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The Role of Aerospace Defense

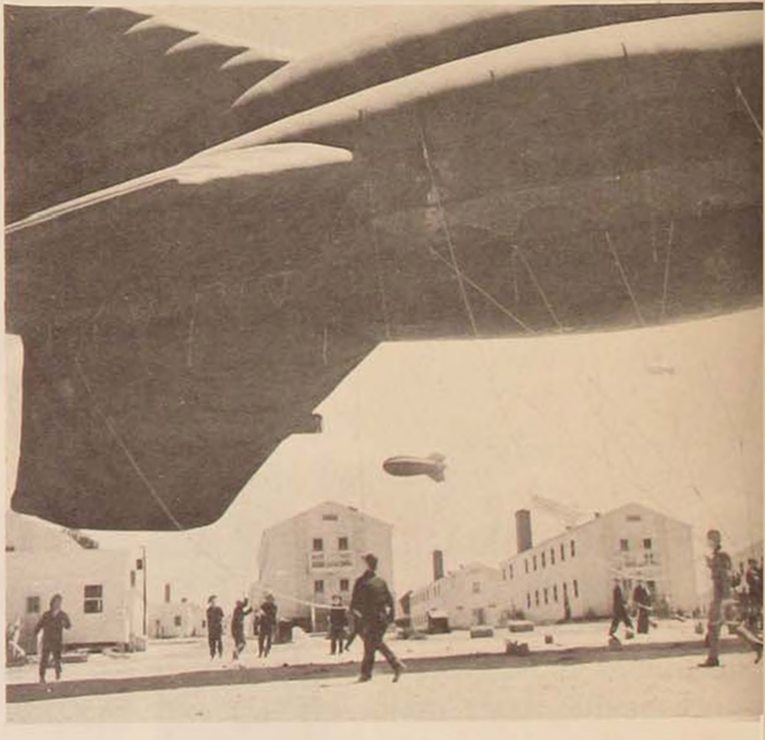
Lieutenant General Robert M. Lee

THE COMMAND Museum at my headquarters has on display a paper by Major Gordon P. Saville dated 1941 and entitled "Air Defense Doctrine." What becomes apparent from a perusal of this document is the fact that air defense doctrine has changed very little since Saville, later major general, did his definitive work. The purpose of this discussion is to consider whether the role of air defense today is consistent with the doctrine we have laid down for it.

A thumbnail sketch of the history of air defense since World War II will suffice to show that the $8-billion air defense establishment which the United States Air Force maintains today is different only in degree from what we had in World War II.

It is not generally understood that the United States possessed a fairly adequate air defense system during World War II. Considering

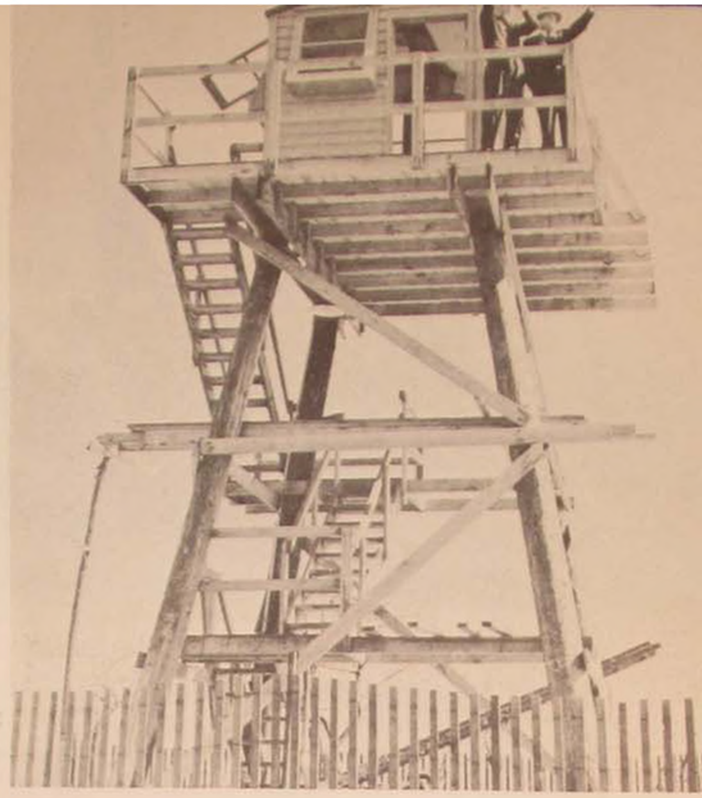
This SCR-270 radar site near Portland, Oregon, was one of 65 World War II stations along our Pacific Coast. Maximum reliable range of the SCR-270B Mobile EW Radar tracking bombers at 10,000 feet was 80 to 100 miles. For fighters it was 50 to 75 miles. Resolution in azimuth was 28°, in elevation, 10°. The SCR-271DA Fixed EW Radar had a maximum reliable range of 90 to 120 miles for bombers at 10,000 feet, 60 to 75 miles for fighters. Its resolution in azimuth was 11° and in elevation 12°. The mobile radar had a maximum range scale of 150 miles, and the fixed radar had a base-line range of 300 miles. Both had a minimum range of 5 miles.



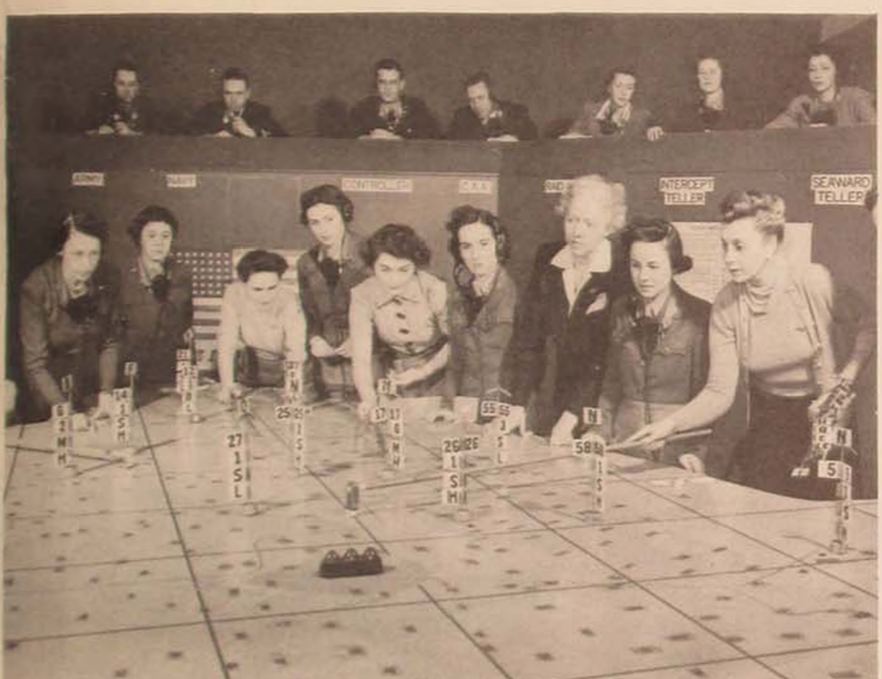
Air barrage balloons were used early in World War II to guard military objectives along the West Coast. The balloons, maintained by the United States Coast Artillery, were anchored by a web formation of steel cables intended to shear off the wings of attacking aircraft.

the relative security which the two oceans provided, it is significant that we had in being 95 radar stations—65 on the Pacific Coast and 30 on the Atlantic. While these radars—the SCR-270 (mobile) and the SCR-271 (fixed)—were crude, they represented a vast improvement over nonelectronic techniques. In 1943 ground-controlled interception radar (SCR-588) was added for close-in coverage (up to 50 miles) to permit tracking and controlling aircraft from the ground.

The beginnings of a Ground Observer Corps had been made by ADC in two large-scale exercises in August 1940 and January 1941.[1] By

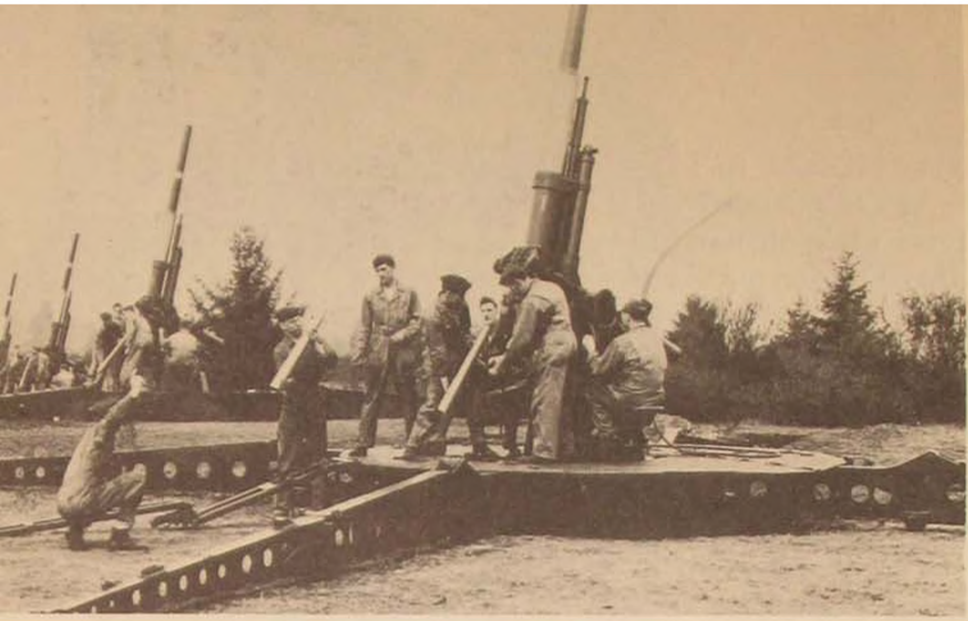


In 1942–43 the civil population played an active role in the air defense of the United States. Many volunteer workers watched at civilian observation posts. Others were plotters with the Aircraft Warning Service, helping identify planes whose standards were placed on the map. Unidentified aircraft were intercepted by Army AF pursuit planes.



February 1942, 9000 observation posts had been set up along the East Coast, 2400 along the West Coast, and 3000 along the Gulf Coast. These 14,400 posts had an estimated one and one-half million volunteers enrolled.

After Pearl Harbor antiaircraft commands were established on both coasts, the First and Fourth Antiaircraft Commands. By 1943 Army doctrine had accepted the tenet that control of AA belonged to the air defense commander. Barrage balloons were employed in the early years of the war, but the units were inactivated on 18 August 1943.



A 3-inch antiaircraft battery of the 205th Coast Artillery prepares to fire during maneuvers in March 1941. The M3 (mobile) antiaircraft gun, with a bore length of 50 calibers, was chambered to use M1918 fixed ammunition as well as shrapnel or high-explosive shell; with the former it had muzzle velocity of 2600 foot-seconds and with the latter 2800 foot-seconds. Here the M3 uses the mobile-trailer-type M2 mount, known as the "spider" mount.

Eighth Pursuit Group pilots rush for take-off in P-39 Airacobras during 1st Interceptor Command maneuvers, December 1941. The same month, after the attack on Pearl Harbor, the 8th was assigned to air defense of the New York City area

While fighter aircraft were always in short supply,* their operation was essentially the same as today. A typical alert order on the East Coast early in 1942 called for one four-plane flight per squadron to be kept on alert from dawn to dusk. The theory behind this sparse manning was that the defense of the country could be ensured by denying the enemy operating bases in the Western Hemisphere. As General Marshall testified before the Senate in 1940:

*In mid-January 1942 there were 12 pursuit planes available for the defense of New York City.

> What is necessary for the defense of London is not necessary for the defense of New York, Boston or Washington. Those cities can be raided . . . but continuous attack would not be practicable unless we permitted the establishment of air bases in close proximity to the United States.[2]

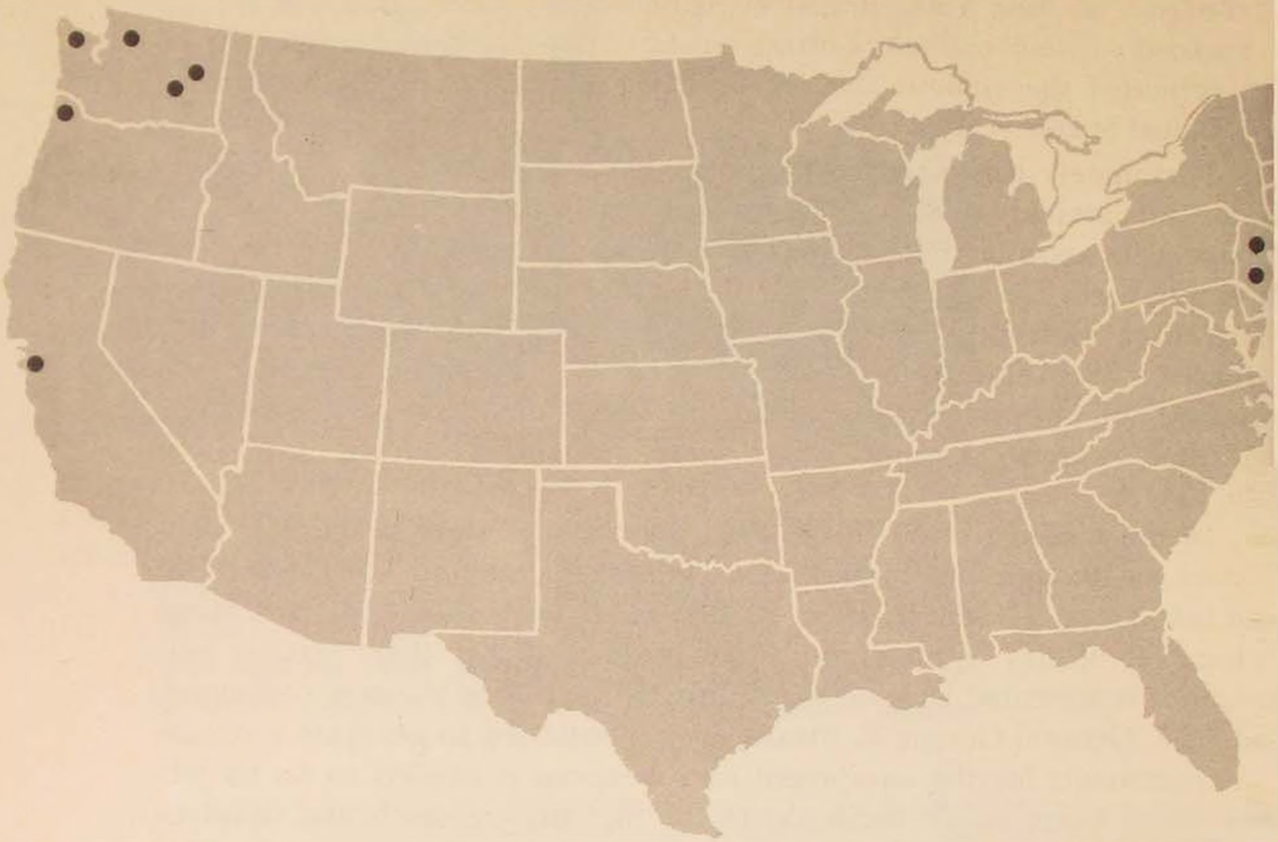
Fortunately this air defense system never had to operate against a major air attack. After the Battle of Midway, when the threat of Japanese invasion of the U.S. was broken, air defenses were progressively de-emphasized. In October 1943 the Joint Chiefs of Staff reduced the coasts to a Category "A" alert, i.e., "probably free from attack, but defenses to be retained for political reasons." In April 1944 the JCS dissolved the Ground Observer Corps, reduced the radar net, and closed the filter centers. Fighter wings were disbanded during June and July 1944.[3]

In the period from 1945 to 1948 air defenses were practically non-existent. Although the present Air Defense Command was formed at Mitchel AFB on 27 March 1946, its first years were lean and frustrating. A handful of day fighters plus some radars of less than certain performance represented its total capability. Nevertheless the new command, under Lt. General George E. Stratemeyer, continued to generate a stream of requirements for the equipment and weapons it needed to do its job. The record bears ample testimony to the fact that research and development on guided missiles and on a defense against the intercontinental ballistic missile (ICBM) were being vigorously urged in 1946—three years before the Soviet Union exploded an atomic device.[4]

That these pleadings fell largely on deaf ears is partially understandable when we remember the period of national complacency that followed World War II. Our atomic monopoly plus the bright promise of the United Nations organization made Air Force advocates of ICBM defense sound almost alarmist. It was not until the Berlin Blockade, the rape of Czechoslovakia, and the outbreak of the cold war that attention was again focused on air defense. Attention changed to urgency when in 1949 the Soviets beat our estimate of their timetable by several years in attaining an atomic capability. Any remaining doubt about the necessity for air defense collapsed when fighting broke out in Korea in June 1950.

The slow buildup had started in March 1948, when ADC was ordered to take World War II radars out of mothballs and deploy them to guard the Seattle-Hanford target complex. Inexperienced handlers plus inadequate radars made this northwest air defense system a farce. The same frustration was experienced in the northeast and at the atomic complex in New Mexico. But throughout 1948 and 1949 this deployment continued. By 1949, after a number of false starts, Congress approved the building of what came to be known as the P-system (Permanent System), consisting of 75 stations equipped with CPS-6B and FPS-3 radars—now obsolete but then the greatest thing going.

The radar net in 1948



The Lashup or temporary radar net, 1950

The "Permanent" radar net, 1953

When the Communists seized power in Czechoslovakia in February 1948, our continental air defenses were at their lowest ebb—one active radar station in the United States and four radar sites in Alaska operating only a few hours each day. Later that year the situation was somewhat improved; several radar sites were activated in the West, Northwest, and Alaska, and in the Northeast a few World War II radar sites were reactivated. In 1949 Congress approved the 85-station (75 in the U.S., 10 in Alaska) "Permanent" radar network, but this system was not scheduled for operation until 1952. In the meantime the Nation was still virtually unprotected; so to provide interim protection for California and the northeast and northwest sections of the country, the Lashup network of radar installations was hurriedly completed by mid-1950. The Lashup system constituted our radar defense until the Permanent System finally became operational in April 1953.

By 1951 the post-WW II lean years were eased in air defense. But although money was now available, the state of the defensive art made painfully slow progress. This slowness was in startling contrast to progress in the offensive art, which was producing better bombers and better countermeasures and was generating disquiet in air defense ranks by news of breakthroughs in ballistic missilry. In the mid-Fifties the operational system in air defense was still the "eyeballin' and grease-pencilin'" method.

The introduction of SAGE in 1958 represented the first Air Force innovation in air defense techniques since World War II. The deployment of the system was not completed in the U.S. until December 1961. Meanwhile slow but steady improvements in radar, interceptors, and armament (including nuclear missiles) have added considerably to our capability against bombers. In addition we now have the Bomarc missile in the northeast, although its final deployment represents about 20 per cent of the originally planned Bomarc program.

In the late Fifties national concern over a "missile gap" abruptly shifted emphasis from completion of our defenses against the manned bomber toward defense against the ICBM. In 1959 the Department of Defense, assuming a calculated risk, radically curtailed expenditures for bomber defenses in favor of accelerated efforts toward ICBM defenses. One of the programs which benefited from this change was the Ballistic Missile Early Warning System (BMEWS), two stations of which are now being operated by ADC. What suffered were Bomarc, SAGE, and the follow-on interceptor.

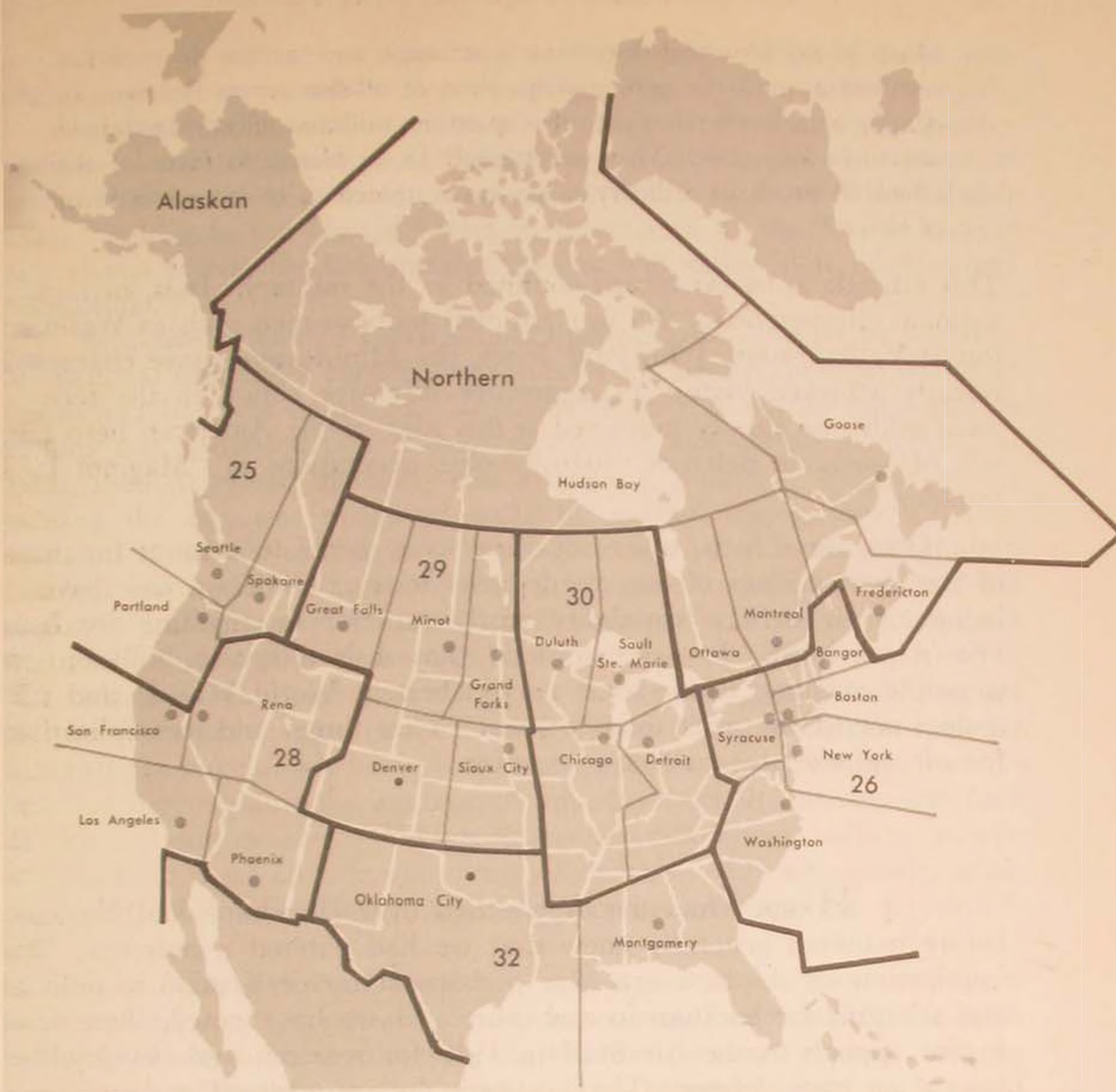
The first year of the Sixties gave us an idea of the shape of things to come. In addition to its missile-detecting capability, the BMEWS system was being used to detect man-made objects in space. The Space Detection and Tracking System (SPADATS), a computerized facility for keeping an inventory of all man-made space objects, was being operated by ADC and fed from sensor sites throughout North America and at oversea points.

Thus, for all practical purposes, active defense weapons for use against manned bombers are now about as complete as planning and funding permit. Our current efforts primarily involve means to preserve the force we have, and the big push is into space. Of its four basic functions—detection, identification, interception, and destruction—ADC is already performing the first two in the space environment.

Three facts become apparent from a consideration of the history of air defense:

▲ The first is that there has never been a significant technological breakthrough in air defense. What progress has been made has come through gradual improvement of basic equipment—radars, interceptors, weapons. The possible exception might be the SAGE system, but even this was five years in planning and was basically the application of computers to classical air defense procedures.

▲ Secondly, since operational concepts are directly related to the characteristics of available weapons, there has been as little change in operational concepts as in weapons through the years. Major Saville held in 1941 that "the purpose of a general air defense is to defend a large area embracing a greater number of potential objectives than can be defended effectively by local defenses."[5] Fifteen years later the Secretary of Defense similarly stated that "area defense involves the concept of locating defense units to intercept enemy attacks remote from and



The divisions and sectors of the present SAGE system

without reference to individual vital installations."[6] The Air Defense Command is today operating on the same concept of area defense in depth that motivated Saville. This is not to say that the concept is wrong but only to suggest that the concept might today be radically different had there been any significant breakthrough in air defense weaponry.

▲ The third fact—and one which may explain the other two—is that neither the Nation nor the military services have ever been defense-oriented. Except for hectic and illogical periods, such as the 1948–49 push to acquire *some* kind of defense immediately, air defense has largely been something we take care of when the problems we currently consider more demanding are on the way to solution. As Bernard Brodie of the RAND Corporation puts it:

> Much of the historical discussion of strategic and tactical doctrine has revolved around the perennial question of offense *versus* defense. In dealing with issues relating to that question, military officers are trained not to be objective. They are trained to be biased in favor of the offensive, much as ordinary persons are trained to be biased in favor of virtue.[7]

This attitude is by no means confined to the military. It is, in fact, a national characteristic. All our national heroes—men such as Washington at Valley Forge, John Paul Jones, the Minutemen—have characteristically achieved victory by aggressive offensive action in the face of great odds. So deeply ingrained is this idea of the American hero that talk of adequate defenses usually evokes accusations of "Maginot Line thinking."

These three facts, taken together, seem to me to account for many of the shortcomings of our air defenses today. While we now have in being an air defense capability vastly superior to anything we have known previously, I would contend that it is a system built on the principle of doing better what we did best in World War II and that it does not wholly meet today's threat. That threat and its implications for air defense we shall now examine.

HARDLY had the dust settled over Hiroshima and Nagasaki before mankind generally knew that we had entered a new era. The implications of this new era were perhaps better understood in military and scientific circles than in any other. As we have noted, there were urgent appeals in the Air Staff in 1946 for research and development toward an ICBM defense. That we have not yet attained one may some day prove to have been the Achilles' heel of Western civilization.

We are presently committed to a counterforce strategy, and this is well. Were we not so committed, then the alertness and aggressiveness necessary to assure ourselves of being able to withstand the first blow would be such as to provoke rather than prevent all-out war. Nevertheless we must realize the implications of this strategy as they affect our nation and our military doctrine.

Regarding the Nation, it is difficult to imagine what is involved in absorbing the first blow in the complete absence of ICBM defenses. Britain's Sir John Slessor, who was present when an earthquake in 1935 wiped out the city of Quetta in Pakistan, has some words on the subject:

> When people talk light-heartedly about that sort of thing on a widespread scale not being decisive, I have to tell them with respect that they do not know what they are talking about. No country could survive a month of Quetta earthquakes on all its main centers of population and remain capable of organized resistance.[8]

When we talk about absorbing the first blow and going on to win, we imply that we survive as a social entity. This may be entirely possible, if we provide the active and passive means of doing so. By passive defense I mean shelters, civil defense organizations, and the means of rehabilitating the Nation after attack. I would agree with Dr. Teller that "as long as the United States is unprepared to absorb and survive an all-out attack, the Communists have a temptation that might prove irresistible."[9]

By active defenses I mean simply that we must develop, as a matter of national urgency, a capability to counter nuclear weapons in whatever form and however delivered. How this is done is not as important as selling the conviction that it *must* be done. Once we are convinced of that, then American ingenuity can attack the problem. That ingenuity during the last war produced synthetic rubber, high-octane gasoline, radar, and the atomic bomb. To produce the A-bomb, the Manhattan Project involved the expenditure of three years and $2 billion and the enlistment of an army of scientists and engineers. In my view, an ICBM defense would justify another Manhattan Project.

Marshal Malinovsky, in his recent statement to the 22nd Congress of the Communist Party of the Soviet Union, said that "rocket-carrying aircraft are increasingly being introduced, capable of delivering a rocket–nuclear blow against the aggressor from afar without entering the zone of his anti-air defense."[10] Thus when we talk about ballistic missile defenses we must include all means of delivery—aircraft, missile, satellite, and submarine. Short-range defenses against bombers are simply not enough.

Even this brief consideration would appear to support the thesis that military and civilian alike must do some serious thinking about air defense. Indeed we should have started the process 15 years ago. In an era when air defense and survival have become almost synonymous terms, we cannot afford to procrastinate because of old habits of thought.

I sometimes feel that we have developed a mental block, precisely at the point where deterrence fails. We refuse to plan for or even to contemplate what happens thirty days *after* an all-out thermonuclear war begins. There is a crucial difference between 20 million dead and 60 million or 100 million. Somewhere in this destructive process we reach the national point of no return. Unless we resolutely study these somber possibilities and plan for them, we may well be living in a fool's paradise.

Time is running, and it may be precious. In warfare itself time as an element of strategy has practically disappeared. From Pearl Harbor to the invasion of North Africa there was an interval of 11 months. From a BMEWS warning to the impact of warheads there may well be only 14 minutes. While no one today seriously contemplates an industrial buildup after the initiation of hostilities, the point we miss is that the time for that buildup is now.

A further fact which lends urgency to the situation is the almost total involvement of civilians in modern warfare. They produce the weapons and will suffer the casualties. We have never previously been in a situation where the land and people who constitute our home base of operations have been vulnerable to immediate, devastating attack. If this base is destroyed, then subsequent military action loses meaning, for our people collectively represent the political and social institutions which we seek to defend. They own the capital, produce the goods, and man the instruments of war. In them resides the will to resist which, once broken, makes further military measures impossible.

One might even go further and say that survival in the event of attack is no longer a purely military problem. No foreseeable air defense can ever be so completely effective that the civilian community can carry on business as usual. As Virgil Couch of the Office of Civil Defense points out, shelters must be accepted and used as routinely as smallpox vaccinations—not pleasant, but necessary.[11] The active defense function is a military responsibility, but it suffers from lack of civilian interest. If the day should ever come when civilians generally took a direct interest in the type and quantity of air defenses in their locality, considerable momentum in the program might result. In any event civilian interest in air defenses is not only legitimate, it is long overdue.

We know that the Soviets lay great stress on air defense. We also know that the Soviet population has been exposed to mandatory civil defense training and that a shelter program has been pursued for some years.[12] What happens if the Soviet Union achieves the first technological breakthrough and produces a good ICBM defense as well as passive defense? What happens to our position at the bargaining table? Will there be a bargaining table? I hold that the side which first attains an adequate ICBM defense will gain a decisive political as well as military advantage.

Last year I had the dubious pleasure of participating in two ceremonies, one accepting the last of the F-101's and the other accepting the last of the F-106's presently programed for ADC. Our Bomarc deployment is also practically complete. This means that for the first time in a decade there are no new Air Force weapons in the pipeline for air defense.

Let me be clear on the fact that we have a better air defense capability today than we have ever had before. We exercise the system constantly. The consistent result of these exercises over the last two years has been that we regularly destroy a very high percentage of the invading force. We have attained speeds, altitudes, and lethal capabilities which were only dreams a few short years ago. Our BMEWS system is looking thousands of miles into space. Our SPADAT Center can give the precise location of any object in space orbiting the earth at any time. My hope is that we do not stop at this point. We need interceptors and missiles that can cope with standoff weapons, we need a capability against the submarine-launched ballistic missile (SLBM), and most especially we need an area ICBM defense.

We need these things because, as I have tried to show, air defense

Lieutenant General Robert M. Lee, Commander of the Air Defense Command, accepted the last F-101B Voodoo from James S. McDonnell, Jr., during ceremonies held 13 March 1961 at the McDonnell Aircraft plant, St. Louis, Mo. On 20 July 1961 General Lee accepted the last F-106 Delta Dart during similar ceremonies at the General Dynamics–Convair Aircraft plant, San Diego.

in the nuclear age has become a *sine qua non* of national survival. It is no exaggeration to say that air defense is an indispensable basis upon which our whole counterforce strategy rests. I do not think we have given sufficient thought or recognition to this fact.

Air Force doctrine states that "survival in aerospace war dictates that offensive and defensive operations . . . must be linked to defeat enemy aerospace force." That doctrine further holds that "an aerospace defense system is indispensable to national security."[13] We certainly have no quarrel with this doctrine; our interest is in the means to implement it. I suggest that senior officers seriously think through the meaning of this doctrine, the meaning of counterforce and second-strike capability, the meaning of survival and what it takes to ensure survival. As Bernard Brodie puts it, "The rejection of a preventive war solution has committed us to a deterrence strategy, and we must now prove ourselves ready to pay the full price of such a strategy."[14]

Let us be clear on the fact that the conflict in which we are engaged is a total conflict. We can lose it economically, politically, psychologically. Conceivably we can also win it without firing a shot. But the ability to survive and strike back is the fundamental factor which underlies and gives validity to our nonmilitary measures in the conflict with Communism. Prudence would seem to dictate that this ability be the best we can make it.

Speaking recently before the Senate Committee on Armed Services, Secretary McNamara stated, "There is no question but that, today, our Strategic Retaliatory Forces are fully capable of destroying the Soviet target system, even after absorbing an initial nuclear surprise attack . . ."[15]

These are reassuring words coming from the highest authority in the Department of Defense. Certainly the alert measures, the dispersal program, and the hardening efforts of our strategic forces have contributed greatly to this excellent capacity for survival. Likewise the contributions of our air defenses toward the survivability of the Strategic

Air Command are significant. The vital task remaining before our air defense is to ensure the continuation of this same kind of survivability for the Nation as a whole.

The fact that SAC can weather a surprise attack constitutes in large measure our national deterrence. The fact that the Nation itself can similarly weather a surprise attack constitutes survival. The Air Defense Command is vitally concerned with both deterrence and survival. One without the other is not enough.

Speaking before the same Senate Committee, the Air Force Vice Chief of Staff, General Frederic H. Smith, Jr., made some encouraging remarks about things to come in the air defense business. Air Force officers should weigh these words carefully. Said General Smith:

> Against missiles and space systems, we have partial warning, but not active defense. New weapons approaches from the sea and sky will be exploited when they are available to an enemy. Improvements in warning and development of a defense will be necessary. As difficult as the problem is, we believe that an effective active defense system against ballistic missiles and space systems can be developed. We desire to reinforce our efforts in this vital field.[16]

Headquarters Air Defense Command

Notes

1. History of ADC, Feb 1940—Jun 1941 (unpublished MS in USAF Historical Division). This refers to the first, not the present, ADC. The first was a small organization activated at Mitchel Field 26 Feb 1940 to study the problems of an effective integration of air defense weapons and procedures. It was comprised of Air Corps, Coast Artillery, and Signal Corps personnel and was dissolved in June 1941.

2. Mark S. Watson, *Chief of Staff: Prewar Plans and Preparations,* "United States Army in World War II," ed. by Kent R. Greenfield (Washington: Department of the Army, 1950), p. 151.

3. Denys Volan, "Air Defense in Theory and Practice 1918–1945" (unpublished MS in ADC Historical Section).

4. In a memorandum from AC/AS-3 to AC/AS-4 dated 23 January 1946 we read the following: "The advent of atomic explosives and energy made all previous defense planning obsolete. It is now considered technically feasible . . . to send long-range guided missiles, carrying atomic warheads, at supersonic speeds to any point on the earth's surface. As all nations must be considered as being able to construct and use such missiles, it becomes imperative that a defense system be established to cover all approaches to the U.S." The memorandum goes on to describe a step-by-step five-year plan for attaining such a defense. The historical archives of ADC contain a considerable body of such material, all of which indicates that ICBM defense was a subject of concern in the Air Staff 16 years ago.

5. Major Gordon P. Saville, *Air Defense Doctrine* (Washington, D.C., 27 October 1941), Sec. I, h, par. 20, p. 10.

6. Secretary of Defense, Memorandum for Armed Forces Policy Council, subject: Clarification of Roles and Missions, 26 Nov 56 (attachment to AFR 55-43, 19 Feb 59).

7. Bernard Brodie, *Strategy in the Missile Age* (Princeton: Princeton University Press, 1959), p. 174.

8. Sir John Slessor, *Strategy for the West* (New York: William Morrow Co., 1954), p. 111.

9. Dr. Edward Teller, "We Must Face the Danger," *Saturday Evening Post,* Vol. 235, No. 7 (17 Feb 62).

10. Quoted by Chief Marshal K. Vershinin writing in *Red Star,* 5 Jan 62.

11. Quoted in *Time,* LXXVIII, 16 (20 Oct 61), 21.

12. For a documentation of Soviet civil defense activities see Leon Goure, *Civil Defense in the Soviet Union* (Berkeley: University of California Press, 1962).

13. Air Force Manual 1-2, *United States Air Force Basic Doctrine,* 1 Dec 59, ch. 4, p. 9.

14. Brodie, p. 176.

15. Quoted in Air Force Information Policy Letter, XVI, 3, 1 Feb 62.

16. Quoted in *Army, Navy, Air Force Journal,* 10 Feb 62.

The SAC Management Control System

BRIGADIER GENERAL ALBERT L. PEARL

THE REQUIREMENT of Strategic Air Command for a strong system for management control rests in the nature of its management task: to direct $16.2 billion worth of resources, annual operating expenditures of over $1.8 billion, and the efforts of a quarter million personnel against a most vital mission. Our responsibility is to develop and maintain a strategic retaliatory force so powerful that no potential enemy dare attack us. The magnitude of the resources and the gravity of the consequences of failure to perform the mission both call for unusual attention to the matter of management control to help define objectives, to furnish performance standards, to see if the units measure up, and to enforce corrective action where needed.

This article will describe SAC's Management Control System and show how it is used by commanders at all levels of command to evaluate accomplishments in an objective manner and to maintain combat capability at the highest level possible.

the system defined

The SAC Management Control System is a detailed procedure for monitoring the status and performance of SAC units. This definition could reflect a cold, lifeless paper operation that occupies the time of a certain number of clerks and fills filing cabinets with records. But as this discussion unfolds, the reader will see that it concerns a dynamic management environment that enjoins the daily attention of commanders in SAC. Some have referred to the Management Control System as a way of life.

So far as definitions are concerned, many arguments are heard over the name of the system itself. Needless waste of time can result from arguing whether it might better be called a "Rating System," a "Management Information System," or something else. To get all on common ground, regardless of label, the Management Control System may be described as follows:

- It identifies approximately 35 performance areas for command attention. Later in this article it will be obvious that the measured areas change and that they include items essential to mission accomplishment, such as bombing, crew training, supply, and the like.

- It gives the relative emphasis for commanders to attach to each area. This is done by a point system combining all the scores for individual items and giving a single performance value for a wing or for an entire base, which might include two wings. At the present time there are 7100 points in the system. This total is not important. It could just as well be 71,000. What is important is the relationship in points allotted to the various items. Heavily weighted items attract the most management attention. As emphasis changes, point values change.

- It furnishes standards to be used in evaluating status and performance. These are in the form of scoring tables. Raw performance data are entered in the table to arrive at a percentage score from 0 to 100 per cent. For example, if the initial supply response rate is 85 per cent of items requested, 100 per cent of the 300 points allotted to supply response capability is awarded. If the response rate is less than 75 per cent, the unit gets a zero percentage score and none of the 300 points allotted. For response rates between 75 per cent and 85 per cent varying point values are awarded.

- The SAC Management Control System utilizes existing reports. It "harnesses" the information already flowing in management reports prescribed by staff agencies, and by means of the standards described above it readily interprets the significance of certain key information that is reported.

- It furnishes procedures for computing performance in each area measured and for computing the over-all score for a unit. This simply means extracting the data from the particular line and column of a recurring report and applying the arithmetical procedures for computing the ratio or average that is entered into a scoring table to arrive at the percentage score.

- The SAC Management Control System produces a statement that shows the performance of each unit for each item scored. It also shows the total score for each unit, combining all items into a single percentage for the unit. A commander knows what his score is before receiving the statement, but it shows him how sporting the course is, considering the performance of other like units.

- It furnishes concise briefings to commanders and their staffs, with an analysis of all performance and particularly the performance in marginal and substandard areas. This puts the information in a form that can be readily used by busy top management.

From this description perhaps we can agree that the SAC Management Control System is partly an information system, partly a management control system, and partly a rating system. Knowing this, we may proceed with the discussion and call it the SAC Management Control System without distraction over the label.

the necessity of a program

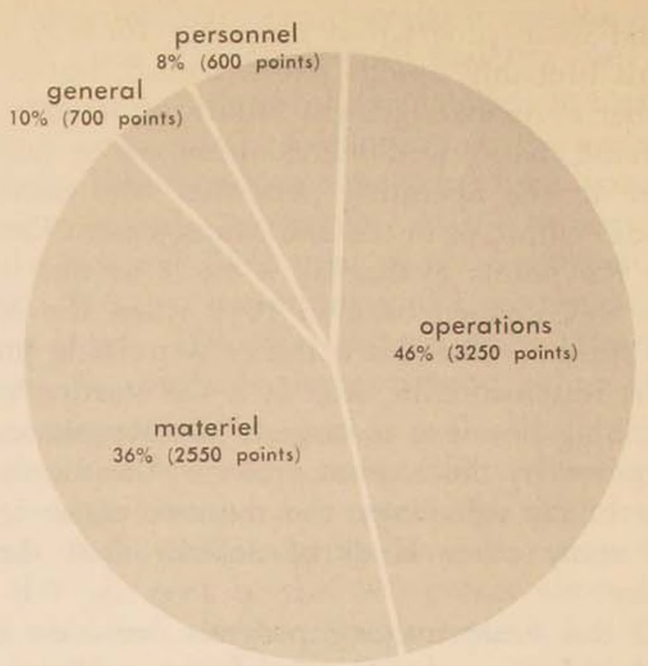
A sound basic program is necessary for any management control system. This probably sounds like a truism, but undoubtedly everyone can remember some management failures that have resulted from either lack of a sound, basic, well-defined program or failure to communicate the program to the operating personnel who must carry it out.

The main emphasis in the SAC Management Control System (82 per cent of all the points available) is built around two basic programs, which were well defined back in 1949 when the Management Control System was started. The first is the crew training program. "Fifty-dash-Eight" is the watchword in SAC. It is the starting place that we like to use in describing how SAC manages. SAC Regulation 50-8 describes the training required by the combat crews in the number of bombing runs, the number of air refuelings, the number of navigation legs, and the number of many other kinds of activity that they must accomplish each quarter.

Around this basic training program we have built the operations section of the Management Control System. Wings are scored on their performance of the amount of training specified. The quality of performance is also scored, based on bombing accuracy, navigation proficiency, and other quality measures related to the training accomplished. In addition to measuring quantity and quality of crew training and performance, the system measures the efficiency with which the flying hour is utilized. In other words the Management Control System measures the units on the quantity of training they accomplish per hour flown. We measure how much training the crews get, how well they perform in accomplishing the various items of training, and how well they utilize the expensive flying hour for accomplishing their training in the vital operations areas.

The other basic program, which SAC also has had for many years, concerns aircraft scheduling, the "Sixty-dash-Nine" program. SAC Regulation 60-9 describes the objectives and procedures used in scheduling a flying hour program. The principal planning session is the weekly aircraft scheduling meeting between the Directors of Operations and Materiel. At this meeting the Director of Operations presents his requirements for sorties, training, alert, etc. The Director of Materiel states his ability to produce the sorties. After whatever negotiation is required, the flying program is scheduled for the following week. The flying program gives the aircraft requirements by take-off time and by aircraft configuration according to the training to be accomplished. This schedule is the basic program used in the measurement of the effectiveness in producing the flying hour program. Effectiveness in turn is measured by the degree to which the flying program conforms to the schedule. Unless there is a specific schedule, there is no effective way of identifying deviations—cancellations, additions, or late take-offs. In addition to these items, the materiel section includes munitions maintenance, supply effectiveness, fuel supplies, and automotive maintenance.

The Point System



The "Fifty-dash-Eight" crew training program and the "Sixty-dash-Nine" aircraft scheduling system have served as the nucleus for the entire Management Control System. As previously mentioned, our main job is to train crews and to maintain the aircraft and missiles necessary to train crews and maintain alert schedules. With concrete programs in these functions, objective measurement is possible.

The personnel section of the Management Control System includes airman individual proficiency training, airman retention, and personnel accounting accuracy—all important in personnel management. The financial operating efficiency of Officer and NCO Clubs is also measured.

Various other items that are essential to performing the mission are measured in the general section, including fire incidents, utilities conservation, safety, security effectiveness, and information activities. Although these support areas are essential to performing the mission, only 10 per cent of the total points is allotted to them.

I am confident that the Management Control System would not have survived for 12 years if it had not been addressed to the hard-core mission areas. This facility in focusing attention on progress achieved and problem areas at hand or forecast for all areas of top management concern ensures commander interest in the system.

The Management Control System coverage for missile units is still not as complete as for aircraft units, but SAC is progressing toward full measurement for missiles. Many items in the Management Control System are not weapon-system-oriented, and these have been directly applied to missile units. This is particularly true for the personnel and general items of base support. A system for scoring missile maintenance training is being developed and test-scored. This is the first item to be developed that is completely missile-oriented.

commander use of the Management Control System

The success of a management control system depends on the use, or abuse, that is made of it by commanders. It could have the best technical foundation and be mission-oriented but do no good at all if ignored by commanders. Pages could be written on this subject, but it would all add up to this: the Commander in Chief SAC from the beginning has used the Management Control System to motivate commanders to give emphasis to certain important areas and to achieve certain standards of performance in these areas. The Management Control System has always had strong backing from the Commander in Chief, and this has been the most significant factor which has kept it alive and promoted its extensive use in SAC. Top commanders have regarded the Management Control System as a valuable motivating device which they could "play like a piano" to keep it responsive to their changing requirements for managing the command. This they do by adding items, deleting items, changing point weights, and changing standards.

Numbered air force commanders have pursued the Management Control System even more vigorously as a tool for motivation and control. They have devised several means of their own to augment the Management Control System in managing their commands. One numbered air force commander required field commanders to visit him and his staff when they had exhausted all capability at base level to improve performance in a vital area. The purpose of such a visit was to bring the talents of the staff as well as the field commander to bear on the solution of the problem. Another example of intermediate command use of the system is an "Operator Emphasis Program," which requires field staff personnel to become actively involved in computing scores at a functional level, analyzing performance, and reporting results. This requirement for total participation and the requirement for charted information and displays to bring Management Control System data to the attention of all personnel concerned have produced results. Trophies are awarded by intermediate commanders to units showing the best Management Control System performance and to units showing the best improvement in performance. This further heightens commander interest in the Management Control System.

Admittedly, wing commanders have mixed feelings about the Management Control System. It is human nature to dislike having someone look over your shoulder. In a rather detailed manner, this is what we do with the Management Control System. Human nature being what it is, the top performing commanders like the system, and oftentimes the bottom performers wish it would go away and quit bothering them. In spite of these mixed feelings, practically all wing commanders have squadron management control systems. These are not required by SAC Headquarters but are encouraged for the same reasons that we have a SAC Management Control System. These squadron management control systems score individual squadrons on many of the items that are scored on a wing basis in the SAC Management Control System. Field commanders score additional items in their squadron management control systems that are not in the SAC-wide Management Control System. They see the Management Control System the same as the Commander in Chief sees it, as a motivation device to achieve their objectives. It can logically be used as a competitive tool at base level, where units, crews, and individuals are operating in the same environment.

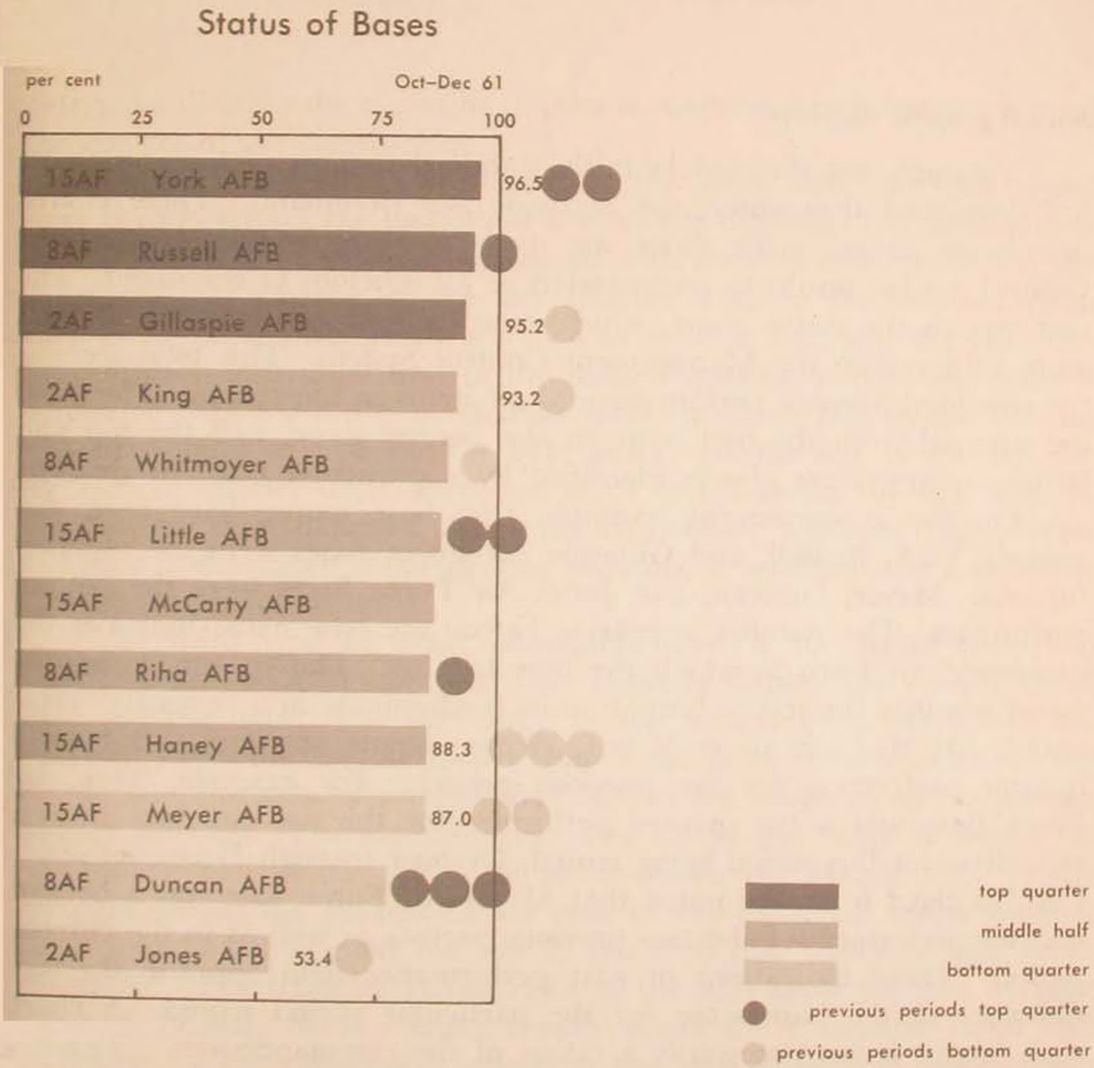
A control system must be responsive to the requirements of the field commanders as well as to those of the commanders of upper echelons. A panel of nine SAC field commanders, wing or air division, meets quarterly at SAC Headquarters to review the proposed system that is to become effective the following quarter. Normally at least three members change each quarter. The SAC staff and the field commanders exchange ideas and recommendations on items to be included for evaluation. The negotiations between the field commanders and the headquarters staff result in a final proposal that is presented to the Commander in Chief for approval.

The field commanders' panel has produced some beneficial results. The commanders are becoming better educated on the over-all command-wide purpose and objectives of the Management Control System; they understand why it is needed and why it has to operate the way it does. The rotation of panel commanders from quarter to quarter is gradually causing a large number of field commanders to be better informed on the policies of the system. A second advantage in having the commanders' panel is the assurance that items in the system are sufficiently mission-oriented to warrant inclusion in the Management Control System. The placing of an item in the Control System automatically creates a demand for attention to the item by a wing commander, the relative amount of his attention being determined by the number of points placed on the item. Prior to inauguration of the commanders' panel, it was possible for over-zealous staff personnel to set up disproportionate emphasis on certain of their programs represented in the Management Control System, so that field commanders would be aware of and promote their particular programs.

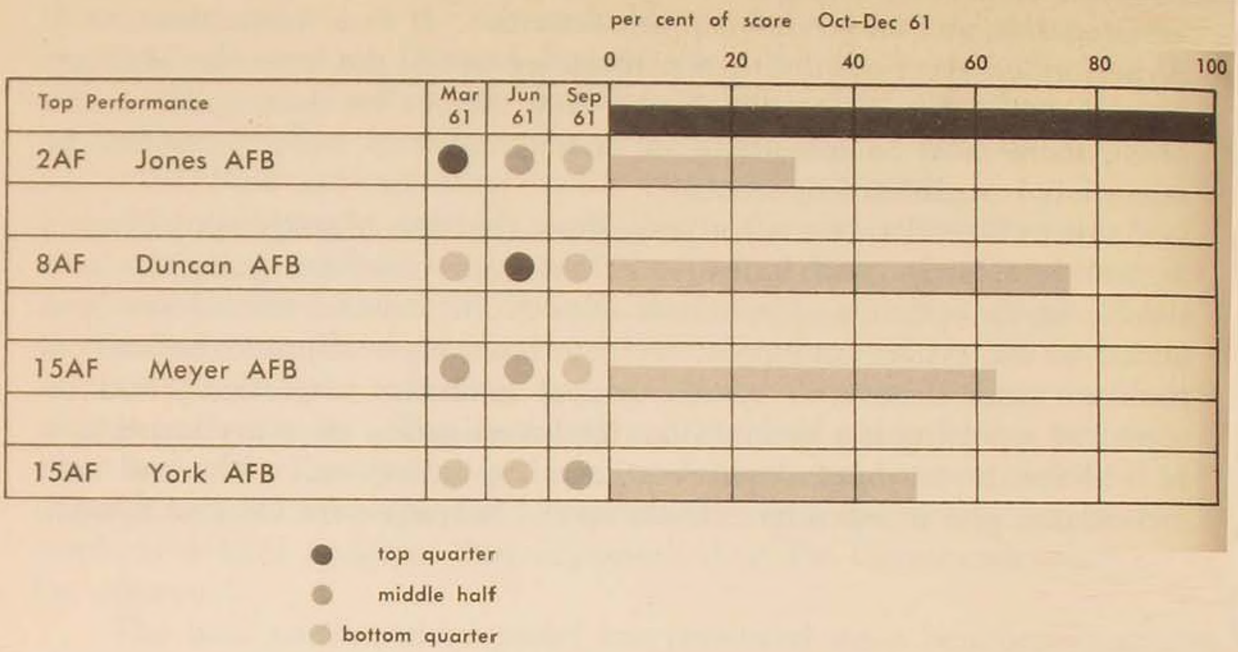
How valid is the system?

Discussion of the Management Control System is not complete until one considers the potential "paper tiger" and the cheater. It is hardly possible for a unit to be good in all items measured in the Management Control System and not have the capability to perform its mission. However, since we must rely on reported information, we must accept the possibility that things may not be as good as the reports show. The best independent checks that we can turn to are the operational readiness inspections made by the inspectors general of both intermediate command and command levels. Their inspections are not a part of the Management Control System. They are unannounced and require the units to generate aircraft and crews according to the emergency war order. Detailed observations are made on the performance of aircraft crews, maintenance, and all ground support activities. If these inspections could be performed every month, then perhaps we would not need the Management Control System at all. Since they cannot be accomplished this often, there must be something for management to use in between the operational readiness inspections.

Over-all results, year after year, show that the Management Control System is a fairly good indicator of the units that are going to have trouble in an operational readiness inspection. Several items have been added to the system and point weights have been adjusted because of problem areas uncovered by operational readiness inspections, and integrity of reporting is a special item for investigation on every inspection. In addition to the operational readiness inspection, staff visits and staff surveillance give independent checks on the Management Control System.



Supply Management (RAMAC)

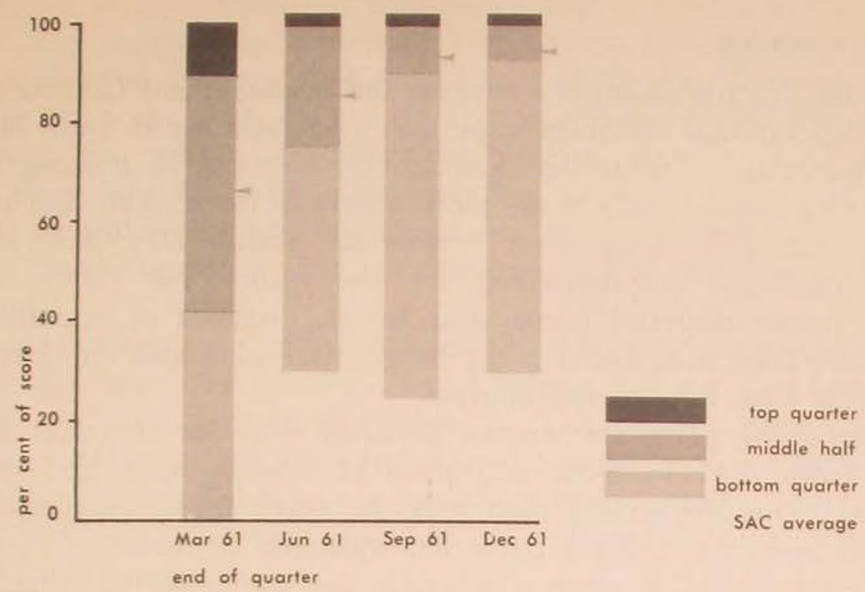


typical graphic displays

Although not directed, a fairly standard pattern of briefing charts has developed throughout the Strategic Air Command. These charts, usually on 35-mm color slides, are used for showing the Management Control System results to commanders at all echelons of command. The first type is the status chart, which arrays the bases according to total score achieved in the Management Control System. This total score is the weighted average performance of all items in the system. The bases are arrayed from the best score to the poorest score, and the top and bottom quarters are always identified by a particular color or shading.

On the accompanying example (the base names have been disguised) York, Russell, and Gillaspie Air Force Bases were the top performers. Meyer, Duncan, and Jones Air Force Bases were the bottom performers. The number appearing before the base name indicates the numbered air force to which the base belongs. Thus it can be readily noted whether the top or bottom units predominate in a particular command. At the end of each bar, circles denote the top and bottom quarter performers for the previous periods. For example, York Air Force Base was a top quarter performer for the two previous periods as well as for the period being scored, October through December 1961. On this chart it can be noted that Meyer Air Force Base was a bottom quarter performer for the two previous periods as well as in the current period. These indications of past performance help appraise the significance of the base score for the particular period scored. A chart such as this is not necessarily a rating of the commanders involved, but it does reveal the bases which predominantly have problems and those which predominantly have good performance. Only investigation can

Supply Management (RAMAC)
Per cent of Score



determine whether the causes lie in poor management or in factors beyond the control of the commander.

After the over-all performance of the bases and the total scores have been observed, the individual item charts highlight the performance of the bottom quarter units. In accord with the exception principle, the aggregate performance of the top quarter units in the selected item, such as supply management, is shown as a single bar, and the performance of each individual unit in the bottom quarter in the same item is compared with the top quarter units' performance. The legend for this chart is similar to that for the base array. At the left of the bar for the bottom quarter units, there are three dots showing the standing for the previous three quarters. As on the array chart, a glance tells whether the poor performance is one of long standing or whether it is a difficulty that has suddenly appeared.

The third type of chart commonly used is the trend chart, on which vertical bars for the past four quarters display the scoring trend in a selected item. The gray area at the bottom of a bar shows the range in scores for the low 25 per cent of the units. The area at the top of the bar, the area of darkest gray, shows the range in scores for the top 25 per cent. The medium gray area shows the range in scores for the middle half of the units. In other words, for March 1961 in the example shown the poorest 25 per cent of the units had scores ranging from zero to 42, whereas the top 25 per cent had scores ranging from 90 to 100. The triangles at the right of the bars show the SAC average for each period. Such a chart readily shows the command trend and also indicates the variation in scores. It has been found that commanders can readily become accustomed to this type of charting. Since time to brief them is limited, the exception principle is always used. Individual item charts or individual trend charts are never shown unless there is a story to be told about them.

future programing

So far this discussion has covered the Management Control System and the operational readiness inspection and their use in SAC. Both are used for measuring units that are actively engaged in training and in maintaining operationally ready alert schedules for aircraft and missiles, and for managing flying hour programs. Another big part of SAC's management task is programing for the future—for future weapon systems, future dispersal plans, and future methods of operation. In such future programs, SAC uses the programing plan and the operational plan as the basis for progress analysis.

Programing plans are written to cover developments such as conversion from B-47 to B-52, activation of missile units, and dispersal programs. The programing plan states in detail the actions required of each staff agency to bring a particular squadron to readiness by a given time. For example, it gives a schedule for the input of personnel to school and the input of personnel to the base where they are required for the programed operation. It also gives a time-phased plan for the delivery of aircraft and other items of hardware required for the unit to attain an operationally ready condition by a designated time. Of prime importance here is getting the program written in specific enough details and with enough events (time/quantity/quality) so that progress analysis can in fact tell whether the program is on schedule or is not on schedule.

In a sense the programing plan serves a purpose similar to that of the SAC Management Control System. It records for the information of the SAC Headquarters staff and the field commanders the actions required and the time limits within which these actions must be performed. In other words, it gives a blueprint for the operation.

Our most recent experience in the use of progress reporting is the adaptation of the program evaluation and review technique (PERT) to four weapon systems: Titan I and II, Atlas F, and Minuteman. It is true that the PERT technique was developed primarily as an aid to R&D efforts; but although SAC is not in the R&D business, it has found the PERT system of networking a very valuable device to ensure a thorough plan complete in all essential details. SAC has many things to do to get ready for a weapon system. For example, it has to develop base support in the forms of supply, office space, transportation, etc. It must select and schedule personnel for training so that they can operate the weapon system once it becomes available on the base. The PERT technique of networking has aided considerably in spelling out the details of SAC's preparation for missiles.

THE MANAGEMENT controls of Strategic Air Command are not limited to those which have been mentioned here. There are many regulations and manuals that truly provide management controls. The Budget Advisory Committees, composed of command and key staff personnel and in operation at all echelons of command, control fund usage according to the most urgent requirements. The reports flowing through staff channels and the constant staff surveillance of all the command mission areas are also a necessary part of the control process. These are common throughout the military establishment, and no elaboration of them is needed here. Nor is SAC the only operating command which has a management control system or a rating system today. We must acknowledge that we have benefited from exchanging ideas with several other commands.

The Management Control System or rating system technique is not the only way to get the job done, but I believe it is the very best way if properly used in a constructive manner. The benefits gained far outweigh the criticisms that are often raised against such a system. I am thoroughly convinced that SAC today offers much greater deterrence for the resources expended than it would have offered without its Management Control System.

Headquarters Strategic Air Command

Early Combat Capability with New Weapons

Colonel Quentin J. Goss

MOST Air Force officers have had some experience with placing a new equipment in service. Memories of this experience almost invariably include anguish and exasperation. Under the accelerating pressures of technology on military weapons and equipment, the problems of getting new equipment into service have increased and will increase in magnitude, complexity, and intensity.

Much attention has been given to shortening the time consumed in the process of getting a new weapon through design, development, and production for delivery to the inventory. Given essentially unrestricted use of resources and priority, this problem can be solved. Examples of drastically shortened lead times are the Thor missile, which reached the operational inventory in slightly over three years, and the Atlas, which reached operational status in a little more than four years. Much less attention has been devoted to what is now the one remaining critical transition period of a new weapon or support system. The hard-won increased competence in delivering new weapons to the inventory calls for a new look at what happens when a new system is delivered to the operational user.

The application of modern science and technology to military systems has become nearly equal as a factor in national strength to the ability to use military force. As with conventional military force, possession of a capability in military technology must be real and clear to all observers in order to be effective in carrying out national policy. A technological potential in scientists and engineers or in millions of reports containing technical data will not impress a possible enemy who has a clear advantage in an immediately usable capability, such as an operational space system. Consequently the ability to bring new military systems quickly to effective operational readiness is at least as important as the ability to design, build, and deliver these systems. Here, as in development and production, the time required is vital. As Mr. Khrushchev has pointed out for us, "In the . . . competition with capitalism . . . the question of the time factor, of gaining time . . . is the main question."

A Look at the Past

Before World War II, technological progress in weapons was so leisurely that its immediate repercussions could be essentially disregarded. With the exception of a few items in World War I, which allowed only a brief glimpse inside the Pandora's box of technology, new items were not permitted to interfere with operational military posture. To take a simple example, if a new and better rifle was developed it was generally regarded with deep suspicion by the military for a long time. To gain acceptance, the rifle had to meet many preliminary requirements, ranging from sound tests to ridiculous criticism. By the time a decision was made to re-equip with the new rifle it was usually obvious to the most skeptical that the new weapon was superior. The process of re-equipment was no more complicated than commanding a company to stack its old rifles and file by the supply sergeant to receive the new rifles. Those who resisted the change to the last justified their resistance by saying it was better to have a soldier armed with an old, trustworthy rifle whose shortcomings could be overcome by individual skill than to have a soldier disarmed on the battlefield by a newfangled piece that he could not work.

Despite the prevalence of this attitude until World War II, combat units rushed into battle after Pearl Harbor were found to have shocking gaps in their knowledge of the capabilities of their weapons. This condition was particularly true in the Army Air Corps. Much equipment was lost through mistakes made because of failure to evaluate weapons realistically and to understand their capabilities and limitations. To remedy the situation, a maze of overlapping evaluating agencies was created. The problem changed from insufficient testing to one of correlating and resolving test results from the many agencies, which all too often did not agree. The Army Air Forces Board and the Army Air Forces Proving Ground were formed. Later the Proving Ground was established as an independent command that tested countless items for operational suitability and often encroached on Air Materiel Command's engineering test functions. Operational analysis teams were formed at home and abroad to solve problems, in part by evaluating equipment on hand. Major commands established evaluation programs of their own. A background of confusion and compartmentation resulted and it still has its influence today.

One clear idea did emerge from the World War II experience of providing troops in combat with faulty weapons. The necessity of testing was forcefully impressed on everyone. Not only was testing necessary, but aircraft had become too complex to be modified in the field. They had to be right when they came off the production line so that they could be used immediately in a combat theater. The idea that the operational command should receive weapons that have no functional flaws is still with us. It is justified by the necessity for combat readiness in our combat units.

Dissatisfied operating commands often conducted their own tests of new weapons. In 1950 SAC, Training Command, and Air Proving Ground Command established a joint test group for the B-47, which had already undergone three years' development testing.

The Ridenour Committee, which reviewed Air Force research and development in 1949, took note of the fact that when weapons went through transition to new hands a critical drop in proficiency occurred. The committee report also noted the existence of a separate agency to do operational suitability testing and advanced the idea that the development agency should not do tactical evaluation testing of the weapons it had provided. It should not "make out its own report card." The weapon systems that result from research and development effort should be tactically evaluated by agencies outside the Air Research and Development Command. The committee report also stated that "closer understanding between operational and research commands must be achieved by mutual education."

Through the early 1950's development testing of aircraft was conducted by the Air Research and Development Command in six phases.* These phases were evolved at the Edwards Flight Test Center and later officially recognized in Air Force Regulation 80-14 dated 11 September 1951. "Functional Development," the final phase for which ARDC was responsible, required testing for functional operation and design deficiencies. In essence, if the system worked functionally, ARDC's major responsibility was completed. The Air Proving Ground Command function was recognized as Phase VII testing, "Operational Suitability." The eventual customer, the combat using command, was given no testing responsibilities. Completely overlooked was the fact that the test phases

*Phase I, Air Worthiness and Equipment Functioning; Phase II, Contractor Compliance; Phase III, Design Refinement; Phase IV, Performance and Stability; Phase V, All Weather; Phase VI, Functional Development.

as set forth in the official regulation did not apply to what was going on in the guided missile test programs or to major support system test programs other than for aircraft.

The dissatisfaction of the combat using commands with the new weapons they received resulted in these commands conducting their own operational tests. In 1950 a joint test group was formed to test the B-47 at Wichita, Kansas, after three years of testing by the development agency. This test group was made up of personnel from Strategic Air Command, Air Training Command, and Air Proving Ground Command. This "do-it-yourself" approach was used in the B-52 program with earlier time phasing. The same approach has been incorporated in most missile programs in varying degrees.

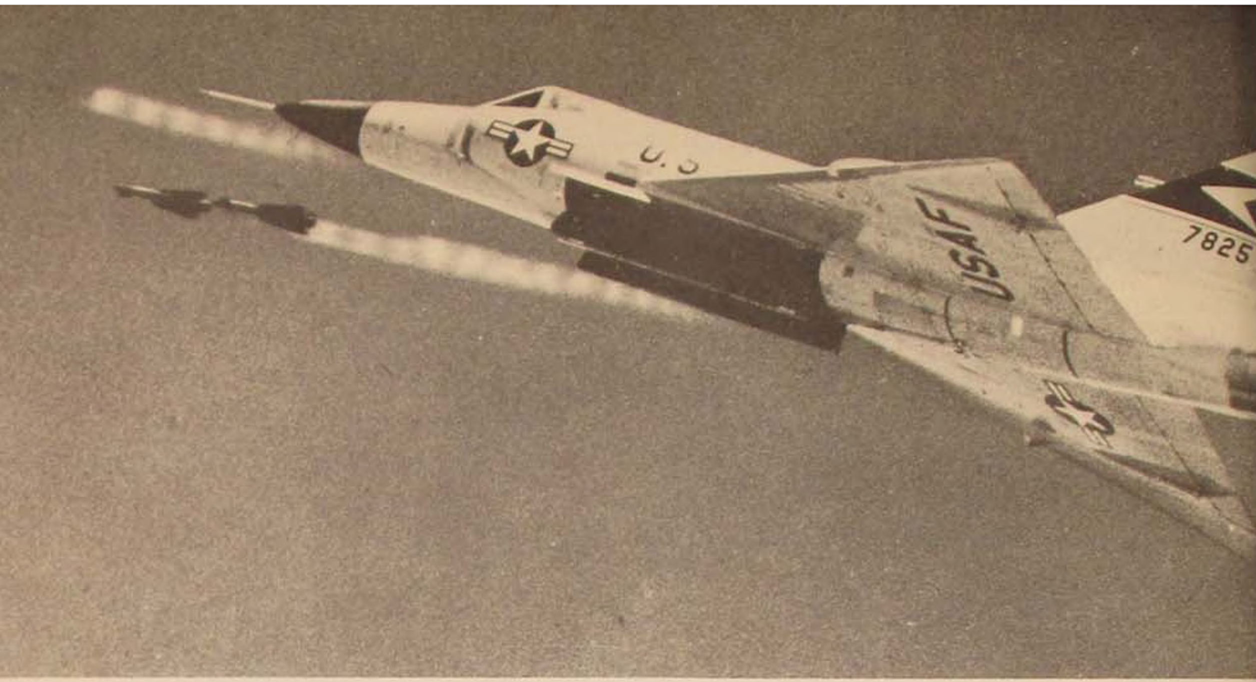
On 8 June 1956, AFR 80-14 was reissued. It then included Phase VIII testing, "Unit Operational Employment," which was an after-the-fact recognition of what was being done by the using commands on several programs, as already mentioned. Belated recognition that the Air Force had guided missile programs lay in one brief paragraph:

> 3.e. In the testing of guided missiles it will be the policy that the test phases herein defined may be eliminated or combined as appropriate. Employment and Suitability Testing (Phase VII) of strategic missiles will be conducted in conjunction with research and development testing.

And finally, the regulation contained the provision for "other major air commands" to participate in the last two test phases "through mutual agreement."

The present version of AFR 80-14, revised on 19 August 1958, has again given after-the-fact recognition to what was happening in actual practice. The eight phases of testing have been dropped and replaced by three categories of system test programs. Roughly Category I, "Subsystem Development Test and Evaluation," corresponded to the testing done by the manufacturer; Category II, "System Development Test and Evaluation," corresponded to ARDC development testing; and Category III, "System Operational Test and Evaluation," provided for the using command to accomplish this testing. For the first time the overlapping of the various efforts involved in the transition from test to inventory was acknowledged. Also for the first time the major using command was directed to assume specific responsibilities, such as conducting the Category III testing. Most important, paragraph 8e(1) states that the major using command will "participate in system and support development from the publication of Operational Support or General Operational Requirements to extent defined by this regulation as to testing and evaluation, and as specified in AFR 5-47 and 80-28."

It must be pointed out that confusion, contradictory concepts, and misunderstanding still exist as to how a new weapon gets into the inventory. The language of the present regulation is so general that to a large extent it can mean all things to all people. As an indication of the



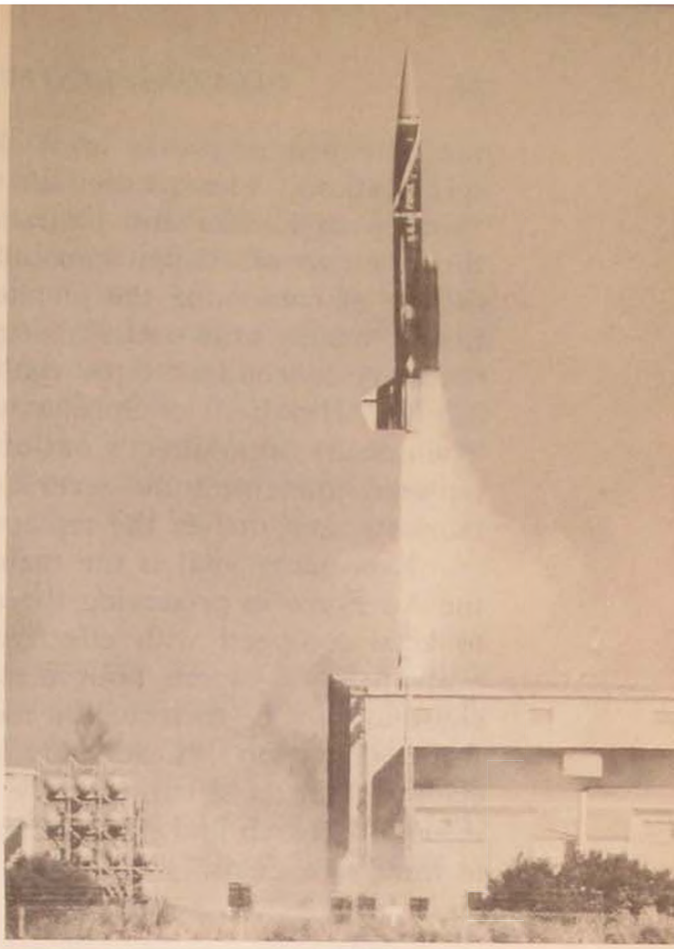
What are the fighting capabilities and limitations? Air Defense Command fired hundreds of the early Falcon to find out. These unscheduled but essential exercises taxed the first combat inventory of the missile. But the first data reported revealed that in its early combat environment the missile did not hit its target.

extent of the difficulty, the preparation and coordination of the current AFR 80-14 was almost a full-time job for one officer in the Directorate of Requirements, Headquarters USAF, for nearly two full years.

An instance of the kind of confusion still existing after issuance of the regulation occurred in setting up the ARDC–ADC Bomarc Joint Test Force at Eglin AFB. Initially the Air Defense Command members were eager to take charge of the test program. All testing of the Bomarc A should be Category III, "Operational Test," with the ARDC team members "looking over the shoulder" and providing support. ARDC, with greater knowledge of the problems remaining, was not ready to agree that development had been completed. Many hours of heated discussion took place, with the ARDC members trying to make a clear distinction between Category II and Category III testing. After some months of the testing, when the problems had been fairly well defined and ARDC felt they were well on the way toward solution, ADC was requested to take over the test program and begin the Category III test phase. By this time the ADC members of the Test Force had become well educated in the equipment problems. They refused, insisting that ARDC had not completed the development work required.

The guidance provided in the present AFR 80-14 and its predecessors has lagged behind practice by several years. The language setting up the three categories of testing and assigning responsibilities is at least permissive, allowing experienced personnel to conduct a reasonable, integrated test program. The former eight test phases seemed to give some official blessing to each agency's going its own way; and sometimes, where specific literal application of one or more of the eight phases was insisted upon, the former regulation prevented the establishment of a well-integrated test program.

Resources of the ARDC/ADC Joint Task Force established to complete Category II and initiate Category III testing of Bomarc were entangled in four command channels.



The new 375 series of Air Force Regulations has brought powerful tools to bear on this problem. The system program director now has clear authority over the entire program up to the point of system delivery. The formation of the Air Force Systems Command in April 1961 immeasurably strengthened control over systems acquisition, including testing through Category II. However, a transition point from the Air Force Systems Command to the user still remains.

Where We Stand Today

Any discussion of the transition from old weapons to new must begin with a reassertion of the fundamental necessity of test. This necessity may seem obvious, since man has never been able to engineer a new device perfectly. Even the large automobile manufacturers submit relatively modest changes on their new model cars to a rigorous test program before venturing to offer them on the market. Yet the essential nature of testing is often compromised by penny-wise, pound-foolish measures. Budget and program reviewers repeatedly ask, "What is the minimum needed to do the job?" Since the test program is required by the uncertainties in building a new weapon, it is difficult to prove the need for a specific amount of testing. Consequently nearly every recent weapon-testing program has been conducted with inadequate resources.

The main point to be made is that it is not enough to determine if the new weapon works or if the new product meets the production specifications. The question that must be answered is, "What are the fighting capabilities and limitations?" Inadequate planning to answer this question of combat capability has the inevitable minimum consequence of consuming the planned combat inventory until the question is satisfactorily answered. For example, Air Defense Command found it necessary to conduct three evaluation exercises with the early Falcon missiles. Hundreds of missiles were fired in these unplanned exercises. The missiles came directly out of the combat inventory and could not be replaced until after the several months required to place new orders, fabricate, and deliver the replacements.

Even more vital is the maintenance of the prominent functions of the Air Force in preserving the national security. The Air Force ability to keep equipped with effective weapons lies chiefly in its ability to evaluate new weapons, both in selection and in determination of deficiencies that must be corrected on the weapons selected. In the words of the Ridenour Report: "Leadership in this work cannot be legislated or proclaimed; it must be earned. The Air Force can earn it only by achieving, through research and development, technical and operational superiority in these new fields."

test facilities

Military space systems, like ballistic missiles, require the establishment of a new operational environment. Billions of dollars have been invested in Air Force test facilities. The most expensive facilities are the test ranges, where weapons are tested under the most realistic conditions possible. Not only must a new environment be created to operate a new weapon, but safety provisions and instrumentation for the collection of data must be incorporated. The data required are voluminous and complex. In the Falcon missile evaluation exercises previously referred to, the first information gained was that the missile did not work. It missed the target. The crews were unable to supply any further information as to what had happened. It was necessary to have data on the performance of the missile guidance system, the aircraft fire control system, and the operating procedures employed before an analysis could be made to determine the cause of the unacceptable performance.

Other facilities besides the glamorous ones of telemetry and instrumentation are equally as essential. During the weapon demonstration phase of the Bomarc program a small building was required at Cape Canaveral for the communications terminal of the command and control system. Because programing of funds could not be expedited for this building, a major phase of the test program was delayed for ten months. All equipments and facilities were ready for use except the communications terminal building.

The tremendous jump in costs of test facilities caused the Department of Defense to create in 1959 the position of Deputy Director of

Defense Research and Engineering for Ranges and Space Ground Support. The investment in huge facilities such as those of the Air Force Missile Test Center is small compared to the global tracking and surveillance systems that are and will be required for space systems. One of the first announcements of the new office was: " . . . on any weapon system development program, it is now policy that range requirements be planned ahead, and submitted as part of the original weapon system plan." This is a more stringent requirement than had existed in the past, and it will require a higher standard of performance of those responsible for weapon programs if all the testing objectives are to be achieved.

personnel

"The development of qualitatively superior air weapons requires qualitatively superior people." This statement was made by Major General Floyd B. Wood, USAF, formerly Deputy Commander for Technical Operations, Hq ARDC. The problem of securing properly qualified personnel in adequate numbers to do the Air Force's technical work was not a new one. In 1949 the Ridenour Report pinpointed the nature of the problem:

> The Air Force presently has far too few officers with technical qualifications, despite the highly technical nature of the Air Force mission. Even the present inadequate number of highly qualified officers are not used now in the most effective way.

Nine years later the Stever Report indicated that the problem had become even more acute:

> Weapons of all kinds have become more complicated. To appreciate what a weapon does, or may be capable of doing, now requires a level of sophistication and technical knowledge far higher than it did only a few short years ago. . . .
>
> The USAF must come to understand that its ability to do its job depends to an ever greater degree on having a far greater proportion of its personnel trained in science and technology; otherwise, it will fail first to carry out its expanding R&D responsibilities, and eventually, to operate effectively its increasingly complex weapons. . . .

Finally, a Headquarters USAF study made in 1959 reported that scientific and engineering trained personnel made up less than 4 per cent of the total Air Force manpower. Of this number, 52 per cent were civilians, 34 per cent were airmen, and 14 per cent officers. The report also gave the annual rate of increase of research and development officers between 1953 and 1959 as an average of 10 per cent per year. The projected rate of increase in authorization of spaces for this type of assignment at that time was given as 3 per cent per year. This figure compared with the annual rate of increase in all industries of similarly trained personnel of 15 per cent per year. Last, but not least, the study pointed out that a directed requirement to train personnel as instructors or training supervisors in all categories of testing for the purpose of developing an Air Force missile test and evaluation capability would not be met. The manpower spaces required, approximately 100 per year, could not be made available.

Since this study was made, the situation has improved, but only slightly. As the procurement of scientific and engineering personnel has slowly progressed, the requirement for the skills has increased by leaps and bounds. In fiscal year 1962 the requirement for trained manpower in the Air Force's test wings stood at more than 300. Projected requirements for these test wings for fiscal years 1963–1965 total over 2000. Another index is the AFSC requirements for professional training. The number of spaces necessary increased by at least one third from fiscal 1961 to fiscal 1964. The forecast is for more difficulty ahead. Sixty per cent of the officers in the R&D career field in AFSC have 16 or more years' service. Nearly 40 per cent of these officers plan to retire in the first 2 years of eligibility. In the critical 4- to 12-year military service bracket a deficiency of more than 800 R&D officers exists.

In the past ten years requests for more than 2500 spaces in this personnel category have been disapproved by Hq USAF. The traditional manpower approach has been that the spaces cannot be approved because they cannot be justified as current requirements. Insufficient recognition has been given to the trends of the technological explosion.

Two points must be made with regard to this category of personnel. First, the definition used for the "research and development" personnel is "personnel trained in science and technology." The qualifications cited include the type of personnel required by a major using command in performing the System Operational Test and Evaluation defined as Category III in AFR 80-14. But also included are some of the personnel skills required in the increasing numbers of missile squadrons of Atlas, Bomarc, and others. Second, the qualifications lump together all the many specialties in the general area of science and technology. Within this miscellaneous collection of many diverse "R&D" skills lies one particular skill which is most precious to the Air Force, the ability to properly plan a test program for the increasingly complex weapon systems.

The experience of many Air Force officers includes training and evaluation with machine guns as the armament. Mesh targets could be towed off the runway, and hundreds of thousands—possibly millions—of rounds of ammunition were available. Today costs dictate the expenditure of very few items in test. Instrumentation for the purpose of data collection must be planned months in advance. This limitation means that not only must the questions to be asked in evaluating a weapon system be clearly defined when the test is planned, but *the way in which the questions are asked* must be known so that the instrumentation planned will obtain data for conclusive answers to the necessary questions. As will be discussed later, personnel with this type of training are required in the combat command receiving a new weapon as well as in the Air Force Systems Command.

As an example of failure to appreciate this problem, the Air Proving Ground Command was reorganized in 1957 and made a center under the Air Research and Development Command. The principal reason for this change was the inability of the Air Force to fill the requirements for scientific and technical personnel to maintain a separate testing command. However, the small group of people with know-how in test planning was broken up and nearly half were reassigned to positions in which their special qualifications were lost to the Air Force. The commands receiving a new weapon must be staffed with personnel with at least an understanding of this problem, or eventually the Air Force, as the Stever Report said, will fail "to operate effectively its increasingly complex weapons."

program planning

A recent article on the program evaluation and review technique (PERT) stated, "The first step is to make a detailed analysis of the over-all weapon system development program, listing every major milestone of accomplishment, called events, that must be achieved and their chronological order." Significantly the example used in the article stops with a last step described as "Unveil aircraft." As previously discussed, major attention has been given to the management of weapon system acquisition. Less attention has been given to the more uncertain area of divided responsibility in which a new system transfers from the Air Force Systems Command to the using command. This transition period has become a critical element of the total lead time of a weapon system.

An example of the difficulties in this phase of a program was the series of five Atlas launching failures that occurred at Vandenberg AFB with early SAC crew participation in launches. Project Golden Ram was then created to standardize procedures and establish the precise operational discipline necessary to achieve successful launchings. The importance of this corollary capability to any weapon system, however good, has been pointed up by General Power:

> A superior engineering product could well be militarily inferior unless it is properly applied and utilized. Technological supremacy is established not by advances in some particular field or area but by correlated advances in all the many disciplines that contribute, directly or indirectly, to the state of the art. Similarly, strategic supremacy is established not merely by superior weapons but also by a superior system available for the operation, maintenance, and protection of these weapons.

Many parallel activities go on as a new weapon moves into the inventory. Operational crews must progress on schedule through training into newly activated units. Fixes for the deficiencies that are always uncovered as equipment moves into the hands of the operational crews must be promptly incorporated in continuing production. The logistic system must phase smoothly from support of the early test phases into support of evaluation test and growing inventory. New base facilities must be finished on a schedule to receive the newly activated units. A command and control system must be concurrently established. There are many others.

When the Bomarc Joint Test Force was first established at Eglin AFB to complete System Development Test and Evaluation under Air Research and Development Command and to initiate System Operational Test and Evaluation under Air Defense Command, the resources and personnel were under four different command channels. One command line went through Air Proving Ground Center to Air Research and Development Command. Another command line went from the Joint Test Force directly to Air Defense Command. A third went from the 4751st Air Defense Missile Wing to the 73d Air Defense Division at Tyndall AFB and then to Air Defense Command. And finally a fourth command line led from the Montgomery Air Defense Sector, which provided control of the Bomarc missiles, to Air Defense Command. These command channels did not meet at a single point until reaching the Chief of Staff, USAF. As might be expected, major difficulties were experienced in managing the program.

The Air Force must profit from such experiences if it is to be more successful in managing future programs, whose sterner demands have been foretold by General Haugen: "There is a very clear trend towards taking larger technical strides in the development of succeeding weapon systems . . . we can look for fewer separate weapon system developments, but those we do undertake will be real king size challenges."[1] These challenges will exist for the using command as well as the Air Force Systems Command. It seems clear that timely achievement of combat capability will only come about if a point of central management exists throughout the entire life of the program, with full authority and responsibility at the working level. Since the Air Force has been quite unsuccessful in providing specific guidance for the conduct of new weapon programs in the past, every effort should be made to man each system project office with properly qualified personnel, and then this office should be relied on to determine the most effective program plan within the present general guidance. Progress of the program will provide the basic measure of the effectiveness of the system project office.

using command participation in testing

The first directive to using commands to provide representation in the system project offices of their future system programs was in AFR 375-2, 31 August 1960: "System Project Offices (SPO's) are joint activities with representation from ARDC, AMC, ATC, and using commands.

Representation from other agencies will be provided when full-time participation is justified." Prior to August 1960 the using commands were not required to have, and usually did not have, continuous representation in the weapon system project offices. AFR 375-2 was revised 12 February 1962 to read, " . . . and the designated operating command(s) provide representatives who will be co-located at the SPO as appropriate."

The necessity of permanent representation in the SPO is indicated by Air Materiel Command Regulation 375-4, dated 10 March 1959, which includes a general list of 146 milestones in the schedule of a weapon system. Eighty-eight of these milestones require action by the using command. Air Force Pamphlet No. 25-2-1, "Weapon System Management," dated 30 June 1959, was issued to "explain the Weapon System Concept and the methods the Air Force uses to manage Weapon Systems." This is the first and only explanatory document on this subject issued by the Department of the Air Force, and the distribution was significant: AMC, 1915; ARDC, 515; other major air commands, 10. Responsible representation of the using commands in the weapon system project offices was repeatedly requested, many times begged for, and seldom provided.

One specific example is the Bomarc Weapon System Project Office. Frequent requests were made of Air Defense Command to provide representation in the project office that could speak for the command. After several years a single officer was assigned in September 1958. After he had been one year in the assignment, the Chief of the Air Defense Command liaison office established at Wright-Patterson Air Force Base in 1958 recommended that the liaison officer in the Bomarc office be reassigned on the basis that he spent so much time on temporary duty attending meetings and conferences that he could not keep up with the program. In October 1959 the officer was reassigned, and again there was no Air Defense Command representative in the Bomarc Weapon System Project Office. This instance did not display the kind of responsible representation of the using command now considered essential.

It is true that the weapon system project offices held frequent meetings of the weapon system phasing groups on each program. These meetings had wide representation from all agencies involved in carrying out the program, and they served as an excellent information exchange. However, representatives were rarely able to speak for their organizations, and the using commands most often sent ineffective representatives. Confirmation of the shortcomings of the weapon system phasing groups is available in almost every Inspector General report on specific weapon programs or Inspector General studies of weapon system management made during the 1950's.

During this same time the operational commands usually originated a new requirement or concurred in a requirement for a weapon for their use which had originated in some other source. After establishment of the requirement, the using command usually retired from direct participation in the program, observing from the sidelines and cheering or booing the progress of the weapon through development, depending on the circumstances of the day. The next direct participation by the using command after validation of the requirement would be upon delivery of the weapon into its hands for suitability test and deployment. Usually deficiencies still existed in a weapon system at that stage, and the delivery would take place accompanied by the strong objections of the user.

An early instance of the consequences of these general circumstances occurred with the Matador missile. In the fall of 1953 a conference on the Matador program was held at Orlando, Florida, just prior to the deployment of the first Matador unit to Europe. All major command headquarters involved were represented, including Headquarters USAF, Headquarters Tactical Air Command, and Headquarters USAF Europe. Two major problems existed. Malfunctioning in flight was still being experienced, and some of the units of the ground handling equipment were still in development. The pipeline of personnel through the training program was filled and on schedule to support the deployment of the first unit and the others scheduled to follow. The logistics support arrangements had been made. Commitments had been made regarding the deployment of the first unit in Europe. The general consensus was that the deployment should take place on schedule. The equipment deficiencies could be corrected by modification kits that would be shipped to Europe later. The Air Research and Development Command representatives expressed the position that solutions to the technical problems were well under way and modification kits to correct the deficiencies would be available in a reasonable time.

Headquarters Tactical Air Command and Headquarters USAF Europe strongly resisted the deployment, taking the position that it should be delayed until the problems were solved. Headquarters USAF directed the deployment on schedule. When the first Matador unit arrived in Europe, no preparations had been made to receive it. Upon arrival the unit was attached to a day-fighter wing. The wing directed the Matador unit to set up on a taxi strip that was not in use on the far side of the airfield. No other facilities had been prepared.

Prior to publication of AFR 375-2 in August 1960, the only positive steps to solve this sort of conflict at the delivery transition stage were taken on the ballistic missile programs, which enjoyed the highest priority and were managed by special procedures. On these programs Air Research and Development Command was assigned the responsibility of developing the initial operational capability. A Strategic Air Command liaison office, SAC Mike, that could speak for the command headquarters was established in the program management office at the Ballistic Missile Division of Air Research and Development Command. Although this procedure has certainly contributed to the establishment of the Atlas in the inventory, the difficulties encountered were still great enough to reach the public press.

To avoid these problems, continuous representation of the using command in the system project office has been required. Using command representation has improved greatly in the last few years. This representation must be much more than liaison. The representatives must have a working relationship with their own headquarters staff so that they can speak for their command in arriving at decisions in the weapon system management. In the engineering area, for example, these decisions usually take the form of a choice between some loss in weapon performance or a minor capability limitation and a delay in the schedule. In the past, because the loss in performance occasioned by any single choice was usually small, the decision has almost always been such as to maintain the scheduled date of initial operational capability. But when the operational date arrives, the cumulative consequences of the many decisions made are usually unacceptable to the user. As the using command must live with the decisions made on system programs in a state of combat readiness throughout the life of the weapon in the inventory, there is no basis on which the user can avoid a full share in the making of these decisions.

Hence the closest cooperation must prevail between the Air Force and industry all along the line from concept to operational aircraft, missile, and space weapon. Industry's mass-production technique must bend to a new pressure. As one commentator has put it, "More and more it is industrial capacity for innovation—not for World War II type production—that is the key to modern defense."[2] For the Air Force, particularly the using commands, the premium will be on bringing new and radically different systems to high combat effectiveness in the shortest possible time. This will not be achieved by waiting until the new infant is delivered on the doorstep, squalling for admission to the family of weapons. And even if the using command has to cut its current combat strength to man the new weapon system positions, it cannot afford to fail to man them effectively.

The Future Outlook

What of the near future, when Strategic Air Command will be shifting a large part of its weight from manned aircraft to missile forces and later when space systems begin coming into inventory? Repeated training in realistic operational exercises will become more difficult and much more limited. But the same sure confidence in capability will continue to be required for the Air Force to perform its mission and provide the essential base for national resolve.

The demands on the responsible military commander will be even greater than they are now. A high degree of readiness must be maintained against the threat of the moment, while greater efforts will be required to prepare for receiving new weapons coming into the inventory. The commander of operational forces will have two obstacles to overcome to accept the new weapons with confidence and bring them quickly to the necessary high degree of effectiveness.

The first obstacle is the natural reluctance to give up a tried and true weapon for which the evaluation of combat readiness has been fully worked out and with which the required combat-ready confidence has been attained. A sacrifice of readiness and effectiveness must be made when a new weapon, whose technical capabilities will probably be in some doubt, must be accepted. For example, when the Air Defense Command began replacing the F-86D with the F-102, there was a strong faction that favored delaying the conversion schedule. Years of experience had been accumulated with the F-86D. Its capabilities were well known, combat-readiness evaluations existed for the F-86D squadrons, and evaluation standards were established. The F-102 due to enter the first units was still experiencing trouble. The missiles often failed to guide, the fire-control system could be kept in commission for only a short time, and the ground test equipment was in short supply and in trouble with technical problems. It is understandable that a combat commander, concerned with the possibility of attack at any time, would prefer not to face these problems.

The second obstacle to the acceptance of new weapons is the conceptual lag. The reality of this bugaboo has been well delineated by General Richardson:

> When we reflect upon military history, it seems to have been easier to change military hardware than military ideas and organizations. For example, the last U.S. cavalry charge was purportedly in the Spanish-American War, yet the cavalry was not disbanded by the United States until we were in World War II some 41 years later. Concepts, force requirements, and organizations have not kept abreast of technology.[3]

There has always been the requirement for weapon change, but with a slower rate of technology it was usually not necessary to meet this requirement in peacetime. There was always time after war started to allow for tests, learning, and adaptation to new weapons or tactics. Besides, the limited technological progress did not often provide weapons that required radical changes in proved concepts.

The independent U.S. Air Force was established after the cavalry was disbanded, but it is old enough to have the same type of conceptual lag in adapting to change. Four years after the decision to deploy the first Matador unit to Europe over the strong objections of the using command, Matador units were airlifted to Africa for operational exercises in the Sahara Desert. These exercises were very successful, indicating a high degree of combat effectiveness. Nevertheless the Matador units had been almost completely unaccepted by the staff of Headquarters USAF Europe. Nearly all the Headquarters paper work on the Matador, including policy statements, was sent down to the Matador squadrons for action, chiefly because most of the staff had not done the necessary hard work to learn about their new missile forces. Furthermore the Matador units had close-to-lowest priority for personnel. Some of the units were as much as 50 per cent undermanned in their critical skills at this time.

In order to accept new weapons, bring them quickly to a high degree of combat effectiveness, and build sufficient confidence in the using command's ability to perform its mission, the using command must participate with full responsibility in its new weapon programs, beginning with approval of the program requirement. Properly qualified personnel should represent the using command to participate in the decisions to be made, to provide continuous information as to the status and capabilities of the weapon system, and to keep the command staff in constant touch with new aspects of the concept of employment of the new weapon. All these actions must be taken with determination to shorten to a minimum the interval between delivery of the first new weapons to the inventory and achievement of a high degree of force readiness. The required readiness includes a sure knowledge and competence. The system program offices have received increased support since the organization of the Air Force Systems Command in 1961. Using command participation in the management of new systems has been required and has greatly improved. These steps and others have resulted in considerably better management.

The pace of technology will continue to increase. Use of the program package method of planning by the Department of Defense will require further attention to "follow-through" planning and management. To maintain an adequate and credible military posture in the face of continually increasing demands, management control procedures, such as the PERT, should be applied to the entire span of a weapon program through operation and phase-down. The system program director should keep full control of his program until the operational user is ready to accept the combat-readiness status with an acceptable evaluation of combat capability. If necessary because of many difficulties, the system program director would keep control of the program until a major portion of the new weapon inventory is in place. Under these circumstances he would even be responsible to the using command for providing whatever fighting capability might be available in the early inventory of his weapon in case of the outbreak of war. The intent here is the same as the general intent of the Stever Report recommendations: authority and responsibility should be effectively joined together at an operating level. This arrangement would be particularly appropriate with future space systems. In any military space system now visualized it seems clear that as soon as the system works, no matter how early the R&D phase, it will become truly operational and employed by operational force commanders to the fullest extent possible.

The major using command should be required to use fully its membership in the system project office. By this means effective working liaison will be provided between the system project office and the commander and staff of the using command. The using command should participate in the program management process with full understanding that many of the decisions made are irrevocable and that the using command must live with the results in the future.

Increased emphasis should be placed on testing by creation of a special office, Deputy for Testing, at the Deputy Chief of Staff or Assistant to the Commander level in Headquarters Air Force Systems Command, as recommended in the Stever Report. This office would have the following functions:

(1) Be responsible for efficient management of Air Force testing resources, including funds, personnel, and physical facilities.

(2) Be the Air Force point of contact on testing and testing resources for outside agencies, particularly for the Deputy Director of Defense Research and Engineering for Ranges and Space Ground Support, Department of Defense.

(3) Provide policy guidance to specific test programs. The Deputy for Testing would maintain a nucleus of personnel highly qualified in the testing specialty. These personnel would review specific program test plans for the purpose of ensuring that previous testing experience and knowledge are incorporated in the plans. Responsibility for the test program and authority to carry it out would remain in the system project office.

Finally, Headquarters USAF should take the necessary steps to determine and fill the requirements for technical personnel. These requirements cover quality as well as quantity. Action should be taken immediately, since deficiencies exist now. These requirements will increase rapidly as the space systems progress.

Headquarters Air Force Systems Command

Notes

1. Major General Victor R. Haugen, "Changing Times in Weapon Systems Management," *Signal*, XII, 10 (June 1958), 34.
2. George F. Metcalf, "Industry's Role—and the Need for Flexibility," *The General Electric Defense Quarterly*, III, 2 (April–June 1960), 15.
3. Brigadier General Robert C. Richardson III, "The Stalemate in Concepts," *Air University Quarterly Review*, XII, 2 (Summer 1960), 4–5.

The Changing Management Role of the Military Departments

COLONEL WILLIAM G. MCDONALD

WHENEVER an officer assigned to the Air Staff manages to leave Washington for a few days and runs into an old friend, he is invariably asked, "How are things in the Pentagon?" The answer almost as invariably has been, "Same as ever . . . organized confusion . . . same old problems, only different solutions . . . same old place."

It appears doubtful that such comments will continue to be applied to Pentagon activities. The fact of the matter is that the Pentagon is changing, and the impact and direction of that change have become increasingly apparent in recent months. Furthermore any assumption that current moves in defense administration represent just another "ripple," another short-lived period of adjustment following the frequent arrivals and departures of top civilian administrators, overlooks the key connection between these current developments and the long-term trends.

This paper will examine these trends in an effort to cast some light on the "pattern" and permanence of more recent changes in defense management.

For our purposes, the defense management job may be observed in three parts: strategic planning, which gives coherence and purpose to the vast and myriad functions of the military establishment; operational control, which guides the development and day-to-day activities of the combat-ready forces; and resource management, which regulates the acquisition of necessary men, weapons, and materiel. The parts, of course, are related, and changes in one have a way of affecting the other two. This paper, however, will review long-term developments in resource management. The conclusions we can draw will go a long way toward explaining why the Pentagon is not "the same old place."

The structure and operation of the defense establishment did not remain static in the intervals between major amendments to the basic military unification legislation of 1947. Much of the actual change since that time has occurred gradually, as the product of executive directive and legislation affecting various aspects of military administration.

In this study no attempt at an exhaustive review has been made. Instead some of the more significant developments in the various functional areas have been highlighted to illustrate the basic trends toward centralized management of the defense enterprise. To simplify discussion of the changing organization and methods of resource management, four major functional areas will be treated separately — first the comptroller function, then the materiel, development, and personnel functions.

comptroller

The unique power and importance of the comptroller function became apparent almost immediately after the National Military Establishment was created in 1947, when one of the three assistants to the new Defense Secretary acted as adviser on fiscal matters. The foundation of comptroller power rested on an identification of civilian control with budget control. As Ferdinand Eberstadt pointed out, "The budget is one of the most effective, if not the strongest, implements of civilian control over the Military Establishment." The 1949 National Security Act Amendment created the post of Assistant Secretary of Defense (Comptroller) and endowed it with statutory authority to direct and supervise the preparation of Department of Defense budget estimates and to supervise fiscal and accounting procedures within the Department. Operating as the principal "budgeteer" and spokesman for civilian demands for economy, the Comptroller came to exert a powerful influence over defense management. Wilfred J. McNeil, who held the post from 1949 to 1959, was even referred to as "the indispensable man in the Pentagon."

Since that time various apportionment, reprograming, and expenditure controls have been introduced and strengthened, to further regulate and centralize Governmental and Department of Defense financial matters. Apportionment controls, originally instituted by Congress in 1933, were revised and appreciably tightened in 1951. These controls establish the limits and procedures whereby funds already authorized by Congress are apportioned to the various Federal agencies by the Bureau of the Budget on a specified, time-phased basis.

Reprograming controls were instituted in 1955 and revised in 1959. These controls require that the Secretary of Defense report to Congress all reprograming actions involving $1 million or more in the budget programs of the Operation and Maintenance appropriations, $2 million or more in the Research Development Test and Evaluation appropriations, and, in the Procurement appropriations, $2 million for additions to the approved procurement list, and $5 million for changes in any line item on the approved list. Expenditure controls, designed to phase the actual spending of dollars with Treasury balances and other requirements of the economy, represent another measure applied by Congress to the financial administration of the Defense Department.

The management of each of these dollar controls for the DOD is centralized in the Comptroller, Office of the Secretary of Defense (OSD).

Such dollar control inevitably involves OSD in the detailed financial administration — and, further, in the program management — of the three services. Thus in 1957 OSD instituted a "deferral system" to serve as a mechanism for regulating the flow of expenditures (expenditure controls). This system enables OSD to withhold appropriated funds from the individual services, at the time they request apportionment from the Bureau of the Budget. By determining which particular program monies will be withheld, OSD and especially the Comptroller have been in a position to apply a progressively detailed and centralized control over service programs.

It should be pointed out that no other executive department (with the exception of the Post Office) has a position with statutory authority comparable to that of the OSD Comptroller. Normally, specific budgetary and fiscal controls are exercised over other departments directly by the Treasury and the Bureau of the Budget. The very size of the Department of Defense, however, clearly makes this kind of control by an outside agency infeasible. As Samuel P. Huntington states in *The Soldier and the State*,

> There was a unique fusing of the activities of the Budget Bureau with those of the Comptroller. . . . For the fiscal years 1952 through 1955, the Budget Bureau and the Comptroller conducted a joint review of budget estimates, a practice not generally duplicated elsewhere in the federal government. . . . The Comptroller's office developed . . . an internal mechanism of restraint and control reflecting external demands and interests.

DOD Directives 7040.1 and 7040.2, in implementation of Public Law 84-863, set forth a program for improved financial management in the appropriation areas of operation and maintenance and in acquisition and construction of military real property. These directives, however, extend beyond over-all policy guidance to include detailed internal operating procedures for accounting, budgeting, and financial management.

The next step toward unifying DOD budgetary considerations also comes within the authority of the Comptroller, though it would not ordinarily be thought of as strictly a budgetary or fiscal matter. Before any of the services may purchase a new automatic data-processing (ADP) installation, regardless of its cost or size, it must first be approved by OSD. This restriction is indicative of the centralized management control exercised by the OSD Comptroller over the ADP programs of the services.

Until the change of Administration in January 1961, dollar control, though energetically applied by OSD, was very largely motivated by "external influences" (Congress, Bureau of the Budget, Treasury, etc.) pressing for economy and determining the essential dimensions of the military establishment. More recent developments indicate a shift in emphasis — a new impetus from OSD toward applying the dollar control afforded by the budget to an "internal" function of program allocation.

Charles J. Hitch, on assuming the duties of OSD Comptroller, almost immediately began the implementation of his theories of budgeting by program and weapon system. These theories, representing a new attempt to apply the economics of resource allocation to the budget process, were expounded in his book *The Economics of Defense in the Nuclear Age* (1960). His first step, quite significantly, was the establishment of a Deputy Assistant Secretary for Programming. This new office has the function of evaluating defense programs by determining the costs and effectiveness of a variety of alternative force structures and weapon systems. As this office expands in technical capability for evaluating and costing out alternative program proposals, there will be less and less dependence upon the services to furnish justification and selection of these alternatives.

The Office of Programming will implement the "program package" concept, which can be seen as a next step. The philosophy of Mr. Hitch in this respect is spelled out in his public statements, in which he interprets his task as "bridging the gap" between planning and programing, on the one hand, and current financial management practices on the other. This means that the service programs will be reviewed by OSD not only during the annual budget exercise but continually as part of a new planning-and-programing/financial-management process. Essentially the program package concept involves two basic changes in the budget process. The first change is the introduction of an additional phase in the budget process in which OSD will make a comprehensive review of the programs proposed by the military services and will decide the exact composition of each service's force structure. The second change is the present requirement for translating budget estimates from the traditional appropriation accounts to program-package/program-element accounts and vice versa.

It is reasonable to assume that, subject to Congressional acceptance, the program package procedure will become a permanent supplement to the conventional appropriation structure. Some OSD and service experts were of the opinion that the full implementation of the program package concept would not be feasible before the FY 1964 budget cycle. Notwithstanding these misgivings, at Secretary McNamara's direction the new procedures were incorporated in the FY 1963 budget process.

A new program and financial control system was recently implemented by the Secretary of Defense. This system, which is based on the program package concept, has three major features: (1) the establishment of a Secretary of Defense-approved "Five Year Force Structure and Financial Program," (2) a formal procedure for the military departments to propose and receive approval of changes to the approved base, and (3) monthly progress reporting. Approval of programs represents the basic building block of this new approach to the budget process. The integration of all three service roles under generalized program groupings (such as strategic retaliatory forces, general purpose forces, etc.) certainly results in a diffusion of service identity. Such identity emerges only in the implementation after the approval cycle has been completed.

A recent significant event in the Comptroller area was a requirement to conduct a comprehensive review of existing financial and nonfinancial information systems and develop a plan for a DOD integrated system for relating programing, budgeting and financing, accounting, and progress and status reporting. It may be presumed that the resultant plan for an integrated system will meet the accounting and financial data requirements of the program package type of budget structure. Then the integrated system will (1) increase the requirements levied upon the services in the reporting of internal operations; (2) enhance the capability of OSD to arrive at decisions regarding service programs; and (3) limit the responsibilities of service comptrollers to the collection and submission of financial and nonfinancial data to OSD.

In sum, the recent and dramatic events that have marked Mr. Hitch's incumbency go a long way toward redefining the dollar control function traditionally held by the OSD Comptroller. Where once such control was wielded primarily as a reflection of external forces and limits setting the dollar dimensions of the military establishment, financial control is now being recast with a new emphasis on internal program control. The program package, in this respect, represents a *functional* division of our combat capability. The Secretary of Defense, then, becomes the integrator not of three total service programs (each with an internal integrity balanced and shaped by service planners) but of a multitude of separate weapon system programs (input from the services and balanced and shaped in the program package by OSD).

materiel

The establishment of the Munitions Board, one of the three original coordinating boards set up in 1947's National Military Establishment, was a big step toward centralized materiel management. Actually some forms of interservice coordination in logistics — more than in any other functional area — had existed prior to 1947.

The Munitions Board functioned on a statutory basis and concerned itself with industrial preparedness, procurement, and supply. In 1951 it was given a DOD inventory control responsibility as a basis for the cross-servicing of supplies.

In succeeding years several factors motivated a continuous drive toward centralized management throughout the whole field of military logistics. The rapid obsolescence and the increasing costs and complexity of modern weapon systems, all pressing against firm budget ceilings, focused more and more high-level attention on efficiency in defense supply. Blurring mission lines further promoted the clamor for unification, especially in Congress, where service competition in missile development led to charges of waste and duplication. It would be little exaggeration to say that Congressional pressure was forcing the DOD to seek a "zero error tolerance" in the management of its vast logistics resources.

Thus in 1952 Congress passed the Defense Cataloguing and Standardization Act, which established a new Defense Supply Management Agency in OSD. The Reorganization Plan No. 6 of 1953 abolished the Munitions Board and set up an Assistant Secretary of Defense for Supply and Logistics with policy responsibilities in procurement, production, distribution, transportation, stockpiling, and warehousing.

In 1955 the Secretary of Defense instituted the single-manager system to provide for single-service management of common-use items and services. The introduction and expansion of the single-manager concept over the next six years became the most significant aspect of integrated materiel management in the DOD. By 1961 eight single-manager assignments had been made, the Army handling five groups of common supplies (subsistence, clothing and textiles, general supplies, construction, and automotive) and the Navy handling three (medical and dental supplies, petroleum, and industrial). The Air Force has no single-manager commodity assignment but does provide a common service, air transport.

The Inter-Service Supply Support Committee was established in 1956 to provide for the interchange of DOD assets among the services. In 1958 further progress in the integration of materiel management was signaled by DOD Directive 5154.14, which established an Armed Forces Supply Support Center. With a full-time systems analysis staff, the center consolidated existing catalog standardization and utilization functions.

The McCormack-Curtis Amendment to the 1958 Reorganization Act states: "Whenever the Secretary of Defense determines it will be advantageous to the government, he shall provide for the carrying out of any supply or services activity common to more than one military department by a single agency or such other organizational entities as he deems appropriate." This broad statutory authority and the impact of a much-publicized Joint Economic Committee report in late 1960, which charged that wasteful procurement methods of the services had cost the American taxpayer "multiple billions of dollars," set the stage for further action by the new Administration in 1961.

The first significant action taken in the materiel area after the change of Administration was the consolidation of the offices of Assistant Secretary for Properties and Installations and Assistant Secretary for Supply and Logistics. The combined office was redesignated the Assistant Secretary of Defense for Installations and Logistics. This step was in conformity with the Defense Secretary's desire to reduce the number of assistant secretaries reporting directly to him. The effect of this reorganization on the Air Force is significant from the standpoint of administrative procedures.

Secretary McNamara also instituted a series of DOD projects to study various aspects of the materiel area. These projects included: (a) an examination of procurement procedures, (b) a consideration of the basis for establishing inventory stock levels, (c) a comprehensive review of bases and installations, and (d) a study of the feasibility of single-manager supply functions.

This analysis of single-manager supply functions resulted in the establishment of a separate Defense Supply Agency, reporting directly to the Secretary of Defense. As noted earlier, there has been a definite trend over the years toward consolidation of service procurement and supply activities. In the magnitude of its impact, the establishment of the Defense Supply Agency can be seen as a continuation of this trend.

Under the provisions of DOD Directive 1430.7, action has been taken to modify the Armed Services Procurement Training Program by further consolidating its structure and unifying its operations. The purpose is to consolidate all procurement educational effort at designated single points to ensure a unified training program that will promote uniform application of procurement regulations throughout DOD.

One of the most recent events in the materiel area involves the establishment by OSD of the Logistics Management Institute. This is a private, nonprofit corporation, employing specialists and operating under contract to the Defense Department. According to Mr. McNamara, "It will bring professional talent to bear upon certain of our very complex logistical problems." The purpose of the Logistics Management Institute is to help the DOD reduce costs and improve the materiel readiness of the armed forces. Its staff will undertake procurement and logistics studies as requested by the Assistant Secretary of Defense for Installations and Logistics. In October 1961 the board of trustees of this newly organized civilian corporation approved an ambitious program to study and make recommendations on a wide range of defense logistic activities.

development

With respect to research and development the trend toward centralized control appears to have been paced by organizational moves rather than by changes in management procedures and fund controls, as was the case in the comptroller area. Thus, in the Pentagon the years since 1947 are marked by a constant and sometimes almost frantic search for a magic combination of organizational elements that can ensure weapon development within acceptable lead times. Soviet missile developments and more recent successes in space have propelled this search into the arena of national politics, where even top-level executive and Congressional attention — and pressure — have not been spared.

One theme can be perceived running through all the organizational shifts and reshifts that have shaped defense R&D — and that theme is centralization. The establishment of the Research & Development Board, one of the three coordinating boards set up by the National Security Act of 1947, was a first step toward supraservice centralization. Though essentially an interservice coordinating medium, the R&D Board took on more extensive functions as the parent of guided missile committees and the Weapons Systems Evaluation Group, an interservice organization to provide analytical services to the R&D Board and the Joint Chiefs.

The Reorganization Plan of 1953 abolished the R&D Board and created two DOD Assistant Secretary positions, one for Research and Development and one for Applications Engineering. Both assistant secretaries were delegated authority to obtain such reports and information from the military departments as were necessary to carry out their policy responsibilities.

Pressures for a speedup in missile development, provoked by accelerated Soviet efforts, led to the establishment of an OSD Ballistic Missile Committee in 1955. The committee was to serve as a single agency within the DOD to monitor service programs and to review and approve development plans. In 1956 the Secretary of Defense appointed a Special Assistant for Guided Missiles, who became chairman of the OSD Ballistic Missile Committee. The Special Assistant/GM (the so-called "Missile Czar") functioned as a central expediter of the services' missile development programs. In 1957 the position was elevated to "Director of Guided Missiles," but in the post-Sputnik era of rapid reorganization the position survived only until 1959.

The creation of the Advanced Research Projects Agency (ARPA) in 1958 reflected the increasing concern of the Secretary of Defense with the importance of other than missile research — in particular, the military potential of space. The administrative charter was broad and general. The Director of ARPA was to "be responsible for the direction or performance of such advanced projects in the field of R&D as the Secretary of Defense may designate."

Also in 1958, under the provisions of the Defense Reorganization Act, the post of Director of Defense Research and Engineering was created. The new director, replacing the Assistant Secretary of Defense for Research and Engineering, which had been established by combining positions of ASD(R&D) and ASD (Applications Engineering), was to take precedence over all assistant secretaries and was given statutory duties. Specifically, the Director of Defense Research and Engineering was to act as the principal adviser to the Secretary of Defense on scientific and technical matters; to supervise all research and engineering activities in the DOD; to direct and control (including assignment or reassignment) R&E activities that the Secretary deemed to require centralized management. Expansion of this organization into the weapons selection field as well as into operations and requirements had become apparent.

In sum, then, Congressional criticism of duplication among service development programs and strong pressure for a speedup of R&D activities led to an increasing concentration of authority and control above the military department level. The medium of this centralization prior to January 1961 had been the organizational change — the creation of new posts and agencies at OSD level providing single-point control over R&D.

Events since the change of Administration in 1961 indicate a continued exercise of the centralized authority that had already been so effectively concentrated in OSD. The exercise of this authority in R&D, however, has not been without some significant delegations of authority to the military departments. In March 1961, for example, Secretary McNamara assigned the responsibility for research, development, test, and engineering of DOD space programs on a project basis to the Department of the Air Force. Nevertheless, as the Director of Defense Research and Engineering holds basic statutory authority over all military development programs, the Air Force's responsibility is subject to the authority of DDR&E in regard to space programs as with all other areas of defense R&D. The situation is complicated by the role of the National Aeronautics and Space Administration in the space programs and its relationships with DOD.

In further recognition of the Secretary of Defense's deep and constant concern with the R&D area, a comprehensive assessment of research and development management in the services has recently been initiated. This assessment has the objective to prepare plans for the establishment of managerial, organizational, accounting, contractual, and other practices to improve efficiency and effectiveness in R&D within the service departments.

When one considers the growing proportion of the Defense budget allocated to development and allied procurement activities, he gains an appreciation for the powerful impact that these increased OSD controls over the entire R&D area will have upon individual service management responsibilities.

personnel

The Officer Personnel Act of 1947, which can be seen as an outgrowth of the National Security Act of that year, established various appointment, promotion, and retirement criteria that were to be applicable to all three services. As a result considerable standardization was achieved, though significant differences still existed between the personnel programs of the Navy and those of the Army and Air Force.

The Career Compensation Act of 1949, which specified rates of compensation and scales of disability benefits, and the Armed Forces Reserve Act of 1952, which prescribed criteria for reserve officer appointments, applied further standard conditions to the personnel administration of the three services.

Responding to what it considered to be abuses in the services' temporary promotion programs, Congress passed the Officer Grade Limitations Act in 1954. This legislation set specific limits to the number of officers serving in each grade above captain or lieutenant, senior grade. Because of certain inequities, in 1959 the Air Force was granted temporary legislative relief from the OGLA for the grade of major. Congress believed this increase was consistent to curb "abuses" in officer promotions.

The Regular Officer Augmentation Act of 1956 was passed in recognition of the need for a larger permanent force in-being. The Act authorized a substantial increase in the regular officer strength of the

Army and Air Force. The Navy, already manned adequately by regular officers, was not significantly affected.

Concern with retention rates led to the 1958 "Pay Act," which established a system of pay differentials within enlisted grades based on proficiency in certain skill areas. Proficiency pay was authorized by Congress at $50, $100, and $150 levels, but OSD restricted its use to $30 and $60 levels. Similar provisions for officer compensation, called "responsibility pay," were also set forth by Congress, but implementation has been withheld by OSD.

Thus by 1958 considerable uniformity had been achieved in the personnel administration of the services. Significantly the legislation that formed the basis of this unification originated, for the most part, out of individual service-sponsored programs. As one service sought legislative authority to adjust personnel structures, Congress saw fit to prescribe similar authority for the other services. In this way, more than as a result of any concerted drive in Congress, personnel administration had become more and more uniform.

It might be observed that in the personnel functional area the role of OSD was somewhat more passive prior to January 1961 than it had been in the comptroller, development, and materiel fields. This is not to say that OSD did not exercise certain centralizing controls. The percentage of enlisted men authorized in the upper six grades, for example, is controlled by OSD. The administration of proficiency pay, already noted, is another example of OSD centralized management. Nevertheless, in comparison with developments in other functional areas, the trends in personnel management could not be characterized as directed by a strong OSD-initiated drive toward centralization.

Certain events since the change of Administration suggest a more active control function for OSD in personnel matters. A recent action on the part of OSD, for example, concerns the employment of consultants and experts. Under a new agreement between the DOD and the Civil Service Commission, additional restrictions have been placed on such hirings. Significantly the services must now obtain the approval of the Secretary or Deputy Secretary of Defense to employ consultants and experts who will be retained for more than 30 working days in any one year. Implementation of this approval control could seriously curtail the influx of expert advice to the services.

A further step toward centralized control can be seen in OSD action on ROTC matters. The Air Force feels that its present ROTC program is obsolete, inefficient, and too costly. To eliminate some of the ills, the Air Force has recommended legislation which will serve as the basis for an expanded officer education program. OSD, however, deferred taking a position on these recommendations until it has time to study the Army proposals. Congressional action this session seems unlikely; action next session is also uncertain. In any event, OSD action subjects Air Force ROTC requirements to a standardization of dubious value.

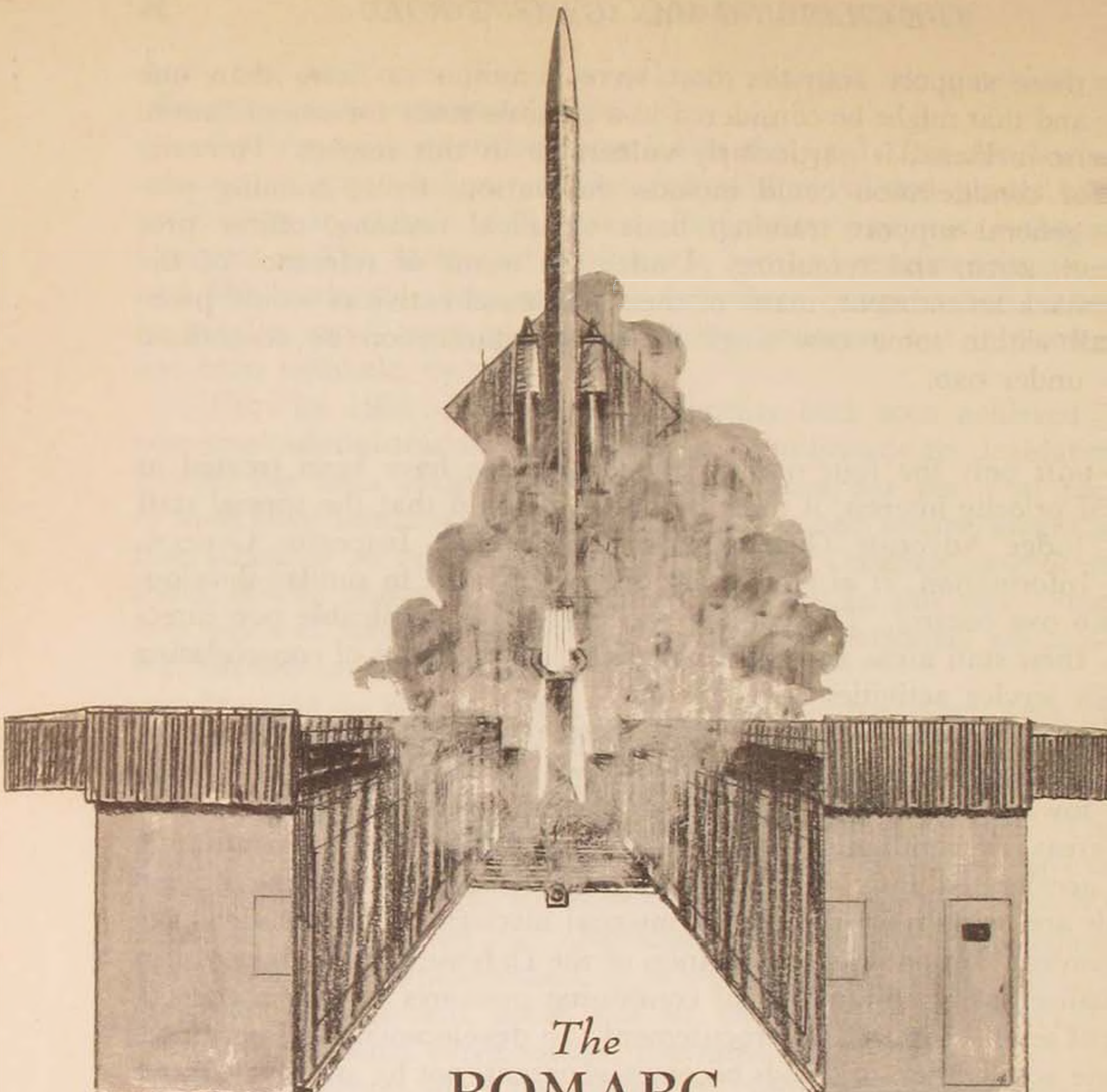
During the summer of 1961 OSD asked the military departments to report those support activities that were common to more than one service and that might be considered in a possible study for consolidation. The personnel area is particularly vulnerable in this respect. Potential items for consideration could include the various flying training programs, general support training, basic technical training, officer procurement, ROTC, and recruiting. Under the terms of reference of the McCormack amendment, many of these personnel activities would probably fall within some new single-manager organization or centralized agency under OSD.

ALTHOUGH only the four major functional areas have been treated as being of priority interest, it must be borne in mind that the special staff areas (Judge Advocate General, Surgeon General, Inspector General, Public Information, *et al.*) have also been subjected to similar developments in OSD control. The volume and content of applicable DOD directives in these staff areas and the far-reaching implications of consolidating common service activities bear this out.

Taking a more general view of these recent developments in the major functional areas, we can draw a basic conclusion. The long-term trends toward supraservice control, as illustrated in these major functional areas, are continuing — and, more importantly, they are continuing at an accelerated rate. In the comptroller area long-standing budget controls are being reoriented as an internal mechanism for detailed program control. In materiel the creation of the Defense Supply Agency can be visualized as a culmination of continuing pressures toward a consolidation of service supply and procurement. In development and personnel the same acceleration of trends becomes apparent, not by any single move of gigantic proportions but by the activism of OSD directives, memorandums, and controls.

In their cumulative impact and direction, these latter moves have served to increase and to concentrate management control over military department activities by the Secretary of Defense. Thus they can be visualized at once as a parallel reflection of and a basis for the more conspicuous changes heralded by amendments to the National Security Act. The Pentagon is *not* "the same old place," and a fundamental question now must be answered: "What is the role of the military departments?"

Headquarters United States Air Force



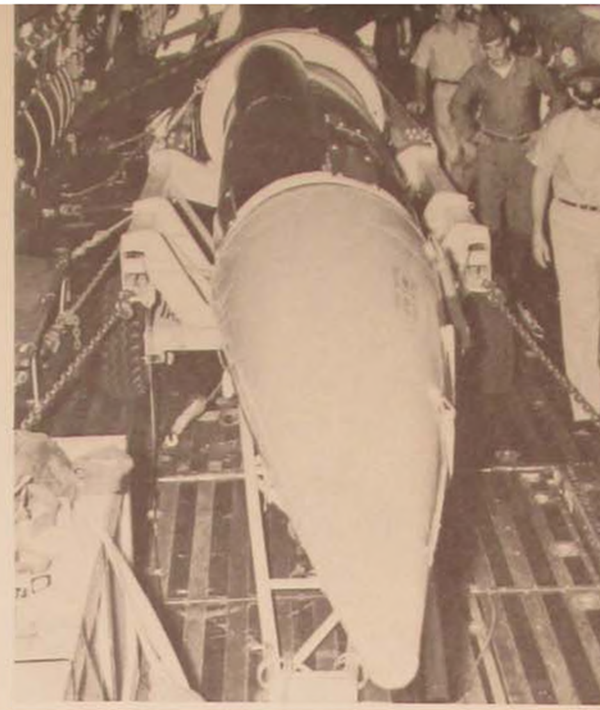
The BOMARC Weapon System

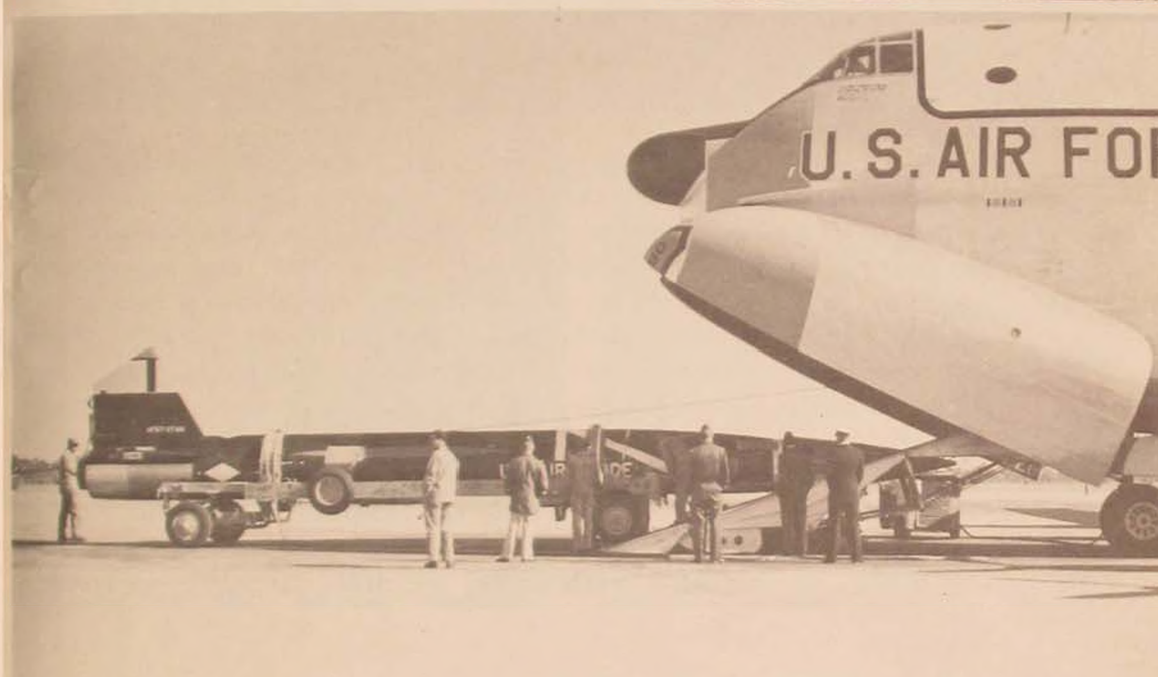
Lieutenant Colonel Charles E. Minihan

In 1962 the Air Defense Command reached a significant aerospace milestone with the complete tactical deployment, in support of the North American Air Defense Command, of the IM-99 weapon system Bomarc. The surface-to-air Bomarc is a classic example of the guided missile, though it is more accurately described as a pilotless interceptor aircraft.

Research and development leading to the supersonic, high-altitude, target-killer Bomarc was begun in 1950 by the Boeing Airplane Company, and on 12 January 1951 the United States Air Force authorized the development of the Bomarc weapon system. The system was designated BOMARC to represent its origin in studies proposed by the *BO*eing Airplane Company and the *M*ichigan *A*eronautical *R*esearch *C*enter. These two agencies recommended the development of a defensive missile system for employment by a ground-based electronic environment. This system should provide for the rapid engagement of massed bombardment formations or scattered attacks.

The Bomarc missile is manufactured at the Boeing Airplane Company plant at Seattle and then transported 3000 miles by C-124 to Hurlburt Field, Florida. For the flight the wings, ailerons, and elevators are packed in separate shipping containers and flown along with the missile. On arrival at Hurlburt officers make a primary inspection of the Bomarc before tie-down chains are released and offloading begins. The movement crew uses an aircraft-loading trailer, a tractor, a flatbed trailer, and a forklift for the delicate offloading operation. The trailer must be carefully controlled to prevent missile damage. When the Bomarc is out of the aircraft, the cable is disconnected from the trailer and tractor.





The weapon system included certain unique features:

- **A rocket-boosted, ramjet-propelled, supersonic missile.**
- **The use of track-while-scan techniques in combination with large digital computers to obtain high firepower.**
- **A missile-borne radar designed to search for, automatically acquire, and give accurate terminal guidance to target, ensuring interception and destruction of hostile aircraft at long range from the target complex and launching site.**

Under a new weapon system management concept, Boeing was responsible for delivering to the Air Force the complete weapon system, consisting of the interceptor missile, weapon control equipment, and the weapon support and maintenance equipment.

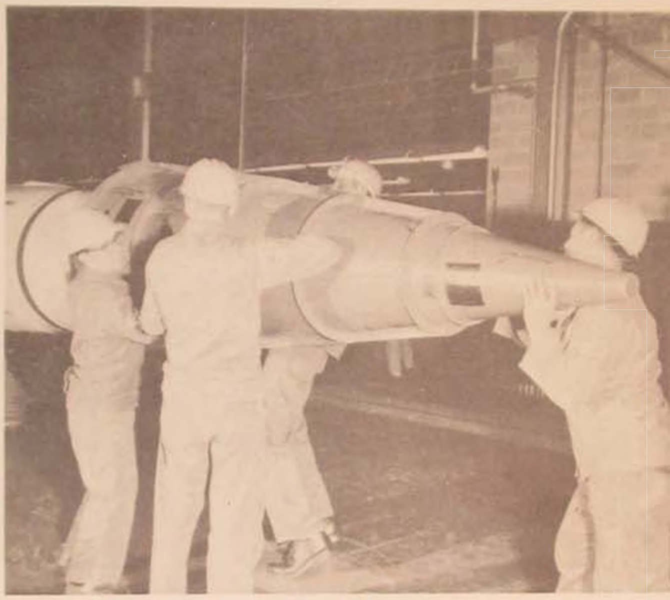
The offloaded Bomarc missile is taken to the assembly and maintenance building where it is removed from the transporter-loader and transferred to the assembly-disassembly cradles by monorail hoists and an overhead crane. Assembly, the job of dressing the missile, includes putting on wings, elevators, probes, blast tube, and other parts. When all trimmings are in place, the missile is joined to the dummy boost case by the ramjet engine team. A complete check of the missile starts with the hydraulic system check and runs through the pneumatic and electrical systems, the propulsion system, the ramjet system, and the electronics system. A final, all-system check is performed at the functional checkout station, after which the missile goes to the all-weather shelter for a simulated firing. The remaining reliability performance checks are performed after the missile is in the shelter. Once on the launcher, the Mobile Inspection Unit is hooked up. Punch cards are fed to the test unit, and the missile is completely tested again. In case of a malfunction, the MIU pinpoints the trouble.

In 1954, following the establishment of operational requirements by the Air Defense Command for a semiautomatic ground environment (SAGE) system for the continental air defense, the ground electronics environment under development by the University of Michigan was deleted from the Bomarc system specifications, and plans were formulated for the integration of Bomarc into SAGE, together with the USAF manned fighter-interceptors and the U.S. Army Nike surface-to-air missile. SAGE was developed in the Lincoln Laboratory of the Massachusetts Institute of Technology. A working committee of USAF and industry representatives, designated the SAGE Bomarc Coordinating Committee (SABOCC), was organized in 1957 to plan and implement the integration of the Bomarc system.

The Montgomery Air Defense Sector and the Eglin Gulf Test Range were major factors in the demonstration of the Bomarc system capability and its compatibility with SAGE. Tests subsequently conducted in this environment established standards for retrofit of the tactical weapon base and operational doctrine to the existing air defense mission system.

Technicians use special mobile equipment to align and install a wing section.

Installation of wing assembly is completed inside the Bomarc aft section.



A missile squadron technician installs antenna on the vertical stabilizer.

Removing the protective casing from the pointed fiberglass radome nose cone.

The Air Defense Command, Air Research and Development Command, and Air Materiel Command jointly established and proportionately manned the organization responsible for conducting tests and certifying weapon system development status and operational capability. The Wright Air Development Division, Air Force Command and Control Development Division, and Air Proving Ground Command implemented ARDC responsibilities. Ogden Air Materiel Area represented the AMC. Air Defense Command participated in the development activity and directed the operational phases through the Commander, Montgomery Air Defense Sector, Gunter Air Force Base, Alabama, and the 4751st Air Defense Wing (Missile) at Hurlburt Field (Eglin AF Auxiliary Field Number 9), Florida.

Bomarc testing by the Boeing Company at Patrick AFB, Florida, was begun in September 1952 and terminated in April 1960. The first IM-99A weapon system flight on the Eglin Gulf Test Range occurred on 15 January 1959 and resulted in a direct hit against a QF-80 drone almost 100 miles

Missile squadron technicians place command system components in the Bomarc.

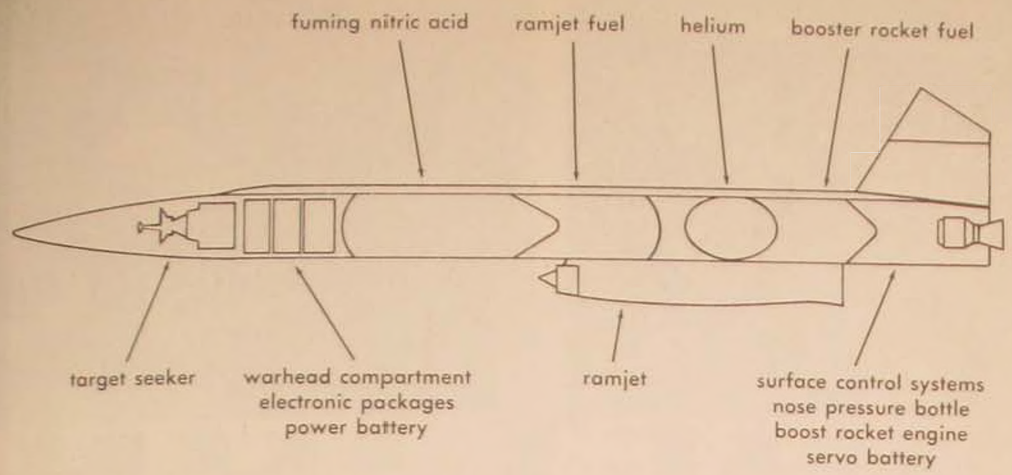
Preparing the missile forward for the installation of its two ramjet engines.

Inspection of the pressure system valves and of the tail section installation.

distant from the launch base. In addition to the Boeing Company as prime contractor on the Bomarc, other contractors, including the MITRE Corporation, Western Electric, Burroughs, Philco, RCA, and Lehigh, supported the joint test force technical operation.

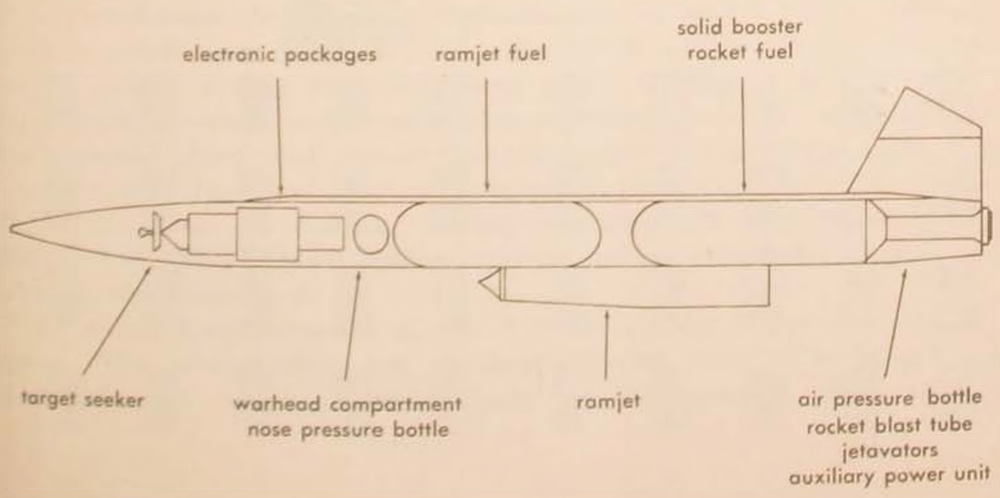
Two individual interceptors are included in the IM-99 weapon system. The first Bomarc interceptor, the IM-99A, became operational at the Air Defense Command's missile base, McGuire AFB, New Jersey, on 1 September 1959. The second-generation Bomarc, designated the IM-99B, initially became operational in the summer of 1961 at the Air Defense Command's Kincheloe AFB, Michigan, missile complex.

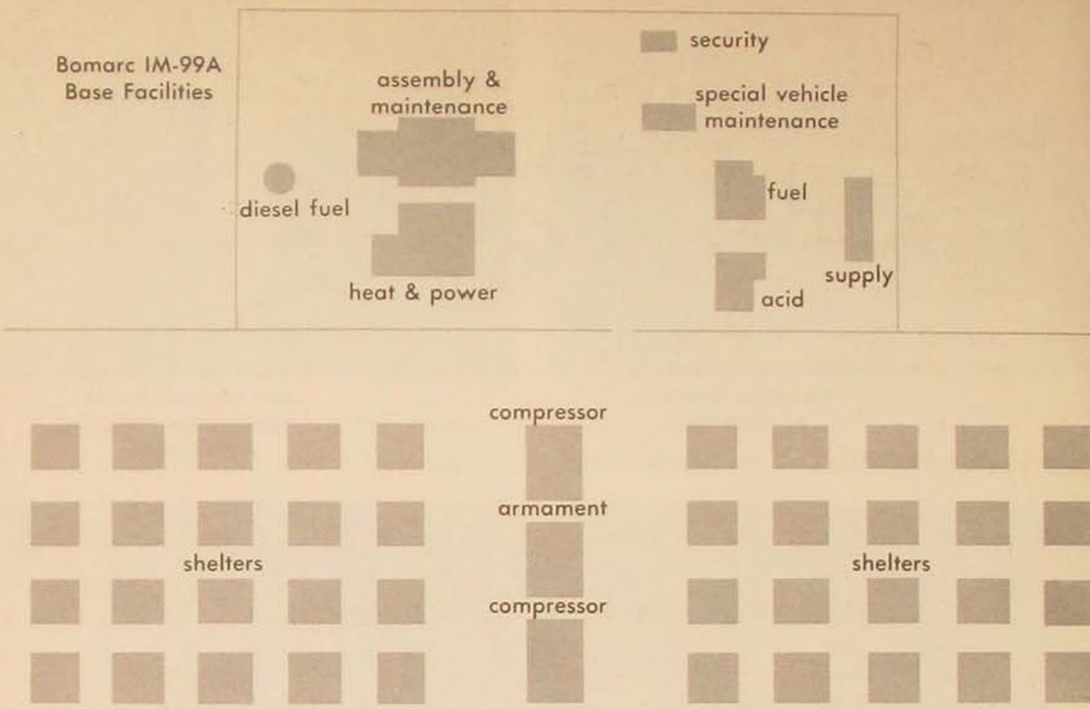
The distinguishing features of the IM-99A and IM-99B are shown in the accompanying illustration. Close inspection reveals that the wings on the IM-99B are farther forward than on the IM-99A. This modification was required to compensate for weight and balance and other aerodynamic performance characteristics of the missiles.



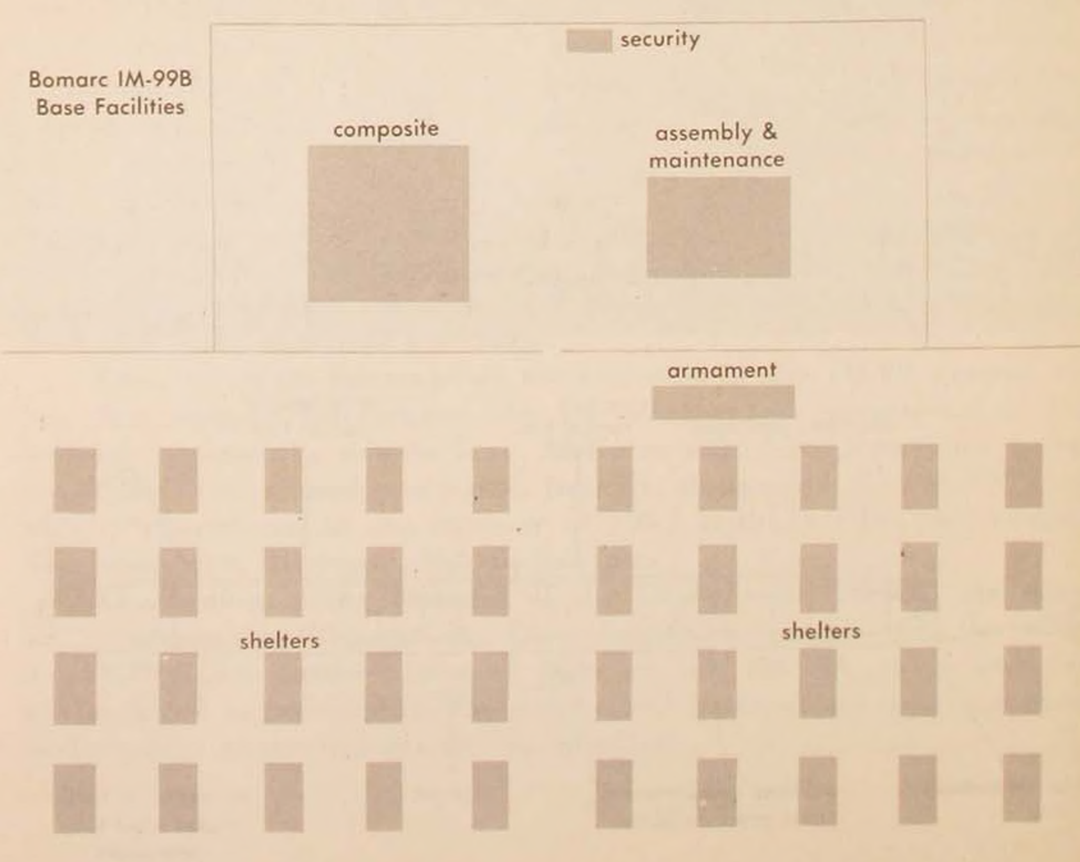
Comparative Bomarc Characteristics

IM-99A		IM-99B
18 ft 2 in	wing span	18 ft 2 in
46 ft 9 in	length	46 ft 5 in
10 ft 3 in	height	10 ft 3 in
35 in	diameter	35 in
about 16,000 lb	launch weight	about 16,000 lb
Aerojet-General liquid propellant booster; two Marquardt ramjet engines for cruise phase	power plant	Thiokol solid rocket booster; two Marquardt ramjet engines for cruise phase
booster: about 35,000 lb ramjets: about 1350 lb each	thrust	booster: about 50,000 lb ramjets: about 1250 lb each
over mach 2	speed	over mach 2
above 60,000 ft	ceiling	above 70,000 ft
conventional or nuclear warhead	armament	conventional or nuclear warhead
250 mi	range	over 400 mi
less than 2 minutes	reaction time between alerting and launching	considerably less than 2 minutes



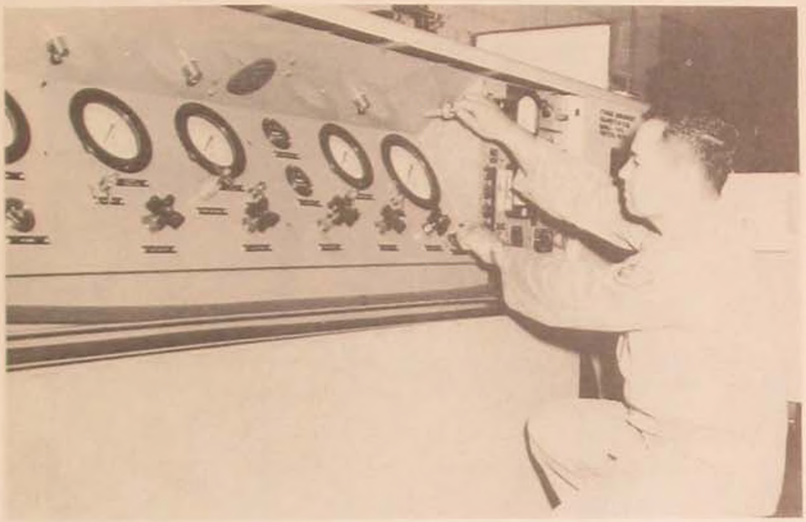


Comparison of Bomarc IM-99A and B base facilities indicates that a "B" base has the fewer missile support buildings. The reduction was achieved by (1) elimination of the complex liquid-fuel booster rocket facilities for the "A" missile and (2) the different maintenance concept of the "B" system, in which more missile maintenance is performed in the launching shelters than in the assembly and maintenance building of the "A" system. Whereas the "A" facilities are a collection of many missile support buildings, the "B" support facilities consist basically of two large buildings: the assembly and maintenance building and the composite building. The latter provides centralized control by bringing together the squadron command headquarters, the operations center, the supply facilities, and the weapon system calibration equipment rooms.



A maintenance technician demonstrates checkout procedure of the missile hydraulic pump at the hydraulic test station.

Bomarc maintenance technicians hook up a ramjet engine for testing in the Hurlburt assembly and maintenance building.

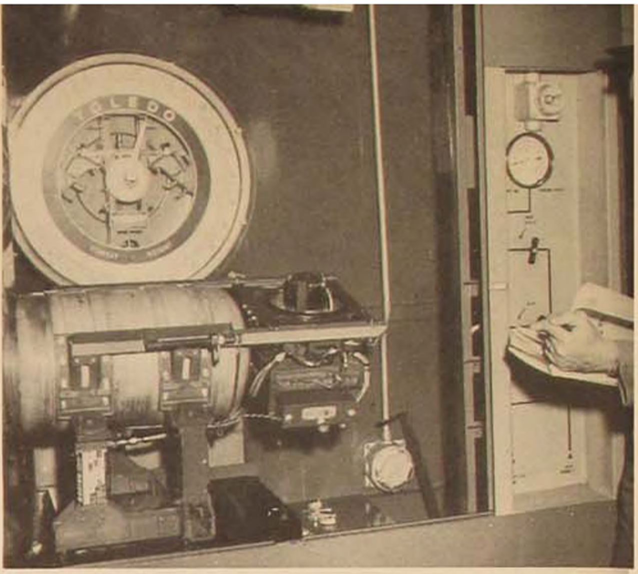


The mobile hydraulic unit, which is used to fill and provide pressure for the missile hydraulic system, is checked by a Bomarc maintenance man.

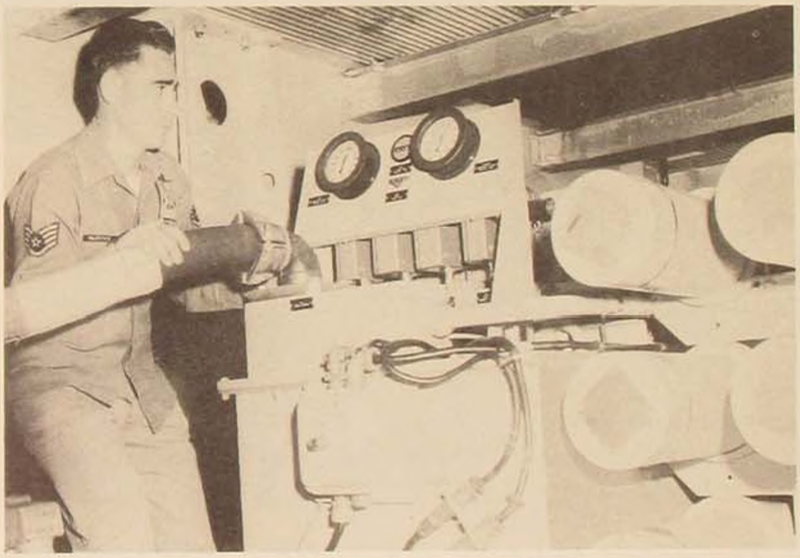
The IM-99A is a medium-range, high-altitude, supersonic cruise interceptor capable of attacking hostile targets above 60,000 feet. A liquid-fueled boost rocket propels the missile from an erect (vertical) position in its self-contained shelter to a high-altitude transition point, achieving supersonic speeds over mach 2. Two Marquardt ramjet engines maintain supersonic cruise during the mid-course phase of flight. The IM-99A is equipped with a search and homing target seeker, which is activated prior to the terminal phase and directs the interceptor to the target after lock-on. A proximity fuze and nuclear warhead complement the demonstrated deadly accuracy of the system. During Category III operational testing, QF-80, QF-104, QB-47, and Regulus II target drones have been blasted from the sky by the Bomarc A.

The outward appearances of the Bomarc A and B are not radically different. The two missiles are of approximately the same length and height, and each weighs approximately 16,000 pounds. However, the

Servicing a 52-volt servobattery, which powers Bomarc hydraulic system. Protective equipment prevents splatter burns.



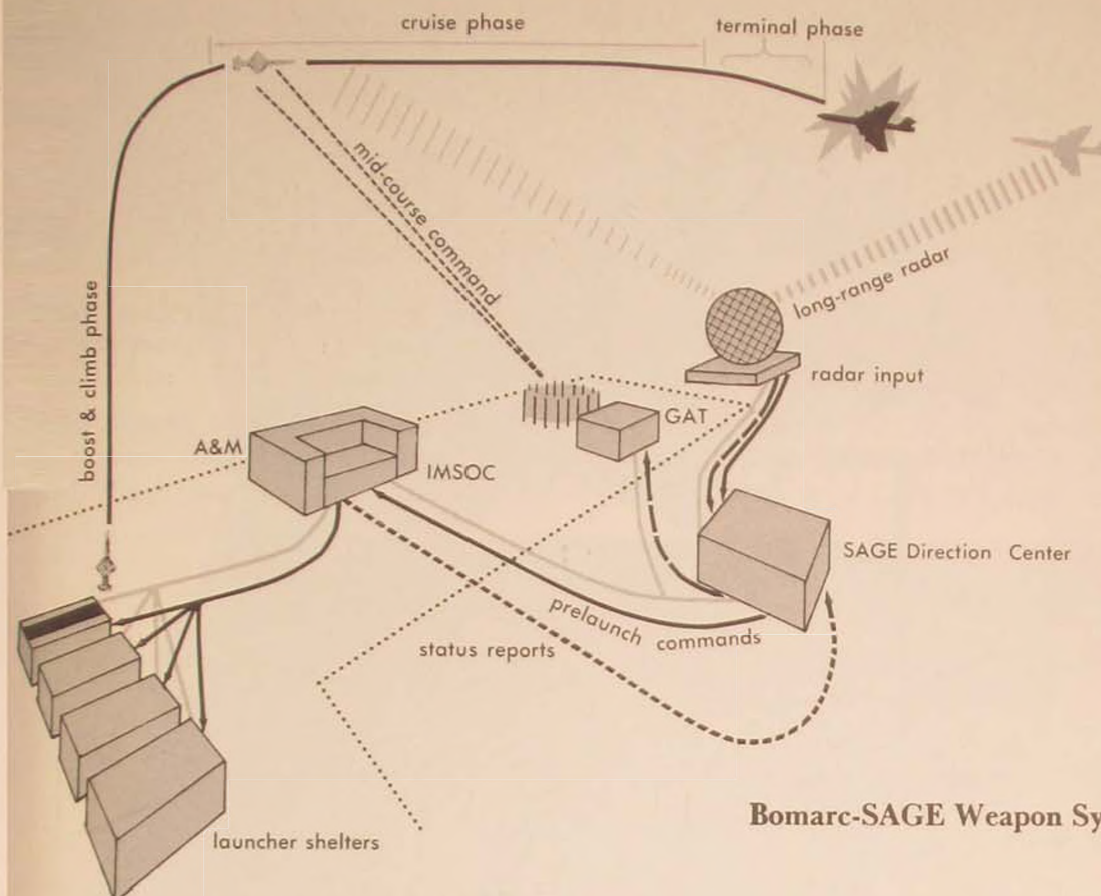
Technician weighs ammonia package in ammonia weight and drain cabinet. Package cools air for sections of Bomarc A.



Monitoring the hydraulic skid pressure and pump gauges in the pit of Bomarc B shelter. Equipment powers the erector boom and the shelter roof.

Bomarc B missile internally differs greatly from the Bomarc A. The nose section of the "B" contains an improved target-seeker system, and the command system or "brain" of the missile has been completely redesigned. The cruise fuel for the "B" is standard JP-4 jet fuel, whereas the "A" missile ramjets use 80-octane fuel. The greatest and most significant difference between the two missiles is the solid-propellant boost system for the "B" as compared with the liquid-fueled rocket boost of the Bomarc A. The solid-propellant fuel has proved exceptionally reliable and requires only minor service and maintenance.

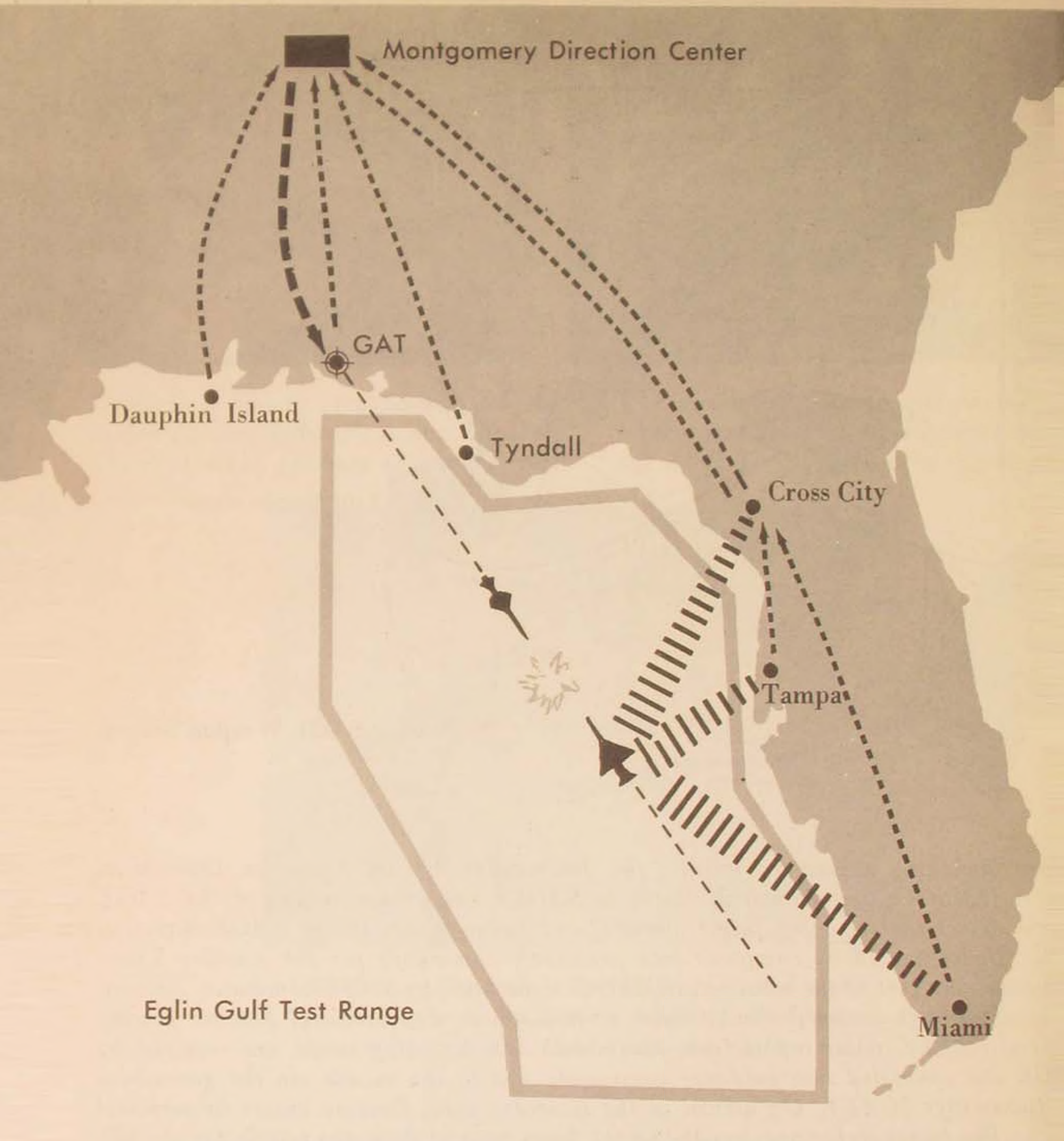
The development and testing of the Bomarc weapon system and its employment by SAGE have been truly complex. The SAGE system provides a reliable employment of electronic information to replace the pilot and the scramble order. The Bomarc missiles are always on continuous high-alert status in individual launch shelters awaiting the fire signal from SAGE.



Bomarc-SAGE Weapon System

Before launching a Bomarc missile, the Interceptor Missile Squadron Operations Center (IMSOC) reports missile status to SAGE. Long-range radars of the SAGE system detect the incoming target aircraft, and radar inputs to the SAGE direction center are converted by computer into prelaunch commands for the missile. These commands are sent to the missile via IMSOC. Launched by SAGE command, Bomarc proceeds through its boost-climb, cruise or mid-course, and terminal phases. During the cruise phase, radar inputs from the missile and incoming target are received by SAGE and converted into guidance commands sent to the missile via the ground-to-air transmitter (GAT). On arrival in the intercept area, Bomarc enters its terminal phase. The target seeker acquires the target, locks on, and dives the missile for the kill.

The mandatory functions of target detection and identification obviously have to be performed prior to employing Bomarc. Also a human decision has to be made to employ Bomarc rather than another available air defense system—manned interceptors or the Nike—against a specific hostile target. Once the commitment is made to use Bomarc and it is paired with a target, then the true "automatic" SAGE system operation is effected. The missile receives fire-up and launch commands automatically from the SAGE computer and rapidly climbs to its cruise altitude, boosted by the liquid (IM-99A) or solid (IM-99B) fuel. The two ramjet engines operate prior to the missile's reaching cruise altitude and continue to propel the missile through the remaining course to intercept. The missile is launched on any



Radar returns of the Bomarc missile and its target are fed into the SAGE direction center (Montgomery Air Defense Sector) from installations at Miami, Tampa, Cross City, Tyndall AFB, and Santa Rosa Island, Florida, and from Dauphin Island, Alabama. The SAGE direction center then performs all computations to make intercept predictions, to form guidance equations, to determine guidance commands, and to make updating corrections to the commands during flight. SAGE commands, which control the flight of the missile during the cruise phase, are directly sent to the missile via ground lines and the ground-to-air transmitter (GAT) at Hurlburt Field. These signals position the missile for the terminal phase of the intercept. The drone target, shown being tracked by the radar installations at Miami, Tampa, and Cross City, will be intercepted by the Bomarc about midway down the Eglin Gulf Test Range (outlined in grey).

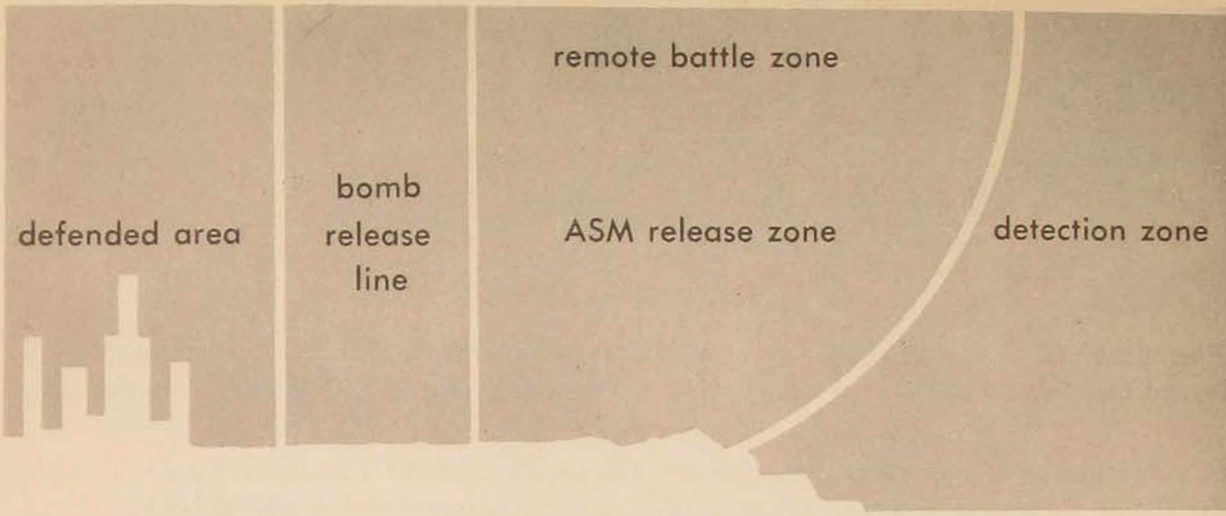
The combined Bomarc IM-99A and IM-99B testing facilities, Santa Rosa Island, Florida. In the foreground "A" shelter launchers are on the left and "B" shelters on the right.

The Bomarc weapon system ground-to-air transmitters (GAT) at Hurlburt Field, Eglin Air Force Base, Florida. At left are the two omnidirectional tower antennas of the IM-99A Bomarc GAT and at right the directional horns of the IM-99B GAT antenna.

azimuth directed by SAGE and shortly after launch receives updated target information from the ground-to-air transmitter sites. The supersonic Bomarc streaks to the general area of battle, where its target seeker provides the terminal guidance required to kill the hostile bomber.

The Bomarc B has a range twice that of the Bomarc A and is a more flexible and diversified air defense system. It is capable of completing intercepts over 400 miles from the base against supersonic and subsonic air-breathing missiles and manned aircraft, from sea level to over 70,000 feet.

The "A" and "B" missiles employed in the northeast and central portions of the United States now serve to provide a highly effective area defense system. One of the primary requirements in the development of the Bomarc weapon system was to give the North American Air Defense Command a quick-reaction supersonic unmanned interceptor with a high rate of fire that could effectively complete intercepts away from the key strategic target areas. The long-range, high-speed Bomarcs ensure that the attacking aircraft will be destroyed before they launch their air-to-surface missiles and decoys and before they reach their bomb-release lines. With

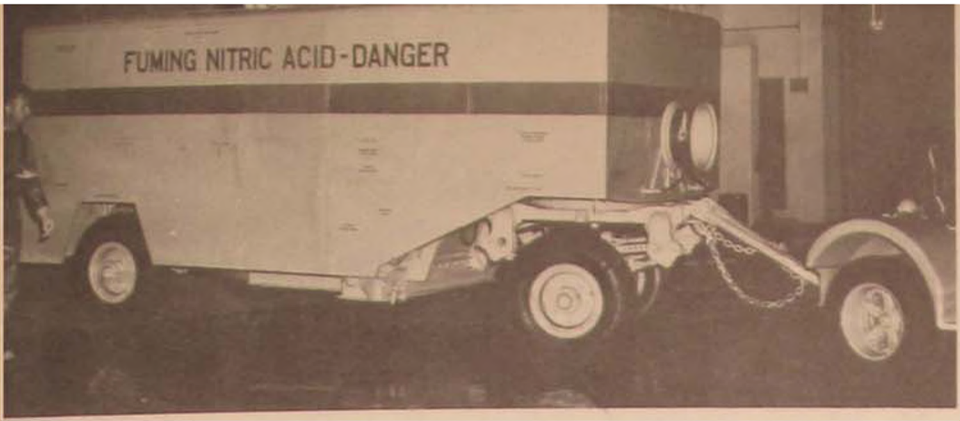


To keep the air battle remote, hostile incoming aircraft must be detected and identified in the peripheral detection zone. They must be destroyed in the remote battle zone, since at this phase of their approach they may fire air-to-surface missiles. If the enemy aircraft penetrate the defense to their bomb release line, they will be able to drop bombs even if subsequently damaged or destroyed. For greatest security of a defended area, the hostile aircraft must be detected and destroyed or turned back as far out from target as possible.

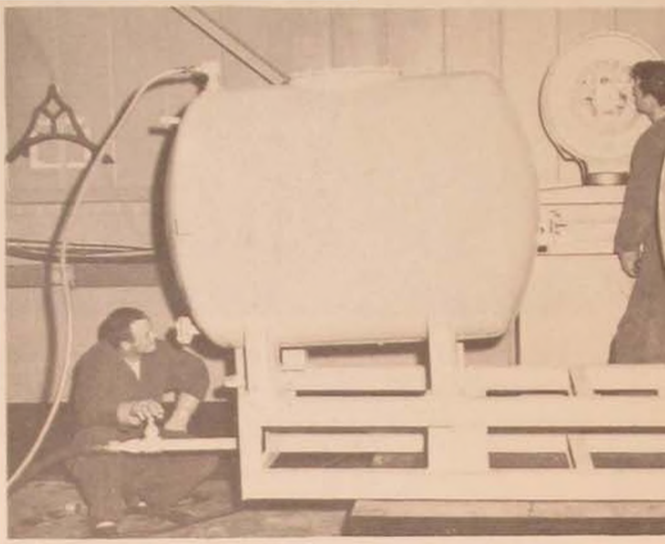
the air defense capabilities of the Bomarcs and the supersonic manned interceptors, together with the backup point-defense Nike-Hercules weapons, the North American Air Defense Command provides a strong defense in depth for the entire North American Continent.

The test program for development of the Bomarc weapon system was unique in many ways. In order for the interceptor missiles to be made available to the air defense inventory as soon as possible, the concurrency concept of development, testing, and procurement of the weapon system was employed. Normally the development and test programs of a weapon system are sharply defined and divided to permit thorough analysis and the incorporation of improvements. However, the three test programs for the Bomarc B, as directed by AFR 80-14, operated concurrently during 1961: Category I—contractor testing, Category II—AFSC testing, and Category III—ADC testing. With the completion of Category I in mid-1961, the Category II and III test programs continued concurrently, with all testing planned for completion in late summer 1962. By compression of the program, the operational IM-99B missile has assumed an air defense mission three to five years earlier than if the category test programs had been scheduled consecutively.

A major management device utilized in the Bomarc B test program was the requirement that the weapon system contractor functionally demonstrate a tactical weapon system to the USAF. This requirement is known as contractor functional demonstration (CFD). Boeing was contracted to demonstrate in accordance with Air Force criteria that the Bomarc B was suitable for USAF use in the tactical environment. Air Force acceptance was to be

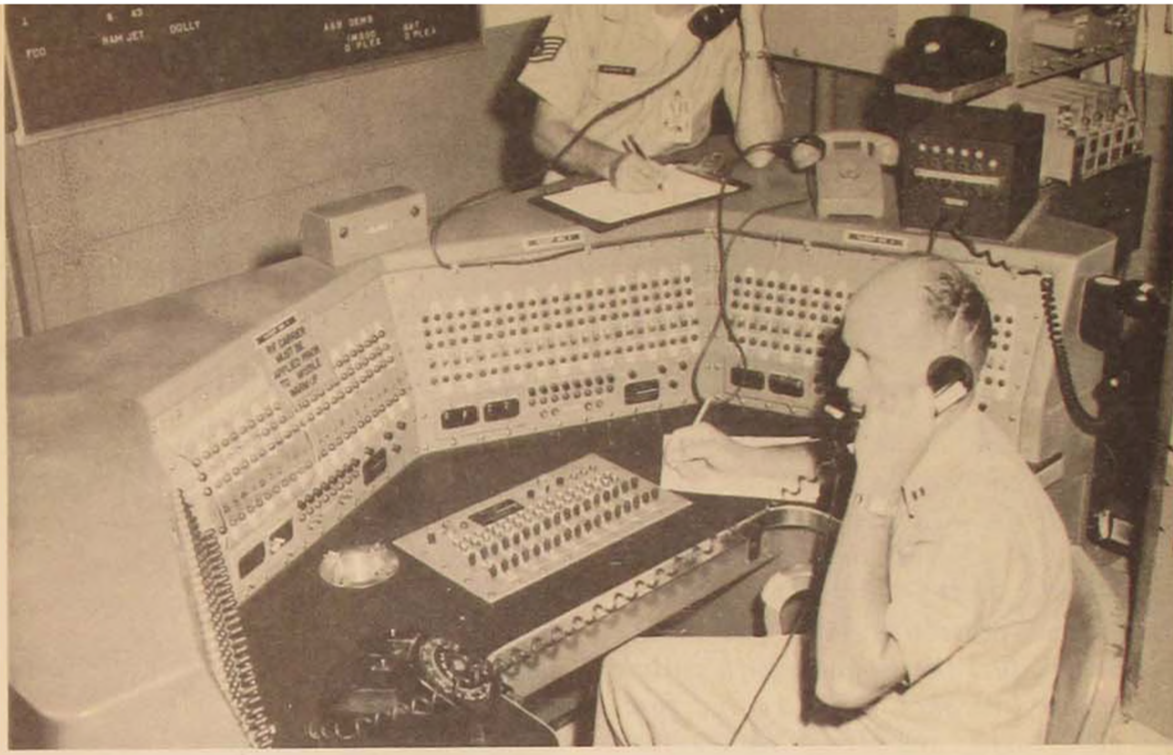


Fueling and defueling personnel receive, store, test, and dispense Bomarc missile fuels and decontaminate the Bomarcs before returning from Santa Rosa Island launch site to the A and M building. Clothed in protective suits and masks, missilemen fuel the Bomarc with aniline and furfuryl alcohol, inhibited red fuming nitric acid, and JP-X rocket fuel. Transferring and controlling flow of fuming nitric acid (above) requires great care. Fuel weight must be accurate to ½ of 1% of missile load. The white tank on the scale showing in the background simplifies weighing of the volatile missile load transferred from the truck. One airman adjusts a valve as another observes weight of the weighing tanks (center) in the fueling and defueling section at Hurlburt. Tank on left is used for weighing 80-octane ramjet fuel; tank on right holds JP-X rocket fuel. Each holds approximately one ton of fuel. Defueling trailer (below) removes fuming nitric acid after test run or simulated firing of Bomarc A missiles.

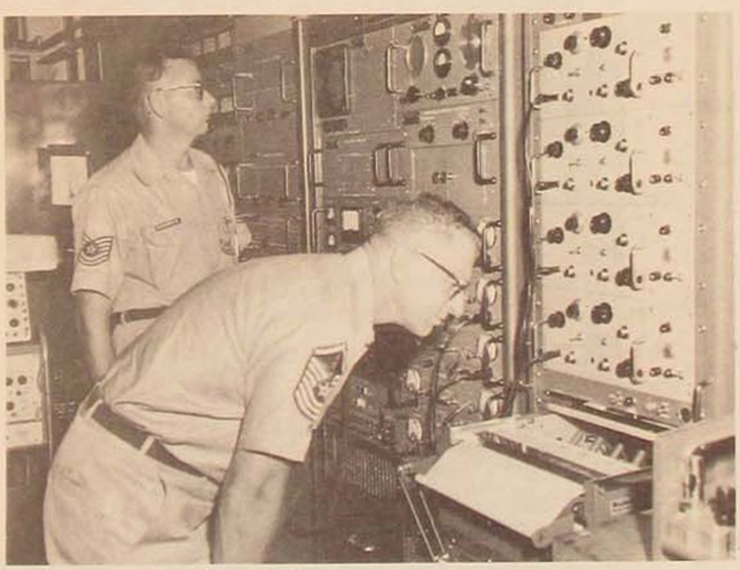


contingent upon the outcome of this demonstration. The criteria of this contract required that Air Force personnel of the skill and training levels authorized for tactical units assemble, check out, and launch seven missiles, utilizing tactical equipment and authorized technical orders. Every piece of tactical equipment was operated at least once and usually several times. All deficiencies found in equipment or technical documentation were formally noted, and a satisfactory fix was designed and demonstrated before the Air Force accepted the article concerned.

The CFD on the IM-99B began in January 1960 and was completed in December of that year. According to written test plans, 135 specific

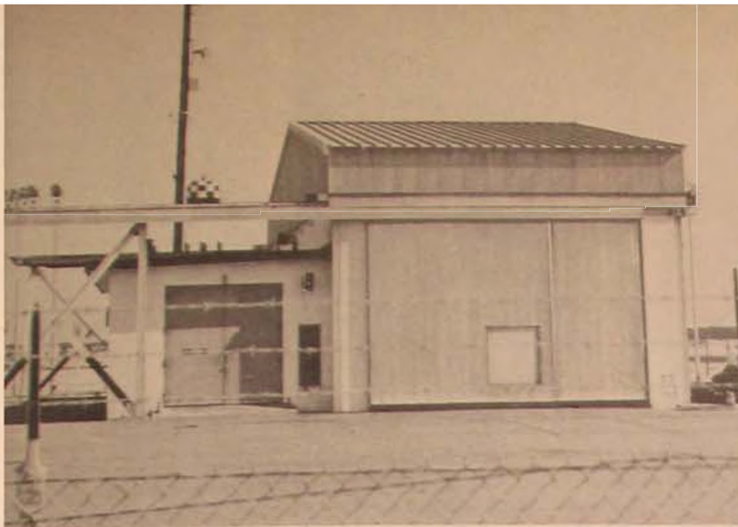


At T minus 30 minutes the officer in charge of the missile console in the squadron operations center (IMSOC) receives verification from SAGE of "ready storage" status of the missile. An assistant logs the information and announces the countdown over the site public address system.



At the telemetry station one technician maintains contact with IMSOC while another checks instrument readings and telemetry print-out equipment that monitor operation of missile systems in flight. Nontactical electronic telemetering packages are installed throughout the test missiles. Data reduction of telemetry inputs determines fitness of components.

Missile electronic technicians (left) operate a test message generator to check out the missile and its systems prior to launch. Others (right) monitor instrument readings of electronic systems that provide data on the prelaunch status of missiles.

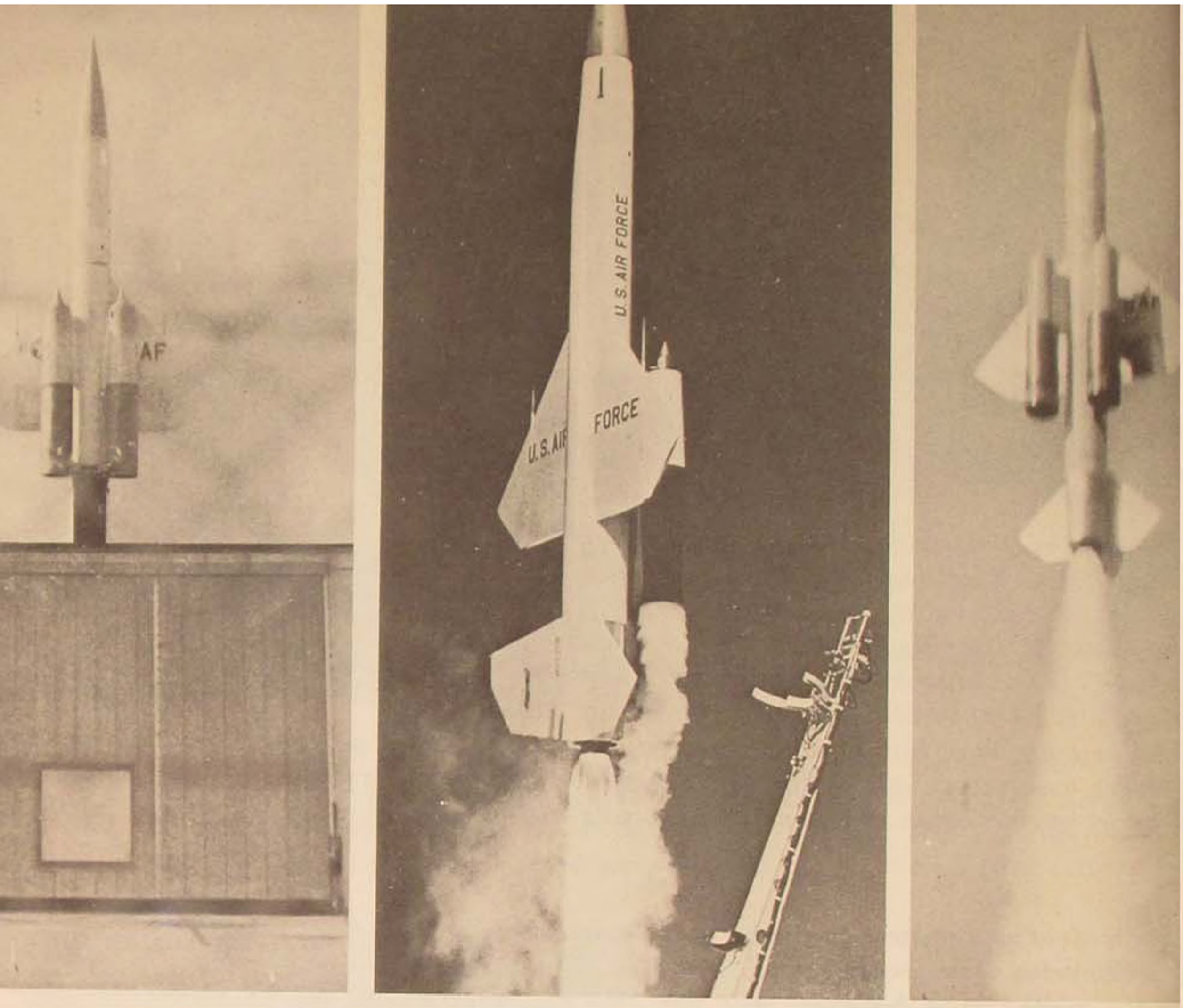


Before the Bomarc A missile is fired from the "A" launcher shelter, the shelter roof is in prelaunch closed position. Preparatory to launching, the shelter roof is retracted laterally to the left, and the Bomarc assumes its vertical launching position on the erector boom (the black T apparatus obscuring the missile fuselage). At the moment of lift-off the Bomarc missile rises vertically on thrust from the booster rocket, and the erector boom falls away from the ascending missile. The Bomarc's ramjet engines ignite and power the missile after the burnout of the booster rocket.

equipment demonstrations were performed. During the demonstrations 87 deficiencies were recorded and corrected, and 1500 technical order revisions were made. It is believed that the CFD program was a major factor in enabling the Bomarc tactical site activation on schedule, and in many instances ahead of schedule, with relatively few equipment difficulties being encountered by the newly activated units.

Complex guided missile systems such as Bomarc are large dollar-value items. The dollar value places a restraint on the test program and limits the number of airframes that can be expended for design, development, and operational investigations. In the plans for the IM-99A and IM-99B test programs, the economic factors were considered, and in a general sense sufficient test vehicles were provided for the initial evaluations. During the early phases of testing it became readily apparent that, with each R&D flight test missile valued at several million dollars (excluding range instrumentation, target drones, or other operating expenses), mission planning had to provide for a variety of objectives, both research and development and operational. The design of each flight test included instrumentation requirements—telemetry, range radar track data on both the interceptor and the target, and optical and electronic scoring devices.

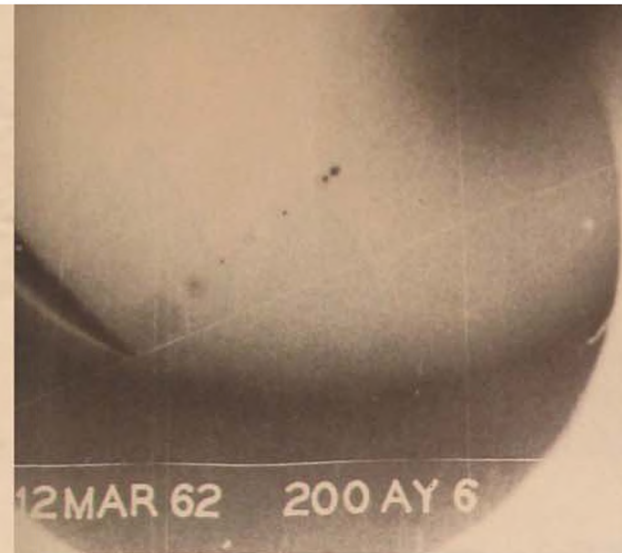
Additionally, with the knowledge that the tactical user "at home" would for some time be restricted from local launches for the purposes of training or tactics and technique investigations, a simulation computer program model characterizing the IM-99 interceptors in a SAGE environment was developed and calibrated with the live flight test data. The computer program calibrated during the Bomarc A and B flight test programs is capable of adaptation to any SAGE environment and of simultaneous execution of multiple intercepts against a variety of target situations. The terminal phase of the missile portion of the simulation program indicates lock-on,

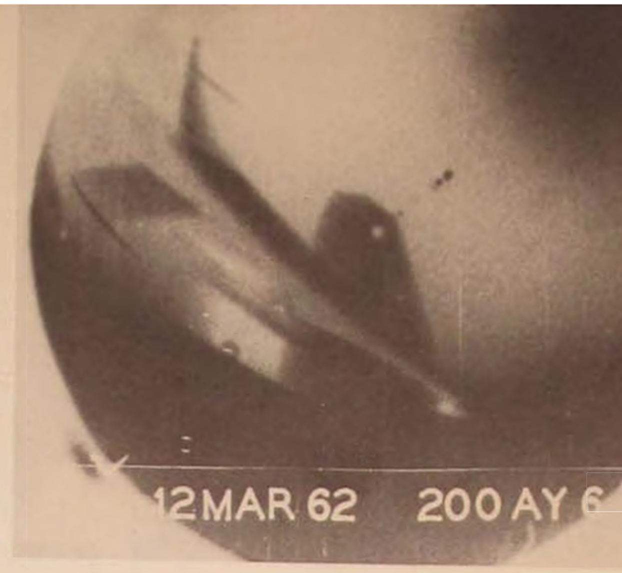


The booster fires . . . the boom falls back . . . and Bomarc climbs.

missile exertion, and miss distance and can be variously influenced by target size. The analytical and statistical performance of the Bomarc/SAGE simulation program enables the Air Defense Command to examine (1) system capabilities and tactics against the existing or changing threat, (2) intercept effectiveness under degraded operating conditions, and (3) specific tactical doctrine problems of the tactical sectors. The simulation program can also be used as a flight test planning tool for future training-test missions, and it will acquire increased calibration accuracy from the follow-on flights.

THE YEARS of planning and development of the present Bomarc area defense weapon system have provided many valuable lessons for the United States Air Force. The Air Defense Command has proved that highly skilled airmen technicians are fully capable of processing and maintaining an exceptionally complicated missile system. The Bomarc system, which during its research and development phases was evaluated and tested by civilian engineers, is now strictly an all-military responsibility. The concurrency concept of testing proved that a weapon system test program could effectively and realistically be compressed in order to meet operational requirements. The over-all history and experience gained throughout the Bomarc testing program should prove of significant value in the development and testing of future aerospace manned and unmanned systems.



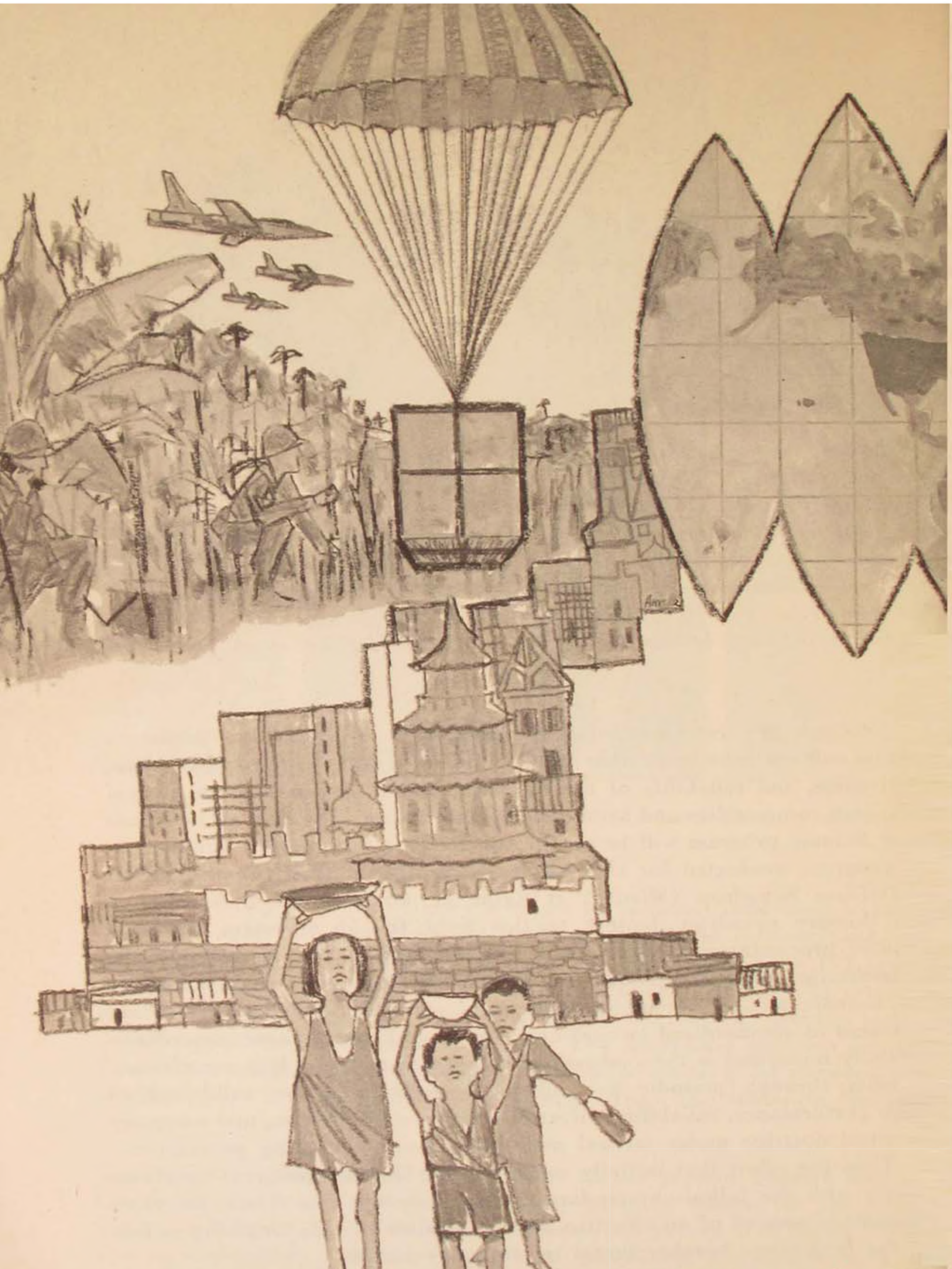


The Bomarc missile passes close to its jet bomber target and crosses the target flight path diagonally from left to right, in these photographs taken by a camera mounted in the target aircraft. Ordinarily, at such close range, the proximity fuze would detonate the warhead in a tactical missile, but this flight test missile was unarmed in order to prevent target destruction. Collision intercept is not necessary for destruction of the target—although missile and target have collided many times during flight tests. The Bomarc warhead is fuzed to detonate at that point closest to the target. A Bomarc missile may be directed at one hostile bomber or at an entire formation.

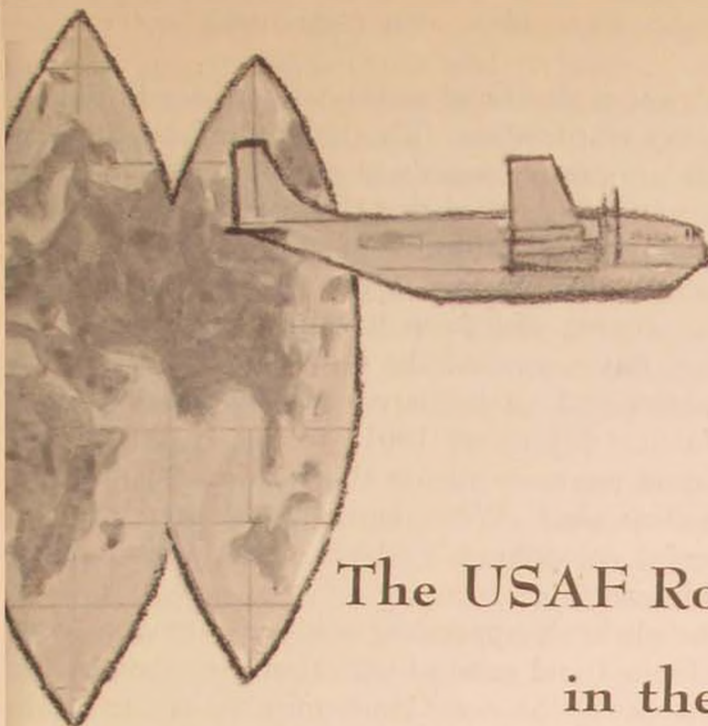
Although the test effort officially terminates in 1962, the simulation program will continue to provide vitally significant data on the employment, effectiveness, and reliability of the Bomarc weapon system to both tactical air division commanders and SAGE sector commanders. The over-all emphasis of the Bomarc program will be on the Air Defense Command's standardization program conducted for each tactical squadron annually by the 4751st Air Defense Squadron (Missile) at Eglin AF Auxiliary Field Number 9. Each Bomarc squadron deploys to this field for an intensive two-week period of processing and launching a tactical missile. Specific tasks of the standardization program include providing supervisor/instructor training to SAGE/Bomarc tactical personnel, ensuring continued development and improvement of standardized tactical operational and maintenance procedures. Especially important is the evaluation of the over-all SAGE/Bomarc systems' capability through periodic live missile launches and the validating of missile performance, reliability, effect of weapon modification, and adequacy of tactical doctrine under tactical maintenance and operating procedures.

Thus the effort that initially went into the Bomarc program continues strongly with the follow-on standardization program. The North American Continent is assured of an effective defense against the air-breathing missile and the long-range bomber threat in the years ahead.

4751st Air Defense Squadron (Missile), ADC



The capable forces desired by the Commander in Chief for nonnuclear operations and sublimited or guerrilla warfare find powerful instrumentalities in the predominant operational characteristics of air forces. The range, speed, mobility, flexibility, and penetrative capability of air forces give eminent effect in varied actions at all stages along the spectrum of conflict. The two accompanying articles by Col. R. W. Fish and Col. W. V. McBride begin a series of expositions examining Air Force roles, capabilities, tactics, and techniques in the small-war and counterinsurgency range of operations.



The USAF Role in the Cold War

COLONEL ROBERT W. FISH

WORLD conflict may be thought of as occurring along a spectrum ranging from one extreme of total war to the opposite extreme of total peace. In recent years this spectrum has been viewed as dividing roughly into three major degrees of opposition—general war, limited war, and cold war.

General war and limited war are the more classical forms of conflict. They have been identified historically by an act of war, a declaration of war, or a declaration of national emergency. They are marked by admission of failure to settle differences through diplomatic negotiations and by resort to the traditional clash of arms. The immediate protagonists are quite clearly defined. These forms of conflict are fairly well understood throughout the Free World.

Cold war is a relatively new term—and to most people a vague one, although it has come to have accepted usage throughout the world. While it names a type of conflict that has been practiced by mankind in varying degrees of intensity since the dawn of recorded history and with greatly increased issues at stake in recent years, it has never been precisely defined. In actual practice the term "cold war" has many meanings to many people. Its use creates an image for all who listen. But the mental images it creates for the Army man and the Navy man will differ from each other and from the images in the minds of the Air Force officer or the Foreign Service officer of the Department of State. Confronting it, we therefore find ourselves in a situation somewhat analogous to that of the fabled blind men when they were introduced to the elephant—each formed a different mental image based on his personal experiences. To communicate intelligently about any idea, men must speak in terms of common meaning.

In the Air Force, cold war is described as the war we are in today. This broad statement requires clarification. The definition and concept of what constitutes cold war are not necessarily of our own choosing, nor do we have the unilateral prerogative to define the cold war. It is the Communists who create cold-war conditions. If we could have real peace on an honorable basis, we would like to get out of the cold war immediately. It is the Communists who keep it going because it serves their purposes. Because they have assumed the initiative, it is they who really determine its parameters and set its pace. Mr. Khrushchev gave us their definition in his famous 6 January 1961 speech. In this speech he said the Communists would use every means short of limited war and general war to accomplish their aims. When he made this statement he was also describing "peaceful coexistence," which is the Communists' sugarcoated name for cold war.

According to Mr. Khrushchev's approach, cold-war activities consist of all actions, short of limited and general war, that are taken by the Communist nations with respect to the non-Communist nations to attain their objectives. Because the United States is a moral and ethical nation, it cannot accept this concept and definition. We cannot accept this principle that might makes right. Most of the activities of the United States with respect to other nations and peoples are not conducted for a cold-war purpose. In fact we try to keep the cold war out of as many areas of the world as we can. Our aid to other peoples in distress is rendered because it is moral and just and right that we aid others when they need help—and not for cold-war purposes.

Nevertheless the United States does have fundamental objectives concerning other nations and peoples. Our two basic objectives with respect to all peoples and nations are (a) that the people have the right to select their own way of life, and (b) that nations be able or assisted to develop a viable and self-sustaining economy. In today's world it is the Communists who categorize as cold war our efforts to help peoples and nations attain these objectives in the cold war.

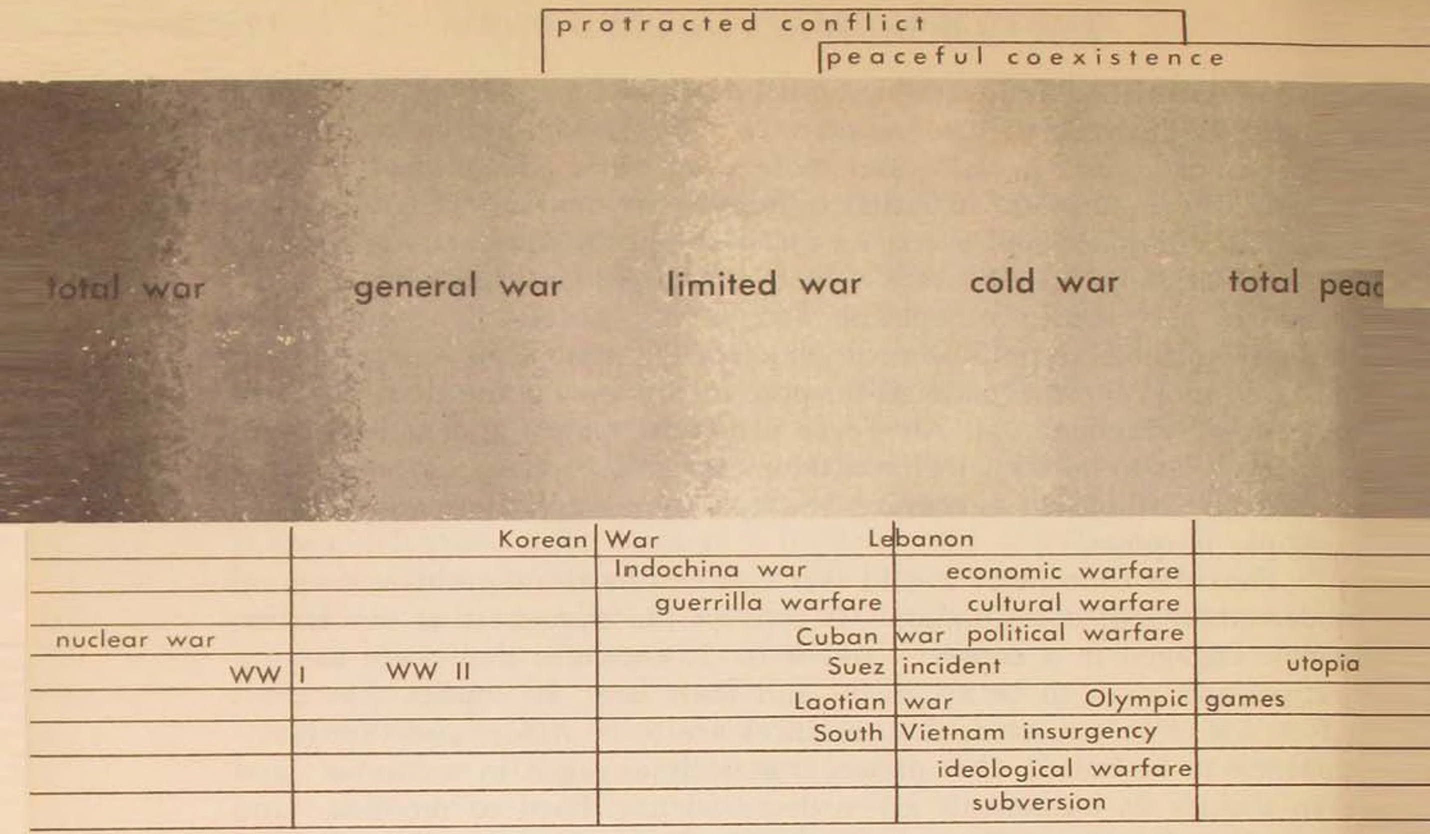
The Joint Chiefs of Staff have defined cold war as "the use of political, economic, technological, sociological, psychological, and military measures short of overt armed conflict involving regular military forces to achieve national objectives. Cold war includes periods of increased international tension, accelerated paramilitary activities, and increased activity by military forces."

The Air Force is primarily concerned with military activities in this situation, although Air Force officers must thoroughly understand the political, economic, and diplomatic activities because they all complement and bear on military activities, and vice versa. Military cold-war countermeasures in each of these fields fall short of overt armed conflict involving regular military forces except for counterinsurgency actions, incursions, infiltrations, hostile local actions, and similar movements. Military forces are maneuvered, deployed, and redeployed to impress enemy and neutrals and to reassure allies. The threat of force is a cold-war measure. Routine military activities and programs have nonmilitary impacts and overtones that can be utilized effectively through proper planning, administration, and coordination. Cold-war countermeasures also consist of specific actions not necessarily required for primary mission accomplishment which are initiated by military units and personnel for the planned purpose of advancing the attainment of objectives. Practically all Air Force programs, plans, and activities can serve as tools to be used in the attainment of U.S. and USAF objectives. Specific activities such as training and operations can be oriented to serve multiple purposes.

Thus the concept of a cold war can emphasize a positive, essential understanding of our situation. It conveys the thought that our nation is now engaged in a conflict—and it is. It connotes that there are objectives and goals to be attained—and there are. It implies that extra efforts are to be expected, that sacrifices are to be made, and that hardships are to be borne. Our nation is actively engaged in a conflict; and even though its battlefields are widespread and hard to recognize and some of its weapons different, this conflict is nonetheless as vital to our national security as the wars we have fought in the past. What really is new about the current struggle is the totality of the Communists' objective, organization, and method for attaining world domination.

IT CANNOT be truthfully said that the Communists are the cause of all the world's troubles today. It is readily evident to any informed citizen that there are many basic problems facing mankind other than those traceable to Communism. The fact remains that it is a major Communist tactic to fish in troubled waters wherever they are found. For example, the basic problems of the Congo are not founded in Communism, but in many instances the Communists have fanned the flames of discontent and obstructed the attempts of the United Nations to help the Congolese to solve their ills. Nationalism is basically an anti-Communist force, but this fact does not prevent the Communists from using it as a tool to serve their world cause.

The cold-war situation has been further confused for many people by the recent profusion of new descriptive words applied to cold-war activities: sublimited war, subterranean war, paramilitary operations, local wars, parawar, subversion, insurgency, counterinsurgency, guerrilla warfare, counterguerrilla warfare, peaceful coexistence, protracted conflict, covert aggression, wars of liberation. The list is not all-inclusive, and more new terms can be expected in the future. They all need precise definition for use in intelligible communication. Air Force personnel must not let themselves be misled by this shower of ear-catching terminology. Most of the terms are descriptive of a part of the cold war. The important thing to remember is that for us the cold war is a



The Spectrum of Conflict spans from Total War to Total Peace — from annihilation to social and political perfection. Between these two poles can be ranged all the conflicts of nations and clashes of ideologies according to their degrees of intensity.

struggle to attain U.S. objectives and we must always turn to our objectives for our basic guidance.

Because much of the activity we have broadly described is basically nonmilitary in nature, the question arises as to the reason for Air Force interest and responsibility in this field. The answer is fourfold.

- Our Commander in Chief has directed military participation. He has repeatedly referred in speeches to a requirement for increased capability for counterinsurgency and civic actions in the military services.
- National cold-war efforts can only be feeble unless there is an adequate backdrop of military strength from which to conduct cold-war operations. Perhaps this is a little like stepping on someone's toes. If he is smaller or weaker than you, and if you are so inclined, you may step on his toes without hesitation. On the other hand if he is big and strong, you will think twice before stepping on his toes because you may receive in turn a quick uppercut. The military backdrop performs that function in the cold war, and it falls upon the Air Force to provide the predominant contribution to the military backdrop in the form of the Nation's strategic deterrent.
- The international deployment of military personnel and their dependents in great numbers provides a ready-made capability in position with tremendous resources that cannot possibly be equaled by any other organization of our Government.

• Activities in the cold war may have direct impact in the fields of limited war and general war. The division between cold and limited war is not necessarily precise; where cold war ends and limited war begins is not always clear. What happens in the cold war may set the stage for either limited or general war and for the way in which these wars may be fought. This is Air Force business.

The Communists have been deterred from general war to date. They have resorted instead to a program of political, economic, military, and ideological erosion, as seen in the Korean War, the Indo-China War, Iraq's defection from CENTO, Cuba's betrayal to Communist control, the Congo crisis under Communist stimulation, the current civil war in Laos, and guerrilla activities in South Vietnam. A timetable for attaining their objective of world domination was presented by Mao Tse-tung to the International Congress of the Communist Party in Moscow in 1953. Their schedule called for taking Taiwan by 1960, but they did not make it. They appear to be behind schedule in Southeast Asia, but it is doubtful if the Free World can take much solace from this fact, in view of current Communist inroads in Laos, Vietnam, Singapore, and Indonesia. The world is currently witnessing their attempts to get on schedule in the Middle East and Africa. Cuba constitutes their first clear-cut conquest in the Western Hemisphere, but several other Latin-American countries by their own admission are walking a tight rope between Communism and freedom. These situations all serve to make the picture most disconcerting.

To date these erosive pressures have consumed much of our efforts in reaction. Until recently we have tried to defend ourselves primarily by containing Communism's advances. It is conceivable that the United States could be driven by this erosive process to a position of either submitting to isolation and domination or fighting the U.S.S.R. and its Communist bloc in limited or general war. Neither of these two courses of action is a satisfactory alternative. The preferable course is to maintain the initiative and win the cold war, thereby preventing the Communists from isolating us or forcing us into limited or general war.

PRIOR TO the first Soviet sputnik on 4 October 1957, too few people in our nation were concerned about the cold war. We felt certain that we were operating from a position of overwhelming strength even though the U.S.S.R. had a proved nuclear capability. Since that first space shot the Communists have on several occasions demonstrated that we no longer overwhelm everybody. We still enjoy many advantages vis-à-vis the U.S.S.R., but the rest of the world is not overwhelmed. Polls reveal that in some countries the people consider us a second-rate power compared to the Soviet Union.

As a result of the Communist advances of the past few years the United States has developed a major concern about the cold war. At various times the President, the Secretary of Defense, and the Joint Chiefs of Staff have directed the military services to participate in this struggle. Even without such specific direction, participation is inherent in the military mission and world-wide organization of the Air Force. More detailed aspects of this inherent participation will be described later.

The Air Force has complied with these various directives by initiating an Air Force cold-war program. Our intelligence has revealed the situation and defined the threat. Headquarters USAF has determined the program objectives and disseminated them as guidance to the major air commands. These objectives are broadly stated to direct the commands as to what is required but not how to do it. As the objectives are redefined and restated at each succeeding lower command echelon, they become more specific and limited in scope.

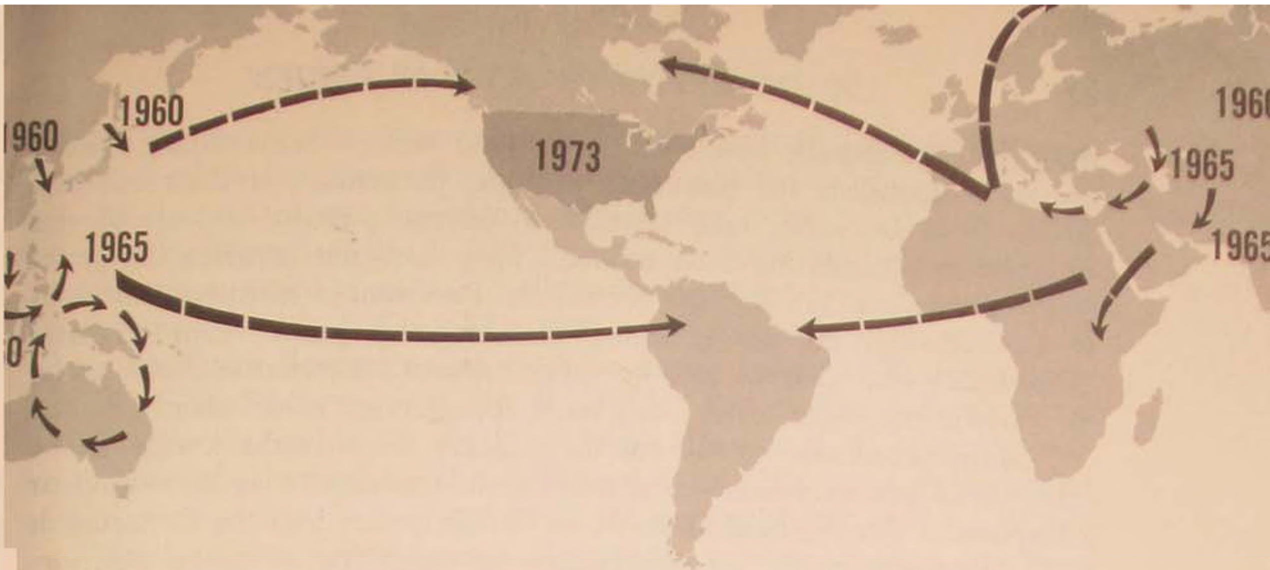
Additional and more detailed planning guidance has been issued to all major commands in the form of a USAF current operations plan. The component commands have received supplementary guidance from both their unified commander and their service headquarters. Wherever possible, actions by a component commander to satisfy his unified commander's requirements are accepted by Headquarters USAF as full satisfaction of Air Force requirements. The major air commands have prepared plans and are in various stages of implementing them.

The Headquarters USAF guidance issued to major air commands contains the basic concepts for Air Force participation in the cold war. The USAF participates in three major ways: (1) by developing and maintaining a capability to perform its combat mission, (2) by planning and executing routine operations and activities so as to maximize their favorable impacts and minimize their adverse effects, and (3) by initiating specific actions to advance the attainment of U.S. and Air Force objectives.

USAF activities in the cold war must be designed to contribute to or complement our combat posture. Constant care must be exercised to ensure that they do not detract from this posture to an unacceptable degree.

For some reason the concept has been established in some echelons that cold-war activities are community-relations activities and that the objective of the cold-war program is to make people like us. This is not the purpose. Community relations play only a small—though important—part in the cold-war program. In reality the cold-war objective of community relations is to make people understand us and not necessarily to like us. It helps if they do like us, but it is not essential. The essential thing is that they understand us so that they evaluate us correctly and do not misjudge us.

To determine the success or failure of any program, one must evaluate it. Although our Air Force cold-war program has not been in effect long, results are evident. The Air Force is participating in a nationwide drive to help our President seize and maintain the initiative



A Communist concept for world revolution, 1953 to 1973

in the cold war. This drive is being sparked at many echelons of both private and public activity. That the armed forces are now playing an essential role in a vital conflict not involving the traditional clash of arms is a new concept which is accepted in the Air Force.

The Communists are engaging us at many points along the spectrum of conflict, and we must consider our activities in the full spectrum. United States military personnel have traditionally been schooled to concentrate on the professional military arts and to avoid the political, economic, and diplomatic aspects of international life. Our contemporary officer corps has been trained and has gained experience in the tactical and strategic application of arms in World War II and in the Korean War. Therefore military personnel tend to see only a military solution to the cold-war conflict. A good example lies in South Vietnam today. Some military officers believe that the solution to our problems there depends upon a straightforward political decision to use United States forces. This feeling persists even though the President has in many speeches, interviews, and messages stated quite clearly that the United States would not strike first and that the military services must measurably strengthen their capabilities to cope with the subversions, insurgencies, and guerrilla activities of the cold war. The President has initiated the education of the officer corps in this area, but it will take much effort and considerable time before the majority of the officers realize that a part of their task is to determine how the Department of Defense can actively support the national objectives without resort to arms. The effect of Air Force participation in cold-war activities has been so significant that we can no longer tolerate the concept on the part of some military officers that planning and acting for the prevention of overt armed conflict is somebody else's business and that the military only steps in when all else fails.

One of the major political instruments that the United States has today is the combat potential of the Air Force. Our civilian leaders and counterparts depend upon professional Air Force officers for advice in their use of aerospace power in the political role. While military officers are not responsible for political decisions, they must, if their military advice is to be valid, take cognizance of the political aspects of the situation in formulating their advice. They dare not consider the problem in a vacuum. On 28 March 1961 the President in his special message to Congress on defense spending clarified this point when he said, "Diplomacy and defense are no longer distinct alternatives, one to be used where the other fails—both must complement each other."

Many people see no role for the military forces in the foreign policy field. This lack of vision stems from their knowlege that the President is responsible for the establishment of foreign policy and the Department of State is responsible for supervising its execution. Foreign policy is executed at many echelons of national activity outside the Department of State. It is in the realm of foreign policy to provide military assistance to a country, but it is the Department of Defense and the military services which implement the policy.

The Air Force is also a major economic instrument of power both at home and abroad. This fact was driven home with startling impact by the November 1960 directive to reduce the number of our dependents in oversea areas. Normally about 9 per cent of our gross national product goes to support the Department of Defense. Of this amount, the Air Force has in the past received, and continues to receive, a substantial share. How this share is spent and the impact of its spending are of vital concern to airmen. A related concern is the problem of national gold flow. Between 1957 and 1961 our net outflow of gold was over three billion dollars. Annually the Department of Defense spends over $2.2 billion overseas. Obviously an easy way to control the gold flow is to control military spending, and this is exactly what is being done. This method of control is of vital interest to airmen because it must be accomplished without degrading our military posture to an unacceptable degree.

The Air Force, in its world-wide operations, has the opportunity to be one of the greatest ideological forces ever organized on this earth. What the deployed airmen and their dependents do and say can have far-reaching effects. Their words, acts, and attitudes can open or close our oversea bases. Americans believe in and live an ideology far superior and far more appealing than anything the Communists have to offer. But as one of our senior Air Force citizens has stated, "Airmen are generally better prepared to die for what they believe than to explain it"!

In the past our airmen have been apathetic toward preparing themselves and their dependents for their ideological mission overseas. Now a healthy change seems to be in progress. Airmen are becoming deeply concerned about these deficiencies. Approximately 90 per cent of the suggestions for cold-war actions which Headquarters USAF receives have to do with preparation for foreign duty. Our commands appear to be responding to this concern by launching continuing courses of study to prepare their people for oversea duty instead of waiting until they are actually en route. Simultaneously the Department of Defense information and education program has been strengthened.

As a result of our evaluation efforts some adjustments have been made in Headquarters USAF. The Director of Plans has been designated as the primary point of contact within the Headquarters for all counterinsurgency matters. A Cold War Strategy Group has been established under the Force Estimates Board. This group provides for ready integration of Air Staff cold-war inputs into Air Force plans and programs. To monitor and guide the USAF cold-war effort, a Cold War Division has been established in the Directorate of Plans. The primary functions of this division are to prepare guidance and evaluate results. Within the Directorate of Operations a Counterinsurgency Division has been established. This division is responsible for USAF interests in counterinsurgency operations around the world.

A detailed plan of action, applicable only to the Headquarters USAF activities in this field, has been published. Guidance to the major air commands has been promulgated by a current operations plan. Supplemental guidance has been issued as required. Many Air Force personnel are receiving specialized indoctrination in guerrilla warfare and counterinsurgency operations and requirements.

There appears to be some validity in the proposition that Air Force experience with combat operations centers for limited and general wars is applicable to many aspects of the cold war. The concept of a cold-war operations center is being explored and tested. Each morning at 0830 hours the Hq USAF Command Post conducts a briefing for the key officers of the Headquarters. As appropriate, this briefing covers what is happening in the world each day, including major cold-war operations and activities. Studies are being conducted by the Deputy Director of Plans for Policy to determine what intelligence is required for cold-war decisions and how this intelligence should be stored and displayed.

THE COLD WAR in some aspect will be with us for a long time—as long as the Communists desire to keep it going. The Air Force is geared to the long pull. Actions are being initiated now to satisfy requirements anticipated fifteen years from now. To date we have some pluses and some minuses as a result of our actions. The Air Force cold-war program is no panacea for all troubles at this time. No gimmicks have been discovered that will make the task simple. But the USAF program does appear to hold some promise for easing some of our problems and helping to attain national goals.

We must think in terms of the total cold-war problem. We must act in terms of the Air Force's responsibilities in the problem area as they complement and supplement the programs of other departments and agencies. The Air Force's cold-war mission is only a small part of the total mission. It is, however, somewhat analogous to the missing blade on a turbine engine—if we ignore it, we ask for bigger troubles.

Headquarters United States Air Force

USAF Responsibilities and Operations in the Cold War

Colonel William V. McBride

The WORLD is currently divided into two major power groups. The basis for this division is the distinctively different ideological systems, both political and economic, of Communism and democracy. The ultimate purpose of the Communist group is to impose its system upon the entire world. This objective has been clearly stated by Communist leaders on many occasions. The purpose of the democratic group is to create conditions which will permit each nation of the world to develop its institutions according to the desires of its people, being at all times cognizant of the impact upon its neighboring nations.

The Free World is a voluntary grouping of individual nations, with many restrictions upon group action. Since World War II, Free World actions in the struggle that has been going on between the two major power groups have been primarily defensive reactions to Communist activities. Among the Free World group, the United States is the primary opponent of the Communist group because the U.S. power position constitutes the only significant block to Communist domination of the world. Therefore an essential objective of the Communists is the destruction of that power position. Under the leadership of the U.S.S.R. the Communist group has no restrictions on method. The timetable for ultimate success is mobile. The operations are slow and devious but thorough. If necessary, they may extend over the next hundred years. It cannot be doubted that for a long time the Free World and the United States will be forced to maintain a strong posture in opposition to Communism. Ultimately, Communism must change to a compatible ideology, or it must be neutralized or destroyed if it is to be denied its grand objective.

The Communists have always been totally inflexible with respect to that major objective of world domination. While in tactics they have been completely flexible—content and able to reverse their positions and methods overnight—in strategy they also stood rigidly in place all through the dictatorship of Stalin. Since Stalin's death they have made certain strategical accommodations. An example is Premier Khrushchev's downgrading of the inevitability of all-out war in favor of "wars of liberation."

Khrushchev in his speech of 6 January 1961 entitled "For New Victories of the World Communist Movement" very clearly stated the Communist position. Wars he divided into three categories: world wars, local wars, and liberation wars or popular uprisings. He rejected world wars and local wars as being impracticable in the modern world. He endorsed "wars of liberation," stating that the Communists would recognize them and would help the people striving for independence by their means. By "wars of liberation" Khrushchev means wars of subversion and covert aggression within a Western-oriented or neutrally oriented political entity for the express purpose of ultimately committing it to domination by the Communist bloc.

This kind of struggle that is imposed by the Communists on the world today has been described by many names, with much confusion and misunderstanding on the part of the people of the Free World. Among the terms coined, adopted, or applied are cold war, protracted conflict, sublimited war, subterranean war, wars of liberation, covert aggression, parawars, paramilitary wars, local wars, guerrilla warfare, counterguerrilla warfare, subversion, insurgency, counterinsurgency, and peaceful coexistence. This list is illustrative but not exhaustive. More terms can be expected to appear in the future.

The term "cold war" is the most widely used and probably the most descriptive of the current conflict. It has also been selected and defined by the Joint Chiefs of Staff as the term to be used. Cold war is conceived by the Joint Chiefs as the use of military resources for the support of political, economic, sociological, technological, psychological, and military measures to achieve national objectives. Cold war includes all the other categories of conflict listed above. Cold-war countermeasures fall short of overt armed conflict involving regular military forces except for counterinsurgency actions, incursions, infiltrations, hostile local actions, and similar incidents. Military forces are maneuvered, deployed, and redeployed to bring pressures to bear on opponents and neutrals and to influence allies. The threat of force is a cold-war measure. Routine military activities and programs have nonmilitary impacts and overtones that can be used effectively through proper planning, administration, and coordination. Cold-war countermeasures also consist of specific actions not necessarily required for primary mission accomplishment, which are initiated by military units and personnel for the planned purpose of advancing the attainment of objectives.

In this conflict the basic objective of the United States is to preserve and enhance its institutions and way of life. Supporting objectives must be oriented toward the attainment of this basic objective. At the same time U.S. activities to support this objective must be pursued in an atmosphere of enlightened self-interest so as to accommodate the objectives and interests of other Free World nations. President Kennedy described these terms of enlightened action in his message of 25 May 1961 to the Congress, which set forth urgent national needs:

. . . This Nation is engaged in a long and exacting test of the future of freedom—a test which may well continue for decades to come. . . .

* * * *

The great battleground for the defense and expansion of freedom today is the whole southern half of the globe—Asia, Latin America, Africa, and the Middle East—the lands of the rising peoples. . . . They seek an end to injustice, tyranny, and exploitation. More than an end, they seek a beginning. . . .

* * * *

We stand, as we have always stood, from our earliest beginning, for the independence and equality of nations.

We stand for a world of peace under law. We stand for the democratic revolution of social progress. We stand for diversity, honest disagreements, and mutual respect. This Nation was born of revolution and raised in freedom. And we do not intend to leave an open road to despotism.

* * * *

There is no single simple policy with which to meet this challenge. Experience has taught us that no one nation has the power or the wisdom to solve all the problems of the world or manage all its revolutionary tides; that extending our commitments does not always increase our security; that any initiative carries with it the risk of temporary defeat; that nuclear weapons cannot prevent subversion; that no free peoples can be kept free without will and energy of their own, and that no two nations or situations are exactly alike.

An Approach to Cold-War Planning

In dealing with the current situation the President has asked the help of all echelons of national activity, particularly the military organizations, although he has been quick to note that the basic problems facing the world today are not always susceptible to a military solution. Diplomacy and defense, he has emphasized, are no longer distinct alternatives, one to be used where the other fails. Instead he insists that they must complement each other. This thesis was incorporated in his special message to Congress on 28 March 1961 relating to the defense budget.

But to meet our own extensive commitments and needed improvements in conventional forces, I recommend the following:

A. Strengthened capacity to meet limited and guerrilla warfare—limited military adventures and threats to the security of the free world that are not large enough to justify the label of "limited war." We need a greater ability to deal with guerrilla forces, insurrections, and subversion. Much of our effort to create guerrilla and antiguerrilla capabilities has in the past been aimed at general war. We must be ready now to deal with any size of force, including small, externally supported bands of men; and we must help train local forces to be equally effective.

In support of the President's new approach, the Secretary of Defense has provided some specific guidance to the military forces. He points out that as we develop a balanced, modern nonnuclear force, ready to move rapidly against aggression in any part of the world, we inhibit the opportunities of the Soviet Union for successful conduct of its local wars. Concurrently, however, the military must develop the capability to deal with "wars of liberation," which often are not wars at all. In these conflicts the force of world Communism operates in the twilight zone between political subversion and quasi-military action. The tactics are those of the sniper, the ambush, and the raid. The political tactics are terror, extortion, and assassination. While we are trying to carry out reforms designed to raise the living plane of our neighbors, their leaders are being systematically murdered. We must be capable of helping the people of threatened nations to resist these tactics by appropriate means.

To deal with such operations requires some shift in our military thinking. We have been used to developing big weapons and mounting large forces. Instead we must work with squadrons, companies, flights, platoons, and individual airmen and soldiers. We must simplify our tactics and our tactical weapons so that they can be used and maintained by men who have never seen a machine more complicated than a wheel. Countering guerrilla warfare demands more ingenuity than money or manpower. It calls for an entirely new way of thinking and for new applications in our use of men, money, and organization. We must constantly put forth new efforts to make our military establishment more effective in this kind of conflict. We have already shown ourselves able and ready to engage in large-scale nonnuclear warfare in response to a Communist provocation. Now we are increasing our effectiveness in the lower scales of conflict. The Soviets can hardly misconstrue two things: first, that we regard this kind of provocation as a challenge to our vital interests and, second, that we will use nuclear weapons to prevail if it becomes necessary.

With this guidance, the Secretary of Defense has directed the participation of the military forces in the cold war. In carrying out the Secretary's directive, the maintenance of a position of military power is the primary responsibility and objective of the Department of Defense. The purpose of maintaining this strong military posture is to deter war or, failing that, to prevail in the ensuing conflict. The Air Force provides the basic nucleus of this deterrent power, which is prerequisite to participation by the United States, the Department of Defense, and the military services in the cold war. Only a strong deterrent posture compels confinement of the basic conflict to the lesser maneuvers and actions of cold war.

The Air Force is now organizing itself to bring its full force into the support of these new national objectives. The basic United States objective, as we have said, is to preserve and enhance the American institutions and way of life. There are other, more detailed statements of U.S. objectives in the speeches and papers of the President of the United States and the Secretary of State. Such statements are distributed to the field in the *Air Force Information Policy Letter for Commanders* and its supplements and in the State Department *Bulletin.* It is the responsibility of all echelons of national activity to contribute towards the attainment of these objectives. This includes the Air Force.

Of the announced United States objectives, the Air Force is responsible for only a part; but to ensure accomplishment of that part, the Air Force must translate its responsibilities into specific objectives. These objectives must be issued as guidance to the major commands. Major commands must, in turn, translate Air Force objectives and guidance into statements of objectives meaningful at subordinate echelons. This normal planning procedure, used in all the military services, consists of the following steps: (a) estimating the situation, (b) determining objectives with respect to the estimated situation, (c) developing a concept of operations, (d) planning courses of action to attain objectives, (e) directing tasks to subordinate units, (f) implementing the plan, (g) evaluating the results, and (h) replanning as required.

The specific objectives of the Air Force in the cold war are:

- To make maximum contribution toward the attainment of U.S. objectives during the cold war to the extent consistent with the primary mission of the USAF.
- To maintain the Air Force in a strategically flexible power position, including technological superiority, so as to make the major contribution which deters the Communist bloc from use of armed forces in either a general or limited war.
- To build and maintain the aerospace force portion of the military power required to prevail against the Communist bloc if the Communist bloc resorts to military force.
- To maintain intelligence on the capabilities and readiness of possible enemies who might initiate or support covert and overt operations in either limited or general war.
- To ensure that the nations and peoples of the world are convinced (1) that the United States has the capability and will to use aerospace power in whatever form is necessary to make the use of force by the Communist bloc an unacceptable course of action and (2) that the United States will prevail in the event the Communist bloc initiates hostilities.
- To assist in creating the climate of opinion abroad that will permit United States Air Force units to be based in and to overfly foreign countries where and when required for the effective accomplishment of the USAF functions and tasks.

• To gain the friendship, respect, understanding, and support of the people of the world by the peacetime use of aerospace power.

• To improve Free World ties and gain the friendship, respect, understanding, and support of the governments of the nations of the Free World by the peacetime use of aerospace power.

• To instill in the principal Air Forces of the Free World an appreciation of and respect for proved doctrine, tactics, and combat posture of the USAF.

To attain the foregoing objectives, the Air Force must accomplish the following tasks:

(a) Maintain secure deterrent forces with war-winning capabilities, acquire timely modernization for these forces, and exploit technology in achieving a distinct strategic technological advantage.

(b) Ensure that technological advances in all domestic and foreign fields of endeavor are used to enhance the deterrent effect of aerospace power and its capabilities in war.

(c) Establish psychological operations to maximize the deterrent effect of aerospace power.

(d) Keep the various departments and agencies of the Federal, state, and local governments as well as the people of the United States informed of the capabilities, requirements, developments, and operations of the USAF and of friendly and potentially hostile foreign air powers; and coordinate with and support these agencies whenever possible in matters pertinent to the national interest.

(e) Support the U.S. civil defense effort as a means of improving the survivability and recuperative posture of the United States.

(f) Pursue a vigorous internal information program which will cause Air Force personnel to counteract and overcome the adverse effects of hostile propaganda and ensure that each individual Air Force member can contribute to the attainment of USAF objectives.

(g) Prepare at major command level and implement at all levels, where appropriate, specific programs to attain the Air Force cold-war objectives.

(h) Exploit the potential for favorable public relations and favorable foreign opinions inherent in the employment of indigenous people and their contacts with members of the USAF.

(i) Emphasize the orientation of USAF personnel (military and civilian) and their dependents aimed at (1) increasing their understanding and use of the language and creating an awareness of the customs and traditions of the countries in which they are or will be located; (2) increasing their knowledge of the importance of appropriate behavior and constructive attitudes toward the country, forces, and people with whom they are or will be in contact; and (3) ensuring their ability to interpret the meanings of the American way of life for the information and enlightenment of others.

(j) Provide for the timely exploitation of the employment of USAF facilities, materiel, and units in the conduct of search and rescue, refugee evacuations, disaster, epidemic, flood relief, and other humane missions for foreign countries.

(k) Encourage, facilitate, and exploit reciprocal armed forces participation in social, cultural, charitable, educational, recreational, and technical activities to reduce frictions and minimize antagonisms toward the creation and maintenance of bilateral and regional defense arrangements.

(l) Support a program of aerospace achievements eligible for international recognition which will emphasize the technological competence of U.S. industry and the superiority of USAF equipment.

(m) Conduct Air Force activities in such a manner as to provide the world (1) concrete evidence of the high order of USAF skills, training standards, and professional competence, and (2) positive demonstrations of the technological and qualitative superiority of U.S. equipment.

(n) Participate in and aggressively support world aviation agencies, forums, and congresses so as (1) to further the principle that the extension of air sovereignty should not hinder the free exploitation of space for peaceful purposes, and (2) to contribute to a favorable climate for protection of and assistance to U.S. air enterprises which are in competition with Communist-subsidized effort.

(o) Execute the USAF portion of the Military Assistance Program in an effective manner, insofar as practical aligning Military Assistance objectives with USAF objectives.

(p) Establish special staff sections in appropriate headquarters to ensure that adequate cognizance is given to cold-war programs.

(q) Establish specialized operational units to conduct internal security and counterinsurgency operations when limited- and general-war forces are not available or do not have the specialized capabilities required.

Air Force Activities for the Cold War

For the attainment of these defined objectives and tasks in the current world struggle three major categories of actions are required of the major commands:

(a) The maintenance of a capability to perform the combat mission.

(b) The planning and execution of routine operations and activities so as to maximize their favorable impacts and minimize their adverse effects.

(c) The initiation of specific actions to advance the attainment of national and Air Force objectives.

Each element of this concept is worthy of detailed examination.

The Air Force makes its most important contribution to the cold-war effort by developing and maintaining a capability to perform its combat missions in all portions of the spectrum of conflict. It is this combat capability that provides the Air Force contribution to the national deterrent posture. The national deterrent posture has been successful.

Both general and limited wars have been deterred. The Communists have been forced to pursue their objective of world domination in the cold-war portions of the spectrum of conflict. If there must be conflict, this cold-war conflict is better than limited or general war.

In Laos and Vietnam the Communists are pursuing conflict in the more intense aspects of the cold-war spectrum—i.e., in insurgency and guerrilla warfare. As the United States builds its capability to fight counterguerrilla actions and subdue insurgencies, it is logical to expect the Communists to be deterred also in this area of conflict. When this happens, the conflict will be pushed still further down the scale, and resolution of the conflict should take place in the political, ideological, and economic fields—a desirable development from the Free World viewpoint.

In one sense the military effort of the United States and the Free World is a creative force, perhaps the major creative force in the world today. It is the deterrent posture of the Free World in general and of the United States in particular that has created those conditions which permit Free World leaders to pursue their objectives under conditions more favorable than limited or general war. The attainment of these objectives leads to greater security and lessened burdens.

Creating these more desirable conditions is not enough. They must be exploited towards the attainment of U.S. objectives, and this exploitation must occur at all echelons of national activities. Obviously the Air Force has a role.

The Air Force accomplishes its exploitation role in two major ways. The first is by planning and executing routine operations and activities so as to maximize their favorable impacts and minimize the adverse effects. This type of cold-war activity might well constitute the bulk of the USAF cold-war effort. An example was the use of a refueling training exercise as a show-of-flag at the dedication of the international airport at La Paz, Bolivia. The training mission was originally scheduled over the Pacific Ocean, but after proper coordination between Headquarters USAF and the Department of State it was rerouted to take place over La Paz at the desired hour. Thus at no increase in cost to the taxpayer and by the use of the originally programed training funds, an Air Force cold-war contribution was made.

A second example may be found in the manner in which Sunday morning training missions were scheduled at an air base in England. As the departing jets could not avoid passing over the local community church at low altitude, take-offs were scheduled to avoid the eleven o'clock church service. Another example is furnished by the use of airlift at various places around the world. If the aircraft is required to fly, if space on it is available, and if United States cold-war cargo needs to be moved, then the available airlift should be used to the maximum extent possible. This approach permits Air Force contributions toward the attainment of U.S. objectives at no additional cost to either the Air Force or the American people.

The second method of exploitation is by planning and implementing special courses of action that are normally not required for the accomplishment of the primary Air Force mission. These actions, however, should be properly within the province of the Air Force. Some good examples of activities in this category are:

(1) Operation Flying Brothers, an annual Asian–USAF Fighter Weapons Conference at Clark Air Base, cohosted by the Philippine Air Force and the United States Pacific Air Forces. This conference is a major factor in ensuring the integration of the various national air forces of the countries of the Southeast Asian area into an effective defense organization. At this conference they learn to supplement and complement each other, thereby greatly increasing over-all effectiveness.

(2) The Military Assistance Programs. By means of the training and equipment provided through these programs the Air Force helps the host countries ensure their internal security and counteract subversive insurgency. An outstanding example of this type of activity exists today in the United States program for South Vietnam, a rather warm part of the cold war.

(3) Civic-action programs in developing countries. USAF advisory personnel can advise host-country personnel on how to use the airlift capability of the indigenous air force to help solve their nation's internal transportation, navigation, and communications problems. A new nation without an adequate transportation system cannot wait for the construction of roads, railroads, and bridges. A practical and economical interim solution lies in air transportation. It can be used to bring security to isolated villages, law and order to the people, doctors to the sick, and personnel and machinery to undeveloped lands. The construction of airports is inducive to the establishment of numerous supporting and supplementary activities, all required to get a new economy off to a good start and running. The development of military aviation skills quickly spills over into abilities and skills required for photomapping, aerial surveying, geodetic sounding, soil seeding and fertilizing, and aerial spraying, to mention but a few. Aviation in civic actions permits a new nation to go from foot trails to the air age in one giant leap.

(4) The integration of Allied officers into the USAF on a regular duty tour basis. The Air Force has identified some 1000 positions in which it can employ Allied officers. In many cases USAF and Allied officers are exchanged for duty. The purpose of this action is to bring our allies into our Air Force and civilian community so that we may get to know and understand each other. By this method we hope to build up a sufficient reservoir of understanding of the USAF in the air forces of Allied countries that send their officers to us which in the future will enable them to judge our intentions correctly. The USAF officers trained by our allies provide a similar capability for us.

THE AIR FORCE bases its activities in the cold war on the additional concept that it must use the same basic resources for cold, limited, and general war. This concept does not preclude the use of special staff sections and the creation of some small special operational units to accomplish specific tasks peculiar to limited portions of the cold-war bands in the spectrum of conflict. The fact remains that it is the regular combat and support forces which create the majority of Air Force impacts around the world. Management of military participation in the cold war requires the same tools as are needed in the management of limited or general wars. It is the commanders and other individuals of our forces who can act to control the impact of what they do. Air Force personnel in both their official and personal capacities must always ask themselves the questions, "What are the cold-war impacts of what I am about to do, and how can I turn them to the advantage of my country?"

Headquarters United States Air Force

In My Opinion...

A MOMENTUM OF NUCLEAR TALK

COLONEL GARLAND O. ASHLEY

A MOMENTUM of talk may sometimes become its own worst enemy. Since this may now be the case for airmen when we talk about nuclear war, possibly a few second thoughts on our nuclear momentum may be timely.

Those among you with long memories will recall that it took us some time and hard work, after World War II, to get the momentum of talk about nuclear weapons under way. By late 1949 the talk was well under way, and we were experiencing in many places a crest of support and approval.

Then came Korea. The air war there had some boundaries. Many farsighted airmen and some other officials pressed for the authority to use a few nuclear weapons on targets which existed in that war. And, lest there be any doubt about it, there were targets for nuclear weapons in that war, and we do not mean automatically Moscow and Peiping.

The men involved wanted to use nuclear weapons, first because the nuclear weapon had been proved to be the most efficient and effective firepower that we have ever been handed by science and industry. Second, the men involved wanted to use nuclear weapons because they saw the danger to us, psychologically, if nuclear weapons came to be considered a "separate weapon" or, worse, a "banned weapon." It was at that time, you may recall, that the alternative talk of "the horror weapons" really began in earnest.

It was at that time, too, that such phrases as "overkill" and "flexibility of response" were beginning to be heard in some volume. Among the more pernicious phrases used at that time was the one ... "You don't set fire to your house to get rid of roaches, do you?"

We may not have noticed, in our momentum of nuclear talk, how statements such as these began to prey upon the civilian mind.

Partly to counter this type of talk, partly out of frustration at the Korean War conditions, and partly as a function of a widely spreading orientation and training program on nuclear weapon effects, following Korea there developed a heavy momentum for thought and talk and speculation about the shape, size, and duration of a nuclear war.

This momentum was necessary and useful. To sponsor it was essential. But there came along an "all or nothing" mind fix, and this was *not* useful. As this mind fix began to develop in some places, one could see trouble. For, from such a mind fix, it began to be popular to say that just *one* nuclear weapon positively could not be used—or two, or three, selectively. "We've got to go all the way with all that we've got" began to be heard all too frequently for our own good.

Yet, when one takes that statement apart and lets it lodge in the mind a bit before allowing it to pass from the ear—on hearing—to the mouth—for saying in repetition, then the self-defeating nature of the statement begins to stand out. In addition, at social gatherings, one often can hear an airman say, "This next war is one that I want to let go by. I'll sit it out in the primitive area above Lake Tahoe."

One cannot help but note the sense of futility that begins to be created in the minds of the civilian listeners. Since each of us could list other such self-defeating examples, let's move on and note the next critical bench mark of this momentum of talk.

When the current Administration took over, it made clear enough for most of us to get the word that it wanted some flexibility of national response "between humiliation and disaster." Yet a nuclear response pattern was still being talked about by some airmen as if uncompromising absolutes had been established as applying to it. Whether we have liked it or not, the Administration began to *find* alternatives. This suggests that still other alternatives may be found. So perhaps it would be clever if airmen were to take the lead in suggesting and developing some of them.

IN SUMMARY, it took a momentum of talk to get us to think in a radically new dimension. Only recently we had been inspired to think in radically new ways about military problems by the airmen who went before us. Now we were handed the most efficient firepower that has ever been handed to man.

But there are signs that we have been carried somewhat beyond a desirable mark, by our own momentum. There are other signs which indicate that if we do not do something—of our own volition—to slow down the momentum, then someone else may do it for us, or to us. This could become embarrassing, to say the least of it.

So, we owe it to ourselves to speak no more slogans or clichés that haven't first passed carefully through our minds. We owe it to ourselves, and to what aerospace power has stood for and can still stand for, to think about this a bit, before we are tempted to open our mouths the next time with some outburst that does nothing but add to the self-defeating momentum of the all-or-nothing talk. Because if we stubbornly keep up the "all" talk, it takes no Isaiah to prophesy that we may end up with nothing. And be grounded to boot.

Office of the Secretary of Defense

LEADERSHIP—A CONTEMPORARY CONCEPT

Captain Howard F. Eaton

Articles presented in recent issues of the *Air University Quarterly Review* have shown some displeasure with Air Force leadership. Major Kenneth L. Moll is concerned over the deficiency in Air Force leadership vis-à-vis that of the Army and Navy. It appears to him that our "combat-baptized leaders are going up or out" and that rather than training our younger officers and NCO's the Air Force has been avoiding the issue. His solution is to place more emphasis on leadership, involving education, exposure, example, and enforcement.[1]

Previously Mr. Oron P. South of Air University's Research Studies Institute was also critical of Air Force leadership, again as contrasted with that of the Army and Navy.[2] He maintains that "to educate and train for leadership there must be some conception of what kind of leadership is desired." He believes that the Air Force's present leadership pattern produces operational competence alone and that it should be abandoned for one that emphasizes both operational and general competence. Such a program he visualizes as requiring broad education, training, and experience—a sort of "liberal arts" approach—eventually producing the type of officer capable of leading our complex military organization—that is, a "specialized generalist."

Research in the phenomenon of leadership has been extensive. The various interdisciplinary approaches make it essential to establish some frame of reference when using the term "leadership." The problem is more than just a semantic one. An early study in the *Journal of Psychology* which surveyed some 100 investigations of personal factors associated with leadership disagreed with the concept that certain necessary traits are associated with leadership phenomena.[3] The evidence obtained suggested a "situational" approach to any adequate understanding. In a comprehensive survey published at Ohio State University treating the characteristics of group situations and their relation to leaders, the results indicated that with an understanding of the demands of a specific situation prospective leaders might be selected and trained to be effective.[4]

More recently attention has transferred from leaders to those being led as the major variable. The Air Force ROTC program, which produces a large percentage of the annual Air Force officer requirement, defines leadership as "the process through which the leader inspires effective individual effort in a group effort to achieve an assigned mission."[5] This definition is quite similar to that in AFM 35-15. Obviously such leadership requires an awareness of mission, some knowledge of human nature, and an understanding of good management practices. Most of this can be taught to any intelligent individual. But having been taught, the individual unfortunately does not automatically become a leader. Why?

Different situations, different functional areas, different organizational levels all require different leadership characteristics and abilities. A recent work on the human element in enterprise holds that "leadership is not a property of an individual but a complex relationship among these variables"—and lists the variables as (1) characteristics of the leader, (2) the attitudes, needs, and other personal characteristics of the followers, (3) characteristics of the organization, such as its purpose, its structure, the nature of the tasks to be performed, and (4) the social, economic, and political milieu.[6] Even in the military these variables remain variables, and therefore the leadership factors are constantly different. However, all these facets must be considered in the leadership phenomenon.

With this in mind, we may conclude that we are unable to predict future leadership circumstances, and that manifestly we need all types of individuals within the Air Force to yield a leadership base.[7]

What is also important is that leadership based on traditional military ascriptive authority is not in consonance with our democratic culture and therefore is not effective. Traditional "staff vs. line" types of leadership and authority have increasingly become one and the same, and they warrant further investigation and clarification.

The Air Force must realize, as more and more industrial organizations are beginning to realize, that individuals can fulfill their leadership potential at various levels within the organization and that in so doing both the individual and the Air Force will be more effective.

In my opinion, it is obvious that there is as yet no systematic science of leadership. It is essential to consider the leadership phenomenon as a process or function. Within this frame of reference we can understand that:

- Certain skills or techniques of leadership, e.g., communication, can be taught to potential leaders. Failure to learn the complementary skills may prevent potential leaders from attaining leadership positions.

- Continuous educational growth must be stimulated. Intellectual competence (aside from mastery of a specific job) is in order. Present Air Force policy indicates an awareness of this necessity.

- Different types of leadership are required for different organizational levels and managerial (executive and operational) functions within the Air Force.

- Increased emphasis should be placed on interpersonal aspects of human relations. The trite phrase that we get things done "through people" is quite true. Obviously the leader must understand human behavior.

• Increased organizational efficiency requires that decision-making be confined to the lowest possible level compatible with knowledge and competence.

• The Air Force should utilize the educational technique of management games. Although simulation itself is not new, the concept of dynamic management development through management simulation has tremendous possibilities for the Air Force.

Certainly the Air Force is aware of its grave responsibilities, not only to itself but to the Nation as well, for effective leadership. And although much remains to be done, much has been and is being accomplished in the area of leadership.

Department of Air Science, Dartmouth College

Notes

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A Permanent Solution for a Perennial Personnel Problem

Colonel Lonnie E. Martin

ONE OF THE most serious problems facing the Air Force today is the loss of seven out of every ten of the college graduates that we commission and bring on active duty each year. The problem is not new — it has been with us for many years. What's more, it has always been recognized as serious. Many people have worried about it, and much effort has been spent in search of ways to improve the officer retention rate. Strangely enough, however, very little improvement has been noted. Why? I maintain that we have conscientiously but falsely analyzed the causes for the lack of a desirable retention rate among our officer corps and, because our diagnosis has been wrong, we have improperly treated the "illness." It has often been said during recent years that a military career is no longer as attractive as it once was. I don't agree. I maintain that the United States Air Force is more glamorous and offers more career opportunity today than at any time in its history. We have two recent orbital space flights to support this contention.

To help overcome the so-called "loss of attractiveness," we have sought to improve career incentives — "fringe benefits," if you prefer — in many ways. I would not want to give the impression for a second that our efforts have been wasted. On the contrary, all the actions which have been taken in this direction are both worthwhile and urgently needed. A permanent solution to the major problem of retaining our young college-trained officers must still be found, however, and rather drastic measures will be needed. We have given every other approach a "fair go." Unless we are willing to take drastic actions, there can be little or no hope for improvement; the present trend of retaining too many unneeded officers and not enough of those needed will continue.

The key to the successful solution of this problem is an improved motivational program for our young college graduates, one that will cause them to choose the Air Force as a career. We must inaugurate such a program in the face of an ever increasing shortage of the skilled people we need. How can this be done? In my opinion we already have the answer to effective officer retention in two proposals which are now under consideration by the Department of Defense and will require legislative approval:

• Double the size of the Air Force Academy for a total of 4500 cadets.

• Replace the present AFROTC program with the Air Force Officer Education Program (AFOEP).

the retention problem

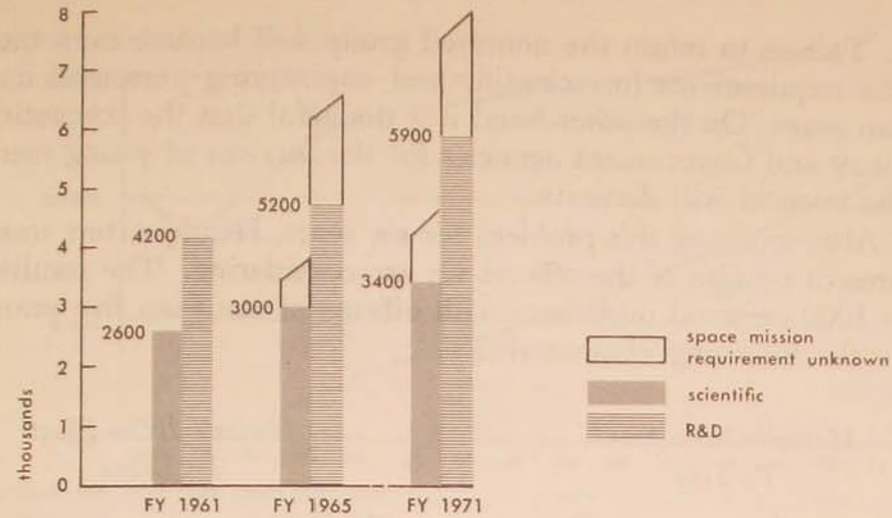
By way of laying the groundwork for the arguments to follow, let me outline briefly the fundamentals of the officer retention problem.

There are approximately 111,000 line officers in today's Air Force. Of this number, 32,000 have 18 or more years' service — about one third more than required; 24,000 have less than 5 years' service — one third less than needed. An optimum spread of service and age would exist if we retained more of our young officers.

Certain measures, such as selective retirement after 20 years and quality control programs, have been taken to reduce the number of officers in the older service group. We are restricted in our enforcement of these measures, however, by the lack of younger officers willing to make the Air Force a career. Since we are limited to a total officer ceiling of 130,000, we cannot increase our yearly officer intake beyond 10,000. Consequently the only alternative is to retain a higher percentage of young officers in the 10,000 yearly input.

The most critical aspect of retention is in the quality of officers retained. We are failing to keep certain needed types of officers within the current 42 per cent retention rate. In such areas as scientific and engineering we retain about 15 per cent, and in some other selected skill areas we are able to retain only about 7 per cent. In these areas little can be done to control quality; at a time when our requirements are rapidly increasing, we must take anyone we can get. Educational programs, commissioning in the regular Air Force, mandatory counseling, career development, and centralized officer assignments have been initiated to help correct the situation, but we still have not been able to convince younger officers in sufficient numbers.

From 1952 to 1962 our technology advanced at rates undreamed of prior to this period. Correspondingly, our equipment became obsolescent. From all indications this trend will continue. Our national survival dictates that we must meet these challenges and provide proper technical support to maintain and operate the equipment which even now is difficult to envision. This need increases the magnitude of our shortage. For example in the scientific area we estimate requirements of 400 additional officer spaces by 1965 and 400 more by 1971. In the research and development area, where our strength has increased by 1500 during the past six years, we expect a further increase of 1700 spaces by 1971 for a total of 5900 people. In the electronics and maintenance career area, where we now have 14,200 people working, we anticipate further growth to 15,200 by 1965 and to 16,100 by 1971. The communications and electronics field, because of our need to develop much shorter reaction time, will increase

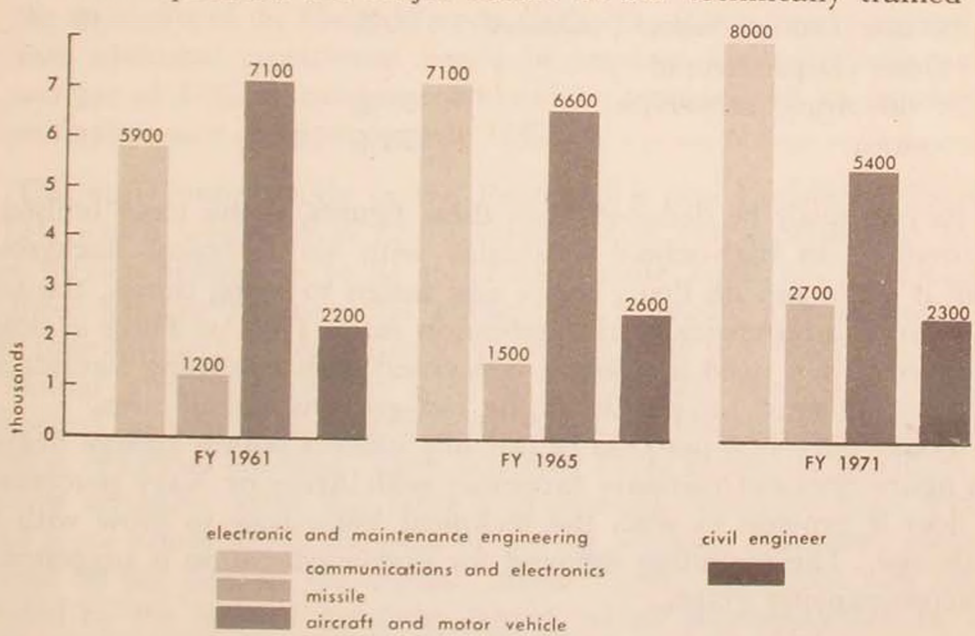


Personnel requirements in the scientific and research and development career areas.

from 5900 to 7100 by 1965 and to 8000 by 1971. The missile electronics maintenance and engineering field is expected to increase from the present figure of 1200 to 1500 by 1965 and then to 2700 by 1971. Within these highly technical skill areas, quality and retention will continue to be our most perplexing problems. We must make major improvements in officer retention if we are to reach and maintain our desired objectives.

categorization of the officers in the problem zone

We currently retain about 28 per cent of the AFROTC graduates, but we keep only about 15 per cent of the ones who are nonrated officers. Yet AFROTC represents the major source of our technically trained offi-



Personnel requirements in the electronic and maintenance engineering and the civil engineering career areas.

cers. Failure to retain the nonrated group will become even more acute as the requirements for scientific and engineering personnel increase in future years. On the other hand it is doubtful that the competition from industry and Government agencies for the services of young men trained in the sciences will diminish.

After studying this problem for six years, Headquarters USAF is able to present profiles of the officers we are considering. The results of more than 1000 personal interviews with officers of less than five years' service show the following characteristics:

Majority Who Elect To Stay	*Majority Who Elect To Leave*
Rated	Nonrated
No college degree	College degree
Regular	Reserve
Academy	
Family favors USAF	Family does not favor USAF
Satisfied with job	Dissatisfied with job

Retention Potential by Source of Commission and Percentage of Input

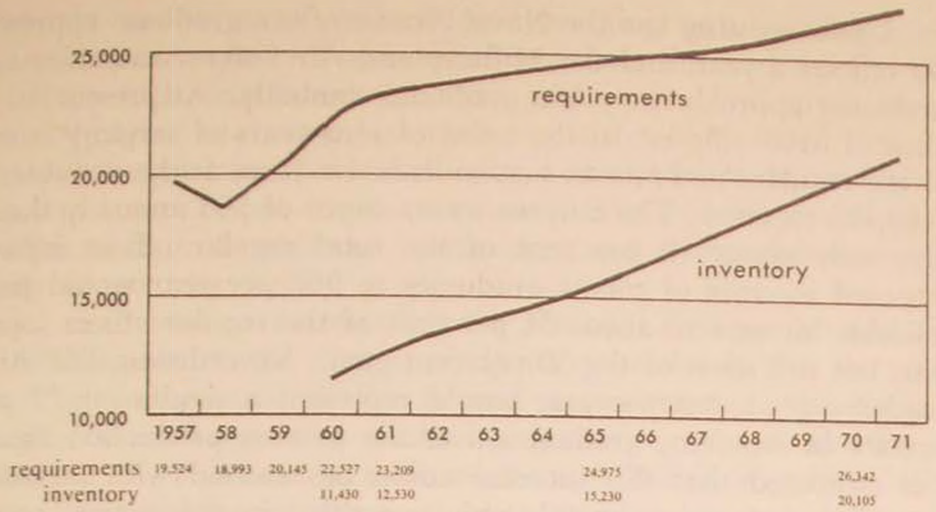
Source	*Retention Potential*	*Percentage of Input*
Academy	90%	6
Officer Candidate School	85%	7
Aviation Cadet	65%	8
Officer Training School (estimated)	50%	18
Other (Department of the Army interservice)	35%	12
AFROTC	28%	49

As can easily be deduced from these figures, if the USAF limited its procurement to high-school graduates with no technical background whom it could put on flying status and assign to flying duties, the USAF would enjoy a fantastically high retention rate. The Air Force is experiencing much less need for people concerned with operating aircraft and an increasing need for people in the fast-growing missile area.

Today only 47.8 per cent of our line officers possess college degrees. This figure does not compare favorably with Army or Navy percentages nor does it provide us with the technical know-how to grow with the missile age. The mounting demand for higher education is suggested by the accompanying graph.

doubling the size of the Air Force Academy

Since the Air Force Academy is our best source of career officers,



Requirements vs. inventory of science and engineering degrees, baccalaureate and higher.

any increase from this source would improve officer retention. Retainability of AFA graduates is currently estimated to be about 90 per cent. Doubling the current output would provide the Air Force with a larger hard core of dedicated career officers. The quality of training at the Air Force Academy has been widely acclaimed by the Nation's educators, and we should utilize the maximum potential of this resource.

The December 1961 Report of the General Officer Advisory Committee to the Air Force Academy contained the following recommendation:

> The Committee urged support of the legislative proposal to permit the expansion of the Cadet Wing to 4500. The Committee recognized that additional construction would be required but noted that an increase of 80% in cadet strength will be possible with an increase in facility costs of approximately 16%.

Currently under study in the Pentagon is DOD Legislative Proposal 87-124, which would revise the present system for appointment to the three service academies so as to provide more equitable opportunities for those desiring to enter the academies. It would also authorize the same basic strength for each academy and increase the maximum number of annual appointments for each to 1382, plus those appointments authorized for sons of recipients of the Medal of Honor. If past academy attrition estimates continue, each academy could expect to graduate 967 students annually. With this large a graduating class, the three services could *more nearly* attain the goal of having academy graduates comprise at least 50 per cent of the regular officer input. This goal was recommended by the Service Academy Board, which was appointed in 1949 by the Secretary of Defense and included Dr. Robert L. Stearns, then President of the University of Colorado, and former President Eisenhower, then President of Columbia University.

Under existing law the Naval Academy can graduate approximately 800 officers a year, and the Military and Air Force Academies are both producing approximately 560 graduates annually. At present an annual input of 3100 officers (at the point of zero years of service) is required for the regular Air Force to sustain its active force at the statutory ceiling of 69,425 regulars. The current USAFA input of 560 annually thus represents only about 18 per cent of the total regular officer input. The proposed increase of USAFA graduates to 967 per year would provide a desirable increase to about 31 per cent of the regular officer input each year, but still short of the 50 per cent goal. Nevertheless, 967 Air Force Academy graduates per year would represent a significant 73 per cent increase in Academy graduates over the present production figure, and it is estimated that this increase could be realized with an additional expenditure of approximately only one third in operational costs.

difficulties with the current AFROTC program

Air Force ROTC is the largest single officer procurement program operating in the Air Force at present, and in December 1959 the Secretary of the Air Force stated at a meeting of AFROTC college presidents that Air Force ROTC would continue to be a major source of Air Force officer procurement for the indefinite future. AFROTC, it is true, accounts for almost half the newly commissioned Air Force officers each year, but since their retention potential is only 28 per cent, this group constitutes essentially an officer potential of short-termers.

The major shortcomings of the present AFROTC program are traceable to the outmoded legislation of 1916, which authorized the training of large numbers of college-educated officers for an inactive reserve force. As a distinct Air Force program, AFROTC came into existence with the establishment of the United States Air Force as a separate service in 1947. Because of its birth within the context of Army organization and the constant feeling that its mission and program must correspond to the larger Air Force mission, the Air Force ROTC has been subject to intense examination and frequent change throughout the 15 years of its existence. Certain questions have recurred:

(1) Is the college campus the best source (other than AFA) for officer procurement? The answer has been consistently in the affirmative. The growing complexity of Air Force operations has demanded a high-quality officer from the standpoints of his education and of his native ability. Only the American college campus can supply men with this combination of training and capacity.

(2) Is the ROTC organizational pattern suited to Air Force officer procurement needs? The history of ROTC throws some light on this problem. The program is now 100 years old. It dates back to the Morrill Act of Civil War times, which directed land grant institutions to provide a course of military training as a part of their curriculum. Obviously in this context military training was of the militia type and was intended

to provide the rudiments of ground-forces training in a comparatively nontechnical era of warfare. The next milestone was the National Defense Act of 1916, which established the ROTC as a national program to be carried on by higher educational institutions. It should be noted that the Federal Government lays no requirement on the states or on individual institutions to accept or provide ROTC training. The Federal Government merely offers ROTC to the states and institutions as a program that may be voluntarily adopted by them.

Again, circumstances surrounding the National Defense Act and the "R" in the title given to the program indicate quite clearly that the ROTC was based on the premise of the Second Amendment to the Federal Constitution, "A well-regulated militia being necessary to the security of a free State . . . " This concept endured through World War II. Under the Soviet threat and the rapid growth of technology, however, it became increasingly clear that the cadre concept of military establishment was no longer practicable and had to be replaced by a force-in-being. As late as 1951 the Air Force ROTC program had a procurement objective of 27,500 per year, almost all of whom were commissioned in the reserve.

The first major change was reflected shortly thereafter in the requirement that all AFROTC officers should be qualified for and sent to flying training. Procurement objectives were sharply cut. Service obligations were gradually extended. The career concept was developed and promulgated. This process was hastened by the Korean conflict. In the years since then this concept has hardened. Only one modification to it has taken place: the requirement for an all-flying officer force has been modified to emphasize the procurement of scientific and technical personnel for the missile age.

The question may well be raised, therefore, as to whether the old Air Force ROTC pattern meets the need for recruitment of a professional force. Most observers are agreed that major modifications in organization, curriculum, and emphasis are imperative and that redesign is desirable if the AFROTC is to be effective in obtaining career professionals for the officer corps.

(3) Is the Air Force ROTC program compatible with changing patterns of higher education? The 1916 National Defense Act was drawn at a time when the configurations of higher educational institutions in America were comparatively uniform and simple. Nearly all colleges and universities followed a four-year program and curriculum. The baccalaureate degree was the end of formal education for most college students. The liberal arts college was the dominant institution. In recent decades junior colleges have come into existence, and they now enroll one out of every four freshmen. It is estimated that by 1972 every other freshman will be in a junior college. Specialized and graduate schools have so grown in number, size, and prestige as to dominate higher education. The baccalaureate degree today is not a terminal but an interim degree, and it may largely disappear in the next ten years. The rapid growth of knowledge, particularly in science and engineering, is reflected in curriculums that are

bursting at the seams. Student competition for academic achievement is so keen today that ROTC, in its present form, is being crowded out of the course of study of those young men whom we would most like to attract to the Air Force officer corps.

All these factors have led to a thorough reconsideration of the AFROTC program and to the development of the Air Force Officer Education Program to replace it.

There has been considerable criticism in Air Force circles about the low retention rate of AFROTC graduates. We tend to blame ourselves and the AFROTC program for not having a much higher retention rate for this group. We have tried desperately (and have been criticized for failing) to make the AFROTC machinery produce something it was never designed to do. A careful analysis of the current AFROTC program against today's environment might well indicate that we should be taking credit for a successful 28 per cent retention rate. Its graduates have trained themselves for a civilian occupation at great expense to themselves and their families. In many cases they have chosen AFROTC merely as a source of a commission, by which to satisfy their selective service obligation. As for the pay comparison facing the new graduates, the following statement by a technically trained AFROTC graduate illustrates rather clearly the noncompetitive position of the USAF: "The present pay scale is discouraging, when I am able to see that when I am promoted to the grade of Captain, I will still be earning less than I was offered as a starting salary in industry five years earlier."

principal features of the new program

The proposed program will provide a new approach to the increasingly difficult task of providing well-educated and well-motivated career officers to fulfill future Air Force manning requirements. The proposed legislation is presently under consideration by the Department of Defense. Certain basic features of the program differ markedly from requirements of the National Defense Act of 1916. The proposed Air Force Officer Education Program legislation would permit the implementation of a two-year (junior and senior years) merit scholarship program to replace the current AFROTC. As mentioned previously, there is very little selectivity in the current advanced AFROTC. Because of quota requirements the USAF finds it necessary to accept almost all applicants. By being able to include junior college and transfer students from schools having no AFROTC, the proposed AFOEP would have a much larger eligible base from which to draw participants (approximately the difference between 200,000 and 600,000). From this expanded group of eligibles the AFOEP is expected to draw 60,000 test applicants; of these applicants approximately 6000 (about 1 per cent of eligible applicant base) will be selected for the AFOEP each year.

The AFOEP has the following main features:

(1) It is oriented to the production of quality regular and reserve officers for the active establishment.

(2) It is a two-year academic program (given in the junior and senior years) which leads to a commission in the Air Force.

(3) It offers many more college students the opportunity to compete for Air Force commissions.

(4) It enables more engineering and science students to seek Air Force commissions because it requires fewer academic hours than the present AFROTC program.

(5) It pays an annual scholarship of $1100 directly to the cadet. The scholarship feature should provide sufficient incentive to cause many men to apply, thus providing a broad base of selection.

manpower and cost comparisons, AFROTC vs. AFOEP

A recent cost comparison between the AFROTC and the AFOEP programs is shown in the accompanying chart. Because of the scholarship feature the AFOEP is initially a more expensive program. If the same comparison is made in FY 1970, it will be noted that the AFOEP is less expensive by $400,000 per year in producing 5200 officers, despite $12.6 million paid as scholarships. The potential manpower savings to the USAF by going to an all-AFOEP is tremendous. A comparison between the 1970 position of a "pure" AFROTC and the 1970 position of fully transitioned AFOEP shows a net savings of 929 manpower spaces. The most important gains to the Air Force, however, would be in both the improved quality of the product and the greater retention of this product as highly motivated career officers.

Manpower and Cost Comparisons
AFROTC vs. AFOEP

	FY 1963		FY 1964		FY 1970	
	ROTC	OEP–ROTC	ROTC	OEP–ROTC	ROTC	OEP
Production of officers	3300	3300	4200	4200	5200	5200
Personnel requirement	1829	1829	1952	1583	2290	1361
Personnel	$14.5	$14.5	$15.5	$12.4	$18.3	$10.6
Operations and maintenance	1.4	1.4	1.7	1.7	2.0	1.8
Summer training	1.0	1.2	1.5	1.7	1.5	3.1
Campus uniforms	3.1	3.1	3.4	2.8	4.3	.8
Subsistence	2.2	4.4	2.9	2.5	3.2	–
Scholarship	–	–	–	7.1	–	12.6
Total in millions	$22.2	$24.6	$25.0	$28.2	$29.3	$28.9

Note: Even if Congress were to pass implementing legislation in 1962, the year 1969–70 has been selected as the first year when all remnants of AFROTC will have been phased out of the AFOEP.

EVEN THOUGH much has been done in the area of career improvement, a number of career shortcomings still plague the Air Force and weigh heavily upon the over-all effectiveness of its people. Some of the more serious shortcomings from which we should continue to seek relief will bear listing by way of reminder:

- —Lack of a rate of pay reasonably competitive with civilian industry
- —Lack of sufficient military housing or an allowance which permits rental of an acceptable standard of housing
- —Lack of sufficient promotion spaces to give opportunity and recognition at an early point in an officer's career
- —Lack of flexibility in fringe benefits so that they work effectively for all, whether at remote stations or large bases
- —Lack of separation allowances
- —Lack of national understanding of "service to country" as an honorable and rewarding experience.

Even in the face of these deficiencies, I firmly believe that if we can secure legislative approval for increasing the size of the Air Force Academy and for implementing the Air Force Officer Education Program, we shall have gone a long, long way toward producing the quantity and quality of highly motivated and dedicated young officers necessary to man today's Air Force and, at the same time, to provide the leadership so essential to the United States Aerospace Force of tomorrow.

Headquarters Air University

The Research Frontier...

PLANNING THE DESIGN AND DEVELOPMENT OF ELECTRONIC COMPONENTS

Dr. John S. Burgess

THE SPACE AGE has introduced a new dimension in the complexity of the electronic systems required for command and control. This in turn has complicated the task of those who plan the direction in which development of electronic components for these systems should proceed, although one does not mean to imply that all applied research must be dictated by system requirements. It is equally true that the results of research may have a profound effect on the types of systems that are possible. For example, the development of nuclear weapons and space boosters introduces totally new system concepts that could perhaps be exploited and hence must be evaluated. Free and easy two-way communication between system developers and the research community is very important.

It may be useful to discuss what is meant by "command and control systems." In 1960, shortly after the formation of the Air Force Command and Control Development Division (AFCCDD)—now the Electronic Systems Division (ESD)—of the Air Force Systems Command, a Winter Study Group was formed to consider the interface problems that existed between the various systems. The final report[1] of the group opens with a discussion of the different types of systems which must be analyzed in attempting to solve interface problems and in effecting integration of the various functions which must be performed. Although it is fairly common practice to link the words "command" and "control" when referring to systems, the report noted a considerable distinction between systems that perform control functions and those that perform command functions.

Dr. Thornton Read, of the Center of International Studies at Princeton University, was commissioned to study the functions of command and control. In his comprehensive report[2] he distinguished between the weapon system, the sensor system that collects information about what is happening in a particular environment, the control system that guides and directs weapons in performing a particular function, and the command system that assists the command authority in performing essentially intellectual functions, such as memory, interpretation of new information in the light of accumulated information, recognition of a pattern of meaning in a complex of information, projection of possible plans, and making decisions among them.

Generally speaking, the sensor system really acts as a subsystem to a weapon system or to a command and control system. Well-known sensor systems are the Ballistic Missile Early Warning System (BMEWS), which detects missiles in flight; a satellite system that detects infrared radiation from a missile firing; and Tiros, the weather satellite system which photographs weather conditions over the surface of the earth and relays the photos back for analysis and forecasting. These systems have one function in common, the collecting of information in a particular environment where something new might be happening.

Typical control systems are the semiautomatic ground environment (SAGE), a nationwide system for directing our interceptor aircraft, and the air weapons control system (AWCS), for controlling interceptions in a limited or theater environment.

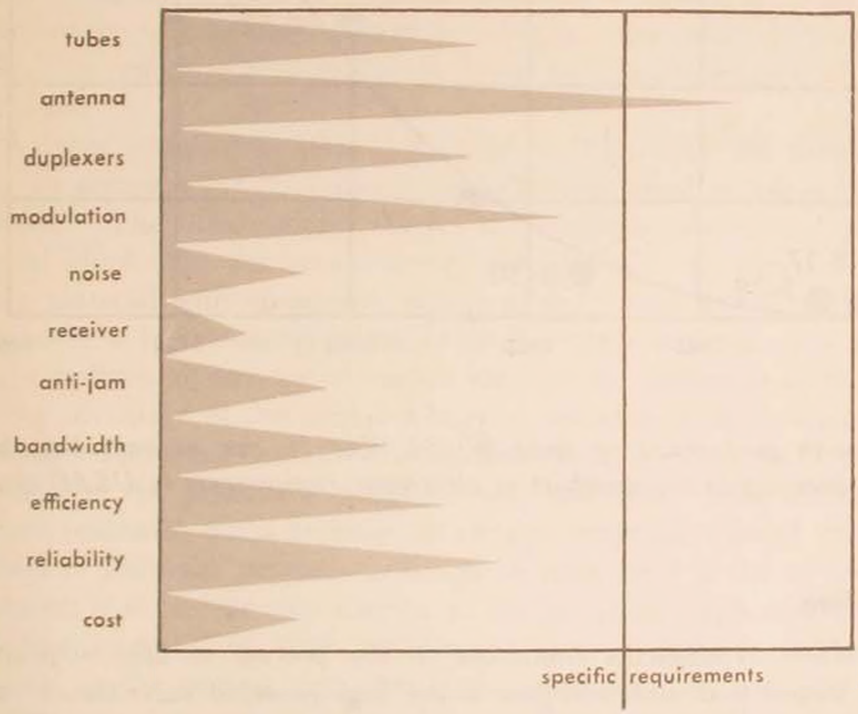
One command system is the 465L, Strategic Air Command Control System, which helps SAC in determining the whereabouts of all its forces and the actions to be taken and decisions to be made in ensuring proper commitment of its forces. Another command system is the 473L, the United States Air Force Operations Control Center, which takes information from all the Air Force resources and presents it for decision to the Air Force Chief of Staff.

It is apparent that all these types of command and control systems have one common relationship—their dependence to a very large extent upon electronic technology. Consequently it is very important that a balanced program be maintained for the development of electronic components that will fit into the system environments. A breakthrough in any one area of electronic technology must not be limited by obsolete types of equipment in another area. Progress must be made in all areas, and an attempt must be made to balance efforts in each of the areas so that technological advances in any one area can be utilized to the fullest possible extent. The planner for electronic component development is confronted with the prodigious task of determining the avenues of approach that hold the most promise, comparing needs versus new technology, measuring the proposed effort against available resources, and ascertaining those trade-offs necessary for the most effective use of our resources. It is the intent of this discussion to describe how planning is accomplished in support of electronic component developments for command and control systems.

The basic function of these systems is broken down into four primary technical areas—data acquisition, data processing, data transmission, and data presentation—to facilitate examining each in detail. By such examination it is possible to determine whether sufficient progress is being made in each area, whether adequate support is being made available, whether duplication of effort exists, or whether overemphasis is producing results that may not be of particular use. The accompanying illustration (a hypothetical example that in no way reflects actual state of the art) shows a method of pinpointing those areas where effort must be concentrated. The jagged line, indicating state of the art for the listed applications, reveals that component development in some areas has lagged to the extent that it becomes a limiting factor in the design of a system. In other examples the state of the art in the technology of a particular device may have advanced to a point where its advantages cannot be completely realized because of other limiting factors. For example, in the development of high-power microwave tubes the process of generating a tremendous amount of power might be well known, but high-power window design might be insufficiently advanced to permit the passing of that amount of power through any type of window. Thus increased effort must be exerted in high-power microwave window design to permit use of the capability to generate high power levels. Concurrently consideration should be given to capability for carrying this large amount of power down a transmission line to an antenna feed. Since acquisition of a working capability depends on all the areas involved, development of microwave and transmission line components and technology in the development of microwave tubes must proceed at the same general power level.

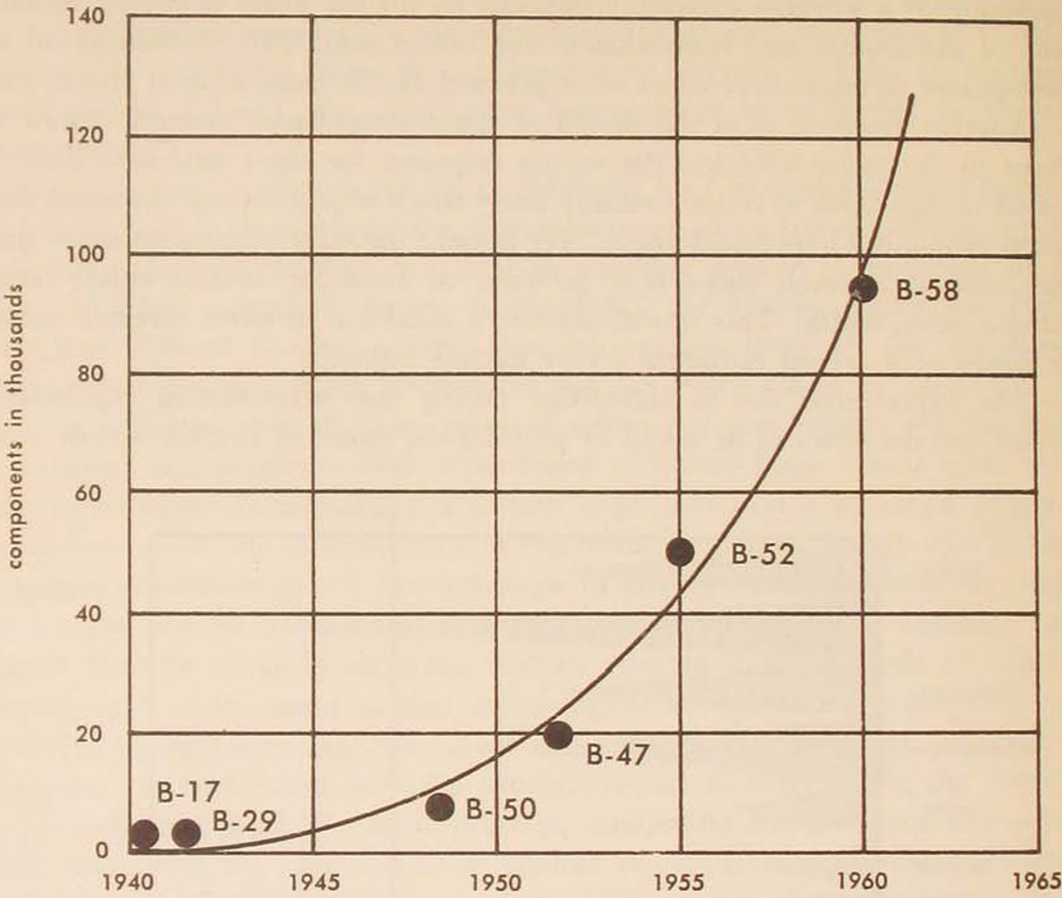
Another example is in the design of space surveillance systems. Since the advent of the space vehicles, the ranges required for their detection have increased to thousands of miles, and any fairly small object several thousand miles distant subtends a very small angle. Yet present antenna beam widths are quite large, and as a result there is a problem of resolving several small targets within a beam width. This would indicate a need for an effort directed toward the design of a system radiating a very narrow beam.

The exponential rise in knowledge during the technological explosion of the last two decades can be noted by plotting the curve of aircraft speeds versus



The state of the art in particular technical areas can be graphed against a specific requirement. This hypothetical example shows that antenna design is adequate to satisfy this specific requirement, but improvement must be made in receiver performance.

time, aircraft altitudes versus time, power levels at various frequencies versus time, low-noise levels achieved versus time—or practically any curve in innumerable technical areas. But nowhere is the advance more pronounced than in the tremendously expanding field of electronics, as may be illustrated by the increased use of electronic components in our aircraft since World War II. One cannot overemphasize, then, the need for maintaining a balanced program in design and development of electronic components.



Exponential growth in technology since World War II can perhaps best be illustrated by the increase in the numbers of electronic components in USAF aircraft.

data acquisition

Many subsystem elements contribute to the process of data acquisition. Perhaps the largest and most complex is the high-powered surveillance radar. The extraordinary progress in radar is easily apparent when the AN/TPS-3 of WW II is compared with the newly operational BMEWS radar. Although this progress is attributable primarily to changes in size, weight, power, and complexity of control equipment, another measure of progress can be seen in the incorporation of the phased array. Electronic components that go into high-powered modern radar include the transmitter, antenna, microwave transmission line, receiver, and antijam circuitry, together with signal processing equipment necessary to extract information from raw radar data. For a wide variety of applications, high power, bandwidth, flexibility, transportability, and many other requirements must be considered.

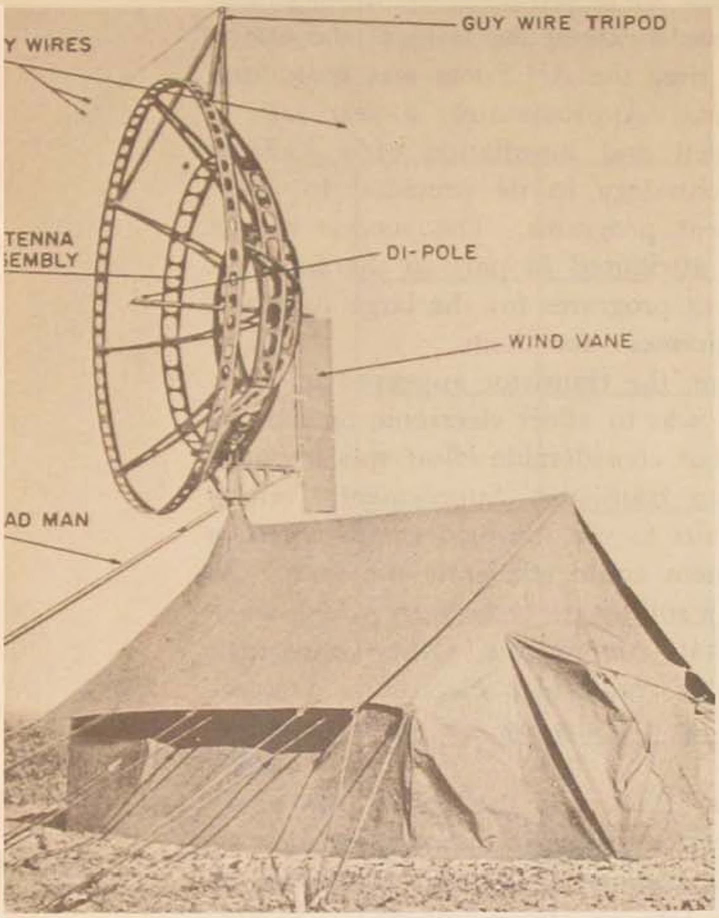
The importance of timeliness in component development was well illustrated in the BMEWS program. In 1957 the Air Force embarked upon the development of a high-powered transmitting tube that would extend the state of the art by a factor of about 100. At about the same time the Air Force was sponsoring research work on a large torus-type antenna. Approximately a year later a program was approved for the development and installation of a ballistic missile early-warning system, based on technology to be provided by these antenna and high-powered tube development programs. The success of the BMEWS stations, as now operating, can be attributed in part to the foresight demonstrated in the initiation of development programs for the large tube and antenna without any previous specific requirement for them.

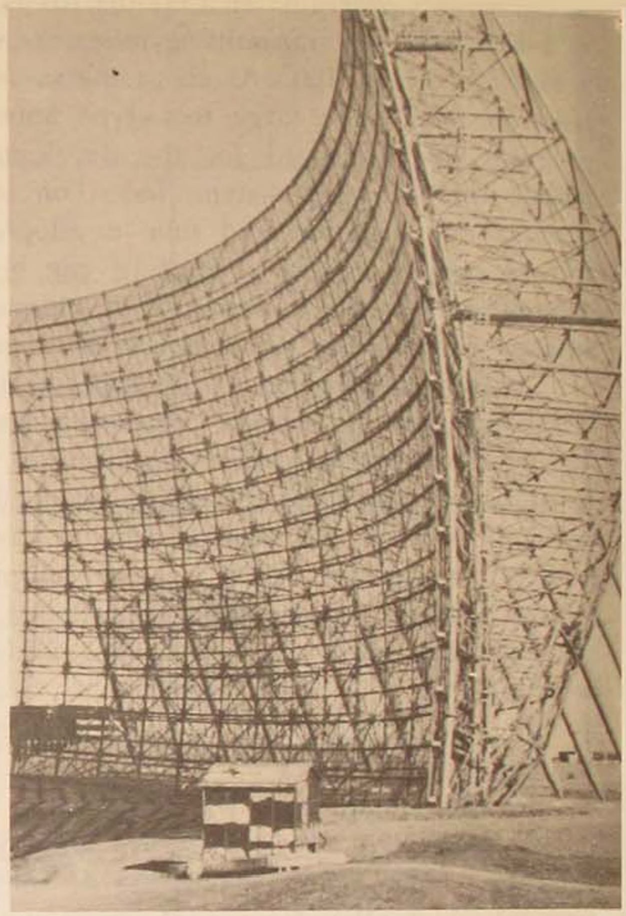
At the opposite end of the scale in sizes, the transistor appeared in 1948. Here was a completely new component that was to affect electronic technology throughout its whole scope of applications, but considerable effort was required in the development of a reliable production transistor. Supplemental efforts included research and development on circuits to use transistors and extensive studies to determine which types of equipment could efficiently use them. As a result a whole new technology developed, a solid-state technology which since has led to the development of several solid-state components. Other consequent developments will be microminiature circuits, molecular electronics (molectronics), or other techniques for building up circuits by use of evaporating techniques.

Another component, which appeared in 1955, was the maser, the name being an acronym for "microwave amplification using stimulated emission of radiation." The maser makes use of the quantum mechanical properties of material which allow for several energy states to exist. By stimulating or radiating the material with microwave energy at the proper frequency, the material is raised to a higher-energy unstable level. When it drops to a lower-energy level, it radiates an amount of energy equal to the difference in the two levels. The big advantage of this device is a great decrease in the low-noise effects in electronic equipments from several decibels down to fractions of a decibel.

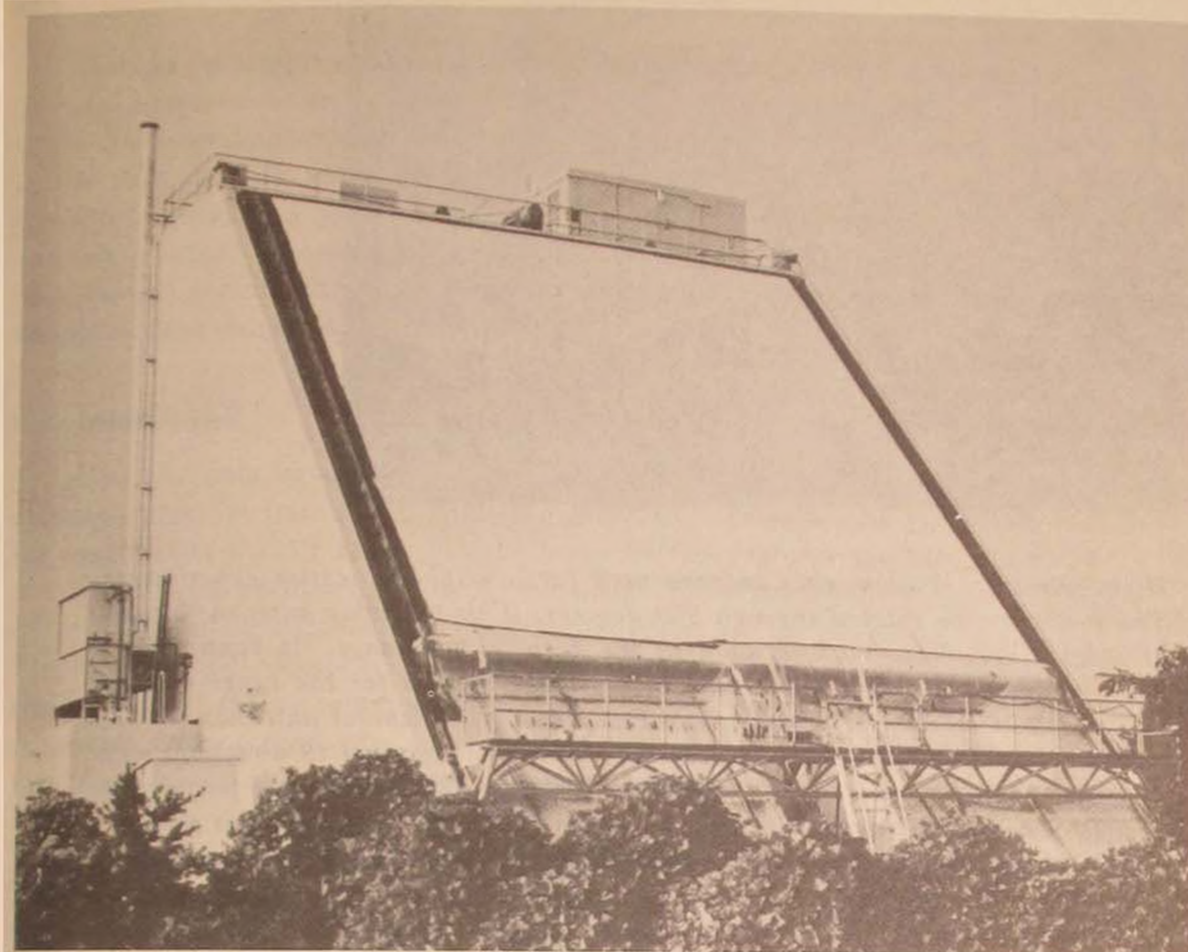
In 1956 the parametric amplifier was developed. This device, using the negative resistance characteristics of certain materials, offered competition in the field of low-noise devices. Although its noise level is not as low as that of the maser, it is considerably simpler to use in system applications.

More recently, in 1960, solid-state maser techniques were applied to materials in the optical frequency band, and for the first time it became possible to generate coherent light, that is, light with constant phase in a very narrow frequency band, rather than with continually changing phase as in conventional light sources. Named laser (for "light amplification by stimulated emission of radiation"), this innovation offers the possibility of developing subsystems for communications or radar with optical frequencies. As a result emphasis has been placed on the development of other optical peripheral types of components that can be used for system applications. Further development of the laser will continue. At the January 1962 American Physical Society meeting, Bell Telephone Laboratories announced the development of a continuous-wave, solid-state laser.



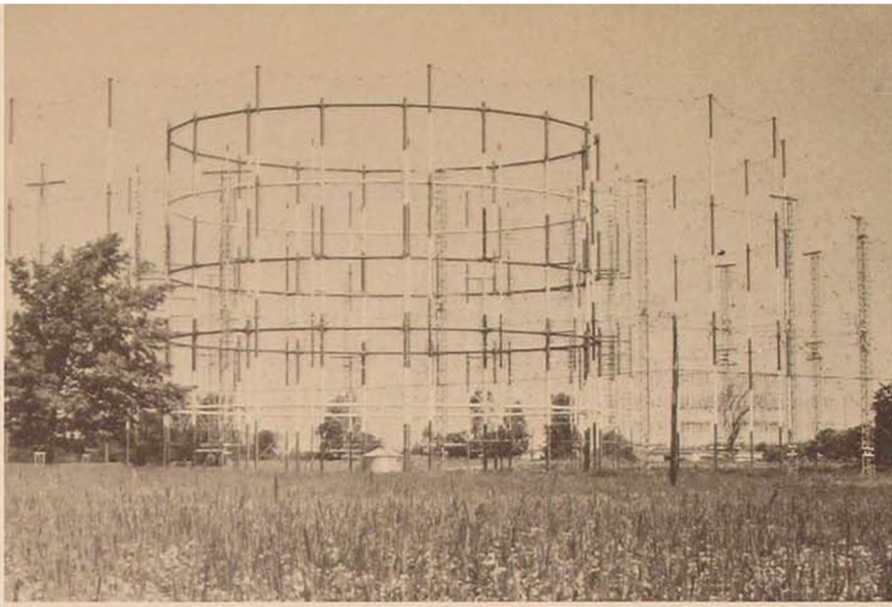


Virtually the whole range of radar development—from small to large and from relatively simple to exceedingly complex—can be seen here. The AN/TPS-3 radar, developed by the Signal Corps Laboratories during World War II, operated at 600 mc/sec with a peak power of 200 kw. It could be packed on the backs of eight men. The antenna of the BMEWS search radar at Clear, Alaska, on the other hand, is about the size of a football field. The feed system for this antenna places a pair of sheet beams into space, one above the other, where they narrow-beam-scan on each sheet. The first detection is made in the lower sheet; the time required by the target to reach the second sheet allows for calculation of its velocity and trajectory. The complexity of current radar systems is also evident in the Electronically Steerable Array Radar (ESAR), shown here in experimental model. The face of the structure contains approximately 10,000 antenna elements, each fed at the proper phase to form a beam in space. Behind the face of the antenna there are five floors, which provide housing for the transmitters, receivers, data-processing equipment, spare parts, and maintenance test facilities. Transmitter modules may be replaced from behind the antenna without turning off the radar.



In the field of antennas, recent emphasis has been placed on the development of phased-array techniques. A specific example is the Electronically Steerable Array Radar (ESAR), built by the Bendix Corporation for the Air Force. This radar consists of a flat face of some ten thousand elements, only ten per cent of which are energized in this experimental model. A beam of great flexibility in the size or shape may be formed, and the beam may be moved simply by controlling the phase of the inputs to the various antenna elements. Many radiators are contained in the face, and the beam is formed in space. A very large increase in power level is possible, since each element can be fed by a moderately powered transmitter; then the energy can be blended in space to form a single, very high-powered beam. Besides the electronic steering characteristics that have evolved in these developments, an interest has been renewed in interferometer techniques whereby a fairly wide base-line system can be used. The major problem to be solved is resolution of the ambiguities that occur in any interferometer pattern. Much progress is being made along these lines.

Of course radar is not the only possible source in the data-acquisition field. A great deal of interest prevails in infrared sensing devices. Particularly in the lookout for missile or space launchings, properly instrumented infrared devices detect the great amount of heat that is produced on take-off or launch. In this field concentration is needed not only on the sensitivity of receiving systems throughout the infrared spectrum but also on the development of higher power



High-frequency Wullenweber antenna used for ionospheric scatter experiments. The beam can be rotated through 360 degrees. This receiving antenna, located at Stockbridge, New York, is used in the 4 to 30 mc range. It consists of a 200′ diameter outer ring of 18 bays of vertical antennas for the range 4 to 11 mc, and a 100′ diameter inner ring of 18 bays of horizontal antennas for the range of 11 to 30 mc. It may be steered horizontally to any of 19 directions with high directivity. Its outstanding feature is the low angle at which the frequencies may be received, in some cases only 8 degrees above the horizon. This provides ranges of communications with but a single reflection from the ionosphere.

levels in the infrared frequencies. Another data-acquisition method is the familiar aerial photographic reconnaissance. The requirement for high resolution of detail on photographs taken from airplanes at high altitudes led to the development of very precise optical instrumentation. When placed on a satellite, though, this instrumentation does not give the type of resolution required for photographs taken 300 to 500 miles up. Hence further effort is needed on optical techniques for long-range photography, film devices, and methods of correction to tilt, aspect, and so on, for a moving satellite or other space vehicle. Films that can operate on a limited amount of light are also required.

data processing

After a data-acquisition subsystem has collected a certain amount of data concerning its environment, the data must be processed for the using agency. Research and development activities must consider the design and development of computing equipments and of all elements incorporated therein. Only a few years ago a computer was a very large and complex but unreliable device. With the advancing technology in solid-state devices, a very high-speed, large-capacity computer has been reduced to a fairly reasonable size, and its reliability has increased manyfold. Emphasis now is required on storage devices, memory, rapid access to memory storage, miniaturization techniques, and use of multiple functions in a computer system. Computers are being applied to translation purposes, storage and retrieval of information, abstracting of documents, reading, and many other Air Force-oriented requirements.

Perhaps the largest and most elaborate data-processing system is represented in the semiautomatic ground environment (SAGE) which has become the heart of the continental air defense command and control system. Each control center in the SAGE network accepts inputs from numerous radar sites assigned to it to detect, track, and identify all aircraft, commercial, private, or military, entering its area. The vast amount of data collected and the thin margin of time for the commander to make a decision demand a volume and speed in data processing that could not possibly be accomplished by human manipulation.

data transmission

After the data have been acquired and processed, the useful information extracted must be transmitted from the point of collection and processing to the user. Hence the Air Force, like the other services and commercial activities, is equipped with world-wide networks for such communications. A big problem is faced in finding sufficient bandwidth to handle all the networks required. Tropospheric and ionospheric scatter techniques are used to reach the more remote areas. Satellite communications, both passive and active, are now in the process of development. An additional problem is the developing of suitable switching circuits, and much effort has been concentrated recently on electronic switching centers.

Another important aspect of the over-all communications problem is coding. Sufficient channels for open communication by voice or teletype must be supplied. Accessibility of channels is a very important phase of the over-all system, since the operation could fail as a result of the commander's inability to get his message to the proper place in time. Cryptographic techniques must also be developed to ensure the security of communications networks when necessary. The development of computer technology has recently led to investigations of digital techniques for application to communications systems.

The planner of component development for communications has before him a wide variety of demands for his attention, among others the need for satellite communications. The major decision here is whether to go active or passive. Should the satellite contain active electronic components to rebroadcast, or relay, or switch its received message, or should it merely act as a reflecting surface for the signals? Commercial communication interests presumably will put the burden of their effort into the active satellite. It then is probably feasible for the Air Force to support the development of passive satellite techniques that would have special usefulness in a hostile environment. When consideration is given to the advantages and disadvantages of both types of systems and to the various types of applications (long-range communications, reconnaissance, point-to-point secure communications, interference), it becomes apparent that sound reasons support the development of both techniques.

The passive satellite system raises its own problems in the selection of the type of reflector, its size, shape, cost of launch, and so forth. Should it be a Westford type, which consists of millions of tiny reflectors orbiting in a band around the earth, or a few discrete objects, such as balloons or corner reflectors? Should it contain some active components? After a particular satellite type has been selected, the configuration of the satellite system must be considered. How often will the satellites be launched? What kind of stability can be expected from the reflecting surfaces? Will they maintain their relative positions? Should satellites be used on a full-coverage, full-time basis?

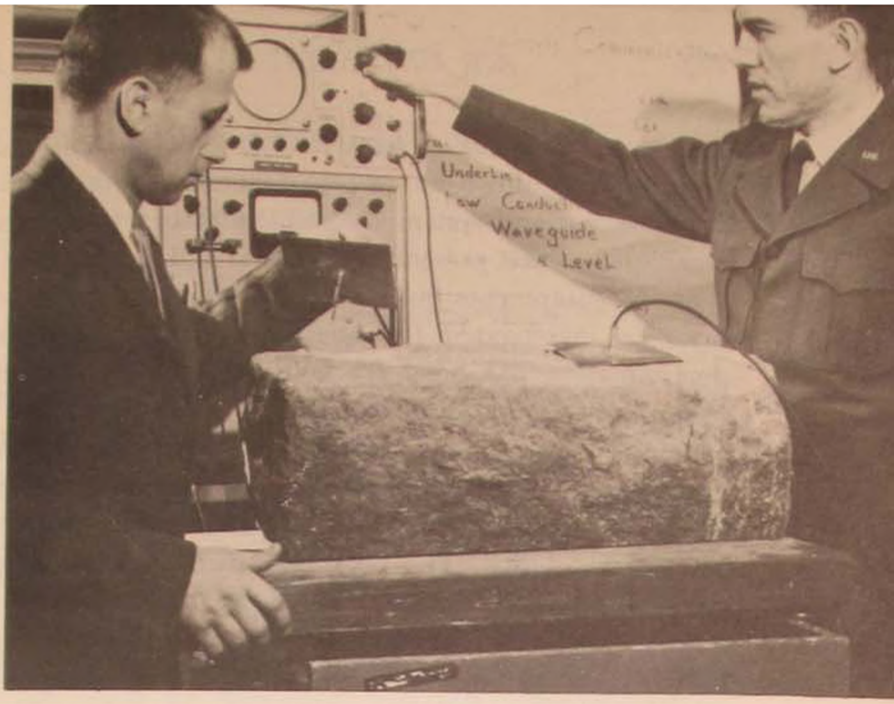
Investigation must cover not only the possibility of communications through the lower portion of the earth's atmosphere and on out into space but also the possibility of communications through the earth's surface or crust. One of the weakest aspects of our communications channels above the earth's surface is susceptibility to bomb damage, cable or wire cutting, ionospheric disturbances, etc. When the elements of a system lose contact with each other or with their central control, they no longer act as a system. The communications link would be considerably improved and the over-all operation much more efficient and reliable if a simple, dependable means could be developed for effective underground communications, even though it offered limited capacity. The tendency is to go underground for many of our functions.

In communications, as in radar, there is an apparent need for higher frequencies. The longer range required again involves much narrower beam widths. Because of the substantial decreases in size and weight of equipment made possible by higher frequencies, much research and development work is being sponsored in the area of infrared, millimeter waves, and optical-frequency communications techniques. Such investigation involves the development not only of power sources but also of modulation and receiver techniques.

data presentation

Huge quantities of processed data flow over our communications circuits into command or control centers. A resulting difficulty is to find a means to display sufficient data before the decision-making authority to inform him of all facets of his situation or environment and yet avoid displaying an over-abundance of information that could confuse him. The problem has two aspects: first, the technical matter of presenting the material, and, second, the psychological matter of determining the type of presentation and the amount of material that a human can handle effectively. Research in both these areas is progressing at a fast pace.

In the presentation of the material itself, the present state of the art includes both wet and dry photographic means for making a slide and projecting it on a large screen. A compendium recently published by engineers at the Rome Air Development Center describes in detail the current state of development in data-display equipment.[3] This compendium enables the selection, from a wide variety of techniques available, of the system best suited to a particular need. Further research is being conducted to develop newer techniques for displaying data. Of keen interest at the moment is work being done on the electroluminescent panel, although unfortunately as of now the brightness level of the panel is not high enough for good daylight viewing. Another problem remaining is that of resolution, which is closely associated with the problem involved in switching from one luminescent point to another. An



High-frequency RF transmission through granite is demonstrated in this laboratory test. The rock sample used is assumed to be typical of the worst-case conditions in the earth's basement complex; in best-case conditions the basement complex would be composed of pure silicon dioxide. Within these boundary conditions, frequencies of 1 kc to 10 mc were shown to be usable for ranges of 50 to 1000 miles. In addition to subsurface conductivity, communications through the earth's basement will be affected by the homogeneity of the media, the conductivity of the boundary layers of the earth, the width of the transition region between layers, and efficiencies of equipments.

additional possibility is the use of light-modulator techniques for dynamic large-screen display of such information in a fast-changing air defense situation.

In the area of human engineering or man–machine relationships, many investigations are necessary to determine the optimum rate at which information can be digested and used by humans. Various sensory-input devices other than those concerning the eye and ear are under study. Among others, investigations are being made into the possibility of using the sense of touch as an input mechanism. A speech study must be made to obtain a quantitative measure of the quality of competitive communications equipments as to intelligibility. Speech intelligibility tests are being developed and used to pinpoint the weakest links in communications systems. Visual sense experiments are also being made to determine the degree of blur that can be tolerated without loss of depth effect, in analyzing aerial photographs for example. Consolidating all these efforts, studies are under way to determine whether the human sensors or brain saturates first. If the eye or the ear saturates before the brain, the use of several different input channels in combination would enable human operators to operate at higher workloads. If on the other hand the brain saturates first, no gain would be realized in using multiple-data input channels. All this research is aimed at determining the best possible techniques for filtering and sifting the torrential flow of available information so that the human operator can make the proper decisions from the information provided.

PRIMARILY, planning a research and development program in electronic components boils down to an examination of the various types of operational requirements and system possibilities in order to determine the components or techniques which present the weakest links. Not only the presently operational types of equipments but also more advanced or hypothetical types of systems must be investigated to ascertain wherein the deficiency exists. When this determination has been reached, research and development can be directed toward correcting the deficiency. As a matter of fact similarities exist between component development work and the PERT system used for large systems management. Instead of the connecting links being drawn on the basis of estimates of time, they would be estimated from the standpoint of state of the art and feasibility. The point at which the flow diagram breaks down on the basis of feasibility would indicate an area that requires emphasis in applied research and development. The purely technical considerations then must be balanced against available resources, funds, manpower, and facilities so that selections for support may be made on the basis of a balanced program. Such planned research and development of electronic components is necessary if we are to have timely, effective, and reliable systems in the future.

Headquarters Rome Air Development Center

Notes

1. Winter Study Group Final Report WSR-7, 15 September 1960.
2. Thornton Read, "Command and Control," Policy Memorandum No. 24, Center of International Studies, Princeton University, June 1961.
3. "Compendium of Visual Displays," RADC Compendium 61-1, 19 December 1961.

METEORITICS AND HYPERVELOCITY STUDIES

Alan K. Hopkins

SPACE vehicle missions of long duration, perhaps years, make the probability of significant collision along the way with one or more meteoroids or micrometeoroids a matter of grave consequence. The potential loss of a multimillion-dollar vehicle because of this little-understood hazard is sufficient justification for more extensive research.

The probability of a significant impact, one that might cause failure of the vehicle, can be determined only with data on two different factors: (1) distribution of number, mass, and velocity of natural meteoroids about the orbit of the earth, and (2) degree of impact damage to be expected from a wide range of particle masses, compositions, and velocities. Data on the first can only be acquired through observations of natural bodies in space, but for the second studies of hypervelocity impact can be performed in the laboratory.

Although knowledge of the meteoroid environment is increasing, making it possible to compute the probability of encounter with particles of various masses, the designer is still faced with the problem of determining an optimum vehicle structure to provide both mission capability and reasonable probability of survival throughout the mission. The solution is in increased knowledge of hypervelocity impact effects of simulated meteoroids and micrometeoroids at meteoritic velocities. This paper has a twofold purpose: one, to survey briefly the present knowledge and completed research of the environment as it affects the techniques employed in the acceleration of particulate matter to hypervelocities; the other, to survey the areas of significant need for continued research. Our concern is not with the specific potential materials to be used in space vehicles but rather with gaining first a complete understanding of the dynamics of hypervelocity particles and of meteoritic impact. Once this is known, materials selection can be made logically and intelligently.

nature of the environment

It is evident from the widely differing information issued by authorities concerning the number, size, density, distribution, configuration, and penetrability of meteoric materials that the field of study is new. Further confusion results from nonuniformity in defining terms. A firm foundation for study of meteoric material impact effects requires a common terminology. The following definitions will be used throughout this discussion.

meteoric particle. An intra-solar-system body or particle of any size smaller than a planet and generally of cometary or asteroidal origin.

meteoroid. A meteoric particle, generally of cometary origin, of any size greater than 10^{-4} grams, i.e., larger than a pinhead.

micrometeoroid. A meteoric particle of mass less than 10^{-4} gm.

meteor. The light flash resulting from the entrance of a meteoric particle into the earth's atmosphere.

meteorite. A meteoric body, generally of asteroidal origin, found on the earth's surface with mass greater than 10^{-4} gm.

micrometeorite. A meteorite having mass less than 10^{-4} gm.

hypervelocity. Velocity exceeding the speed of sound in the target material.

Composition of Meteoric Material. With the particulate matter found in space defined, discussion can proceed to the composition, relative numbers, and velocity distributions of the particles. Meteoric particles are stony, iron, or other metallic masses. Apparently they are concentrated in the ecliptic plane, and they move around the sun in the same direction as the planets. Large meteoric particles may be concentrated in streams irregularly located in space. Meteorites are hard, high-density materials and are the remainder of meteoric particles of large mass which have not completely vaporized or burned. They vary in mass from milligrams to several tons. There are three types of meteorites: siderites or metallic bodies, consisting of iron or nickel alloys; aerolites, consisting of stony materials primarily composed of silicates and oxides; and siderolites, which are a combination of iron and stone. Of the three types, the siderites constitute less than 10 per cent of the total.

Although the origin of meteoric materials is not of concern here, some of the potential research outlined later will cover the determination of their origin. Most authors agree that the bulk density of particles of cometary origin ranges from 0.05 to 0.3 gm/cc—not unlike a pile of household dust; whereas the meteoroids of asteroidal origin have densities as high as 8 gm/cc, the density of iron.

Velocity Distribution. Because of the earth's gravitational effects, material entering the earth's atmosphere cannot have a velocity of less than 11.2 km/sec, about 33,000 feet per second. Since the velocity of the earth in its orbit around the sun is about 30 km/sec and the maximum heliocentric velocity of a meteoric particle is about 42 km/sec, the maximum combined relative velocity is about 72 km/sec. Secondly, in this velocity range of 11 to 72 km/sec, there appears to be a distribution of velocities which varies with particle size. In addition, meteoric particle velocities vary at different times of day and month, their mean observed speed in the earth's atmosphere being highest in early morning and lowest in late afternoon.

If particles of a diameter of less than one micron (μ) tend to be blown out of the solar system by solar radiation pressure, and the ejection mechanism also depends on particle density, then to stay in the system those particles with a density of 0.05 gm/cc must have a diameter of 23 to 46 μ. However, particles 0.01 μ in diameter may not be affected by radiation pressure if their scattering power is low. The interplay of

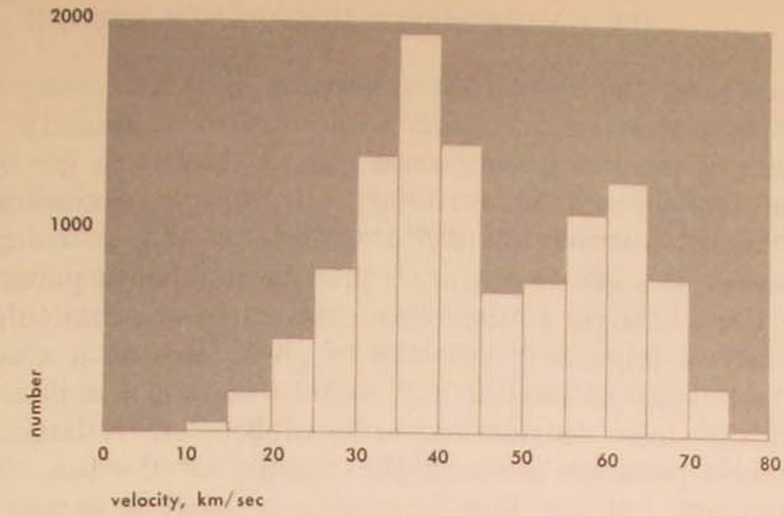


Figure 1. Distribution of velocities for some 11,000 sporadic meteorites.

the gravitational effects and radiation pressure of the sun determines whether these minute particles will be spiraled onto the sun or blown out of the system. Figure 1 shows a distribution of meteor velocities as determined by radio methods in a 15-month study during 1948–1950. [1, 2] The smallest particles observable by radio methods have a mass ranging from 10^{-4} to 10^{-5} gm, and their average velocity appears to be 37.5 km/sec. We account for the zodiacal light, that light reflected by minute dust particles, by assuming that many smaller particles must exist having lower velocities. Therefore the average of 37.5 km/sec is probably high and should be reduced to between 28 and 35 km/sec.

Particle Distribution. The frequency of particles in the vicinity of the earth can be determined from the intensity of zodiacal light. Beard has determined that in order to produce zodiacal light there must be a

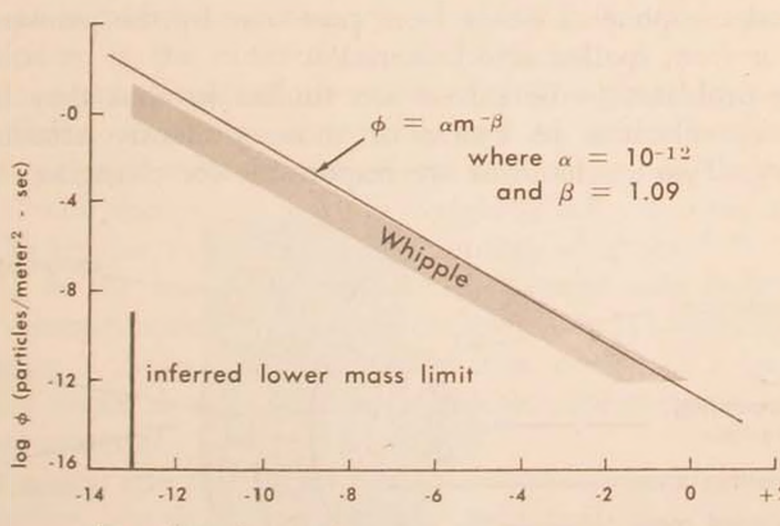


Figure 2. Meteoric flux vs. mass. On a log-log plot the mass distribution appears as a straight line. The line is according to Broyles,[4] whereas Whipple gives an uncertainty spread in the flux data. Actually the only rocket data substantiating this curve lie in the 10^{-4} to 10^{-5} gm range. Recent Air Force rocket data show this curve to be as much as two orders of magnitude too low. The inferred lower mass limit is that mass which would not be blown out of the solar system by solar radiation pressure.

flux density of 10^{-6} particles/cm^2/sec of particles having radii between 1 and 10 μ, which corresponds to a mass of at least 10^{-11} gm.[3] The frequency of particles having mass greater than m (a given mass) entering the vicinity of the earth/sq meter/sec is, according to Broyles, $F_{>m} = \alpha\, m^{-\beta}$, where α and β are constant.[4] Figure 2 depicts this mass distribution; at a glance one notes that the number of particles diminishes as they become larger in size. From this curve one may infer the relative probability of impacts of particles of given sizes on a space vehicle.

The amount of satellite and rocket data taken to date tends to substantiate the mass distribution curve of Broyles. A large concentration of meteoric particles exists in the vicinity of the sun. Zodiacal light measurements indicate that a maximum particle density between the earth and the sun occurs in the ecliptic plane. In addition, dust concentrations are expected to occur within the gravitational fields of the planets and moon, their density varying inversely with the 1.5 power of their distance from planet centers.

meteoric impact

The hazard to space vehicles from impact with meteoric material can be considered as two problems: (1) surface erosion by dust particles, and (2) penetration and puncture of skins by more massive bodies.

Surface erosion has as a major consequence the reduction of thermal control, since the physico-optical properties of the surface may be changed by erosion. Another consequence is increased drag from air friction on the roughened surface and the resultant overheating of the vehicle skin upon re-entry into the earth's atmosphere.

The consequence of puncture to a manned vehicle is obvious in view of its required pressurization, but damage may also be disastrous to internal components either from puncture by the primary impacting particle or from spalled skin material.

The problems to be solved are similar in that they both involve impacts at velocities in excess of those presently attainable in the laboratory. Two mechanisms are responsible for changing the character

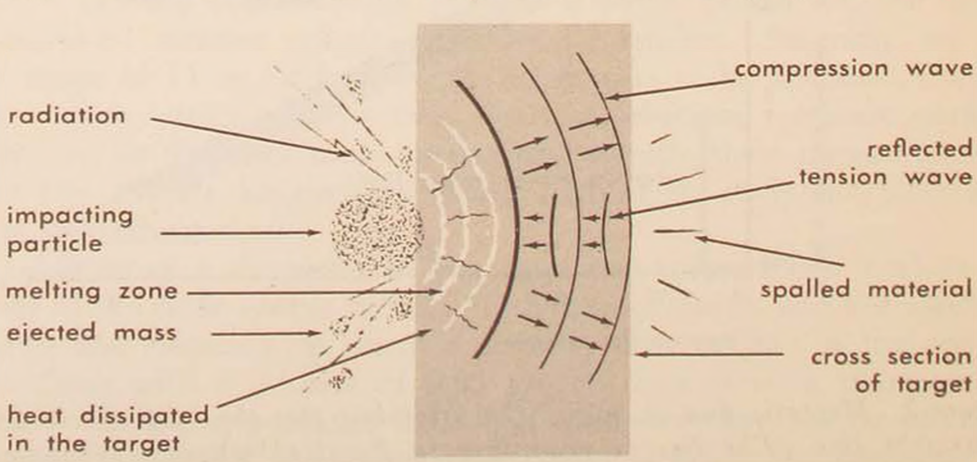


Figure 3. Cross section of meteoroid impact.

of the impact process at high velocity as contrasted to that occurring at low velocity. First, since momentum effects are linearly dependent upon velocity, they will dominate the low-velocity impacts. Energy varies as the square of the velocity, and therefore energy effects will be predominant at high velocities. At high velocity, target materials are more resistant to momentum effects, since the greater inertial stress of the target atoms dominates the common static stress of the target material at high rates of strain.[5] Second, at the maximum laboratory velocities presently attainable, the shape of the crater resulting from impact bears small relation to the incident particle momentum. We know, however, that the shape of the crater becomes slightly elliptical and that the penetration decreases as the incident particle deviates from head-on impact with the target.

impact effects

The probability of impact by low-bulk-density projectiles will be greatest because of their higher frequency of occurrence and will include predominantly particles of cometary origin. Since the low-density particles ($\sim$ 0.05 gm/cc) have low cohesive strength, the major concern is the surface erosion caused by the impact of these particles on skin, mirrors, reflectors, windows, radar and infrared gear, energy collectors, thermal protection, and heat balance systems.

Because of its low mass and resulting low kinetic energy, such a particle will probably fly apart upon impact and transmit only a very small portion of its original kinetic energy to the target. The most probable effects would be many small pits of slight penetration (or dimples) as well as deposition of particulate matter on the surface of the target. A dust particle 10 μ in diameter with density of 0.05 gm/cc and velocity of 30 km/sec has an incident kinetic energy of about 2×10^{-5} joules, which will be dissipated in the outer layers of the target.

By contrast, meteoroids of asteroidal origin are generally high-density materials. Collisions with such particles will occur less frequently than with dust particles, but the impact effects will be catastrophic because of their high kinetic energy. A particle weighing 0.5 gm traveling with a velocity of 30 km/sec possesses a kinetic energy of about 2×10^5 joules (comparable to the energy of an ultra-high-speed rifle bullet). This amount of energy cannot be dissipated completely in the outer shell of the vehicle. Figure 3 shows a representative cross section of a particle impacting and gives an idea of the manner in which the energy is partitioned in the target material.

The four basic effects of high-density meteoroid impact are light emission or radiation, penetration, spallation, and vibration.

Light Emission. The initial effect of impact is the explosive removal of both target surface material and a portion of the particle itself. This matter is partially vaporized, liquefied, or dislodged as solid material. A major portion of the energy is converted into radiant energy, which ac-

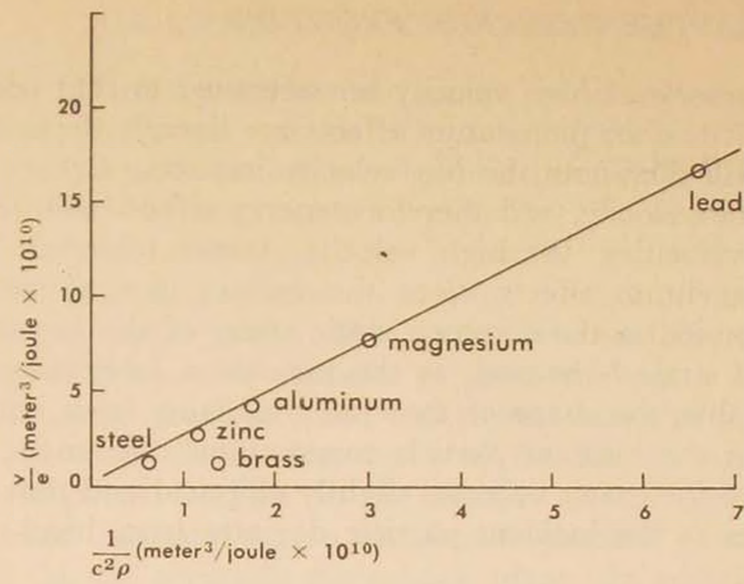


Figure 4. Volume/unit kinetic energy vs. $\frac{1}{c^2\rho}$. *This graph shows the apparent linear relationship between the common hypervelocity cratering–energy parameter (y-axis) and the target strength parameter (x-axis). The points on the graph represent the reduction of many pieces of input data from several experiments. It must be pointed out that the data presented here may be representative of impacts below 7.5 km/sec.*

counts for the luminosity associated with the impact. The disturbed matter which does not leave the target surface forms the crater lip.

Penetration. The kinetic energy of the impacting particle is higher than the sublimation energy of most metals. Consequently a meteoroid with high velocity penetrates a metal as if it were a liquid and continues until the meteoroid atoms lose enough energy to be in the range of the binding energy of the metal lattice. There are several theories at present that attempt to predict the depth to which a particle will penetrate a given material as well as the volume of the resultant crater. Perhaps the most widely quoted equations for making these predictions are those set forth by Kornhauser.[6] Changes are reflected in the curve of Figure 4 as crater volume per unit kinetic energy becomes a function of target parameters as given by Partridge.[7] Another related graph could show that the slope of the line plotting crater volume versus energy of the projectile will be different for different target materials, depending on the modulus of elasticity or strength modulus of the material. As all the theories thus far developed have dealt with velocities below 7.5 km/sec, they say nothing about the effects at expected meteoroid velocities, which start at 11 km/sec.

Spallation. Meteoric material penetrates a surface at hypervelocities, and the mach number at which this takes place is determined by the speed of sound in the particular target material. The meteoric particle is preceded by a shock wave of high strength. As the energy of the shock wave is transferred to the target atoms within the shock cone, the atoms participate in the bulk motion and attain extremely high temperatures, with some of the material vaporizing. The vaporized material in the shock cone then attains velocities in the sonic region. The lattice energy of the target material may be considered negligible, and the energy of the vaporized material is carried deeper into the skin by a compressional wave to an extent dependent upon the elastic properties of the target material. These compressional waves will be reflected as tension waves from the discontinuity offered by the rear surface of the structure or skin.

At this point the analysis becomes somewhat complex and uncertain, since the breakup at the inner surface, known as spallation, depends upon the tensile strength, the existence of faults, cleavage planes, and in general the crystalline properties of the material. The spalled material will have a certain kinetic energy imparted to it, which depends upon the strength of the compression wave as well as upon the other factors mentioned as contributing to the production of spallation. If the kinetic energy of the spalled material is sufficiently high, these secondary particles may produce damage upon impact with internal components in the vehicle.

Vibration. The impact of massive meteoric particles can induce vibrations within the target material. The amplitude of these vibrations may be sufficient to spall or flake off thermal coatings or may even crack open welded joints in the structure.

At present there are experimental and theoretical programs in progress to study existing laws and establish new laws of hypervelocity impact. Notable variation exists in the equations proposed to describe these phenomena. Henderson and Stanley[8] attribute this to two factors:

(1) The processes which occur are extremely complex. Under low-velocity conditions a small particle penetrates the target as a projectile and produces a deep hole. As the particle velocity approaches the speed of sound in the target material, a situation arises similar to that occurring when transonic aerodynamic conditions are approached in wind tunnel tests or in actual flight. Penetration under these conditions depends on the rate at which the compression wave moves into the target, on how efficiently the heat produced is conducted away from or melts the target-projectile combination, and on some other factors not clearly understood.

(2) Experimental data, while available at relatively low speeds for large, solid projectiles, are completely lacking for the range of velocities, particle size, and particle materials involved in the meteoric environment. At the present time essentially no data exist for speeds above 7.5 km/sec, which for most materials is between mach 1 and 2. Particle sizes down to 10^{-11}gm and densities around 0.05 gm/cc are about an order of magnitude below that currently attainable in the laboratory. Therefore the equations relating to material properties, velocities, and energies have taken a variety of forms.

experimental observations

Despite the fact that, almost without exception, the experimental research on hypervelocity impact to date has been in the region below 7.5 km/sec, considerable work has been done which has resulted in large amounts of data, especially in the studies of crater formations, penetrations of high-density projectiles ($>$ 2 gm/cc), surface glancing effects, and target surface erosion from gases and shattered particulate materials. A brief review of some of the work accomplished in these areas may be of interest.

Crater Formation. The two primary studies of hypervelocity impact have been in the area of cratering and penetration. Gehring has analyzed the dynamics of crater formation using high-speed photography to watch the qualitative features of the impact.[9] From the data obtained from these photographs he postulated equations for the impact dynamics and determined the portion of energy partitioned from the particle to form the crater.

Penetration Studies. The principal work in hypervelocity has been in penetration studies. Research has run the gamut from qualitative observations of just what occurs upon impact to quantitative determinations of crater volume and particle penetration depth as a function both of particle energy and particle material and of target material and target configuration. Nearly all the work has been conducted using metal projectiles impacting on metal or plastic targets. Only recently have tentative data been disclosed on experiments in which borosilicate (glass) beads were employed as projectiles.[10] These projectiles more closely approximate the stony meteoritic materials in density. Data are essentially nonexistent on the effects of "puffball" or dust impacts.

The one bright spot in all the research conducted to date is general agreement that in crater volume–energy relationships the volume exhibits a linear dependence upon the kinetic energy of the projectile. The exact dependence is not firm but appears to be related to the modulus of elasticity or strength modulus of the target material.

Oblique Impact. Depth of penetration and the shape of the crater produced by a particle impacting on a target can vary with the angle of incidence of the particle as well as with its velocity. As velocity of the

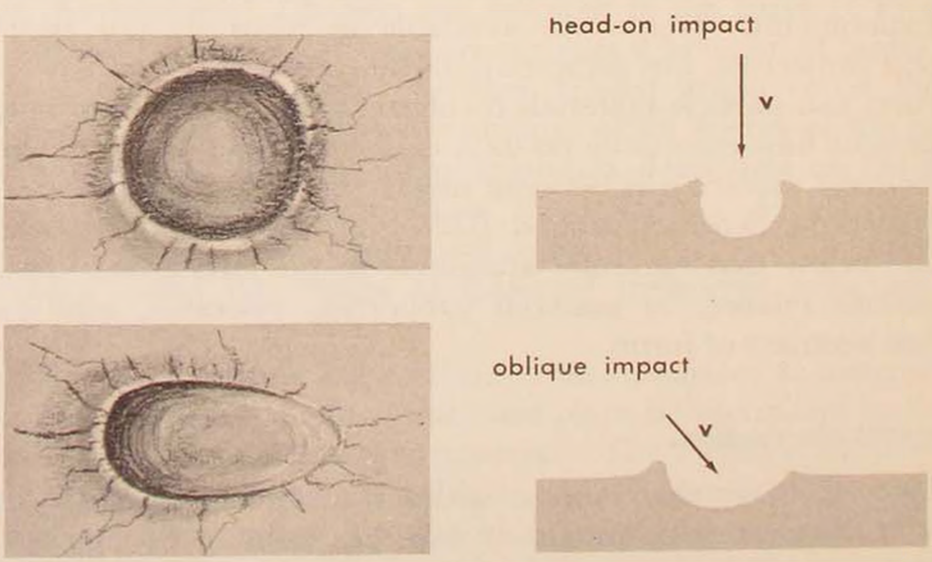


Figure 5. Crater shape. Crater shapes show a rather interesting anomaly of nature in that under oblique impact the high-side lip forms apparently on the wrong side of the crater. The vector **v** *indicates the direction of the impacting particle.*

impacting particle increases, dependence upon the angle of incidence decreases, within small angles, because of the predominance of energy over momentum. The results of Culp's experiments show that eccentricity, or the amount of departure from circular shape, decreases with increasing velocity at fixed angles of incidence.[11] Bryan has attempted to set up a model of oblique impact that can be used as a starting point in describing the phenomena associated with this type of impact.[12] Figure 5 shows the difference between head-on and oblique impact.

Experimental Techniques. In all the research conducted to date on hypervelocity, nearly as many methods for projecting particles have evolved as the number of experiments. Thus far the vast majority of these experiments in projecting particles have used the light gas gun and "shaped" charge techniques or variations thereof. However, these two methods have been unsuccessful in their present stage of development in achieving the required velocities for simulation of meteoroid impact.

Several workers, in a novel approach to the problem of achieving hypervelocities, employ high-energy, fast-discharge capacitor banks that generate large electric currents of microsecond pulses. Scherrer describes a system employing an expendable barrel-type gun.[13] A capacitor bank is discharged through a fine wire located at the breech of the gun. The wire is vaporized and creates high gas pressures behind the projectile, which forces the particle down the barrel at hypervelocities. Scherrer has achieved particle velocity in excess of 30 km/sec when accelerating Mylar projectiles of 11 mg initial weight. However, he has not measured the mass of the projectile just prior to impact, rendering any particle momentum or kinetic energy unknown in these preliminary experiments. Webb *et al.*[14] have been working on a hypervelocity projector of much the same design as Scherrer's except that theirs uses dense agglomerations of materials rather than a single particle to impact on a target. Scully and Cowan generate a high-density, high-temperature gas by capacitor discharge into a partially confined lithium metal cylinder, and the resulting plasma pulls borosilicate spheres down an evacuated tube by aerodynamic drag.

needs for the future

The foregoing sections and the report of Whipple[15] provide a foundation for exploring some of the directions that future work in hypervelocity should take.

Extension and Correlation of Present Work. Probably the most urgent single objective is the extension of presently attainable velocities to those well in excess of 10 km/sec, perhaps to 50 km/sec. Granted, this is no small task, especially with the forces imposed on a particle accelerated to above 10 km/sec in one step; but if the ultimate velocity is achieved in multiple steps, these forces can be minimized by use of a series of shaped charges or a series of capacitor discharges. Velocities must be extended so as to (1) confirm the theory that increases in velocities decrease the importance of the angle of incidence on crater shape, and (2) prove that scaling laws can be used to predict behavior of particle impact. Essentially we must establish that particles with identical kinetic energy but with differing mass and velocity produce identical effects at speeds above the speed of sound when impacting in the target material.

In view of the fact that no research has been reported using projectile materials of densities or sizes comparable to those of micrometeorites, this is one area needing exploration. The program may include impact studies of materials which have a range in bulk density of 0.05 through 8 gm/cc and for which kinetic energy is kept constant, again assuming that scaling laws are valid.

The many differing theories concerning crater formation, depth of penetration, volume of craters, etc., need to be collected, analyzed, and consolidated.

Spallation. At present there are no data concerning the dynamics of spalled material. A problem area may derive from spallation in that dislodged material of high kinetic energy may do further damage to interior components of a vehicle. Experimentation in this area may include measuring variation of the mass and velocity of spalled material as related to the impacting particle, its kinetic energy, the target thickness, and the target material.

Erosion Effects. Although a small amount of research has been conducted on effects of erosion, more work is needed using fine particles at hypervelocities to impact on potential materials for space vehicles.

Satellite-Based Observations. Despite all that may be said in favor of ground-based observations, the fact remains that, to study meteoritics properly, observations must be made of the natural particles in the natural environment, i.e., space observations. Although we may not be ready to make full use of the numerous satellites being placed into orbit at present, they may be invaluable in future meteoritic studies. Potential programs include:

(1) Mass and composition of particles. It is imperative that a determination of mass and composition of meteoric material be made prior to the development of methods to prevent catastrophic puncture of vehicles. This determination would necessitate catching the particle and recovering the entire vehicle—a task of monumental proportions. The alternate approach would be to combine the "catching" substance or artificial atmosphere with an optical spectrometer to analyze the particle's constituents, thus eliminating the need for recovery. If the meteoroid is let interact with an artificial atmosphere to produce a light flash (excitation of both the atmosphere's and meteoroid's atoms), the spectrum of the flash may be observed with an optical spectrometer and the data telemetered back to earth for analysis in the laboratory.

(2) Total velocity vectors. If the velocities of particles, in both direction and magnitude, can be determined, then this information

combined with the mass distribution will assist in yielding data on the total distribution of matter within at least one astronomical unit of the sun. Whipple lists several potential methods that can be used with vehicles for obtaining these velocity vectors.

(3) Charge on space particles. Determination of the electrical charge on solid particles would be useful in studying sun–earth relationships, conditions of the interplanetary gas, and the corpuscular radiation from the sun. Perhaps the temperature of the interplanetary gas could also be derived from measurements of electrical charge on space particles.

IN THE STUDY of hypervelocity and meteoritics we have just scratched the surface. There remains a tremendous amount of research to be completed, research that is urgently needed for the proper design of both space vehicles and space experiments. The work yet to be accomplished may also yield answers to questions about motion patterns of particles in space.

Aeronautical Systems Division, AFSC

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Officer Career Development

Captain William E. Simons

"WHAT KIND of assignments should I shoot for?" "Should I go into pilot training?" "Should I specialize in engineering?" "Would I be better off as a specialist or as a generalist?"

These are typical of the questions which Air Force Academy instructors frequently receive from cadets. Young men who are vitally interested in getting started on a rewarding officer career are concerned about the direction that career should take. Unfortunately the experienced officer has little basis for a confident reply. He too is perplexed concerning the kinds of experience and preparation which promise a progressively challenging future. And why shouldn't he be? In his years of service with the Air Force he has seen little evidence of systematic career development or guided professional growth.

Despite numerous, well-publicized statements about "career management," we see about us officers who have been reassigned in the same technical specialty for three or four successive tours. We see other officers whose combat experience provided background invaluable for command and staff competence but who hold routine flying jobs in the same general type of aircraft for continuous periods in excess of five or six years. We see others of field grade who carry the specialty designation of "X" Staff Officer but who perform the same kind of duties in the same occupational field that they had previously performed in the company grades. Too many line officers, from whom must eventually be chosen commanders with responsibility for varied and broadly ranging programs, are expending the formative years of their careers as narrow specialists. Where is this so-called career management? What evidence is there of effective career development?

Obviously the Air Force has here a serious problem. It is a problem complicated by the continuing demands for greater specialization of function that result from rapid advances in weapon technology. However, it is not a new problem; our sister services are dealing with it today, and our military ancestors dealt with it continually in the past.

Ever since the development of the state system in sixteenth and seventeenth century Europe, when the military profession first took form, various kinds of military career specialization have continued to emerge.

Creation of a special corps of artillery and engineering officers, occasioned by rapid advances in cannon technology and fortress construction, was the first major instance of such specialization. Similar developments have taken place among military forces ashore and afloat right up until the present day. The process has been essentially the same in each case: weapon developments and organizational growth have made specialization necessary because the whole profession became too complex for one officer to master. For this reason the artillery and engineer corps eventually split into separate organizations, and naval officers came to elect either deck or engineering career patterns. The same process was again at work when careers were established in military and naval aviation.

It is important to note that in each instance cited the requirement for specialization was met by affixing a new technical or combat corps to an existing administrative structure. Thus by the time the Navy created its Engineering Corps in 1842 it already had a rudimentary organization to look after such functions as the provisioning, construction, and repair of its vessels. Similarly when the Army Air Corps was created in 1926 the Army already had specialized forces to provide the necessary logistical, communications, and administrative support.

the Air Force problem

Herein lies the key to much of the Air Force officer career problem. When it gained independent status in 1947, the U.S. Air Force made a dramatic shift from a specialized combat corps with small, highly technical support units to a complete, all-encompassing military organization with responsibility to perform its own logistical and administrative functions. Further complicating its situation was the decision not to create specialized corps within the Air Force—a decision conditioned by years as a specialized "second-class citizen" in the Army's administrative structure. As a result personnel with little appropriate training assumed a multiplicity of noncombat functions in an organization which gave lip service to the postulate that any line officer, regardless of occupational specialty, theoretically could become Chief of Staff.

Fortunately the thinking officer has never been naive enough to believe such an absurd premise, but his realization of the absurdity has only served to confuse him in view of the lack of programed practical career alternatives. Adding to his confusion have been our outdated promotion policies, which continue to advance many of those officers least well-equipped to handle the specialized responsibilities of a modern military force. Looking about him, in the midst of brand-new weapon systems, complex training requirements, and specialized logistics demands, the officer sees all but a trickle of the promotions going to those whose primary qualification is time spent in commissioned status. Even the criteria for "below the zone" selections are somewhat vague. True, education has been given emphasis; but the kind of education desired and the purpose for which it is intended have not been made clear. To what guidelines can a career-minded Air Force officer turn? From what recognized standards can an ambitious professional take his cue?

To eliminate this confusion concerning the officer career, we need recognized patterns of career development which reflect those areas of Air Force activity requiring special competence and which at the same time provide adequate opportunity for the increasing leadership responsibility characteristic of the officer role. These patterns must uphold the highest standards of the military profession by recognizing and rewarding those traditional officer skills that are still essential while encouraging the development of new skills now equally important. At the same time the career patterns must distinguish between those areas of competence that appropriately qualify individuals for various levels of *officer* rank and those areas which more appropriately equip individuals as technical or professional specialists. Finally, through clearly stated assignment and promotion policies, it should be made explicit just how the Air Force defines the term "officer" and what kinds of experience it regards as ideal for its various officer careers.

Thus far only token progress has been made in these directions.* The present personnel system gives adequate attention to the requirement for specialized competence, but it has done little toward ensuring continuous opportunity for increasingly broad leadership responsibility. Its basic planning document, "Officer Career Management Structure," originally enumerated nine career areas for line officers and three for professional specialists. In practice, primary emphasis has been placed on the 38 specialized line officer utilization fields, each of which is given a separate identity right through the rank of colonel. While appropriate for professional or technical specialists, this narrow channeling neglects the traditional role of the line officer. The covering regulation, Air Force Regulation 36-23, discusses the importance of an officer's gaining increased managerial responsibility and urges commanders to heed "maximum desirable utilization limits," designed to permit progressive broadening of experience; but its stress on "progressive assignments patterned on the awarded Air Force specialty in which best qualified" has set the predominant tone for personnel actions. The major emphasis of the present system is on specialization, and it is typified by recent changes to the Officer Career Management Structure which have created two new line officer career areas—Scientific (separated from Engineering) and Information—from what were originally only utilization fields. Similar changes have created five new utilization fields from former temporary specialty codes: International Politico-Military Affairs; Manpower Management; Safety; Scientist, Special; and Engineering, Special. The latter two have absorbed many specialties, including the old Research Psychology field.

This emphasis on narrow career specialization reflects the desires

*Most career development projects consist of such self-development aids as a "Career Fact Book," "Career Progression Guide," "Career Management Chart," and career counseling. No effective controls over officer career patterns have been instituted.

of technical staff agencies concerned with the perfectability of only one area of Air Force activity; and their evident self-interest is understandable. After all, what officer would not like to work continuously in the activity in which he is most comfortable—whether it be flying, public information, or laboratory research—and theoretically be able to reach the rank of colonel? What is not understandable is the willingness of higher command to permit this particularism and fragmentation within the *line* officer resource.

In its preoccupation with the artificial principles of equality among career areas and the prevention of specialized corps, the Air Force has allowed its line officer force to become a heterogeneous collection of specialized individuals whose military rank is no longer necessarily indicative of general command or staff qualification. Typical of this overlooking of the general competencies and experiences which constitute proper officer orientation is one of the recommendations emanating from a Headquarters USAF Personnel Conference, held on 13–14 June 1961, stating that "all possible efforts should be expended to raise the prestige of scientists and engineering officers in the Air Force." This conference, to which representatives of several major commands were called to plan improvements in the officer career management program, omitted an essential consideration from its final report: Should scientists and engineering officers obtain added prestige as line officers through normal promotion channels, or as vitally needed technical specialists through some other means of recognition? This is the real issue, as it is an issue with every other specialized officer category claiming particular importance and treatment.

Another matter of great importance to a really effective system of officer career development, namely centralized assignment procedures, has also been hampered by particularism. In this instance the particularism has been associated with major command interests. Attempts at establishing the automatic data system so necessary to the processing of vital assignment information at Headquarters USAF have been stymied by individual commands, some of which have already invested heavily in their own mission-oriented and somewhat incompatible systems. Although the centralization of assignments at major command level was originally ordered by Headquarters USAF as a first step in an eventually complete centralizing process, major commands have taken the position that this is as far as centralization can feasibly be carried.[1] As of this writing, it remains to be seen which of these two positions will effectively dominate officer assignment practices.

These, then, are characteristic features of the Air Force's career development morass. Let us now examine some considerations that may provide a way out.

role of the line officer

The officer profession has developed as one in which members of a military service prepare themselves continually to direct the employment of military force in ever widening spheres of impact. For the higher levels of command, toward which every capable line officer theoretically is progressing, the pattern of preparation must be that of a generalist. In preparing himself to command a battle group, an Army officer must first acquire the skills necessary to lead a basic combat unit in his own arm and then develop the ability to command larger units of that arm. Finally, either through rotational assignments or study, he must come to understand the employment problems of the other combat arms and support activities that comprise the battle group structure. Similar progressive career development, through different specialized engineering and deck divisions, shipboard command assignments, and fleet staff billets, is required before a naval officer can take command of a major fleet division. In other words the professional officer must gain experience at all the major activity *levels* embraced by the large-scale organization he will one day direct. He must also acquire either experience or knowledge pertaining to the various *kinds* of activities which contribute to that organization.

In the Army and Navy examples cited, two facts are crucial: (1) the careers described have been general line careers as distinguished from specialized staff careers, and (2) at each level and area of assignment the functional responsibilities have been those primarily of administration and organizational leadership as distinguished from those of a technical operative nature. The parallel existence of these constants is not accidental, for historically the primary functional role of the line officer has been executive leadership—the direction of organizations composed of many people performing specialized tasks. The fact that line officer responsibilities have usually been related to combat activities is important in characterizing these responsibilities as military, but it is not paramount in distinguishing them as strictly officer functions. The crucial consideration is that at all levels these responsibilities (as differentiated from those of the noncom or the technician) involve coordinating, planning, and directing the activities of others.

the line career in the Air Force

I have used examples from the Army and Navy deliberately, because in these services the essentials of officer career development have not been allowed to become obscured. In the Air Force, thinking in this regard has been confused by rated and nonrated distinctions. However, any similarity between the Air Force's rated officer and the Army's combat-arms officer vis-à-vis line officer qualification is more apparent than real. The ever increasing complexity of aircraft and their equipment has turned the pilot and navigator into technical specialists—highly trained equipment operators. Even the term "aircraft commander" as applied to bomber crews lost much of its original significance when the size of these crews was reduced from ten or twelve to as few as three individuals.

Not that these skills are unessential officer skills; they *are* essential for *some* line officer responsibilities. The important fact is that by themselves they make only limited contribution to the more significant aspects of the line officer career. They do not provide the general administrative ability which needs to be developed for positions of high-level executive responsibility. As Professor Janowitz has pointed out in his penetrating analysis of careers in all military services, "This process of transition of roles from tactical to large-scale operations is perhaps most difficult in the Air Force." And again, ". . . the Air Force, with its great technological base, lagged behind in the development of managerial generalists who had been exposed to multiple roles and skills."[2]

Since criticism without suggestions for improvement is irresponsible, let us continue with the example of the rated officer in order to clarify what I consider to be the proper concept of a line officer career for the Air Force. Officers who have performed only as aircrew members have not yet become, strictly speaking, line officers. The same can be said of officers who have served only as researchers, as intelligence analysts, or as design engineers. Line officer qualification commences when the officer takes on administrative responsibility and begins to develop leadership and executive skills. Hence a pilot *could* develop as a line officer if he gained experience in such positions as operations officer or squadron commander or in executive positions associated with other fields. Similarly the researcher, intelligence analyst, or design engineer would need to add appropriate administrative experience to his technical competency. These statements in no way imply that there is no need for the technician in our modern Air Force; on the contrary the need is great. What I assert is that specialized technicians are not line officers and that they should not be regarded or rewarded as such.

Career patterns that are appropriate for line officers must necessarily provide ever increasing managerial experience in those activities which contribute directly to the effective employment of Air Force weapon systems. This kind of experience will provide the background and conditioning necessary for acceptance of high-level command and staff responsibility. From the present range of specialized officer activities it is possible to identify five broad field groupings within which such experience can be provided; each field embraces certain current line specialties. Other more concentrated fields of activity are not appropriate for line officer development and are more properly designated as technical or professional specialties. See Tables 1 and 2.

Each of the five fields suggested in Table 1 is broad enough to provide a range of officer experience extending from direction of highly specialized, technical functions to general management of diversified, multiple-activity organizations. Each provides ample opportunities for high-level command and staff assignments in activities

Table 1

Suggested Career Fields for Line Officers

Field I: Scientific and Technological Development Career	
nuclear research	research & development management
mathematics	special research & development
physics	aero engineering
chemistry	electronic engineering
metallurgy	mechanical engineering
Field II: Materiel Resource Management Career	
supply	transportation
procurement	motor vehicle maintenance
production	
Field III: Personnel Resource Management Career	
personnel	administration
manpower	technical training
Field IV: Current Weapons Operation Career	
pilot	communications–electronics
navigator–observer	armament
guided missile	maintenance engineering
weapons direction	aircrew training
aircraft control	
Field V: National Policy Development Career	
intelligence	international affairs
targets	professional education

Table 2

Technical and Professional Specialties for non-Line Officers

Technical Specialties	
weather	photography
civil engineering	special investigations
cartography	air police
comptroller	information
Professional Specialties	
medical	veterinary
dental	legal
chaplain	research psychology

uniquely a part of the military profession. Yet each field demands areas of competence and theoretical knowledge that are unique to itself and that require continuous attention if they are to be mastered. In short, each of these fields offers opportunity for a full career suitable for the Air Force line officer.

career specialization in the Air Force

The forces which brought about the emergence of military aviation as a specialized career—namely, rapid advances in the technology of weapons and equipment and an expanding role for airborne weapons in national defense—have created a need for career specialization within military aviation itself. The fact that an independent, unified Air Force organization has been created administratively has not diminished the effects which increasingly complex operations have had upon Air Force officer capability. Today's officer, and presumably the individual officer of tomorrow, will have little more innate capacity to master a range of competencies and professional knowledge than his predecessors. Individual human capacity, although never yet completely tapped, is nevertheless limited. Therefore, as vital competencies have become more numerous and available knowledge more comprehensive, the proportion that can be mastered by one individual has decreased significantly. The workings of these phenomena have been demonstrated repeatedly in the military profession, in other professions, and in industry. The Air Force is no exception.

Recognition of the need for career specialization in the Air Force provides an effective start toward developing career patterns appropriate for line officers. Indeed this fact was brought to light ten years ago by the special Secretary's Committee on Personnel Utilization and Training, known as the Thompson Committee:

> There are certain outstanding benefits [from professional career specialization] which should not be ignored. . . . Only by a planned development through major specialization can required executive talent be developed. No American business enterprise is as large and complex as the Air Force; yet every well-managed business has come to rely upon greater career specialization than exists in the Air Force.[3]

Since that report was rendered, a greater degree of specialization has been introduced into the officer corps; but it has been *occupational* rather than *professional career* specialization. The main point of the Thompson Committee's recommendation has been missed, and systematic preparation for high-level *professional* responsibility has not been provided. Instead of integrated assignment patterns designed to develop administrative abilities, our present system of Air Force Specialty Code (AFSC) designations has encouraged overemphasis on technical skills and functional sameness. *In practice, officer classifi-*

cation and assignment policies have not recognized that the purpose of officer career specialization is to make possible the development of competent executives.

THE CONFUSION emanating from this situation can be relieved by the following courses of action:

• Establish recognized line careers in each of the five fields listed in Table 1, each leading to appropriate commander and director qualifications as shown in Table 3.

Table 3

Career Field	*Commander & Director Specialty*
Scientific & Technological Development	Organization Commander Planning & Programing Officer Research & Development Director
Materiel Resource Management	Organization Commander Planning & Programing Officer Director of Materiel
Personnel Resource Management	Organization Commander Planning & Programing Officer Director of Personnel
Current Weapons Operation	Organization Commander Planning & Programing Officer Director of Operations
National Policy Development	Planning & Programing Officer International Political-Military Affairs Officer

• Develop typical assignment patterns for each of these careers which integrate the kind of duty experiences and educational programs appropriate to produce high-level executives for the career field concerned.

• As an aid to top-executive qualification, provide for occasional assignments in other career fields which utilize the officer's specific competencies. For example, an officer experienced in missile maintenance would contribute markedly to related technical training organizations. Similarly officers experienced in aerospace weapon development would frequently be needed for technical intelligence assignments.

• Develop promotion policies which recognize the key distinctions between line officer capacities and those of the technical and professional specialists (see Table 2). Corresponding incentive pay policies should be developed to ensure an adequate resource in the specialist ranks.

Establishing a line officer career in each of the fields listed in Table 1 would put into practice the essential concept that career specialization should exist for the purpose of developing better executives. By development of controlled assignment patterns within each field it is possible to guide officers into the kinds of activity and levels of responsibility that will permit efficient utilization of specialized education and skills, provide leadership experience appropriate for line officers, and produce executives with experience sufficiently broad to have developed the competencies necessary for managing large, complex organizations. Those officers who demonstrate appropriate potential can obtain preparation for positions requiring knowledge of more than one field through periodic short assignments outside their primary field of career specialization. Such experiences would be invaluable in developing the insights and integrative skills vital to high-level command and staff functions.

With controlled assignment patterns for each of the five line officer career fields it will be possible to develop promotion policies which recognize officer progress toward clearly defined career development objectives. In this manner promotion to particular ranks can be based more nearly on demonstrated ability to perform essential officer functions at specified levels of responsibility. Only in this manner can a continuous resource of line officers fully qualified for high-level responsibility be systematically produced.

That there is a serious gap in present career programing is evidenced by the recent Pentagon concern over officer retention. In 1961 a comprehensive study of the full range of personnel practices was made under Project Top Star. The responses to Top Star have shown repeatedly that the lack of recognized career development opportunities has been a constant source of frustration and disillusionment among Air Force officers. Adoption of a program similar to the one proposed here would go a long way toward providing the sense of direction now lacking among many career-minded officers.

United States Air Force Academy

Notes

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Military Opinion Abroad...

RED STAR ON DOCTRINE

Dr. Kenneth R. Whiting

RESPONDING to the plea of a junior officer for enlightenment, the official Soviet Army newspaper *Red Star* recently gave space for an article on military doctrine signed by a senior officer in reply.* Whether the author accurately represents the thinking of the top echelon of Soviet leaders is certainly open to question, but what he sets forth is the official doctrine for the overwhelming mass of officers and soldiers in the Soviet armed forces.

In the first section, which describes prewar Soviet military doctrine, the damnation of Stalin as a military genius is complete. The second section allegedly sums up the basic points of today's Soviet military doctrine. The third section is devoted to a lurid description of what the Soviet leaders would have their soldiers believe is Western military doctrine. There is little in the article that is new, but it does rather succinctly, for a Soviet article, summarize the official line on this subject. A translation follows.

CONCERNING SOVIET MILITARY DOCTRINE

Dear Editor: In studying the materials of the 22nd Congress of Communist Party of the Soviet Union and the problems of military organization elaborated in them, our officers are displaying great interest in the substance of Soviet military doctrine and its relationship to Soviet military science.

I am asking you to explain this question, explaining in detail the Soviet prewar and postwar military doctrine and the problems that arise from it. If possible, say a few words about the basic features of the military doctrine of the imperialist countries.

Lieutenant A. Turtanov

*Colonel I. Sidel'nikov, "O Sovetskoy Voennoy Doktrine" (Concerning Soviet Military Doctrine), *Krasnaya Zvezda*, 11 May 1962, pp. 2-3. *Krasnaya Zvezda* is a daily published for the Army by the Ministry of Defense.

I.

Military science and military doctrine are closely connected, mutually related. But military doctrine and military science are not one and the same thing. Soviet military science is a unified *system of knowledge* about the training for and conducting of armed conflict in the defense of the socialist Fatherland against imperialist aggression. Being based on the theory of Marxism-Leninism, on the Marxist-Leninist teaching about war and the army, it examines and explains the laws of armed conflict, the significance of economic, moral-political, scientific-technological, military, and other factors in the course and outcome of war. It studies armament and technology, works out the most effective means and methods of armed conflict, the basis of the organization of the army and the navy, the training and education of the personnel of the Armed Forces. It also examines and evaluates the economic, moral-political, and military potentialities of the imperialist aggressors.

Soviet military doctrine comprises the unified principles adopted by the Soviet government which guide its views regarding the character and aim of a possible war, the fundamental problems of readying the country and the whole people for repulsing an imperialist aggression, the fundamental problems of the organization and strengthening of the military power of the Armed Forces of the U.S.S.R. and their utilization in a war. Soviet military doctrine is based, of course, on the conclusions of Soviet military science and is, as it were, a synthesis, a generalization of its military-scientific achievements and its military-scientific knowledge. But this does not mean that military doctrine is passive in relation to military science. Finally, the tenets of Soviet military doctrine formulated and established by the leaders are the guide for the further development of Soviet military science.

The working out of the deeply scientific Soviet military doctrine was begun as early as the years of the Civil War and the foreign military intervention. Already in 1918 the journal *Military Affairs* began to publish discussion articles about a unified military doctrine. In 1920 the discussion of this problem flared up with new force. The teachers and students of the Academy of the General Staff actively participated in it.

In 1921 in the first number of the journal *Military Science and the Revolution* there was published the great article of one of the outstanding Soviet military leaders, M. V. Frunze. It aroused great interest among all the commanders and political workers and was hotly discussed in general meetings of command and political personnel as well as in the pages of the military press. A special meeting of the military delegates to the 11th Party Congress was devoted to a discussion of the unified military doctrine.

Soviet military doctrine was worked out on the solid theoretical basis of Marxism-Leninism and its teaching about war and the army and on the basis of the military policy of our Party and the instructions of its TsK [Central Committee], taking into consideration the rich experience of the Civil War. The basic ideas of V. I. Lenin about the defense of the socialist Fatherland had decisive importance for the working out of Soviet military doctrine.

As is known, Stalin denied the leading role of Lenin in the development of military theory and in the formulation of the Soviet military doctrine. In answering a letter of the military historian Professor Razin, Stalin held the professor's statement of a question about Clausewitz as incorrect because "with such a statement of the question it is possible to think that Lenin analyzed the military doctrine and military works of Clausewitz, made a military evaluation of them, and established for us as a legacy a number of guiding principles on military questions which we must accept as guidance. . . ."

These arguments were needed by Stalin to cancel out the military legacy of Lenin, to disparage the leading role of Vladimir Il'ich in the organization and strengthening of our army.

In this article there is no opportunity to examine the military works of Lenin, to analyze his military legacy. But it must be said that Lenin vigorously investigated the military doctrine of Clausewitz just as he studied and critically interpreted many other works on military problems.

Soviet military doctrine, which became the guide for the organization of the Soviet army and navy in the years preceding the Second World War, was worked out on the basis of the Leninist concepts about the character of wars in the epoch of imperialism and proletarian revolutions, about the role of social-economic, moral-political, and military factors in the course and outcome of wars, and about the laws of armed conflict, taking into account the conclusions arrived at in Soviet military science.

The most important principles which constituted prewar Soviet military doctrine were as follows. If the imperialists unleash a war against the U.S.S.R., it will be a war to the death with decisive objectives and a protracted character. War will put high demands on the rear, will make necessary the reconstruction of the whole economy, the whole political and spiritual life of the state, in harmony with military demands. War will be waged by massive armies and all types of troops, with the wide utilization of all kinds of combat technology and weapons, and will be distinguished by its wide scope, by the mobility and maneuverability of troops. The chief type of military activity will be the offensive—only the decisive, skillfully organized offensive actions of well-trained, technically equipped armed forces, having a personnel high in moral-combat qualities, will guarantee a complete victory over the imperialist aggressors. Military actions will assume the character of operations and battles in depth in which tanks, mechanized forces, and aviation will play a large role.

These basic principles of Soviet military doctrine, subjected to severe tests in the Great Fatherland War, were correct. But on the eve of the war not everything had been done to make sure that the combat level of the Armed Forces, their organization and mobility, fully complied with the demands of the doctrine, the demands of modern warfare. At the beginning of the attack by fascist Germany on the U.S.S.R. we had not attained a sufficiently high degree of technical equipment in all branches of the service. Not long before the beginning of the war, the armored corps were mistakenly disbanded. In the *early* period of the war there was almost a complete absence of well-worked-out general principles and concepts about the waging of military actions. Proper attention had not been given to this question in the course of operational and tactical training of the troops.

The cult of the personality of Stalin resulted in enormous damage to the defensive capability and combat readiness of the army and navy. In personally making decisions on the most important governmental and military questions, Stalin committed the gravest errors in evaluating the situation on the eve of the Fatherland War. He rejected the almost incontestable evidence of the preparation of fascist Germany for an assault on the U.S.S.R. and rejected the demands of the commanding circles for the necessity of putting the Armed Forces in an accelerated combat readiness. All this placed our country and army in an exceptionally difficult position at the beginning of the war.

Under the guidance of the Communist Party and its Leninist Central Committee, the Soviet people and their Armed Forces not only held out against the mad onslaught of the fascist hordes but even completely shattered them and gained a universal-historic victory in the war.

The lessons of the war were: For a victorious defense of the socialist Fatherland it is not enough to have a correct, scientifically worked-out military doctrine. It is necessary to make skillful and complete use of all available economic, scientific-technological, and moral potentialities so that the defensive capabilities of the country, the combat might and combat readiness of the Armed Forces, comply fully with the requirements of the war, so that these requirements underlie Soviet military doctrine, underlie all practical work in the training and educating of the troops.

II.

The period immediately after the Second World War saw a real revolution in military matters. As was pointed out at the 22nd Congress of the CPSU, we completely re-equipped the army in accord with rocket-nuclear technology.

On the basis of a deep, scientific analysis of all the new phenomena in the development of military matters and a complete stock-taking of the peculiarities and potentialities of the new weapons and combat technology, new principles continued to be worked out about the character of a possible war, about the problems and objectives of military organization in our country, and about the preparation of the whole people and the army for a victorious defense of the socialist Fatherland. Comrade N. S. Khrushchev's report to the 4th session of the Supreme Soviet of the U.S.S.R. in 1960 had an enormous theoretical and practical importance for the working out of the concepts that make up the modern Soviet military doctrine. The analysis of the character of modern warfare made in this report laid the basis for the present Soviet military doctrine. In the materials of the 22nd Congress our military doctrine received further development and substantiation. It is possible to designate its concepts as follows:

First, if the imperialist aggressors succeed in unleashing a world war, it will inevitably take the character of a rocket-nuclear war. This means that the chief instruments of attack in such a war will be nuclear weapons and that the basic method of putting them on target will be rockets.

In consideration of this, the Communist Party and the Soviet government have been untiring in their efforts to equip the Armed Forces of the U.S.S.R. with the very latest weapons. The rocket-nuclear weapons are the basis of the combat strength of all branches of the service of the Armed Forces of the U.S.S.R. By a decree of the Central Committee of the CPSU and the government we have a new branch of the Armed Forces, the Rocket Troops of Strategic Designation.

Second, the use of nuclear weapons with unlimited capability in getting to any target in a matter of minutes with the help of rockets makes it possible to gain decisive military results in a very short time at any distance and over an enormous area. Not only troop formations and air and rocket bases but also industrial and population centers, in which the production and storage of nuclear weapons and communications centers are concentrated, will be targets for shattering blows.

Our country occupies a large area. It is less vulnerable than capitalist countries. But this has not at all diminished our great attention to antiaircraft defense. This problem is always the center of attention for our Party and government. Now the antiaircraft defense of the U.S.S.R. is based on the might of the antiaircraft rocket troops. We have successfully resolved the problem of destroying enemy rockets in flight.

Third, the decisive role of rocket-nuclear weapons in war has not belittled the importance of other types of weapons. The final and decisive victory over the imperialist aggressors can be attained only as a result of the combined, well-coordinated, and determined actions of all branches of the Armed Forces and all types of troops. The rocket-nuclear war will be waged by massive, multimillion-men armies.

In the last few years we have carried out a tremendous effort directed at perfecting all branches of the service of the Armed Forces and all types of troops. "The Soviet government," it is stated in the Program of the CPSU, "will see to it that its Armed Forces are powerful, have at their disposal the very latest means for the defense of the Motherland—atom and nuclear weapons, rockets of all ranges, and supported by up-to-date military technology and weapons of all types."

Fourth, the very first massive nuclear strikes are capable to a large degree of determining the entire consequent course of the war and of inflicting great losses on the rear and on the troops. Therefore the matter of the first period of the war has exceptionally great importance. *Soviet military doctrine holds that the chief, most important, and the very first priority task is to be in constant readiness for a reliable repulse of a surprise attack by the enemy and the frustration of his aggressive plans.*

And still one more concept. If the imperialists unleash a world rocket-nuclear war, then this will be war between two coalitions, two world social systems—between imperialism and socialism. Both sides will be pursuing very decisive political and military objectives. The achievement of these objectives will entail the use of the full, all-embracing mobilization and utilization of economic, moral, scientific-technological, and military potentialities of the governments.

In this respect the socialist camp possesses an enormous superiority over the camp of imperialism. Historical experience has demonstrated that the socialist social structure permits mobilization in the best way and the utilization of all available potentialities and resources for the complete destruction of any aggressor.

The Communist Party is taking all this into account and is paying unremitting attention to the strengthening of the economic might of the country and to building up the technological base in every way. In the Program of the CPSU it is stated that one of the main tasks of heavy industry consists in guaranteeing completely the defense needs of the country. In resolving the great tasks for the development of the structure of Communism, in creating the material-technological basis of the Communist society, the Soviet people are creating the material basis of the indestructible defense capability of the U.S.S.R.

In carrying out the function of building up the defense of the U.S.S.R. and the combat strength of the Armed Forces, our socialist government is guided by the concepts of Soviet military doctrine. These concepts are directly related to the political activities of the military personnel.

Indeed, if the chief instruments of warfare are to be rocket-nuclear weapons, then in both the theory of military art and in operational-tactical training we must educate the troops above all in the use of these weapons. This means that each officer, sergeant-major, sergeant, soldier, and sailor must learn to function, to carry out his responsibilities and combat orders as required under the conditions of rocket-nuclear war.

If, in spite of the decisive role of rocket-nuclear weapons, victory over the aggressors can be attained only as a result of the combined activities of all branches of the service of the Armed Forces and all types of troops, then this means that it will be necessary henceforth to improve not only the new but also the old, so to speak, types of troops of the Armed Forces. The soldiers, sailors, sergeants, sergeants-major, and officers must learn to master perfectly the weapons they now have, to be masters of their military specialties, and to be able to win a victory over the enemy by means of their general, coordinated efforts.

If the significance of the first period of the war has increased greatly, if the most important and outstanding task of the soldiers is the job of being in constant combat readiness to repulse a surprise attack of the enemy, then in the process of combat and operational training the soldiers must henceforth assiduously study and master the means of reliably warding off a surprise nuclear attack by the aggressor as well as the capability of frustrating his aggressive intentions by a simultaneous devastating strike against him. All military service people without exception must show the greatest vigilance, maintain a model organization, be ready at any minute to engage in combat and to operate skillfully, resolutely, and with the full intensity of their moral and physical strength.

If the rocket-nuclear war is to be characterized by its exceptional ferocity, by the resoluteness of the combatants in the achievement of their objectives, then in such a war the role of man, the role of the moral-combat qualities of the military personnel, and the importance of military discipline and organization will be increased as never before. From this arises the job of raising to the highest possible level all the Party-political work—the ideological work—among the soldiers, the perfecting of their moral-combat qualities, and the strengthening of military discipline. "However absolute and mighty the military technology," said Comrade N. S. Khrushchev, "it can fulfill its purpose only if it is in the reliable and skillful hands of soldiers who are ideologically hardened, courageous, and selflessly devoted to their Motherland."

If victory in war is to be attained by the combined forces of the peoples and armies of all the socialist countries, then we must continue with even greater persistence to strengthen combat coordination among the armies of all the countries of the camp of socialism and to foster in the soldiers a spirit of absolute faith in this international task.

Our military cadres approach the concepts of Soviet military doctrine from just such a position. Being guided by its principles, they convert into reality the demands of the Program of the Party that our Armed Forces be an efficient and coordinated organism, have a high degree of organization and discipline, fulfill in a model way the tasks put before them by the Party, government, and people, and be prepared at any moment to deliver a shattering rebuff to the imperialist aggressors.

III.

The Communist Party and the Soviet government are exerting every effort to stave off a rocket-nuclear world war, to abolish war, to maintain eternal peace on earth—this is the historic mission of Communism. In the name of the realization of this mission, for the prevention of the mass annihilation of the people in the fire of a nuclear war, the Soviet Union proposed a minutely worked-out plan for universal and complete disarmament. The imperialist governments under various pretexts refuse to accept this plan. And what is more, the imperialist circles of the U.S.A. are continuing the arms race, are building up their stockpiles, are carrying out new tests of nuclear weapons, and are openly threatening war on the Soviet Union and the other socialist countries.

This arch-reactionary and antihuman aim serves as the military doctrine of the imperialist governments. The military theorists of imperialism do not conceal the fact that a future war will be a rocket-nuclear war with definite objectives. They stoutly maintain that it will not be limited to the seizure of someone else's territory and that the main objective of the imperialist governments participating in it will be the destruction of the world socialist system, the rehabilitation of the world system of capitalism, and the strengthening of the world rule of the U.S.A. In accordance with the military doctrine of the U.S.A., the main strategic aims in a war are the destruction of the military-economic potential of the enemy, his human and material resources.

One of the basic features of the contemporary military doctrine of the principal imperialist governments is a gamble on the further buildup of the rocket-nuclear might of the armed forces and the development of conventional weapons. The imperialist military clique is trying to liquidate one-sidedness in the development of the armed forces of imperialism and to prepare them for diverse methods and ways of waging war. With the help of conventional weapons, nonnuclear weapons, the imperialists of the U.S.A. count on waging broad and effective interventionist wars of a "local" character. With just such an intention the Pentagon is creating special forces, called "partisan" and "counterpartisan" in the U.S.A. The purpose of these forces is to export counterrevolution into countries which have freed themselves from imperialism and colonialism or are fighting for their national liberation.

It is important to note that the military doctrine of the imperialist states is being worked out mainly within the framework of the military-aggressive blocs, the leading one of which is the North Atlantic Alliance. A good deal of effort is being devoted to the elaboration of a so-called "unified military doctrine." The Pentagon military clique is showing especial zeal in this. With the help of a "unified military doctrine," the imperialists of the U.S.A. aspire in even greater degree to subordinate to their aggressive aims the economic and military potentialities of their partners in the blocs and to preserve the leading role of America in these blocs. Furthermore the imperialists of the U.S.A., in unleashing a war, want to put under the return rocket-nuclear attack those states whose territories are serving as platforms for the attack on the U.S.S.R. and other socialist countries.

In working out their military doctrine, the imperialists are trying by every means to conceal from the people its aggressive content, to mask the predatory aims of the advocates of a new world war. At one time the aggressive doctrine of the U.S.A. was concealed by the so-called principle of "nuclear restraint," "massive retaliation." But when it became evident that the U.S.S.R. had surpassed the U.S.A. in the development of rocket-nuclear weapons, then the imperialist military clique junked the doctrine of "massive retaliation."

This, of course, did not mean a repudiation by the imperialist aggressors of their extravagant plans for the destruction of the U.S.S.R. and all the other countries in the camp of socialism. The theory of "preventive war," which is one of the basic features of the military doctrine of imperialism, is now serving for the implementation of those plans. Preparation for such a war is a definite component of the so-called "grand strategy" proposed by the ruling circles of the U.S.A. In the past imperialist plunderers have subdued whole countries and peoples under the cloak of "preventive war." The Hitlerite aggressors extolled the theory of preventive war and put it into practice. It is now being extolled by the militarist clique in the U.S.A.

The advocates of preventive war, with the help of coarse slander, are trying to "show" the existence of a threat to the Western countries on the part of the Soviet Union and the other socialist countries. Day and night they jabber about the alleged aggressive intentions of the U.S.S.R., about how it wants to impose the Communist way of life on the people of America, England, France, and other capitalist countries by force. Hence the conclusion about the necessity, and even the "legality," of a preventive war against the Soviet Union, of a surprise attack on it. *This surprise attack,* *this surprise rocket-nuclear strike, constitutes the heart of the military doctrine of the imperialist aggressors.*

Thus, for example, the American General Power in one of his speeches said: "I would like to put to one side for the time being the question of the role of the means of deterrence and to speak about the philosophy of the unleashing of war and about the enormous advantage which will accrue to the one who begins the war." In explaining the essence of his man-murdering "philosophy," Power concluded: "We must always be in position to inflict the first strike. . . ."

The military theorist of the U.S.A., Bernard Brodie, in his book *Strategy in the Missile Age,* devoted a good deal of attention to the question of preventive war. Brodie portrays the U.S.A. as a country that is allegedly "forced to defend itself" from the Soviet Union, and he openly writes: "Without exaggeration, it may be said that our plan of strategic attack, whatever it may be, will have better chances of success if we deliver the first strike. . . ."

The doctrine of the first strike, advocated by the frantic military clique of the U.S.A., is receiving the ardent support of President Kennedy. Not long ago he stated that the U.S.A. "will show initiative in the nuclear conflict with the Soviet Union." In other words the American president, before the whole world, blessed the adventurous theory of preventive rocket-nuclear war, gave it an official character.

In the capitalist world can be found maniacs who are attempting to put into practice the plundering doctrine of preventive war. This demands from the Armed Forces of the U.S.S.R. the greatest vigilance and a high, reliable combat readiness. The Soviet army and navy have available the very latest means of defense of the Motherland, the very latest in combat technology and weapons. The sacred duty of the Soviet soldiers is to perfectly master this technology and these weapon systems, to be at any moment ready to devote all their strength, and if need be their lives, in the defense of the Land of the Soviets which is building Communism.

Research Studies Institute

The Quarterly Review Contributors

Lieutenant General Robert M. Lee (USMA) is Commander, Air Defense Command. Commissioned in the Cavalry in 1931, he graduated from flying school in 1932 and was assigned to the 55th Pursuit Squadron, Barksdale Field. In 1937 he was assigned to the First Cavalry (Mechanized), Fort Knox, and the following year returned to the Army Air Corps with assignment to the 12th Observation Squadron, Fort Knox. In 1939-40 he was Aide-de-Camp to General Adna R. Chaffee, known as the "Father of the Armored Force." After attending the Air Corps Tactical School in 1940, he commanded the 12th Observation Squadron, then became Chief of Corps Aviation, Hq I Armored Corps, and later Air Officer for Armored Force Headquarters. In 1942 he organized and commanded the 73d Observation Group, Godman Field, Kentucky. In 1943 he became Chief of Staff, 1st Air Support Command, Morris Field, N. C., which became successively the I Tactical Air Division and the III Tactical Air Command. In 1944 he joined the Ninth Air Force in France as Deputy Commanding General for Operations and took part in the campaigns in northern France, the Rhineland, the Ardennes, and central Europe. After hostilities ended he served as Chief of Staff, Ninth Air Force, and with the Air Section of the Theater General Board. Postwar assignments have been as Chief of Staff, later Deputy Commanding General and Commanding General, Tactical Air Command, 1946–1950; as Commander, Air Task Group 3.4 preliminary to the Eniwetok atomic tests in 1951; as Director of Plans, DCS/O, Hq USAF, and AF Member, Joint Strategic Plans Committee, 1951–1953; as Commander, Fourth Allied Tactical Air Force in Europe, 1953–1957—and of Twelfth Air Force until it was made a separate command in June 1956; as Commander, Ninth Air Force, TAC, Shaw AFB, 1957–58; as Chief of Staff, U.N. Command and U.S. Forces, Korea, 1958–59; and as Vice Commander, ADC, from 1959 until he was named Commander in 1961. General Lee is a 1947 graduate of the National War College.

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