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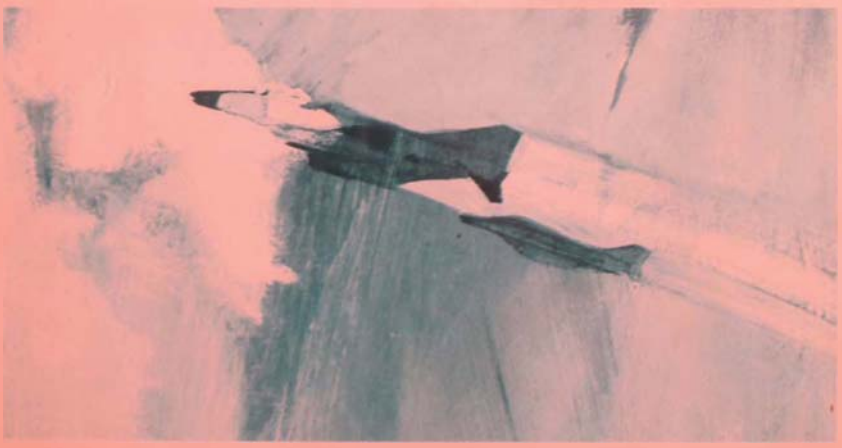

CANADIAN DEFENCE POLICY . . . TACTICS AND TECHNOLOGY FOR LIMITED WAR . . . TACTICAL AIR DOCTRINE AND EMPLOYMENT

NOVEMBER-DECEMBER 1967

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the cover

With "Canadian Defence Policy," the Honourable Paul T. Hellyer, formerly Canada's Minister of Defence, terminates a series of articles begun in our January-February issue to recognize Canada during her Centennial of Confederation. Throughout 1967, the *Review* has considered aspects of Canada's defense structure and international role. This issue also presents General James Ferguson's appraisal of technology's support of limited war and concludes the survey of tactical air operations, which we featured in September-October.

CANADIAN DEFENCE POLICY

THE HONOURABLE PAUL T. HELLYER

Adherence to dogma has destroyed more armies and lost more battles and lives than any other cause in war.

Major General J. F. C. Fuller

MANY of the basic principles that govern Canada's defence policy are constant because they are determined by factors, such as geography and history, which are specific. Others, such as the nature and the magnitude of the threat to peace and security and the development of weapons and weapons technology, change rapidly and drastically. Defence policy must adapt itself to such changes, while principles remain constant.

The modern military force must be a dynamic organization—dynamic in the sense that it must be constantly changing and improving. It must be able to adapt to the products of today's advanced technology; it must have the best equipment available in sufficient quantity to meet the requirements of national policy. Most important of all, it must be manned with responsible men highly trained in the art of modern military techniques.

Underlying the major revision of Canada's defence policy announced in 1964 is the concept that any organization, military or civilian, which does not adapt to a changing environment will surely decline. In the early 1960s it became apparent that two aspects of this problem demanded special attention. They were the management and control structure and the influence of rising costs.

One of the issues stressed in a statement before a Parliamentary Committee on Defence in 1964 was the number of senior officials with direct access to the Minister. I pointed out at that time:

> With the present prerogative of the Chiefs of Staff to come directly to the Minister with their problems and submissions, there are many cases where proposals are dealt with by the Minister in isolation. This will be overcome in our proposed organization by the fact that all military proposals will come through one channel, and therefore, must in effect be co-ordinated before they come to the attention of the Minister.

The desirability of adopting sound management principles and a simplified chain of command was reiterated in a subsequent statement I made before the same committee.

> I think it [the Canadian defence organization] will be the best military organization, the most responsive to co-ordinated action, and that because of its simplified lines of communication it will be able to develop new concepts and techniques more quickly.

This point reflects the growing complexity of defence choices, which often involve political, economic, and scientific problems as well as issues of military effectiveness.

The impact of sharply rising costs for personnel, maintenance, and operations had been observed for some time, and its consequences for Canada's defence activities were strongly emphasized in the policy discussions of 1964. It was recognized that the total funds available for defence were not likely to change greatly, so that money available for capital equipment would inevitably decline drastically unless something was done about it.

In the White Paper on Defence, which was tabled in the Canadian House of Commons in March 1964, and previously in the Report by The Royal Commission on Government Organization, great stress was placed on the importance of reducing manpower costs associated with headquarters, training, and similar establishments, as well as operating and maintenance expenses which could be cut without impairing operational efficiency.

After considering the factors of management and control, the influence of rising costs, as well as personnel considerations and the nature of modern warfare and the influence of technology, it was necessary to apply general conclusions reached to the specific military requirements of Canada. If we were to maintain useful forces to meet our national and international commitments, we had two choices: we had to increase defence spending or reorganize our forces. The decision was to reorganize.

Broadly speaking, the objectives of Canadian defence policy fall under four major headings:

(a) Collective measures for maintenance of peace and security as embodied in the Charter of the United Nations, including the search for balanced and controlled disarmament;

(b) Collective defence as embodied in

the North Atlantic Treaty;

(c) Partnership with the United States in the defence of North America;

(d) National measures to discharge responsibility for the security and protection of Canada.

These are not in any order of priority but are merely broad headings under which priorities may be established.

To carry out these objectives, we have concentrated our efforts on our forces in being. The purpose of our forces in being is to preserve peace by making a contribution to the deterrence of war in cooperation with our allies. This principle applies throughout the whole spectrum of possible conflict. At the high end of the scale, thermonuclear war and major nonnuclear war are deterred by the existence of sufficient force to make any aggression unprofitable. Similarly, at the lower end of the scale in peacekeeping and other activities, it is the existence of and in some cases the use of forces in being which contains or tends to contain the conflict in a limited way and prevent it from escalating into something more dangerous. In most situations in the real world, then, it is flexible forces in being which may be useful to keep the peace and deter war. The chance of calling on mobilization potential, though possible, is remote.

This assessment was the guide to the setting of our priorities. Forces in being, which traditionally have been low priority, are now at the top of our list; and reserve forces, which were the backbone of our mobilization in two World Wars, have been moved down the scale proportionately.

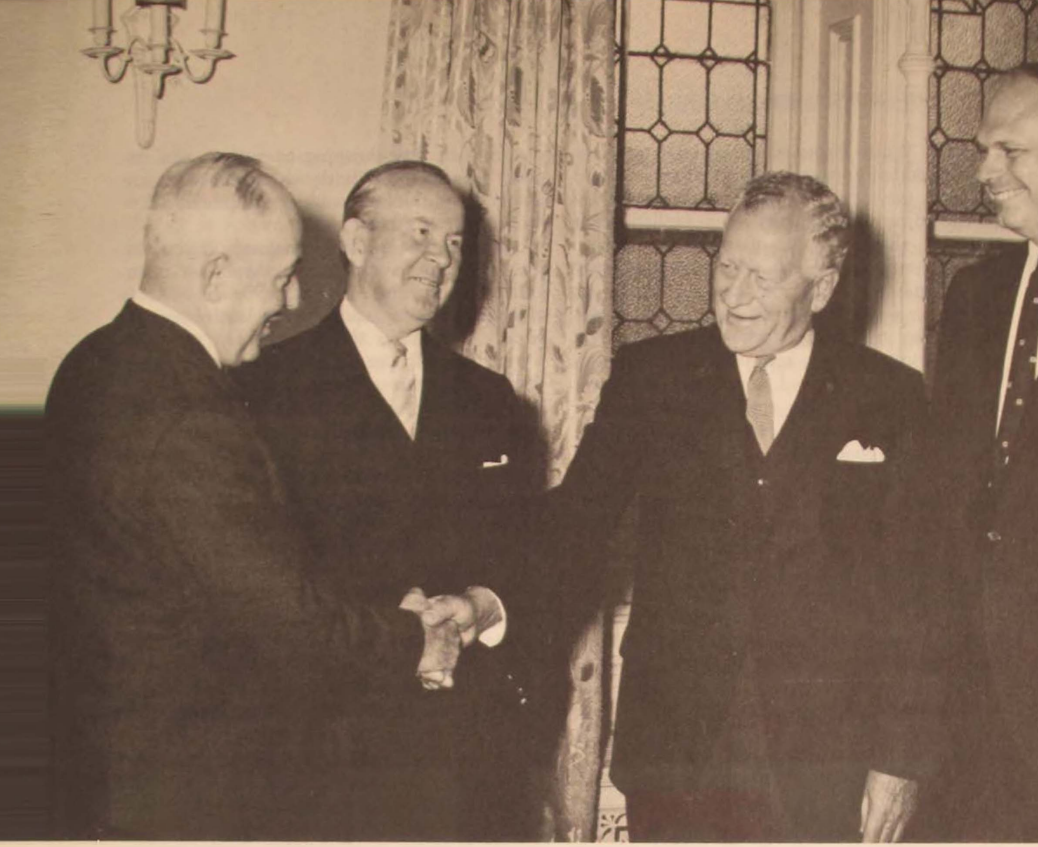
Following careful study we concluded that the most unlikely development at this time would be an all-out thermonuclear exchange. The second least likely would be a major conventional war in Europe lasting for any extended period. At the other end of the spectrum, the most likely possibility of conflict will be a continuation of small wars, riots, insurrections, overthrow of the civil power, etc. These are likely to continue, perhaps on an increased scale.

The reasons for this assessment, which incidentally was unanimous in the Defence Department, are obvious. Under existing circumstances an all-out thermonuclear exchange, even after a surprise first strike by either side, would inflict unbelievable damage on the two great power blocs. Casualties on each side would number in the tens of millions, and there is no known way that this result could be avoided. An exchange could take place as the result of miscalculation, though the chance is remote. From a rational standpoint, there is no conceivable national purpose to be achieved by an all-out thermonuclear exchange, and consequently the probability of its happening is low—provided, of course, a credible deterrent is maintained.

Almost equally unlikely is a major conventional war in Europe, since a war on this scale would almost inevitably escalate into nuclear conflict, if for no other reason than it would soon threaten the nuclear capability of one or both sides.

At the other end of the scale, and far more likely, is a continuation of small wars, insurgency, riots, overthrow of civil government, and other minor conflicts of this sort. Not only have we been warned that there will be activity in these areas, but in some cases it could be a legitimate extension of an aggressive foreign policy from the standpoint that the potential gain might justify the risk taken and, therefore, we should expect continued and, perhaps, accelerated activity at this level.

Once having decided what we believed the possible spectrum of conflict to be, we began to design a force structure flexible enough to contribute throughout the scale. This means forces equipped to contribute to the deterrent on the central front in Northwest Europe and also capable of being employed in peacekeeping activities, brush-fire wars, and related missions. The range of training and equipment required for these varied tasks is very great indeed. Requirements range from the heavy equipments needed on the central front for deterrence to that of light air-portable equipments for peacekeeping, brush-fire wars, etc. Training ranges from that required to cope with the possibility of nuclear war to lightly armed peacekeeping. To meet these varied



On 19 September 1967, the Honourable Leo Cadieux, M.P., became Canada's new Minister of National Defence; he had served as associate minister since February of 1965. Governor General Roland Michener congratulates Mr. Cadieux (left) after swearing him in at Government House. Participating in the ceremony are Prime Minister Lester B. Pearson and the Honourable Paul T. Hellyer, newly appointed Minister of Transport and Mr. Cadieux's predecessor as Minister of National Defence.

contingencies, forces must be flexible and mobile. Key words in our force structure then are "flexibility" and "mobility."

For our purposes we decided the best way to achieve flexibility and mobility was through a single force. It has been suggested that the idea of a single force is new and should be approached with extreme caution. Actually it is not a new idea. It is one which has been discussed and debated for at least a generation. The idea has won the support of some of the greatest military commanders this century has produced. These include General Eisenhower, Field Marshal Montgomery, and Air Chief Marshal Harris, to name a few.

Each of these on the basis of his own command experience came to the conclusion that the old lines of demarcation were no longer valid. The grey areas are increasing, and the trend to combined operations involving two or more of the traditional elements requires a unity of command and control to ensure maximum success.

The White Paper of 1964 would not have recommended integration as a first step toward a single service if we had not been certain of the improved capacity of a unified force to meet the demands of modern warfare. The pattern of warfare in which armies fought armies, navies fought navies, and air forces fought air forces is not likely to be repeated. Under the traditional three-service concept, the individual service recruited, administered, trained, equipped, and supported the combat force units within that service. Joint or combined headquarters were created, where necessary, to coordinate and direct the operations of the elements of two or more of the services. This is a device necessary in a three-service system, but it has built-in drawbacks arising out of the very fact that units and elements belong to different services. Each component depends on its parent service for support in a host of ways which require special channels of communication and complex methods of coordination throughout.

Commanders and staffs down to the lowest level of operations, and in the support echelons from the scene of operations back to the home base, must act together and in unison as the situation demands. Under conditions of modern warfare, consultation between services having different areas of responsibility and different channels of communication is time-consuming. More important, it cannot achieve the high degree of coordinated response that could be critical and would be immediately available through a single organization. The old system can result in misunderstanding and delay which, at best, a military activity can ill afford and, under some circumstances, cannot afford at all.

Fast decision-making and quick reaction are synonymous with modern warfare. The introduction of jets, missiles, rockets, computers, satellite reconnaissance vehicles, and other new military techniques demands an expeditious resolution of problems and rapid response. For intercontinental warfare, the impact of the contraction of time and distance is evident, but it is also valid in relation to military activities at the lower end of the spectrum. Even the success or failure of peace-restoring or peacekeeping operations can depend on the speed with which decisions are reached and the force and its equipment delivered to the trouble zone.

I believe it is a fair conclusion that a single organization which works and thinks together day-in and day-out, with direct lines of communication and a single line of responsibility, eliminates the self-inflicted problems associated with the three-service system of coordinating combined operations.

Concomitant with the change in our force structure are the changes in management techniques which have been introduced into the Defence Department since 1964. One of the most important problems in defence management was the reconciliation of the programs of the three services, that is, the setting of the real priorities between the programs of each.

The integration of Navy, Army, and Air Force headquarters aided materially in the solution of this problem. An Integrated Defence Program (IDP) has been established, which displays all approved defence activities and forecasts spending over the current year and the following five-year period. The program data relate the various military functions and missions to resource requirements of manpower, money, and materiel. With this information available, we can determine at once the implications, both on a particular mission and on the integrated defence program as a whole, of any new requirement.

The defence programming system includes a program change procedure which keeps the IDP current as it reflects changing national and international conditions and the adoption of advantageous technological advances. The development of this comprehensive system has been taking place for some months. To assist in its implementation, we have retained a civilian consultant group familiar with the process, to advise us.

The operation of this system insists on the solution of the two management problems raised. First, since it includes all missions and the elements of all missions, it displays each of these in a way which facilitates the consideration of priorities and demands their solution. Second, the data required for the system

include capital costs, personnel and support requirements, and operating costs, and therefore the total effect of each new program change is known at the outset and available for review at any time. The information necessary for management to make decisions is readily available, and the system itself ensures that the data are presented in a manner that tends to realistic decisions.

Another important area which has been subject to reorganization is that of development. Each service had its own development funds, and in each case the administration and screening were carried out within the service concerned without consultation with the other services unless a particular field in which it was known that there might be more than a one-service interest. Since integration, the three service development programs have been amalgamated and coordinated to fit the overall defence program.

The facts are clear and incontrovertible. Either the defence budget has to be substantially increased or substantial cost reductions have to be made, else funds would simply not be available for the capital expenditures that are essential to effective military forces. These pressures will continue. The integration-through-unification process will generate important new cost reductions for some years to come. It cannot be expected that these will match the increasing costs in current dollars from year to year, but without them we would face much higher defence budgets to maintain defence forces at approximately the level we have today.

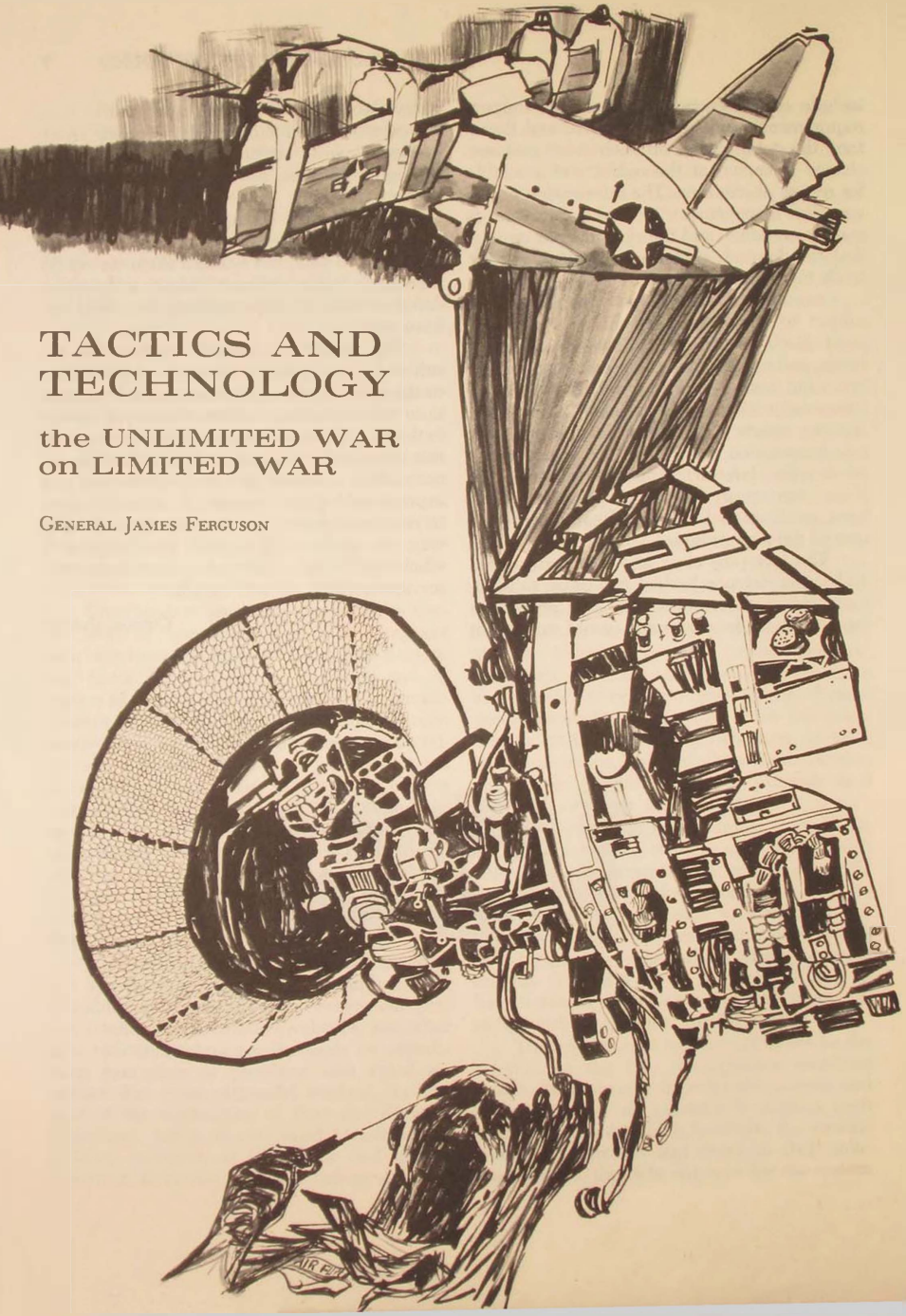
The nature of modern warfare has resulted in a compaction of time and distance to the point that decision-making and reaction time must be much swifter than ever before in history. I feel a unified force best meets this demand. Unification will broaden the opportunities available to service-motivated and expensively trained personnel when changes in roles or systems alter requirements. In this way, the nation will benefit, the forces as a whole will benefit, and—just as important—the serviceman himself will benefit.

Ottawa, Ontario

TACTICS AND TECHNOLOGY

the UNLIMITED WAR on LIMITED WAR

General James Ferguson



RESEARCH and development is charged today with the responsibility of being in two places at once—at the frontier of future opportunities and on the doorstep of present problems. The challenge of supplying the needs of our operational forces, whether those needs are ten minutes or ten years away, is resulting in a new order of responsiveness on the part of the Air Force Systems Command. The contributions of research and development to U.S. needs in Vietnam represent an "unlimited war" on limited war, a concerted effort within the Air Force to influence tactics by the use of technology.

Historically, nations have entered into successive wars with the weapons and concepts that had been successful in the last war. If the conflict lasts any length of time, innovations in techniques or technologies will occur, and these tend to persist until other wars bring about other changes. However, the circumstances of recent years in the course of the cold, hot, and technological wars going on among nations suggest that the time interval for innovation and technological inventiveness is growing increasingly shorter. In fact, the day may be near when "leftover" weapons and on-the-shelf technologies will be inadequate, insufficient, or ineffective as a means of winning a war or discouraging an aggressor from starting one.

This eventuality brings into sharper focus the preventive mission of defense research and development, which in the past decade or so has been eminently successful in satisfying national policy requirements for weapons and systems of a strategic nature. These same channels of policy, budget, and technology decision-making have been somewhat less successful in assuring U.S. tactical superiority under limited-war conditions. In this respect, our collective foresight has not been as perceptive as it might have been.

Accordingly, those of us charged with research and development responsibilities must ask ourselves two related questions:

- Is R&D delivering the goods today, in terms of today's needs and in support of the current emphasis on tactical capabilities?
- Are we simultaneously addressing our talents and technologies to the needs of the future?

Recognizing that world conditions and national policies can change overnight but that weapons cannot, we must be continually aware of changing conditions, long-range prospects, and the possibility that unless development lead times are respected we could again be found wanting at some point downstream. The test is to determine how ably we are looking for new and better ways to do familiar things, seeking new technologies to overcome old problems. At the same time, are we trying to look ahead to the kinds of difficulties that might plague us in any future use of military forces in the defense of freedom, ours or other people's?

Because Vietnam is a "different" kind of war, there is no reason to believe it will be unique. Unwilling to challenge the strategic power of the United States, the Communists have resorted to aggression at the lower conflict levels, where massive power cannot be used without restraint. To overcome U.S. vulnerability to this tactic, we have moved to strengthen our general-purpose forces, improve our technology, and enrich our R&D resourcefulness. In short, Air Force responsiveness to the situation in Southeast Asia is intended to discourage subsequent "wars of national lib-

Project Underbrush

the Air Proving Ground Center, Eglin AFB, Flor-a, "Underbrush" simulates an actual battlefield uation in South Vietnam, providing realistic test-g for military engagements being fought there. mulated effects include scarecrow-like troops in e field, Viet Cong sampan, and Vietnamese village.

eration" as well as assist in resolving the present one.

To avoid exploitation at the hands of the Communists or anyone else, the U.S. show of strength clearly must span the spectrum of threat. Toward that objective, the Air Force Systems Command mission today has three prime facets:

First, we are seeking ways to serve the diverse needs of the operational forces in Southeast Asia better and more quickly.

Second, beyond that immediate goal, we are searching the horizons of technology for those capabilities which will deter tactical threats as effectively as our long-range missile and bomber forces have deterred strategic threats.

Third, we are energizing all the technologies and resources at our command to assure the continued adequacy of our strategic forcefulness.

In every case our intention is to deter, discourage, or dissuade aggression, and in each facet of this three-part mission the meaning of deterrence is the same—assurance to the enemy that he cannot succeed.

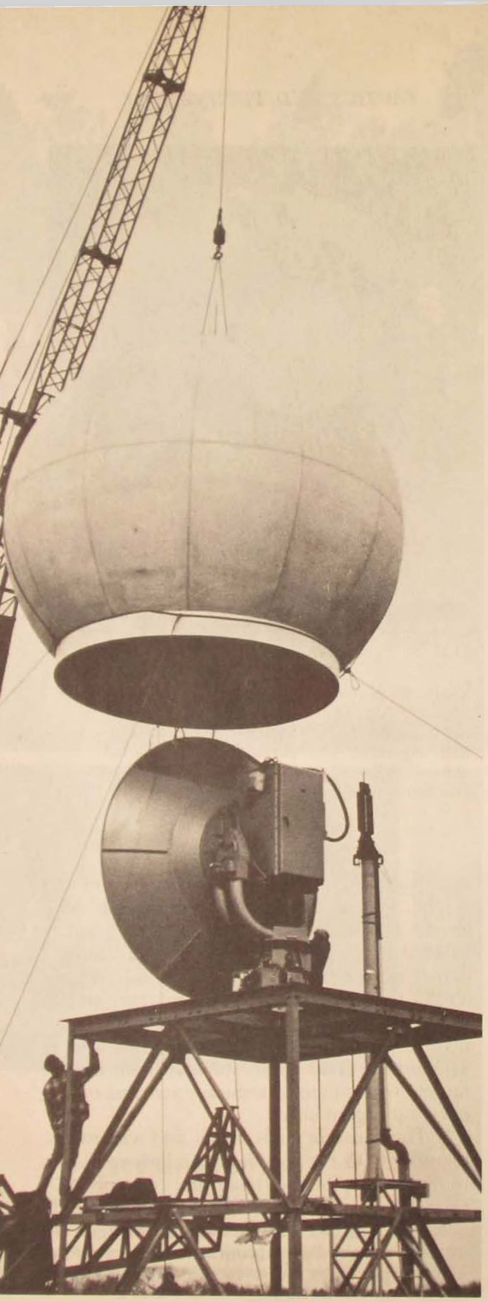
We have come to understand that in a limited war the aggressor has the advantage of picking the time and place of confrontation. In the past, the choice of tactics and weapons from among those available to us has not always been broad enough to offset that advantage. The research and development community today has the opportunity to introduce new weapons and technologies either not available to the enemy or unsettling to his "style" of warfare. Ideally, these should be innovations that can overcome an enemy's advantage decisively and at costs that are not prohibitive.

Despite the superiority of Free World forces opposing the Communists in Vietnam, the environmental conditions favor the enemy. These conditions include "guerrilla-absorbent" terrain and the advantages of familiar ground. In addition, the enemy forces are trained to live off the land, to function at night and in adverse weather, and to pose as noncombatants. They are exceedingly adept at hiding, tunneling, and merging with the landscape.

The novelty, to say nothing of the difficulty, of trying to fight a war without front lines and in the absence of a readily distinguishable enemy has been reported many times but is still not fully appreciated in terms of the burden it places on the defender. The enemy's ability to blend with his surroundings and to use geography to maximum advantage represents the most difficult obstacle to our success in Vietnam. The ability to hit small, mobile targets with pinpoint accuracy remains one of our most urgent needs.

The mazes of trails, roads, and waterways, together with the seemingly endless resources of manpower for the repair and resupply missions, make interdiction of supply lines a difficult and constant job. Roads and bridges are quickly repaired or circumvented. So vehicles and supply lines must be hit directly, accurately, and repeatedly.

A 51-foot-diameter parasail parachute, developed for high-altitude cargo drops, is static-tested by Air Force Flight Dynamics Laboratory engineers. The parasail can be guided automatically or manually into an impact zone and homes on signal from a ground transmitter.



The long-range weather radar, procured and installed by Electronics Systems Division, AFSC, is now in use in Southeast Asia. Three of them, spaced in a triangle, provide coverage of several hundred thousand square miles.

The real turn in the tide, not only in Vietnam but in discouraging similar situations, may well come when U.S. technologies overcome the enemy's natural advantages with respect to terrain, tactics, and manpower. In the Systems Command, we are committed to the earliest possible realization of this objective. Technological progress already has contributed substantially to the improvement of U.S. capabilities in Vietnam. The opportunities for further advances are getting prompt and emphatic attention in current research and development efforts.

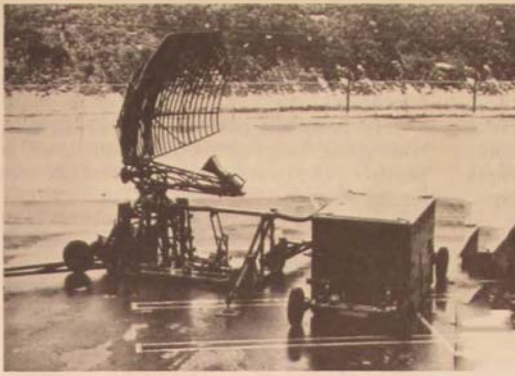
The Systems Command's key contribution to success in Vietnam is fast technical assistance, or, as Secretary of the Air Force Harold Brown has put it, "a capacity to make swift innovations tailored to the immediate circumstances." All the resources of the Command have been made available to the Southeast Asia support requirement. An Assistant for Southeast Asia on the Headquarters staff serves as the central coordinator for the Command's multiple limited-war activities.

These activities begin with an on-the-scene assessment of combat-area problems. Our Systems Command liaison office in Saigon, located with Hq Seventh Air Force, maintains close contact with all Southeast Asia operational units.

Through a Southeast Asia Operational Requirement (SEAOR) procedure, the Seventh Air Force can address a requirement to the Systems Command. Upon receipt, the stated need generates an immediate search for a technical solution. This response first takes the form of a best preliminary estimate (BPE), expressed concurrently with Tactical Air Command's determination of the best operational tactical solution.

SEAOR's serve to bring a required operational capability to the surface for immediate ex-

The fold-away aircraft detection radar, TPS-44, is to be used in the forward air control post of the 407-L Tactical Air Control System (TACS). It can be set up in less than twenty minutes, is readily transportable, and in severe weather is folded rather than dismantled.



posure and prompt consideration. The intent of the SEAOR is to elicit swift response, both technically and procedurally. Problems demanding broad, long-term action may "graduate" from the SEAOR category once it has been determined that a quick-fix solution is not possible or attainable. The need for an airborne command post, for example, was originally identified through the SEAOR procedure, which led to the procurement of the C-130E aircraft equipped for the control of airborne and ground operations in battle areas. Another SEAOR stated the need for a long-range weather radar, and AFSC satisfied the requirement by procuring and developing suitable equipment that was commercially available.

The direct line that we have established from the origin of the need in a Southeast Asia operational situation to the source of the research and development action authority in the Pentagon can, if necessary, be traveled by telephone or radio. Along with this fast-reaction approval channel, we have set up a funding source to assure rapid evaluation of new hardware and techniques for limited-war needs. This source has provided the funds necessary to buy, test, and try readily available equipment with promising potential. Although it allows only for funding of test quantities, the availability of this funding source shortens the time span through development and operational testing to the point where a procurement decision is practical.

In seeking ways to continually improve the timing and the quality of the Command's responsiveness, we have concentrated on making our technical assistance efforts personal, prompt, and professional. One of the ways it has become personal is through the direct contact our Saigon liaison people have with the forces in the field. Recognizing that those who are directing the operations or engaging in combat actions are the best qualified sources of operational requirements, we insist that our people talk with forward air controllers, strike pilots, and other aircrewmen at every opportunity.

Among other things, we have found from these and other experiences that "requirement" and "problem" are not necessarily the same thing. A requirement generally is a definite and definable need, while a problem may lack specific identity. On occasion, the cure for a problem may be available but unknown, or the problem may exist but remain unidentified. There may be technologies on the shelf which

could lead to new or more effective ways of doing a particular job but the application of which has not been discovered or realized. This situation represents a solution looking for a problem.

To avoid the possibility of needed solutions going begging, we have attempted to improve and expand communications between the Air Force's using commands and its technology teams. We have taken a number of steps to provide research and development personnel greater "visibility" in actual combat situations. These steps include short-term tours and orientation visits of research and development officers and civilians to the combat zone, for on-the-spot exposure to problems which they may be able to solve or alleviate.

Another effort in this direction aims at recouping as many combat-experienced R&D officers as we can, following completion of their SEA tours. At the moment, among the most precious resources we have in the Command are the science and engineering officers lately returned from Vietnam and assigned to active limited-war research and technology projects. Many of them may return to the combat area, but in their R&D status.

As rapidly as possible we expose new ideas and new technologies to the operational environment, through our liaison office in Vietnam. We have found that it is as useful to have R&D-qualified officers assigned to key positions in the combat theater as it is to have combat veterans selectively assigned to R&D programs here in the States.

Mating technology to operational needs involves considerable "imagineering" as well as engineering. At the Air Proving Ground Center, Eglin Air Force Base, Florida, a simulated Southeast Asia jungle environment—complete with sampans—provides a realistic setting for the testing of ideas and equipment potentially useful to U.S. forces.

Last June we established the Directorate of Technical Applications for Southeast Asia. This is an intentionally small, mission-minded task force located at Eglin as a part of the Air Proving Ground Center organization. Our purpose in forming this group is to bring operationally oriented and technically qualified people into direct contact with those battle-zone problems amenable to quick-fix solutions.

THROUGHOUT the Systems Command, as well as in other elements of the Air Force, other innovations in procedures and in the development of technologies and their applications are being encouraged and emphasized with a view toward improvements in combat effectiveness today and deterrent effectiveness tomorrow.

The primary problems we encounter are the classic ones of offense and defense, but they are greatly complicated by the natural restraints and the political and military constraints applicable to the Vietnam situation. Technology probably can never overcome all these limitations, but we are confident that novel approaches, new ideas, and capabilities structured on technological advances can provide added thrust to our offense and greater strength to our defense.

The offensive power of the Free World forces in Southeast Asia has been impaired by a limited ability to locate and identify the enemy, to curtail his mobility and his freedom to function at night and in bad weather, and to discriminate with enough precision to assure accurate strikes against proven military targets.

We are further handicapped by having to risk aircraft and other costly equipment in attacks on relatively low-value targets, such as truck convoys, bridges, river traffic, and the like. Such interdiction actions, of course, are necessary to cut down the flow of supplies and to reduce the infiltration from the north. Technological advances enabling us to carry out such strikes more effectually, while minimizing the risk to our own people and equipment, would contribute substantially to the value of our offensive power.

Defensively, we need better base security, with devices for detecting enemy intrusion, to safeguard our forces against surprise attack. Some of the answers to these problems are already realities; others are coming.

Sensor technology is being advanced rapidly under the impetus of the Vietnam conflict. Night traditionally has favored the enemy, and

Communications Aids for Limited War

Sixty-foot inflatable UHF/VHF antenna, which fits into a twenty-pound manpack unit, assists combat control teams in dense jungle.... Jeep-mounted equipment links ground forces with forward air controllers.

bad weather conditions long have afforded him cover and security against air attack. These advantages soon will be denied to the enemy through systems which will make our "eyesight" almost as good at night or in poor weather as it is under favorable daylight conditions. The SHEDLIGHT program is a comprehensive technical effort to eliminate darkness as the enemy's asset. The program involves the advancement of surveillance, detection, illumination, and attack technologies.

In addition, detection devices sensitive to heat, odors, and even colors are under development. We are looking for ways to find tunnels, weapons, and concentrations of enemy troops. High on our list of priorities are better ambush detection equipment, fully effective base-intrusion detection devices, and foolproof booby-trap alarms.

Through the provision of better electronic and communications equipment, munitions, and lifesaving, rescue, and evacuation techniques, field elements already have witnessed the effects which up-to-date tactics and technologies can make on battlefield situations. Compared to Korea, for example, there are more and bigger helicopters, superior communications, faster response capabilities, and a much better record of personnel rescue. Most important, the death rate among battle casualties is significantly lower because of the improved medical and air evacuation facilities.

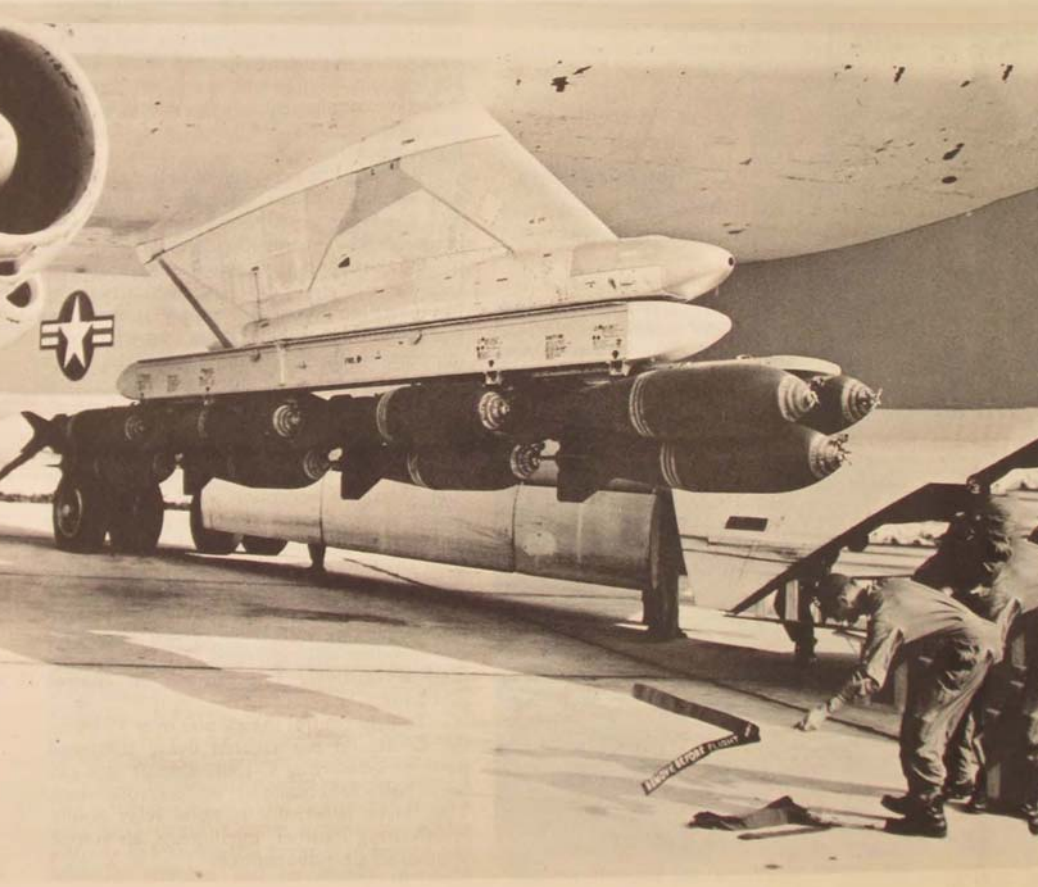
Rescue and survival are more nearly the rule than the exception, and ground-to-air rescue devices have been developed which make it possible to pick up downed airmen from any type of terrain. A new crash-position indicator, also developed by the Systems Command, has been successfully tested and is in use, simplifying search and rescue procedures and speeding responsiveness. These are examples of relatively fast answers to combat problems.

To help control the air war over Vietnam, the Command has created flying command posts by converting C-130E aircraft into airborne battlefield command and control centers. They serve effectively as radio relay points, coordinating weather, intelligence, air rescue, attack, and air traffic control.

Space systems also contribute to the effectiveness of U.S. combat capabilities. Thirteen days after the last three satellites in the Initial Defense Communication Satellite Program were orbited last July, that system was declared operational in the Pacific, handling up to 1000 messages a week over the Hawaii to Saigon link. Other Defense Communications Agency terminals are in operation in the Philippines and at Nha Trang, South Vietnam.

In the same time period, tests were begun on the early components of a tactical communications satellite system. Using an all-transistorized ultra-high-frequency repeater satellite, the LES-5, the Army, Navy, and Air Force conducted test transmissions that linked

M-117 bombs on external racks designed for the B-52 greatly increase its total bomb load.



aircraft, ships at sea, and submarines. The high-power satellite, together with the small, lightweight, highly mobile terminal (which can be jeep-mounted or back-packed, for that matter), makes the tactical system under development ideally suited to combat situations.

Other direct support items of limited-war value which have flowed from Systems Command research and development efforts include expandable shelters, new adjustable litters for air evacuation, a cold-water-cooled flying suit for pilots flying low-altitude missions, and techniques for low-level parachute supply deliveries. Four types of steerable parachutes, including one capable of lowering a 2500-pound load, have been tested. Development work and field tests have been completed on radar sets small enough and compact enough to be back-pack carried into remote sites where they can be quickly assembled and put into use. Portable air traffic control equipment, mobile weather stations, and rapid preparation of remote landing sites have also contributed to the flexibility of U.S. forces.

As another indication of the extent to which Systems Command resources have been marshaled in support of limited-war forces, the eight Air Force Laboratories under my Director of Laboratories have been searching their specialized and highly advanced inventory of technologies for applications useful in the Southeast Asia conflict. Laser technologies, among other things, have been particularly promising, especially for illumination and communication purposes.

Research and development attention has also focused on flight control techniques designed to minimize the exposure of low-flying aircraft to radar detection. Other sophisticated equipments, like terrain-following radar and electronic countermeasures, are critically important to the penetration capability of attack aircraft and to their survival in the hostile environment of enemy planes, antiaircraft fire, and surface-to-air missiles.

As a safety measure, an explosion-proofing polyurethane foam material has been developed and qualified for use in aircraft fuel tanks. The foam virtually assures that an explosion will not occur as a result of the fuel tank's being punctured by an incendiary projectile.

New and improved types of munitions, including better air-to-air and air-to-ground missiles, also have been developed as part of the research and technology approach to limited-war effectiveness. Bombs designed to penetrate jungle foliage before detonating, bombs to assure low-flying attack aircraft ample escape time, and various area denial devices are among the special types developed for use in Southeast Asia.

Research and development work of a more traditional nature is exemplified in the design and acquisition of aircraft tailored to the conditions of counterinsurgency, limited war, and the needs of our general-purpose forces.

In the Concept Formulation Package stage are several aircraft systems, including the F-X tactical fighter for future assured air superiority and the A-X specialized close air support aircraft. The Concept Formulation Package is our basic means for advocating new systems and is the foundation for justifying the resources necessary to their development.

More immediate to the needs of Southeast Asia are a number of aircraft being acquired or modified to serve the various missions of close air support, interdiction, forward air controller, and psychological warfare. Among these are the A-37, A-7D, O-2A, O-2B, and OV-10.

The Air Force's R&D assault on limited-war problems and obstacles ranges from armaments to aircraft and from laboratory ideas to field equipment. Since Systems Command technicians joined with tacticians to produce technical answers to tactical problems, a variety of items to meet a variety of needs have been developed and put to use in the combat zone.

In short, we are trying very hard in the Systems Command not to overlook any area of opportunity that will improve our advantage in Southeast Asia. Yet there are still many problems to be solved, many challenges to be met.

Our operational forces find that their aircraft can still be shot down. Overall, there is a great need to improve our capability to detect the enemy, distinguish friend from foe, and strike small targets more precisely and—perhaps—more economically.

Despite all our advances in detection techniques, we can still benefit a great deal from any new-found means for obtaining real-time reconnaissance of ground targets that move, radiate heat, or reflect or consume power.

The Air Force's success in the technological war is having a pronounced effect on the current "hot" war. Without the advances of a scientific or technical nature that have been developed and applied to the Vietnam situation, our losses there would surely be much greater and our effectiveness much less.

Air Force resources for research and development are pledged to the continuing support of Southeast Asia needs and requirements. Those same resources of talent and technology are pledged equally to the deterrence of subsequent wars and to a readiness to fight and win them should they occur. This preparation goes on in full awareness that future wars may entail different sets of circumstances, may be waged under very different conditions, and may require wholly new technologies.

"One should be very careful," Secretary Brown has warned, "in remembering that [Vietnam] is not the only kind of war, and if we proceed to organize and procure equipment and train people only for this kind of war, we can very easily get a bad surprise if we find ourselves in a war where, unlike the one in South Vietnam, the enemy has rather advanced weaponry and can operate advanced surface-to-air equipment, missiles, artillery and aircraft themselves."

This possibility alone is good reason to pursue the whole spectrum of research and development programs designed to maintain and extend U.S. technological superiority. Our goal is to be prepared for the future and to cause our capability for preparedness to impact on the present. We seek to make tactics and technology the winning combination in a balanced force structure geared to any degree of controlled response required by national policy.

Hq Air Force Systems Command

Another Role of the P-38

In response to "Three Bullets on a Knife: Saga of the P-38" (*Air University Review*, XVIII, 2, January-February 1967), Brigadier General Howard T. Markey of the Illinois Air National Guard writes:

The RP-322 was a P-38 without turbos or armor plate and with both propellers rotating in the same direction. A number of these RP-322s were built for Great Britain, but for some reason they were not accepted and were parked at Tonopah, Nevada. Some of us brought them to Williams Field, Arizona, and they became, I believe, the first combat-type aircraft to be employed in cadet training. We moved the radios and squeezed the cadet behind an instructor pilot before soloing him. Among the many great things about the P-38 type was its capability of functioning, at least in this lightened version, as an excellent trainer.

The activation of United States Strike Command (USSTRICOM) in October 1961 and the establishment of its mission were part of the implementation of the Department of Defense Reorganization Act of 1958, which amended the National Security Act of 1947. Briefly, this law states that it is national policy—

> *. . . to provide for the unified strategic direction of the combatant forces, for their operation under unified command, and for their integration into an efficient team of land, naval, and air forces.*

The functional responsibilities assigned to USSTRICOM by the Joint Chiefs of Staff include the requirement to conduct joint training exercises to assure maintenance of a high level of combat effectiveness and a rapid reaction capability. Since its inception, USSTRICOM has provided the centralized command and control necessary for the sponsoring, planning, and conducting of a wide variety of exercises for U.S. Army Strike Command (USARSTRIKE) forces and U.S. Air Force Strike Command (USAFSTRIKE) forces. In the implementation of joint training responsibilities, the primary objective of USSTRICOM is to integrate the combat capabilities of assigned forces into effective joint combat teams that are capable of executing joint combat missions. Such training provides all participating units with meaningful experience in an adequate field combat environment and assists participating personnel in acquiring or further developing all the essential skills and knowledge that they would have to apply in combat.

SINCE its activation six years ago, USSTRICOM has conducted large-scale exercises, such as SWIFT STRIKE, DESERT STRIKE, GOLD FIRE, and SILVER HAND; augmentation exercises in which USSTRICOM tests its capability to augment other unified commands with specifically tailored forces; operational exercises, which are similar to augmentation exercises with the exception that the forces involved remain in the reinforced theater for an extended period of time; and "rapid reaction" exercises.

Rapid reaction exercises are conducted periodically by USSTRICOM to test and enhance

the rapid reaction capabilities and operational readiness of the Army and Air Forces assigned, in order to assure a timely and effective response to the implementation of the various contingency plans for which USSTRICOM is responsible. Rapid reaction exercises include the BRIM FIRE series and the BOLD SHOT series. BRIM FIRE exercises are designed to test the preparedness of the Rapid Reaction Force, a brigade-size force from the armored, infantry, and mechanized divisions, to deploy by air or surface means from their home stations. Since the rapid reaction exercises involve the alerting, marshaling, and preparation for movement of the designated force but do not involve the actual deployment and employment, this article will be devoted instead to the BOLD SHOT series.

The BOLD SHOT exercises were developed to exercise the Division Ready Force (DRF), a reinforced airborne infantry battalion of either the 82d Airborne Division, Fort Bragg, North Carolina, or the 101st Airborne Division, Fort Campbell, Kentucky, in conjunction with Air Force tactical fighter, reconnaissance, and tactical airlift units. The purpose of the exercise, in addition to testing the rapid reaction capability, is to test the operational readiness of participating forces through the conduct of a tactical field exercise. The forces participating in these exercises are of limited size, tailored from basic force packages for a specific tactical mission. Upwards of 1200 to 1500 Army, Air Force, and Headquarters USSTRICOM personnel are actively engaged in each BOLD SHOT exercise. During an exercise, procedures are stressed for the marshaling, deployment, and tactical commitment of initial assault forces. The employment phase is normally of short duration and emphasizes the requirement for accelerated joint planning and swift execution. The exercise involves the rapid deployment of a joint task force (JTF) by air, directly or through an intermediate staging base, to an objective area, where the force is employed in an airborne or airlanded assault or in a combination of the two.

USSTRICOM has conducted nineteen BOLD SHOT exercises since March 1962. The present USSTRICOM joint training exercise program provides for five of these exercises each year.

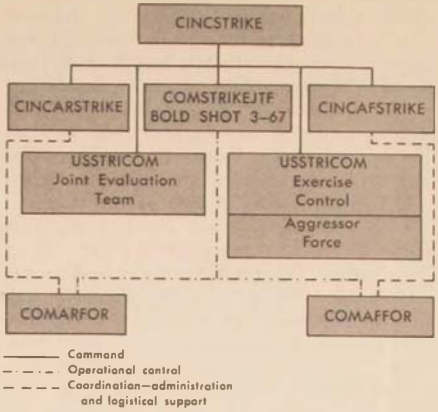
Prior to a BOLD SHOT exercise, elaborate preplanning is necessary. Consideration is given to the exercise site location and climatic data, force availability, and the development of a logical and realistic concept of operations. A decision briefing is then presented to the Commander in Chief, U.S. Strike Command (CINCSTRIKE). Once the decision is made, a mission-type operations plan is transmitted to the component forces, and subsequently a mission directive is issued to the Commander of the USSTRICOM Joint Task Force (COMSTRIKEJTF). The mission directive includes those key operational matters which CINCSTRIKE desires that the COMSTRIKEJTF stress during the conduct of the exercise. These matters are usually based on areas noted during previous exercises which from a training point of view require additional attention. They may include camouflage, communications, discipline, air cover for the approaches to and the peripheral areas of the drop zone, proper drop zone signals, surprise, tactical security, speed and vigor, mission-type orders, humane care for rescued civilian personnel, and operations involving riot control agents. The COMSTRIKEJTF and his staff develop and disseminate a JTF operations order, which outlines broad guidance to the exercise participants. Detailed orders are not the vogue within USSTRICOM, since CINCSTRIKE permits subordinate commanders the maximum freedom possible in the development of their own tactical scheme of maneuver.

EXERCISE BOLD SHOT 3-67, conducted in March 1967, was typical of the BOLD SHOT rapid reaction series of training exercises and is selected to describe the joint planning, force structure, and actual execution of an exercise of this type.

The exercise setting was focused on a situation in the hypothetical Republic of Mateke, actually represented by North Carolina. On 25 March, after an unsuccessful attempt to assassinate the Prime Minister of Mateke, a country friendly to the United States, Thomas Bowba, Deputy Prime Minister and a known Communist, fled to his home province of Bangia, rep-

resented by the Fort Bragg–Camp Mackall complex in southeastern North Carolina. Upon arrival in Bangia, Bowba ordered the immediate confinement of 64 U.S. nationals residing in the province in an attempt to embarrass the Mateke Republic and gain support from Gubanya, a Communist-led country bordering Mateke that had openly promised to support Communist-inspired insurgency in neighboring nations. Approximately 1000 Bangia guerrillas rallied to Bowba's efforts and began operations throughout the province in bands of 50 to 200. Jena Airfield, the only airfield in the province, had been seized and was being held by a well-equipped company-size guerrilla force. The Prime Minister of Mateke indicated his inability to secure the release of the U.S. nationals being held by Bowba and appealed to the United States to intervene in the rescue of the hostages. The President of the United States, in an official communiqué, declared that he had no alternative but to take the action necessary to rescue the Americans and to effect their safe evacuation from Bangia Province. Bowba in turn declared that he would assassinate all the hostages if Bangia was invaded.

The Joint Chiefs of Staff had tasked USSTRICOM to plan and conduct those operations necessary to comply with the President's decision. In response, Headquarters USSTRICOM activated a joint task force headquarters and



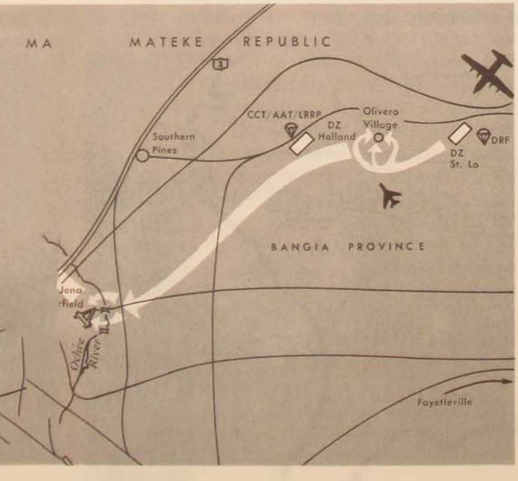
Command relationships, Exercise BOLD SHOT 3-67

Map 1. The geographical setting for USSTRICOM Joint Exercise BOLD SHOT 3-67

selected the following forces necessary to accomplish the mission: the Division Ready Force of the 101st Airborne Division—the 1st Battalion, 502d Airborne Infantry; a Psychological Operations Element from the Special Warfare Center at Fort Bragg, North Carolina; the 40th Tactical Fighter Squadron from Eglin AFB, Florida; reconnaissance elements from the 363d Tactical Reconnaissance Wing, Shaw AFB, South Carolina, and the 186th Tactical Reconnaissance Group of the Mississippi Air National Guard, Meridian, Mississippi; an Airlift Task Force consisting of 36 C-130 troop carrier aircraft from Dyess, Sewart, and Pope Air Force Bases; and two Airborne Forward Air Controller O-1E aircraft and crews from the Special Air Warfare Center at Eglin AFB, Florida.

The Division Ready Force (DRF) commander was designated as the Army forces commander (COMARFOR), and Headquarters Twelfth Air Force, Waco, Texas, provided the Air Force forces commander (COMAFFOR). The command relationship for the exercise was typical of the command structure normally utilized when a USSTRICOM joint task force headquarters is employed on BOLD SHOT exercises.

Map 2. *Concept and execution of Exercise BOLD SHOT 3-67*

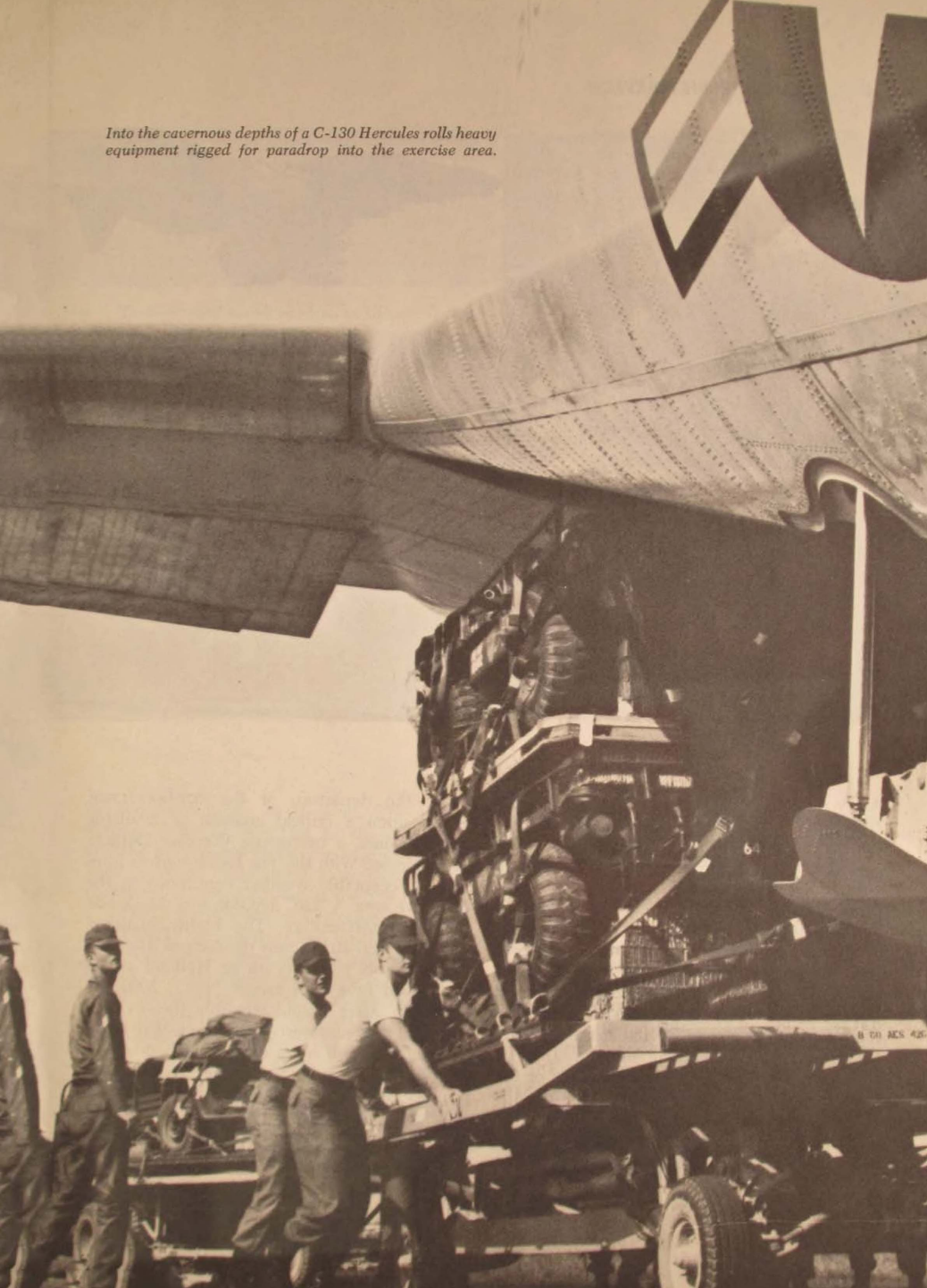


Early on the morning of 27 March, USSTRICOM forces were alerted by CINCSTRIKE through normal command channels. From this point on in time, the actions taken by participating units and personnel were characterized by speed, vigor, determination, and professionalism. The COMSTRIKEJTF and his staff moved by C-130 aircraft from their home station at MacDill AFB, Florida, to the designated staging base at Fort Campbell, Kentucky. Within five hours after the initiation of the alert, the COMSTRIKEJFT assumed operational control of the component forces and immediately commenced joint planning for the conduct of the operation with the COMARFOR and COMAFFOR.

By noon the next day the tactical fighter aircraft had closed at their forward operating base (FOB) at Seymour Johnson AFB, North Carolina; the tactical airlift aircraft were in position at Campbell Army Air Field, Fort Campbell, Kentucky; and the Tactical Reconnaissance Element had conducted prestrike photo reconnaissance in the objective area and delivered the completed photo products to the COMSTRIKEJTF. Operational planning by the COMSTRIKEJFT, component commanders, and staffs had been completed, and briefings were conducted at all levels to assure that all personnel were aware of their unit's mission and the part they themselves would be required to play during the operation. H-hour, D-day, was established as 0600 EST 29 March.

The concept of operations, which was jointly developed, envisioned an airborne assault at H-hour, D-day, with the DRF on Drop Zone St. Lo; the assault force would immediately seize objective Olivero and rescue the U.S. hostages interned there, move with dispatch to seize and secure Jena Airfield, and conduct a tactical withdrawal of forces from Jena Airfield and Bangia Province. All phases of the operation were to be supported by tactical air.

By early afternoon on D—1, 28 March, preparations for the operation were being finalized. Attention was now focused on a parachute infiltration of a joint force composed of an Air Force Combat Control Team and an



Into the cavernous depths of a C-130 Hercules rolls heavy equipment rigged for paradrop into the exercise area.

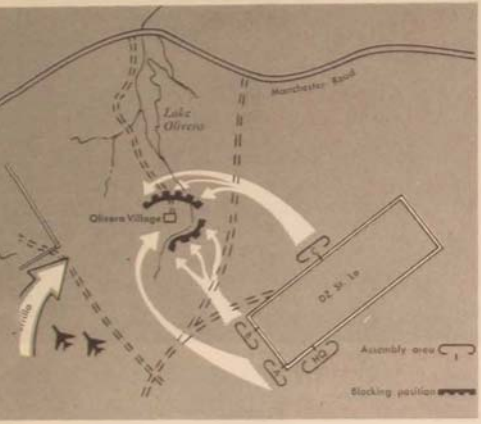
A Blue Beret forward air controller relays a call for an air strike. . . . An F-4 Phantom responds with a load of incindejel. . . . ZAP! Next target, please. . . .

Army Assault Team (CCT/AAT) into the objective area, which was scheduled during the hours of darkness that night. The mission of this joint team was threefold: (1) to parachute onto DZ Holland, located some distance from primary drop zone St. Lo; (2) move covertly overland to DZ St. Lo, to secure the approaches to the drop zone; and (3) be prepared to provide terminal guidance for the assault airlift aircraft during the DRF parachute assault on D-day. For the first time during a BOLD SHOT exercise, a Long Range Reconnaissance Patrol (LRRP) was to accompany the CCT/AAT. Its mission was to conduct reconnaissance of the approaches to Jena Airfield, as well as the airfield defense established by Bowba's guerrillas.

On the eve of D-day, thunderstorms and high winds in the objective area threatened to delay the departure of the CCT/AAT/LRRP. Based upon a critical analysis of available weather data, a USSTRICOM Weather Detachment located with the JTF Headquarters forecasted acceptable weather conditions in the objective area. A "Go" decision was then made by the COMSTRIKEJTF. The highly qualified C-130 tactical airlift crew discharged its group of infiltrators precisely on DZ Holland at the prescribed time over target (TOT), 2000 EST 28 March. After a rapid assembly, the CCT/AAT carefully and cautiously made their way to DZ St. Lo. Although some contact with guerrilla patrols did occur en route, they reached the primary drop zone in time to establish themselves for the DRF parachute assault. The LRRP in the meantime commenced its reconnaissance patrol to Jena Airfield, located approximately

"Partisan" forces plan an approach to the objective area.

3. Map 3. Three-pronged assault on objective Olivero, D-Day



25 kilometers from DZ Holland. The move, without delay or detection by the guerrillas, and the subsequent reconnaissance of the airfield defenses contributed materially to the successful accomplishment of the JTF mission.

On D-day, the first of 13 personnel assault airlift C-130 aircraft launched for the objective area, followed by nine heavy-equipment drop C-130s. The parachute assault force, consisting of 650 members of the 1st Battalion, 502d Airborne Infantry, and the JTF Headquarters advance echelon (ADVON), hit the silk over DZ St. Lo at H-hour. Once again the Airlift Task Force, with tactical fighters providing air column escort, displayed their accuracy by placing both personnel and heavy equipment right down the middle of the drop zone.

A flight of four F-4D fighter aircraft was on airborne station prepared, if necessary, to conduct preassault strikes, suppressive fire on the drop zone periphery during the parachute assault, and close air support for the DRF during their ground assembly following the paradrop. However, guerrilla resistance in the vicinity of the drop zone did not materialize sufficiently to warrant their employment.

The paratroopers were assembled with speed and vigor. To provide the COMSTRIKEJTF with timely intelligence, photographs of the initial objective, Olivero Village, were taken just prior to the airborne assault by a single RF-4 reconnaissance aircraft. They were quickly processed by a photo processing cell (PPC) at Shaw AFB, South Carolina, and delivered to the user in the objective area by a T-33 using the canister delivery system.

Out they go, down to a BOLD SHOT drop zone.

Bulk aerial delivery to forces on the ground

General Theodore J. Conway, USA, Commander in Chief, United States Strike Command, observes the exercise.

Because of Bowba's threat to assassinate the U.S. hostages if Bangia were invaded, it was necessary to accomplish the first phase of the ground operation swiftly before the guerrillas could react. The tactical plan for the seizure of the objective was basically simple, yet quite effective. Utilizing available cover and concealment, Company B and Company C maneuvered into blocking positions while Company A prepared to make the main attack to seize the village and liberate the hostages. Scattered guerrilla security elements took the lead elements of the DRF under fire on the outskirts of the village. The forward air controller called for tactical air support, which effectively stopped a guerrilla unit attempting to reinforce Olivero Village, thus enabling Company A to overrun the objective. The hostages were quickly prepared for the move to Jena Airfield. None had been assassinated, but some had been seriously wounded. The objective had been secured within four hours after the commencement of the parachute assault.

Taking advantage of the cover of darkness and using confiscated vehicles from Olivero Village to supplement the limited number of vehicles heavy-dropped into the objective area, the JTF and rescued hostages began a tactical shuttle movement toward Jena Airfield. Moving a company at a time and detrucking at a point selected by the LRRP, all elements of the force were able to close at an assembly area near Jena Airfield before daybreak on 30 March, D + 1. Guerrilla opposition to the JTF's move was in the form of ambushes, designed to gain time for reinforcement of the airfield defenses.

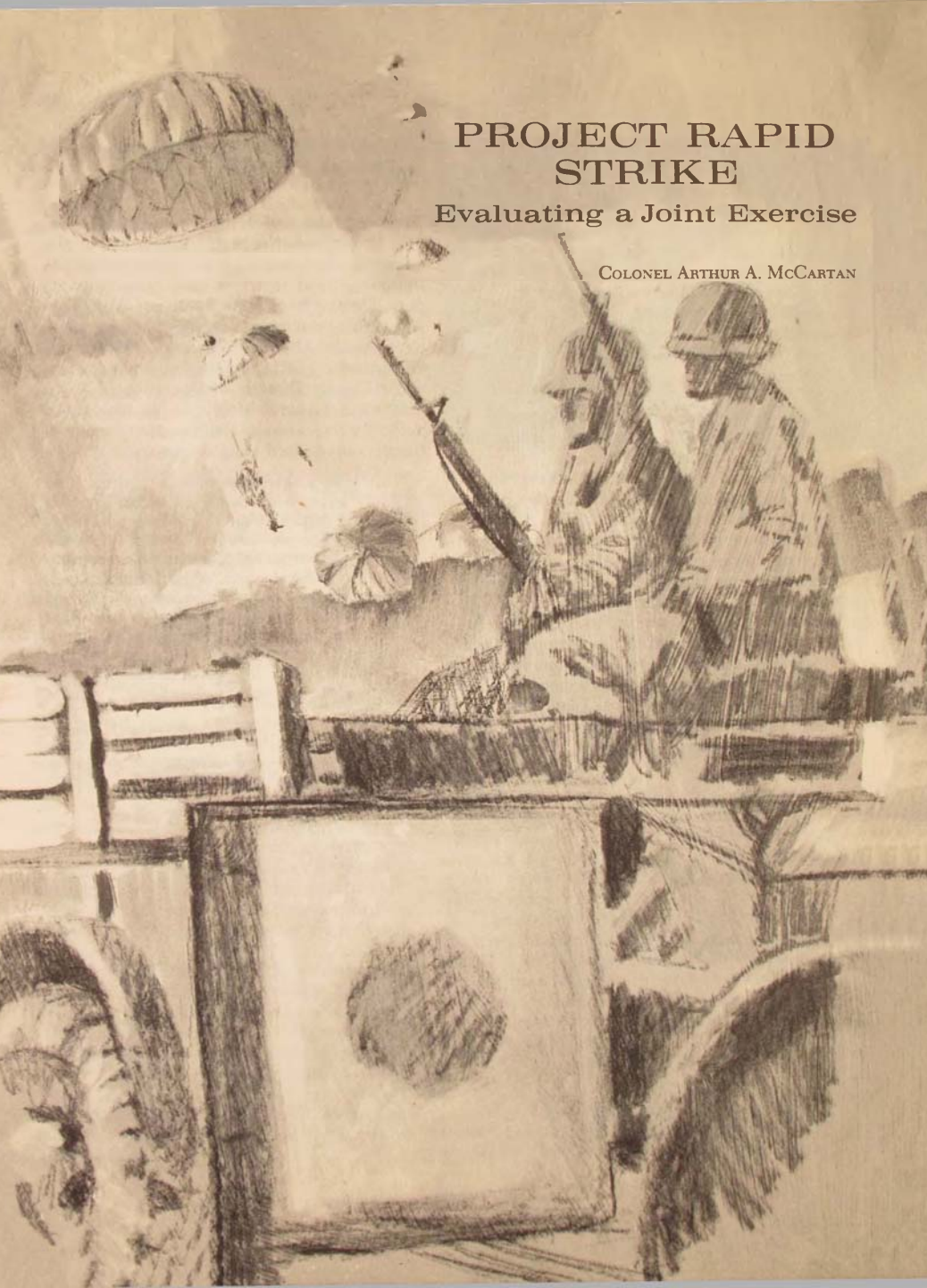
Prior to the assault to seize Jena Airfield, an emergency ammunition resupply mission for the DRF was flown. COMAFFOR, utilizing a

Paradropped men and mule get together and move into action.

PROJECT RAPID STRIKE

Evaluating a Joint Exercise

COLONEL ARTHUR A. MCCARTAN



PROJECT RAPID STRIKE, the third phase of a United States Strike Command evaluation program, included an examination of all Army and Air Force activities having a bearing on efficient and effective airdrop delivery of airborne units and their subsequent assembly. The project was designed specifically to test procedures and techniques necessary to achieve a higher density of paratroopers and heavy equipment on the drop zone and their rapid assembly into cohesive units ready for combat.

With the ever pressing and increasing possibility that an airborne force may at any time be introduced into combat, obviously the best possible techniques and procedures must be identified and employed by Army and Air Force units conducting joint airborne assault operations. Joint doctrine in the area of airborne operations has not kept pace with organizational and technological improvements. Changes in techniques, procedures, and organization over the past years have taken place piecemeal, largely without central focus or criterion against which each change could be measured to assure that each specific apparent improvement did not, in itself, have a detrimental effect on airborne operations in their entirety. Significant organizational changes and striking increases in combat equipment have occurred in airborne units. Concurrently, the Air Force has progressed from relatively slow and small aircraft, such as the C-119 and C-123, to the faster and larger C-130 and C-141, with accompanying, and sometimes forced, changes in capabilities and technical procedures. As a result of increases in total equipment and greater numbers of paratroopers per aircraft delivered during an airborne assault, as well as faster, larger aircraft, the parachuted force is now extended over a larger drop zone area, with many more items of equipment to retrieve. Follow-on assembly of the force on the ground is delayed by the increased problems of locating and derigging heavy equipment and assembling both personnel and equipment over extended surface distances.

Whereas much effort and expense have been concentrated on the airmobile concept and the development of associated units in recent years, no similar development and improvement program of major magnitude has been applied to joint airborne activities. When one realizes the contingency options offered by airborne and supporting Air Force units and the degree of national reliance placed upon this alert and ready joint tactical force, then the conclusion must be reached that procedures and techniques employed must keep pace with equipment changes, and current training must be in consonance with all three.

Close observation and evaluation of airborne forces during a continuing series of USSTRICOM BOLD SHOT readiness exercises over the past two years have pointed up an urgent need for substantial improvement in achieving sufficient density of paratroopers and their equipment on the drop zone to ensure a capability for rapid assembly into airborne units ready for combat.

To test and evaluate those service-recommended procedures and techniques designed to improve drop density and more rapid assembly, CINCSTRIKE directed that Project RAPID STRIKE be conducted on a carefully documented and scientific basis.

the task

Analysis of the broad task of achieving adequate paratrooper and equipment density on the drop zone and more rapid unit assembly indicated the need to examine the following primary operational matters:

Aircraft formations. A search for the optimum assault airlift formation to maximize paratrooper and equipment delivery rates on the drop zone and at the same time retain tactical flexibility while en route to the drop zone, during the final approach to the drop zone, and throughout the recovery phase of the mission.

Integration of the C-130 and C-141 in simultaneous assault airlift operations. An investigation into alternative methods of employing these two types of airlift aircraft to drop paratroopers and heavy equipment on single and multiple drop zones in a closely integrated operation.

Assault aircraft loading. An investigation into the comparative advantages of two meth-

ods: either cross-loading personnel of different units in single aircraft and dropping equipments of several units on multiple impact points, so that personnel and equipment of a specific unit land in a specified area; or straight loading of personnel of one unit in a single aircraft and employing a single heavy-equipment impact point, thus placing that unit down the entire length of the drop zone.

Drop sequence. A determination of the relative merits of dropping personnel first or dropping equipment first, and the effects of this determination upon serial separation.

three-phase test and evaluation program

Certain operational matters could economically be examined in relative isolation by USSTRICOM Component Forces, USARSTRIKE and USAFSTRIKE, prior to review by CINCSTRIKE in a larger joint test environment. Accordingly, a three-phase program was accomplished during the first half of 1966.

PHASE I

Phase I, conducted at Sewart Air Force Base, Tennessee, 14–25 February, under control of the Tactical Air Command's Tactical Air Warfare Center, Eglin AFB, Florida, investigated the feasibility of modifying present assault airlift formation tactics to increase the density of paratroopers landing on the drop zone, thereby decreasing the total time for force delivery and contributing to more rapid assembly.

Phase I tests were conducted with up to 18 C-130 aircraft to determine whether, by varying formations, sizable numbers of aircraft could be flown accurately over a drop zone in less time than that presently required for similar numbers of aircraft employing the standard assault airlift in-trail formation configuration. (Figure 1) Army paratroopers rode in the C-130s to observe aircraft stability from a jumper's viewpoint.

The tests investigated the effects of

—reducing the interval between aircraft from 2000 feet (approximately ten seconds' separation) to 1000 feet (approximately five seconds), thus doubling the number of aircraft over the drop zone in a given period of time;

—employing two parallel in-trail formations simultaneously over a single drop zone, thus doubling the delivery rate; (Figure 2)

—employing multiple routes and approaches to the drop zone to reduce the size of each formation and the vulnerability of the entire air column during the enroute portion of the airborne operation;

—reducing drop airspeed below 125 knots, thus reducing the length of each stick of parachutists on the drop zone and reducing the dispersion of equipment.

As a result of this brief test, employing minimum essential resources, CINCAFSTRIKE reached these conclusions:

a. Reduction of the interval over the drop zone from 2000 feet separation (ten seconds)

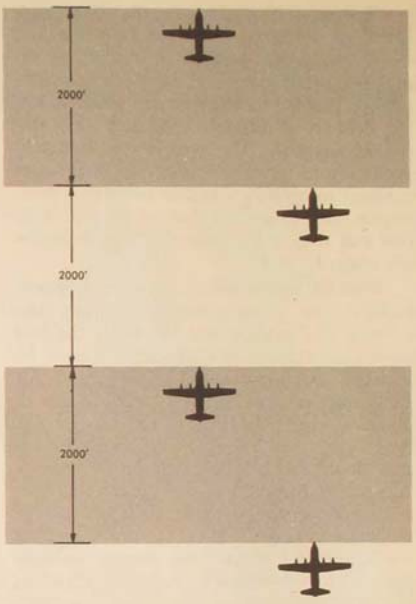


Figure 1. In-trail formation configuration

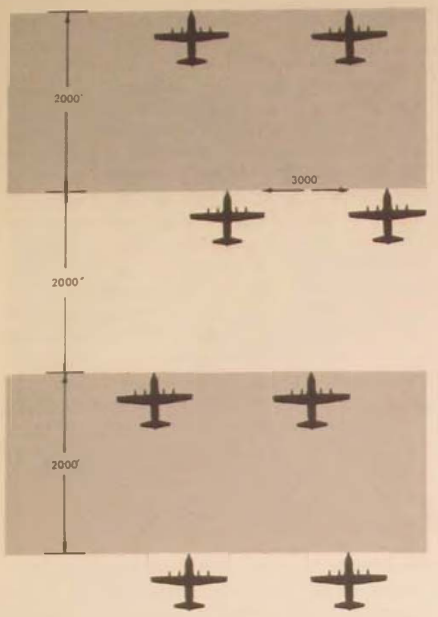


Figure 2. Parallel in-trail formation configuration

to 1000 feet separation (five seconds) is not feasible. Aircraft controllability and jump platform stability are detrimentally affected by increased turbulence in the condensed in-trail formation. Employing reduced-interval formations provided only slight improvement in density on the drop zone.

b. Employing two parallel formations to increase paratrooper density over the drop zone is feasible, providing a minimum lateral distance of 3000 feet between impact points and therefore between parallel streams is maintained. However, flexibility and maneuverability are compromised during the final run-in, and an extra wide drop zone is required.

c. Multiple routes and approaches to the drop zone enhance force survivability and are feasible either in conjunction with single formations or the parallel formation. Formation rendezvous time tolerance over the initial point is critical.

d. Reducing the drop airspeed below 125 knots for C-130s in formation was not considered safe by test personnel and was not attempted.

Phase II

Phase II was conducted at Fort Bragg, North Carolina, on 21–25 March 1966, under control of the XVIII Airborne Corps. This test phase investigated the effects of various aircraft loading and airborne unit assembly techniques. To facilitate rapid assembly, various personnel, equipment, and area assembly aids were introduced.

USAFSTRIKE employed 25 C-130s to support USARSTRIKE's test series of three separate battalion-size drops of personnel and equipment. All drops were made from the standard in-trail assault airlift formation. Conclusions reached by USARSTRIKE were that unit assemblies adjacent to the drop zone can be accomplished more rapidly by using the following drop and assembly procedures:

a. Cross-load single aircraft and/or aircraft elements for the arrangement of personnel, and use multiple impact points for associated heavy equipment. (Primary-type heavy equipments associated with the airborne battalion were the 105-mm howitzer and prime mover, 106-mm recoilless rifle, ¼-ton truck and trailer, field ambulance, and the Army mule.)

b. Drop door bundles from any aircraft in the formation and from any position in the stick so that these heavy, cumbersome bundles are placed close to an associated unit assembly area. (Door bundles contained those items of equipment or supplies assigned to combat units which were too heavy or bulky to be carried by individual paratroopers during a jump, e.g., the 81-mm mortar and base plate, sand-filled boxes to simulate ammunition and rations.)

c. Although heavy equipment can be dropped over paratroopers on the drop zone with an acceptable degree of risk, the separation time between the personnel and the heavy-equipment flight serials is critical and is something greater than 5 minutes and less than 15 min-

During Exercise **RAPID STRIKE**, *C-130s in V's-in-trail formation delivered paratroopers of an infantry battalion (reinforced) onto the drop zone at the rate of 11 men per second. . . . An Army mule is palletized for airdrop, with ammunition loaded directly on the pallet.*

utes, the present standard serial separation time employed in training.

d. Remaining aircraft retain original positions in formation whenever an aircraft is forced to abort. This procedure permits personnel previously dropped on the drop zone to identify visually the aborted aircraft position in the formation stream and make immediate adjustments to compensate in assembly and attack actions for the personnel and/or equipment that could not be dropped. Although only the assault in-trail formation configuration was employed during the three live drops of Phase II, it was suggested that a more dense aircraft formation, such as the V of V's, could contribute to more rapid assembly.

e. Drop personnel and equipment at one altitude. Personnel and equipment drops from 1000 feet were successful with the exception of piggyback mule loads. This was considered a minimum practical peacetime drop altitude.

f. In reference to markings, there is a definite assembly advantage if all personnel assigned to a unit wear a temporary distinctive unit marking, such as a tape over or around the helmet. Heavy equipment loads can be located and identified more readily if distinctive unit markings are placed on the bottoms of drop platforms as well as on the front, rear, sides, and top of each load. Finally, the marking of unit assembly areas with tethered balloons or smoke streamers assists rapid assembly. Unit assembly area marking is accomplished by members of the Army assault team who have been clandestinely dropped with the Air Force Combat Control Team in some near area and infiltrated overland to the drop zone, prior to the main airborne assault.

Phase III

Phases I and II were unilaterally conceived tests with each service providing mutual support to the other as necessary. Forces involved were small and the duration of each examination necessarily brief. Following a thorough review of the separate and somewhat limited results of the first two test program phases, and with full realization of the broad impact that significant findings might have on future joint airborne operational and training requirements, CINCSTRIKE directed a thorough testing and evaluation of all associated aspects of joint airborne operations. The resultant Phase III, Project RAPID STRIKE, provided a series of ten joint field experiments that permitted careful scientific documentation. This documentation formed a basis for verification or disqualification of those procedures and techniques developed separately by service agencies in Phases I and II and for additional innovations that were natural developments of the earlier phases.

CINCSTRIKE assigned responsibility for this phase to Brigadier General William G. Moore, Jr., USAF, who commanded Joint Task Force RAPID STRIKE in the experiments conducted in the military complex of Pope AFB/Fort Bragg, 15 May–2 June 1966, using the following organization:

a. STRIKE JTF RAPID STRIKE Headquarters, including attached operations analysts, evaluators, and photographers.
b. Army forces (ARFOR):
   1. Brigade Headquarters
   2. Two airborne infantry battalions (reinforced).
c. Air Force forces (AFFOR):
   1. AFFOR Headquarters
   2. Troop carrier force
      (a) Forty-five C-130 aircraft (USAFSTRIKE)
      (b) Six C-141 aircraft (MAC).

Purpose. COMSTRIKEJTF RAPID STRIKE was directed to test and evaluate ways and means to achieve a higher density of paratroopers and heavy equipment on the drop zone and their rapid assembly into cohesive units ready for combat. He was also required to identify areas needing further study or evaluation beyond Phase III.

Specific objectives. Specific objectives established for Phase III, RAPID STRIKE, were as follows:

a. Determine the most feasible, practicable, and efficient formation or formations to achieve rapid and accurate placement of parachutists and essential combat equipment on the drop zone.

b. Determine the most efficient techniques

and procedures for rapid assembly of parachutists and essential combat equipment into a viable fighting force after landing.

c. Identify and make recommendations concerning areas needing further study, test, or evaluation within the USSTRICOM, the services, or research and development agencies of the Department of Defense.

Scope and methodology. Practical consideration of force availability and overall costs caused the scope of Phase III, Project RAPID STRIKE, to be limited to the minimum number of experiments necessary to provide an acceptable level of confidence for the data collected. Eight basic field experiments, employing two battalions alternately and from 22 to 45 C-130 aircraft, were determined to be the minimum essential to satisfy the specific objectives. In the interest of economy, heavy drops were simulated on four events by prepositioning heavy equipment in a fully rigged configuration in varied patterns on the drop zone. Three experiments employing a combination of C-130 and C-141 aircraft were added in order to examine other areas, such as

—utilization of C-141 aircraft in combination with the C-130 in the airborne assault role

—employment of a larger assault force (brigade)

—a variation of the in-trail formation (augmented-in-trail)

—effects upon unit assembly times of conducting an airborne assault over unfamiliar terrain.

A bonus return from these three additional events was the collection of additional confirmatory data similar to those obtained from the basic series of field experiments.

A Joint Evaluation Group of approximately 80 Army and Air Force officers and noncommissioned officers recorded detailed data concerning the following:

a. Times required to drop the personnel and equipment of an airborne Division Ready Force (DRF).

b. Locations of personnel and equipment on the drop zone with reference to intended impact points.

c. Times required to locate and derig heavy equipment.

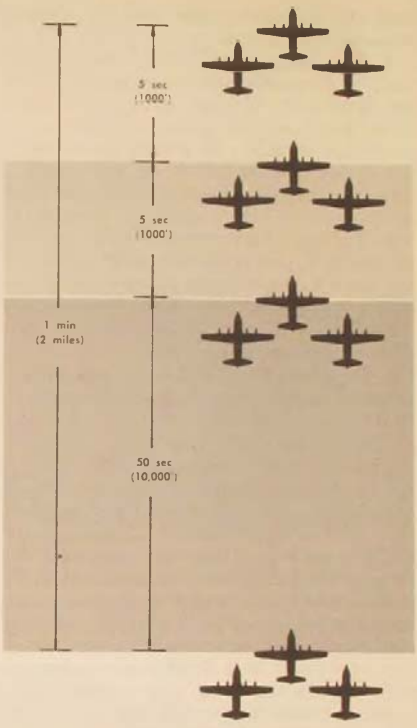


Figure 3. V's-in-trail formation configuration

d. Times required to assemble company-size units at designated assembly areas adjacent to the drop zone.

e. In-flight data such as aircraft formations, timing, speed and altitude during drop, degree of turbulence en route to and over the drop zone, adherence to the computed air release point (CARP) procedures, circular error average, visibility, and safety factors.

About twenty Army and Air Force photographers recorded specific and general events during all airdrops, using a variety of equipment—16, 35, and 70-mm motion picture

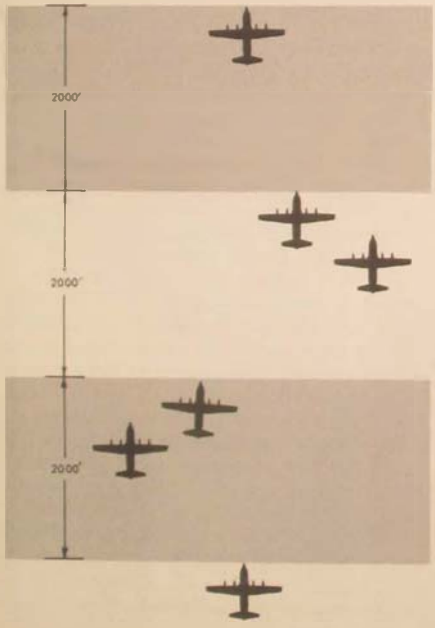
cameras, hand-held and stabilized mounts, timeframe cameras, and still cameras.

The Chief Scientist, USSTRICOM, the principal technical adviser to the JTF commander, directed activities of the operations analysts, reviewed data for completeness and accuracy, and assisted in the preparation of the final written and film reports.

discussion and findings

Of the number of airborne assault techniques subjected to thorough scrutiny in Joint Exercise RAPID STRIKE, only those of principal concern to the Air Force will be discussed: assault airlift formations, integration of the C-130 and C-141 in simultaneous assault airlift operations, assault aircraft loading, and drop sequence and serial separation.

Figure 4. Augmented-in-trail formation configuration



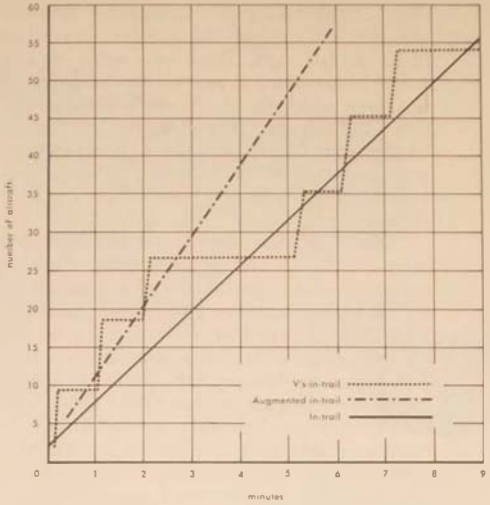


Figure 5. Comparative rates of delivery

Assault airlift formations. The three C-130 aircraft formations employed during the series of experiments were the in-trail, V's-in-trail, and augmented-in-trail, which are depicted graphically in Figures 1, 3, and 4. The average paratrooper delivery rates per second for the three C-130 formations engaged in the delivery of an infantry battalion (reinforced) are as follows:

in-trail	7 paratroopers/sec
V's-in-trail	11 paratroopers/sec
augmented-in-trail	10 paratroopers/sec

If larger than battalion-size airborne units are employed, the number of C-130s required increases; and as this occurs, the rates of delivery change in favor of the augmented-in-trail and in-trail formations. In Figure 5, it can be seen that at a total of 27 aircraft, the rates of delivery of the augmented-in-trail and the V's-in-trail are equal. Now the in-trail and V's-in-trail are also equal but at a slightly later point in time. The steps in the V's-in-trail curve are reflec-

tions of the time-space separations between elements of 9 aircraft each and between serials of 27 aircraft each. These time-space separations are necessary to provide flexibility in the maneuver of blocks of aircraft in close formation. In-trail and augmented-in-trail formations require no such time-space interruptions, as maneuver of the formation is accomplished essentially by individual aircraft flying in a stream.

The formations flown and the indicated rates of delivery had no measurable effect on personnel or equipment assembly throughout the numerous battalion and brigade airdrops. This is not to say that delivery rates do not affect unit assembly, but it does indicate that differences in delivery rates of a reinforced battalion or brigade by any of the formations examined are so slight that the contribution to rapid assembly, if any, could not be detected. Although high initial density of personnel and equipment on the drop zone may have other tactical significance, it alone does not contribute to rapid unit assembly within the context of the RAPID STRIKE experiments.

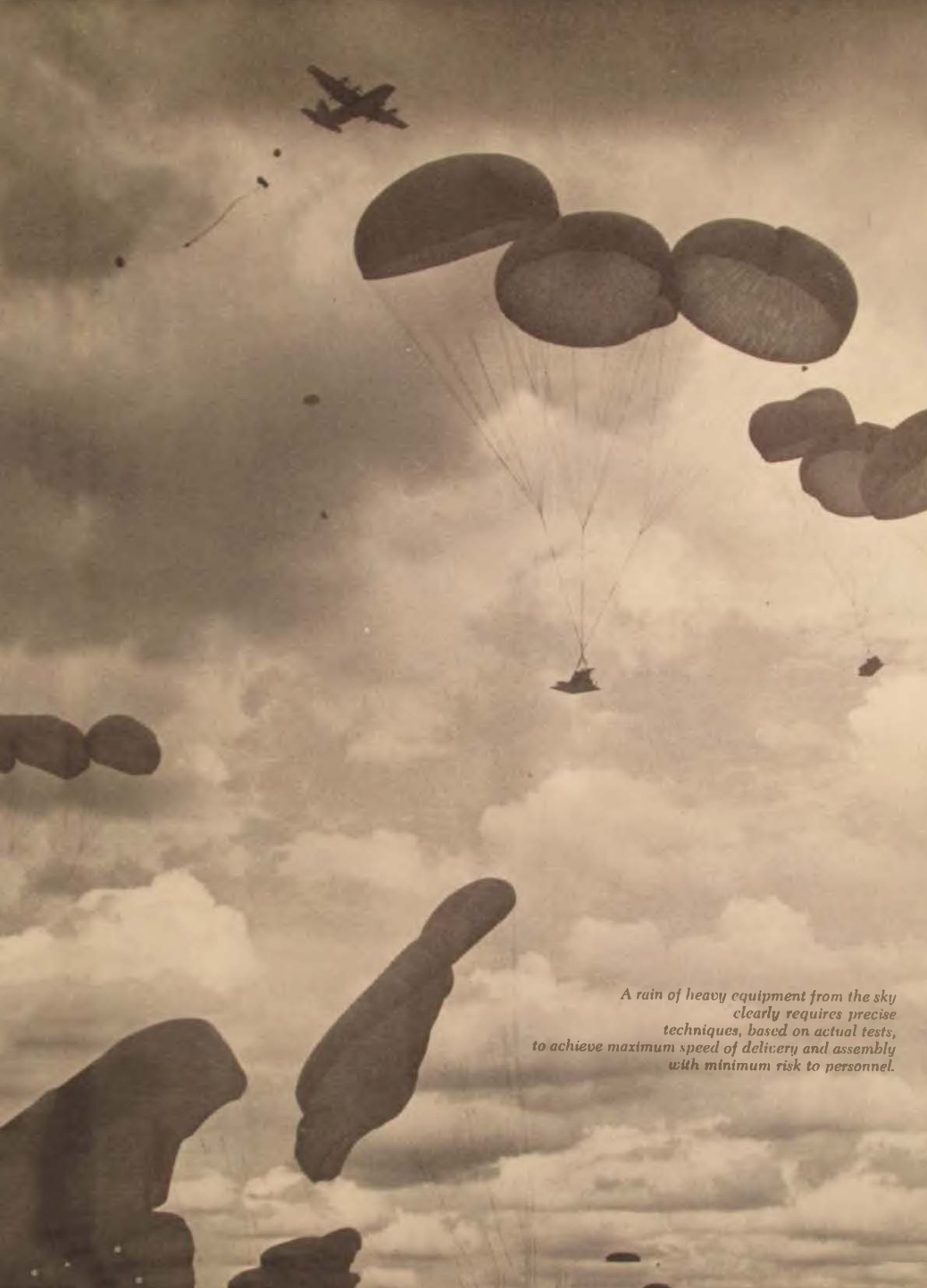
In an actual airborne combat operation, if the choice of drop zones is limited and if an organized defense is encountered and engaged from the outset and prior to unit assembly, density of personnel and equipment on the drop zone could take on tactical significance. Maximum firepower would be essential. Such a venture would likely not be undertaken knowingly unless there was no other choice, and then tactical air support would be employed prior to and in conjunction with the initial and follow-on phases of the airborne assault.

Each of the formations tested has distinctive vulnerability factors for the enroute phase of the operation and for the flight over the drop zone. Although only a few bits of data taken during RAPID STRIKE contribute to an understanding of vulnerability factors, it was possible to apply a theoretical mathematical approach to the three formations employed, their airspeeds, altitudes, and ability to maneuver around known or suspected ground fire sites, and thus to arrive at relative vulnerability figures for the three formations. Both the in-trail and the augmented-in-trail formations permit lower enroute altitudes and higher speeds than does the V's-in-trail formation. The V's-in-trail formation, however, may have three aircraft in a ground-fire envelope simultaneously, thereby splitting the firepower on any one aircraft, whereas the in-trail formation, consisting of a stream of single aircraft ten seconds apart, may permit concentrated fire on one aircraft at a time, although for a relatively short time. Over the drop zone, however, each formation flies at or near 1000 feet altitude and 125 knots airspeed, and only the differences in length of the air columns contribute to differences in vulnerability. Suppressive and destructive fire from friendly aircraft would be concentrated in the vicinity of the drop zone to reduce the vulnerability of the joint airborne force in that area.

No factor evolved from RAPID STRIKE which suggests that any one airlift formation offers overriding advantage over the others. The augmented-in-trail formation, demonstrated for the first time in this exercise, gives delivery rates comparable to the V's-in-trail for a reinforced battalion-size force. At the same time it retains much of the flexibility of the in-trail formation and requires little or no additional aircrew training. The augmented-in-trail and the in-trail formations are adaptable to future all-weather delivery concepts incorporating station-keeping equipment. The V's-in-trail, on the other hand, would be cumbersome under marginal weather conditions and might be disastrous under thick weather conditions.

With reference to formations demonstrated, it was concluded that each was adequate to assure rapid assembly of personnel and equipment; however, none demonstrated any measurable advantage over the others in terms of density of drop. Each type of formation, employing drop altitudes of 1000 feet for personnel and equipment, resulted in accurate drops. Revision of certain rigging procedures may permit standardizing heavy-equipment drop altitudes at 800 feet or lower, which would contribute to even greater accuracies and to more rapid assembly.

Integration of the C-130 and C-141 in simultaneous assault airlift operations. As indi-



A rain of heavy equipment from the sky clearly requires precise techniques, based on actual tests, to achieve maximum speed of delivery and assembly with minimum risk to personnel.

A C-141 of the Military Airlift Command tests airdrop techniques in cooperation with USAFSTRIKE. . . . Paratroopers derig a 105-mm howitzer, ammunition, and prime mover.

An airdropped jeep is readied for action.

cated in the earlier description of Phase III, Joint Exercise RAPID STRIKE, six C-141s of the Military Airlift Command joined the 45 C-130s of USAFSTRIKE for the final three events: two reinforced battalion airborne assault operations, and one brigade-size operation. These live field experiments, although the first attempts at integration of these two aircraft, did indicate the feasibility and practicability of their simultaneous use in assault airlift operations.

Integration of the C-141 aircraft with the C-130 proved particularly feasible in the vicinity of the drop zone. The two types of aircraft operated at compatible airspeeds and maintained proper spacing; however, basic design characteristics and fuel consumption differentials made a lengthy joint formation en route to the drop zone undesirable. The use of separate routes, speeds, and altitudes to a rendezvous point for join-up and drop is necessary to obtain maximum efficient performance from the two aircraft types.

While the C-141 has approximately double the capacity for personnel and equipment of the C-130, it was not possible to exploit this differential to provide higher density of paratroopers and their equipment on the drop zone. Delivery methods, as demonstrated, required either multiple passes over a single drop zone or the use of two separate drop zones. No attempt was made to drop an entire C-141 load of 120 paratroopers in a continuous line because the ground pattern that would have resulted was deemed tactically unsound. Restricted to a drop zone normally associated with the C-130, the C-141 was forced to make two passes on the same drop zone, discharging 60 paratroopers on each pass. The total time involved in this technique included the go-around time, resulting in a much slower overall paratrooper delivery rate than that demonstrated by the C-130.

Although the troop compartment space in the C-141 is approximately twice that of the C-130, the space available aft of the paratrooper in each aircraft is approximately the same. The Division Ready Force of a reinforced battalion normally carries with it 29 door bundles weighing 300 to 400 pounds each. Equally distributed, this averages approximately two bundles per C-130 or four bundles per C-141. Manhandling these bundles near open jump doors requires space as well as manpower. Space is extremely critical in the C-141; however, overhead rails might relieve

the space and the handling problems to some degree. Techniques to significantly reduce paratrooper stick exit time and door bundle discharge time are required to capitalize on the larger capacity of this aircraft.

On one RAPID STRIKE event the C-141 was employed in the heavy drop role. Because of the length of the aircraft and the length of the tail aft of the main ramp, a 120-foot extraction line is required. On five and six platform drops from a single aircraft, the extended times between successive heavy drop platforms resulted in significantly longer and less dense heavy drop patterns on the drop zone. Certainly the state of the art must be extended to provide a positive discharge system that will contribute to greater density of heavy equipment on the drop zone and, as a bonus, be more reliable and accurate.

In spite of the differing characteristics of the C-130 and C-141, their integration in the airborne assault role is feasible. Since this was an initial attempt to employ these aircraft simultaneously in the airborne assault role, there is obviously a fresh challenge to study and develop integrated tactics of various mixes of C-130s and C-141s in assault airlift operations.

Assault aircraft loading. Two basic C-130 arrangements for personnel and equipment were examined: straight loading and cross-loading. The term "straight loading" applies to the technique of placing personnel of only one unit (e.g., personnel of A Company) in an aircraft designated for that unit. The term "cross-loading" applies to the technique of mixing units (e.g., personnel of A, B, and C Companies) in each aircraft so as to drop increments of each company in sequence and at specific locations down the length of the drop zone.

In Joint Exercise RAPID STRIKE the average exit time for a stick of 31 paratroopers, including door bundles, was 44 seconds. Sticks exited the two personnel jump doors simultaneously. At the normal drop speed of 125 knots, one second equates to 70 yards of flight. Individual parachutists in each stick landed about 100 yards apart. When A Company was straight-loaded it had personnel distributed over 3100 yards of varying terrain, while the company's heavy equipment was dropped on an impact point near the center of the long narrow drop pattern. When A, B, and C Companies were cross-loaded, each had 20 or 22 paratroopers on a single aircraft. A Company personnel were dropped in the first third of the total drop pattern, B Company in the next third, and C Company in the last third. Successive aircraft, carrying personnel of those companies, rapidly dropped increments of the three companies in the same respective sectors. Heavy equipment for each company was dropped in the appropriate company sector of the drop zone from straight-loaded C-130s. The cross-loading technique theoretically permitted three times the concentration of company personnel and placed more of the company personnel closer to their equipment than the straight-loading method. In actuality, the cross-loading technique for personnel and the use of associated multiple impact points for heavy equipment did significantly speed up the personnel assembly of each company and did reduce confusion and congestion on the drop zone. However, data did not substantiate a similar finding for more rapid equipment assembly.

Of course a mandatory prerequisite for rapid assembly is drop accuracy, whether on one impact point or on multiple impact points. When one considers the average ground speed of the combat-loaded paratrooper to be about three miles per hour or approximately 100 yards per minute, and the distance he must travel from his impact point to his unit assembly location off the drop zone, the need for airdrop accuracy is apparent. The distance reflected by one second of flight is roughly equivalent to 60 seconds of surface travel and exposure on the drop zone. Aircrews of MAC and USAFSTRIKE had opportunities to practice formations and run-ins to the drop zones prior to and between various live drop events. Overall crew training was excellent. Crew proficiency coupled with the 1000-foot drop altitude for both personnel and equipment did reflect in excellent drop accuracies. A circular error average of 123 yards was recorded for the lead paratrooper of each element lead, and a circular error average of 152 yards was recorded

for the first item of each element lead dropping heavy equipment. If the ability to drop accurately is lost through inadequate training or for any other reason, the refinements of cross-loading techniques are of little value.

Drop sequence and serial separation. Any airborne force commander has the choice of dropping his personnel first or his equipment first. In the case of a large airborne force there could be a critical time in which some personnel would be on the drop zone without benefit of their heavy equipment. If equipment were dropped first, some of it could lie relatively unprotected for a critical length of time until personnel were dropped, disengaged themselves, and derigged and manned their heavy equipment.

Those who support dropping personnel first cite, among other reasons, the advantage of having personnel on the drop zone to identify and locate specific heavy equipment loads as they descend to the ground. Personnel can begin positioning themselves so that derigging may commence as soon as the heavy drop is complete. The primary disadvantage of this sequence is that a definite safety time delay is necessary between the last aircraft of the personnel serial and the first aircraft of the equipment serial, to insure that paratroopers on the drop zone have time to disengage from their parachutes and clear the drop zone. Present standards require a 15-minute interval for this purpose; however, in RAPID STRIKE the interval was reduced to five minutes. The majority but not all paratroopers had cleared the drop zone in this five-minute period.

Of course, the primary advantage of dropping equipment first is the reduction of the interval between the equipment serial and the personnel serial. This interval was reduced to two minutes in RAPID STRIKE. Paratroopers have a brief interval during descent to scan for and locate specifically marked heavy equipment. Once on the ground and disengaged from their chutes, those who have identified their assigned equipments can head directly for them.

Data from the multiple experiments show that when personnel are dropped first, assembly times for the first 50 percent of the unit personnel are improved; however, this effect rapidly diminishes for the assembly of the last 50 percent. The delay factor in equipment assembly approximated the time interval between completion of the personnel drop and the beginning of the heavy-equipment drop in each case.

In a tactical situation where the commander requires his heavy equipment as early as possible, or where it is desirable for any reason to shorten the total air column length, RAPID STRIKE results suggest he drop equipment first, then personnel. On the other hand, where assembly of at least certain of the airborne rifle companies near the drop zone is important and immediate recovery of heavy equipment is less critical, RAPID STRIKE results suggest that personnel be dropped first. RAPID STRIKE data do not suggest a single standard drop sequence. The choice of drop sequence, therefore, is one that the tactical commander should make, based upon his plan of action and the tactical situation at or near the time of the airborne assault.

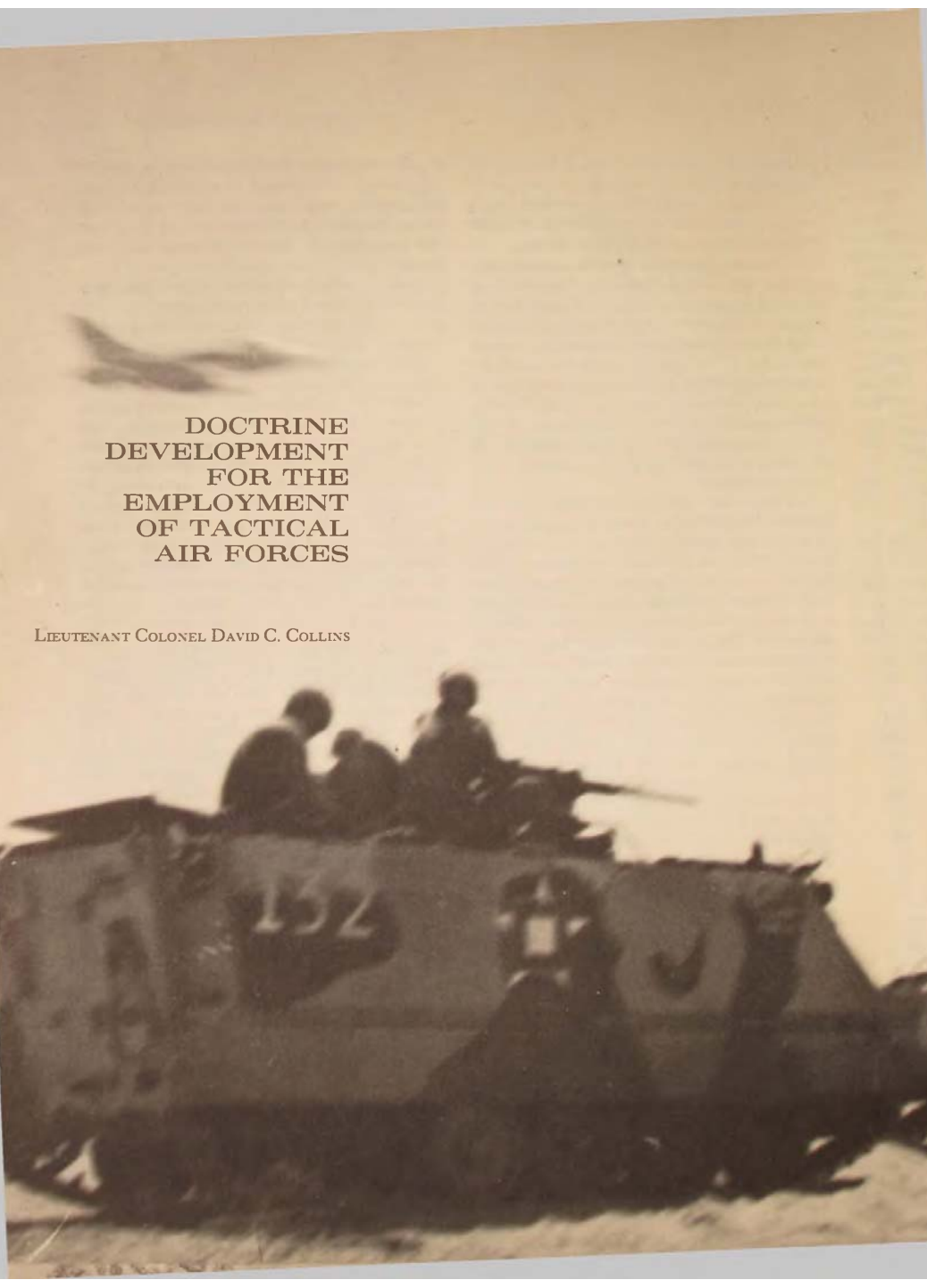
AS A RESULT of Joint Exercise RAPID STRIKE, a body of quantitative data on airborne assault operations now exists. The data contributing to rapid assembly are based upon several formations: the in-trail, augmented-in-trail, and V's-in-trail; and upon the two capable aircraft that make up the bulk of the airlift fleet: the C-130 and the C-141. Unfortunately, existing data are limited to daylight operations only, to pre-surveyed drop zones, and to a single tactical scenario. In recent USSTRICOM BOLD SHOT readiness exercises, supplemental data have been recorded on the effects of strange and unfamiliar drop zones and upon a variety of tactical situations. Still required are data on night airborne assault operations and on the ability to perform accurate station-keeping and blind positioning for all-weather drops.

Future USSTRICOM BOLD SHOT exercises will continue to add to the data now available. This large body of valid information is of greatest value when applied to the constant and necessary task of revising and updating joint airborne operational methods, procedures, and techniques for future combat use.

Hq United States Strike Command

DOCTRINE DEVELOPMENT FOR THE EMPLOYMENT OF TACTICAL AIR FORCES

Lieutenant Colonel David C. Collins



STATEMENTS by leaders at all levels concerning military operations in South Vietnam are unanimous on one subject: air power is being applied more effectively in joint Army–Air Force operations than in any past war. Many reasons are readily apparent for this endorsement—improved aircraft capabilities, better training, improved communications support, and others equally well known. One that has received little recognition, however, concerns the intensive effort by the Tactical Air Command during recent years to develop improved doctrine for the employment of tactical air forces.

Air Force Manual 11-1, *Air Force Glossary of Standardized Terms and Definitions*, defines doctrine as: "Fundamental principles by which the military forces or elements thereof guide their actions in support of national objectives. It is authoritative but requires judgment in application." From this definition, we can isolate three basic elements of doctrine. First, it consists of fundamental principles; second, it guides the actions of military forces; and third, it supports our national objectives. The first two of these elements are readily recognized and widely accepted. The third, however, is less well known.

Military forces are maintained to support national objectives. National policies, as expressed by the executive and legislative branches of our government, determine the means by which we seek to achieve our national objectives. Thus, a change in national strategy can generate a requirement for new doctrinal concepts regarding the employment of our forces. A prime example of this occurred in 1960. International political trends indicated that future armed conflicts were most likely to be limited wars that would not involve the employment of nuclear weapons. Accordingly, U.S. military strategy changed from massive retaliation to flexible response. This reorientation of our strategy for future warfare created a requirement for a careful examination of individual service concepts for the conduct of operations. It was evident that significant military operations in the future would involve forces of at least two services and that the ground battle could again assume a major role in any conflict. Consequently, the increased emphasis on conventional munitions for fighting limited wars had its most stunning impact on the Army and the Air Force.

It was only natural that some divergence of opinion between these services would result from such a major change in concept. Under the atomic concept, the Army had been relegated, in the minds of many, to a police-force role following the air delivery of nuclear weapons, which would be the decisive phase of the war. Air Force thinking had been centered around its strategic retaliation capability for general war and the Composite Air Strike Force (CASF) concept for limited war. The change in national emphasis from nuclear to conventional weapons caused both the Army and Air Force to develop concepts for increasing the mobility and combat effectiveness of Army forces. The Army wanted to divest itself of the need to depend exclusively on the Air Force for all its close air support, reconnaissance, and airlift support. The Air Force, on the other hand, while indorsing the need for increased mobility for the Army, felt that such mobility should be provided by each service's contributing those capabilities that it was best organized, equipped, and trained to perform.

The reader will recognize the preceding sentences on Army and Air Force positions as being generalized statements of the results of the Army Tactical Mobility Requirements Board and the USAF Tactical Air Support Requirements Board, commonly referred to as the Howze Board and Disosway Board, respectively.

A major recommendation of the Disosway Board was that extensive joint testing and war gaming be conducted to determine the best method of providing increased Army mobility. Tactical Air Command was directed to develop comprehensive Air Force concepts for the employment of tactical air forces in anticipation of such tests. This involved a major study effort by TAC and led to the formation of the Tactical Air Warfare Center (TAWC) at Eglin AFB, Florida, with the mission of developing and refining tactical air concepts and capabilities for Air Force participation in joint operations.

These concepts were given extensive tests both unilaterally and under the auspices of United States Strike Command. The tests of Air Force concepts culminated in Joint Exercise Gold Fire I, conducted by CINCSTRIKE in the fall of 1964.* Although the Air Force's basic concepts were proved valid, Army aviation was greatly expanded to provide vastly increased numbers of helicopters and a limited number of short-range reconnaissance and airlift vehicles.

During this period Tactical Air Command undertook a major revision of the seven Air Force doctrinal manuals dealing with tactical air operations. The timing of this endeavor was very appropriate, for TAC was able to include in these manuals the latest concepts and doctrine that reflected the lessons learned in the tests just mentioned. Although these revised manuals adequately fulfilled the immediate requirement for current unilateral Air Force doctrine, they did not fill the void which then existed in doctrine jointly agreed to among the services.

The Air Force took a positive step to fill this void in early 1963 when Air Force Regulation 1-1, "Responsibilities for Doctrine Development," was published. One of the primary purposes of this regulation was to clarify and assign the responsibility for developing, coordinating, and establishing doctrine and procedures for joint operations. Tactical Air Command was assigned responsibility for developing doctrine in coordination with designated agencies of the other services in the following areas:

Air defense from land areas other than continental United States

Tactics, techniques, and equipment of interest to the Air Force for amphibious operations

Procedures and equipment employed by the Air Force forces in airborne operations

Close combat air support of ground forces

Tactics, procedures, and equipment employed by air forces in counterinsurgency operations.

TAC immediately opened negotiations with the Army Combat Developments Command (CDC) to develop joint doctrine manuals on those subjects of primary interest to the Army and Air Force. CDC was not only receptive to the idea but eager and enthusiastic. Working together, TAC and CDC prepared draft manuals on airborne operations, tactical air support of land forces, and air defense from overseas land areas. This effort constituted the first major attempt by the Army and Air Force to reach agreement on joint tactical doctrine since the late fifties. The joint Tactical Air Command/Continental Army Command (CONARC) manual, *Joint Air-Ground Operations*, which was published in September 1957, had served well to guide Army–Air Force operations throughout the world, although it did not enjoy departmental blessing. The shift in national emphasis from a strategy of nuclear retaliation to one of flexible response focused new attention on the requirement for joint operations. Since planning for such operations must be based on sound principles of doctrine, the requirement for jointly agreed, up-to-date doctrine assumed major importance.

Inasmuch as TAC is the Air Force command most closely associated with the Army for joint training, it was appropriate that TAC should work with CDC on development of joint Army–Air Force doctrine. The initial efforts between the commands produced important expressions of the two services' views on several controversial issues. While the first drafts of the several manuals involved were of great value, an important side benefit was derived from the development conferences. Participants on both sides came to recognize the facts of life concerning future warfare involving conventional weapons. Basically, this boiled down to an acceptance of the idea that no single service could by itself completely dominate or win a future war. When this premise was accepted by all, the next step was obvious.

How can the capabilities of the services best be utilized to accomplish the overall objective? From the discussions this question provoked, a better understanding of the other service's problems, limitations, and requirements for support emerged. As this mutual understanding developed, many of the past

*See "Exercise Gold Fire I" by Major Robert G. Sparkman, *Air University Review*, XVI, 3 (March-April 1965), 22–44.

misunderstandings of the other service's position disappeared. At this point in the discussions, a method of operation began to appear that would serve as a guide for future doctrinal development. Simply stated, this method was a recognition by all that progress in solving divergencies could only be achieved by a full and complete exchange of information by both services. Without complete knowledge and understanding of the other's position, no discussion leading to militarily sound concepts could develop. With acceptance of this method of operation, true progress in the development of joint doctrine began to occur.

One of the first significant products to emerge from the efforts to agree on joint doctrine was a concept for improved joint air-ground coordination. In 1962 the Army–Air Force fire support coordination system then in effect was based on organizational and procedural arrangements set forth in the 1957 TAC/CONARC manual, *Joint Air-Ground Operations*. In an effort to improve joint operations, CINCSTRIKE requested that a joint effort be undertaken by TAC, CDC, and CONARC to analyze the organization for fire support coordination and determine the optimum arrangement to support forces of varying magnitude. As a result of this effort, a system referred to in the Air Force as the revised Tactical Air Control System was developed. It corrected many of the faults of the old system and provided an increased responsiveness of immediate close air support and tactical air reconnaissance for the Army. The new system underwent extensive testing in four USSTRICOM joint exercises—Three Pairs, Coulee Crest, Swift Strike III, and Desert Strike. These tests proved conclusively that the new system was vastly superior to the old. The concept was officially approved by the Chiefs of Staff of the Army and Air Force in early 1965 and is presently being used in Vietnam with great success.

From the Army viewpoint, it seems likely that the most significant aspect of the jointly approved concept is the provision relating to apportionment and allocation of the tactical air effort. Prior to the agreement, no formalized arrangement existed by which tactical air would be routinely apportioned in advance to perform the close air support mission. The approved concept provides:

> *Apportionment.* The unified/joint commander will decide, on a day-by-day basis, the proportion of the air effort he intends to apply to counterair, interdiction, and close air support tasks. His air and land component commanders will submit recommendations in this matter. Only the joint commander can change the daily apportionment of air effort.
>
> *Allocation.* The air component commander will inform the land component commander daily of the number of close air support sorties that the component will commit in response to the apportionment by the joint commander. The land component commander may allocate these sorties to his subordinates. Subordinate commanders may sub-allocate the sorties. Land commanders allocating, sub-allocating, re-allocating sorties will inform the DASC [direct air support center] through the ALO [air liaison officer] at their echelon in addition to normal notifications through the chain of command.

Other significant achievements in the realm of joint doctrine include JCS Publication 8, *Doctrine for Air Defense from Overseas Land Areas;* AFM 2-50/FM 100-27, *U.S. Army/U.S. Air Force Doctrine for Tactical Airlift Operations;* JCS Publication 12, *Standardized Procedures for Use in Joint Operations;* and FM 31-11/NWP22(B)/AFM 2-53/LFM01, *Doctrine for Amphibious Operations.* Many other manuals on subjects of joint concern are in various stages of coordination or preparation. They include such subjects as airborne operations, close air support of land forces, and ground defense of air bases.

Another milestone in the area of joint doctrine development was the agreement between the Chiefs of Staff, Army and Air Force, on the control and employment of certain types of fixed-wing and rotary-wing aircraft. The agreement resulted in the transfer to the Air Force of all Army-owned CV-2 aircraft, now designated C-7A. From a doctrinal standpoint one of the most important points in the agreement was a recognition by the Air Force that in cases of operational need the CV-2, CV-7, and C-123 types of aircraft performing supply, resupply, or troop-lift functions in the field area

may be attached to the subordinate tactical echelons of the field army as determined by the appropriate joint force commander. In effect, what this amounts to is an Air Force commitment to the Army to meet its requirement for support from these types of aircraft. When operational requirements so dictate, we have agreed to attach these units to the Army, which can then employ them as it sees fit.

It becomes obvious that tremendous progress has been and is being made in development of joint doctrine. However, much remains to be accomplished. TAC is convinced that as new weapon systems are developed a corresponding development of operational doctrine for their employment is required, to insure that they are properly integrated into the overall efforts of tactical air forces. In this regard, the conflict in Vietnam has re-emphasized the old adage that no two wars are alike. New threats and improved methods of countering them constantly emerge throughout the course of any war. TAC is deeply involved with taking the lessons learned in Vietnam and developing the doctrinal concepts by which tactical air forces can be more effectively employed in the future.

Although TAC initiates and develops most of the new doctrinal concepts for employment of tactical air forces, careful attention is given to the ideas and recommendations of all Air Force commands with tactical forces assigned. Almost every agency within the Air Force either directly or indirectly concerned with a doctrinal subject is given an opportunity to comment and coordinate on proposed doctrine. Comments received from these sources are included in revised drafts, which are then recirculated for additional coordination. Thus draft manuals may go through several revisions and require extended periods of time to progress from the initial stage of preparation to the point where the manual can be submitted to Hq USAF for Air Staff approval. In revision of joint manuals, the process is complicated by the fact that all the services must agree to each change proposed, which further lengthens the time required for approval and publication. This seemingly endless process can be frustrating, particularly to the action officer responsible for shepherding a manual from inception to publication. It is, however, a necessary process, since doctrine, once published, becomes authoritative and influences operations and planning decisions at all levels.

In spite of the success being achieved in developing doctrine, one pitfall remains. It concerns the difference between doctrine and procedures. There is an increasing trend throughout the services to incorporate within doctrinal manuals not only guidance on what to do but also instructions on how to do it. They are usually incorporated in a section of the manual called "procedures for." The danger in this approach is twofold. First, fundamental principles, which are intended to be used as a guide to actions, are often overlooked or ignored by the individual concerned with getting the job done. He becomes obsessed with the "how" rather than the "why" of doing something. Second, according to the JCS definition of doctrine, those fundamental principles are authoritative but require judgment in application. Judgment is required to apply the principles in accordance with the situation as it exists at a particular time and place. Thus the procedures for conducting air strikes against the enemy might be entirely different in Vietnam from those that would be required if the war were being fought in Europe. The inclusion of detailed procedures in basic doctrinal publications is neither desirable nor practical. Procedures are fine when they have been developed to accomplish a specific task under a given set of circumstances. However, warfare has not become so stereotyped that it can be conducted worldwide on a check-list basis.

While major progress is being made in resolving some of the problems of long standing between the Army and Air Force, the job is far from complete. Much remains to be done in such areas as airspace control and reconnaissance. A major problem concerning airspace control is the desire on the part of the Army to reserve a block of airspace over a prescribed area wherein Army aircraft would operate freely without regard to Air Force control. Conversely, the Air Force believes the need for proper identification is a must if we are to

maintain an effective air defense capability. Safety is also a consideration. It takes little imagination to visualize the chaos and danger that could be created by the entry of an Air Force close air support jet aircraft into a prescribed area already occupied by some 400 helicopters. Nevertheless it is easy to see that flight clearance procedures presently employed by the Air Force would, if applied to Army aviation in a fluid battle situation, completely disrupt the Army's methods of employment.

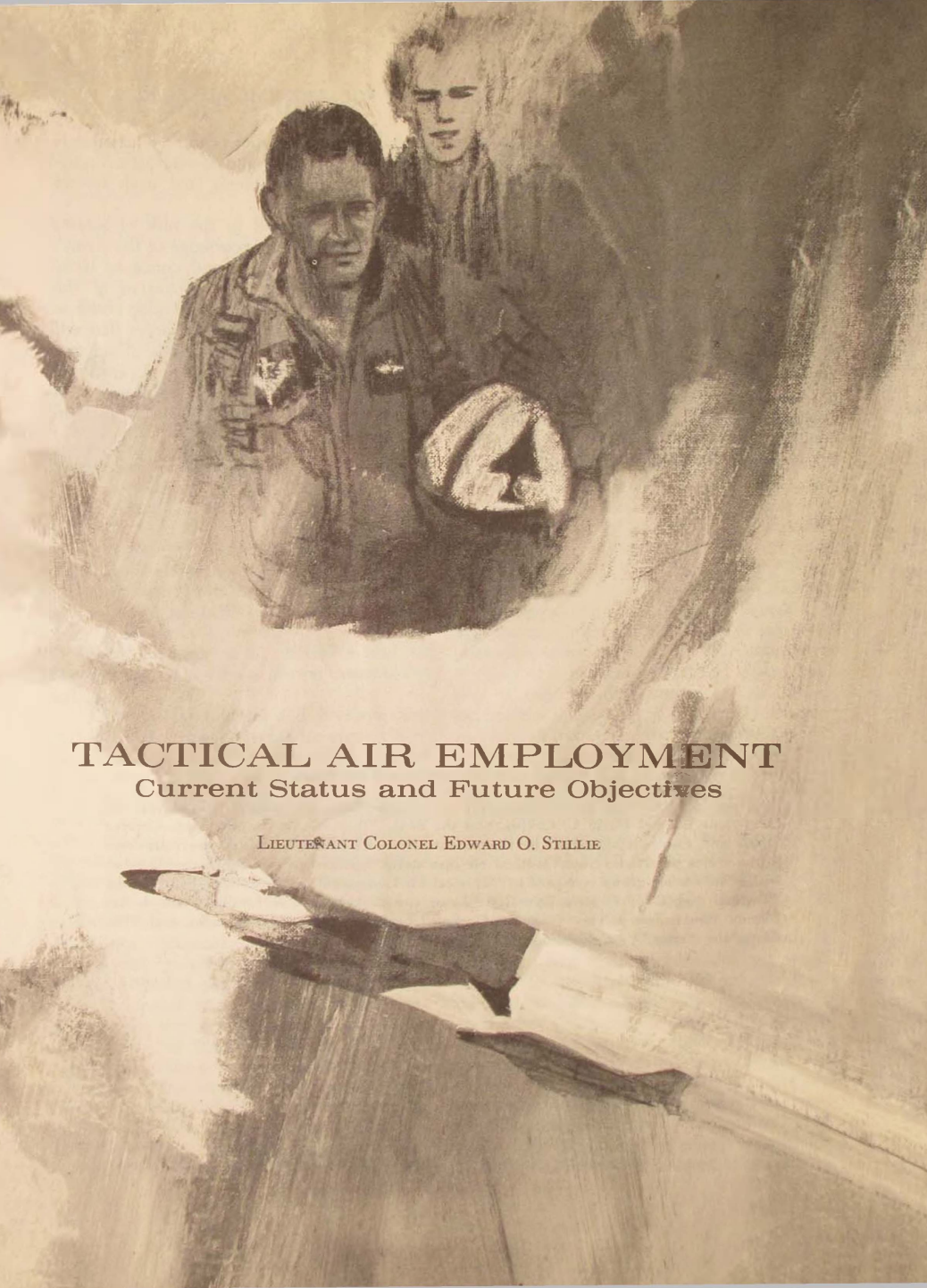
The answers to this and similar problems lie somewhere between the extremes of the opposing positions. Proper solutions will depend on compromise that will allow both services to employ their respective weapon systems effectively. Such solutions can be reached only through a thorough and sympathetic understanding of the problems that each service faces.

TAC is dedicated to the task of solving these problems. Our knowledge of the Army's capabilities, limitations, and concepts is increasing every day. The expansion of this knowledge will permit us to develop concepts of employment of tactical air forces that will not only enhance the effectiveness of our own forces in joint operations but also permit the Army to operate with greater confidence in the Air Force's ability to provide the support the Army needs.

Hq Tactical Air Command

Tactical Air Operations—Continued

This article, "Doctrine Development for the Employment of Tactical Air Forces" by Lieutenant Colonel David C. Collins, and the next, "Tactical Air Employment—Current Status and Future Objectives" by Lieutenant Colonel Edward O. Stillie, are follow-ons to the series of articles about tactical air operations featured in our September-October issue. The earlier group consisted of "Tactical Air Command" by General G. P. Disosway, "Tactical Airlift" by Captain Lowell W. Jones and Captain Don A. Lindbo, "Battles Are Bloody Maneuvers: A View from the Cockpit" by Major John P. O'Gorman, and "The Closer the Better" by Colonel John R. Stoner.



TACTICAL AIR EMPLOYMENT

Current Status and Future Objectives

LIEUTENANT COLONEL EDWARD O. STILLIE

THE war in Vietnam has re-emphasized the dynamic nature of modern warfare and the need for continual evaluation of our capabilities to meet these changing situations. Today we are engaged in a conflict unlike any we have experienced in the past, a frustrating war complicated by restraints and constraints and the very nature of the enemy we face. At the onset, we underestimated the military potential of our adversary and were inexperienced in his type of warfare. Subsequent to our commitment to Southeast Asia, however, some revolutionary new concepts have evolved, and the lessons we have learned will undoubtedly influence our strategists and decision-makers for years to come. With tactical air power involved so deeply, we in the Tactical Air Command are among the first to recognize the complexities and problems associated with limited warfare, and, guided by experience and logic, we are carefully looking for ways to optimize the effectiveness of our current and future forces.

Most of us agree that today's world situation indicates a strong probability of United States involvement in low-level conflicts in the future. Who can predict what other types of wars we may encounter? Even general war, though improbable in our current world environment, is always a possibility. If we are to survive, it would seem that we have no choice but to build and maintain in the future the military capability to respond to any situation or threat throughout the complete spectrum of warfare. With this in mind, the planners in TAC are attempting to mold, with realism, the future of this command.

evolution of national and military policy

To refresh one's memory of the changing nature of national policy and its inherent effect upon military doctrine and strategy, it is necessary to look back a few years into our military past. History has recorded, and we as students of military strategy are familiar with, the nature of the conflict and the conditions surrounding World Wars I and II and the Korean affair. Perhaps the period immediately following Korea deserves closer observation and will serve to establish our point.

U.S. national policy after Korea was one of massive retaliation with nuclear weapons against any power that committed an act of aggression against the United States or its allies. This policy resulted in radical changes in military doctrine and in the posturing of our forces. In the Air Force, the buildup of strategic bomber and missile forces received first priority; tactical forces, tailored for a conventional warfare environment, were left to struggle for their very existence.

Our dilemma was short-lived, however, as the development of a nuclear delivery capability within our fighter force soon created a new dimension in tactical air warfare. Air refueling extended the range of fighter aircraft, permitting rapid intercontinental deployment of forces. In 1956 the Composite Air Strike Force (CASF) concept was conceived, and this capability to rapidly deploy small units with an abundance of destructive firepower helped further to shift the emphasis from a large strategic bomber/missile force to a more flexible and mobile system of employing nuclear weapons. During 1957, the fighter wings of the Strategic Air Command were either transferred to TAC or deactivated as the massive retaliation concept continued to gain momentum. Little capability was retained within the Air Force to fight a conventional type of war, and such a requirement for the future was given little consideration.

Our sister services also were geared for all-out warfare. The Navy removed guns from ships of the line and replaced them with missiles. Fleet air groups were converted to nuclear delivery roles, and the ballistic missile submarine was introduced. The Army equipped its forces with guns capable of nuclear delivery and developed rockets and missiles with a nuclear capability. By 1960 the servicewide conversion was completed, although during this period there had been little interservice relationship and interface of effort, each military department being allowed to proceed more or less on its own volition.

During the period of our nuclear conversion, however, there began to materialize some definite and different trends in the Soviet approach to international conflict. Her classic

announcement of the decision to foster and support worldwide insurgencies was made to the world, and her intentions to promote this policy soon became evident. Red China's challenge to Soviet primacy in the Communist World, her nuclear progress, and her revolutionary fervor added food for thought for the geopoliticians. Our involvement in various contingency situations clearly indicated that there were serious threats to our national security far short of general war. With changes being made in our foreign policy to counter these situations, it again became necessary to develop new concepts for the employment of our military forces.

TAC capabilities at the beginning of Vietnam

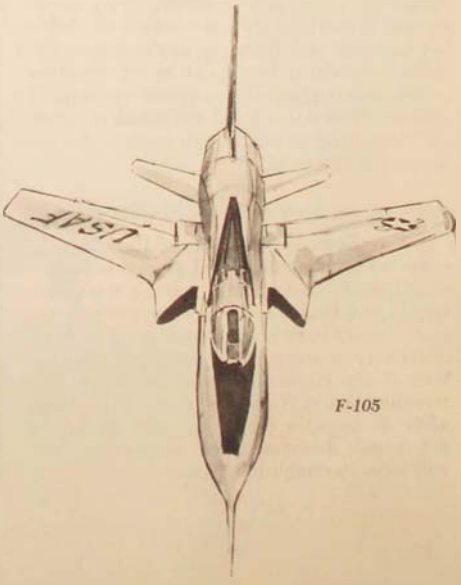
Today it is academic whether we fault the national policy-makers or the military planners for failing to respond to these geopolitical trends. As we entered the war in Vietnam, however, it became obvious that our nuclear might would be of limited value in a conflict of this nature. Needed was a brand of air power schooled in conventional warfare, capable of rapid response, and offering a variety of deployment/employment options. Confronting us were certain hard facts: (1) We had no special air warfare (SAW) capability. (2) Conventional air warfare expertise was outmoded as our forces had almost exclusively been trained in the techniques of nuclear warfare. (3) Conventional weapons development had virtually ceased, and those resources we had retained were of World War II vintage and in short supply. (4) Tactical fighter procurement had been meager, and equipment was basically designed or modified for high-speed penetration and nuclear delivery. (5) Despite the advent of the C-130 and the development of new assault airlift techniques, our ability to provide air resupply and battlefield mobility to the Army was in question. Tactical airlift and close air support were, perhaps, our most critical areas.

Fortunately, during the period immediately preceding Vietnam a growing interest in the philosophy of joint operations had emerged, and limited but invaluable experience and training had been gained through joint field exercises and TAC/CONARC planning efforts. The activation of U.S. Strike Command in 1961 was a major milestone in the redesigning of our concepts and reposturing of our forces to meet contingency-type situations with a joint, rapid-reaction strike capability.

Generally speaking, however, we had again conformed to the pattern that has prevailed throughout history by permitting our military potential to reach a state of limited effectiveness—this time through inflexibility resulting from overemphasis on the philosophy of nuclear warfare.

tactical air forces to Vietnam

The air resources most likely to be employed in limited wars and counterinsurgencies are tactical air forces. Such forces must possess the flexibility to react instantly and effectively to differing situations and constraints requiring a variety of weapon systems to perform the classic roles of air superiority, close air support, interdiction, air defense, reconnaissance, tactical airlift, and special air warfare. TAC units became gradually, but deeply, involved in Southeast Asia. Our efforts to support that operation are well known—the initial special air warfare operations; the TDY expedient and



F-105

subsequent transfer of our general-purpose forces to PACAF and their deployment to Southeast Asia; our ConUS training programs; and our newly reorganized functional centers that test and evaluate our weapon systems and operational concepts and train our people in their application.

In essence, we have had to relearn to live and fight in a conventional war environment and to fight jointly with the other services. Strange things have occurred. and often we have had to improvise to fit some obsolete system to a particular job. The role of the lowly O-1 forward air controller (FAC) aircraft has often overshadowed that of the mighty intercontinental bomber. The venerable C-47, redesignated AC-47 and armed with three 7.62-mm cannon, is being used in a ground support role against the Viet Cong. We have become experts in the not-too-glamorous art of special air warfare. The Special Air Warfare Center was activated at Hurlburt Field, Florida, to train our personnel in the techniques of counterinsurgency, psychological operations, and unconventional warfare. High-priority research and development programs have been initiated and already have shown considerable promise, particularly in terms of equipment designed to meet the needs of Army ground combat forces.

problems in Southeast Asia operations

We have had problems in Southeast Asia, and the need to revise our concepts and capabilities for waging war in a controlled and sensitive environment has often been uncovered the hard way—through experience on the battlefield. Numerous examples became evident: (1) Our reconnaissance capability to locate well-concealed targets in jungle or mountainous terrain, in adverse weather, and at night was poor. (2) Our ability to deliver conventional weapons on small targets in close proximity to friendly forces was generally limited to a daylight, visual type of operation. (3) Our capability to penetrate enemy defenses needed improvement. (4) Identification of friendly and enemy aircraft was limited to visual sighting. (5) Weapon delivery accuracies needed improvement so as to reduce crew exposure and sorties required. (6) We needed assault transports with STOL or VTOL characteristics to enhance our forward area delivery capability. (7) Reliability, security, and versatility in our tactical command and control and communications systems needed improving.


F-100

We are aware of these and other operational problems, and many have already been overcome. Our R&D, testing and training programs, and planning actions will provide other solutions at the earliest possible date.

Future Plans and Objectives

Actual combat is the final test of the effectiveness of a military force. Just as our current capabilities, whether adequate or deficient, are tied to past decision, so will our future military posture become the result of the planning effort of today. Projecting ahead, we shall examine the thinking in TAC in terms of future capability objectives, force employment, and the organizational structure we feel will best enable us to do our job. Numerous analyses and studies have also been made or are in progress to insure that we will profit from experiences in the current conflict in designing our future forces. Considering first the hardware most likely to be employed by TAC in the future and the capability objectives we have set for these forces, we look first at the tactical fighter area.

tactical fighter force

In the development of a tactical fighter

F-4C

force, we must consider the need to perform a variety of discreet tasks, and, therefore, we are beset by a number of competing requirements. If we had the resources to specialize, we could provide a specific weapon system for each fighter task—counterair, interdiction, close air support, and air defense. This is not the case, and most of our fighter aircraft today are designed for penetration and ground attack, with the air-to-air combat capability, until recently, receiving little interest.

Air Force doctrine stresses that the crucial counterair battle will be won by attacking enemy aircraft on their home airfields. This rationale is particularly valid in general war; but, as we have seen, in a limited-war situation international considerations may preclude such strategy, and we may be required to destroy enemy air power solely by air-to-air combat. Whether control of the air is gained by suppressing the enemy force in the air or on the ground or by a combination of the two, we must possess the means to control the air and to do so as quickly as possible. Our experiences in Korea and Vietnam have taught us that there are deficiencies in our ability to perform air-to-air combat: obviously needed are improved aircraft maneuverability, armament, and methods of identification.

In terms of air defense of overseas land areas, we must be able to detect, intercept, and destroy an enemy intruder force under any type of weather situation and in any environmental condition. Needed are improved systems, both stationary and airborne, for identifying and tracking enemy aircraft—systems designed specifically to support the air defense mission. Our air defense resources must be flexible and deployable on a global basis. Airborne Warning and Control System (AWACS) and other methods of enemy detection and intercept control are being studied and show considerable promise.

The objective of interdiction operations is to destroy enemy forces and material resources prior to their arrival at the time and location required to conduct effective, sustained military operations. Tactical air forces must be designed to disrupt the enemy line of communications (LOC) through destruction, delay, or harassment, to neutralize the effectiveness of enemy reserves and compromise the position of enemy forces engaged directly in combat. Air interdiction efforts must be based on continuing reconnaissance information and conducted in accordance with the plans and objectives of the theater commander. We must have the capability to respond with effective weapons and sensors to locate the enemy and to conduct interdiction operations on a sustained basis.

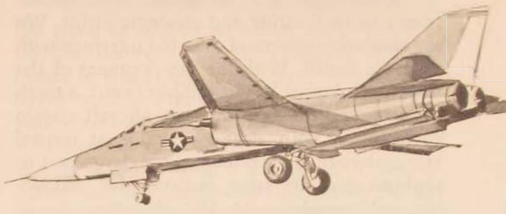
Close air support provides supporting firepower closely integrated with ground forces' fire and maneuver. It provides escort and suppressive fire for airmobile forces and surveillance and security for Army patrols and probing operations. Adequate, well-coordinated close air support will normally be the decisive factor in the outcome of the battle. We must, therefore, be able to respond quickly and

with adequate striking power to do the job. Such a capability demands mobile, flexible units with aircraft that offer a variety of trade-offs among speed, range, loiter time, and payload.

Current and future tactical fighter forces will include the F-100, F-105, and F-4, the latter possessing our main air superiority capability. The F-111, soon to become operational, will modernize and greatly enhance our fighter force. We strongly support the F-X, a follow-on air superiority vehicle designed to counter the air threat imposed by technology of the 1970-plus time period. The prop-driven A-1 of the Special Air Warfare Force and the F-100 are being employed in Vietnam in close air support roles. Soon the A-7 will appear in the TAC inventory, and this subsonic ground attack aircraft will improve our capability to deliver weapons in adverse weather, both day and night. To cover the spectrum in our capability to provide optimum close combat air support of ground forces, the A-X has been proposed. This vehicle will be a simple, rugged, highly maneuverable aircraft, capable of being operated from austere, semiprepared airfields with a high utilization rate. The A-X will be less sophisticated and cheaper than the A-7 and will possess a capability equal to or greater than that of the A-1. Our future family of close air support aircraft will be designed to fulfill all the roles throughout the wide range of missions required to support the Army's needs.

reconnaissance

During peacetime and all phases of conflict, there is a requirement for accurate, adequate, and timely intelligence information. Airborne methods of collecting intelligence data include visual, photographic, radar, infrared, and electronic systems. Reconnaissance aircraft must be able to operate during all types of weather conditions, both day and night, and systems will vary from low-altitude, low-speed vehicles to supersonic, deep-penetration aircraft and missiles or drones. A systematic, visual surveillance program with strike aircraft on call for quick reaction is in-being today and is effective in visual weather conditions during daylight hours. In permissive environments, the airborne visual reconnaissance pilot is of invaluable service in the recce role, and this method of intelligence collection will continue to be used to great advantage in the future, particularly in light of the improved aircraft that are being programmed. High-performance aircraft are required for deep penetration of hostile territory, and high-speed, high-altitude characteristics are needed to insure reliability and survivability. Today the latter concept employs tactical fighter aircraft specially configured for the reconnaissance mission. Greatly improved sensor equipment is also needed for detection of enemy forces and LOC's under adverse weather conditions and in all types of



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climate and terrain. The acquisition of reliable, jam-free sensors could, some day, revolutionize concepts for employing tactical air and Army ground forces in a combat situation. Our objective is to acquire a complete tactical air reconnaissance intelligence capability that includes, as part of the tactical air reconnaissance cycle, delivery of the product to the user.

As for equipment, the O-1 has been the workhorse of the visual reconnaissance pilot. These aircraft are soon to be replaced by the O-2 and OV-10, which will provide greater capability in low-altitude reconnaissance and control. In the deep-penetration role, the RF-101 and RF-4 are now being employed, but the RF-101 is soon to phase out and the RF-111 will be introduced as a reconnaissance vehicle.

tactical airlift

Tactical airlift is the means by which personnel and materiel are air-delivered on a sus-

tained, selective, or emergency basis to dispersal locations at any level of conflict, during all weather situations and over any type of terrain. These forces must be organized, trained, and equipped to provide maximum battlefield mobility and an effective air line of communications for ground combat units. Priorities are established and airlift sorties apportioned by the joint force commander to meet the needs of all the services. Centralized control of tactical airlift resources under the Air Force component commander provides the flexibility necessary to perform effectively and to insure that aircraft are available to respond to the apportionment made by the joint force commander.

There must be a coordinated interlock between tactical airlift and strategic airlift. We are similarly concerned over the interface with strategic sealift. With the development of the Fast Deployment Logistics Ship (FDL), a tactical STOL and follow-on V/STOL aircraft system could mesh with strategic sealift at coastal areas, obviating our reliance upon large port or sophisticated air base facilities for offloading and transshipment. Our objective, simply stated, is to satisfy user needs by delivering what is needed, where and when and in the quantities desired.

Today the C-130 aircraft is the basic system being employed in the role of tactical airlift. The C-123, originally assigned a special air warfare mission, is being used chiefly for tactical airlift in Vietnam, as well as the C-7 recently acquired from the Army. Needed in the future are replacement systems with emphasis on S/VTOL capabilities so as to better accommodate the ground combat forces' requirements for mobility on the battlefield and forward area support.

special air warfare forces

The all-important and widely diversified special air warfare mission of tactical air forces involves the three interrelated areas of counterinsurgency, psychological operations, and unconventional warfare. More important, particular emphasis must be placed on using SAW forces in overseas internal defense operations prior to the occurrence of organized insurgent warfare. This includes the use of highly trained area-oriented Mobile Training Teams, which will train and assist indigenous air forces in internal defense, including civic-action and nation-building programs, psychological operations, and conventional/unconventional warfare. Aircraft whose configurations can be changed in the field to meet a variety of offensive, reconnaissance, logistics, and other tasks are required. Small, rugged aircraft are needed that can be operated from semiprepared surfaces under primitive conditions. They should be armored for crew protection, possess a high degree of survivability, and be capable of varying crew and payload configurations. Helicopters and fixed-wing vehicles with VTOL/STOL characteristics are vital in this type of operation. There should be commonality between USAF and Military Assistance Program (MAP) equipment committed to the SAW mission. Emphasis must be placed on low initial and support costs for SAW aircraft destined for use by indigenous air forces, and the equipment should be compatible with the varied technological capability of less-developed nations.

Psychological operations, designed to influence the behavior of the enemy, require tactics and techniques which may vary widely as the level of conflict changes. Airborne and ground communications equipment and leaflet-delivery devices are employed in concert with the ground effort to influence human behavior. Improved audio and leaflet-delivery systems are needed to insure a greater degree of effectiveness, and V/STOL or helicopter aircraft are particularly suited for this type of operation.

In unconventional warfare, SAW forces are used for the infiltration and exfiltration by air of personnel and materiel in areas under hostile control. Fixed-wing and V/STOL aircraft designed especially for this task are required. They should possess a low-level navigation capability, guidance devices for night and all-weather landings in unimproved areas, apparatus for airborne pickup and delivery, and secure air/ground communications.

Today we are using a variety of "cats and dogs" for the SAW mission, even some modified World War II aircraft. Among these are the O-1, U-10, B-26, A-1, C-47, and C-123. Needless to say, these aircraft have outlived their intended life-span, but to date no other weapon system specifically designed for special air warfare has been made available. TAC has proposed a family of aircraft purposely designed for the many and varied tasks of this mission.

O-1E

organization and force employment

Perhaps the top priority program in TAC today concerns future reconstitution of our forces. Called the TAC Enhancement Program, it thus far concerns only our fighter force but could involve our other forces as well following cessation of hostilities in Southeast Asia. In developing the most effective organizational structure and concepts for employing our forces, we took a long hard look at our status today and where we feel TAC is going in the future. The objective was to determine the most efficient organization for a tactical fighter wing both in peace and war—one that would provide the flexibility to deploy units worldwide, ready to fight and capable of sustained operations. The key word "sustained" has a direct impact on the type of organization and capabilities that must be inherent to it.

We have given careful consideration to the types of conflict in which TAC is likely to become involved and the changing environments in which our forces must operate. Our forces must be configured to support national policy, and we assumed that the United States would continue to combat aggression wherever and in whatever form it should occur. Recognizing that our national policy allows the aggressor the benefit of initiative and that he may initiate conflict anywhere at any time, we concluded that tactical air forces must be maintained in a constant state of readiness so as to respond quickly and effectively.

We have established that, in the future, we are most likely to encounter low-intensity, conventional, nonnuclear conflicts, probably involving the so-called Third World of less-developed or emerging nations. This means that our forces must have the capability to operate from austere bases, some offering nothing more than a landing area and a water

A-1E

supply. In developing our force structure, however, we considered possible involvement in a variety of conflicts, including general war, and recognized that our force requirements could never be fixed. We anticipate variable national and military objectives which could have a decisive impact upon the type and size of force required. Whatever the requirement, the TAC force must be capable of meeting each specific national objective and of operating within the political restraints imposed throughout the conflict.

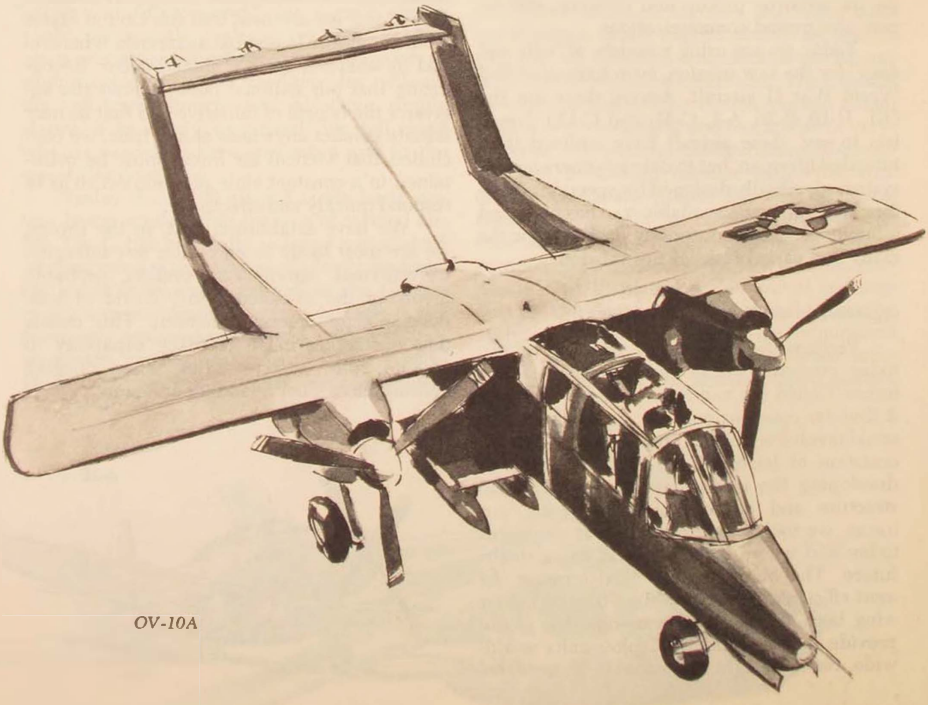
Philosophy of Employment

Our philosophy for employing tactical air forces is based on three main points:

First, the United States Air Force must be capable of operating as a unilateral instrument of national policy should this requirement be imposed by authority. Thus, the force must possess the full range of tactical air capability and should be politically suitable to carry out a show of force under control at the highest level or, as an alternative, to execute combat operations.

Second, tactical air forces must be capable of operating with indigenous forces, each force possessing its own level of capability and sophistication. This requires careful consideration when planning for the capabilities that must be built into our units.

Third, the tactical force must be ready to assume its role as a coequal partner with the Army and to interface with the Army's current capabilities and those it will possess in the future. We also have similar though lesser responsibilities in our relationships with the Navy.



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In developing our future force, we were careful to bear in mind our total responsibilities as a major USAF command: to organize, train, and equip forces for close combat and tactical airlift support of the Army; to carry out tactical air defense and interdiction operations; to conduct the full spectrum of special air warfare operations; and to participate in joint amphibious and airborne operations. Simultaneously, as AFSTRIKE, we must maintain a general reserve of combat-ready forces for overseas deployment and employment by the overseas unified commanders. Our forces must, therefore, be able to mesh with existing command structures without loss of motion or effectiveness, and they must readily adapt to existing command lines and operating procedures. Further, TAC forces may be required to operate where no command structure exists at all. In this type of environment, the command element will be provided as an integral part of the force on deployment.

It was against these considerations that we designed and postured our future fighter force. With the success we anticipate, this concept may well be applied to other organizations requiring a flexible, mobile, quick-reaction capability. Also, against the employment philosophy outlined, we have developed some broad objectives for the TAC Enhancement Program:

- The force will have a rapid-reaction capability. Combat units will deploy with all essential resources and be ready to commence operations within a matter of a few hours after reaching their operational base. They will be able to sustain operations indefinitely, provided an LOC is established to give the needed support.
- In order to respond to a wide variety

RF-101

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B-26B

of conflicts on a worldwide basis, TAC units will be able to operate from any one of an assortment of air bases: a main operating base with everything the commander needs to support his unit, a forward operating base with reduced facilities, a dispersed operating base that provides minimal support, or a bare base where any facility other than the landing strip would be considered a luxury.

• Not the least important of our objectives is the ability of TAC units to conduct wartime operations *without reorganization*. This may appear basic until one recalls that these units may be required to move into some other existing command structure or to conduct a variety of tasks from bases that offer support ranging from unlimited to almost none at all.

Doctrinal Application

As specified in AFR 23-10, TAC is the Air Force agency responsible for developing doctrine for the worldwide deployment of tactical air forces. In this regard, we work closely with overseas tactical air force units in PACAF and USAFE to bring the widest range of knowledge and experience to bear on this task. A great deal of emphasis has been devoted to documenting our basic concepts and convictions, and these have been tested by war-gaming, validated by CINCSTRIKE, and translated into USAF doctrinal manuals. Our unilateral Air Force manuals have recently been updated to provide our forces in the field with current rules for employment, and we maintain close liaison with our Army counterparts—particularly the Combat Developments Command—to insure that the same is true in the joint operations area. From this favorable position and applying the guidance contained in joint and Air Force publications, we evaluated our enhancement program from the standpoint of established doctrine and have postulated a future force capable of moving faster and fighting harder and more effectively than ever before.

basing requirements

In analyzing our ConUS basing requirements to establish the optimum, we considered a variety of options: Should we have one tactical fighter wing per base? Two wings per base? Or should we mix fighters, reconnaissance, and airlift forces on the same base? Optimum basing is required to meet the rapid-reaction criteria and the closure time to meet foreseeable contingencies. We desire that our forces be located in close proximity to the U.S. Army units that we must support, so as to facilitate joint training. We further desire the best basing arrangement to permit maximum use of available weapon ranges in the ConUS. Our forces would be balanced between TAC's two geographically oriented air forces, the Ninth Air Force in the eastern United States and the Twelfth Air Force in the western.

aircrew training

From the standpoint of our wartime aircrew training program, our enhanced organization must be able to operate effectively in peace and war. Here we had to consider our overall aircrew requirements, the effect of the Southeast Asia operation and its short tour lengths and attrition rates, and our capability to support these requirements. Our analysis considered both peacetime and wartime aircrew training requirements and the organizational structure best able to meet this aspect of our enhancement program.

The training concept which evolved was to maintain the three centralized combat crew training schools (CCTS's) on a reduced basis, to introduce new pilots into our weapon systems. These schools would train pilots for the F-4 rear seat and F-111 right seat and provide A-7 pilots with training in transition and tactics. We would decentralize other training which has been accomplished by the CCTS's to the tactical wings and give them additional aircraft and people to do the job.

This concept is important for two reasons. First, and most important, the additional aircraft and people in the tactical wings will increase the resource base from which to deploy a full combat-ready wing, this being our goal. In addition, this configuration allows us to transition easily to the greater wartime aircrew

training program because we will have not only the three centralized training schools, which can be expanded, but also a training capability existing in each wing. In other words, with our present force structure, we would have 15 potential Replacement Training Units (RTU's) to support wartime training requirements. The RTU's would support the wartime training requirements for both aircrews and maintenance personnel. The CCTS's and RTU's would both provide the same aircrew training course in wartime.

equipment

We recognize the need for additional equipment for our units to meet the mobility requirements we have established. Each tactical fighter wing will have as an objective its own bare base equipment, and certain items of heavy equipment can be prepositioned or pooled. Equipment-wise, however, the wing will be capable of deploying one, two, or three squadrons to operate from a bare base or from two forward operating locations, one of which may be a bare base.

squadron functions

We believe that numerous functions must be organic to the squadron and that the squadron commander should have something to command. We propose to give him people to handle his administrative needs and monitor his personnel program, and a small dispensary with a flight surgeon and some Medical Corpsmen; he will retain normal flight operations and training of aircrews; and he will have intelligence people to provide target folders and handle his escape and evasion program. Also organic to the squadron will be security and law enforcement personnel to guard its assets, some people to operate motor vehicle dispatch and vehicular maintenance sections, and a unit supply to maintain its mobility kits and records. It will have a maintenance capability to remove and replace parts, including aircraft engines, and to calibrate, test, and accomplish phased inspections on its aircraft. Mobility kits will contain spare parts and equipment to support operations while an LOC is being established.

Other resources required by the squadron may also deploy with the basic unit. This will vary according to the support capability of the deployment base. In other words, the squadron may be deployed to a main operating base that already supports the type of aircraft involved and may operate indefinitely with little or no additional help from the parent wing, or it could deploy to a bare base that requires additional people and resources from the wing to support its operation.

internal wing organization

This planned decentralization of functions will have a definite impact upon the internal organization of the tactical fighter wing. The wing will be geared to deployment/employment requirements, and the added training responsibilities. The objectives are (1) to provide a more effective organizational structure for our fighter wings; (2) to establish a training concept that will take us from peace to war and back to peacetime operations without reorganization; (3) to establish mobility requirements and long-lead-time items to meet these requirements; (4) to determine the additional personnel and materiel assets needed to configure the force; and (5) to recommend a ConUS basing structure.

THE EFFORTS we have expended in the current conflict and the opportunities we have for further enhancing the effectiveness of our tactical air forces are part of a continuing search for means to discourage aggression. The plan discussed here will permit the Tactical Air Command to perform its mission better and provide the air support needed by the Army in its peacetime and wartime operations. Our goal, in simple terms, is to realize a tactical force with the strength and effectiveness to deter limited aggression as effectively as our strategic retaliatory forces have deterred general war, and, should this fail, to provide the United States with an effective military instrument of national policy.

Hq Tactical Air Command

THE TEST TRACK

Brigadier General Leo A. Kiley

THE goal of the Test Track Directorate at the Air Force Missile Development Center is perfection in meeting project objectives. Success in meeting the goal results in savings of personnel, time, and money. These savings are possible at the test track because of the track's unique testing capability. A guidance system, for example, despite rigorous quality control at the factory and thorough engineering and testing in the laboratory, still needs a shakedown to prove its worth. Track testing subjects the system to the dynamic loads of actual operation, then allows its repeated recovery for further evaluation and analysis. If such testing finds but one flaw that could cost the country an R&D or operational missile, millions of dollars will have been saved. Several such flaws have been found in the numerous systems tested. A similar case can be made for ejection system testing. No doubt many lives have been saved because track testing proved the reliability of an escape system, but there is no way to compute that kind of savings.

evolution of the track

Construction of the track facilities had a rather inauspicious start. The Air Force needed a special launch facility to conduct tests on two missile projects; Holloman had available land and a well-instrumented range. Conceived about 1948, the initially accepted specifications for the track called for a precision test facility. An era of economy justified a track of only 3550 feet. Accepted on 15 June 1950, the track saw its first sled test eight days later and

Table 1

Tests on Original 3550-foot Track
23 June 1950—29 March 1956

Project Objective	Number of Tests	Dates
Snark missile launch	33	23 June 1950—28 March 1952
Warhead acceleration/deceleration impact	39	March 1952—10 February 1954
Q-2 drone acceleration	6	Sept 1952—21 Oct 1952
OQ-19 drone launch	6	(5) 25 Nov 1952—9 Jan 1953 (1) 16 February 1955
Jet vane control tests missile	6	Feb 1953—20 Sept 1954
Parachute recovery system for Matador missile	6 3	3 Jul 1953—14 Dec 1953 24 Feb 1956—20 Mar 1956
Aeromedical research on deceleration/windblast/aircraft crash	58	21 Jan 1954—21 March 1956
Aerodynamic testing for the B-58	16	8 July 1954—15 March 1955
To detect what linear acceleration could be imposed on flight control gyroscopes	10	11 Jan 1955—16 March 1955
Development and testing of track equipment	40	4 Feb 1954—29 March 1956
Threshold of Space, motion picture for Twentieth Century Fox	7	27 Sept 1955—13 Oct 1955
Total	230	

operated for six years and 230 tests. (Table 1)

Periodically—from around 1953 on—there were requests to lengthen the track. It simply was not long enough to accommodate all the work proposed. Construction of a 1521-foot addition was completed in 1956, and the 5071-foot track remained in operation for a little over two years and 117 tests. (Table 2)

Just as 3550 feet became inadequate, so did 5000 feet as further uses of the track became evident. Then the potential value of track testing of inertial guidance systems for intercontinental ballistic missiles looked promising. For that matter, there was a test potential for aerodynamic work, controlled acceleration/deceleration experiments, instrumented impacts of warheads and fuzes, and, if the track were extended to 90,000 feet or more (the ultimate concept), for testing complete major structures (e.g., Atlas).

The resultant new 35,000-foot track saw its historic first run on 23 August 1957.

While various efforts have been made to realize the desired 90,000-foot track, there has been but one other addition to the length. In July 1966 a 500-foot section, designed specifically for blast testing, was completed. This addition brought the track to its present length, slightly over 35,588 feet.

Since the first test in August 1950, which was the launching of a Snark missile at the speed of 149 feet per second, the track has accommodated over 3000 test runs in a variety of projects, some vehicles reaching about 7000 feet per second! (Table 3) On 5 May 1967 a slim, aerodynamically shaped monorail vehicle set a new land speed record for a recoverable vehicle by reaching a velocity of 6750 feet per second (4600 miles per hour) during a 30,000-foot run down the track.

the facility

The track is made of crane rail weighing

Table 2

Runs on 5000-foot Track
19 May 1956—2 August 1957

Project Objective	Number of Runs	Dates
Development and testing of track equipment	48	19 May 1956—2 August 1957
Guidance	7	19 Nov 1956—28 March 1957
Rocket ballistics investigations	42	2 June 1956—4 May 1957
Aeromedical/Biodynamics	15	20 Oct 1956—16 Mar 1957
Tests of Lockheed downward ejection seat	3	14 March 1957—25 April 1957
Tests of Fairchild decoy missile	2	16 Feb 1957—6 April 1957
Total	117	

171 pounds per yard, spaced seven feet apart. The mill workers cut the track in 39-foot lengths and marked the segments to indicate the sequence. At the site the segments were butt-welded together, first to form 10,000-foot lengths and finally into a continuous rail almost seven miles long.

The rails are tied down under tension and normally remain so. This tends to straighten the rails and maintain alignment. Compressive stresses are possible only when the rail temperature exceeds 120°F. Adjustable tie-downs are spaced at 52-inch intervals to hold the rail in precise alignment and to prevent buckling at temperatures above 120°F. The adjustable mounts make it possible to align the west or master rail to a tolerance of ±.005 inch throughout its entire length, referred to a first order reference line. The east rail is aligned to the master rail to within ±.010 inch. The criterion for alignment is that the minimum radius of curvature must be at least one million feet.

Rail alignment operations are performed at night with special optical tooling and alignment equipment. Night operations are necessary to avoid heat turbulence and shimmer, which affect the use of precision optical equipment. Also, working at night precludes interference with daytime sled activity. (A somewhat unusual difficulty encountered as a consequence of night operation in the Tularosa Basin is posed by the rattlesnakes, which seek the warmth of the rails. The track crews have learned to cope with these unwanted guests and have suffered no casualties—seldom even a bite anymore. But the trophy room is full of rattles from the fallen foe.)

For braking purposes, a water trough 60 by 14 inches lies between the rails, with a holding fixture every 10 feet 10 inches for the entire track length. The fixtures hold frangible dams, so that level and still pools of water can be kept at any height desired for water braking. The scoop or brake on the sled picks up the water and ejects it, transferring kinetic energy from the sled to the water and bringing the sled to a stop.

The track runs north-south, and there are four blockhouses on the west side—a large one at each end of the track, one at the center, and an auxiliary at track station 2970. A complex of administrative, shop, laboratory, and maintenance buildings lies near the south breech.

The data collection center for track operations is in a large concrete building called "Midway." It is equipped to handle sled in-

Table 3

Types of Tests

Type	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	Total
Guidance										12	51	63	47	57	70	47	38	385
Dispensing*	2	16	15				4	40	12			12	57	26	39	30	73	326
Rain erosion												2	9	14	40	32	55	152
Escape								3		1				8	21	64	39	136
Feasibility:			2	29	8					4		13	12	12	6		28	114
Sleds—Boosters																		
Impact									12	9	16	9	22	10	5	3	2	88
Aerodynamic				14	2	27				1	1	1		6	14	10	17	93
Blast-Vulnerability													1	4	16	5	12	38
Recovery:					6		3	7	7	2				24		11		60
Parachute and T-358																		
Development**					16	13	16	40	131	209	158	107	174	138	102	111	84	1299
Aeromedical					11	30	24	15		9	6	5			3			103
Detecting***													24	12	14			50
Component													6	29	2	14		51
Braking													16					16
Gemini observation NASA																	3	3
Total	**2**	**16**	**17**	**43**	**43**	**70**	**47**	**105**	**162**	**247**	**232**	**212**	**368**	**340**	**332**	**327**	**351**	**2914**

*Dispensing tests include all track tests in which test items are ejected from a moving sled.
**Development tests include all track tests conducted to improve the track testing capability.
***Detecting tests include tests on miss distance indicators and target detector devices.

formation on Frequency Modulated (FM/FM), Pulse Code Modulated (PCM), and Pulse Duration Modulated (PDM) telemetry channels. Presently the track has a capability to transmit and receive, in real time, 84 channels of FM/FM, 90 channels of PDM. PCM can be transmitted at any rate from 200 to 1,000,000 bits per second. Reception and recording means go beyond this. Some information (e.g., sled velocity) is transmitted by land lines.

Initially data on sled velocity came from metric optical instrumentation and by wires tied across the rails. The cutting of the wires started and stopped time/interval counters. Finally, the Track Directorate developed the measurement methods now in use. Today, at 13-foot intervals along the track are small light-beam interrupters. A small sled-borne sensing head, containing a light source and a photosensitive pickup, passes over the interrupters and interrupts the light beam, producing a voltage pulse. The pulse is sent from the sled to the ground receiving station and recorded on magnetic tape. The old method of cutting wires to trigger time intervals is still in use but only where great accuracy is not needed.

The track still makes use of photographic coverage too. The permanent metric photographic system consists of 72 data cameras spaced at 500-foot intervals on a line parallel to and 1040 feet east of the track, so as to provide photographic space-time coverage over the entire track. Cameras for trackside data purposes vary from 16-mm through 5½-inch film. Slow-motion studies and other methods of data recording are used, among them image motion cameras and shadowgraph recording systems. Complete trackside photographic instrumentation gives close-up magnified observations of programmed events, such as ignition, flame pattern, engine shutdown, operation of internal units, impact studies, etc.

track versatility

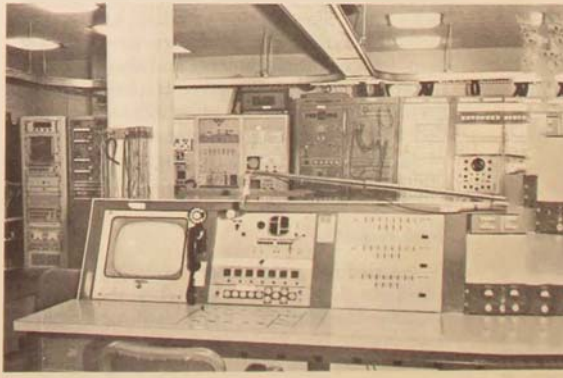
A sled run is the closet simulation of a missile flight that can be achieved on the ground. Because the Holloman track can closely simulate missile free-flight environment and allow close observation of test items during and after a run, it is an ideal development facility for use between laboratory and free-flight tests. Further, the track permits nondestructive testing. Thus the engineer can "debug" new equipment while testing and calibrating it, as, for example, in guidance systems. He finds out what happens to the parts under acceleration/deceleration, what happens during wind loading, how much flutter an airfoil can stand, and whether the product will stand up under rain. There is a specially designed 6000-foot section of track built just to answer this last question. The track achieved a measure of fame in past years with its capability for research into aeromedical problems. How much vibration, windblast, g-loading, etc., could a man survive? And where else would you find chimpanzees banging at a psychomotor panel as they moved downtrack? This type of work is rarely done on the long track anymore, but it stands ready for further testing of this sort when the need develops. The performance of guidance systems can be repeatedly tested and calibrated, with full recovery of undamaged hardware and instrumentation. Such tests are performed under realistic and varying combinations of conditions of programmed acceleration, shock, vibration, and temperatures.

The track offers an ideal test environment for ejection systems, and it has served this purpose for the T-33, F-102, F-104, F-106, and F-111, to mention a few. Our Canadian neighbors brought their RCAF escape systems to the Holloman track for test, too. In these tests the engineer can evaluate such aspects as man/seat separation and parachute deployment.

Test requirements levied on the track through the years have varied from a simple determination of the structural integrity of a missile or aircraft component to the complex test objectives of evaluating inertial guidance systems destined for the nation's missile arsenal. Between the two extremes are any number of additional uses, such as the evaluation of new or improved aircraft escape systems, materials, warhead fuzes. Using the specially equipped rain section, track people can determine the effects of rain on almost any material. Also, we are finding a valuable use of the track in blast-vulnerability testing. The track tests the blast

The Track

The 35,588-foot Holloman high-speed test track points north into the Tularosa Basin on the eastern edge of White Sands Missile Range, New Mexico. It is long enough to enable extended acceleration and still leave sufficient track for low-g recovery of current test systems. The track can be lengthened if needed in the future. . . . The Data Collection Center is a completely shielded structure built on a counterpoise, air-conditioned and dust-free throughout.



effects on missile forward sections by passing them through a high-pressure wave generated by detonating large quantities of TNT at a trackside station.

testing on the track

The major test categories that have comprised the workload on the track since testing began in 1950 are shown in Table 3. Dispensing tests, for the purpose of this illustration, include all track tests in which test items are ejected from a moving sled. Firing of spin rockets from a sled, at a predetermined sled velocity, is an example. Development tests include all track tests conducted to improve the track testing capability; for instance, checkout of new test vehicles and certain propulsion techniques, testing of instrumentation under development, testing of new braking devices.

Many tests conducted on the track do not individually represent a large enough workload to be designated under a major test category. Such testing varies from structural and aerodynamic tests of airfoils to contractor propulsion systems. Frequently these tests are one of a kind. One typical question answered at the track was, "What happens to the internal structure of a 155-mm shell as the result of firing it?" Normally, once a shell is fired, it simply is destroyed at impact. But the track engineers set up a mattress-equipped sled, programmed it to match the projectile's speed, and made a soft recovery just as the missile trajectory and sled path coincided. Results of the test were sent to the U.S. Army's Picatinny Arsenal for analysis and evaluation. How much flutter can an airfoil stand? This question too was answered at the track and was instrumental in the successful development of the B-58 bomber.

It may be of interest to describe in more detail some of the major testing categories:

Impact testing. During impact, a missile warhead must operate within an environment of severe stresses. This environment consists of hundreds of g's and causes rapid deformation of the missile's warhead and nose cone. The warhead must be designed so that this deformation does not prevent detonation at expected impact velocities. The warhead fuze often must work in time intervals measured in nanoseconds before it is destroyed by impact.

The primary aim of impact tests is to determine the operating sequence of components in the fuzing circuit and warhead. The missile is strapped to the sled and "launched" off the end of the track into prepared barriers, or else prepared barriers are run into the nose cone while it hangs suspended off the end of the track. Some kind of data-collection system is required, depending upon the individual test item. System operation may be monitored in several ways: by telemetry carried on the impact vehicle; by using colored strobe lights on the test item, with high-speed trackside optical instrumentation to observe operating sequence; by direct recording of signals from the test item while it is being hit by a target sled; or by combinations of these or other methods.

Inertial guidance system testing. Sled testing complements laboratory testing of guidance components and systems. Generally, guidance components—principally accelerometers with their associated electronics—are sled-tested after preliminary laboratory tests have been completed. These laboratory tests show the accuracy limits of performance of the accelerometer as well as its error trends in the simulated ballistic missile environment. In addition, a main aim is to determine if the component hardware validly represents the manufacturer's claimed theoretical performance model. After component tests, sled tests are run to evaluate the entire inertial measurement unit, with associated electronics and other system equipment, including computers. These tests are performed to determine the functional integrity of the system and to evaluate it while operating in a dynamic sled environment.

The environment to which a system is subjected during a sled run can be tailored for acceleration and deceleration as dictated by the system design specifications. One large-scale system, weighing approximately 1200 pounds, was subjected to an acceleration of 8 g's for three seconds and deceleration of 10 g's for two seconds. Future sled tests of guidance systems are expected to involve decelerations at levels of 100 to 150 g's.

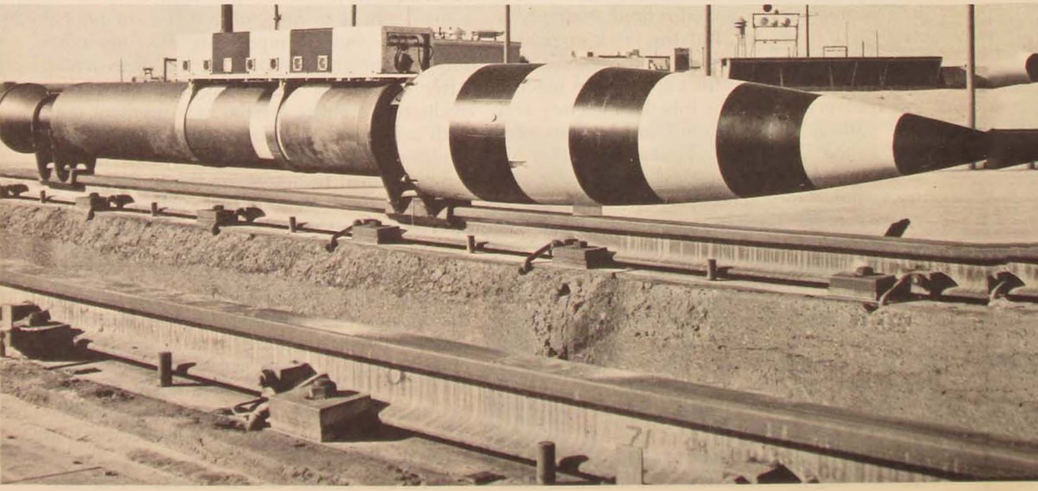
Escape system testing. A variety of per-

formance requirements and payloads is encompassed in the testing of escape systems, including static tests as well as a large range in dynamic performance, with test velocities up to around 1100 miles per hour. Single- and double-seat systems have been tested, as well as modules weighing up to 3000 pounds.

Typical instrumentation in escape system testing includes both telemetry and optical coverage. Optical coverage is available for systems having trajectory envelopes of up to 8000 feet longitudinally, 1200 feet laterally, and about 2000 feet altitude. Specific data gained in a typical program are module trajectory, dynamic pressure, attitude, position, component velocity, total velocity, angle of attack, flight path angle, and acceleration (of both component and total system). In dual-seat ejection systems, a frequent requirement is to evaluate blast, burning, and acoustic effects, and debris damage on the remaining occupant after one seat ejects. Other tests demonstrate canopy ejection capability, seat ejections through canopies, and the effects of birds striking aircraft windshields. Sled-borne telemetry provides velocity, acceleration, temperature, and pressure, while the telemetry units on anthropomorphic dummies provide data that can be related to human subjects.

Rain erosion testing. In 1961 the track acquired a 6000-foot section of rainmaking equipment. Addition of this equipment gave the track one of the longest facilities of this type and an entirely new potential. The rain erosion area starts 8867 feet from the north end of the track and has adjustable spray heads at four-foot intervals. The distance allows enough track for vehicle acceleration before entering the rain area and also provides about 20,700 feet of track for free run and braking after leaving the rain area.

The rain system can produce raindrops of about 1.5 millimeters in mean diameter, which is, statistically, the drop size often found in a natural rain condition of one-half inch per hour; or it can produce any selected concentration up to ten times that. In the latter case a test item that travels 1000 feet in the rain erosion environment has been subjected to the equivalent of 10,000 feet through natural rain. Stud-



ies of the test methods by Sandia Corporation indicate that the raindrops, even in a concentration ten times that of natural rain, are far enough apart that the drops do not bunch at impact. Each impact is complete before the next drop hits the test item on the same spot.

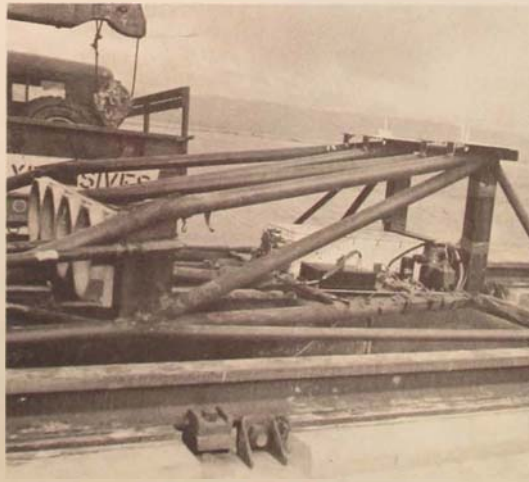
The rain spray from the nozzle system is concentrated to fall on the west side of the track. Rain erosion tests customarily use monorail vehicles, with the missile nose cone, radome, or other test item mounted on a stinger or gooseneck in front of the vehicle. Most rain erosion tests, to date, have been performed at velocities of mach 2 to mach 4; future tests are programmed up to mach 5. Rain erosion tests are conducted generally under early morning "no wind" conditions between March and mid-December when the ambient temperatures do not fall below freezing.

Blast-vulnerability testing. A recent test effort is aimed at determining the vulnerability of re-entry vehicles. Re-entry environments have been simulated by passing the test vehicle through shock tubes filled with heavy gas, such as Freon, or through a high-pressure wave generated by detonating large quantities of TNT at a trackside station. Also planned are free-flight impacts at velocities between mach 3 and mach 6. The test vehicle will leave the north end of the track and subsequently pass through a blast field.

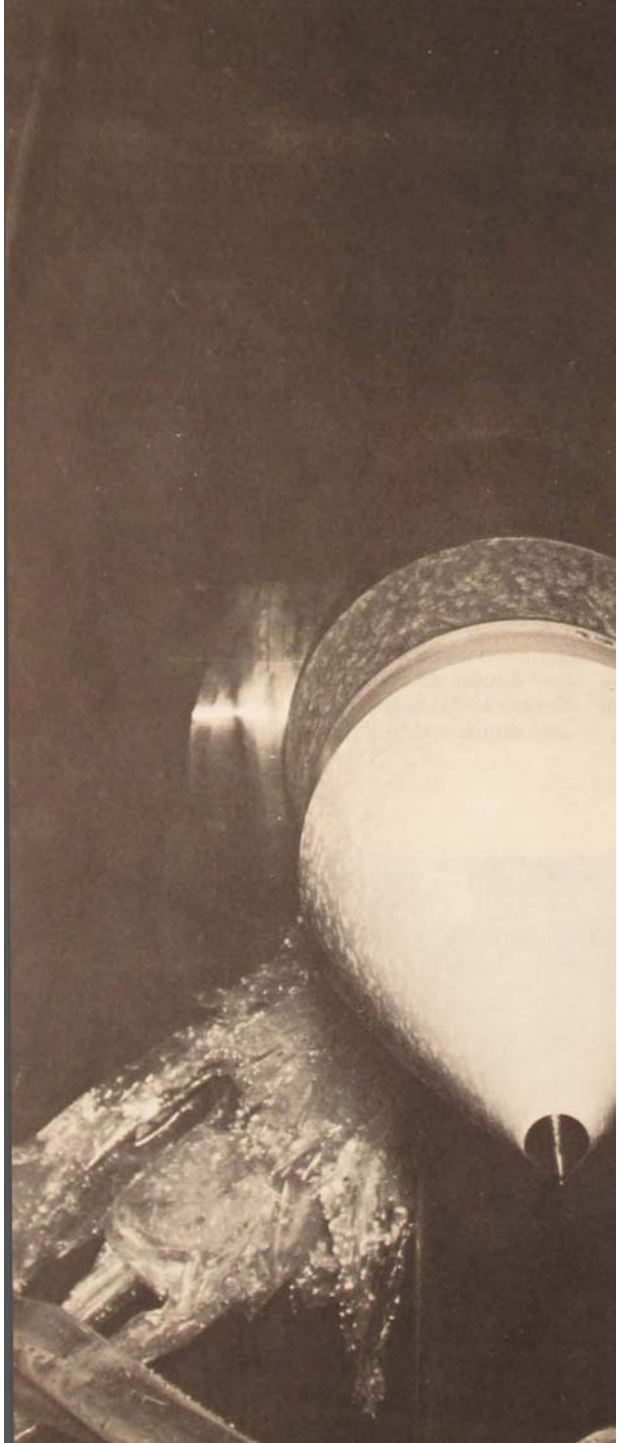
Special facilities have been constructed for the testing of blast effects: (1) A captive site, 13,000 feet from the south end, provides protection for the test track and gives a clean blast wave over the recoverable re-entry vehicle. (2) The north breech area has been hardened to withstand four to six pounds per square inch (PSI) overpressures. (3) A 500-foot extension at the north end allows for free-flight and impact of the test items.

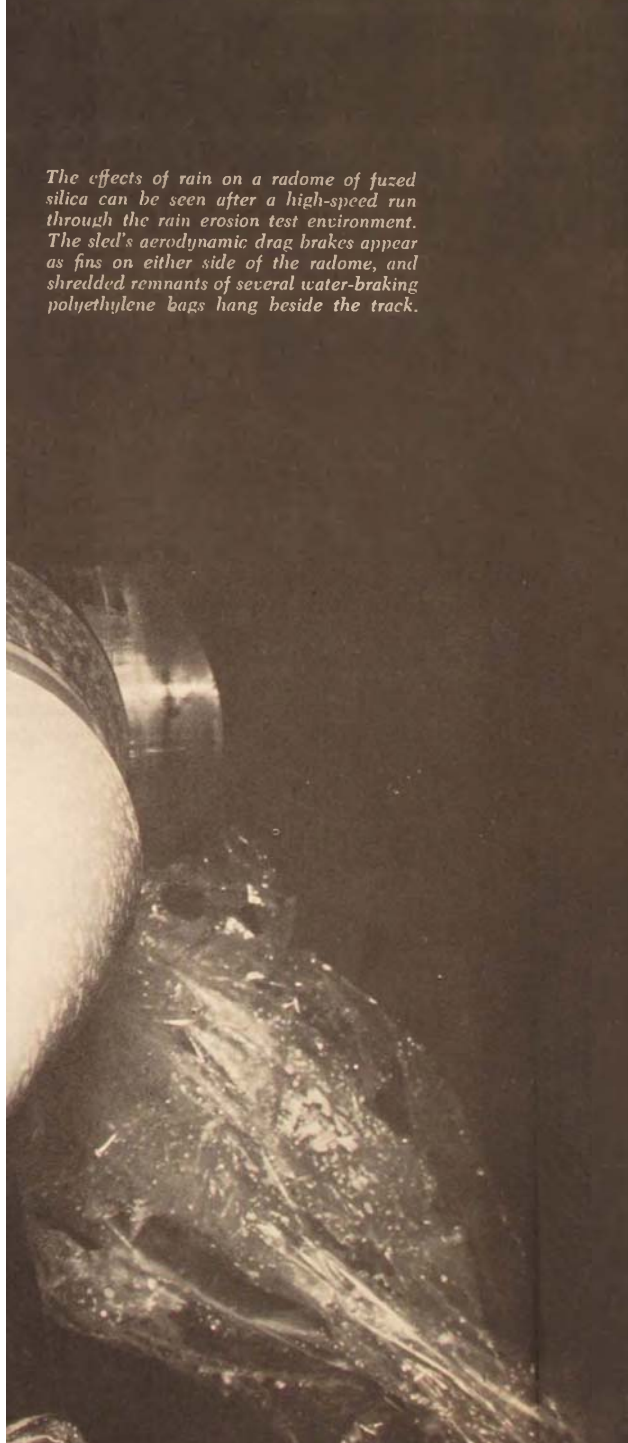
Blast tests require special efforts because the sled/blast encounter must be precisely timed to occur at a specified track station. In one of these tests, it is planned to accelerate a two-ton sled to mach 3 and have it meet the blast wave at the captive blast site.

A more detailed view of the vehicles using the track will better explain how the tests are performed.



A Lance missile nosecone is mounted for an impact test. The monorail sled carries it to the impact area just beyond the track. Fuzing switches actuate strobe light systems or telemetry links, to indicate the sequence and time intervals between fuzing events. High-speed photography records the actions. . . . The early GAM-67 sled, originally expendable in testing the Crossbow missile nosecone's fuzing system, as modified is still used today.





The effects of rain on a radome of fuzed silica can be seen after a high-speed run through the rain erosion test environment. The sled's aerodynamic drag brakes appear as fins on either side of the radome, and shredded remnants of several water-braking polyethylene bags hang beside the track.

track vehicles

Holloman keeps over 100 sled test vehicles in its inventory of both dual-rail and single or monorail design. They range in size from a vehicle of 15 pounds to a 15-ton giant. It is quite a change from the day when the sleds in use were little more than a missile cradle with a booster rack for solid-propellant motors.

Today the track boasts vehicles for virtually any use. And if the sled needed is not in stock, it can be designed. Dual-rail vehicles are used where the need is for large payload capacity, space for extensive instrumentation, and precise acceleration, deceleration, and velocity profiles. In comparison to the dual-rail sled, a monorail vehicle has a smaller payload capacity; but its advantages of high velocity potential, light weight, minimum propulsion requirements, and ease of handling make it an excellent vehicle for various applications, such as the impact testing of missile nose cones and warheads. On the other hand, most testing of guidance systems currently requires use of dual-rail vehicles.

Both solid and liquid propellants are used, and just as in the choice of sleds, each offers advantages as well as disadvantages. Solid-propellant motors are readily available in assembled form, relatively easy to store and handle, and require only simple hardware to adapt them for track testing. On the other hand, there is a relatively high cost per unit for some of the high-performance motors, and they lack precise thrust control for individual units during burning. For pushing very large payloads to moderate test velocities, liquid propellants are more economical, and their controllable thrust over a long thrust period is a definite advantage required in some tests. The low rate of acceleration onset and the ability to vary thrust profiles accurately make liquids particularly well suited for use in testing guidance systems and guidance system components.

An interesting problem that might not occur to all is that caused by the local bird population. Birds can be sled wreckers. This might seem highly improbable: a few ounces of bird versus a 200-pound sled. But at supersonic speeds the laws of physics still prevail, and strange things do result. Hitting a bird can leave a jagged hole in the test vehicle. Half-inch steel sheathing is torn almost like paper, prows are dented, and slippers have been knocked loose. The track lures birds because the braking water makes an ideal birdbath and a good place to satisfy their thirst in the arid desert area. The rails make a good perch, but they also serve as death traps: the sleds travel faster than sound so that the population of "avian heaven" is increased before the birds can fly away. Numerous devices have been tried to correct the situation. Track engineers finally decided upon sending a small monorail sled ahead of the primary test vehicle to disperse the squatters. And currently Primacord is set off just prior to a run, which quite effectively scatters the birds.

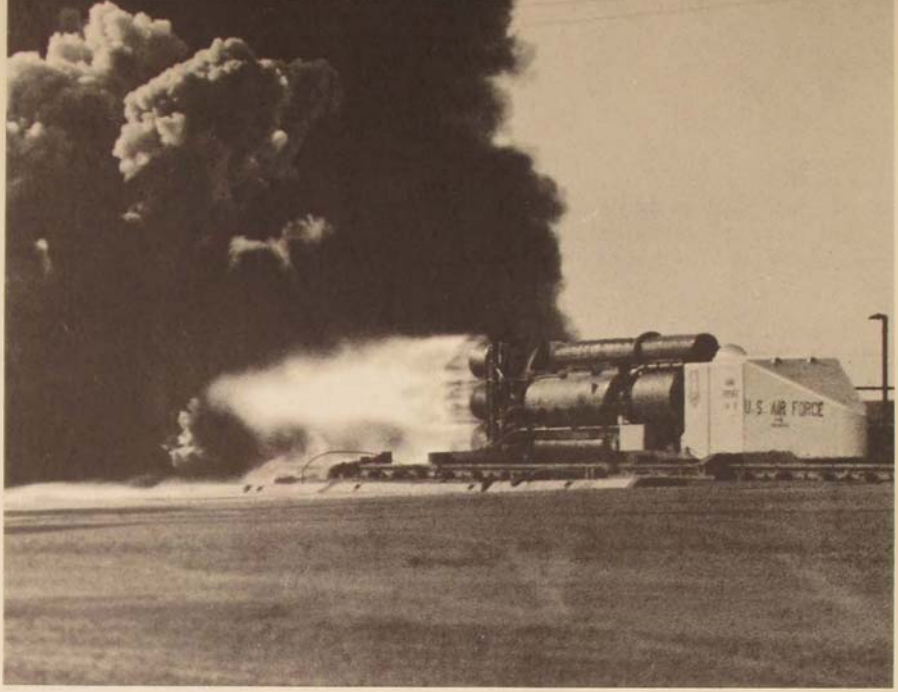
current test efforts

A visit to the track reveals one obvious fact: there is no set hour for test programs. Testing may begin in the early hours of the morning or late at night.

One of the current early morning tests is that conducted for the Army's Frankfort Arsenal on 20-mm point-detonating fuzes. The weapon, a Mann gun, is mounted on one rail of the track and fired into a rain curtain. At a predetermined distance, the fired ammunition is caught in a sand-filled hopper. The test answers a very simple but important question: "Are the fuzes sensitive to rain?"

The normal rain erosion test, however, makes use of a sled. For example, we recently completed a series sponsored jointly by the Air Force Materials Laboratory at Wright-Patterson AFB, Ohio, and the Naval Air Development Center at Johnsville, Pennsylvania. The project aimed to determine the effects of rain on various materials while traveling at supersonic velocities. Stainless steel wedges capable of holding 80 samples were furnished by the U.S. Navy. The fixture, mounted on a gooseneck in front of a sled, presented the materials to the rain field at five different impact angles: 15, 30 45, 60, and 90 degrees. The series was quite successful and provided useful data.

A continuing effort at the track has been



concerned with the testing of various dispensers. These projects generally had as their aim the development of better methods for delivering bomblets or agents such as that used for defoliation. Somewhat in the same category is the series of track tests designed to fire the 2.75-inch folding fin aerial rocket (FFAR) from an SUU-20/A dispenser. The aim, as in most launch projects, is to determine the actual rocket trajectory and compare it with the theoretical. The ultimate goal, of course, is to determine whether or not the rocket and launcher can be used on an aircraft.

As noted earlier, a portion of the track's effort is devoted to blast testing. As part of a program sponsored by the Defense Atomic Support Agency, TNT charges are being detonated close to the track to measure structural loading and dynamic response of supersonic sleds during blast wave intercept.

A continuing series at the track involves the F-111 crew escape module. This two-man cockpit section separates from the parent aircraft by explosive charges, is propelled away from the sled by a rocket motor, and finally is recovered by a 70-foot-diameter main parachute. The module has been tested more than 50 times since September 1964.

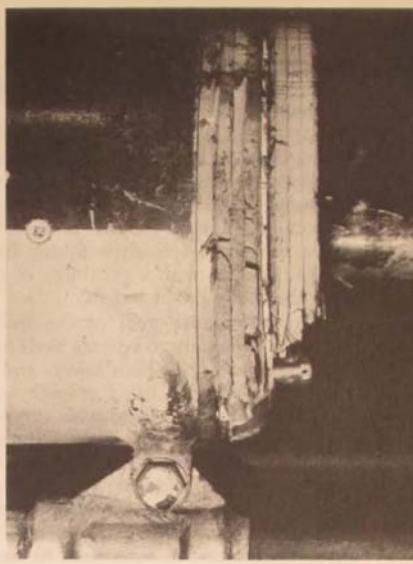
The F-111 escape system is by no means the only one under test. The track completed a test series for Lockheed Aircraft Corporation to evaluate an improved seat ejection system for the F-104. Similarly a program is under way to test an all-purpose system designed by the Douglas Aircraft Company. The RCAF's Central Experimental and Proving Establishment located at Ottawa, Ontario, is using the track to evaluate the escape mechanisms of the Tutor and T-33 trainers and CF-5 tactical aircraft.

The work on guidance systems is progressing, with sled tests being conducted to provide data on the suitability of a strapped-down inertial measurement unit for both boost and space guidance applications. One test unit is a modified lunar excursion module (LEM) abort sensor assembly (ASA). Another program aims to evaluate an improved accelerometer; it was no accident that the instrument returned to the track, the scene of earlier evaluations in the Minuteman guidance programs.

No less important in a day's activity are

Typical Test Situations

Liquid engine ignition, with red fuming nitric acid as oxidizer and JPX as fuel. The combination produces over 125,000 pounds of thrust for 7 seconds and achieves a sled speed of over 1000 mph. Developments in liquid propulsion have increased thrust to 150,000 pounds. . . . The F-111 cockpit is mounted on a dual-rail rocket sled for track testing of the ejection system of the crew escape module. . . . Bird damage—a problem being solved.



the tests to determine the effects of impact on a test specimen. For example, Ballistic Systems Division of Air Force Systems Command is sponsoring a series to determine the performance of a contact fuze system and the structural response of the payload to impact.

With the advent of operations in Southeast Asia, the track has played its part in qualifying weaponry for that area. Tests have been conducted to qualify 20-mm ammunition, to check out various dispensing systems, and to evaluate the rain erosion characteristics of numerous materials.

While this survey of the track activity gives only a sample of the 31 separate projects now in progress, it does indicate the broad spectrum of test capability. As one former track commander said of the track: "Its uses . . . are limited only by the engineer's imagination."

future goals

The Track Directorate is a complete operating entity, providing the facility itself, the test vehicles, propulsion, electronic and optical instrumentation, engineering services, and project officers. This facility at Holloman AFB is the major test track in the Air Force today. Backed by over fifteen years' experience, track personnel are constantly exploring new avenues for sled testing and ways to extend the range of test environments that can be offered to users.

The tendency in track testing—for many programs—is toward even higher sled velocities. One goal is a hypersonic mission capability, at velocities up to 8500 feet per second, with recovery of the sled and its payload. Another goal is to achieve velocities of 10,000 feet per second for impact work. To meet these demands, track engineers and scientists are constantly evaluating numerous means. For example, the conventional solid-propellant rocket motors used on monorail sleds reach a practical limit when the air drag approaches the thrust level of the motor. To achieve high-sustain velocities, track people are looking at the application of air-augmented rocket systems. These ducted rockets promise an increase in propulsion efficiency by providing a higher specific impulse (e.g., existing motors, 200 pound-seconds per pound; ducted motors, 600

pound-seconds per pound). Further, there is the possibility of reuse of the hardware with the ducted system.

As to dual-rail vehicles, efforts are under way to develop a sled whose performance will significantly surpass the mach number range currently available. Tentative performance goals call for a mach number range to five and above, carrying payloads weighing from 1000 to 3000 pounds, with a capability of recovery using the existing track length.

Another future goal of the track is to attain the capability to operate sleds for a part of their trajectory in both lower- and higher-density atmospheres using polyethylene bags fixed to the rails and filled with various gases, such as Freon. The aim of the operation in a low-density atmosphere is to reduce drag, impact pressures, and stagnation temperatures at hypersonic speeds. Through high-density gases the sleds will experience aerodynamic environments nearly equivalent to those of a higher mach number in ambient air.

To conduct tests at velocities in the realm of mach 6 and above, we shall have to develop instrumentation equipment capable of withstanding the more severe environments. Higher velocities dictate, for example, reductions in sled volume and wetted area, thus reducing the space available in the vehicle for instrumentation. Thus increased use of miniaturization of instruments will become a necessity, besides improved tolerance of the instruments to stronger vibrations. The successful use of high-speed sleds as research tools depends further on improved data-retrieval techniques. Currently, sleds moving at 6000–7000 feet per second are operating on the threshold of radio frequency (RF) blackout due to ionization similar to that experienced in re-entry. Frequencies fitting atmospheric transmission windows or delayed data transmission may solve this problem. Yet another demand caused by the increased velocities for such tests as impact and free-flight blast is better motion picture coverage. Track operators are now working toward rates of 100,000 frames per second and beyond.

As to other goals, there are many. Improvement of the velocity measuring system is one. One aim is to obtain a passive system (e.g., a laser) with an accuracy goal of .01 foot per second. Yet another is improvement of the rain simulation facility. Rain erosion experiments on the track are the only known means for realistic ground testing of the destructive effects of rain on warheads, radomes, etc., during supersonic or hypersonic flight. We hope to improve the rain facility so that it can simulate real rain intensities ranging from a light mist to a thunderstorm cell. Dust and sand testing are also currently being considered.

Continuing research and development in all areas of track performance capability, concurrent with actual testing, have resulted in an outstanding track facility. I believe that the facility will continue to improve and expand its already diverse and proven worth to the nation's aerospace test programs.

Air Force Missile Development Center

THE BRITISH APPROACH TO STRATEGY:

Perspectives for the U.S.

LIEUTENANT COLONEL RAY L. BOWERS

The military posture of the United States today rests primarily upon this nation's strength in sea and air power. It is through command of the sea and air that America extends military power to far-flung corners of the globe, containing and balancing the power of her cold war enemies—enemies whose natural strength lies in land forces. Our sea power and air power reach into the Congo, the Middle East, the Dominican Republic, Korea, and Southeast Asia. Behind these global activities stands the ultimate deterrent, our strategic nuclear forces, which are themselves expressions of America's power in sea, air, and space.

Our current world position holds striking resemblance to that of Britain—the nation of sea power—during the past several centuries. Britain represented a technically advanced and relatively wealthy society, confronted with Continental enemies who possessed superior strength in manpower and in land warfare capabilities. Again and again over the decades, Britain succeeded in making her strength felt in conflicts with Continental foes. Her methods constituted the classic weapons of a nation of sea power; in retrospect they serve to suggest the possibilities and the pitfalls of similar strategies for the future.

The current global military involvements of the United States are relatively new in American policy, and thus our strategic thought cannot draw on a historical continuity rooted in our own experience. The American public as well as our strategy-makers — soldiers and statesmen—are thereby at a disadvantage in attaining the deeper view and historical perspective required of them. It is useful, then, to condition our view to the essential continuity of America's current strategic problems from the past by examining the classic and traditional British approach to war.

the continuum of air warfare from naval

During and after the Second World War, the United States became the heir to Britain's historic command of the sea. American military policy reflected as well a strong preoccupation with the air weapon, a recent intruder as an

instrument of global power. During the eight years beginning in 1950 (a period which included the ground fighting in Korea), 68 percent of the nation's military spending went to the Navy and Air Force.[1] Thus, although the mass citizen army vanished along with the notion of universal peacetime conscription, the nation's ability to deploy strength globally has remained strong. How, then, does the intrusion of air power validate the picture of American strategy as analogous to Britain's historic approach to war?

Both sea power and air power have been the natural tools of the more technically advanced nations; both take strength from a society tuned to technical things. Both are concerned with bases and lines of communication. In both arenas, conflict lacks fixed fronts and is concerned with achieving command of the medium. It is no coincidence that Mahan's doctrine of the command of the sea found reflection in the English title of Douhet's book, *The Command of the Air*. Both air power and sea power yield access to distant regions; both possess the mobility and striking power to exert force over great distances. Both can make a show of force, unmistakably supporting the nation's diplomacy. The expanding possibilities of strategic and tactical air transport suggest past strategies of sea power. The ability of air forces to strike directly against enemy land communications constitutes a new and reinforcing capability. Thus, the far-reaching sea power and air power of the United States today and the strategic considerations underlying their employment may be viewed as similar to Britain's past global use of naval power.

Britain's historical sea power strategy

A nation's historical approach to war is a product of three broad circumstances: the nation's geographical and strategic situation, the prevailing attitudes and characteristics of its society, and the ideas of its military theorists and leaders. Generally speaking, the first of these factors—particularly the happenstance of location—has been the most fundamental in influence, itself coloring the other two. The states of Continental Europe, for example, because of the contiguity of dangerous enemies, have been obliged to give close attention to doctrines and readiness for land, as opposed to sea, warfare. Poland failed to organize herself effectively for war despite strong neighbors, and as a result Poland vanished from the map throughout the nineteenth century and again in 1939. Poland's example underlined for Prussia and modern Germany the significance of strength for land warfare. Regular involvement in Continental wars caused France and the Austrian Empire to give first attention to problems of land rather than sea warfare. Modern Russia and China became almost exclusively powers in land warfare because of their interior situations, vast populations, dependence on land communications, and technical backwardness handicapping development of sea power. The Japanese crushed emerging Russian sea power at Port Arthur and Tsushima Strait in the war of 1904–5, as they had crushed that of China ten years earlier.

Nations outside the Eurasian mass—Britain, Japan, and the United States—in their security from land invasion, have historically developed naval strength as the first instrument of national power. In Britain and the U.S., this has been accompanied by strong distrust of militaristic tendencies and aversion to large standing armies, conditions which have strengthened democratic political development; but in Japan, antimilitarism and democracy are recent conditions of uncertain endurance. In wars, these sea power nations have generally been successful against enemies that stress continental land forces. Of the three, the British experience has been by far the most prolonged and consistent.

The English preoccupation with naval strength, begun in the reign of Elizabeth I, became established as a conscious and permanent approach to strategy during the wars of the seventeenth and eighteenth centuries, maturing in the Seven Years' War (1756–63) against France. Shaken by early defeats in the Mediterranean and in North America (Braddock's defeat), the British cabinet turned to William Pitt, the Elder, who soon emerged as supreme director of the nation's war energies.

Allied to Frederick the Great of Prussia

and holding important territorial possessions in Germany. Britain might have elected to dispatch large land armies to the Continent. Many Britishers, including the King, supported such a course of action. Aware of Britain's limited capability in manpower to decisively influence land campaigns on the Continent, Pitt turned toward less direct strategies. He would aid his Prussian ally with financial subsidies and token fighting forces, but England's principal energies would be directed elsewhere—toward developing and exploiting Britain's naval might, to win world empire in North America, India, and the Caribbean.

Under Pitt, the tide of war turned to favor the British. The French New World bastion of Louisbourg at the mouth of the Saint Lawrence fell before determined British action in 1758. Wolfe's subsequent amphibious campaign against Quebec, a thousand miles up the Saint Lawrence, assured the conquest of North America for the British. Meanwhile in the West Indies, British expeditions seized valuable French possessions—Guadeloupe, Martinique, and Dominica. On the opposite side of the globe, French forces in India witnessed the blocking of their support from home, while English supplies and reinforcements increased. Pitt's global strategy also included successful attacks against French stations in Africa, conquest of prized Spanish Manila, and several hit-and-run assaults on the French coast itself. Command of the seas was absolutely vital to all these campaigns; it had been achieved in 1759 by two decisive victories over French fleets, at Lagos Bay off Portugal and at Quiberon Bay on the French coast. To the last, the English remained aloof from the grand campaigns on the Continent; and Pitt's strategy won world empire for Britain.[2]

The French Revolution at the end of the century served to revitalize French arms. Under the brilliant Napoleon, France defeated her Continental opponents, uniting all of Europe by 1807 against British economic strength. French sea power, however, had been crushed through a succession of British naval victories, culminating in the triumph of the incomparable Nelson at Trafalgar in 1805. For a decade thereafter the giant of the seas and the behemoth of the land each remained supreme in its own realm, neither able to bring the other to ultimate defeat.

Upon the outbreak of conflict in the 1790s, Britain promptly put into effect her traditional naval-oriented strategy, opening a series of overseas campaigns, notably in the Caribbean, entirely peripheral to the campaigns on the Continent. Britain's colonial and commercial activities prospered increasingly with the elimination of French sea competition. Having learned the futility of warring without Continental allies during the war of the American Revolution, Britain now engineered a series of coalitions against France, financing Prussian, Austrian, and even Russian armies with the fruits of British commercial prosperity. Meanwhile French schemes for direct invasion of the British Isles floundered at the coastline before the reality of English sea power. Napoleon's Continental System, an economic boycott against English trade embracing most of Europe after 1806, hurt him more than Britain, straining the economics of the Continental states and turning their peoples toward nationalistic anti-French restlessness. Weaknesses in the Continental System helped bring Napoleon to his enervating involvement in the Peninsular War and to his disastrous campaign in Russia.[3]

Napoleon's invasion of Spain and Portugal, and his subsequent difficulties in stamping out the people's resistance there, provided an opportunity for British intervention. Wellington's small Anglo-Portuguese army on the peninsula, deployed and comfortably sustained for six years by British sea power, fought one of the classic campaigns of military history. The large French armies found their overland communications ruined by extensive partisan activity, and they were unable to live off the countryside because of the poverty of the region—attempts to do so only further enflamed the fierce Spanish resistance. Scattered over wide areas in order to police the insurgent countryside, the French armies never could concentrate sufficiently to crush Wellington. The Peninsular War, conducted in a peripheral theater where Britain's sea communications were easier than the enemy's by land, epito-

mized the British approach to war. The years of involvement in Spain drained France's strength and helped lead toward her final defeat. By the close of hostilities in 1814, Wellington's army had pressed across the Pyrenees and into southern France.[4]

The final convulsion—the campaign at Waterloo—found sizable British ground forces at last committed in the central theater. Wellington's 94,000 absorbed Napoleon's heaviest and most desperate blows on the final day. Significantly, however, only a third of Wellington s men were British; the rest were Dutch and German allies.

During the century after Waterloo, Britain's naval and commercial strength yielded vast prosperity and power. Her control of the seas permitted deployment to the Crimea in 1854–56, to fight a peripheral war along the fringes of Russian strength. Otherwise, Britain remained aloof from the Continental wars of Germany, Austria, and France, although she willingly used her warships to block Russian control of the Straits at Constantinople in 1878. In both the Crimea and the Straits, Britain was practicing a policy of containment toward imperial Russia, using naval strength to check the land power most dangerous to the Continental balance.

the twentieth century

The First World War constituted for Britain a drastic departure from her traditional strategy. Following prewar understandings between Sir Henry Wilson and the French military planners, Britain's army moved into France at the outbreak. Repeated Allied offensive efforts in the west led to the deployment on the Continent of the bulk of Britain's newly trained manpower. Planners became obsessed with the front in France, following the writings of Clausewitz that stressed destruction of enemy strength in a single, direct, grand engagement. Proposals for peripheral ventures of the historic type were emotionally resisted by the field commanders on the Continent, British as well as French. Yet until the war's final year, every attempt at smashing the deadlock in France only intensified the bloodbath. The feeling that no forces should be spared from the decisive western theater contributed to the tragedy of missed opportunities surrounding the Dardanelles undertaking of 1915, and the momentous consequences sought by this classic peripheral venture of sea power went for naught.[5] Admiral Fisher, who himself urged amphibious operations in the North Sea and the Baltic, expressed the frustrated traditionalist view:

> *25 January 1915*
>
> It has been said that the first function of the British Army is to assist the fleet in obtaining command of the sea. This might be accomplished by military cooperation with the Navy in such operations as the attack of Zeebrugge or the forcing of the Dardanelles. . . . Apparently, however, this is not to be. The English Army is apparently to continue to provide a small sector of the allied front in France, where it no more helps the Navy than if it were at Timbuctoo.[6]

During the thirties the brilliant young writer B. H. Liddell Hart led the reassessment of the war in Britain. In the first chapter of his book, *The British Way in Warfare* (1932), Liddell Hart pointed out the historical inconsistency of Britain's wartime policy. Was the Kaiser's Germany any more dangerous to Britain than Napoleonic France had been? If not, why had Britain poured out her strength in "wholehearted abandon," sacrificing a generation of her youth and her global economic leadership? At first British military leaders reacted coolly to these painful questions, but gradually they began to divide toward partial acceptance of Liddell Hart's view.[7] The approach of Britain's military leadership to the strategy of the Second World War was to be unmistakably colored by the reacceptance of the traditional British view.

In 1942 and 1943 the question of an early cross-Channel assault brought the British strategic approach into focus. American leaders pressed for firm agreements on specific planning dates for the Continental invasion, while British strategists responded unenthusiastically and sought enlarged activity in the Mediterranean. The Mediterranean constituted a peripheral theater, one which many Ameri-

can planners denounced as a strategic dead end but which suggested to the British an importance like that of Spain in the Napoleonic wars. Germany was to be progressively weakened by strategic bombing, blockade, and constriction of the ring about her, prior to the final assault. Grim memories of the First World War strengthened British caution; Churchill feared a Channel "red with the blood of British and American youth." The Americans, who needed early and firm commitments in order to organize their mass-production economy toward the vast logistics requirements of the buildup, seemed unnecessarily rigid to the British, who preferred a more flexible and opportunistic approach to future plans. Churchill denounced the unsophisticated American view as a "logical, large-scale, mass-production style of thought." As late as the Teheran Conference in November 1943, Churchill was talking about delaying the cross-Channel assault in order to stage new amphibious ventures in the eastern Mediterranean; Stalin's firm opposition finally served to close the matter.[8]

In retrospect, the British reluctance about OVERLORD, the cross-Channel invasion, now seems less definite than it did to American strategists at the time; many of the British reservations were based on sound appraisal of factors not always fully assessed by the Americans. Sometimes British military officials viewed the Prime Minister's far-ranging strategic imagination with as much irritation as did the Americans. When in early 1944 Churchill pressed for an "Asiatic-style North Africa operation," the heads of the three British fighting services threatened resignation in opposing this "Bay of Bengal" strategy. One critic of Churchill attacked the "traditional" approach, writing that before 1939 "the British public was trained to put faith in every conceivable means of winning wars save by fighting battles and beating the enemy." Meanwhile Britain's traditional practice of subsidizing Continental allies was suggested in World War II by her eagerness to aid the Soviet Union with material and financial aid, a willingness shared by the Americans. After the war Churchill's defenders could show, perhaps speciously, that the United Kingdom suffered only a third as many military deaths in the Second World War as in the First, attaining an equally complete victory despite the early collapse of her closest ally.[9]

the British way

In summary, the British have historically used a variety of techniques in seeking to employ their supremacy in sea power to defeat Continental land powers. Taken together, these techniques constitute a "British way in war" that has been consistently followed save during the war of 1914–18. Generally the British have sought indirect measures of strategy and have avoided deployment of mass armies in Continental campaigns. Four principal techniques appear salient, all of which have rested upon the fundamental command of the sea assured by the Royal Navy:

(1) Use of naval superiority to blockade enemy commerce and to maintain or expand one's own commerce.

(2) Use of wealth from commercial activities to subsidize allies, sustaining their strength for land warfare.

(3) Peripheral land-sea ventures in theaters more easily accessible by sea than by the enemy's land communications.

(4) Limited participation in large Continental campaigns, contributing physical and psychological stiffening, especially when the enemy has been weakened by the attritional effects of the first three.

This formula served Britain well and brought her power disproportionate to her numbers. Her victories have usually been won at relatively small cost in manpower.

The principal twentieth century intruder into Britain's hegemony of the seas, the United States, has practiced each of the four techniques at various times. This nation's strategies during the nineteenth century wars with Mexico and Spain and during the Civil War rested heavily upon naval superiority. During the Second World War this country generated enormous power for land warfare, so that our leaders approached the strategy of the European war mainly from this viewpoint. The

needs of the Western Front during our involvement there in 1917–18 had even more thoroughly obscured any strategy oriented to sea power.[10]

lessons for the United States

Actually, the Americans have since 1950 followed clearly, if perhaps unconsciously, the British example. Our presence on the peninsula of Southeast Asia suggests the British posture in Spain and Portugal at the time of Napoleon. In each case, the British and the American, access by the nation controlling the global sea (and/or air) routes was easier than the laborious land communications of the enemy. Meanwhile, each of these peripheral strategies rested upon a bedrock of ultimate power: in the one case Britain's battle fleet of ships-of-the-line, and in the other, the strategic nuclear forces of the U.S. Navy and Air Force.

There are difficulties in correctly applying the historical British experience to the American strategic situation of today. The American problem of maintaining an almost nonexistent balance of power in continental Asia has been staggering, whereas the British could usually find in Europe several competitive states of roughly equal dimensions of strength. Thus the British technique of subsidizing Continental allies has been less successful for the Americans, and this country has felt obliged to intervene with significant land forces on the Asian periphery twice since 1945.

It may be that study of the war against Japan holds particular significance for contemporary strategists. The victory in the Pacific represented the successful application of overwhelming preponderance in sea and air power, although Japan scarcely represented the kind of continental land power posed by China now. In Europe, Allied sea and air strategies were blurred by the decisive role of land fighting on the Russian front and in the west after D-Day. Perhaps the situation during the later stages of the Korean fighting presents the most meaningful example for the future. American sea power sustained deployment in Korea of land forces to maintain a defensive stalemate on the ground, while U.S. air forces punished lines of communication and other air pressure targets, inflicting attrition and preventing enemy buildup for major offensive operations despite his numerical preponderance. The similarity to Wellington's essentially defensive methods in Spain was notable. Another Chinese intervention against American power along the fringes of the Asian continent in Southeast Asia might be met by even more successful strategies, following the British pattern. Our methods could include: (1) sustaining a defensible perimeter on the ground through sea and air transportation, (2) intense air attack against selected targets, including enemy land communications made vulnerable by their length, by the needs of the enemy's enlarged ground forces, and by the absence of sanctuary, (3) subsidy of Asian allies to help in the ground fighting, and (4) the threat of offensive amphibious sea and air operations to unbalance the foe and weaken his concentrations.

This would be no panacea formula promising quick success without the agony of bitter ground fighting. Only the scope and not the intensity of land warfare would be limited. The notion of invading and occupying a large part of the Chinese homeland would be beyond consideration.

All that would be needed, perhaps, is an astute national leadership strong enough to overcome the inevitable impatience of the public for quick results regardless of costs or hazards and calling for either withdrawal or major "escalation" as alternatives. The idea of containing and balancing enemy power, not eliminating it, must, in my opinion, be viewed as an acceptable objective. The British in history have usually been patient for success. It was the Americans who wished to stage a cross-Channel assault in 1942 and 1943; it was the Americans who planned invasion of Japan for 1945–46 despite the clearly accelerating effects of Allied sea and air power. Unless the United States accepts not merely the outward patterns of the British approach to strategy but also the state of mind required for consistent application of that strategy, our vigorous world policy might end either in retreat or in total war.

The British have shown that a technolog-

ically advanced society, favored by geographic location, may by sound strategy contain and balance the awesome strength of Continental enemies. Britain did this generally without fighting major Continental land wars. America's global strategy parallels the British model, but it remains for Americans consciously to recognize and accept our inheritance from the historic British way in war. The reward is a perspective toward problems of global strategy, a perspective which may point to a permanent approach to world power, along with the necessary resolve to apply such an approach with consistency.

United States Air Force Academy

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Military Affairs Abroad

THE PARTY AND THE MILITARY IN THE SOVIET UNION

Major John F. McMahon, Jr.

THE reasons for the ouster of the Soviet "collective leadership" in June 1957 and Nikita Khrushchev in October 1964 are both complex and simple. Much of what really happened must remain in the realm of educated speculation. In both instances, however, several preliminaries occurred which have a well-documented parallel in the history of recent Soviet politics. Some of them are germane to our discussion of the evolution of the military as a political force in the Soviet Union: First, there was a threat to downgrade and weaken Soviet military power through the reduction of defense expenditures. Second, covert activity, directed against the incumbent leadership and supported by some deterrent power-oriented Party members, took place at the highest levels of the Party hierarchy. Third, but not last, the military leadership was prevailed upon to wield a balance of power in favor of the anti-incumbent faction. This political-military coalition succeeded both times in overthrowing the incumbent political leadership, so that a new leadership rose to power with its very existence indebted, temporarily at least, to the military.

In many respects the 1964 pattern closely resembled that of 1955–57 when Khrushchev used the military to depose Malenkov and his associates. In both instances the one major consideration that tended to draw the military into the issue was the threat to Soviet military might and prestige through reduced defense expenditures. The military supported the anti-incumbent faction on the premise that the latter would continue to make Soviet defense policy its chief concern. It was considered essential that Soviet military power retain its posture vis-à-vis the United States nuclear force.

It is of little significance whether the real cause of the beginning of the end of the Khrushchevian era was the Cuban missile crisis and its disastrous aftermath, or the agricultural failures, or the Sino-Soviet rift. What is of interest to students of Soviet military history is the emergence of the military hierarchy for a second time in seven years to act as the balance of persuasion in toppling one dictatorship and supporting the installation of a successor. Although no single military leader emerged as a "hero of the day" as did Marshal Georgi Zhukov in 1957, the rise in influence of the military in the new Soviet government in 1964 was noteworthy and quite significant.

One Soviet affairs analyst in attempting to interpret the 1964 Soviet leadership crisis saw Khrushchev's ouster as the loss of an uphill battle by those who opposed the military ele-

ments. Yuri V. Marin of the Institute for the Study of the U.S.S.R. believed that the move was planned and carried out by a caucus of the orthodox top Party members under pressure from the armed forces supported by state security organs. Other Kremlinologists felt that political motives were absent from this particular military power play. However, the vast potential of the Soviet military machine as a practical political force had been awakened by Khrushchev in his drive to power in 1957, and now, seven years later, the same force that guaranteed his rise to Party leadership was instrumental in the demise of his political power.

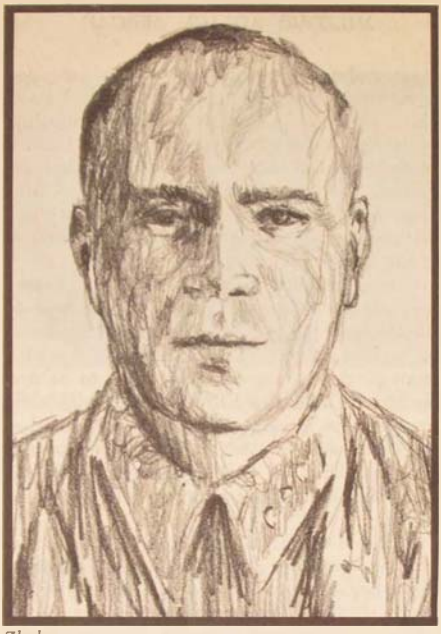
It is of great import that at the present time another potentially significant episode is taking place in the Soviet Union. The facts thus far made public suggest that traditional Soviet defense-mindedness and pressure by military leaders have induced Khrushchev's successors to accept the concept of an antiballistic-missile (ABM) defense net around Moscow and other Soviet cities. Some six years have passed since a rather intense debate began between Khrushchev and the military over the merits and demerits of such an ABM system. From 1961 until mid-1963 Soviet military leaders attempted to correct what they considered to be an erroneous appraisal by the political leadership of the value of an ABM system. Initially, Khrushchev was against a further buildup of defensive capability, as he assessed the Soviet limited offensive missile inventory to be an effective deterrent. However, in the face of an expanding United States offensive missile force the military leaders were able to persuade Khrushchev to retreat from his original position. It was agreed that an ABM defense net would make the Soviet deterrent more credible. Thus, since 1963, a great deal of effort has been applied to perfecting an ABM defense system. Some five billion dollars has been spent on the development and initial deployment of this system.

Present Soviet policy seems to have settled for an ABM capability to enhance the image of Soviet military power as a deterrent force vis-à-vis present United States and future Red Chinese capabilities. Current United States policy is to seek a moratorium on the development and further expansion of this ABM defense net, to preclude an increase in the tempo of the arms race. Although the Party leadership has agreed to exploratory talks with the United States, Soviet military leaders contend that the defense net is needed to nullify or seriously degrade United States offensive capabilities, thereby lending a greater degree of credibility to the Soviet nuclear deterrent.

It seems quite certain that if United States pressure does cause the Soviet political leadership to agree to a moratorium or a scaling down of the ABM effort, then the entire issue of Soviet strategic deterrence would be open to debate once again. The neo-Khrushchevian approach to deterrent strategy would be considered a direct affront to Soviet military expertise and prestige. Then all the ingredients would be available for another political-military showdown.

If a showdown were to occur over the issue of ABM defenses, a new element would most likely be added to the preliminaries. It is believed that two deputy premiers of the Soviet Union, Ustinov and Smirnov, are considered strong supporters of the military and the armaments industry. With the increased military posture of the United States confronting the Soviet Union throughout the world, it is not farfetched at this time to envision a military-political-industrial alliance arguing for the continued development of the ABM defense net and precipitating such a state of affairs in the Soviet Union that the military could be catapulted once again onto the political stage. The argument would most certainly rest on the proposition that military response and preparedness were being sacrificed and de-emphasized in the face of an ever modernizing United States nuclear threat. Then, too, Kosygin and Brezhnev would be accused of going "soft" and of reneging on a once-settled debate.

A conceivable military-political-industrial alliance in the Soviet Union would certainly have far-reaching effects on the Soviet scene. For example, the control of the military has recently become highly centralized in the Ministry of Defense. The Supreme Military Council, which is responsible for top-level control of military operations, now considers all military



Zhukov

matters of the highest order. These two facts alone suggest that the military is controlled by the military at the highest political level, save for the top Party leadership. Much of this has come about due to the pressures of the nuclear age. It is therefore significant to note that if the deterrent-power-oriented Party leaders were to weld together this more independent military structure with the industrial leadership of the Soviet Union over the question of ABM defenses or other defense matters, a major functional change would most likely occur in Soviet political-military relations. Long-held theories about the role of the Soviet military in Soviet society would fall, and Soviet political and military doctrines would have to be re-evaluated in the light of this new-found political wherewithal.

Not since the days of World War II have Soviet military leaders wielded such domestic political influence as they seemingly do at the present time. Indications are that the pressures and patterns of the nuclear age have had far-reaching effects upon Communist doctrine. Soviet military power as an insular tool of the Party has given way to a newer interpretation that the military shares the leadership in the patriotic movement to counter the awesome power of the United States.

Soviet international affairs have forced the military to accept a role foreign to Marxist theory. The Party has had little recourse but to allow the Soviet military to be portrayed as a most awesome and feared force in order to carry out foreign policy goals in a nuclear environment. The military has welcomed this transformation, for it has released them from a past fraught with frustration, fear, and repression.

It is, therefore, logical that we consider the past in order to understand present-day events as well as the theoretical foundations and historical precedents underlying the Party and the military relationship. With some knowledge of what has gone before, a more meaningful appraisal of the military's future role in Soviet political maneuvering can be more adequately determined. In this manner it is possible to arrive at some feasible conclusions while avoiding the penchant for comparing Soviet military tradition with the evolution of the military profession in the United States.

Evolution and Revolution

One of the chief continuing concerns of Soviet leadership has been to maintain and maximize the loyalty of its armed forces. The totalitarian nature of the Soviet Union makes its leaders extremely apprehensive lest any hostile elements penetrate its military establishment or subversive thoughts develop within it. Such a development would be very dangerous to the fabric of Soviet society, and for this reason elaborate safeguards have been formulated to prevent it.

The position of the Soviet armed forces is crucial. The Kremlin is vitally concerned with its absolute strength and spares no effort in building up its military might. On the other hand the very existence of a professional corps of military men, wielding considerable power and gradually tending to develop their own

esprit de corps, has been a constant threat to the totalitarian character of the system. The Kremlin, therefore, has had to absorb within itself the military machine and make absolutely certain that a second force capable of turning against it would never exist. The officers and men of the Soviet armed forces have been trained to conceive of themselves as being, first of all, willing supporters of the political system and the philosophical assumptions on which it is supposedly founded and only secondarily military men, professionally trained in the art of war. As we shall soon discover, the Soviet regime is today plagued to a greater degree by this last proposition, since the advent of nuclear weapons has thrust the military into a new and important role in Soviet power politics.

The Marxists have always closely related the military to domestic politics, considering the military more as an instrument for a ruling class to maintain its power at home than as a tool of international combat. To the Marxists, the soldiers in any country are the second line of defense when the police have been overwhelmed. Lenin said often that a revolution could not be successful under modern conditions of warfare if it did not win to its side enough of the military to neutralize the effectiveness of this strongest weapon of the rulers. The military is thus recognized as one of the most important instruments in politics.

According to the official Soviet view, the Red Guard was the principal and decisive armed force in the November rebellion. The Red Guard was *par excellence* the military organization of the proletariat which was fostered and developed by the Bolsheviks in 1917, in preparation for the armed rebellion they were planning. However, at the first conference on military affairs after the revolution, there arose differing opinions as to the place of the Red Guard in the new society. The members of the Central Committee, Communist Party of the Soviet Union (CPSU), wanted to arm the workers and form them into separate armed units under political control. The professional military wanted to maintain the military as a fixed unit for national defense, using the Red Guard as the foundation of a new army. These latter views could not prevail against the Party's wishes, and so the military was forced to accept second-best within its own profession.

The expression of these views marked the beginning of conflict within the Party military organization as to policy and tactics. These conflicts became an integral part of the military life of a regime under which the military was deposed from its position of political aloofness and made politically conscious—at times acutely conscious—of the political disputes within the Party. To this day the professional military officers have waged an unending battle against political controls in the armed forces. The ever present fear of military influence has caused the Party to use direct methods of control of the Soviet armed forces to a greater extent than in any other mass organization. The long-range success of the Soviet leaders in holding the loyalty of the armed forces is related directly to the general emotional acceptance of the Soviet system by the great majority of the high command. Sufficient military discipline exists

Malinovsky

within the armed forces to enable the high command to maintain its authority over the rank and file.

One of the chief concerns of the Soviet leaders has been to maintain and maximize the loyalty of the armed forces. The masses in a totalitarian state are deprived of even the smallest vestiges of political power, and so a crisis finds them unable to produce from the ranks any organizations ready and able to do battle on their behalf. They can only apply for assistance to groups already formed and persons possessing some sort of authority. In such a crisis, history points to the military as the governing factor. By means of the proceedings taken against the leaders of the Bolsheviks' Old Guard and the Red Army in 1937, Stalin was insuring his totalitarian power against any such crisis into which the country might be thrown. The fear that the military was becoming an influential force automatically resulted in the destruction of the visible representatives of this group. Since de-Stalinization, the Party's tasks have become much more difficult because of the present age of "enlightened existence" in the Soviet Union, the "elite" economic and social status of the military high command, and the apparent rise of the military into the higher levels of political activity (e.g., the Zhukov affair and Marshal Malinovsky's role in the U-2 incident, the Cuban missile crisis, and Khrushchev's downfall).

The Soviet government has attached exceptional importance to the political training of the Soviet Army, Navy, and Air Force, holding that in the hands of men who are ignorant of the object for which they are fighting military technique loses a great deal of effectiveness. In the hands of men who are fighting for definite ideals, however, military technique acquires added power. The shibboleth of the Party during the formative years of the Red Army was "political expediency"; military and other needs took a back seat to political needs. Even if the military took in illiterate and ignorant men, as long as they were "class-trustworthy," they were accepted. The ex-czarist officers were not to be trusted but had to be utilized in the military for lack of other experienced military leaders. Because of this situation the Commissariat for Military Affairs was established in May 1918. It consisted of three commissariats, one military (which dealt with enlisted personnel) and two political (which dealt with officers and commanders). The political commissars shared command with the military specialist (the commander), and all orders had to be countersigned by both political commissars. This system originated because the Party was fearful of counterrevolutionary activity, especially from the ex-czarist officers who had been pressed into service with the Communists. Even the Commander-in-Chief of the Army, in the Revolutionary War Council, had to have his orders cosigned.

The military commissars were the imme diate political organ of the Soviet government in the ranks of the armed forces. They were appointed from "irreproachable revolutionaries, able to remain the embodiment of the revolution under the most difficult circumstances." The persons of the commissars (both political and military) were declared inviolate, and an insult offered to a commissar while on duty was proclaimed equal to the most heinous crime against the Soviet government. The military commissars were tasked to see to it that the military did not become a thing apart from the entire Soviet system and that the various military establishments did not become the focus of conspiracies or instruments against the Party.

The institution of political commissars had its origin in the political necessity of watching over the politically suspect ex-czarist officers and the guerrilla leaders who rose to command positions in the military. From these early shoots grew a mighty tree with roots penetrating deeply into the military. As time passed, the later aim of the political organs was not to watch over the ex-czarist officers but to supervise, from the political viewpoint, the entire military and its political indoctrination.

The military was a crucial problem for the Party. The latter needed a strong force for national defense, yet was exceedingly reluctant to allow *any* other group to develop a power situation that might present itself as a possible rival. There was a fear that certain groups might agitate, causing a counterrevolutionary

element within the military. The Main Political Administration of the Red Army had been set up in May 1919 to serve under the Central Committee of the Party as its Military Department. In essence this gave the Party direct control over the activities of the military. To those even remotely familiar with the autocratic institutionalization of military systems, a curious conflict suggested itself: conflict between this new institution, breaking down the sacrosanct principle of unity of military leadership, and the general posture of military life. For example, as soon as the Red Army had become a regularly organized armed force, commanded by men welded into it by the fire and stench of battle, the commissar had no place in it. However, the Party could not lose contact and control; consequently, political and Party life continued to pulsate and to circulate within the body of the Red Army. Thus was born the principle of dual command.

An unsuccessful attempt was made (by the military) to have the institution of commissars abolished in the early 1920s. In 1924, however, the age-old military principle of unity of command was to a degree established in the spheres of combat, supply, and administration, while the political commissars were relegated to political and Party work. The Party leadership could not abdicate its control of the military without running a risk that the officer corps would develop into an independent power center. The military had entrenched itself in its principle of single command, and a definite power struggle ensued between the hopeful political commissars and the determined military commanders. Under the powerful influence of Marshal Tukhachevsky, the Commissariats of Army and Navy were replaced by the Commissariat for Defense in March 1934. At the same time the Revolutionary Military Council was abolished, its powers being transferred to the Commissar for Defense. Thus, at the top echelon, the collegial method of military command and administration gave way to the principle of single command. In like manner, the collegial system was discontinued throughout the military at every echelon of command in 1934, and in keeping with the single command principle its powers were transferred at least theoretically to the commander.

Rokossovsky

A reaction to this state of affairs by the Party leaders was fairly certain because the military was developing into a competing power-oriented organization. Marshal Tukhachevsky had put military loyalty above strict Party discipline. He had carried on a campaign against the Party's interference in military matters and against the intolerable dualism. He had waged an intense campaign to cause Stalin to rid the military not only of the political controls with which it was bound but also of the shackles imposed by Stalin's secret police. The antagonism between the military and the secret police (GPU) was of long standing and grew continuously sharper until 1936.

So it was that Tukhachevsky complained bitterly against this dualism, and suddenly in 1936 Stalin acceded to the High Command's demand and ordered the GPU liquidated. Tukhachevsky had wanted to end the dualistic military system in order to suppress the GPU's high-handed terroristic regime in the interests of Soviet democracy; Stalin eliminated the GPU in the interests of his own totalitarian terroristic despotism. Stalin used the support of the mili-

Timoshenko

tary to destroy the GPU as a state within a state; then he turned around and crushed the so-called "Soviet-democratic internationalistic opposition" within the military. The trend toward further unity of command was rudely halted with the Great Purge of the Red Army less than a year later.

In mid-1937 the armed forces were struck by the purge. With the development of their prestige and professionalism, they had reportedly formed a plot to get rid of Stalin. The military had now regained much of its power, and certain elements in the Party wanted its support. The purge was devastating. A dozen of the top military leaders were executed, including, naturally, Tukhachevsky. Thousands of other commanding personnel were executed, imprisoned, or dismissed, or they simply disappeared. A conflict of major importance had arisen between a large section of the military leaders and Stalin's group, and the purge reached out to the military to mitigate the Party's fears of a rising political force. No clearer illustration exists for the mistrust and fear in which the military was held by the Party leaders (Stalin) than the reintroduction, as a concomitant to the purge, of the collegial system (dual command) and the political commissars in full vigor. Thus, the purge and consequent closer supervision of the military resulted in the re-established equality of the political commissars with the commanding personnel in both the military and political phases of Soviet military life. The commissars —"the eyes and the ears of the Party and government in the military"—launched a vigorous campaign for increased political activity. The process of creating a professional officer corps had suffered severely in the purge. A very great proportion of the higher officers had been removed and many of them executed. This impressed all military officers with the political nature of any authority in the Soviet Union and weakened their professional devotion as well as their sense of initiative and personal security. The Party had succeeded, in *this* crisis, in making the officer corps first supporters of the political system and secondarily military men.

impact of World War II

The shortcomings of dual command showed up, however, in the Finnish campaign and brought back unity of command to the military units. Marshal Timoshenko, having assumed the office of Minister of Defense on 8 May 1940, called for the abolition of the political commissars, and this move was carried out on 12 August 1940. The political commissar now became an assistant commander for political affairs, subordinate to the unit military commander. A few years later, in order to enhance officer prestige, the military salute was reintroduced, new uniforms were adopted for the officers, and stricter standards of discipline were established.

Just as suddenly as the commissars had lost their position of influence, they recovered it after Hitler's attack on the U.S.S.R. in 1941. This may be attributed to the mass defections that were taking place in the Soviet Army. Restoration of the political commissar was a desperate attempt to restore the loyalty of the crumbling political machine. The Army was

disintegrating, the Party was in a state of panic, and to rescue his machine Stalin hoped for the same zealous leadership that had been shown by his first political commissars in the Civil War. This setting up of Communist to watch Communist in command positions (at this time almost 90 percent of the higher-ranking officers were Party members) was one of the anomalies brought about by the struggle within the Party and by the purge. It was not sufficient to be a Communist; it became necessary to be a staunch follower of Stalin.

On 9 October 1942, with the military situation improved, an effort to increase military efficiency was commenced by abolishing once again the political commissars and re-establishing the assistant commander for political affairs. This last pattern is essentially in effect today, with the main political directorate of the Soviet armed forces established as an entity within the Ministry of Defense.

By the conclusion of the Second World War the military had once again regained prestige and prominence in Soviet society. The propaganda organs hounded the people with praise for Stalin and his "military genius," yet greater tribute was paid to men like Marshal Zhukov by the Russian people. Once again the Party acted to undermine the military, only this time the measures were not so drastic, possibly because of the adverse effect on rebuilding war-torn Russia.

Men like Marshal Zhukov were relegated to minor posts because they were too highly respected in the military. Some military officers who sensed Stalin's desires were quick to denounce their fellow officers in the hope that they might replace those dismissed. Whatever Stalin's reasons were in "exiling" his top generals and marshals, the fact remains that the military had become a powerful internal force to contend with. In early 1953 the favor of the military was solicited while a purge was begun of all other elements in the Soviet ruling circle. This occurred in conjunction with the so-called "doctor's plot," which also saw the Chief of Staff, General Sergei M. Shtemenko, removed twelve days prior to Stalin's fatal illness. This had all the earmarks of a new Stalin purge.

The dominant role at the time of Stalin's death and again at Beria's crisis was played by the military. At Stalin's deathbed six top military men were present. Marshal Zhukov was called back from obscurity to accept the position of Deputy Minister of Defense. The fortunes of the armed forces rose and fell in direct proportion to the intensity of the factionalism within the "collective leadership." The military appeared in many public and diplomatic displays, and once they even tempered the political situation by having Zhukov (now top military representative in the political power structure of the Soviet Union) publicly call, in so many words, for Beria's removal.

post-Stalin era

Behind the Party scenes, a hard-fighting political professional struggled for power. In his climb to the top, Khrushchev made clever use of the military. Fearing unrest at home and desiring to capitalize on war hero Zhukov's popularity, Khrushchev had induced the "collective leadership" to appoint him First Deputy Minister of Defense under Bulganin. Khrushchev had also succeeded in having Zhukov appointed a member of the Central Committee following Beria's fall in June 1953. Although military power and prestige became greater through the mid-1950s, Khrushchev did not allow the military to become too powerful or too important. Certain demands were acceded to in keeping the favor of the military at his side; but Zhukov's poor political judgment and the developing factionalism within the military high command allowed Khrushchev to force Malenkov's resignation and to replace him with Bulganin without much fear of a military coup d'etat.

Under the existing unstable conditions Zhukov, who was named Minister of Defense at the time Malenkov was ousted, felt able to demand stricter enforcement of the principle of unity of command. The military press campaigned vigorously for the abolition of political assistants, for a policy requiring subordinates' unquestioning obedience to officers' orders, and for the termination of interference in military decisions by the Party organization. Zhukov was able to reduce further the power

Sokolovsky

of the Main Political Administration by making the company commanders responsible for both military and political training, by reducing the number of hours devoted to political indoctrination of enlisted men, and by making officer indoctrination voluntary rather than mandatory.

When it came to reducing the Party's direct control over the military, Khrushchev and Zhukov clashed. In a series of speeches and articles, Zhukov criticized the Party groups for failing to back the officers in strengthening military discipline. Notwithstanding the dispute, Zhukov was elevated to full membership in the Presidium of the Central Committee following the June 1957 leadership crisis. Zhukov had backed Khrushchev in the purge of Malenkov, Molotov, Kaganovich, and Shepilov, and Khrushchev had utilized his support. Having solidified his power position, Khrushchev was now ready to deal with Zhukov. Immediately following the purge, the press opened a campaign for increasing the role of Party organizations in the armed forces. Efforts were intensified to strengthen Party control, and Zhukov found himself isolated in a Presidium packed with Khrushchev supporters.

It was obvious that Khrushchev and the Party machine would not tolerate such conditions. Increasing autonomy of the armed forces, regardless of Zhukov's possible personal ambitions, would in the end have created what has been noted many times before: a power center rivaling the Party. On the other hand, the Party leadership could not neglect the military support and loyalty that were necessary to guarantee its power position as well as to insure that its international aspirations remained feasible and viable. Thus, a dichotomous situation existed wherein the armed forces had to be kept in close check while the military high command was wooed and catered to by the Party leadership. Khrushchev, however, could not permit Zhukov to remain in his top post any longer because he was reaching heights of power unknown to the military of this Communist state. So Zhukov was dismissed, and the Party made it clear that an officer was first of all a Party member whose primary loyalty must be to the Party and to his professional military duties, rather than to his professional hierarchy or personal ambitions.

The Continuing Bid for Power

History has unfolded an unending struggle which has existed in the Soviet military since the early days of the Soviet state and which, as far as I am able to discern, exists at the present moment. This, of course, is the oft-mentioned struggle for unity of command. Actually the Soviet military has been much more interested in establishing itself on the pattern of Western powers, i.e., a military hierarchy internally free from political controls. The thought of becoming a rival political force has not focused into the Soviet military picture.

However, one of the most difficult issues to judge has been the extent to which the Soviet officer corps and particularly its high-ranking members have constituted a closely bound group with strong group loyalties that could have overridden loyalty to the Communist Party in time of crisis. Stalin thought there was

such group loyalty, so it seems, for he had most of the Soviet High Command executed in 1937. The present generation of top Soviet officers may be solidified to some extent by fear that their careers would suffer a similar fate, (figuratively) at the hands of the political leaders. Another solidifying influence, presumably, is resentment at the manner in which Stalin and the Communist Party leadership tried to avoid giving credit to the marshals and generals for their roles in World War II.

Divisive forces probably exist among top Soviet military leaders, too. Intense rivalry, jealousy, and competition for favored positions certainly have been evident. It would not be surprising if Marshal Zhukov's meteoric rise in 1953–57 stirred up jealousy among some of his associates. Beyond that there has been much speculation as well as factual evidence that some high Soviet military commanders—Marshal Konev, for one—worked very closely with Khrushchev, presumably hoping that his influence would help them attain their personal goals. The precedent of great military condemnation of Zhukov by Marshals Konev, Rokossovsky, Yeremenko, Sokolovsky, Timoshenko, and Biryuzov makes it doubtful that the top Soviet military leaders would all work together against the Communist Party if the goal were conditioned by personal or political ambitions.

The Soviet military has managed to reduce the rigid controls of the secret police as well as limit to an extent the realm of responsibility of the political assistants. An article appearing in the 13 June 1959 issue of *Sovetskaya Aviatsiya* (Soviet Aviation) states that in October of 1958 the Central Committee of the CPSU confirmed the status of the "Statute of Political Organs (1957)" in the Soviet military. (This was a Khrushchev concession to Zhukov before the latter's fall from power.) The article states that the political organs of the Party were directed to strengthen the one-man command in the military; protect the authority of commanders; help them to eliminate shortcomings which obstruct the increasing of combat readiness of the commands, units, and ships; and teach all personnel a high level of discipline. If nothing else, this is an indication of the increased power of the military to extract a standing concession concerning unity of command. It is worth noting that in recent years the regime has tried a compromise cross-training program, one in which political officers are trained to be commanders and given command of troops while military commanders are given "special military [political] training."

In examining the past and current political role of the military, as well as speculating on the future, I see several points that seem worthy of emphasis. First, the military has become a political force of sorts. The death of Stalin in 1953 created a power vacuum that caused the unstable political forces to look to the military for support. The arrest of Beria and the sharp reduction of the role of the secret police and political commissars keynoted the newly achieved prestige and influence of the Soviet military leadership. The very issues which arose between the rival political leaders

Tukhachevsky

drew the military into important, even if passive, political action. Between 1953 and 1957 the military played the role of "balancer" in the power battle among the members of the "collective leadership." It was Khrushchev who eventually achieved personal power with the overt support of the military. For their efforts, the military gained a new status, which survived the Zhukov affair, as top Party leaders vied for the support of the military as a hedge against the day Khrushchev would fall. Having been thrust onto the political scene, the military were less than eager to revert to the status of the Stalin era.

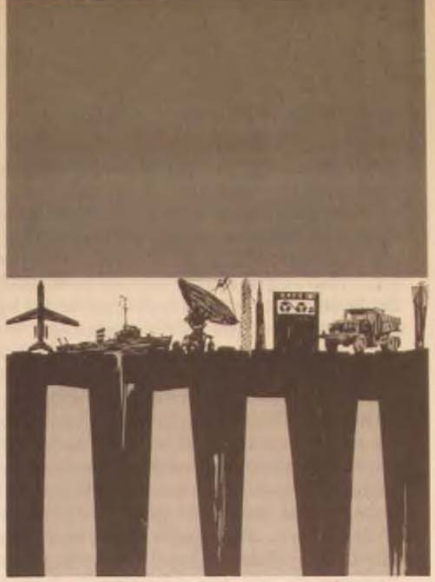
A second point worth mentioning deals more with the circumstances of time and technology. The advent of the military as a key factor in Soviet nuclear-age policy strengthened their new-found political role and destroyed the original idea that the military was more an instrument for helping a ruling class to maintain its power at home than a tool of international combat. The threat of thermonuclear war forced the Soviet armed forces to be *the* tool of international persuasion that is so necessary for the U.S.S.R. in countering the U.S. nuclear posture. Since 1957 many a general and marshal has put military loyalty and military interests above strict Party dictates. Many able and patriotic military leaders debated quite openly with Khrushchev on the issues of strategic and tactical nuclear warfare. Soviet military leaders maintained a lively debate throughout the early 1960s, and many of their positions ran counter to public statements made by Khrushchev. The eventual ouster of Khrushchev signified the independent power position that the Soviet military had achieved in just a few short years. It was obvious that Khrushchev's intent to downgrade defense efforts and focus his concern elsewhere turned his military support against him. The pressures of the nuclear age and the complexities of international strategies guaranteed that the military as a body would remain undisturbed while the political element went about its business of establishing a new leadership amenable to the Soviet military.

The current status of the Soviet military leaders was born of certain issues seemingly influenced by a history of repression, the advent of the nuclear age, and the reliance placed upon them by Khrushchev. Basic changes made during Khrushchev's rule continue to exist. The basic unity of the armed forces is evident in the single High Command organization, the General Staff of the Soviet Armed Forces. The Soviet military organization has been "Westernized" to the extent that military leaders now participate in discussions and decisions on major issues of military policy at the highest level. Soviet military leaders have also been thrust into important Party and government positions because of their knowledge and expertise in nuclear matters. It is obvious that the Party looks to the military to make credible the deterrent vis-à-vis the United States and Red China.

While the future political role of the military is somewhat speculative, it will no doubt hold true that any future conflict among the political leaders, or between the political leaders and the military, which directly affects the military may force the latter to become active among the contestants for power. If faced with a serious compromise of Russia's military posture, the Soviet military leadership would become a most powerful and determined force within the Party hierarchy. With the aid and support of certain Party leaders and industrial directors, the military could control the accession to power of whatever political group it desired. Although the military would not be desirous of assuming the political leadership in its own right, its support of a particular group would be the *sine qua non* to Party leadership. In any event, the Soviet military has found itself thrust into a new role on the political scene, and undoubtedly it will not relinquish this new-found power and prestige.

Hq United States Air Force

In My Opinion



LOGISTICS—THE BRIDGE

MAJOR GRAHAM W. RIDER

THE time for agreement within the Department of Defense about the meaning of the word "logistics" is long past due. It is axiomatic that if our military efforts are to succeed at all, they will succeed because of, not in spite of, logistics. Yet logistics is all too often ignored, misunderstood, abused, or barely alluded to in military planning. Under these conditions, disaster in some form is imminent for the planned military operation. Thus, not only must we reach agreement within the Department of Defense about the meaning of logistics but we also have to reach an agreement concerning the application of logistics to our Defense organization.

But good logistics and bad logistics, perhaps more of the latter, will coexist in military operations until the aforementioned agreements are reached. In fact, we really cannot know the difference between good and bad logistics until the agreements are achieved. Accordingly, this article has a dual purpose: to achieve an understanding of what "logistics" really means and to establish an insight regarding the reason for the current confusion about logistics. Professional military men need this understanding if they are to recognize the mistakes of the past and their causes. Comparison of present actions with the past will then establish the existence of similar errors, which might then be resolved. Finally, an analysis of current Defense organization can reveal possible errors in the logistics structure, thus clearing away much of the confusion. With this knowledge and understanding, the military profession will be able to satisfy the need for good logistics in military operations.

logistics defined

What is meant by the word "logistics"? A few centuries ago it was everything military other than fighting. A highly regarded military historian, Mark M. Boatner III, relates that in sixteenth century France an officer known as *le Major Général des Logis* was charged with just about all the duties now performed by the entire general staff of modern armies. Furthermore, as recently as 1870 *Der General Quartier Meister* was the second officer to Von Moltke on the Prussian General Staff.[1] Thus, until at least a century ago logistics was consolidated under one officer and included all military efforts except actual combat. As recently as World War II the U.S. Army was organized into forces. Significantly, the Army service force was responsible for full support of air and ground combat forces. Over time, the name had

been changed, but the function remained essentially the same.

Bringing the definition of logistics up to date has been an appropriate task for the academicians within this nation's armed services. That responsibility has not been shirked. In determining what is and what is not logistics, logisticians owe a debt of gratitude to the U.S. Navy for its efforts toward analysis and definition of logistics as it applies to military operations. Foremost in the Navy effort stands Rear Admiral Henry E. Eccles, who dedicated his career to a study of logistics and who inspired many other Naval officers to similar study and research. One of these officers is Captain R. B. Hunt, who published *Definitions of Logistics* in 1956 under the sponsorship of the George Washington University Logistics Research Project. His definitions include:

> *Logistics* is the process of planning for and providing goods and services . . .
> *Military logistics* is the process of planning for and providing goods and services for the support of the military forces.

Subsequent research on the subject by Admiral Eccles himself contributed some refinement to these definitions. In particular, a theme of his book *Logistics in the National Defense* (1959) is that logistics is a bridge between our national economy and the actual combat operations of our forces in the field. The Admiral's efforts resulted in this definition:

> *Logistics* is the provision of the physical means by which power is exercised by organized forces. In military terms it *is the creation and sustained support of combat forces and weapons*. [Italics mine.] Its objective is maximum sustained combat effectiveness.[2]

Thus, logistics is the creation and sustained support of combat forces and weapons. Once this definition had been established, only one more academic effort remained: to explain how logistics is accomplished. The how of logistics was hinted at by Captain Hunt's use of the word "process" and by Admiral Eccles' characterization of logistics as a bridge.

With this background information and more obtained through additional research, two students of the Graduate Logistics Course in the Air Force Institute of Technology School of Systems and Logistics analyzed and described the logistics process in their master's thesis. Their conclusion was that the process consists of three major areas of activity:

> Military logistics is the process at the strategic level of determining the force structure; at the support level of translating the broad statement of requirements into usable military assets; and at the operational level of distributing and applying the assets as well as providing the broad range of services and facilities necessary for the movement and sustained support of the combat force.[3]

In this view, logistics encompasses a broad spectrum of military effort and consists of a myriad of detailed activities that are so interrelated as to create a process directed toward the support of military operations. This conceptual description firmly indicates the span of logistics.

Successful military operations are directly dependent upon successful logistics. Logistics has a direct interface with operations at both ends of the military spectrum. Strategy cannot be devised without logistics planning for its support. And the reverse of this relationship is also true. While at our highest government-military levels operations and logistics staffs must work together, at the business end of the military spectrum, the firing line, the other interface occurs. In a tactical environment the supply of "beans and bullets" to the fighting man becomes critically important to success in combat.

Admiral Eccles' concept of the logistics bridge is considered confirmed. The bridge can be visualized as having one end planted firmly in the nation's economic base (support logistics); the other in actual combat organizations (operational logistics); and the structure itself as a representation of national policy (strategic logistics). This concept is taught in the Graduate Logistics Course, AFIT School of Systems and Logistics. The definition of logistics which has been established—the creation and sustained support of combat forces and weapons—is accepted and taught by the school's faculty; so too is the conceptual definition of the logistics process.

the real problem

The challenging task of defining logistics has been successfully completed by military academicians. The real problem, then, is not that we do not know what logistics is. We do know. The real problem is that we have not used the knowledge properly in practical applications within the Department of Defense. What needs to be accomplished is a sometimes harsh, but necessary, analysis of logistics as applied to our military organizations and operations. Analysis is one way of determining whether or not the mistakes of the past are being repeated. It is also a way of finding and applying what was obviously good logistics in the past to our current and future organization and operations.

Some examples from recent military history are readily available for analysis. For instance, after World War II, the German General Friedrich von Paulus is said to have remarked that two hundred additional tons of supplies daily could have turned his defeat at Stalingrad into a victory. By today's standards that is a relatively small tonnage even for airlift. But for the German Army in Russia its nonavailability was a disaster, a disaster caused by inadequate logistics. We Americans were not immune to inadequate logistics either. No military historian will ever forget how General Patton's slashing attack with the Third Army toward the German heartland in 1944 ground to a halt: the cause—lack of gasoline. Not that there was exactly a lack of it; plenty of gasoline was available on the docks back on the coast. But the gasoline simply could not be gotten up to the front lines in sufficient quantities to support General Patton's advance. Disaster? Well, certainly not the disaster which Von Paulus met, but nevertheless a disaster in that military operations were effectively halted, the enemy was afforded respite, and the conclusion of the war was delayed. Again—inadequate logistics.

Of course, our history is not all so bleak. On another front, and later in the same war, logistics was a shining success. Okinawa was the locale, some six thousand miles from the economic, industrial, and military base of the United States. The invasion of Okinawa was a success because logistic support was adequate—in fact, more than adequate for military operations. Good planning for and management of logistics assured that success. There are too many examples of military logistics—good, bad, and indifferent—to be cited here. The point is that we must learn from our past, for experience appropriately and selectively applied is the best teacher.

Thorough analyses of logistics in past military operations have yet to be completed. This task can be done, now that we understand the meaning of logistics. But until it is done, success in the practical application of our theoretical knowledge will be frustrated. And frustration can cause confusion. Because these analyses have not been made, we find it difficult to identify what, in practice, is and what is not logistics.

logistics organization

This difficulty is reflected in a somewhat confused organizational structure for logistics in the Department of Defense. A brief but critical look at the structure hopefully will create an insight as to how our misunderstanding of logistics has created confusion in our organization for logistics. It should also show why the organization itself confuses the minds of military men regarding what logistics is, thus compounding an already difficult situation.

Let us start at the top of the Department of Defense and work down through the organization. The current U.S. Government Organization Manual is a most appropriate reference for this task.[4] It contains charts of the major organizations in the department. We first notice in the Office of the Secretary of Defense an Assistant Secretary for Installations and Logistics. His title implies that installations are not a part of logistics. But installations are normally a part of support for forces and weapons. Confusing? Yes, but still an improvement over past structure. In the mid-fifties there was an Assistant Secretary for Supply and Logistics and another Assistant Secretary for Properties and Installations. The implication then was that supply, property, and installations were not part of logistics. So the organization under the

present Secretary is improved, though not perfect, from a logistics point of view. Next we notice the separate existence of a Director of Defense Research and Engineering, who is responsible for the research, development, test, and evaluation of new weapon systems. One would logically assume that since this effort is involved in the creation of military weapons, it is logistics. Yet the organization structure plainly says it is not. Are the reasons for confusion about logistics becoming apparent?

Let us turn next to the Department of the Air Force chart. The structure of the Air Staff reveals some very interesting interpretations of logistics. Starting with the Deputy Chief of Staff for Systems and Logistics, we find by implication that systems are not part of logistics. In the Air Force a system is known as consisting of a weapon and the related personnel, equipment, and facilities required for operating it. Furthermore, implied by the word "Systems" in the title is the process of conceiving, defining, acquiring, and delivering to operational units the weapon and its associated facilities and material. That process appears to be the creation of combat forces and weapons, yet Air Staff structure implies it is not part of logistics. This impression is confirmed when the next-lower level of Air Force organization is viewed: at the major air command level we find an Air Force Systems Command and an Air Force Logistics Command—the first to create forces and the second to support them.

Are there other functions which might rationally be assumed to be part of logistics but which the Air Force has separated for independent operation? Let us look again at the Air Staff structure. There is a Deputy Chief of Staff for Research and Development. Again, this function seems to be part of the process of creating forces, yet it is not under logistics. Its existence, however, does align Air Staff structure more closely to that of the Office of the Secretary of Defense. Then we discover the Deputy Chief of Staff for Programs and Resources, who is "responsible for developing Air Force programs pertaining to the attainment of operating and supporting forces." That stilted phraseology sounds suspiciously like our definition of logistics. Is it any wonder that there is confusion; that a misunderstanding of logistics exists; that logistics efforts in the Air Force face difficulty, perhaps partial failure, in accomplishing the mission?

Our sister services are in some respects better organized for logistics. A recent reorganization of the U.S. Army created the Army Materiel Command, responsible for procuring and distributing combat weapons and materiel.

But even that word "materiel" adds to the confusion. Both the Air Force and the Army continue to use it. Such titles as Deputy for Materiel and Materiel Management make one wonder where materiel fits in logistics. An attempt to answer that question is beyond the scope of this article. Perhaps the services would be better off if use of the word "materiel" were discontinued. For most applications, "logistics" should be used instead of "materiel."

Interestingly enough, the U.S. Navy does not use the word, having chosen to use instead the anglicized version "material" and thus adding to the confusion. However, by establishing the Office of the Chief of Naval Material the Navy has achieved what is possibly the best military organization for logistics to be found in the Department of Defense. Only three military functions are to be found outside the jurisdiction of that office: operations, personnel, and medicine. All other functions—procurement, supply, distribution, facilities, finance, etc.—are under the Chief of Naval Material. Naturally there are similar functions organic to the operating fleets, but the creation and sustained support of combat forces and weapons are the responsibility of the Office of the Chief of Naval Material.

Why, then, is the office not designated as "Naval Logistics"? Perhaps the reason is that the personnel and medicine functions are not included in the office. One can reasonably assume that both functions are properly part of the creation and sustained support of combat forces. Nevertheless, none of the armed services place personnel or medicine under logistics.

the task ahead

The purpose of this article is not arbitrarily to decide what is and what is not logistics in Defense organization. Its first purpose is to

achieve an understanding of the meaning of logistics. Therefore, it has been shown that within a military organization there appear to be only two functions. The first is to create and sustain combat forces and weapons. The second is to conduct combat operations.

The other purpose of this article, it will be recalled, is to establish an insight regarding the confusion surrounding logistics. It has been established that the confusion does not result from a lack of knowledge of what logistics is. Apparently the confusion results from what might be termed a misapplication of theory to practical military organization. It seems that our knowledge of logistics has been ignored in the structuring of the Department of Defense. Therein lies the problem. If we are ever to avert future disasters in military operations, if we are ever to assure success through efficient and effective logistics, then we must analyze and refine our structure.

We simply must decide which military functions are operational and which are logistical. It can be done because we know what logistics is. A thorough analysis of logistics in past military operations will either confirm or disprove our decisions regarding an organization for logistics. It appears that some decisions will be nothing more than amending titles and office designations. Other decisions may require consolidation of staff functions or perhaps a complete reorganization. These decisions must be made. All that remains is to get on with the job. Until the job is done, confusion and potential disaster will continue to surround logistics.

School of Systems and Logistics, AFIT

Notes

1. Mark M. Boatner III, *Military Customs and Traditions* (New York: David McKay Company, Inc., 1956), pp. 16–17.
2. Henry C. Eccles, *Logistics in the National Defense* (Harrisburg, Pa.: The Stackpole Company, 1959), p. 22.
3. Richard C. Williams and Robert L. Breeding, "A Conceptual Description of Military Logistics" (unpublished master's thesis, School of Systems and Logistics, Air Force Institute of Technology, Wright-Patterson Air Force Base, Ohio, 1965).
4. All organizational references were taken from the U.S. Government Organization Manual 1966–67, published by the Office of the Federal Register, National Archives and Records Service, General Services Administration, Washington, D.C., 1 June 1966.

PLANNING FOR REUSABLE LAUNCH VEHICLES

A new and necessary outlook

Captain John J. Francis, Jr.

IN A RECENT meeting of the American Institute of Aeronautics and Astronautics held in Boston, the proponents of reusable space boosters made the latest of many unsuccessful attempts to stimulate the nation toward development of such a system. All these attempts have been very similar, and their failure not surprising. I believe it is possible to explain their failure as a lack of understanding that we are no longer dealing with transportation on earth from point to point but from earth to a totally new environment. This misunderstanding is evident in proposals that suggest *airline*-like operations to and from orbit. I suggest that the space environment requires new concepts in thought regarding transportation and that we who advocate reusable boosters must reorient our thought to correspond to new operations.

The notion that we must choose a system and begin immediate development if we are ever to achieve our goal will only result in further rebuttals from decision-making levels. Let me present the reorientation of thought which I feel will release us from that notion.

Our space program has been determined and developed through its kinship to the ballistic missile program. Expensive, expendable boosters are used to boost very expensive, expendable payloads into orbit. In ten years American industry has provided developments which enable the government to carry out its operations within the constraints of this fixed situation. However, this same industry has not been able to participate in ways other than supporting governmental activities. Mass consumer exploitation of a new medium, which has characterized American industry's participation in other fields, has not occurred in the use of space. Costs for space operations are still too high for profitable investment. We have, then, the paradox that industry's latest developments are reinforcing the trend of expendable systems, which in turn are causing specific costs to be so high as to preclude industry's own capital investment. Let me outline these developments and point out their contribution to a type of inertia to which the U.S. seems bound.

inertial law

The inertial character of the space program reflects the tendency of an object to remain in motion once placed in motion. That is, the trend of high-cost operations, low traffic rates, and expendable systems will continue so long as no positive action is taken to change it.[1] Furthermore, the longer these conditions continue, the harder it will be to obtain the conditions required to justify reusable boosters, i.e., high traffic, low-cost operations. The low traffic and high costs tend to reinforce one another.

Because of the high launch costs, space system designers are forced to use sophisticated methods to reduce the number of launches required. More sophisticated design generally tends to raise the cost of the payload. This then requires that the booster reliability be improved, which raises the cost of the booster. And so it goes. Several specific patterns of this nature are developing which tend to perpetuate these conditions.

Because the larger boosters generally are more cost-effective than smaller boosters, system designers tend to gravitate to their use. By substitution of a large booster to handle the load of several smaller boosters, the number of launches required for a given weight in orbit is reduced. This trend is supported by the development of multipurpose and multilaunched satellites. Under the multipurpose concept, a

single satellite carries out several missions: instead of requiring several boosters to support several systems, what is needed is only one booster that can support the single more-sophisticated system—which is more expensive. The more cost-effective, larger boosters can be so used, since these multipurpose systems also tend to be larger. A single booster may also launch many satellites and thus deploy a complete system, a prime example being the communications system of seven satellites deployed by the Titan IIIC.

New technology, redundancy, and simplicity contribute to the extended operational life of satellites. Extended operational life means, of course, fewer launches of replenishment satellites.

Synchronous orbit operations tend to reinforce these patterns to an even greater degree. As operations at higher altitudes improve, it will be possible to combine several types of missions in several multipurpose satellites deployed by a single launch. Because earth surface coverage is greater from orbital altitude, fewer satellites will be needed originally, and as their operational life is extended, fewer replenishment launches will be required.

With microminiaturization of electronic components, circuits are smaller, simpler, and more reliable, thus contributing to the concept of more satellites per launch and extended operational life of the satellites.

Although these trends bear more directly upon unmanned systems, similar trends can be identified for manned systems. Generally, technical development will provide methods for extending the life of space stations, improving man's toleration of the environment, and developing large and efficient ferry-logistic vehicles. These, in turn, will serve as a depressing influence on launch rates supporting manned activities.

This, then, is the inertial law that must be circumvented if the concept of reusable boosters is to materialize.

It is not enough to await the development of the right conditions. The right conditions will never materialize without a positive change in the character of the entire space philosophy.

It is not enough to plead for more advanced technology. Technology is being pursued vigorously, but in areas other than reusable boosters; it is providing economic and operational rewards in support of current trends.

What is required is that reusable vehicles show a saving not only over existing systems but also over tomorrow's systems—systems that will operate adequately within the constraints of a moderately growing budget.[2]

new outlook

There is a very real prospect that the current trends in the space program will continue for the next fifteen years. Yet, at present there seems to be little likelihood of real mass exploitation of the space environment by the nation's industrial complex. The primary reason remains the high specific costs. Apparently these costs can be reduced enough only by reusable systems. How, then, can the character of the space program be changed so as to provide for mass exploitation of space, by which the people of the U.S. can ultimately realize the benefits of their investment?

The change can be made in either of two ways. The first and most unlikely way appears to be a high-level revolutionary decision to expend the R&D funds necessary to develop the entire reusable system in a single program. (The decision to develop the intercontinental ballistic missile is similar.) Such a decision would have to be predicated upon anticipated savings in the launch rates and payload costs. This way would be high risk and very expensive, and the decision to follow it is highly unlikely to be made. This decision is what the reusable booster proponents have been seeking.

The alternative is more evolutionary but by its nature also requires a top-level decision. A long-range planning approach that will make use of evolutionary development to finance further change appears to offer the best chance of success. There are several ways in which R&D expenditures could be used to generate savings, and these savings could be used to provide for further R&D, in a self-perpetuating operation.

I am suggesting two possible approaches, to stimulate the type of thinking which I feel will eventually produce the rewarding result of reusable space systems. Both approaches are general and need development considerably beyond the scope of this article.

The first approach is to make use of savings accrued by reusing our unmanned satellites that require recovery. If these savings are used for technology to make manned spacecraft reusable, further economy can be achieved. Finally, these savings could be appropriated against the R&D cost of a reusable first stage.

Another approach for carrying out this sort of evolutionary change would make use of gradually increasing degrees of booster reusability. Such a program could begin by simple recovery of current boosters by means of a recovery package attached to the first stage. The savings from this operation could be directed toward developing a first stage designed for reuse with near-term technology. The savings from this program might ultimately aid in developing a reusable launch vehicle with very low cost.

Too often the planner who wants to bring about a change in the space program is too much occupied with the ultimate realization of his dream, a particular pet design. He has given no consideration to the real world, other than to express his dissatisfaction with it. He has given no consideration to how such a change could take place, only that it should.

I have tried to suggest potential means of bringing about change in the basic character of our space program. A planner must realistically assess the world and its trends. He must forecast how developments will proceed if he takes no positive action. He should then determine what action is appropriate to bring about needed change. I feel that the alternatives suggested here represent the kind of positive action that is necessary and should be taken to bring about desired change in the space program.

Space Systems Division, AFSC

Notes

1. Adequate funding could provide for development of a reusable booster. However, without a major political or military perturbation, it is unwise to expect more than a moderate resumption of budgetary growth in the next fifteen years. Therefore, any reusable booster must be developed within the established economic bounds.

2. Expendable launch vehicles are projected to produce launch costs of approximately $100 per pound in orbit—almost an order of magnitude below today's costs.

Books and Ideas

WHEN ARE BATTLES LOST AND WON?

COLONEL ALFRED F. HURLEY

HANSON BALDWIN describes his latest book, *Battles Lost and Won*,† as a "military panorama of World War II." Of course, when a writer is ambitious and brave enough to try a one-volume treatment of eleven gigantic battles (actually, campaigns) scattered throughout so vast a war, he will have problems. To be at all successful, he must be both selective in his coverage and heavily dependent for his information upon the work of

†Hanson W. Baldwin, ***Battles Lost and Won: Great Campaigns of World War II*** (New York: Harper & Row, 1966, $10.00), 532 pp.

others. Baldwin, the distinguished military editor and analyst of the *New York Times*, has chosen to focus on land and sea warfare and to use primarily the publications and criticisms of the historical staffs of the U.S. Army, Navy, and Marine Corps. The only air fighting he treats at chapter length is the RAF-Luftwaffe encounter during the Battle of Britain and the Japanese suicide strikes against our naval forces off Okinawa.

Considered on Baldwin's terms, the book has many merits. He notes that military history is "often written and read simply as chronology or tactical narrative with little accent on the human drama," whereas in his view military history without drama is "incomplete." His emphasis on the individual fighting man, where his sources permit, adds a dramatic element too often found only in novels about World War II. His passion for authenticity is attested to by the more than one hundred pages of footnotes and bibliography at the end of a five-hundred-page book. In that position, they will probably be overlooked by the general reader, which is regrettable, for many of the footnotes are rich in data and argumentation that would have added considerably to the text.

There can be few quarrels with Baldwin's coverage of specific battles, documented as they are. But his work is open to criticism in one key respect: his approach does not take into account the point that the battles he discusses were not always lost or won within the time frame marked by the beginning and ending of the fighting. Rather, as in the case of his discussion of the battle for Corregidor, our struggle for that piece of real estate probably was lost in the niggardly budgets demanded by an isolationist nation in the 1920s and '30s. Another aspect of this same deficiency in Baldwin's approach is his treatment of key personalities. For instance, General MacArthur's most vulnerable period to criticism is overstressed by choosing the Corregidor battle as the subject of a chapter and ignoring his later manifold contributions.

This deficiency in perspective on Baldwin's part is clearest in his minimal, one-sided treatment of the work of the U.S. Army Air Forces. Its mistakes get the biggest emphasis. Not without justice, Baldwin points out that Generals Marshall and Arnold were too optimistic in their expectations as to the combat potential of the B-17 forces in the Philippines when the war began; and it is true that troop carrier navigation in the paratroop operations in Sicily and Normandy was frightful. Yet only a few sentences cover the crucial role of American and Allied airmen in almost completely wiping out German air opposition before the Normandy invasion. No other Army Air Forces' activities rate Baldwin's consideration, except as discussed below.

Baldwin neatly applies Professor William R. Emerson's most critical insights* about U.S. Army Air Forces' strategic operations in Europe before D-Day to British and German airmen as well. In Baldwin's view, there was a "general lack of prescience" among those airmen, too, about both the effectiveness of strategic bombing and the size of the effort required. However, in using Emerson's critique, Baldwin leaves out an important point. He quotes Emerson on American airmen: "In particular, they failed completely to grasp the essential meaning of air superiority . . . if American airmen made mistakes, certainly they made fewer than did the airmen of any other nation . . ." Baldwin leaves out Emerson's statement following the words "air superiority": "This is not surprising; the second World War, after all, is the first, and so far the only, experience we have had of large-scale air war. During the 1920's and the 1930's, all that they had to go on was hunches and guesses. In such a pioneering venture, error is unavoidable."

Baldwin's omission of Emerson's point becomes important only when one reads his account of the gallant but mistake-ridden Marine effort at Tarawa. Quite sensibly, Baldwin puts the battle in focus by describing it as an indispensable wartime test of the amphibious doctrine that Marine planners had worked out before the war. He quotes the Marine Corps historians on this score: "There had to be a Tarawa. This was the inevitable point at which

*Harmon Memorial Lectures in Military History, Number Four, "Operation Pointblank—A Tale of Bombers and Fighters," United States Air Force Academy, Colorado, 1962.

untried doctrine was at length tried in the crucible of battle." The same fundamental consideration should have been applied by Baldwin in evaluating U.S. Army Air Forces' strategic operations in Europe.

Baldwin's limited treatment of the work of the U.S. Army Air Forces may be no more than a matter of restricted perspective or lack of sufficient space. However, it also may be symptomatic of a problem affecting the full history of our service. Certainly one major theme in our history is the propaganda efforts of some of our early leaders, notably General William ("Billy") Mitchell. As Professor Emerson pointed out in his Harmon lecture, the airmen of earlier years were right in their appreciation of the importance of aviation in future warfare and in their conviction that only airmen could direct aerial combat operations. Beyond these basic considerations, the airmen at that time could only be hypothesizing about air strategy (especially in its details) until they had tested these ideas in combat. When one considers that Mitchell alone hypothesized about air strategy in some 150 articles and three books, claiming as much as he could in the context of an interservice struggle over a tiny budget, critics such as Baldwin should find it easy to isolate claims unrealizable in World War II.

Hopefully, we airmen of this generation will do more than closely scrutinize the work of critics like Baldwin. Rather, we should be fully aware that our own published record is only piecemeal. We have yet to get down to the job of taking our own hard look at the record of our service in the decades since the Wright brothers' first powered flight in 1903. We can learn an important part of the story by plowing through Wesley Frank Craven and James Lea Cate's seven volumes on our role in World War II. A few hours of reflection on the reports of the Strategic Bombing Survey might gain us an appreciation of the contributions of the B-17, B-24, and B-29 in the war. Only the true specialist in our history has gone to the National Archives to study Colonel Edgar Gorrell's unpublished collection of data on the achievement of the Air Service, American Expeditionary Forces, during World War I. Much more accessible is Robert F. Futrell's published work, *The United States Air Force in Korea, 1950–1953.* Far shorter but also important reading is available in the works by Irving B. Holley on our World War I doctrine and aircraft development, *Ideas and Weapons,* and by Thomas Greer on air doctrine in *The Development of Air Doctrine in the Army Air Arm, 1917–1941.* Other scholarship has been done, but I believe the foregoing works are the most important. In any event, the scattered nature of what is available proves the point I wanted to make.

The theme of a full history might be the maturing of our service from the Wright brothers era until its strategic element became the cornerstone of our foreign policy in President Eisenhower's administration or the lever by which President Kennedy forced Russian missiles out of Cuba. As Baldwin says, military history is more than "chronology or tactical narrative"; drama is essential to its telling. The inclusion of the recollections of the shrinking number of early aviation's veterans should add drama to the projected history. The oral recollections of those who knew General Arnold, as gathered by the staff of the Columbia University Oral History Project, offer an excellent starting point.

Our service, then, is at the place in its development where its record is more than a collection of yesterday's headlines. The struggle for recognition has ended. We can, if we wish, look long and hard at what we have done and produce a full record of our development. This will give critics such as Baldwin a far better basis than they now have for evaluating aviation's role in past and present military policy. Far more importantly, the airmen of this generation might learn lessons from the full record which will equip them to win battles in any future wars.

United States Air Force Academy

RISE AND FALL

Dr. Robin Higham

BY CHANCE, recent months have seen the publication of a number of books dealing with the rise and decline of British air power.† They trace some of the basic changes that have taken place in the status of air power and British power in the twentieth century. They vary in style and content from the romantic through the disillusioned to the didactic. Viewed chronologically in terms of their contents, they move from the mundane and romantic to the profound.

British air power had its diverse origins in the years before the First World War when army officers at the Balloon Factory at Farnborough, naval officers under the leadership of Admiral Sir John Fisher, the Prime Minister under Fisher's guidance, and wealthy amateurs all developed aeronautical equipment and ideas. Official recognition of aviation started early, with the founding in 1909 of the Aeronautical Research Committee (later Council). In 1912 the Royal Flying Corps (RFC) was established, with military and naval wings. But owing both to internal service situations and to practical political considerations, the two wings went their separate ways, and before war broke out in 1914 the naval wing had become by Royal Warrant the Royal Naval Air Service (RNAS). Neither air wing has had a proper official historical treatment; the nearest thing to that is the official six-volume *The War in the Air*[1] and the semiofficial condensation of that history, *Per Ardua*.[2] The most detailed history of the RNAS will probably be contained in Arthur Marder's fourth volume, due out in 1968.[3] A serious history of the RFC is yet to come.

WHAT Geoffrey Norris has written is a nostalgic adventure story that fills in from standard sources some of the details while concentrating upon the individual heroism which was the dominant theme of the 1914–18 air war. As the story of the wild kind of things that happened to pilots flying unreliable aircraft they barely understood, it is a romantic book. Occasionally Norris mentions the lack of training and the losses, but never does he really see the tragedy of this sort of operation. Given machines that were all too often unstable, with engines that might run three hours without breaking down, it was suicidal to send aircrew on operations with as little as 17 hours' total flying experience. Moreover, the British disdained parachutes, though successful ones had been tested at Farnborough and were available before the war. Thus, one of the sad things about the war was the abuse of gallantry and the building of a tradition based upon physical courage rather than upon carefully planned operations designed to make maximum use of the limited force available. The skilled survived, it is true, until bad luck or overconfidence killed them. But myths die hard, and

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†Geoffrey Norris, *The Royal Flying Corps: A History* (London: Frederick Muller, 1965, 30*s*), 256 pp.

David Divine, *The Broken Wing: A Study in the British Exercise of Air Power* (London: Hutchinson, 1966, 45*s*), 400 pp.

Richard Worcester, *Roots of British Air Policy* (London: Hodder and Stoughton, 1966; distributed in the United States by Lawrence Verry Inc., Mystic, Connecticut, $6.50), 224 pp.

Sir Solly Zuckerman, *Scientists and War: The Impact of Science on Military and Civil Affairs* (New York and Evanston: Harper and Row, 1967, $4.95), 177 pp.

the fact that the same man (Sir Hugh [later Lord] Trenchard) was virtually in command of the RFC and later the RAF (Royal Air Force) from 1915 to the end of 1929 was to continue the Army traditions of the nineteenth century in the air force of the twentieth, with tragic consequences. What was needed was some serious analysis of the whole war effort. This need might have been filled by *The War in the Air* had it not been written largely by a civil servant awed by the former field commander of the RFC.

The romantic glow about air operations was not really shattered until Sir Charles Webster, a stubborn and noted European historian, and Noble Frankland, a former Bomber Command navigator, produced in 1961 the four volumes entitled *The Strategic Air Offensive against Germany*.[4] Anyone who wishes to write the aerial history of the First World War might well adopt the Webster-Frankland technique, which was to consider each period from three aspects: plans, operations, and analysis. If this were done for the 1914 air war, a very different picture would emerge of this ancillary operation.

In part, this is David Divine's approach in *The Broken Wing*. Having already rapidly surveyed the army's procurement of weapons in *The Blunted Sword*,[5] he has next tackled the air force. His general thesis is journalistic; despite rave notices on the dust jacket, it is not good history. It is provocative and well worth reading, but the sources are unclear and there are a number of errors of fact and more arguable interpretations. His thesis is that for decades the British public has not been getting its money's worth in defence because the British system is incapable of producing weapons on time or in sufficient quantities. The old story of too little too late is examined in detail. As in *The Blunted Sword*, the author's bias and didacticism detract somewhat from balance, while his historical research is often shallow or skimpy. Nevertheless, his indictment is one which cannot be lightly shrugged off, for the lessons he draws are ones which, because they were the work of human beings, must be recalled when we consider our own programs.

Divine looks at the First World War analytically and comes to the sound conclusion that far too much mythology has grown up about the fighter pilots and the so-called independent air force and the effects of strategic bombing. He argues that the cost of the independent air force was far more than the damage it did and that it had no effect on the outcome of the war. Divine's approach must not be taken lightly, for he has long been defence correspondent of *The Sunday Times*. Yet his account of Lord Trenchard's conversion to the bombing mystique in the early twenties differs considerably from my own reading of the same materials. The second third of the book is devoted to "The Bomber Years," when the counterstrike theory was predominant. Logic is again on the side of his analysis, especially when he emphasizes the failure to provide an "army-cooperation" (tactical) air force despite the brilliant work of then Wing Commander John Slessor, *Air Power and Armies*.[6] Thus the Second World War found the British, despite efforts by such people as Captain B. H. Liddell Hart and General Sir Frederick ("Tim") Pile, seriously lacking in air defences, both fighter and gun, and largely without a tactical air force. The latter in particular had largely to be built in the Middle East desert campaign of 1941–42 along German lines. The latter part of *The Broken Wing* is much more the author's métier, a slashing account of the muddle over the development of a V-bomber force as a little deterrent and the subsequent dabbling with missiles.

Underlying all the problems with which *The Broken Wing* deals is the fact that Britain has been steadily losing her pre-eminent place as a world power. The air force arose late in the history of the British Empire. It was to prove in the years after the 1914 war that it could provide a useful service as a policeman in areas where tribes were primitive and distances great. In Iraq it showed that a significant savings could be effected by employing the air arm to quash troubles as soon as word was flashed to it that action needed to be taken.

On the North-West Frontier of India it could also aid in patrolling and containing the tribesmen along that difficult and constantly troubled border. But effective use of the air force depended upon several factors: intelligent political appreciation and direction, adequate equipment, and suitable training. Its effectiveness was compromised by the failure to appreciate that it could not with the then-available equipment handle night infiltration and terrorist activities in a populous area such as Palestine, where the correct solution remained firm political control reinforced by police and infantry supported by a reliable intelligence service. Its effectiveness depended, too, upon proper foreknowledge of trouble which its limited forces could nip in the bud. In much of the period between the wars it was limited by lack of equipment and by the failure to develop a continuously flexible and advancing doctrine.

To this then had to be coupled some other very real difficulties. These included a natural extension of the struggle for an adequate share of the defence budget in promises that the RAF could take on more responsibilities. Outside of Europe the most notable of these was the concept that the Air Force in India could be used as a mobile reserve to defend Singapore if a war with Japan developed. This strategy might have been sound if two conditions had existed: first, if the squadrons in India had been adequate in number and equipped with up-to-date machines and weapons; and, second, if the support route to Malaya had been invulnerable to attack. But neither of these conditions was fulfilled, in part because of parsimoniousness at home and in part because no one until very late in the game envisaged Britain's being involved in wars both in Europe and in the Far East at the same time. Added to this was the arrogance that viewed the Japanese as inferior fighters—an arrogance from which even Wavell is said to have suffered.

There is a lot of irony to the final situation as it developed in late 1941. The RAF had weeded out most of the RNAS personnel after the 1918 merger and the establishment of peacetime levels. The ex-RNAS personnel thus left unemployed trained the Japanese navy. Ironically, the Japanese attack on Singapore had in it many of the lessons that might have been learned from Gallipoli. All this could be drawn together in the person of Churchill, who had conceived the Dardanelles operation in 1914 and who in 1919 had as a mandate the disbandment of the RAF. It was his Chief of the Air Staff, Trenchard, who not only saved the RAF as an independent service but also advocated taking over anti-invasion defence by means of torpedo-bombers; however, he did little about it and became involved in the bomber deterrent defence. A further irony is that though Trenchard did not provide the equipment to undertake such an operation, neither did he foster the colonial strike forces which might have kept the peace abroad. The RAF was hamstrung in part by the same problems that plagued the army, which never had its role decided until the spring of 1939. Divine can argue correctly that the RAF did know that it was to be the Home Defence Air Force and that it was supposed to achieve a 52-squadron goal by 1928, though in fact this had not been reached even when rearmament began in 1934. And the events which followed showed that it was not capable of fulfilling the primary role of armed forces—keeping the peace.

Military terminology unfortunately often obscures this central fact. And because many politicians, especially in the interwar years and since in Britain, have not been trained in strategic thinking, they have failed to understand that armed forces are a part of diplomacy in peacetime. They are the sheathed sword. However, it is equally important to assure in peacetime that the sword is not rusted into its scabbard and that it is not only sharp but of sufficient strength to do the job in wartime. This also assumes, though, that the Higher Direction understands how to use it and knows its limitations. It may be trite to say so, but, like insurance premiums, the budgets for the services must ensure that the protection purchased is sufficient. Faced with a parsimonious government, the military leadership must present the best case possible, naturally; but it must also ensure that what it obtains with limited funds is capable of expansion into a viable modern force as rapidly as possible.

One of Divine's complaints is that the British deterrent has never been viable. It takes study to be correct, and it takes courage to say when your role is no longer necessary. The latter is perhaps the most difficult of all; empire builders do not like to wither away.

This is a problem which the British and others have faced in recent years as their place in the world shifts. The forces and costs have become too great for any one service or even any one nation in competition with the United States, the Soviet Union, and probably Red China. NATO was a step in the direction of a military alliance; but nationalism has been too strong, especially in Britain and France, for the necessary combinations to be achieved—and there has always been the problem of Britain's special relationship with the United States and France's special relationship with itself.

MANY of the same problems which Divine assaults are tackled in Richard Worcester's controversial study of the roots of British air policy since 1945. Unfortunately the author has been so wrapped up in his own role as a demi-Liddell Hart in the aeronautical business that he fails to write clearly. Even the informed have trouble figuring out some of his references. Yet despite this, the main theme is clear—that Britain has never developed a practical aeronautical policy which has taken into account the needs of the RAF, the airlines, and the aircraft industry. Whether or not the recently announced Board of Trade inquiry will do this remains to be seen. The story is, in parts, much the same as Divine's and overlaps with it in treating the mismanagement of the V-bomber and the missile.

More important, Worcester shows that there is a definite need to apply the principles of war to national industries. This is evident in the tales of the Handley Page Herald versus the Fokker F-27 and the BAC-111 versus the DC-9. In 1942 the Brabazon Committee met and came up with a postwar plan for the industry. Through misassignment, prevarication, lack of responsibility, and cold-shouldering of genius, among other causes, not all of the committee's proposed types were successfully developed. Nevil Shute told the tale of the Tudor in his *No Highway* (1948), but the official report as to the losses of that type remains impounded under the Official Secrets Act. On the other hand, the Comet well illustrates the longevity even today of some technological developments, for it was conceived in 1943 and modifications are still being built.

But the force of Worcester's arguments, which range over the whole structure of the industry from the ministries to space, can well be seen in the case of the British Aircraft Corporation and its two jet aircraft. The VC-10 has turned out to have great passenger appeal but for sound economic reasons to be unsalable to most airlines. It was conceived as part of a package deal in which BOAC could buy fifteen Boeing 707s if it also bought twenty equivalent British aircraft. So a jet Vanguard, which the then Vickers company had been trying to sell to BEA, was made first into an Empire-routes and then into a trans-Atlantic design. While the result was an aircraft technically ahead of the Boeing and Douglas designs, it was actually six years behind and somewhat more costly. At the same time the break-even point was unrealistically figured at 20 aircraft versus the American giants' reckoning of 300. Like Vickers' successful Viscount, the BAC-111 also cracked the American domestic market—in itself no mean feat. But by dividing its effort between the VC-10 and the BAC-111, the company lost its margin over Douglas's DC-9. The handwriting was on the hangar wall by the mid-fifties—the Americans were going to get the big jet market.

But the Americans were not then able to aim at the small jet, and this is the market upon which the British should have concentrated their forces. They should have focused also upon underdeveloped countries, so many of which would emerge from the old Empire. As proof of what could have been done, one has but to look at the Canadian industry, where de Havilland of Canada in particular, taking a leaf from its parent's prewar record, has produced the Beaver and the Caribou, even selling some to the United States military. If further proof were needed, there is the revival of the Ford Trimotor. All these aircraft are

being sold in a market which Britain could have had but in which it has not gotten a corner, primarily for failure to concentrate on a few really competitive designs and to get them into the marketplace come hell or high water.

A lecture by Worcester to the Royal Aeronautical Society and his subsequent book have stirred up a rash of hostility in Britain. Part of this has been because the Labour Government has been willing to listen to him, but a good deal of it has been fear. Worcester is only one of a number of critics who have in recent years been pointing to the lack of policy-making finesse while at the same time urging that Britain take a realistic view of the future. Reports on the latest Paris Air Show indicate that some of the hard facts of modern life are beginning to sink in and that Europeans in general are recognizing that for both their own and the world's economic, diplomatic, and military health they had better pull together. For the British, who have traditionally regarded the Continent as something to which they do not belong, this means abandoning some national pride and the pursuit of mere prestige projects.

JUST AS Worcester deals with both the past and the future, so does Sir Solly Zuckerman in *Scientists and War*, but from a much different point of view. Sir Solly is currently Chief Scientific Adviser to the British government. As such, he is familiar with the problems of making policy. As a scientist—he is a professor of anatomy—he has warned that there must not be a tendency on the part of leaders to have scientists make their decisions for them. Few people bring to military problems such a wide background and so much expertise. He has had an acknowledged influence on the work of Air Vice-Marshal E. J. Kingston-McCloughry, a talented air thinker.

Perhaps Zuckerman's major contribution is the sensible rationale which he brings to the whole subject of military policy. The book itself is certainly very much worth reading, for, unlike the other three volumes already discussed, it is not a piece of special pleading but rather is a series of essays and lectures given over the last half-dozen years on both sides of the Atlantic. Certainly those who want to understand the problems of the present age can hardly find a better starting place than this short book, in which the author ranges from nuclear weapons through the problems of scientific secrecy to those of liberty in a scientific age and to the social function of science itself. At a time when the best minds in the United States are grappling with the stupendous cost of the antiballistic missile system as a counter to the intercontinental ballistic missile, Zuckerman points to the "inexorable law" that the cost of defence may well outweigh the benefits and that it may be much more sensible to find ways of cooperating with other powers to obtain the spin-off benefits of this kind of science in a more economical way.

While this thought may not be very pleasing to many Americans, yet its author speaks from experience in Britain. There the country's ability to expand its war production peaked in 1944. From then on, the accumulated physical and financial toll of two World Wars, coupled with rapidly rising costs in a highly technological age, not to mention certain other realities, forced the country out of the defence business. Zuckerman is not arguing an abstract point; he is facing the problem which on a smaller level can trouble all of us—How much insurance is enough? What risks are we prepared to take?

Turned another way, the question is one asked me some years ago by one of the directors at the Navy's China Lake establishment: What is an adequate level of armament for any nation? The answer will never be easy. It depends upon a calculation of warning time, assets, friends, risks, and contingencies; and it depends upon a fine judgment based upon scientific, economic, political, social, ideological, and historical understanding. The answer also depends upon who is supplying the data and upon how much of it is really only a "guesstimate." It is important, therefore, that the whole be studied objectively and that all factors be weighted on a plus-or-minus basis.

One of the joys of Sir Solly's work is that he puts the ideas not in abstruse mathematical formulas but in language that everyone can understand. Thus he enables people to start thinking again with a clear head.

THESE FOUR BOOKS span British aeronautical history from the romantic to the rational. There is something to be learned from each author, even though we may not always agree with him.

Manhattan, Kansas

Notes

1. Sir Walter Raleigh and H. A. Jones, *The War in the Air* (London: Oxford University Press, 1922–37), 6 vols.
2. Hilary St. George Saunders, *Per Ardua: The Rise of British Air Power, 1911–1939* (London: Oxford University Press, 1944), 358 pp.
3. Arthur Marder, *Fear God and Dread Nought* (New York: Oxford University Press, 1961–), 4 vols.
4. Sir Charles Webster and Noble Frankland, *The Strategic Air Offensive against Germany* (London: Her Majesty's Stationery Office, 1961), 4 vols.
5. David Divine, *The Blunted Sword* (London: Hutchinson, 1964).
6. [Marshal of the RAF] Sir John Slessor, *Air Power and Armies* (London: Oxford University Press, 1936).

The Contributors

THE HONOURABLE PAUL THEODORE HELLYER, P.C., M.P., (B.A., University of Toronto) was Canada's Minister of National Defence until September, when he became Minister of Transport. He was graduated in aeronautical engineering from the Curtiss-Wright Technical Institute of Aeronautics at Glendale, California, in 1941. Subsequently he was employed by Fleet Aircraft Limited at Fort Erie, Ontario, starting as junior-draughtsman and working up to group leader in engineering on the Cornell aircraft elementary trainer. Mr. Hellyer obtained a pilot's license in California and was working toward his pilot's wings in the Royal Canadian Air Force when he transferred to the Royal Canadian Artillery. After demobilization, he went into business in Toronto and at the same time worked his way through the University of Toronto. When elected to Parliament in 1949, he became, at the age of 25, the youngest member of the House of Commons. In 1953, he was re-elected and in February 1956 was appointed Parliamentary Assistant to the Minister of National Defence. Fourteen months later, Mr. Hellyer was sworn into the Privy Council as Associate Minister of National Defence. He was re-elected to the House of Commons as Member of Parliament for Toronto-Trinity in a December 1958 by-election. He acted as Chairman of the 1961 National Liberal Rally in Ottawa, and he served as a Parliamentary representative to NATO under both Liberal and Conservative administrations. He was president of a Toronto construction company when he resigned to devote full time to public life in 1962. Re-elected in the general election of April 8, 1963, Mr. Hellyer was named Minister of National Defence when the Cabinet was formed.

General James Ferguson is Commander, Air Force Systems Command, and Director, Manned Orbiting Laboratory (MOL) program. Commissioned from flying cadet in 1937, he served in fighter units until 1943, when he organized the 405th Fighter-Bomber Group and took it to the European Theater. He was Operations Officer, XIX Tactical Air Command, during the planning of the Normandy invasion and was its Director of Operations on V-E Day. He then served with the 5th Fighter Command in the Philippines and Okinawa until September 1945. Postwar assignments have been as instructor in tactical air operations, Air Command and Staff School, to 1947; with the American Mission for Aid to Turkey, finally as its Chief of Staff, to 1950; as Assistant to the Vice Commander, later Assistant Deputy for Operations, Far East Air Forces, to 1951, and as Vice Commander, Fifth Air Force, to 1952; as Deputy Commander, Ninth Air Force, TAC, to 1955; as Deputy Director—later Director—of Requirements, DCS/D, until 1959; as Vice Commander, Air Research and Development Command (later AFSC), until 1961; and DCS/R&D, Hq USAF, until assuming his present assignment in 1966.

Colonel Arthur A. McCartan (USMA) is Chief, Joint Operations Analysis and Test Group, Hq U.S. Strike Command. At Strike Command since August 1963, he served as Chief, Field Test Division, Joint Test and Evaluation Task Force (JTETF), until its deactivation upon completion of mission 30 June 1965. He was Chief Evaluator, Joint Exercise RAPID STRIKE, 1966. Colonel McCartan served in the armed forces during World War II and the Korean War and is a 1948 graduate of the Naval War College.

Lieutenant Colonel David C. Collins is Chief, Supporting Systems Branch, Doctrine Division, Hq Tactical Air Command. During World War II he served as navigator on B-29s, completing 25 combat missions against Japan. After the war he attended Air Tactical School and served on its faculty until he entered pilot training. Since his graduation in 1950, he has served in Goose Bay, Labrador, and in Air Defense Command at Kinross AFB, Michigan; as a student, instructor, and group chief, Squadron Officer School; as student, Air Command and Staff School; with a C-119 squadron, later C-130, at Dreux and Evreux, France; and in TAC as squadron operations officer, squadron commander, and assistant division operations officer until his present assignment in 1963.

Colonel Benny L. Costello (M.S., George Washington University) is Chief, Training Branch, J-3, Hq U.S. Strike Command. He entered the service in 1942 and during World War II flew 30 missions in B-24s in the European Theater. Colonel Costello has held his present assignment since graduating from the Air War College in 1963.

Lieutenant Colonel Donald M. Wood, USA (B.S., University of Vermont) is assigned to the Joint Training Branch, J-3, Hq U.S. Strike Command. During World War II he served with the U.S. Navy in the Pacific Theater. Since entering the U.S. Army in 1951 he has served in the 11th Airborne Division, the 25th Infantry Division, the 101st Airborne Division, and the 5th and 6th Special Forces Groups (Airborne). In 1961–62 he served as a Senior Regimental Adviser in the Republic of Vietnam. During his second tour of duty in the RVN in 1965–66, he commanded an Operational "C" Detachment while assigned to the 5th Special Forces Group (Airborne). Colonel Wood is a graduate of the Army Command and General Staff College.

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LIEUTENANT COLONEL RAY L. BOWERS (USNA; M.A., University of Wisconsin) was Associate Professor of History, U.S. Air Force Academy, from 1958 until his assignment to the 345 Troop Carrier Squadron, Far East Air Forces, in 1967. He flew as navigator-bombardier, 47th Bombardment Wing (B-45), United Kingdom, 1952–55. He participated in the testing of the B-66 aircraft at Edwards AFB in 1955–56 and served with the 17th Bombardment Wing (B-66) during 1956–58, successively as aircrew member, air targets officer, and wing special weapons officer. Colonel Bowers' articles have been published in *Military Review*, *Aerospace Historian*, and Naval Institute *Proceedings*, as well as *Air University Review* (May-June 1966).

BRIGADIER GENERAL LEO A. KILEY (Ph.D., Ohio State University) is Director of Science and Technology, Office of the Deputy Chief of Staff, Research and Development, Hq USAF. Commissioned in the Air Corps Reserve in 1941, he served in various weather assignments until accepting a regular commission in 1946. Subsequent assignments have been as Commander, 15th Weather Squadron, Philippine Islands and Okinawa; Commander, Hickam Weather Central, Hawaii; student, Air Command and Staff School; Chief, Plans and Operations Division, 2059th Air Weather Wing, Tinker AFB, Oklahoma; USAFIT student, Ohio State University; Chief, Programs Branch, later Deputy Director, Atomic Warfare Directorate, Air Force Cambridge Research Center; Deputy Chief, then Chief, Biophysics Division, Air Force Special Weapons Center; Assistant DCS, later DCS, Weapons Effects Tests, Field Command, Defense Atomic Support Agency, also Military Deputy Test Manager, Nevada Test Site, and Commander, Joint Task Unit 8.1.3 of Joint Task Force Eight, Pacific Proving Ground; Vice Commander, later Commander, Air Force Cambridge Research Laboratories; and Commander, Air Force Missile Development Center, Holloman AFB, New Mexico, until his present assignment on 1 July 1967.

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COLONEL ALFRED F. HURLEY (Ph.D., Princeton University) is Professor and Head of the Department of History, U.S. Air Force Academy. He enlisted in the Air Force in 1950, was commissioned from Officer Candidate School in 1952, and rated as navigator in 1954. His assignments have been as instructor, Air Force Observer Instructor School, James Connally AFB, Texas, to 1956; student, Princeton, to 1958; instructor in history, USAFA, to 1963; navigator and executive officer, 7499th Support Group, Wiesbaden, Germany; staff officer, War Plans Division, Hq USAFE; and temporary member, Chairman's Special Study Group, J-5, Joint Chiefs of Staff, until his assignment to the Academy. Colonel Hurley is author of *Billy Mitchell—Crusader for Air Power* (1964).

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DR. ROBIN HIGHAM (Ph.D., Harvard University) is Professor of History, Kansas State University. After obtaining his pilot's wings in the Royal Air Force in 1944, he was assigned to 48 Squadron, South-East Asia Command, operating out of Chittagong. Upon his return to the United States in 1947 he resumed his education, 1950–57. He assisted in oceanic history at Harvard and taught at the Universities of Massachusetts and North Carolina before moving to Kansas State in 1963. Dr. Higham is active in several professional societies, has written numerous articles and book reviews, and is the author of *Britain's Imperial Air Routes, 1918–1939; The British Rigid Airship, 1908–1931: A Study in Weapons Policy; Armed Forces in Peacetime: Britain 1918–1939;* and *The Military Intellectuals in Britain: 1918–1939;* and is coauthor (with Major David H. Zook, Jr., USAF) of *A Short History of Warfare.*

AWARD

The Air University Review Awards Committee has chosen "The Closer the Better" by Colonel John R. Stoner, USAF, as the outstanding article in the September-October 1967 issue of the *Air University Review.*

ATTENTION

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