground until released by an explosive bolt) to an altitude of more than eighteen and a half miles in a little over six minutes.

In addition, the Phantom II holds world's records in these categories:

- Straightaway speed of 1,606.3 mph.
- The 100-km., closed-course record of 1,390 mph.
- The 500-km., closed-course record of 1,216 mph.
- The 3-km., low-altitude record of 902 mph.
- The sustained-altitude record of 66,443 ft.
- The transcontinental Los Angeles to New York record of two hours, forty-eight minutes.

USAF, on March 5, filed a claim for the latter record after one of its B-58s flew coast-to-coast in two hours, one minute, 39.6 seconds.

Perhaps most significant of the F4H's current rec-



ords is the absolute world speed record of 1,600-plus mph—about Mach 2.8. This is an indication that the plane flies at about the top speed possible with an aluminum airframe. A structure of steel or some other high-temperature material would be needed for cruise at Mach 2.8, or for a short-period dash to higher speeds.

In prospect for the Air Force are 336 F-110s, worth about \$1 billion (including engines and electronic equipment), under the present Administration plan. Most of the money is in the FY '63 budget, which still needs congressional approval. Most—310—of the new planes will be slightly modified versions of the F4H. The other twenty-six will be used for a reconnaissance mission.

Much of the credit for the F-110's fine high-speed and time-to-climb performance is given to its variable-geometry inlets for engine air. Each engine air duct has two sections that move automatically to adjust the duct's size and shape for efficient airflow at all times.

The plane is powered by two General Electric J79-GE-15 turbojets, each producing a maximum 17,000 pounds of thrust with afterburning.

With its drooped-down tail and tilted-up wingtips, the F-110 presents a strange appearance at first view (*see cover drawing*). The plane is a relatively large fighter—fifty-six feet long with thirty-eight-foot, five-inch span, as compared with the forty-seven-foot length and thirty-eight-foot span of the F-100F Supersabre. It was the Navy's requirement for a maximum

length of less than fifty-nine feet that was a controlling factor in the F4H's design. This length limitation posed problems in designing a stable, Mach 2.5-plus aircraft with good range and weighing more than 35,000 pounds.

In solving the stability problems, the horizontal stabilizer was given a large negative dihedral. These tail surfaces were drooped downward twenty-three degrees to get their center of area down near the plane of the wing. The positive dihedral in the wingtips was needed to maintain the proper ratio between lateral and directional stability after the tail was drooped. The wings are swept back forty-five degrees.

Approach speed for the F-110 is about 140 mph. The aircraft has blowing boundary layer control on both the leading-edge and trailing-edge flaps to keep landing speeds low. The Phantom II was first flown in May 1958.

Equipped with very-long-range radar, the F-110 can carry a wide variety of armament—including more than twice the conventional bomb weight capacity of the World War II B-17 Flying Fortress. It also has a nuclear capability. The F-110 armament load includes several mixes of the Martin Bullpup radio-controlled missile, guided into the target by the pilot and the radar operator (the missile is shown in the outboard position in artist Roy Grinnell's dramatic cover painting of the F-110 in flight); the Philco Sidewinder, heat-seeking air-to-air defensive missile; or Raytheon's Sparrow III air-to-air missile.—END



F-110



F-105



F-101



F-100



F-84F

SOME OF THE FIGHTERS STRIKE WOULD USE

tached to STRIKE Headquarters is a communications support element with 311 people, equipped to provide worldwide communications wherever the CINC may go. The communications element, too, is manned half by Army, half by Air Force people.

But STRIKE is assigned continuous operational control of all combat-ready units of TAC and CONARC, and calls on them for whatever it needs. In STRIKE's command post are listed the strength and location of all TAC and CONARC elements. If TAC or CONARC wants to shift the location of any unit in their command, they must check in first with STRIKE for approval before making the move.

These forces include a dozen TAC fighter and re-

connnaissance wings and eight Army divisions, airborne, armored, and infantry.

But since these combat forces assigned to STRIKE already existed in TAC and CONARC, what are the particular contributions of this new unified command? General Adams has set them forth in the following terms:

First, it provides mobile, integrated, flexible, and readily available military forces.

Second, it furnishes these forces under JCS direction and a single responsible commander.

Third, it affords a display of force capability for cold-war operations.

Fourth, it reduces US reaction time in dealing decisively and resolutely with any type of aggression.

Fifth, it facilitates integration of CONARC and TAC operations.

Sixth, it enhances the conduct of joint planning and joint training as directed by the JCS, and

Seventh, it provides an organization to develop joint doctrine for the combined employment of land and tactical air forces.

"We feel that the STRIKE Command will substantially increase the flexibility, readiness, and combat efficiency of the forces available to it," General Adams said in an address soon after assuming command. "We also feel that the STRIKE Command will represent a potent deterrent force and will add to our military posture the kind of strength needed to give us, in the President's own words '... a wider choice than humiliation or all-out nuclear action.'"

STRIKE leaders are careful to explain, too, that "conventional" does not necessarily mean "nonnuclear."

"The choices of action open to STRIKE forces range from no weapons to nuclear weapons," General Holloway has remarked.

The refinement of our conventional warfare capability is being undertaken to meet an apparent shift in Soviet military strategy. Having concluded that global war for the time being (and no one knows how long or short this time may be) involves unacceptable risks, Khrushchev has directed Communist energies toward what he calls "wars of liberation or popular uprisings." But we cannot afford to forget that the wide choice of responses available to STRIKE in combating such "uprisings" is possible only because STRIKE forces are covered by our powerful nuclear delivery systems.

Secretary McNamara emphasized this point in a recent speech when he remarked that America's guerrilla capabilities is an important option growing from our nuclear deterrent missiles and bombers.

He said, "The first requirement for such a policy is clearly to maintain our nuclear strike power as a realistic, effective deterrent against Soviet initiation of major wars. The Soviet decision to concentrate on wars of covert aggression was not taken in a power vacuum."

STRIKE is keeping its forces busy to indoctrinate them in joint operations. From January 1962 to June 1963, STRIKE will be engaged in twenty-seven joint exercises, plus others which may be laid on without

(Continued on page 41)

CALL COLLINS

Tropospheric Scatter Communication?

From Formosa, a Collins scatter system beams 12 voice channels 409 miles to a similar installation on Okinawa. And the reliability exceeds telephone toll quality. This over-water link required Collins complete service: site survey, systems engineering, equipment, construction, installation, test, maintenance and instructions. □ Resistant to jamming and atmospheric distortion, Collins scatter systems are ideal for long-hop voice and data communication, telemetry and remote control, and radar and video relay. Up to 132 channels can be transmitted on a single RF circuit, using frequency division multiplexing. □ A pioneer in scatter propagation, Collins started a continuing research program in 1945 and since has been a leading supplier of systems for industry and government. Users include telephone, petroleum and mining companies; military applications include early warning, command-control, logistics and transportable tactical missile weapon communication systems. □ Collins scatter communication systems employ a basic modular concept providing common "building blocks" in the 1, 2, and 4 kmc bands with output powers to 10 kw for fixed station and transportable applications. □ If distance, over-water paths, rugged terrain, and communication reliability are your problems, call Collins Radio Company, ADams 5-2331, Dallas, Texas.





Other days, the S-62 is a bus, crane, or tow

The turbine-powered Sikorsky S-62 has been chosen by the U.S. Coast Guard for search and rescue after more than a year evaluating utility helicopters. Search and rescue is only one of this versatile aircraft's capabilities.

This jack-of-all-missions is also an aerial bus, ambulance, troop transport, and drone recovery vehicle. It can hover and use its hoist like a crane. It can tow ships. It has a cruising speed of 110 mph, a load capacity of 2,900 pounds, and the

longest range in its class. With its boat hull, it can land on swamp, ice, snow, mud, ships, or 10-foot waves. The versatile S-62 does all these things day or night, in virtually any weather.

Sikorsky's S-62 has been certified by the Federal Aviation Agency for commercial cargo and scheduled airline passenger service. As a proven Sikorsky design, it is available now for military utility missions. All spares are in stock and 1,000 hours time between overhaul is authorized for all dynamic components.

Sikorsky Aircraft

STRATFORD, CONNECTICUT

DIVISION OF UNITED AIRCRAFT CORPORATION

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A



STRIKE'S planes include versatile C-130E transport, C-135 aerial command post, KC-135 tanker, refueling jet fighter.

notice. Even before its headquarters were operational last December, STRIKE took charge of Exercise Trail Break in the Griffiss AFB-Camp Drum area of upstate New York. In February, STRIKE forces participated in Great Bear in Alaska, Great Shelf in the Philippines, Banyan Tree III in the Caribbean. May exercises include one in the Atlantic theater, another in the Fort Bragg, N. C., sector. In June STRIKE forces join in maneuvers in Western Europe.

Members of STRIKE's headquarters staff are also "exercised" at frequent intervals, and on extremely short notice. Alert orders require designated members of the staff to report in thirty minutes and be prepared to depart within two hours. Destination may be literally almost anywhere in the world. Against such contingencies, each headquarters member has three bags already packed and stored near the flight line, one for the Arctic, one for the tropics, a third for general use. Along with the orders go instructions to operations to load the appropriate bag on the plane.

Two exercises this spring merit special attention. In Track Down in April at Fort Hood, Tex., and Clear Lake in May at Eglin AFB, Fla., STRIKE will seek to test and review air-support doctrine and techniques. To make conditions as realistic as possible both ground and air units will use live fire.

"STRIKE can bring to these joint exercises a formal degree of planning and execution that we have never had before," General Holloway explained. "With single control, we can inject more realism and assure a better approach to evaluating air-ground doctrine."

The subject of tactical air support of ground forces occupies considerable attention among STRIKE leaders.

"Since we are charged by the Joint Chiefs of Staff with developing joint doctrine pertaining to the forces assigned to this command," General Adams noted, "we maintain a lively interest in the subject, and when changes appear appropriate we will, after testing any proposed changes, make appropriate recommendations to the JCS."

But, for the present at least, STRIKE is going along with the doctrine developed and employed during World War II. "Air superiority, battlefield isolation, direct support—these are still the main tasks of tactical airpower," General Holloway said.

"The F-105 was designed to do all these things. The F-110 possesses very useful capabilities. And the TFX is even further oriented toward that objective."

General Holloway lists three "freedoms" which he expects to see achieved in the TFX. Freedom from concrete, freedom from tankers, freedom from spe-

cialization. He has little doubt that such a plane can be built.

"Our early jets were limited in capability. But the state of the art is reaching the point where we can expect to come up with a jet comparable in versatility to the late piston fighters," General Holloway said.

General von Kann, who before joining STRIKE had been in charge of Army aviation, was asked about reports that some Army officers are still dissatisfied with the degree of close air support the Air Force can provide, and would like to see the Army acquire its own close-support aircraft.

"Yes, we've had some discussions on the subject," he replied. "Some infantry officers have mentioned the Marines' system of close support. But they forget that Marine ground-air requirements are different. Marines don't have the variety of artillery employed in the Army."

"There are things we can do to improve our system. Part of the problem is in the Army's request network. Because our Army people often call for air strikes on targets that are better suited for their own artillery, we lose time checking requests through the Army's fire-support control centers. The Marines go direct. But it's the system that causes the lag—not the Air Force's readiness to respond."

He said he thought Marine pilots were better ground-oriented because fighter pilots are rotated in forward air-controller duties. But he added that Tactical Air Command pilots are now being given more intensive ground orientation.

"It helps to know each other's problems more intimately," he said, "just as we are learning from each other here at STRIKE. I've gained a new perspective on the subject. I think I may have made one or two Army points with General Holloway."

"But the Army does not intend to get into the Air Force's air-support tasks. The purpose of Army aviation is to improve our mobility—to do things better than we can do them with surface vehicles."

As this exchange between General Holloway and General von Kann demonstrates, the men of STRIKE are giving renewed attention to the problems of air-ground operations in conventional war conditions.

Clearly, STRIKE, young though it is, is already prepared to back up these words of President Kennedy, contained in his defense message of a year ago:

"Any potential aggressor contemplating an attack on any part of the free world with any kind of weapons, conventional or nuclear, must know that our response will be suitable, selective, swift, and effective.—END

Current and planned nonrecoverable rocket boost systems are eventually going to prove too expensive for purposeful, economical, sustained space missions. Time is short for us to start intensive efforts to prove the feasibility of . . .

AEROSPACE PLANE:

Answer to Rocketing Costs

By J. S. Butz, Jr.

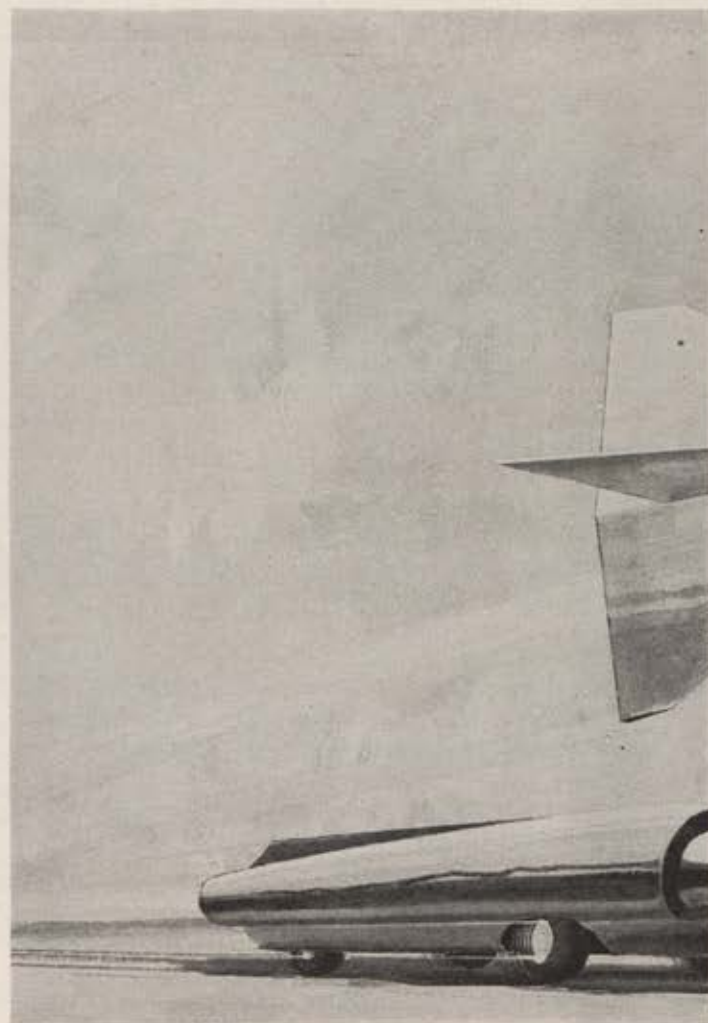
TECHNICAL EDITOR, AIR FORCE/SPACE DIGEST

EVENTUALLY I see the development of a manned vehicle that can take off from existing runways, go into orbit, maneuver into a parking orbit, deorbit, maneuver while reentering the earth's atmosphere, and land at an air base in the conventional manner."

This is Gen. Curtis E. LeMay's short description of one of the most important aerospace vehicles of the future.

In discussing the same type of vehicle Lt. Gen. Roscoe C. Wilson, while Deputy Chief of Staff/Development, USAF, talked about, "... a winged, manned vehicle which could go from the earth into orbit and return, solely on its own power. This one-stage-to-orbit vehicle would use aerodynamic lift while rising through and reentering the atmosphere. Such an aerospace vehicle would be able to take off and land conventionally, and combine many of the advantages of a rocket booster and an aircraft. From our investigations, this concept of a future aerospace vehicle appears feasible, and we look forward to it as a follow-on to the Dyna-Soar."

Generals LeMay and Wilson were both discussing a one-stage, airplane-type vehicle that could fly itself into orbit and could also cruise at hypersonic speeds in the atmosphere. This vehicle has the potential to



—DRAWING BY GORDON PHILLIPS

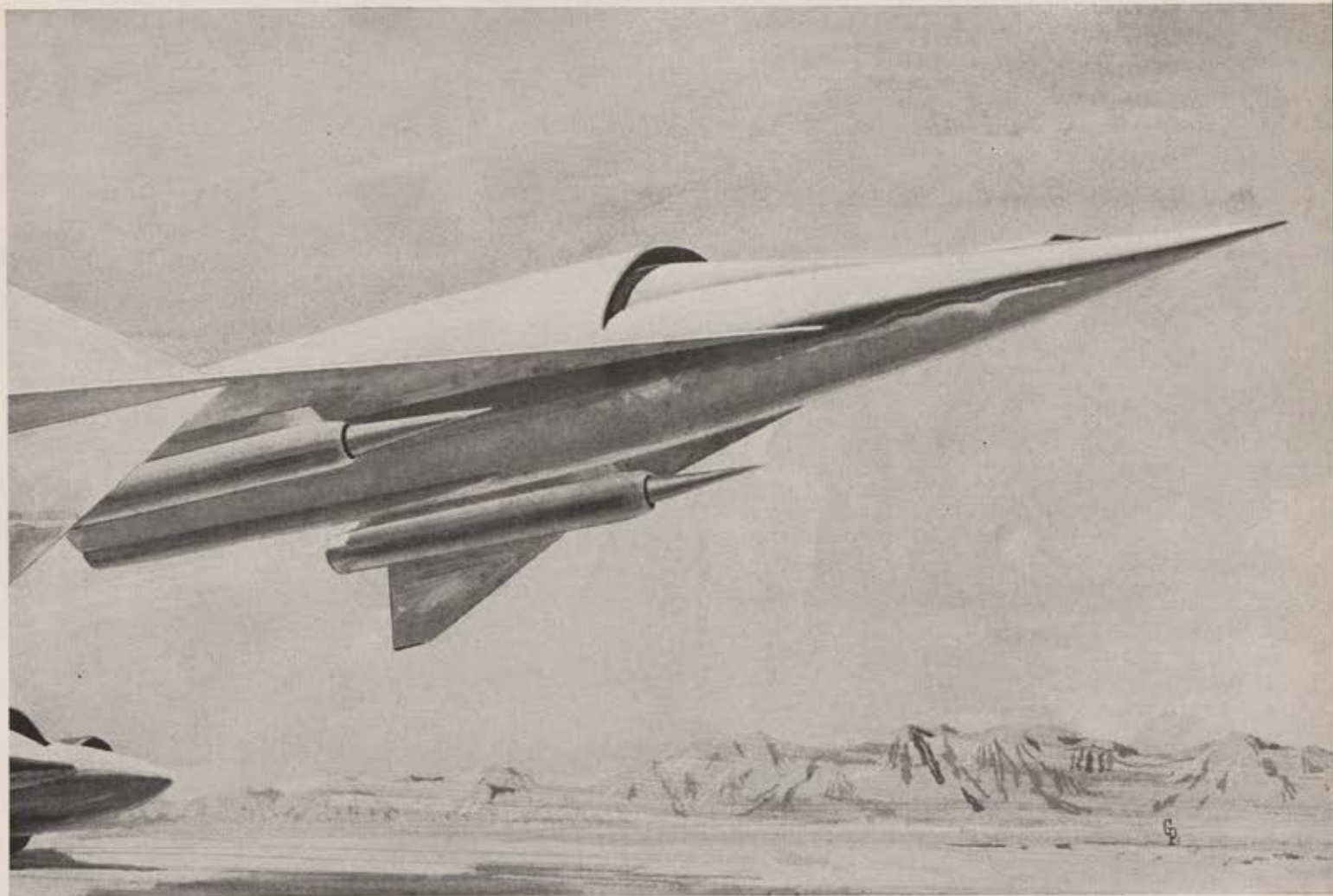
fundamentally alter the economics of spaceflight. According to current estimates, it would be 100 times cheaper to operate than the rocket-propelled boosters now used in the space program. And it would be ten to twenty times cheaper than any booster now under development.

Nomenclature for this fully recoverable airplane booster has changed from time to time in recent years, usually for political reasons. The name tags have included: Spaceplane, Aerospace Plane, orbital airplane, recoverable booster, and hypersonic-cruise airplane. To avoid confusion the term Aerospace Plane will be used in this article.

Opponents and proponents of the Aerospace Plane agree that this vehicle, with its advanced capability and unusual performance characteristics, belongs to some new technical era in the future. It can have little or no effect on the US lunar-landing expedition or the other operational events in space scheduled during the 1960s.

The main management problem with the Aerospace Plane today is to determine in which future era it belongs.

In discussing management problems of this type, the Hudson Institute's Herman Kahn, author of *On*



Takeoff of the orbital research airplane, proposed by NASA as a follow-on to the X-15, is shown here in artist's conception. The aircraft is lifting away from a turbojet-powered cart, one of the assistance devices being considered to conserve on-board fuel during the ground run. Two large turbojet engines in pods operate as turbojets during takeoff and accelerate the aircraft to about Mach 3 at 50,000 to 70,000 feet. Then they function as ramjets to about Mach 8 and 100,000 feet while air is collected through the dorsal inlet, liquified, and stored. From Mach 8 power is supplied by a hydrogen-oxygen rocket.

Thermonuclear War, has pointed out that probably from now on, two technical revolutions, and consequently two eras, will occur every decade. He characterizes time as the "handmaiden of instability" and concludes that the nation must plan with some accuracy at least ten years ahead if we are to maintain a stable world, even as we know a stable world today.

In applying this thesis to the space field, and attempting to find the place of the Aerospace Plane, three questions come to mind. Is the US planning ahead through two technical revolutions in its advance into space? Is it possible in this case to plan intelligently two revolutions into the future? If so, how badly is the nation's position jeopardized by failure to do so?

Available evidence indicates that US space plans extend only through one technical revolution when two are clearly in sight. And there is a serious possibility that the space program could founder economically in the 1970s if the second revolution is ignored much longer.

The next two revolutions in space, by this definition, are:

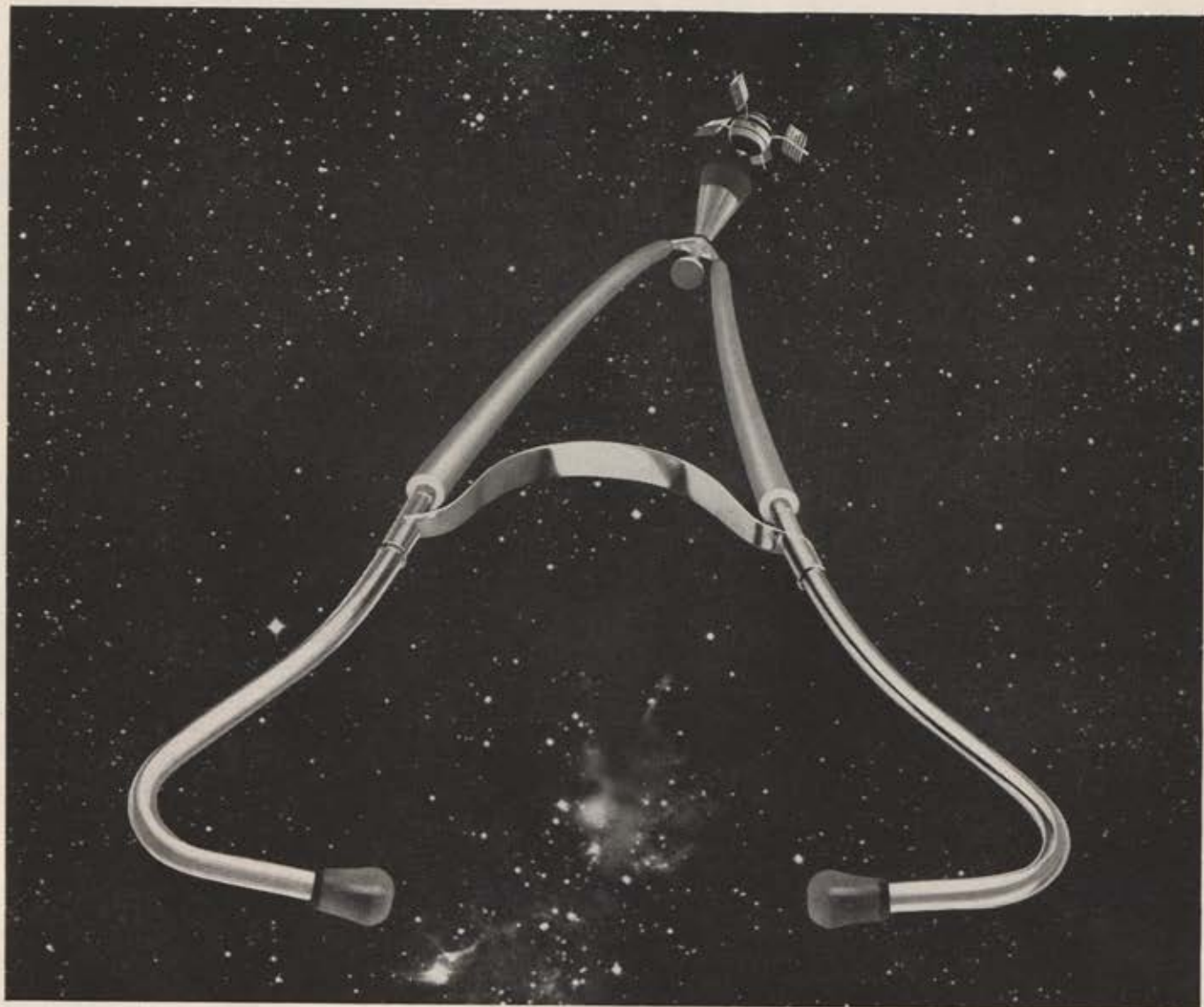
- The ability to operate out in space at great distances from the earth and to land men on the moon.

Many, many technical advances are necessary to achieve this goal, but they add up to one revolution. The nation generally has accepted this goal and applauded President Kennedy's tough-minded leadership in this adventure. The Apollo moon program, which is the focal point for the new technology, also has been generally approved by the Congress.

- The second revolution, the ability to operate economically in space between the earth and the moon, has received little official attention to date. To paraphrase Mr. Kahn, rapid obsolescence is the handmaiden of time. The Saturn and Nova launch vehicles, which are the backbone of the NASA moon program, are no exception. They will undoubtedly be obsolete before they are operational. They are geared only to the first revolution. New vehicles, more reliable and substantially cheaper, could be in an advanced design state during the last half of the 1960s if the need is recognized soon enough.

Saturn and Nova have one vital purpose. They are buying time. They are the only type of launch vehicle that could possibly be ready to send men to the moon by 1970 or before. In addition they will make it possible to develop an advanced operational capability in

(Continued on page 45)



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space with manned orbiting stations, etc., before this decade is out. But these chemical-fuel rockets will be too expensive, even in their most highly developed and reliable form, to sustain a large space program and to keep it growing.

The need for less expensive launch vehicles is critical even if our government continues to consider space as primarily an arena for peaceful competition. The high cost of space operations, even of the civilian variety, could place a damper on the program with the Congress and the public. For instance, a fifty-man space station 300 miles above the earth would cost about \$6 billion to build and maintain for ten years—using today's technology. Saturn and Nova can lower these costs. But as long as chemical-fueled rocket boosters of the throwaway, nonrecoverable type are used, the minimum cost for such an orbiting station probably will remain above \$1.2 billion. (*For further examples of both military and civil space costs, see AIR FORCE/SPACE DIGEST, April 1962, page 54.*)

Today, there is a broadly based but uncoordinated effort to start the development of low-cost recoverable booster systems. The goal is to bring the ten-year cost of the space station mentioned above down to \$100 million or less. During the past several years a great deal of industry and governmental talent has been applied to the problem. Little is to be gained by further studies of concepts. The time has come to make some choices as to structural and powerplant design.

The conceptual studies have confirmed the somewhat obvious assumption that low-cost space operations will never be achieved with throwaway equipment. Space operations must take on many aspects of airline operations, if space is ever going to be available for useful purposes, including the pursuit of exhaustive scientific studies. Space boosters and vehicles will have to be nearly as reliable as airline aircraft. They will have to be rugged, able to make the round trip from the earth into orbit and back again on a regular basis. High utilization of equipment is a key to low-cost operations in space just as it is with an airline. And a high utilization rate depends upon a bare minimum of vehicle maintenance and refurbishment at ground bases in between flights.

Three general types of recoverable, reusable boosters are under serious consideration. In order of complexity, they are:

- Saturn- and Nova-type first stages with retractable or inflatable wings that are extended after engine burnout and the booster mission have been accomplished. No pilot would be on board, and control would be maintained through standard radio-controlled automatic-pilot equipment. A soft landing would be made, either in the ocean with retrieval by ship or on a skid strip on shore. First-stage recovery is attractive because it is the biggest and most expensive part of the vehicle, and it is easier to recover than are the upper stages. Early tests showed that considerable money could be saved by refurbishing and reusing the first stages after such a recovery. NASA originally planned to try this scheme at an early stage in its large-booster program. Recently, however, most

of the funds earmarked for this development were transferred to other activities.

- A new type of first stage with fixed wings, which could return and make an airplane-type landing on a conventional runway. Both manned and unmanned versions of this type of recoverable booster have been studied. Suggested powerplants have included several types of rockets and air-breathing engines. Upper stages might even be recovered in the same manner. The main attraction of this approach is low refurbishment cost and easy reusability. The airplane-type landing should prevent significant damage to booster parts, and the booster should be ready for reuse within a day or so. NASA recently has instituted some advanced studies of such systems.

- The Aerospace Plane, a one-stage booster which has no throwaway parts and can take off and land on conventional airfields is the theoretical ideal. All other types of boosters seem to be interim steps leading to this goal.

Air-breathing hypersonic engines are the key to one-stage boosters. Even the best chemical rockets of the current variety are not efficient enough to put a one-stage vehicle into orbit carrying a useful payload. The nuclear rocket has the efficiency, but it probably will be used only in space. At the moment, the only powerplant available to power an economical one-stage booster is the air-breathing engine. Actually this one-stage booster is a hypersonic aircraft and will resemble an aircraft rather than a rocket.

The Air Force, NASA, and many companies have been hard at work for more than three years on preliminary design and applied research on such a booster. It is the key to a large, operationally mature space program for the 1970s.

The Aerospace Plane can be much smaller than a rocket to lift a given payload. In terms of specific impulse or engine efficiency, the hydrogen-oxygen rockets on the Saturn have a specific impulse of a little more than 300 seconds while the hydrogen-fueled air-breathing engines being studied for the Spaceplane have a specific impulse of around 6,000 seconds during part of the climb into orbit. This high value falls off to only a few hundred seconds as the vehicle nears orbital speed, however.

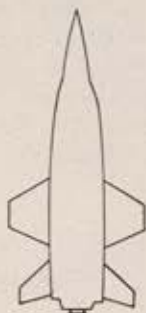
As the result of this high propulsive efficiency, the Aerospace Plane can carry a higher percentage of its takeoff weight as payload than any vehicle powered by chemical rockets. The payload weight fraction for three large rockets, a modern transport aircraft, and for the Aerospace Plane are roughly estimated below:

- Nova—payload of about 1/27 of the maximum gross weight.
- Saturn C-5—payload weight fraction of around 1/30.
- Saturn C-1—payload weight fraction of 1/52.
- Lockheed C-141, turbofan-powered transport—payload weight fraction less than 1/5, for a transatlantic flight.

- Aerospace Plane's payload fraction will lie somewhere between the subsonic transport airplane and

(Continued on following page)

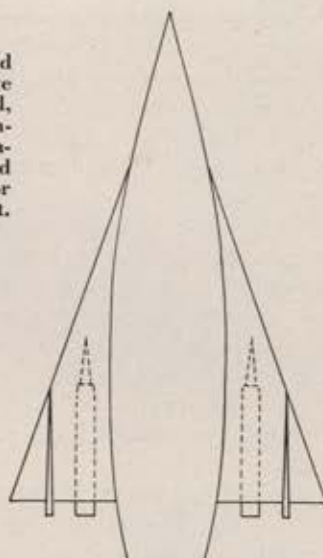
Orbital research airplane is compared with the X-15 and the Dyna-Soar in this scale drawing. Its large fuselage is necessary to carry the load of liquid hydrogen fuel, which is only about one-tenth as dense as gasoline. Construction of the fuselage, which must withstand temperatures of minus 423° Fahrenheit on the inside and around 2,000° Fahrenheit on the outside, is one of the major problems to be faced with this ambitious research project.



X-15



DYNA-SOAR



ADVANCED RESEARCH AIRCRAFT

AEROSPACE PLANE

CONTINUED

the large rocket, possibly about 1/12 or halfway between the C-141 and the Nova. Therefore, a single-stage, air-breathing booster weighing 600,000 pounds at takeoff could deliver a 50,000-pound payload into a low orbit around the earth.

This high weight fraction, by itself, would be enough to make the Aerospace Plane attractive. The fact that this vehicle would be completely recoverable is a second strong factor in its favor. Another plus is the Aerospace Plane's ability to operate from a conventional airfield.

These three factors have caused many Aerospace Plane proponents to predict that it ultimately will be able to deliver payload into orbit at a direct operating cost of only \$10 per pound. This compares to \$200 or more for the Nova and \$300 for the Saturn C-5, under the best possible operating conditions with no booster failures, etc.

But payload-per-pound alone is not enough to indicate the worth of the Aerospace Plane to the national space program. The nation is committed to spending \$10 billion or more on large rocket-powered boosters for the moon program. Even with their high operating costs, it would be cheaper to use these boosters for all space missions, if US space operations during the 1970s are going to be small. It will take a large number of flights into orbit and a high total tonnage delivered into space every year to justify the cost of developing a new booster system, no matter how low its operating costs.

No official estimates of total US space activity during the 1970s have been made public, but it is possible to piece together some figures. Some NASA technical leaders have said that if their agency puts 3,000,000 pounds into orbit in 1970, it still won't be able to handle half of the jobs that are being planned.

Another indication of future activity is NASA's estimate that it will take the equivalent of 6,000,000 pounds of payload in a 300-mile orbit to put a ten-man observatory on the moon. And its yearly logistical re-

quirement will equal 3,500,000 pounds in the same orbit. There is little doubt that such an observatory will be constructed a few years after the Apollo moon landing.

On the basis of these estimates, it seems reasonable to predict that during the 1970s NASA's average yearly requirement for payload in a 300-mile orbit will run close to 10,000,000 pounds. This includes no military activity.

Thus, the Aerospace Plane could conceivably save about \$200 per pound of payload in direct operating costs compared to a fleet of Nova and Saturn vehicles. So there is the possibility of "saving" \$20 billion during the 1970s in meeting NASA's probable requirement of 100,000,000 pounds in orbit. If the Aerospace Plane was developed for \$10 billion, a reasonable estimate, and used as the primary booster during this period, the national treasury could be \$10 billion ahead, on the basis of the civil space program alone.

Even if these estimates are wrong by more than fifty percent against the Aerospace Plane, it still seems worth the development cost. If US space activity turns out to be larger than generally predicted today, the Aerospace Plane booster appears more mandatory than attractive.

Today, there are three general approaches to a proper development course for the Aerospace Plane:

- Make it a research airplane, a follow-on to the X-15. This opinion is held by some, but by no means all, of the technical management people in NASA. The top NASA officials have approved this course, and John Stack, NASA's Director of Aeronautical Research, has asked Congress for money in the FY 1963 budget to begin such a project. The original plan was to fund final industry and government studies needed to select a detailed structural design method and powerplant operation cycle. It would have been possible under this plan to hold a design competition next spring and choose a contractor to design and de-

(Continued on page 49)

The New York Times

APRIL 8, 1962 • SECTION 11

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velop the aircraft by July 1, 1963. Hopefully, early flights could have begun by 1967. Now this schedule is slipping as NASA hasn't made the necessary notification of a selection action to pick contractors for the final design studies which should begin in July.

The main advantage of a research-aircraft program is that its only purpose is to advance the state of the art. This could be handled using a relatively simple, stripped-down vehicle without either a multiorbit capability or the ability to maneuver extensively in space. This research aircraft would provide design information for operational vehicles in the manner of experimental aircraft of the past. Estimated cost of this program is \$1 billion spent over ten years.

- The second approach is to go all-out for an operational system now and make the Aerospace Plane a major national program. The argument is that five years or so of valuable time will be wasted if the US waits to get data from a research aircraft before beginning work on an operational vehicle. Even though there are many uncertainties, some in the Air Force and industry strongly believe that the technology is available to carry such a program through to the development of an operational system in the early 1970s.

- A third group says that it is much too early for either of the first two approaches. They say that much more research must be accomplished before even the feasibility of the Aerospace Plane can be definitely established. This "it-can't-be-done-yet" argument is as old as aviation, and the only way it has ever been overcome has been by positive leadership at high levels.

The Aerospace Plane presents new problems in structures, propulsion, and aerodynamics.

Structurally, the main concern stems from the fact that it must use liquid hydrogen as fuel. Its fuselage must be an enormous liquid-hydrogen tank. A general idea of the size of the problem is given by the NASA's research airplane proposal. Congressional testimony indicated that the aircraft would weigh around 100,000 pounds at takeoff. Half of this weight would have to be fuel if the vehicle is to accelerate to high hypersonic speeds. Since liquid hydrogen weighs less than 6.0 pounds per cubic foot with less than 1/10 of the density of conventional jet fuel, the research aircraft must have an internal volume of about 7,000 cubic feet just to hold its fuel. This is more than half the fuselage volume on the 5,000,000-pound-plus gross weight of the B-52.

Since the fuselage length on the research airplane has been given as about ninety feet, its maximum diameter must be close to fifteen feet to get the required internal volume. Such a bulbous structure would weigh more than the customary fuselage even if no other problems were involved.

However, two other factors will push up structural weight even higher. The internal temperature of a liquid-hydrogen tank is minus 423 degrees F. And the Aerospace Plane's tank is the first that will be required to reenter from space and to cruise at hypersonic Mach numbers in the atmosphere. Its outer surface will get heated to temperatures above 2,000 degrees F in many areas.

This high temperature differential is complicated by the fact that a vacuum must be maintained between the inner and the outer surfaces of a liquid-hydrogen tank. The common feature of all "superinsulation," used today to store and transport liquid hydrogen, is double-wall, vacuum-jacket construction. The material placed in this jacket to cut down heat transfer between the walls is the element that varies among the various insulations.

A new type of insulation material is required because of the higher temperature differential between the walls. And the double-wall structure must be able to flex and vibrate and absorb heavy airloads without leaking. If air entered the space between the walls, the insulation effect would be destroyed, causing disastrous overheating and thermal stresses in the structure.

No one claims these problems can be easily solved. But most engineers, familiar with current research, believe they can be licked with an adequate design and test program. This work will depend heavily on hot-skin, radiative-cooling technology developed in the Dyna-Soar program. There is also the possibility that ingenious design might turn the big temperature differential into a strong plus factor in the cooling of personnel, equipment, powerplants, etc.

On the powerplant side several types of engines might eventually be able to send a one-stage booster into orbit. However, only one seems to be in a development state advanced enough for the research aircraft NASA has proposed to fly in 1966.

Actually, this is a system of engines, all possibly burning hydrogen fuel. The first engine is a turboramjet, which operates off of its turbine-compressor unit from takeoff to a Mach number of about 3. From Mach 3 to about Mach 8 it would function as a ramjet, powering the vehicle while another system probably will scoop in air with a conventional inlet and pass it through a radiator to liquify it. The refrigerant would be liquid hydrogen. Marquardt and Pratt & Whitney have worked extensively on such engines, and many other firms have assisted. Small-scale engines have run over a wide Mach number range. This work is in an advanced state.

During the flight of the research airplane, after the oxygen-collection system has completed its job, the vehicle is powered by a hydrogen-oxygen rocket.

Most of the powerplant testing in the research airplane would be done below Mach 15. The aircraft would not have to go into orbit to thoroughly investigate the engine system. Ultimately, the vehicle would run all-out and go into orbit.

Another system using a chemical separation cycle rather than a radiator to gather oxygen is also considered attractive and might be tested at a later date. It could be much lighter and smaller than the radiator system.

External-burning ramjets undoubtedly will be tested. Small-scale tests of such engines continue to be favorable, and the time is rapidly approaching when full-scale flight tests will be needed to advance this promising engine technology.

(Continued on following page)

The external-burning engine is the simplest high-speed powerplant suggested to date. Hydrogen or some other highly reactive fuel is sprayed out of small holes and burned along the vehicle's outer skin. This increases the static pressure in the area of burning. If this area is properly controlled, the burning produces lift and thrust. The burning also creates its own shock-wave system and a drag. Experimenters are now searching for optimum shapes which produce great increases in lift and thrust and little shock and interference drag.

If the external-burning system produces the proper thrust with adequate fuel economy above Mach 3 or so, it may be possible to go into orbit either using this system alone after takeoff with a turbojet. Even so the air-collection system will be useful because it will provide oxygen for rockets which will allow rapid maneuvering in deep space.

Aerodynamic design will lean heavily upon Dyna-Soar technology and information gathered in NASA and the Air Force research programs that are already completed. The rotund fuselage will present some new drag and stability problems, but they are considered to be within the state of the art. It is hoped that the vertical stabilizing surfaces can be placed out near the wingtips to improve their effectiveness by getting them out of the thick boundary layer surrounding the fuselage at high speeds and altitudes. However, this might not be possible structurally, and a large fuselage-mounted vertical tail would be necessary.

One of the main concerns is getting good low-speed handling characteristics, much better than those of the X-15 and predecessor research aircraft. The desire is to land and take off at fairly slow speeds on a regular basis from Edwards AFB, Calif. To do this without undue risk or strain on personnel, good supersonic handling qualities and a minimum safe flying speed near 150 mph are necessary. Possibly variable-sweep wings will have to be used.

For takeoffs, especially at maximum gross weights, a powered sled or cart will probably be used as an assist device (see illustration, pages 42 and 43) to conserve fuel and to get the airplane well above maximum flying speed before becoming airborne. Landings would be power-on, and the aircraft should be fairly lively since the landing weight would be about fifty percent of the takeoff weight. Either skid or wheeled landing gear could be used.

The arguments over the feasibility of the Aerospace Plane are strongly reminiscent of those over supersonic flight. Less than fifteen years ago the usefulness of supersonic flight for either civil or military purposes was seriously questioned. There also was serious concern among competent technical people about maintaining stability and control in the transonic region, about unpredictably high structural loads near Mach 1, and about the ability to design a temperature resistant structure.

There is a historical lesson for today in the contrast between British handling of their supersonic program and our own X-1 approach. In 1943 the Air Ministry ordered design work on the Miles M.52, whose

"three-stage" engine was to make it supersonic. But the plane was canceled when Sir Ben Lockspeiser, in charge of the program, decided the risk to the pilot was too great. Though some in British aeronautics disagreed with the decision, many experts applauded it, and the program continued with unmanned vehicles.

But during the early 1940s US air leaders were willing to take chances. In 1942, Gen. H. H. Arnold, Commanding General of the Army Air Forces, and Dr. George Lewis, Director of the National Advisory Committee for Aeronautics, after consulting personally with a number of high-speed aircraft specialists decided, without benefit of committee advice, that the US could not afford to be second in the supersonic aircraft race. They began the joint Air Force-NACA research aircraft program which produced the X-1.

This decision was an even bigger gamble, in the face of formidable go-slow advice, than the Aerospace Plane is today. There were no transonic research facilities available nor did available aerodynamic theory extend through the transonic.

In the case of the Aerospace Plane there are no such absolutely blind spots. Facilities on the ground can simulate most of the aerodynamic and structural conditions under which it will operate. It is also possible to flight-test fairly large-scale models at very high speeds to verify and fill out ground experimentation data.

In 1944, the X-1 design was frozen. Its bullet-shaped fuselage and very thin wings, cut from a solid piece of aluminum, were considered to be the most conservative possible. Its payload was kept extremely low, and all available weight was used to beef up the structure to withstand 18 G. After flight testing began, several months were needed to make changes in the engines and flight-control system before an attempt was made to exceed Mach 1.

The delay gave the program's detractors time to sound off and they did. A quote from the November 13, 1947, issue of *Flight*, the respected English aeronautical magazine, was typical: "One's own guess is that sonic speeds may not be attempted with this aircraft [the X-1] at all, as the Bell Company themselves would probably decry any attempt to label this project as supersonic. It was, in fact, most unfortunate that the early publicity blurbs, and the usual irresponsibility of some sections of the press, gave the impression that here was the first supersonic machine."

This was actually written after Chuck Yeager had flown faster than sound. As word leaked out, *Flight* said on January 29, 1948: "Then came the rumors of success of the Bell XS-1 in its attempt to reach the speed of sound. . . . If the reports are true it would seem that the sonic barrier wasn't such an insurmountable one after all."

The X-1 might never have flown had not US aeronautical leaders of the 1940s believed that a systematic effort to increase flight speeds and altitudes would have to pay off in operational capabilities they couldn't begin to describe in detail. They refused to waste time looking for unanimous agreement that the next group of technical problems could be solved in the immediate future.—END

THE SPACE AGE IN PERSPECTIVE



SPACE

DIGEST

VOLUME 5, NUMBER 5

• MAY 1962

Military Space Efforts . . . The Evolutionary Approach

By Maj. Gen. James F. Whisenand, USAF53

If there should be a major breakthrough in weaponry comparable to the nuclear revolution, the ability to operate militarily in space may be decisive. If we fail to develop this capability and our opposition does develop it, it will be too late for us to do anything about it.

A Tenth of a Second of Arc

By M. L. Story58

For the public to understand the significance of the space age in all its ramifications, there must be a conscious effort to change the traditional and distorted public view of science and scientists. Educators have to compress "cultural lag."

Speaking of Space

By William Leavitt64

Peaceful cooperation in space is a laudable aim, deserving of earnest negotiation on both sides, but the Soviets really ought to have the courtesy to stop damning us for our astronomical "bellicosity" if they're serious about joint efforts. There is nothing warlike about planning for security, no matter which side of the Iron Curtain you happen to live on.



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If, down the road a few years, we have another breakthrough in weaponry similar in significance to the thermonuclear breakthrough, the capability to operate in space may be decisive. If we have failed to develop this capability—and by accident or design the opposition has developed it—it may be too late for us to do anything about it . . .

Military Space Efforts

THE EVOLUTIONARY APPROACH

BY MAJ. GEN. JAMES F. WHISENAND, USAF

DIFFERENCES of professional judgment occur quite naturally and honestly in almost all human endeavors. Medical doctors differ on diagnosis and treatment; astronomers and physicists differ on the origin of the universe; Madison-Avenue types differ on sales techniques; and even the Supreme Court frequently comes in with a split decision on interpretation of the law.

It is small wonder that there are differences in point of view and judgment in the business of research and development. In the research-and-

development effort we are truly exploring the unknown—or it would not be research and development. Because the answers are not known, most of us in the business expect and are somewhat tolerant of these inevitable differences in professional judgment. In fact, logic would indicate that progress would be slower if we all had the same approach, the same intellectual bias, and went down the same conceptual and technical roads.

In recognition of this fact of human existence, my purpose . . . is to talk about an area which



is the subject of considerable current public controversy. . . .

My subject is "Military Man in Space."

Back in Kitty Hawk in 1903 it would have been rather difficult to visualize a Mach 2 bomber carrying a multimegaton weapon. Ten years after Kitty Hawk the general professional judgment on the future of the airplane was to the effect that it might have some limited military application as a reconnaissance vehicle—but that it could never compete with the railroads and seagoing vessels as a mover of cargo or people. Visualization of use as an offensive or defensive weapon of war was left to the wildest dreamers. The conservative viewpoint on the future potential of space vehicles is somewhat similar.

I am not the first to draw this analogy—but it is a fact that space vehicles are regarded by some of our associates as offering limited military value in a variety of unmanned satellite roles—but eventual use as a cargo carrier or as a platform for offensive and defensive military systems is not taken seriously.

Now, no rational man can quarrel with the right of individuals to hold this conservative judgment. They may be right—but history will make the ultimate judgment based on the activities of both the free world and the USSR.

What worries many of us on the military side of the house, however, is that such judgments may have an inhibiting effect on the timely exploitation of space technology for national security purposes.

Many of us remember that even though the

first airplane was flown in the United States, no American pilot flew a US-built combat airplane in World War I. European powers were much quicker to react to the new technological opportunity, and, consequently, US pilots flew European-designed and -built aircraft in that war. The worrisome thing is the possibility that we may fall even farther behind in space, on a comparative basis, because we did not have the advantage of flying the first space vehicle.

However, in dealing with the conservative approach to the problem of military man in space, we are apt to make ourselves look foolish if we are not extremely careful. Essentially, we face the double question: "What is the military mission in space for man, and what is the specific weapon system which will accomplish the mission?"

In responding to this question, we may be tempted to stand at Kitty Hawk and try to produce the blueprint for the B-70 and the H-bomb. We may be tempted to do this because we may fear that national security space programs will not be approved unless we clearly tie them to a finite military mission to be accomplished by a clearly evident manned space weapon system.

Most of us in the planning business in the Air Force firmly believe that manned military operations in space are inevitable and, further, will be absolutely essential to national survival at some point in time. However, in the judgment of most of us who have studied the problem, we think that we should avoid attempting to stand at Kitty Hawk with the plans for the B-70. We advocate a more rational, evolutionary approach.

In advocating an evolutionary approach, we do not mean a "wait-and-see," "do-nothing" policy. We feel that an evolutionary approach can be vigorous and that it will save time and money—not lose time and waste money.

To be more specific, we visualize a military space development program of essentially three phases—three phases which will overlap somewhat in time. I shall briefly state the objectives of these three phases as I see them.

First—we should continue with the present military programs of unmanned satellites which perform the useful functions with which we are all familiar.

Second—and this should be the immediate objective of additional applied research and advanced technology programs—we should concentrate vigorously on obtaining certain basic capabilities for space operations. By basic capabilities I do not mean capabilities in the sense of specific offensive military mission capabilities. These will come later. The kind of capabilities I am talking about are the following:

- The capability to put larger useful payloads in space on a repetitive, reasonably economical basis.
- The capability to maneuver in space, to rendezvous in space, to dock with other space vehicles, to transfer personnel, fuel, and supplies from one space vehicle to another.
- The capability to reenter the earth's atmosphere from both high and low orbit, and to effect controlled horizontal landings back on the surface of the earth.
- The capability to sustain life in space, and for man to perform useful work in space.

There is already at hand a limited, specific military mission which requires these capabilities. I refer to the military logic of inspecting satellites of foreign origin which pass over US territory. Such is Phase 2 as many of us in the development planning business visualize it. As experience develops in the advanced technology programs associated with attaining these basic capabilities, the future will become more clear. The capabilities and limitations will become more evident. Concurrently, the basic character of armaments may even change. And Phase 3—a military space force—will become more definable in terms of mission and hardware.

It can be argued that if we don't get ahead with development of these basic capabilities, we might again be faced with something comparable to the so-called missile gap.

It will be recalled that in the late '40s scientific judgment on the military potential of the ICBM was generally unfavorable. The accuracies which were predicted, when coupled with the limited power of old-fashioned atomic bombs, did not make the weapon look too promising. However, the thermonuclear breakthrough—the H-bomb—changed these relationships. But even after the thermonuclear breakthrough, there were many professionals who doubted that the guidance problem and the reentry problem could be solved. It took people of extraordinary courage, like Trevor Gardner, Gen. Bernie Schriever, and the late Johnny von Neumann to press for the gamble that had to be taken.

By accident or design the Soviets, of course, made their decision earlier than we did. And, again through accident or design, the Soviets determined to build bigger boosters than our own ICBM program required. Their "firsts" in space are, of course, a direct result.

It has been claimed that a "missile gap" existed as a result of our late decision to push development of that weapon system. I will not become involved in that debate, but if a missile gap did exist, it was possible for us to catch up through crash programs. It was possible to catch up because no one could interfere with our development program without starting a war.

The troublesome thing about a military space gap—should one develop—is that it might be possible for the one who gets there first to preempt the activities of one who would run second, without a direct attack, and without necessarily starting a war. If a hostile power develops the basic capabilities which I have outlined—the capability to maneuver, to rendezvous, dock, reenter, and so forth—it would seem evident that these capabilities might be exploited to deny our use of space for any purpose whatsoever—whether that purpose might be for scientific investigation, for exploration, for communication, for weather, for navigation, or for what not.

Now the question may be logically asked—will not the NASA Manned Lunar Landing Program lead to the attainment of these basic capabilities? This is an important question and the people who have to pay the bills are entitled to a complete answer.

On this subject I want to say, first, that the US Air Force fully supports the concept of a manned lunar landing and return and the decision of the Chief Executive to assign the program to

the National Aeronautics and Space Administration. In the attainment of the objectives of this program, the Air Force will provide every bit of support which it can from its various Development Divisions and Test Centers. In fact, we have provided extensive support to the past NASA programs, and we have been actively planning with NASA for many months for support of the Lunar Program.

Now to the question—what will come out of this program which has military application? Will the required basic military capabilities be developed as a by-product?

Certainly, there will be important military dividends from this program and there will be research-and-development effort associated with the program which will not have to be repeated for military purposes. We will have the same kind of technical cross-fertilization which has existed over the years in the development of military aircraft and the development of civil aircraft. However, it is not expected, at this time, that all basic capabilities visualized as necessary to future military operations in space will be attained through the lunar exploration. In fact, attainment of the basic objectives of the Lunar Program would probably be compromised by attempting to slant the program to satisfy all military requirements.

One specific consideration, as an example, should serve to make the point: A meaningful military effort of any kind will require repetitive and sustained operations. The requirement for repetitive and sustained operations establishes a secondary requirement for a reasonably economical means of going to and from space, and a tertiary requirement for going to and from space at times other than those selected months in advance.

The requirements for scientific investigation and exploration will, of course, be somewhat different. A specific bit of scientific information may be obtained by one successful experiment in space—and the requirement for repeating the operation may not exist. The cost of sustained operations in such cases is, therefore, not an acute problem. Exploration, likewise, is a problem which differs from sustained military operations. Consequently, the research-and-development roads for military space operations and scientific/exploratory space operations are somewhat divergent at the very outset.

However, we are acutely aware of the fact that the national interest demands that there be the

closest possible integration of the military space program and the civilian-directed programs. We must work together as a team to get maximum dividends from each other's programs, and we must avoid duplication of effort, dilution of technical talent, unnecessary duplication of facilities, and unnecessary divergence in technical approach. The military program should be designed to give maximum assistance to the civilian program, and the civilian program should be designed to give maximum assistance to the military program. This is our objective in the Air Force, and I know that it is the objective of the National Aeronautics and Space Administration. I am confident that the proper integration of the effort of the National Aeronautics and Space Administration and the military effort will be accomplished.

However, as we go farther down the road in our joint planning efforts with NASA, our ingenuity is going to be taxed in the development of justification of requirements for defense space programs. We will have to ask higher authority and the Congress to approve the expenditure of rather large sums to develop the basic capabilities which do not fall out of the Lunar Program—and we are going to have to ask for such support while we don't have the blueprints for the B-70 at Kitty Hawk.

However, we know that technology is exploding on a broad front. If, down the road a few years, we have another breakthrough in weaponry similar in significance to the thermonuclear breakthrough, the capability to operate in space may be decisive. If we have failed to develop this capability—and by accident or design the opposition has—it may be too late to ever do anything about it.

I would like to close with a thought that, to me, is rather intriguing. In all the history of mankind, exploration has been dangerous, and the unexpected has been expected by the explorer. Explorers, traditionally, have been armed. I don't know whether or not there are any little green men out there—but we are planning the longest exploration in the history of man—into the greatest of unknowns—and the explorer will be, for the first time, unarmed.—END

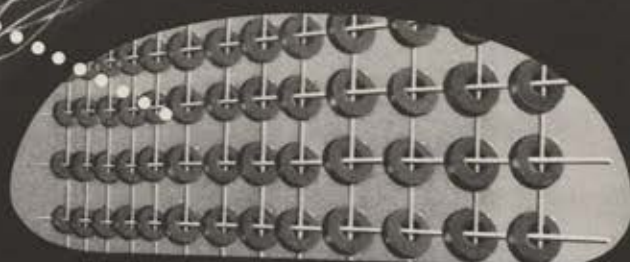


This is a slightly condensed version of an address by General Whisenand, Deputy Chief of Staff, Plans, Air Force Systems Command, to the Chicago Chapter of the Armed Forces Communications and Electronics Association, at Broadview, Ill.

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Educating the public about the space age requires a conscious effort to change the traditional popular image of science and scientists. Technology requires critical tolerances in measurement, but the educator's problem of compressing the well known Cultural Lag is, in its way also like attaining the accuracy of . . .

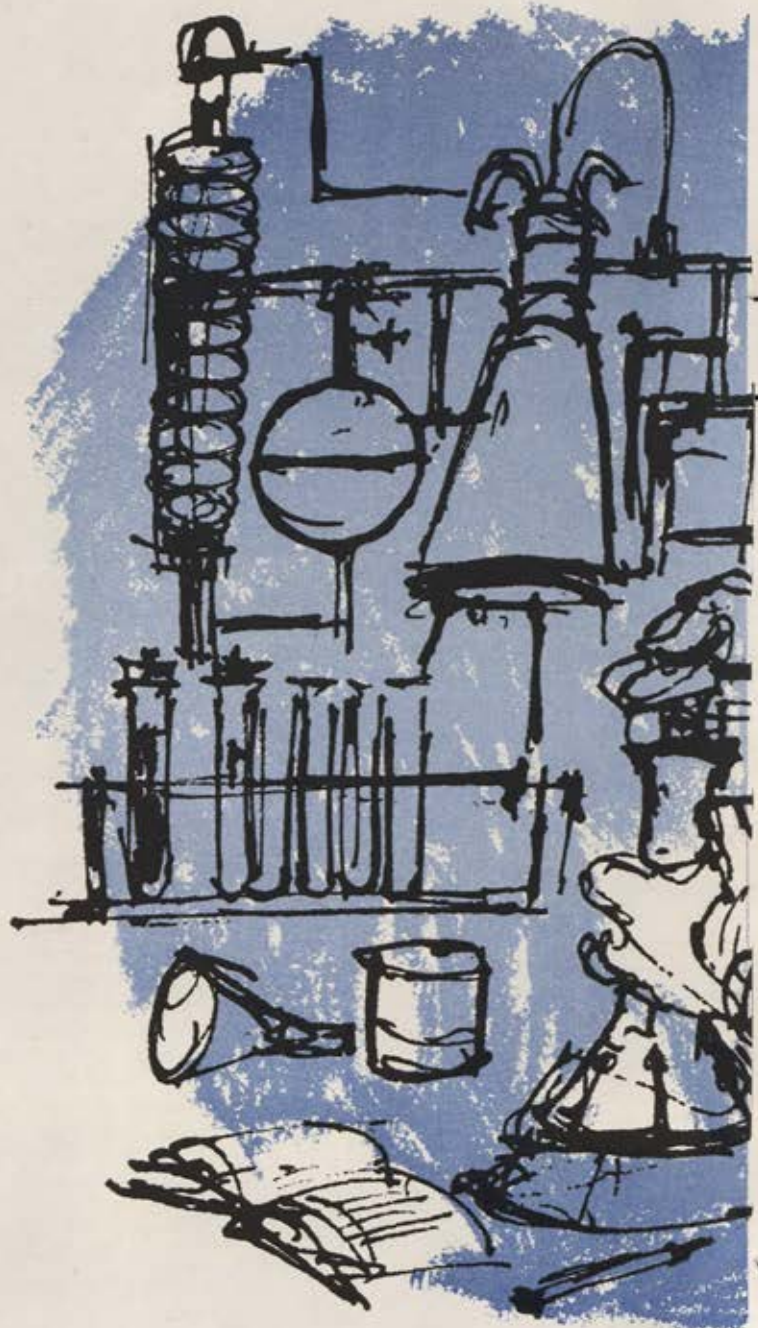
A TENTH OF A SECOND OF ARC

BY M. L. STORY

ARMED with a bundle of colorful booklets, I recently accosted an attractive school-teacher at a large convention of educators, with the innocuous purpose of acquainting her with some of the Civil Air Patrol aerospace education materials. After a casual glance at the display booth, with its space exhibit in the background, she smiled sweetly and said: "You know I am completely happy right here on

earth. I haven't the slightest interest in outer space." Then she walked dreamily away. A highly disturbing reaction, yet not nearly so unusual as one might suppose. Clearly, not everybody is worked up about aerospace education—not even all the teachers. Such a state of affairs, it may be argued, is proper cause for a measure of alarm.

The task of educating the public continues to be of number-one importance to the success of the





nation's aerospace enterprises. We have, thankfully, completed the first phase of this critical effort simply by reaching, at least among ourselves, a complete unanimity on its necessity and urgency. We must begin, however, to do more than solemnly reiterate its importance at the banquet-table rostrum or through hortatory appeals to educators at national meetings. The larger obligation of actually pushing forward a wide-scale, working pro-

gram of aerospace education now confronts us squarely.

Public awareness and full acceptance are acknowledged essentials of aerospace power. These ingredients, however, have always been notably difficult to secure and maintain. We are now faced with the paradox that today's all-out venture in air and space, a much more complex and expensive bundle to sell, simply cannot brook the uncertainties and periodic vacillations which have historically impeded the building of airpower. Public understanding and support must be complete, wholehearted, and sustained.

Above all, our problem in the space age today is infinitely more difficult to define. In the past it was perhaps sufficient to apply such labels as public *apathy* and *ignorance* and to frame our countering efforts in stirring "pep talks" and floods of informative material, using all available media. The barriers to public understanding, however, are no longer quite so simple. The space age, while it perpetuates accustomed problems, adds unique complexities. We are suddenly combating something infinitely greater than mere indifference. To educate the public about the implications of today's space effort is to modify not only their traditional attitudes and knowledge, but to reconstruct their whole inner rationale—the very images and models which give meaning and order to their existence.

Public inertia and lack of understanding are merely the surface results of certain *attitudes*. We must take the long-delayed step of diagnosing these attitudes in depth.

Why is the need for public education so great, especially in this age of mass media? Three major causes come to mind immediately. First of all, our basic approach has been faulty in the extreme; we have simply failed to create the right image. Second, we have not made the necessary alliance with an academic tradition which still has a firm grip on the educational reins of this country. Third,

we have too often simply ignored the element of fear—actual physical fear, fear of the unknown, spiritual rejection, and various other psychological shades of trepidation. Until these root causes are recognized and confronted, our hopes of a major change in the public attitude are not likely to be realized.

We have helped to perpetuate the wrong image simply by placing too great a stress upon the incredible. Science is continually in danger of remaining, for the mass mind at least, a sort of believe-it-or-not diversion. Even a televised space shot is in danger of being viewed by great numbers simply as a more elaborate magic show, like the traditional science demonstration in high-school assemblies, eliciting audience reactions of wonder and amazement with little or no understanding at all.

Thus science, while paradoxically playing an incalculably fateful role, continues to occupy a position outside the normal flow of people's lives. Even its useful products and life-preserving discoveries, because their inner workings remain esoteric, are simply accepted by the consumer as the inevitable new artifacts of a progressive culture. In short, we are failing to emphasize the great Deweyan thesis that science and all knowledge are inseparable, and this simply because we, ourselves, are so amazed at the wonder of each new discovery.

We are only too fond of stating, for instance, that certain systems of the space age require the accuracy of "a tenth of a second of arc," and of elaborating with some dramatic analogy such as that of taking a dime and cutting it like a pie into 12,960,000 slices. Admittedly, this is a small enough tolerance to bring a gasp of awe from the most hardened sophisticate. However, like so many similarly amazing aspects, it is apt to intimidate and thus literally push away the uninitiated by its very incredibility. The public response to such a barrage of imponderables is simply to avoid pondering them. After all, the creation of an attitude of awe is not, in any sense, our primary mission. Such emphases have the potential disadvantage of placing the whole scientific endeavor on a what-have-you-done-for-me-lately? basis. They are not even fittingly impressive to a youngster in school who, logically enough, often knows no simple, older context with which to compare them.

All too many books which are written for the public are mere catalogs of the incredible, carefully cultivating the I-can't-imagine-it frame of mind with which science is so generally regarded.

What is even more tragic is the tendency of learned scientists to resort lamely to this sort of audience bedazzlement when they are called upon to speak to a lay group. Instead of educating the public to a larger grasp of their attitudes, methods, and aims, they are obligingly entertaining, although they seldom threaten the popularity of the professional magician.

The extreme urgency of the need for a revised image of the scientist is nowhere so apparent as in the attitudes of writers of fiction and drama. To minimize their influence is to discount foolishly the vast impact of novels, short stories, plays, and television dramas upon that major segment of the population which already feels little enough rapport with the scientific effort. Characters from fiction become the literal symbols of their profession for virtually all readers and viewers who have no real firsthand knowledge or impression.

Some share of the blame belongs perhaps to Nathaniel Hawthorne, our first great fictioneer, who established a still-extant stereotype of the scientist in America. His concept of the brilliant mind twisted by an obsession for science into a monstrous disregard for human values can be summed up in the tragic concluding lines of one of his better-known stories: "Rappacini! Rappacini! and is *this* the upshot of your experiment?"

This concept of the scientist as a dangerous crackpot may be an extreme case in point, but it is thoroughly entrenched in our literature. This fact can be currently attested by a memorable episode in Saul Bellows' highly regarded *The Adventures of Augie March* in which the irrational Basteshaw describes his efforts to create human life and then, as Augie says, "goes off his rocker." The pathetic helplessness of the scientist, once he is in the grip of his mysterious intellect, is perhaps the underlying theme. Innumerable examples from recent literature could be cited to support the continued prevalence of this abortive picture. The scientist is seldom an admirable figure (excluding, of course, the soap-opera medic) even in science fiction, which most often pictures him as a ruthless idealist bent on recreating the race or remodeling the universe.

Thus we continue to fight against unfavorable stereotypes, ranging from the sex-mad scientist, tiresomely exhumed in a recent spate of horror pictures, to the myopic and grubby little men in the laboratory, still highly favored by television writers. Perhaps the old, archetypal wizards and alchemists of ancient times are the true culprits. At any rate, our large job is to present a com-



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Martin Company, the aerospace division of Martin Marietta, designed and built Titan for the U. S. Air Force and is the integrating contractor for Titan hardsites.



A new science-technology helps SAC leaders command their world-wide forces. Their command decisions must be made in minutes or seconds. And they must frequently base those decisions on vast amounts of changing information—gathered from distant sources and literally up-to-the-second. A new science-technology has emerged in recent years to help SAC commanders and other military and governmental leaders make decisions and exercise control under those conditions. It involves the development of far-reaching, computer-based systems that provide information processing assistance to

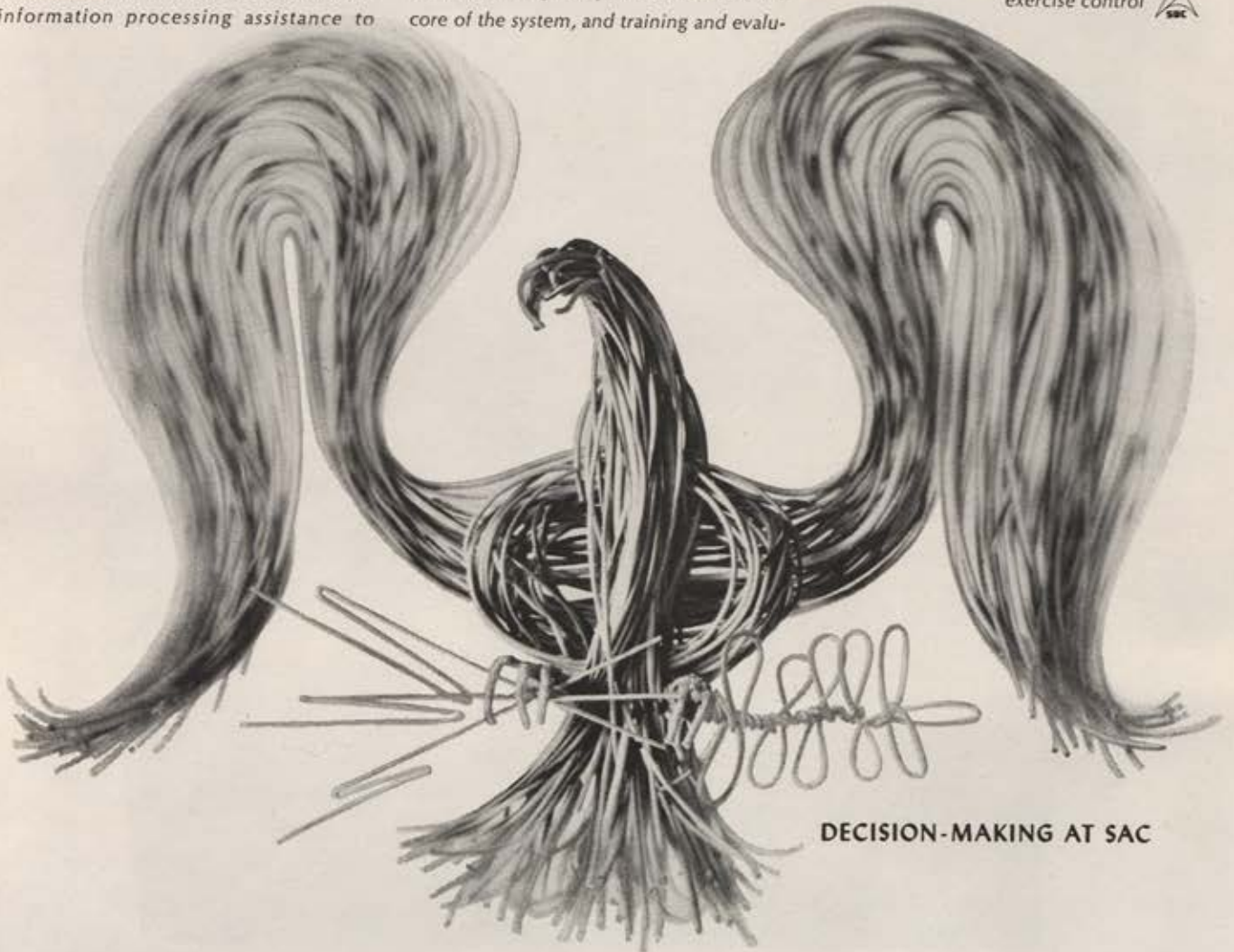
decision-makers. It has created a number of new positions at System Development Corporation. SDC has helped create this new science-technology, beginning with SAGE—the first major system for decision and control. Today its scientists, engineers and computer programmers are at work on the SAC Control System. They are also contributing to a number of other command and control systems now in their early stages. They participate in the key phases of system development: analyzing system requirements, synthesizing the system, instructing computers which are the core of the system, and training and evalu-

ating the system. Human Factors Scientists, Operations Research Scientists, Engineers and Computer Programmers interested in joining this new science technology are invited to write Dr. H. L. Best, SDC, 2423 Colorado Ave., Santa Monica, California. Positions are open at SDC facilities in Santa Monica, Washington, D.C., Lexington, Mass., Paramus, N.J. "An equal opportunity employer."

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DECISION-MAKING AT SAC

pletely new exhibit. And it is, of course, the "literary half" of C. P. Snow's dual culture who need desperately to be shown a completely revised version of the men who today are shaping our destiny.

Closely related is a second large hindrance, the absence of a close working alliance with the strong liberal-arts coterie who continue to dominate higher education and who are, more often than not, oriented in literature, language, and various social studies. Disciplines in these areas are not necessarily biased against science and technology. However, they do have their own distinctive attitudes toward science which, unfortunately enough, are not unmixed with snobbery and professional jealousy. It is, of course, the old romanticist-realist dichotomy which has been adequately analyzed many times over. Our problem here is to disperse the ownership of today's breakthrough in knowledge among all its rightful heirs.

It may be something of a bombshell to state that science has arrogantly preempted modern progress and thereby made itself thoroughly obnoxious—claiming not merely the major credit, but stealing the whole show. After all, who is to say that historians and teachers of English composition have not contributed as much, even more? Existing antipathies here are perhaps well justified. It is not a question of bringing these people into the act. It is more a matter of restoring a large measure of credit due them and of thereby recognizing the integrity of the whole education process. There are few schools where scientists, engineers, and mathematicians teach all the courses. If their colleagues are contributing anything, it is high time they were recognized for it, congratulated on it, and brought into full participation and partnership.

Finally, the element of fear, which is too seldom mentioned, continues as a large operant in the reluctance of the masses to enter fully into the space venture. Not to be confused with cowardice, a kind of native inadequacy or fear of the unknown still functions strongly in this area. Threats to the fundamental inner constructs, beliefs, and general outlook of an individual undoubtedly create what Eugene O'Neill called "little formless fears" which act to restrain natural interest and curiosity.

We must never forget, first, the newness of modern science; second, that it is a highly disciplined, specialized way of thinking; and third, that the overwhelming majority of our adult population have no formal training in it. Thus, a cautious reticence on the part of many may be wrongly

construed as indifference when it is simply a kind of fear of showing one's ignorance.

Actual fears of a nuclear war undoubtedly place the whole scientific endeavor in an ominous context for a certain number of people. Thus an occasional aversion is encountered which is perhaps completely unreasoned and illogical. Also, the extent to which religious doubts and uncertainties are widely felt is an area that remains largely unexplored. It is perhaps fair to state that such concern does undoubtedly exist. All these factors remind us that if scientific advances make people uncomfortable, then people are likely to avoid exposure to them as often as possible.

What is our cue? Our stress should be placed upon facts and ideas which will help the individual *understand* his universe rather than arrive at the conclusion that it is utterly unfathomable except to a few extraordinary minds. We must recognize that many of the basic hindrances to public receptiveness are deeply embedded attitudes, but that these will undoubtedly respond to an all-out program of enlightenment. We must literally become status seekers in a number of fields, notably the often-disparaged areas dealing with the complex creation and manipulation of "hardware."

We must not be content with displaying magical or stunt-man aspects which, despite their attention-getting value, serve only to mystify and confuse understanding. We must, above all, rightfully identify scientific progress with the broad, humanistic advancement of the race and cease to think of science as a separate, glorified category of knowledge. Our aim, far from creating a closed-shop mystique, is to bring *rocket compressors* and *solid propellants* into the common vocabulary, so that they may attain the homely familiarity of automobile mufflers or sink plungers.

Space, as a context, is still exceedingly awkward for most people. Thus, we in aerospace education have our own "tenth of a second of arc"—the problem of radically compressing the well known Cultural Lag—usually approximated at fifty years.—END



Dr. Story, now Educational Services Specialist in the Office of Educational Programs and Services of the National Aeronautics and Space Administration, was formerly Director of the Civil Air Patrol's Editorial and Curriculum Division. A veteran educator who has held a variety of teaching and administrative posts in colleges in the South and Southwest, he has contributed numerous articles to professional journals.

Speaking of SPACE



BY WILLIAM LEAVITT
Associate Editor, AIR FORCE/SPACE DIGEST

Memo to Radio Moscow

"The problem of the conquest of outer space has gained firm possession of the people's minds. Daring projects are being worked out for the investigation of the universe for peaceful purposes, so to place it in the service of mankind. Some leaders of the Pentagon, however, are racking their brains over the conquest of the cosmos from another point of view. The American strategists are reflecting on how to use the interstellar ocean for their aggressive plans. Mr. [sic] Thomas Power, who occupies the high post of Commander of the US Strategic Air Command, made a sensational discovery. He declared publicly that it is quite possible to conduct military operations in outer space. Moreover, Power appeals for measures to be taken to create American cosmic ships which would be armed and maneuverable. Yes! The nightmarish designs about war in outer space are regretfully becoming some sort of doctrine in the United States. . . ."

You would have heard this on Moscow radio April 12, first anniversary of Maj. Yuri Gagarin's historic orbital flight, if you happened to be listening to the barrage of broadcasts heralding that important astronomical date. Moscow Domestic Service was referring to a speech made by SAC Commander in Chief, Gen. Thomas S. Power, to the Union League Club in New York on April 10, an address painted by Russian radio to Russians as highly bellicose and symptomatic of the "aggressive" plans of the Pentagon.

Moscow radio tries always to touch all bases, foreign and domestic. The same speech by the General also got attention in Russian broadcasts to the United Kingdom the next day, April 13, in which it was remarked that General Power had "announced that the Pentagon is now making plans to set up a space command." The broadcast to Britain went on to say that the Pentagon "in

other words, plans to make wide use of outer space for military purposes" and concludes: "The Pentagon's plans, of course, are a great menace to peace. If they are implemented, the danger of an aggressive war, of which certain circles in Washington dream, will become even greater. Consequently, it is obvious how very important it is for space to be used only in the interests of science, for the good of man, as the Soviet Union has repeatedly proposed, and that space be used for no other purpose whatsoever."

What's all this about a "space command"? What did General Power really say in his Union League Club speech? Significant excerpts follow:

"... It should be evident that the advent of the missile era has necessitated the evolution of an entirely new and different SAC. The question arises whether a similar transformation will be needed to adapt the present SAC to the future demands of the dawning space age. Surprising as it may seem, the answer to that question is 'no' because the changes made during the past five years were basic and broad enough to transform SAC from a strategic bomber command into a strategic aerospace command.

"To appreciate the significance of SAC's aerospace role, it may be well to review the military implications of space as we see them today. The considerations that must guide us in this respect were summed up pointedly by President Kennedy when, as a Senator, he said: 'Control of space will be decided in the next decade. If the Soviets control space, they can control the earth.' This means that it is not enough for us to catch up and keep up with the Soviets. We must surpass them; that is, we must achieve what President Kennedy recently called 'mastery of space.'

"Such absolute superiority is not merely a matter of scientific pride and national prestige but essential to the future welfare and security

of the free world. Our government has emphasized that this requirement applies to every facet of our space efforts, because as Vice President Johnson declared: 'The present world situation allows us no choice. We must have a military as well as a civilian space capability. . . .'

"It is still too early to be specific about the vast potentials of military operations in space, just as it would have been impossible a few decades ago to predict what impact the airplane would have on military strategy and tactics. But there can be no doubt that the possibilities of military space operations are indeed staggering. It would, therefore, be folly to assume that the Soviets would fail to recognize these possibilities and would hesitate to exploit them for both their political and military ends.

"Under these circumstances, I believe that we have no choice but to take whatever precautionary measures may be needed, in spite of our desire to reserve space for peaceful purposes. This calls for a twofold task. First, we must achieve the capability to defend ourselves against the wartime use of space by any and all potential aggressors. Second, we must achieve a strategic space capability of our own which will help us preserve if not improve our deterrent posture throughout the future.

"I shall address myself only to the second requirement because, as an extension of our present strategic mission, it is of direct and utmost concern to the Strategic Air Command. Although SAC is no longer the sole nuclear strike force, it still represents between eighty and ninety per-

cent of the total nuclear firepower of the free world. Hence, SAC must continue to provide our principal military deterrent, regardless of whether it operates in the air or in space. . . .

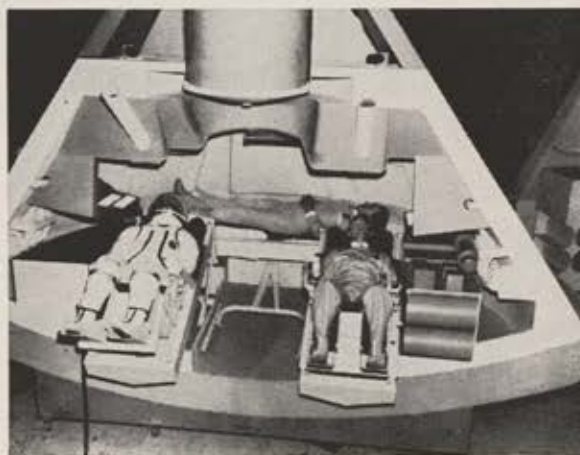
"To extend this mission into space SAC will need, in addition to its bombers and missiles, weapon systems that can perform the functions required by its mission in the space environment. This means that instead of the present mixed force of bombers and missiles, SAC eventually must have a triple-mixed force of aircraft, missiles, and spacecraft so that it can cover the entire spectrum of aerospace operations.

"There is as yet no manned space system under development that would meet SAC's future needs. There are various research projects and studies under way which are designed to explore the military potentials of manned and unmanned space vehicles. But none of them gives any assurance that, within the next decade, this country will have in operation a space system that could help us achieve and maintain 'mastery in space.' I submit that there can be no more important and urgent national project than the expeditious development of such systems.

"The SAC mission calls for a capability of reconnaissance and control of effective strategic deterrent forces in space. To permit a continuous space alert, if necessary, this weapon system must be maneuverable and, of course, be able to defend itself. I am convinced that such a weapon system should be manned . . . because it will need the reliability, judgment, and control only human operators can ensure.



Engineers at North American Aviation's Downey, Calif., plant view mockup built there of National Aeronautics and Space Administration's Apollo spacecraft. Technical direction of the Apollo moon-landing program is by NASA's Manned Spacecraft Center.



During normal cruise and lunar orbit, the three-man Apollo spacecraft crew will assume positions similar to these pictured in the mockup. One Apollo astronaut will remain in the commander's seat at all times, while others will be able to move about during flight.



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"All this will require intensive and coordinated efforts in many areas. . . . The most critical element, however, will be *time*. Whoever will assert his place in space first will be its master, and we simply cannot afford to lose the race for mastery of space. . . .

"Thus, while the Strategic Air Command has, in effect become a strategic aerospace command, the letters 'SAC' will continue to stand for what they have stood in the past—the free world's most powerful weapon for peace with honor."

We have quoted General Power's speech at some length because it is a thoughtful and candid statement by an American military leader on a supremely important subject. Radio Moscow to the contrary, it is by no stretch of the imagination a "bellicose" statement. The job of military men is to plan for the security of their countries, and, viewing the past record of the Soviet Union, there is little doubt that *its* military planners have worked long and hard at that job.

In recent weeks, there has been much talk of Soviet-American cooperation in the peaceful exploration of space, following Mr. Khrushchev's response to President Kennedy's suggestions on this score. It is, of course, much too early to tell if the Russians are serious or to define what they mean by cooperation. We have and will continue to talk with them whenever they are willing to talk, and one may suppose that miracles *are* possible. Peaceful joint Russian-American efforts in space technology could undoubtedly benefit the world and ease the cold war.

But if the Soviets are serious about cooperation, they owe the world and the US the courtesy of ceasing and desisting their incessant accusations that "aggressive circles" in this country are plotting space war. They know perfectly well that even if negotiations for a measure of cooperation are successful, the US is not going to denude itself of defense capability, any more than the Soviet Union would in the present state of the world. This fact by no means makes peaceful cooperation impossible. There are many areas where joint efforts can be undertaken: meteorology, communications, bioastronautics, to mention a few. The problem—and the Russians know it—is how much of their space technology they will show to the Americans. The Russian penchant for secrecy is a dreary ancient tale. It goes back to medieval Muscovy when foreigners were confined to a narrow portion of the city. But, withal, the Russians know that cooperation is possible and that its extent depends on them. They will



NASA spacecrew trainees will simulate round trips to the moon in Martin Company's 400-cubic-foot simulator designed for NASA's Langley Research Center, Va. Crew will "launch," make "lunar landings," and effect "earth reentry" in tests of up to a week.

just have to do better by way of deeds and words than this recent gem as broadcast from Moscow in English to North America on April 13:

"It is significant that the parents of Soviet triplets, ordinary people not particularly interested in politics, have named one of their children after an American Cosmonaut [John Glenn]. This is not only a tribute to the valiant American; it also reveals the desire of the Soviet people to place side by side the names of Soviet and US spacemen, to see our two nations aim jointly outward into space."

Doubtless true. The Russian man on the street would probably like nothing better than joint space efforts. And certainly most Americans support the concept of cooperation if the Soviet government meets us at least halfway. But official Soviet shrieking about American space bellicosity just isn't going to sell cooperation.

The irony in all this is that, even as General Power points out when he says, as quoted above, that "none [of the various US research programs under way] gives any assurance that within the next decade, this country will have in operation a space system that could help us achieve and maintain a 'mastery of space,'" our military effort in space is really quite conservative (*see AIR FORCE/SPACE DIGEST, April 1962*). We are damned if we do and damned if we don't by the Russians who somehow manage simultaneously to threaten us with their rocket prowess and denounce us for even thinking of military uses of space as contrasted with their "peaceful program."



Hughes Aircraft has developed a "third eye" it calls the *Electrocular*. The device allows airplane pilot or other specialist to watch video image from either a remote source on the ground or a control site such as a radar screen while performing his regular duties.

As Arnold L. Horelick pointed out in his "Power and Politics in the Soviet Space Effort" (*AIR FORCE/SPACE DIGEST*, April 1962):

"It is curious that in an era when the central concept of US strategy is deterrence . . . some Americans still manifest discomfort when confronted publicly with their country's military power. This distinctively American attitude has been exploited repeatedly to Soviet advantage, currently in connection with US military space efforts. . . . It is an ironic tribute to the persistence of the American attitude and to Soviet skill in exploiting it that until the most recent phase of the Berlin crisis, the US could still be made uncomfortable about justifying its acquisition of

new military capabilities (*e.g. in outer space*). . . ."

But then for once the Soviets may outsmart themselves by talking too loud and too long with a forked tongue. They may not only wreck the peaceful cooperation they say they want but also stir this country to more intensive efforts in the utilization of space for our defense, the last thing Mr. Khrushchev wants.

Space Capsules

Scientists and press heard a comprehensive report on Astronaut John Glenn's epochal first American orbital flight at a daylong meeting held in the Department of Labor auditorium in Washington, April 6. Of particular interest was Colonel Glenn's Pilot's Flight Report. Some of his comments follow. On weightlessness: "Weightlessness was a pleasant experience. I reported I felt fine as soon as the spacecraft separated from the launch vehicle, and throughout the flight this feeling continued to be the same. Approximately every thirty minutes throughout the flight I went through a series of exercises to determine whether weightlessness was affecting me in any way. To see if head movement in a zero-G environment produced any symptoms of nausea or vertigo, I tried first moving, then shaking my head from side to side, up and down, and tilting it from shoulder to shoulder. In other words, moving my head in roll, pitch, and yaw. . . ."

Colonel Glenn then described zero-G vision and physical exercise tests and went on to the subject of eating in zero-G: ". . . On the relatively short flight of Friendship 7, eating was not a necessity, but rather an attempt to determine whether there would be any problem in consuming and digesting food in a weightless state. At no time did I have any difficulty eating. I believe that any type of food can be eaten as long as it does not come apart easily or make crumbs. Prior to the flight we joked about taking along some normal food such as a ham sandwich. I think this would be practical and should be tried." Colonel Glenn ate squeeze-fed applesauce puree.

On what you can see from orbit: "As I looked back at the earth from space, colors and light intensities were much the same as I had observed when flying at high altitude in an airplane. The colors observed when looking down at the ground appeared similar to those seen from 50,000 feet. When looking toward the horizon, however, the view is completely different, for then the blackness of space contrasts vividly with the brightness of



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the earth. The horizon itself is a brilliant, brilliant blue and white. It was surprising how much of the earth's surface was covered by clouds. . . . The different types of clouds . . . are readily distinguished. There is little problem identifying them or in seeing the weather patterns. . . . Only a few land areas were visible during the flight because of cloud cover. Clouds were over much of the Atlantic, but the western [Sahara Desert] part of Africa was clear. . . . I believe . . . that most people have an erroneous conception that from orbital altitude, little detail can be seen. In clear desert air, it is common to see a mountain range 100 or so miles away very clearly, and all that vision is through atmosphere. From orbital altitude atmospheric light attenuation is only through approximately 100,000 feet of atmosphere so it is even more clear. An interesting experiment for future flight can be to determine visibility of objects of different sizes, colors, and shapes."

The Astronaut commented on what to this writer was one of the most moving aspects of the Glenn flight, the greeting from the city of Perth, Australia, via the glow caused by city and private-home lights turned on in profusion by the people of Perth for the Colonel to see as he passed over: "The lights of the city of Perth, in Western Australia, were on and I could see them well. The view was similar to that seen when flying at high altitude at night over a small town."

The illustrated report is 204 pages long, packed with interesting data, and belongs in your astronautical library. Write to the Office of Public Information, National Aeronautics and Space Administration, Washington 25, D. C., for information on availability, or to the Superintendent of Documents, US Government Printing Office, Washington 25, D. C. It's well worth the cost of \$1.25.

Although Colonel Glenn's successful orbital flight was an outstanding engineering and aeromedical success, there are still many questions that have to be answered, especially on the biomedical side, in longer flights. Two papers, among many presented at the April 9-13 annual meeting of the Aerospace Medical Association in Atlantic City, underscored the need for added information. Dr. Charles F. Gell, a veteran specialist now with the Astronautics Division of Chance Vought strongly urged intensified research on the basic effects of weightlessness on body cells. He said in part: "Two recent (incomplete) reports on Russian aerospace medical research involving the exposure of living cells indicate that the rates of mitosis [cell division] of both animal and plant cells increase during spaceflight, and that biochemical investigations have been stepped up to determine the basis for this increase. It was strongly indicated in these flights that the level of radiation was not high enough to have been responsible for producing the response observed. . . . There is a possibility of zero-G subtly interfering with the normal metabolic processes of the cellular constituents of the human body." Dr. Gell advocates experimental exposure of simple organisms in weightlessness for their entire life cycles to determine whether zero-G has permanent and deleterious effects on the cells.

Although eating has been successfully demonstrated in US and Russian orbital flights, there may still be problems associated with gastric activity in weightlessness, according to a paper delivered at the Aero Med meeting by Navy Lt. Cmdr. Norris K. Combs. Dr. Combs raises the question of food processing in the stomach and the lack of unanimity as to how much of a role gravity plays in moving food through the stomach. He suggests that "the weight of food plays a definite role in its ultimate passage to the pylorus where it is processed prior to gastric evacuation. If the food is without weight, it appears highly probable that muscle tonus of the upper stomach, stomach distention, and the usual method of exposure to gastric juices will be seriously impaired. Such impairment could pose a serious threat to man's performance and well-being in spaceflight. During early flights into space it might be necessary to provide personnel with [chemical] agents in order to stimulate peristalsis."—END

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Ready Room



By Jackson V. Rambeau

AFA DIRECTOR OF MILITARY RELATIONS

Rebuilding Job

President Kennedy's announcement on April 11 that units mobilized for the Berlin emergency will be released by the end of August clears up one major uncertainty about future plans of the Air Reserve Forces but leaves several other problems unresolved.

Chief among them is the question of rebuilding Air Guard and Reserve units on their return, particularly since a number of F-84Fs and all but twelve of the Reserve's C-124s are to be retained by the Air Force, along with significant numbers of officers and airmen who have applied for extended active duty.

The impact on the Reserve is considerable but not as

In building its two wings at MacDill, TAC has worked out a plan to leave Air Guard F-84F squadrons enough aircraft to operate but on a considerably reduced level. And here is where the new operating concept comes into play.

Under this concept, the *flight* would be the basic operating organization within a squadron, with three flights per squadron. The first flight would be a fast reaction force of eight planes, maintained at peak combat readiness with all support personnel and equipment. The second flight would be a follow-on force. If it, too, bore a C-1 rating, it could be used as a rotational replacement for the first. The third flight would be a standby, deployed only in an emergency.



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widespread as in the Guard. The five Reserve C-124 squadrons will return with sharply decreased UE. The other aircraft will be turned over to MATS.

To help meet the five-wing buildup in tactical fighters for the active Air Force, the Air Guard will give up a large share of its F-84Fs, at least for a while. But if a new operating concept now under discussion is adopted, Air Guard Thunderjet units will still maintain a useful degree of combat readiness.

In USAF's five-wing buildup, it will keep all the F-84Fs flown to Europe by the Air Guard. By replacing Guardsmen on a man-for-man basis between now and August, the capability of those four squadrons will be maintained, especially if, as is likely, a majority of the replacements—particularly pilots—will themselves be Guardsmen accepting extended active duty.

TAC will form two more F-84F wings at MacDill AFB, Fla., this summer. A fourth new wing, to be made up of F-105s, is to be established at George AFB, Calif. Plans for the fifth wing have not been announced.

With this structure, a wing of three squadrons could provide one task force squadron for deployment on short notice. Three wings could produce an operational wing.

Thus, despite the reduced equipment with which it will be working in the immediate future, the Air Guard could develop a combat-ready force of one-flight squadrons almost immediately after units return from active duty, building up the second and third flights as each squadron gains additional trained personnel and equipment.

New AFA Councils Formed

Pictured on this page are the members of AFA's new Retired and Airmen Councils.

Chairman of the Retired Council is Lt. Gen. William E. Hall, former CONAC Commander, now living in Washington, D. C. Serving with him are Brig. Gen. E. R. Barber, Miami, Fla.; Maj. Gen. Lucas V. Beau, Washington, D. C.; Cols. William F. Harrison, Springfield, Va.; Raymond J.

(Continued on following page)

Higgins, Annandale, Va.; and O. W. Lunde, McLean, Va.; and Lt. Col. Alan Wilber, Arlington, Va.

The Airmen Council is headed by MSgt. Francis E. Nowicki, Wayne, Pa., a former member of AFA's Reserve Council. With him are CMSgt. Robert Horace, Philadelphia, Pa.; MSgts. Emery P. Kertesz, Jr., Philadelphia; John R. Mann, Smyrna, Ga.; Robert T. Sanders, Alexandria, Va.; and Arthur L. Thornton, McLean, Va.; and CMSgt. James Atkeson, Alexandria, Va.

The USAF Retired List is growing rapidly as many twenty-year men are joining older regulars in retirement. Establishment of the Retired Council is one measure by which AFA expects to keep abreast of the problems and capabilities existing among this segment of Air Force personnel.

The Airmen Council is an outgrowth of a move last year to include airmen in AFA's Air Guard and Reserve Councils. Their contributions to these Councils have been so effective that AFA felt they should have a forum of their own to consider and act upon matters affecting active, retired, and Reserve Forces airmen.

Actions by the Councils

All four AFA military Councils met in Washington recently to act on matters affecting their spheres of interest. Those resolutions passed by the Councils and subsequently approved by AFA's Board of Directors were:

That the Department of Defense, to offset employer discrimination against Reservists, should be urged to reestablish its program of awards to civilian employers who



Guard aeromedical squadrons will get C-121s starting in July, following talks by Maj. Gens. Raymond J. Reeves, left, MATS Vice Commander, and W. P. Wilson, ANG Chief.

encourage their employees to serve in the Reserve Forces.

That the DoD be urged to allot the Air Force a more equitable share of available drill-pay spaces and call on the Congress to provide the Air Reserve Forces with modern equipment.

That AFA support a House bill to establish a uniform retirement system for full-time Air Guard technicians.

That DoD clarify the "extensive confusion" existing within industry on conflict-of-interest rules.

The Retired Council also asked that Congress be urged to reexamine dual compensation laws and urged Senate action on a House-approved bill to recompute retired pay.

The Airmen Council, noting that airmen manning of recovery units stands at only forty-three percent, urged that DoD be requested to authorize them forty-eight paid drills and suggested that such units be allowed to recruit nonprior-service WAF for administrative duty.

USAF Policy Committee Meets

One hundred percent manning in drill-pay spaces, adequate equipping of units returning from active duty, and establishment of an *ad-hoc* committee to improve the quality of its efforts were recommended to the Secretary of the Air Force by the Air Reserve Forces Policy Committee at its spring meeting in Washington, April 11-12.

The committee actually convened on April 2 for an eight-day visit to Air Guard units on active duty in Europe, and went into its normal session upon its return. Mr. John Lang, Deputy for Reserve and ROTC Affairs, characterized the visit as "extremely worthwhile to the Committee."

It declared that drill-pay restrictions are "redundant" because adequate program controls already exist in Ready Reserve authorizations, manning documents, and budget appropriations.

While noting that the current Air Force buildup may preclude units from keeping all their equipment when they are released from active duty, the committee recommended that, "consistent with availability of aircraft, sufficient equipment should be assigned to permit these units to retain their operational readiness."

Maj. Gen. Clarence A. Shoop of California, committee chairman, named a six-man *ad-hoc* committee to develop "methods of improving the quality of this committee's efforts in fulfilling its legal responsibilities" (in this connection, see "A Constructive Critique" in December '61,

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"Ready Room"). Named to the committee were Maj. Gens. Charles H. DuBois, ANG, and Prescott M. Spicer, USAF; Brig. Gens. Joseph T. Benedict, AFRes; Walter B. Putnam, USAF; and Edward R. Fry, ANG; and Col. Charles E. Heidingsfelder, Jr., AFRes.

In other actions the committee:

- Recommended establishment of a Reserve Forces Policy Committee for the new Air Force Communications Service;

- Urged that officers assigned as Reserve Forces advisers at major commands be explicitly assigned duties comparable to those of the Assistant Chief of Staff for Reserve Forces at Hq. USAF;

- Called for assignment of Reserve Forces advisers to the three new Defense agencies—for Supply (DSA), Intelligence (DIA), and Communications (DCA);

- Requested that Reserve Forces units be permitted to perform active-duty training overseas upon recommendation of their gaining commands; and

- Approved revisions in flying status regulations to terminate ratings of officers within one year of their release from EAD if they are not assigned to Reserve Forces duties requiring rated status, and under other similar conditions.

Ricks Event to Feature ANG F-102s

The Air Guard's seven F-102 fighter-interceptor groups have been invited to compete in the 1962 Ricks Trophy event this fall.

The event is traditionally scheduled in conjunction with the annual Convention of the Air Force Association, to be held this year at Las Vegas, Nev., September 18-23. AFA has sponsored the Ricks Trophy event since its inception in 1954.

Units invited to participate in the 1962 event are the 112th Fighter Group, Pittsburgh, Pa.; 114th, Sioux Falls, S. D.; 125th, Jacksonville, Fla.; 147th, Houston, Tex.; 149th, San Antonio, Tex.; 154th, Honolulu, Hawaii; and the 159th, New Orleans, La.

As in recent years, the National Guard Bureau is planning a combined operational exercise and speed run to determine the top combat-ready team among its F-102 units.

Competition will begin at Tyndall AFB, Fla., with a two-day interceptor weapons meet September 18-19, under auspices of the Air Defense Command. Then, after a day's rest, pilots will make a speed run from Tyndall to Las Vegas on September 21, with two intercept exercises and a refueling stop en route. They will depart Tyndall at ten-minute intervals, beginning at 7:30 a.m. (CST).

The first Delta Dagger is expected to arrive over Las Vegas about 10:00 a.m. (PDT) and the last sometime before 11:30 a.m.

"Rules of the event are designed to test the capability of ground crews and aircraft controllers as well as of the pilots," said Maj. Gen. W. P. Wilson, Deputy Chief of the Guard Bureau.

The winner will be determined by the best over-all score in the weapons meet and the speed run. But each pilot will be required to complete two valid intercepts during the run to Las Vegas. Anyone who fails to make two successful intercepts will be ineligible for the trophy, regardless of his total score to that point.

PARTING SHOTS....The Air Force Reserve may engage in a troop-carrier competition keyed to AFA's Convention this year. At press time, USAF had just okayed Tactical Air Command plans for a meet at Ellington AFB, Tex., in

mid-September with finalists of that meet to compete in a long-range airdrop mission terminating over the Indian Springs range near Las Vegas at the conclusion of TAC's firepower demonstration September 22. More details here next month. . . . More than 200 members of Congress have replied to a letter from AFA President Joe Foss to all Senators and Representatives setting forth achievements of the Air Reserve Forces on active duty.

USAF has authorized big increases in lieutenant colonel slots in Reserve Forces flying units. Fighter squadrons, for example, are allotted five light colonels—squadron commander, Ops officer, and three pilots. C-97 squadrons get eight—C.O., Ops., chief pilot, three other pilots, two navigators. C-119 units get six L/Cs, C-123 squadrons get eight. Slots for major stay about the same as before. . . . All Reserve troop carrier units, except those on active duty, will participate in joint exercises during FY '63 field training. Biggest exercise is Swift Strike II, August 5-19, with five wings and supporting units.

Field training for Air Guard units is slim this year, with thirty-one squadrons on active duty and many others engaging in year-around training. . . . Forty-two ANG squadrons won awards for an accident-free year during the Air Guard commanders' conference at Knoxville, Tenn., late in April. USAF flying safety plaques were awarded to the 127th Tac Fighter Squadron of Wichita, Kan., and the 146th

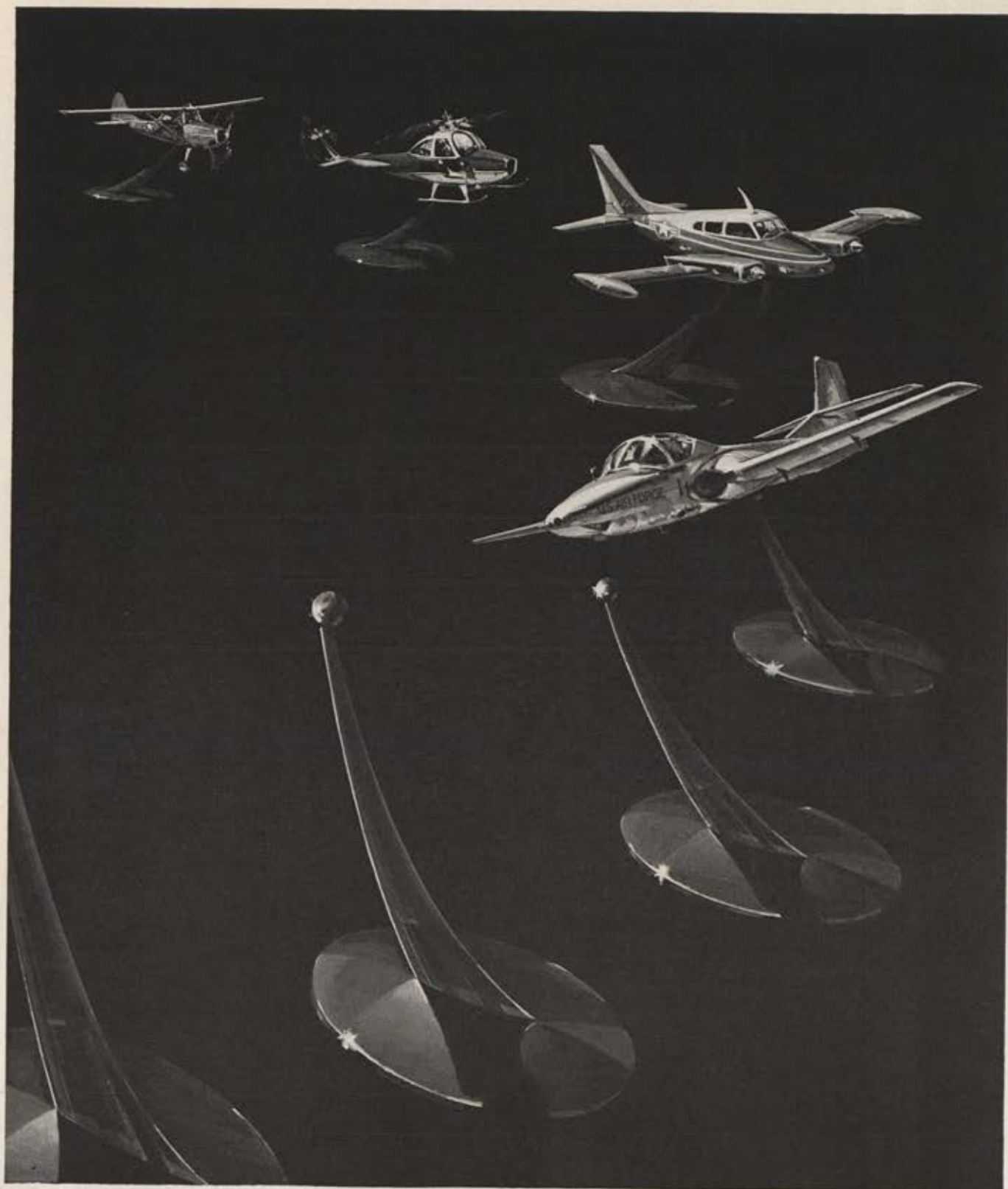


—US Air Force photo

Reserve Flying Safety awards are presented by Lt. Gen. Gordon A. Blake, CONAC Commander, to Brig. Gen. John Bradshaw, left, who heads the 434th Troop Carrier Wing, Bakalar AFB, Ind., and Col. Leonard Dereszynski, representing 96th TC Squadron, Minneapolis-St. Paul, Minn.

Fighter-Interceptor Squadron of Pittsburgh, Pa. ADC, TAC, MATS, and PACAF were represented at this conference (see cut).

Seven Senators rose in the Senate chamber recently to salute the Reserve Forces for exceptional service on active duty. They were Senators John Stennis of Mississippi, Henry M. Jackson of Washington, William Proxmire of Wisconsin, John Sherman Cooper of Kentucky, Stuart Symington of Missouri, J. Caleb Boggs of Delaware, and Ralph W. Yarborough of Texas. Earlier, Congressman Mendel Rivers of South Carolina had paid similar tribute in the House of Representatives. . . . The Hébert Subcommittee of the House Armed Services Committee is conducting extensive hearings on the status of the Reserve Forces. AFA will testify before the Subcommittee in mid-May and make specific recommendations for improvements of the Air Reserve Forces. . . . Seattle's two Reserve recovery squadrons conducted a simulated exercise at Sand Point Naval Air Station late in March.—END



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NEWS

SQUADRON OF THE MONTH

St. Louis, Missouri, Squadron Cited for significant accomplishment in aerospace education in the sponsorship of the Second Annual Aerospace Symposium.

Possibly the most successful AFA function held in St. Louis in all the years the organization has been active there was sponsored on March 9-10 on the campus of St. Louis University. This was the 1962 Aerospace Conference, hosted by the St. Louis Squadron under the leadership of Squadron Commander Edwin Howard, Jr.

Chess Pizac, then Vice President for the Midwest, served as General Chairman, with Howard and Cameron S. Orr, Missouri Wing Commander, as Vice Chairman. Others capably serving on the committee were Harold Wood, Parks College; Col. Leland Money, USAF; Kenneth Wander, Wing Vice Commander; Truman Mellies, Squadron Treasurer; and Kenneth Fetter, Squadron Vice Commander. All turned in topnotch efforts.

Joe Foss, AFA President, was the speaker for the banquet, while the luncheon featured a panel presentation by C. H. S. Murphy, St. Louis research consultant; Carl Gottlieb, Universal Match Co.; F. H. Langenfeld, Monsanto Chemical Co.; and G. C. Philpot, Emerson Electric Mfg. Co.

Keynote address was delivered by Everett Collin of the Educational Service Branch of NASA, followed by a lecture and demonstration on the Agency's space efforts by Dr. Elva Bailey.

Dr. Hubert Wheeler, State Commissioner of Education and a key member of AFA's Aerospace Educa-

tion Council, presided over the afternoon symposium, assisted by Mr. Collin; Paul J. Rodgers, Ozark Air Lines vice president; Marshall Benedict, FAA; and Dr. Evan Evans, Executive Director of National Aviation Education Council.

Complete cooperation was received from area education heads, and we're proud to pay tribute to a fine program with recognition of St. Louis as Squadron of the Month.

During California's tragic forest fire last November, Joe E. Brown was one of the notables who lost his Los Angeles home. Adding to the loss was the destruction of his lifetime collection of awards, citations, and trophies.

Several of these awards have been

replaced by the organizations that originally presented them, and on the evening of March 10 AFA made a second presentation of its Citation of Honor, presented to Brown in tribute to his wonderful contributions to Air Force men and women everywhere, and to the Air Force Association particularly.

Jimmy Doolittle, a founder and first President of the Association, made the presentation at a dinner sponsored by the Los Angeles Squadron on the occasion of its seventh anniversary. In accepting the Citation Brown said, "I never suggested that anyone should duplicate my trophies. The reason they are worthwhile is that they were given to me. But this whole

(Continued on following page)



At St. Louis Squadron Aerospace Symposium, Missouri Commissioner of Education Hubert Wheeler addresses the group. Others, from left, include: NASA's Everett Collin; Marshall C. Benedict, Regional Public Affairs Officer of FAA; and Paul J. Rodgers, vice president of Ozark Air Lines.

Mayor Tucker of St. Louis proclaims the week of March 9 "Aerospace Education Week," as NASA's Everett Collin, far right, explains operation of latest earth satellite. Others, from left: Regional V-P Chess Pizac; Mayor Raymond R. Tucker; Hubert Wheeler, State Commissioner of Education; F. H. Langenfeld, Monsanto Chemical Co.



Carl J. Long, far right, AFA Director, serves as Moderator at "God and the Space Age" program sponsored February 2 by Greater Pittsburgh Squadron. The panel, from left, includes the Rev. Frederick T. VanderPoel of St. James Episcopal Church; the Rev. Father Velimer P. Kovacevich, of Serbian Eastern Orthodox Church; the Rev. William Laird, AFA National Chaplain; Daniel Danieli, representing B'nai B'rith; and the Rev. Father Glenn T. Connor, Nativity Parish.

thing has made me realize how wonderful people really are." Obviously, people in AFA feel the same way about Joe.

• • •

Santa Monica Squadron has been in business since December of 1946, making it the oldest unit in the California Wing. On February 3 the members celebrated the Squadron's sixteenth anniversary with a big dinner-dance and awards ceremony at the Miramar Hotel, regular meeting place of the unit. More than 200 members and guests turned out to pay their respects.

Maj. Gen. Frank B. Rouse, Director of Materiel, ADC, was the guest speaker. Awards were presented to Miss Margie Oster, Santa Monica Evening Outlook; to Maj. Loren B. Lardon, Vandenberg AFB; and to Prof. Thomas A. Devine of Pierce College. A special tribute was paid to Joseph D. Myers, long-time member of the Santa Monica Squadron and Wing Organizational Director who recently moved from the area.

The arrangements were completed by Vera Wright, Chairman, and Billie Plunkett, former Squadron Commander, under the direction of W. M. "Bud" Mahurin, current Squadron Commander.

• • •

When the Robert H. Goddard Squadron, headquartered at Vandenberg AFB, Calif., held its installation dinner on March 23, it was planned as just a nice social affair. But the surprise acceptance of her invitation by Mrs. Goddard, the widow of the famed rocket expert, made it a memorable occasion for everyone concerned.

Some 150 members and guests got

acquainted with the charming lady who told them, in informal remarks, of her husband's dream of interplanetary travel, and said, "It is now up to you, and others like you, to make those dreams come true."

Prior to the dinner Jack Withers, later reelected Squadron Commander, escorted Mrs. Goddard on her first tour of the missile base, and, as though it were planned for her, they witnessed the launching of an Atlas ICBM.

At the dinner, where Past AFA President John R. Alison served as Toastmaster, John Beringer, Far West Vice President, installed the new Squadron officers. Other officers of the Squadron installed were Robert Weaver, Vice Commander; Alan Sannes, Treasurer; and William Dunlap, Secretary. All but Weaver were re-elected on the basis of the Squadron's highly successful first year of activity. Among the honored guests present was Lt. Gen. Howell M. Estes, Jr.,



Mrs. Robert H. Goddard, here with Jack Withers, Squadron Commander of AFA unit at Vandenberg AFB named in honor of her late husband, examines a poster that outlines some of the achievements of her scientist husband.

Commander for Aerospace Systems, AFSC.

• • •

CROSS COUNTRY . . . Word has just been received that the Ohio Wing will hold its 1962 Convention July 14-15, at the Imperial Hotel in Dayton . . . AFA's Past President Pete Schenk is passing out cigars these days in behalf of his new daughter, Andrea, born April 2 in Washington . . . With applications still coming in, the Ak-Sar-Ben Squadron in Omaha reports that its 1962 membership campaign was the biggest success of all, with more than 3,000 members enrolled. Board member Arthur C. Storz is the spark-plug of this effort and reports outstanding cooperation from all concerned, particularly the "team captains" at nearby Offutt AFB . . . AFA's Aerospace Education Council will meet in Washington May 11-12 to discuss the education programs to be held during the 1962 Convention.

—GUS DUDA



At sixteenth anniversary dinner-dance of Santa Monica, Calif., Squadron, from left: Prof. Thomas A. Devine of Pierce College; Col. John Oberdorf of the UCLA ROTC program; the guest speaker, Maj. Gen. Frank B. Rouse, Director of Materiel for the Air Defense Command; Vera B. Wright, chairman of the arrangements for the celebration; and Walker M. "Bud" Mahurin, Squadron Commander of the Santa Monica unit and one of the leading fighter aces of World War II.

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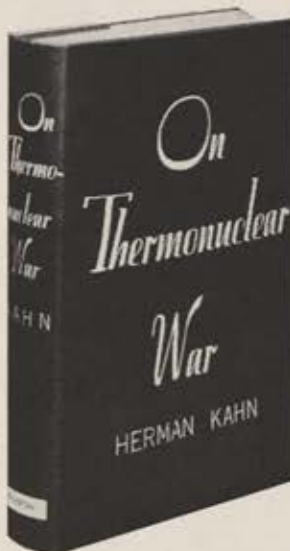
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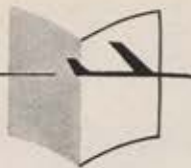
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airman's bookshelf

Competing Strategies

100 Million Lives, by Richard Fryklund (Macmillan Co., N. Y., 1962, 171 pp., \$3.95).

Reviewed by Col. Paul S. Deems, USAF

This is a first-rate analysis of a subject increasingly tortured by writers with competence in every area but nuclear warfare. It is not very elegant; it omits game theory and reliability data and other things attractive to scientists. The reporter's style will disqualify it for those who feel that the mystique of "deterrence" deserves a rationale at least as complicated as the defense budget. The easy assertions on survival will enrage those who feel that universal martyrdom is just judgment against mankind for unshackling the Promethean giant in the first place.

Fryklund's general approach is: Let's call "thermonuclear holocaust" by a less terrifying name and take a common-sense look at what can happen. What strategic alternatives are presented to us if our "peace-keeping" machinery fails? Will we be dead, will we be Red, or will we be neither but wish we were dead? The author sees an answer to these questions in what he chooses to call the No-City Strategy.

Fryklund describes four competing strategies: Pure-City, City-Plus, Devastation, and No-City. Pure-City (for those who prefer the semantic approach) equates with minimum deterrence; City-Plus equals finite deterrence; Devastation is "over-kill" or maximum deterrence; and No-City is counterforce. (There is a difference between counterforce and a City-Plus strategy with cities removed from the target list. The difference is that counterforce seeks a clear military win, as opposed to some lesser goal like stalemate.) The writer measures these in turn against the following criteria:

- Their value as a deterrent to attacks on the US, our allies and alliances, intrawar limitations against mass murder, Korea-type actions, "brushfires," and blackmail;
- The possibility (and aftermath) of accidental war;
- War-fighting capability, first- or second-strike;
- Reconstruction.

Pure-City, because only a limited number of "invulnerable" missiles is needed, is the cheapest strategy in peace but most expensive in wartime.

It cannot rescue an ally, war by accident is as bad as war by choice from the standpoint of casualties and postwar recovery, and it is no better in the first-strike role than the second-strike. Big conventional forces are needed to handle "brushfires" safely.

Cities-Plus has one advantage over Pure-City; there are enough weapons added to take care of all known significant military bases. But, while it can mitigate damage to the US to some extent, the fact that cities die if it is used lowers its credibility as a deterrent. The deterrent "gap" is filled with conventional forces, funded out of the savings realized by scaling down the Devastation force to City-Plus size.

A Devastation strategy is what most people think of when the term "massive retaliation" is used.

The Cities-Plus strategy has some strong supporters. It is the usual starting point for arms control and disarmament, though some, as Fryklund points out, would as soon start from Pure-City. If there is controversy, it is mainly between supporters of a "stable," arms-controlled City-Plus strategy and those who think that we might as well fight to win if something happens to ruin the so-called Balance of Terror.

Counterforce — or No-City — clearly comes out ahead in Fryklund's analysis. What's more, the exercise of restraint on both sides and the preservation of each other's population as hostages also results in saving 100 million American lives. Obviously, it isn't simple to fight a nuclear war this way: It means smaller weapons, very small CEPs, a durable strike/reconnaissance capability, sophisticated warning, and extra hard command and control. It also means a realistic civil-defense effort, cool heads, and steady nerves.

The author's arguments are clear and convincing, provided you have not, by service or personal bias, al-

ready decided that general war simply Kahn't be contemplated as a rational national alternative.

Some very hard questions are asked — and answered. The process may be unnecessarily painful to SAC, even though the author agrees "... the whole free world owes the officers and men of the Strategic Air Command an unpayable debt for keeping the peace in the postwar years. It was either SAC, a garrison state, or surrender, and SAC performed its nerve-wracking job superbly." As the Army does, Fryklund identifies SAC with the Devastation strategy. This is what it used to sound like, but nobody can deny it was also a successful deterrent.

Military forces are created and maintained to protect—not to jeopardize—the citizen and his property. Fryklund thinks the Secretary of Defense realizes that there is more to defense than is contained in the phrase "annihilation and surrender." There are options within options, now. We have multiple ways of waging war. Do we also see a way of ending it on our terms? This question is as important as any.

Reading *100 Million Lives* will be no substitute for the degree in social science which seems necessary to the study of war these days. It will, however, help you understand the emerging defense posture and what it will be able to do—or not do—if deterrence fails.

ABOUT THE REVIEWER: Colonel Deems, who is assigned to Hq. USAF in the Pentagon, regularly reviews books for AIR FORCE Magazine. He is the author of the poem "Paradise Beguiled" in the January 1962 issue.

The Russian Air Force

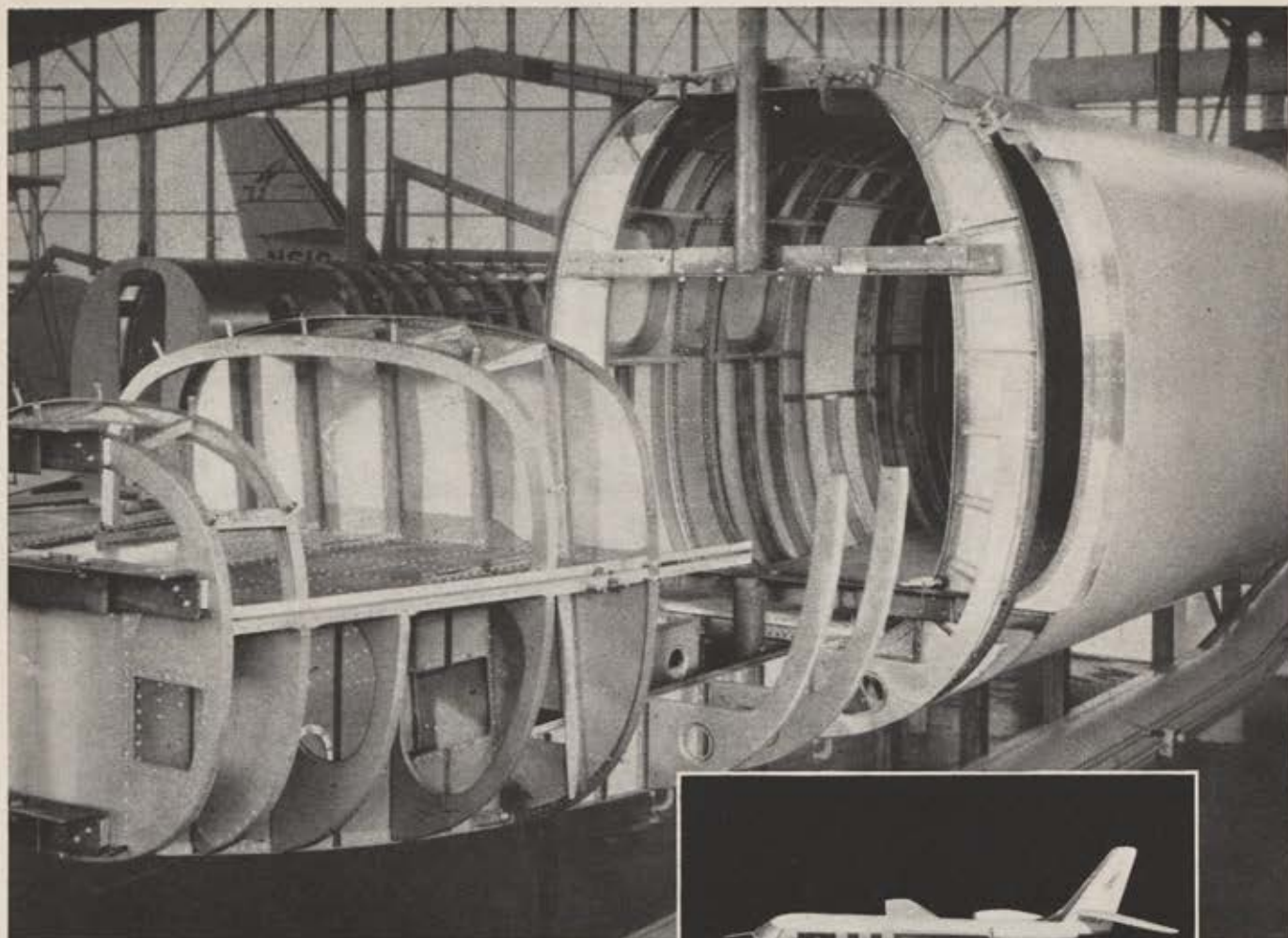
A History of Soviet Air Power, by Robert A. Kilmarx (Frederick A. Praeger, N. Y., 1962, 359 pp. \$7.50).

Reviewed by Col. Edward M. Collins, USAF

Studies of the Soviet have been perhaps least noteworthy in the field of Soviet military affairs, where Soviet security has shrouded much and revealed little. It is for that reason that Kilmarx's painstakingly researched and documented *A History of Soviet Air Power* provides a badly needed addition to scholarly work on Soviet subjects.

(Continued on page 87)

NOTE: Any book reviewed in Airman's Bookshelf may be obtained, postpaid, from the AeroSpace Book Club, 1901 Pennsylvania Ave., N.W., Washington 6, D. C. Full payment must accompany order. Information on the Book Club may be obtained from the same source. Club members are eligible for substantial savings on Club selections.



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11. Loss of life shall not be deemed as loss for purposes of this insurance.

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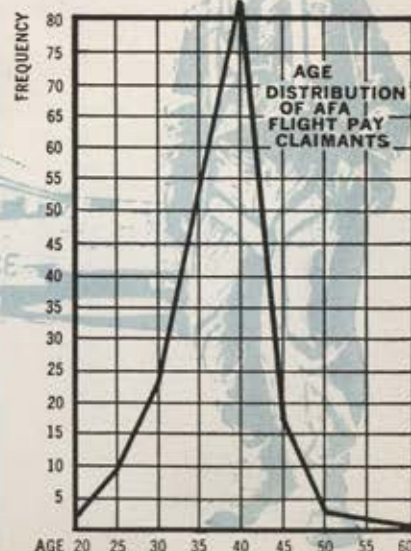
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The book traces the development of Soviet military aviation from its birth in the pre-World War I period to its present maturity as a jet aircraft and guided missile force, supported by advanced technology and a highly developed industrial establishment and striding confidently into the space age. Chapters are devoted to the period prior to the October Revolution in 1917, the civil war period of 1917 to 1922, the influence of the formative 1922-1932 years, and the developments during the period (1932-1941) which foreshadowed World War II.

A separate chapter is devoted to World War II. This is followed by a chapter showing the transition of Soviet airpower from an adjunct of the Soviet Army to a force which retains its interest in supporting surface operations but has broadened its scope to provide powerful strategic nuclear delivery capabilities as well. The climb from technological inferiority to technological sophistication is also developed in this chapter, which sets the stage for a concluding chapter on the increasing Soviet strategic delivery threat during the 1953-1961 period.

The whole is documented with footnotes which, happily, are organized by chapters and placed after the text, where the reader may consult or ignore them, as he chooses. There is an appendix on "Designation Systems for Soviet Aircraft," a comprehensive bibliography, and an index.

In a work of this kind, sources and documentation are of the greatest importance, for sound scholarship cannot compensate for simple lack of information or unreliable data. Much of the early history is based on reports from American military attachés in Russia or countries bordering it, such as Poland or Latvia. Official Soviet publications contribute to this era, and, of course, the memoirs of Russian expatriates and of Western officials with direct experience in Russia during the period have been extensively used. A wide variety of sources support the narrative for the period from about 1925 to the eve of World War II, without any one of them dominating.

The World War II discussion is supported by much material from official sources or from the memoirs of participants. The period after World War II benefits from the generally increased interest in Soviet power since that time, and the vastly increased reportage from the Soviet Union—for example, from the reports of the Twining visit, from testimony

of US officials before congressional committees, and from reports of the Soviet air shows. There are, of course, parts of the book where one might wish for greater certainty, but on the whole the surprising feature is not that so much can be said regarding the development of Soviet airpower, but that what is said can be so comprehensively supported.

Dr. Kilmarx's book is, apparently, the first attempt to use the historical method in a comprehensive treatment of the Soviet Air Force from its origin to the present. Like most pioneering efforts, it is not without its imperfections, primarily because of the difficulty of organizing the material and maintaining the flow of narrative in a subject with so many ramifications. On the other hand, the book is valuable precisely because so many aspects of the subject are covered, and it is likely to become a standard reference work for that reason.

This reviewer would like to see greater attention given in future editions to the operational practices and doctrine of the Soviet Air Forces from the beginning of World War II until the present. In many ways, this period marks the full emergence of airpower as a major force in world affairs. The development of strategic thermonuclear delivery capability by the West, followed at some distance by a similar growth in the Soviet Union, has profoundly influenced strategic thought in both the Western and the Soviet camps. More coverage of this influence, and the general interplay between Soviet strategic thought and the advance of Soviet technology and thermonuclear delivery capability, would have been most welcome.

ABOUT THE REVIEWER: Colonel Collins is Chief, Special Advisory Group, Assistant Chief of Staff, Intelligence, Hq. USAF. He has written and lectured on problems of military strategy with particular emphasis on the Soviet bloc.

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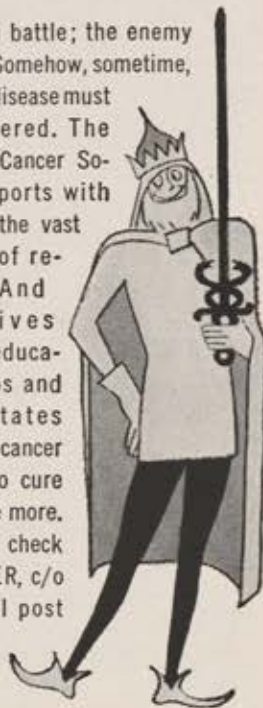
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Now the Bell System integrates switching and transmission in a new digital communications system

Right now transmission and switching of communications are *separate* functions. They are usually performed by space-divided processes.

However, the development by Bell Telephone Laboratories of an experimental high-speed electronic model called ESSEX (for Experimental Solid State EXchange) may change all of this. And it may revolutionize military as well as civilian communications systems.

ESSEX works on a *time-division* principle. For the first time, it integrates both transmission and switching.



Above is an over-all view of the ESSEX (Experimental Solid State EXchange) research model set up at Bell Laboratories. Units behind the control console are only half of the total equipment.

Faster, more efficient service

By harnessing time, ESSEX may introduce the following revolutions in communications:

More messages can be transmitted on fewer lines. Through the use of Pulse-Code Modulation (PCM), signals are converted into coded, digital pulses. These pulses are carried at high speeds to their destinations on just a few lines and are then reconverted to standard signals for delivery.

Central office switching networks can be much smaller. The PCM conversion is done at special "concentrators" close to a number of customers. Today every telephone is connected to a central office by two wires. By consolidating many signals on a few lines, the "concentrators" will allow central office switching networks to be much more compact.

Promising Development

Although full-scale use of ESSEX is still in the future, it shows how Bell System developments arising out of basic research can pyramid into extraordinary communications advances.

ESSEX becomes practical through Bell Laboratories' discovery of the transistor and developmental work with semiconductor devices. What ESSEX will lead to—in both military and civilian communications—only the future can tell.

This is another example of the Bell System's continuing efforts to improve communications techniques and services.



Bell Telephone System

THREE YEARS and 39 DAYS

On January 12, 1959 the National Aeronautics and Space Administration (NASA) selected McDonnell Aircraft Corporation for the design and construction of a manned spacecraft to be launched by an Atlas booster, placed in a controlled orbit around the earth and returned safely. This project was called Mercury.

Twelve months and 3 days later the first spacecraft was delivered for flight testing.

On January 31, 1961 a chimpanzee was boosted into space in a Mercury Spacecraft. After a 418 mile flight down range, the spacecraft and Astro-Chimp, Ham, splashed into the Atlantic and were recovered safely.

Two years, three months and 23 days after the contract was announced, Astronaut Alan Shepard climbed into a Mercury Spacecraft for a down range flight witnessed by the world. Eleven weeks later, Astronaut Gus Grissom duplicated the feat.

On November 29, 1961, another high flying Chimpanzee, named Enos, rode twice around the earth and was successfully recovered.

... the Evolution of a Spacecraft



Three years and 39 days after the project began, a Mercury Spacecraft carrying Astronaut John Glenn was launched by an Atlas booster and placed in a controlled orbit. After three orbits, spacecraft and astronaut returned safely to the Earth and were recovered. It is significant to note that the initial assignment has been completed. The Mercury Spacecraft is now operational, a literal laboratory for astronauts as they continue the study of man's capabilities in space. McDonnell is now designing and building a two-man spacecraft for NASA. Called Gemini, it will be capable of long term orbital missions and rendezvous with another space vehicle while in orbit. Chapter 1, Book 1 of a great new American enterprise has now been written. Chapter 2 is just beginning.

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