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SPECTRUM OF SPACE: A MILITARY APPRAISAL . . . LIMITED-WAR RESEARCH NEEDS . . . LESSONS FROM COIN OPERATIONS

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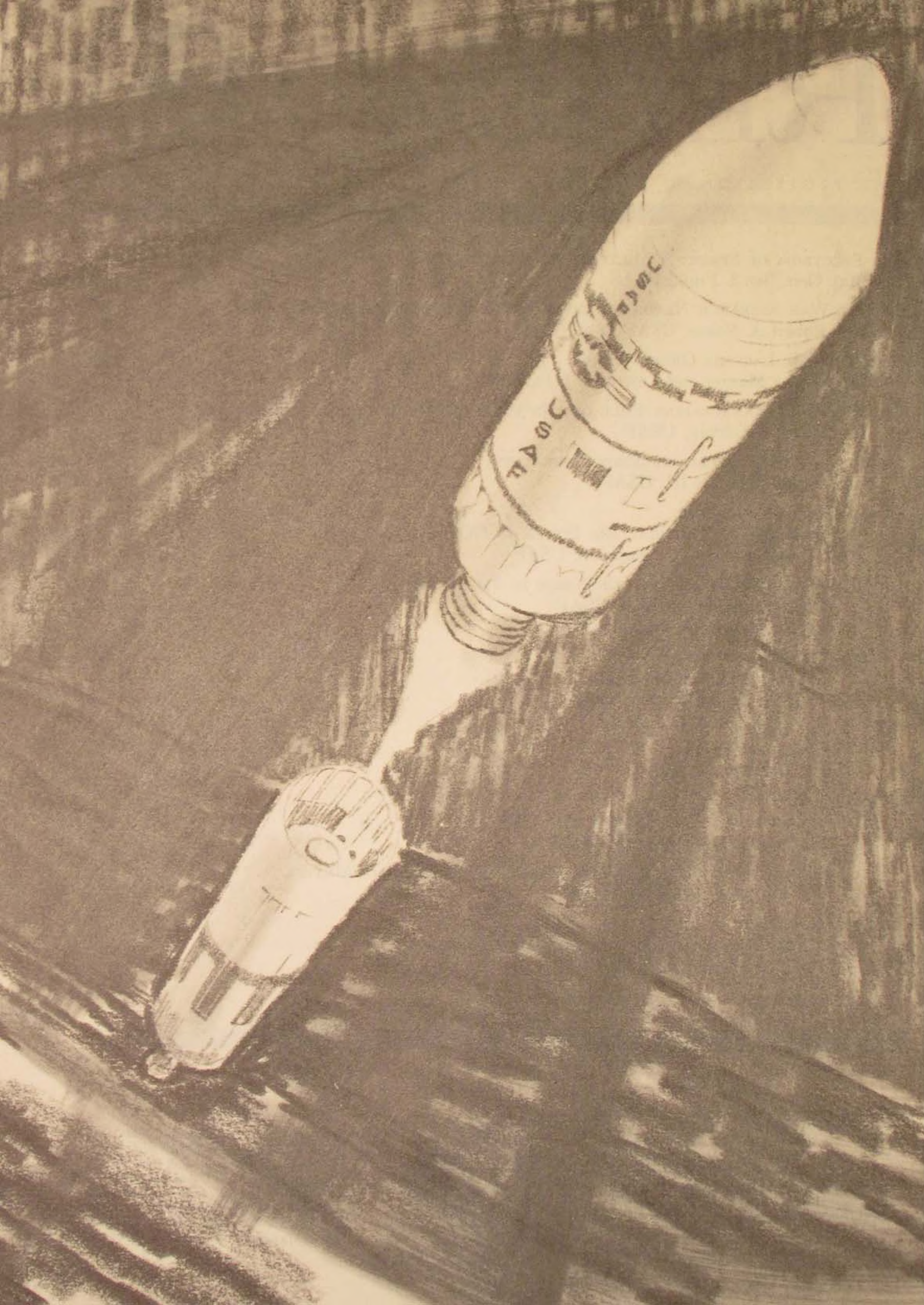
"During these in-between years . . . of space knowledge and experience" which Major General Ben I. Funk discusses in "The Spectrum of Space: A Military Appraisal" some of our space hardware (here NASA's second-generation weather satellite Nimbus) bear a striking resemblance to our earliest aircraft.


USAF

THE SPECTRUM OF SPACE: A MILITARY APPRAISAL

Major General Ben I. Funk

The military space program accounts for more than 20 per cent of the total 1964 research and development program. It is the largest single program grouping in the RDT&E category exceeding, for example, total expenditures for the development of strategic weapons. . . . Broadly speaking, about half of our space effort is directed to relatively well-recognized and understood military requirements, such as satellite communications and navigation systems. The balance of our effort is aimed at creating a broad base of new technology, devices, and even systems for possible future applications.

—From Secretary Robert S. McNamara's statement to Congress, 30 January 1963

NO VALID assessment of our country's future defense posture can be made today without giving serious consideration to the nature, the potential uses, and the ultimate influence of space.

I believe that space will prove to be a dynamic and revolutionary element of national power. Yet in its present emerging state, space represents both threat and opportunity not only militarily but politically, morally, psychologically, and economically as well. It is necessary to appraise the broad spectrum of space during this, its period of infancy, if we in the Air Force are to be instrumental in minimizing the threatening aspects of space while at the same time maximizing its potential benefits.

The military character of space has been the subject of intensive and extensive discussion and debate. Much of this has been thorough and enlightening. Unfortunately much has also been cursory and superficial. As a result large segments of the military as well as the civilian public have not had the opportunity to comprehend or appreciate the far-reaching significance that may derive from what we do or neglect to do in the direction of space. The purpose of this article then is to put military space considerations into the perspective of national purpose.

Readers of this journal are well aware of the expansive mission belonging to the United States Air Force. Secretary Eugene M. Zuckert summarized this mission in explicit terms.

> With about 39 per cent of the Defense Department budget, the Air Force not only provides our nation with the Strategic Air Command and its more than 80 per cent of the free world's nuclear delivery capability, but it also provides some 70 per cent of the personnel for the North American Air Defense Command, and the greatest portion of the facilities for defending our skies against attackers.
>
> In addition, the Air Force provides global military airlift and aerial assault power, air support for the Army, the major research, development and engineering programs in the Department

> of Defense space effort, and the major Defense Department support of the national space program.[1]

Implementation of these mission requirements places upon the Air Force heavy and sobering responsibilities for maintaining our national security, *both present and future*. It is a standing obligation that has been met, in part, through the development and employment of strategic bomber and ballistic missile forces in the years since World War II. For the future it is an obligation that must be met during the years just ahead by an equally positive response to the challenges implicit in the medium of space and those resulting from the applications any unfriendly nation might choose to make of space capabilities.

This is not to say that we shall necessarily duplicate or imitate the course of action we pursued in the conduct of the ballistic missile program. A fact of life accompanying the advent of any new operational medium is the necessity to recognize that while history may repeat itself, it never does so in the same fashion. One temptation we must guard against is the tendency to bring old solutions to bear on new problems. The uniqueness of space has led already to certain innovations in our methods of doing things and may require further rethinking of our traditional concepts and customary patterns of action.

None of us within the Air Force need have any doubt as to its primary space responsibility, which, briefly stated, is to develop and maintain those capabilities in space necessary for the protection of the national security. How best to exercise that responsibility to ensure U.S. aerospace superiority in the face of spirited competition is the burning question to which we must address ourselves during these in-between years, the interlude "between the dark and the daylight" of space knowledge and experience.

In my position as commander of the Air Force Systems Command's Space Systems Division, I am frequently asked for my personal or professional opinion on the strategic systems or military space capabilities that may be developed during the next several decades. While it is possible, on the basis of the torrent of technologies and the deluge of data already acquired from our initial ventures into space, to postulate with some certainty the shape and substance of a few military requirements that will be met in or through space, it is impossible to be very definitive about ways in which all potential military needs might be fulfilled. Security restrictions aside, it just is not possible to spell out answers when all the questions or problems have not yet been identified.

Of course this situation is not unique. Predicting the future is always a hazardous and often an unrewarding occupation. No one, in or out of the military, could have been expected 50 years ago to anticipate the supersonic jet, the B-52, or the nuclear bomb which, as a parallel technological advance, increased the strategic value of the airplane exponentially. Speaking of this point, General Thomas S. Power, Commander in Chief of the Strategic Air Command, has made this observation:

> Improvements come not only through new discoveries and advances in the state-of-the-art, but even more so through experience in actual operation and the expanded requirements resulting from such operation.[2]

The cardinal difference between past and future in the weapon system development process is the time element. The problem today is that, as the numbers and kinds of systems grow greater and more complex and as technology leaps forward at geometric pace, the time in which to capture these accelerated technologies and apply them to military requirements grows progressively shorter. This means that by the time a system does become operational new discoveries and developments may already impair its utility, if not make it obsolete altogether. This eventuality was recognized at the outset of the ballistic missile program, and the practice of concurrency was instituted to shorten the acquisition cycle and thereby lengthen the operational life of the system.

Aptly enough, it is this same interaction between time and technology, together with the shifting but unrelenting impact of the factor we think of as "the threat," that has already enforced upon us in the Air Force an awareness of and appreciation for the uncommon demands we must fulfill for competence in the direction, management, and implementation of the U.S. military space program. All of us recognize that our problem is one of meeting future military needs while we are at the same time searching out and identifying those needs. The situation, therefore, is complicated by the quantity and extent of the unknowns and uncertainties that have to be resolved, and these apply to Soviet intentions in space as well as to the space environment itself.

For these reasons, a practical approach to military space progress must take into account several qualifying factors.

- First, we must gear our aspirations and our programs to the pace of technology, to our capacity for applying technological advances productively, and to our ability to produce systems that will not be overtaken by events. And these parameters, I want to point out, are not necessarily restraints to progress, since our national affluence in matters of technology and production has traditionally been much greater than we realized at the outset.
- Second, we shall be wise to include in our equation for progress our forecasts of Soviet intentions, capabilities, and actions and to evaluate as soundly as possible the practicality of these forecasts within the framework of our own military projections. Clearly, the danger of overestimating the Soviet space prowess—current or future—is not as great as the danger of underestimating it. But in these days of sophisticated and costly systems, we can ill afford to engage in the development of capabilities that will not contribute significantly to our well-being.
- Third, we must appraise, quantitatively and qualitatively, the degree and caliber of space experience that has been and will be available to the Nation and, more specifically, to the Air Force.
- Finally, we must predicate our actions to a large extent on the realization of certain space-age "building blocks," on the availability of technology, and on the competence of our management function in the proper disposition of resources—both funds and scientific manpower.

Each of these four areas of space interests has been acted upon during these introductory years of the space age, and we in the Air Force are keenly aware that we must continue our efforts if we are to further develop, implement, and pursue a blueprint for rational and effective military space progress. I cannot proceed to a discourse on each of these points, however, without establishing the frame of reference in which military space considerations properly belong: namely, as part and parcel of a larger national program devoted to peaceful purposes and to the utilization of space capabilities for the benefit of mankind. I am sure that I do not need to remind a predominantly senior military readership that in this respect the U.S. space program is totally consistent with the political, moral, and ideological principles of this nation and fully compatible with the policy of deterrence as a fundamental means of preserving and promoting global peace.

At the same time I believe it is important for all of us concerned with the national security, in the Air Force or without, to be cognizant of the rationale underlying the Department of Defense space-consciousness. This was expressed quite eloquently by Dr. Lawrence L. Kavanau, Special Assistant to the DOD Director of Defense Research and Engineering.

> In the address of problems of national security national defense missions and objectives are essentially unchanged by the medium in which solutions to these problems must be sought. For example, the inalienable right of nations to self defense . . . applies universally to land, sea, air and—if necessary—to space. We need a great variety of military capabilities in order to meet the many different levels of threats . . .
>
> Further, in the broad context of national security, U.S. successes and failures in space may have significance for cold war political maneuvering while affecting, as well, the balance of world military power. This should be true to whatever extent peacetime developments in space vehicles and operations shape our national image around the world and to the extent that space systems may credibly function in a supporting or deterrent role.[3]

Dr. Kavanau also noted that:

> . . . while we acknowledge that space is not inevitably or predictably the key to future military power, we recognize that unpredictably or conditionally it could become so. Hence, we must prepare for such future contingencies as appear technically and economically reasonable.

Perhaps the comment by Dr. Kavanau that is most pertinent to those of us in the military service who must understand, respect, and respond to space-age dictates is in his observation on the relationships between military space and the Soviet threat.

> As we extend the rule of law on earth, we must find the means to extend it to space. In so doing, we must face the ever-present possibility that the Communists will not cooperate with us in the attainment of this goal. To the extent that they do not, we may be denied the predilection of our rightful choice in the future prosecution of our national defense and space programs. Therefore, while pursuing a national objective to reserve space for peaceful exploration, we must continue to sustain the balanced military force structure necessary to support national security objectives, on earth or in space. Only in this way can we create a national strength image which has the substance required to engender credibility.

Dr. Kavanau has expressed the prime reasons substantiating our concern and interest in military space. More simply stated (and I respectfully suggest that it is to Dr. Kavanau's credit that he did not oversimplify the military case for space), these reasons are: for self defense, for prestige, to guard against the attainment of a strategic advantage by an enemy, and to ensure our continued freedom to pursue the development of those military options that may, indeed, affect the course and character of our country's freedom.

If space capabilities are our goal and timely action toward the early realization of these capabilities our immediate order of business, then I submit that our success in these ventures will be dependent to a large extent on the manner in which we deal with the four qualifying factors which I have outlined.

Technology as Pacemaker

The first of these considerations, technology and the consequences of technological development in terms of timely systems, has manifested itself profusely and profoundly in the past decade. The effects on the Air Force and the Nation have been startling.

It has been said that we are afflicted today not by a shortage of technology but rather by an abundance and that the filtering, refining, selection, application, and management of technologies constitute our major problem. From my own view, I am not sure that I agree with this rather glib generalization, nor do I subscribe to the belief that technology in abundance is an "affliction." True, technological progress requires of us as a nation exceptional degrees of intellectual competence and a fair amount of hard decision-making, but such demands should be regarded as challenges, not obstacles. Frankly, I think that we in the military, who depend so heavily on the fruits of technology for our superiority, should welcome with open arms all the outpourings of scientific and technical eminence attainable. The proper use of these technological resources, on the other hand, is primarily the job of management, and I shall have more to say on that subject later.

Nonetheless it is evident from our recent experiences in the ballistic missile program that rapid technological ascendancy requires on the part of our political, military, and industrial leadership certain adjustments both in outlook and approach. The pages of modern history offer ample instances of the shortsighted manner in which several previous technological breakthroughs were viewed. The shortsightedness stemmed largely either from a natural resistance to change or from an ultraconservative opinion regarding our capacity for unprecedented achievement.

In 1910 the authoritative magazine *Scientific American* declared editorially, "To affirm that the aeroplane is going to revolutionize the future is to be guilty of the wildest exaggeration." There was clearly some justification for this attitude. In 1910 airplanes were impractically expensive. Their payloads were small, their ranges short. Their uses, even military uses, appeared to be severely limited and ill defined. Yet the order-of-magnitude changes occurring within fifty years totally transformed both the nature of the airplane and its place in world affairs. This transformation has been nowhere more evident than in our own Air Force.

More recently, in the ballistic missile program, we have witnessed and participated in an even more graphic illustration of the effects of accelerated and compressive technology. To produce a modern ICBM using a German V-2 as the point of departure meant that we had to improve range by a factor of 33, accuracy by a factor of 20 (in terms of burnout velocity error tolerances), gross weight by a factor of 8, and warhead yield by a factor on the order of millions. Achievement of all these objectives, within a shortened time period, has served not only as a vivid lesson in the potentials of technology but also as an example of the merits of a positive and optimistic approach to seemingly impossible requirements.

It is needless, I am sure, to labor this point for a professional Air Force audience. Yet in the months just before Sputnik an Air Force general, now retired, caused some consternation in the capital by the casual remark in a speech, "Who knows, someday we may want to go to the moon."

I offer these illustrations not as indicative of Air Force wisdom or prophetic acumen (the Air Force certainly has no monopoly on foresight, neither is it immune from errors of judgment) but rather in support of my contention that in today's environment it is well for us to be somewhat bold, imaginative, and open-minded with respect to technological eventualities that may seem extreme. Certainly, if we hope to capitalize on burgeoning technologies, it is necessary not only that we keep our development lead time short but that we reduce our lead time on foresight as well.

Each of these two imperatives, then, requires not only a revamped attitude toward the role of technology in the pattern of national progress but also an equally enlightened approach with respect to the manner in which technological advances are or might be applied. Air Force officers, particularly those with R&D qualifications, are quickly learning that in an era characterized by a multiplicity of technologies and a myriad of alternatives there are parallel needs for two types of individuals: (1) those who are space-age specialists in a narrow field of technical or scientific endeavor and (2) those with sufficient knowledge and experience in administration to qualify them as managers over a project that encompasses diverse technologies. In other words, the "one-man staff" type of operation may be ideal at the basic research level, but for applied research, for engineering and test, and for full-blown development work nothing short of a team effort will suffice.

The late Albert Einstein remarked shortly before his death that in his younger days he had no difficulty in reading all the material produced in the entire field of physics. Yet when he reached 70 and was still mentally alert, he could not keep up with all that was being written in his own specialized field of relativity.

This sort of proliferation in the sciences and technologies has necessitated our design and adoption of a selective approach in the nurturing and use of technologies. Further, since our objective is the production of *systems*, it has become mandatory for us to monitor the rate of progress in specific but related technical areas. It would not, for example, be productive to expend much money and effort to develop an ingenious and greatly advanced space vehicle guidance system if such a system would be too heavy for existing boosters or if we had no vehicle structurally designed to accommodate it. Clearly the whole must be equal to the sum of its parts, and—to modify this axiom slightly—the complete product must be equal in quality to the potential best of each of its parts.

This dictum may seem to express the ideal, but it is the controlling principle that lies at the root of our efforts to achieve quantum jumps in concurrent or at least in progressive fashion. Technology moves today, as in the past, in increments. But our rate of advancement depends on the extent to which these incremental improvements are *system oriented*.

In appraising the importance of technology, there is also the matter of utility.

During the years immediately following Sputnik our national space efforts were characterized by those attitudes and reactions that might reasonably be expected of any new field of endeavor. A barrage of ideas representing a broad range of viewpoints and proposals appeared regarding the use of space. We came up with a variety of gadgets and a number of fledgling systems. We made some false starts and we had some failures. But out of many uncertainties and in the face of difficult obstacles the United States produced some proud successes and recorded a battery of remarkable achievements.

We acquired vast technologies, which are still growing. We sampled a variety of space-flavored data. And, gradually, we arrived at the point where it was necessary to consider judiciously just where we were going and what we really hoped to achieve. In this respect, surely, the first generation of the space age has focused attention on the necessity for maturity of purpose.

It should certainly be clear now that our space activities constitute a *national* program. It should be equally clear that in space, just as in other fields, there are military and nonmilitary objectives, functions, and responsibilities. Finally, it must be apparent that the ultimate delineation of the military and nonmilitary aspects of space, within the confines of a unified national program, will rest on the crystallization of three factors:

(1) facility in the advancement and application of space technologies,

(2) the identification of definite defense needs that can be satisfied by space-associated capabilities, and

(3) the ability of the military/industry team to fulfill those defense needs.

To the present time, the "division of labor" in our national space workshop has been, to some extent, arbitrary. Missions that are basically scientific and exploratory, such as investigation of the moon and the solar system, are being conducted by the National Aeronautics and Space Administration, with military assistance and cooperation, of course. Those earth-orbit programs which support or are likely to support vital defense requirements, such as satellite rendezvous and inspection, are being performed by the Department of Defense, aided, not incidentally, by knowledge and experience gleaned from NASA ventures. Beyond such logical allocation of missions, there are space projects that might have been assigned to either agency. For example, NASA was selected to manage the lunar expedition and to carry out interplanetary exercises. On the other hand, it was agreed that the Air Force would develop the large solid boosters to be utilized by both NASA and DOD.

Despite the mutual benefits to NASA and the Department of Defense resulting from this interface relationship and the greater benefit thereby accruing to the Nation, there is a growing realization that the dictates of time and circumstances point toward the desirability of increased military participation in certain space activities.

Dr. Hugh L. Dryden, Deputy Administrator of NASA, has said that programs such as Apollo, heart of the lunar project, are designed to enable us to learn how to do jobs in space. Certainly this is true. And as he points out, once Apollo is a demonstrated success the United States will possess ". . . an enormous industrial base competent in the space arts, a gigantic space port plus the ground facilities required for space exploration, large rockets able to do anything we want to do between here and the moon, skill in docking and joining craft in space and transferring men and equipment between them, knowledge of how men function in space and how they react to the space environment, and the ability to return spacecraft to earth at speeds of 25,000 miles per hour."[4]

At the same time we must recognize that while the multibillion-dollar lunar program will yield tremendous "fallout" benefits to the Nation as a whole, there are certain specific, purely military requirements that cannot be satisfied entirely by the NASA program.

In terms of launch vehicles these elements translate into a need for booster systems of ample capacity, outstanding reliability, and low operational cost. Boosters for military purposes must also demonstrate a high degree of responsiveness not demanded by most nonmilitary space programs. By this I mean it is conceivable that at some time in the future we may have to get space systems off the ground with the same kind of urgency now practiced in the SAC and TAC alert scrambles. Launch vehicles to support future military missions will have to have a similar degree of reliability, since any unexpected "hold" might jeopardize mission performance.

With respect to costs, there are two distinct but related considerations that we dare not overlook in the structuring of our military booster systems. First, since many space missions will undoubtedly require repetitive launches to support continuously operating systems, costs per booster will have to be greatly reduced without compromising reliability. Today some 90 per cent of the total cost of a space launch is vested in the booster and its ground support equipment. One course of action that may be prudent is the development and use of recoverable boosters.

The second fact about cost is the proved savings that accrue through the use of standardized hardware, primarily by virtue of increased reliability. For example, the Thor has long been applauded for its reliability, having performed successfully in 93 of its first 100 launches as a space booster. Similarly, standardization of the upper-stage Agena spacecraft, used in combination with both the Thor and Atlas boosters, has given us something on the order of a 95 per cent reliability record in 200 launches.

Requirements that are largely peculiar to the military appear also in the category of the spacecraft. Eventually, we may expect military-oriented spacecraft to be capable of routine maneuverability, permitting rendezvous, station keeping, docking, and the transfer of men and materials. While such capabilities may be expected also of civil satellites, military parameters in these respects will likely be more demanding.

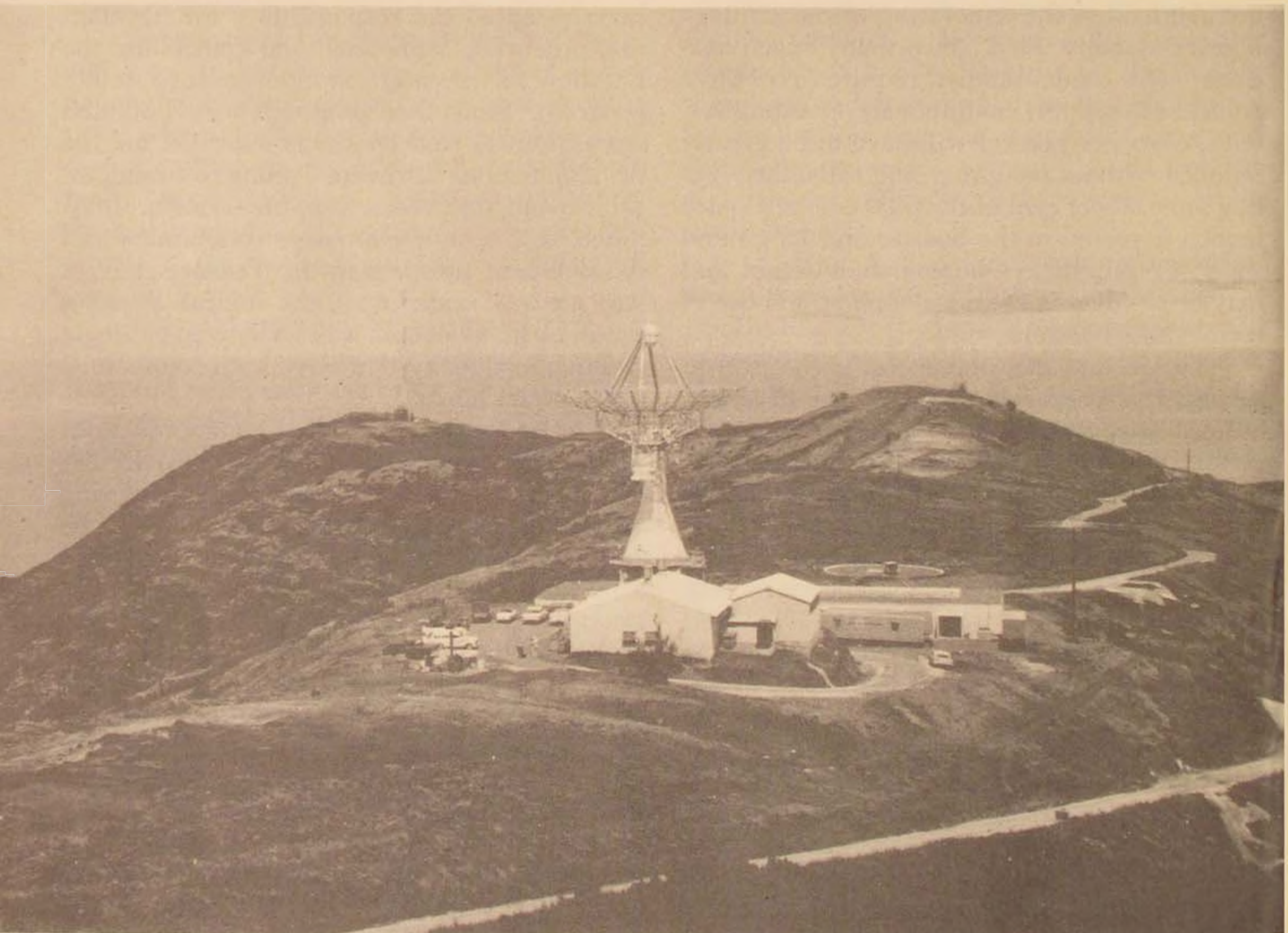
Rendezvous in space, for example, is not an easy task under any circumstances. But the simple rendezvous and the transfer of fuels or liquid food that might serve for civil spacecraft may not satisfy the military requirements that may emerge. As a point of difference, it is one thing to rendezvous with a friendly satellite in a controlled environment and predetermined orbit; it is quite another thing to rendezvous with an uncooperative vehicle that might be equipped to take evasive action.

Satellites for communications purposes serve as still another example of the distinctions between military and nonmilitary on-orbit performance requirements. Last spring Secretary Zuckert announced that ". . . the Air Force has been assigned the responsibility for developing, procuring, launching, and controlling the satellites for the DOD communications satellite program." Since then proposals were obtained from industry and contracts awarded for the development of hardware leading to a random-orbit communications satellite system. Inasmuch as a commercial space communications development program in the Telstar satellites was already under way, the logical question posed by many people was: Why won't a single communications system serve both commercial and military needs?

Aside from the fact that communications might well be the lifeline of survival in any future conflict and that systems supporting such a critical requirement would have to be survivable, the answers to the question "Why a military system?" are largely technical. For example, the military requires relatively few channels, but these must be jam-proof and the command-control function must be secure from enemy interference. Further, military communications satellites will be most effective if they can function with simple ground stations. Eighty-five-foot antennas and receivers soaked in liquid helium are acceptable for commercial installations, but they are hardly suitable for installation in a trailer or for landing in the Congo by airlift. Moreover, multiple ground stations and the hardening of key stations, both in the interest of survivability, are desirable attributes of the military system.

Finally, a military communications system

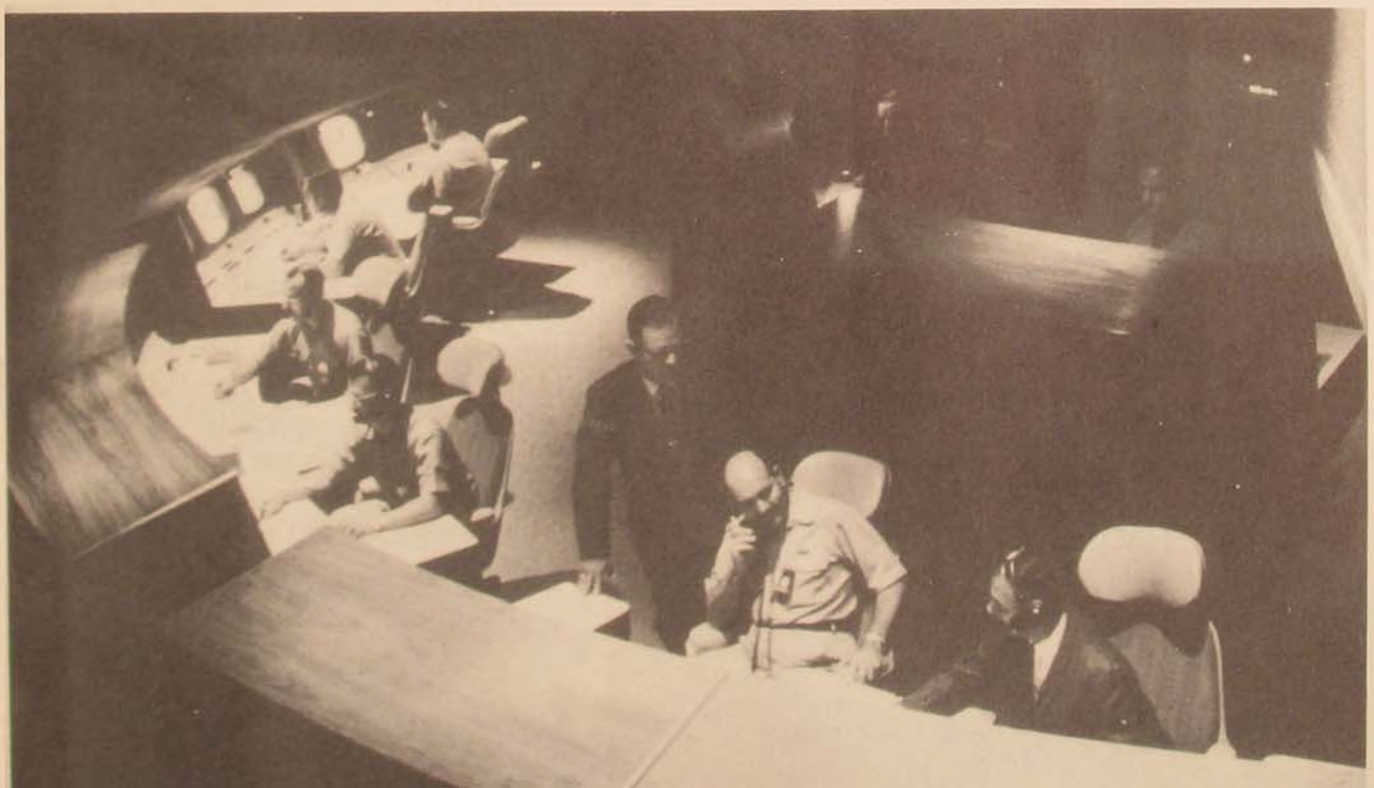
Satellite Command and Control



The tracking station at Kaena Point, Hawaii, and similar ones in Alaska and other states make up the command and control network enabling technicians at Space Systems Division's 6594th Aerospace Test Wing to monitor and control orbiting satellites.

The "traffic pattern" of an Agena satellite in polar orbit is projected on a plotting board at the 6594th Aerospace Test Wing, Sunnyvale, California. SSD capabilities permit tracking, command, and control of ten simultaneously orbiting spacecraft.

Establishment and operation of the Space Systems Division's satellite control facility has served to put a "pilot" at the console for conducting space test operations.



will be required to function reliably 24 hours a day, with built-in redundancy to guard against chances of induced failure. By comparison, commercial systems, although necessarily operating a large percentage of the time, may have silent periods with only a proportional loss of revenue.

In the third facet of our "round-trip" military-space considerations, we need only look to the precise manner in which we have learned to land aircraft systems, from Piper Cubs to the X-15, to appreciate the requirement that exists for a similar capability in the re-entry, return, and reuse of manned spacecraft. We cannot be forever fishing our astronauts out of the ocean or obligating large tracts of real estate as recovery areas.

Potential utility, therefore, must be the deciding factor in the delineation and priority of the various military and nonmilitary tasks looming on the infinite space horizon. We view the broad range of potential military space operations as among the possible "options" which will extend the present versatility and flexibility of our military posture into the regions of space. As Dr. Kavanau has said,

> Space systems which we are now developing for military support missions should evolve to where they are principal elements of mission capabilities, no longer to be regarded as redundant extensions of contemporary systems. . . . probably the most important factor influencing future decisions [regarding military space systems] will be the release of most of the technological restraints which inhibit many of our present endeavors. We may expect to advance rapidly to an era where technical factors are superseded by political, military, or economic factors as the principal determinants of space activities. . . . These may be further complicated by the emergence of other nations as space competitors just as we must face the prospect of a future world with several nuclear powers.[5]

These two thoughts—the expected easing of technological restraints and the possible tightening of political, military, and economic influence—lead directly to the second major qualifying factor in our consideration of the elements which shape our outlook on the vistas of space.

The Soviet Influence

The importance of anticipating Soviet intentions and capabilities with reasonable accuracy is one of the two recurring themes in Secretary McNamara's 163-page 1963 statement to Congress on the status of U.S. military posture and the FY 64 defense budget. Incidentally, his second theme, the current shift in policy from large numbers of systems and weapons to a more selective defense structure maximizing military options, is clearly related to our evaluation of expected Soviet achievements as a motivating factor in the decisions affecting our own defense planning. General William F. McKee, USAF Vice Chief of Staff, has put it this way:

> We must watch our own and the Soviet's space programs carefully. This is probably the area of greatest demand on our vision as a nation. For it is here that one of us, probably, will find the key to the strategic superiority of the 1970's.[6]

This is not to infer, of course, that our own space plans and programs are or should be predicated solely on *reactions* to Soviet space demonstrations. Comparison certainly is inevitable, and it is well known that the early efforts of the Soviets toward large-thrust ballistic missiles have afforded them a decided advantage in weight-lifting capabilities. It has often been stated that our intention, from the military point of view particularly, is not to engage in any kind of technological race by which, through constant reaction, we would find ourselves always second but rather to develop and maintain those capabilities in space essential for the protection and enhancement of our national security. Further, we must continually concern ourselves with military developments in all technological areas not only in order to match or offset any Soviet accomplishments but simultaneously to find new ways for augmenting our own strength and versatility. And *space* developments, clearly, lie at the very forefront of modern technological advances.

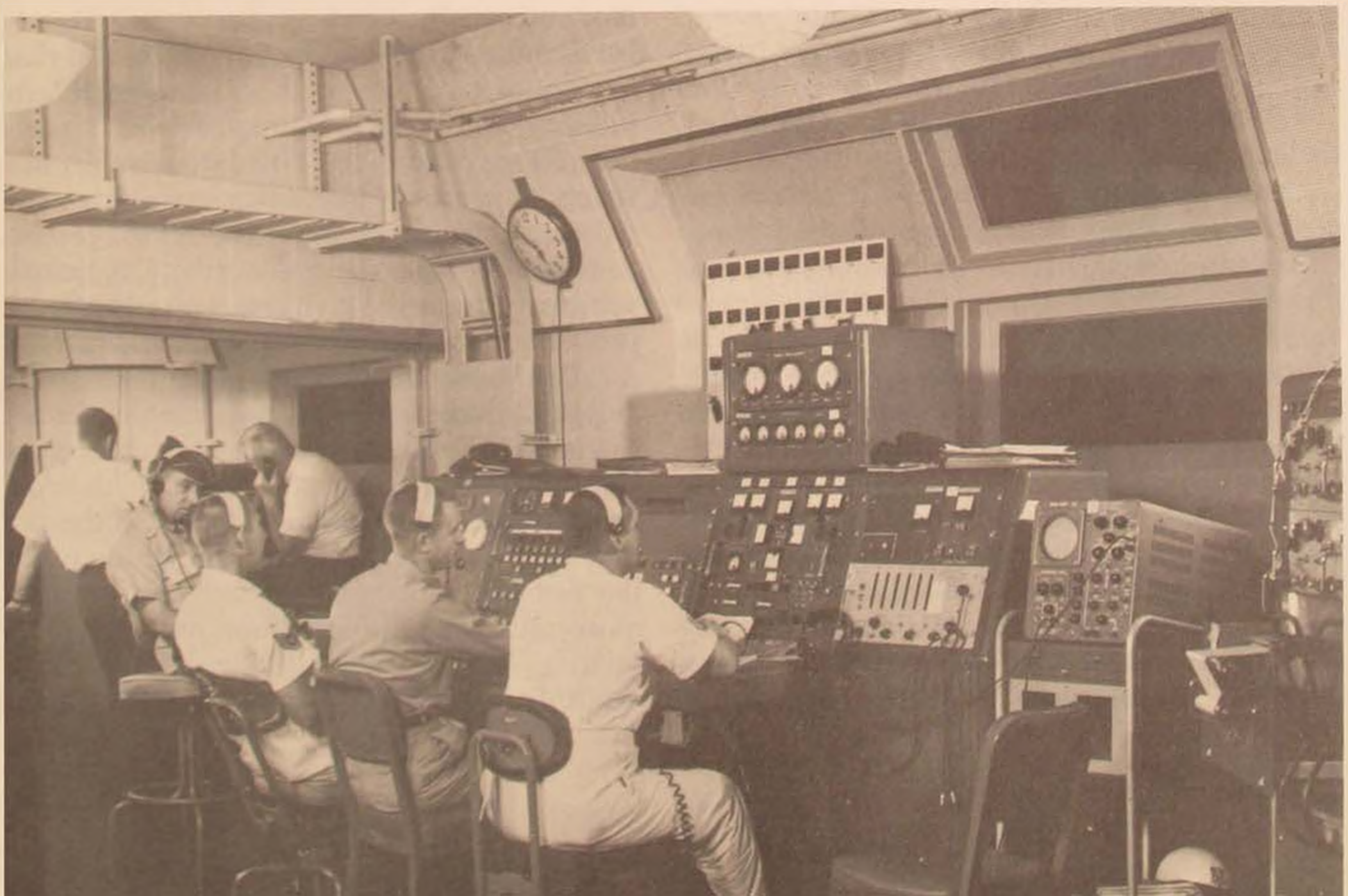
Recognizing the importance of space and mindful of our technological estimates of 15 to 20 years ago, we dare not rule out the possibility that certain discoveries or developments may suggest new applications and capabilities in ways we cannot now wholly perceive or plan. This is all the more clear when we admit that possible military uses of space are among the national purposes that have motivated space efforts, on the part of both the Soviet Union and the United States.

It goes without saying that the nub of our concern lies in the ideological differences, stated in terms of political objectives and confirmed by history, which constitute the breach between the two major world powers and which reveal the polarity of purpose in their respective international goals. In short, there is no reason to assume that long-standing Communist intentions with respect to world affairs will prove to be different in space.

Through their space program, the Soviets appear to be working for a broad technological base on which to conduct future operations. While specific military applications have not been directly evident in Soviet space achievements thus far, their feats have followed a highly methodical and orderly progression, and they have succeeded in timing their most spectacular efforts in a manner calculated to maximize Soviet prestige. It is in the light of these graphic demonstrations of the effects of the Soviet singleness of purpose that we take heed of the counsel offered by President (then Vice President) Lyndon Johnson:

> It is conceivable that an unfriendly power might use space for arms storage, or foı the stationing of an offensive weapon, or for other hostile purposes. If we are to be responsible and prudent, we must anticipate today what the Soviets or others might have or might develop to threaten our freedom. We cannot wishfully or unrealistically assume that no nation will extend its objectives of world domination by means of space weapons.[7]

Air Force technicians in a blockhouse at Cape Kennedy conduct a routine Blue Scout launch. Formerly a job for technicians from science and industry, the launching of space vehicles is now well within the capability of our trained military personnel.



It follows, then, that if we want to safeguard peace and freedom we must continue to possess the capability and the determination to do so. The twin policies of strategic deterrence and military responsiveness through the use of options—policies proved by past experience—now must be extended wherever practical into space. General Schriever, Commander of the Air Force Systems Command, has repeatedly pointed out that there is the same obligation to counter aggression in space as there is on land, on the seas, or within the atmosphere.

The rationale of this contention should be readily understood by all professional military officers. It should be equally apparent that today and in the foreseeable future, with a favorable balance of military power necessary along the entire spectrum of national defense, it is all the more important to provide for protective strength in space, which is the new leading edge of the defense perimeter.

It also follows that, if we are to accurately assess and properly respond to the space-age challenges of both technology and Soviet intentions, then we must do all that is economically and technically possible to increase our funds of knowledge and experience—the best credentials we can possess in qualifying for full-fledged national space dexterity.

Experience as Prime Mover

While it may be trite to say so, it is nevertheless true that there is no substitute for experience. In space as in any other area of endeavor, we cannot make meaningful advances unless we gain experience under realistic conditions.

We need experience at every level and at every point in our time-phased march toward space superiority. We must acquire experience today in areas where technologies and hardware are available to us. We will need experience tomorrow in those areas where technologies may be already in hand but where hardware must yet be fashioned. And we must prepare *now* for the day after tomorrow and the experience that will be needed to prove out those space capabilities sure to emerge from the proper blending of technologies and hardware which are elusive today. This quest for experience is basic to the Air Force's growing professional interest in the Gemini and Apollo programs and in military participation in a national manned orbiting laboratory (MOL).

In our space activities to date there are several excellent examples of the results and benefits to be derived from practical experience. One of these is the Mercury program. Neither the public nor the Air Force community at large is aware, I suspect, of the extent of USAF participation in the Mercury program. The NASA Group Achievement Award presented to the Space Systems Division, which I was privileged to accept from President Kennedy, has perhaps helped to familiarize the Nation with the part which the Air Force did take in the conduct of this significant program mileposting our way to space. Certainly the knowledge and experience gained in the course of the Mercury program, in terms of booster performance, pilot safety, and data on manned space flight, transcend the importance of credit accruing to any agency contributing to a national achievement.

Particularly important, in my opinion, was a statement made by President Kennedy in commenting on one lesson emphasized by Major Gordon Cooper's flight: "Man is still the most extraordinary computer of all." This has been and continues to be a fundamental thesis in our joint activity with NASA to search out, identify, and resolve the problems inherent in mating man to the hostile environment of space. Our efforts in this direction stem from our conviction that over and above the progress in space that can be achieved by unmanned vehicles there exist tremendous potentials for productive manned space ventures.

Through laboratory life-support studies and other bioastronautics projects and through the Mercury program, we have made a promising beginning in the still infant field of man in space. Yet to lengthen effectively the time that man can safely stay in orbit and to extend the distance he can travel there, we must acquire much more information and experience relative to the possible dangers of radiation exposure, the effects of prolonged weightlessness, problems of nutrition, cabin design, and oxygen supply, as well as the weight limitations and psychological factors always to be considered.

A second measure of the results of experience is the decline in the failure rate of our national space efforts. In 1957 we were one-for-one—one launch attempt, one failure. In 1958 we suffered 12 failures and achieved 5 successes. In 1959 we attained 11 successful orbits out of 19 attempts. The record for 1960 was 16 successes, 13 failures. In 1961 we put 29 space packages into orbit and failed on only 12. During 1962 we as a nation were successful in 52 attempts, incurring only 11 failures.

A third yardstick of our growing space prowess is one in which the entire Air Force should take pride. This is the unmatched operational capability that has been developed and implemented for the purpose of conducting effective routine* space test operations, not just in support of a single satellite system but in support of many systems at the same time.

Central to this capability, unparalleled anywhere in the world, is the satellite test annex and control facilities of the 6594th Aerospace Test Wing, a Space Systems Division subordinate organization located at Sunnyvale, California. Built by the Air Force Systems Command together with Lockheed as the prime contractor, the satellite control center represents a vital space-age service, *in-being and working*.

Those of us long familiar with the indispensability of the pilot can appreciate the importance of command and control. In graduating to unmanned satellites, flown to acquire data and experience in our R&D space programs, we have of necessity put the pilot at the console. His functions there become no less important, and they entail a complex, far-flung network of tracking stations and command centers for the remote control of Air Force satellites.

Significantly, from the viewpoint of both experience and future space operations, the 6594th Aerospace Test Wing's satellite control facility had successfully tracked and controlled more than 75 Air Force satellites on orbit during FY 63. Some 100,000 ground-to-space commands had been executed, linking control personnel with satellites which collectively traveled more than 200,000,000 miles on orbit.

Beginning in February 1959, with the launching of the first Air Force satellite, the command and control facilities at Sunnyvale have since expanded capabilities progressively until today they can control several separate programs at any one time.

All of the 6594th's functions—tracking, command, control, and data acquisition—are conducted in real time, utilizing facilities in Alaska and Hawaii, on the East and West Coasts of the U.S., and elsewhere around the world.

This vital capacity for space test operations not only has been a boon to our appetite for practical experience but also has contributed heavily to our passion for knowledge about the space environment and the behavior of satellites there. Along with its own projects the Air Force has conducted space-oriented experiments for the Aeronautical Systems Division, the School of Aerospace Medicine, Cambridge Research Laboratories, National Research Laboratory, Defense Atomic Support Agency, Army Mapping Service, the Applied Physics Laboratory of Johns Hopkins University, the Smithsonian Astrophysics Laboratory, the University of Illinois, and others.

Within the framework of our appraisal of space experience, there is a fourth development that applies directly to the substance of our progress. This development, the drive toward standardization in our space systems, is best illustrated by the evolution and success record of the Agena vehicle.

The Agena is a versatile USAF spacecraft that doubles as a satellite and an upper stage, to date flown in conjunction with Atlas and Thor boosters. It has been used primarily as a satellite carrying various military and scientific R&D payloads into space for test purposes. Since its first launch in 1959 the Agena has been subjected to a rigorous refining process, so that it

*I use the word "routine" advisedly. While space itself can hardly be considered to have become routine any more than certain of the operations we conduct there, the fact remains that our capability is such today that we may correctly term many of the R&D missions we perform as commonplace. Further, "routine" infers practiced competence, a quality we may validly ascribe to the manner in which we carry out space test operations.

has now become a standardized vehicle capable of performing a number of missions. Standardization, of course, is a key factor in improved reliability and greater cost effectiveness—two constant goals of Air Force space research and development.

An index to the level of reliability demonstrated by the Agena is the fact that, as of 15 June 1963, in 40 of the last 42 launches in which the booster performed properly, enabling the satellite to reach separation altitude and velocity, the Agena performed with unqualified success. As a reliability record, this is consistent with the excellent performance of the Thor as a space booster. Recently, for example, we had 24 successful Thor launches—out of 24 attempts. Taken together, the Thor and Agena success records underline the benefits to be derived from standardization of components, from repetitive performance, and from the total proving ground of practical experience.

It is against this kind of background and on this solid foundation of competence that the Air Force today is looking to the space future and to further fulfillment of its two primary responsibilities for support of the national space program and for continued research and development of military space systems. In these missions, experience is both a prerequisite and a consequence.

In the near future we in the Air Force can expect to add substantially to our knowledge and experience in the exercise of various space disciplines. Through the Gemini program, for which the Air Force will provide both the booster and the Agena target vehicle, we will assist NASA in the demonstration of space rendezvous techniques. Other areas of potential mutual advantage in the conduct of the Gemini program are being explored.

Definition of a national manned orbiting laboratory will, we are confident, provide ample opportunity for full military participation in activities involving a semipermanent type of satellite suitable for multiple occupancy.

It is readily apparent that a variety of purely scientific reasons exists for putting a manned laboratory into space. There are equally valid and pressing reasons justifying a militarily oriented space laboratory. If military man is eventually to become functional in space, he must acquire the kind of experience best afforded by an orbiting laboratory. In such a station man can undergo the effects of the genuine space environment, conditions which can never be entirely simulated on the ground. He can test and check out equipment, perhaps determine the limits of human endurance under severe circumstances, evaluate the life-support facilities and services required of future space missions, and gain practice in docking operations and the transfer of men and equipment.

The "Building Blocks"

Thus far in this commentary I have attempted from the military perspective to evaluate the place and significance of technology, Soviet capabilities, and experience as influences affecting our reach into space. There now remains a consideration of the physical and the intangible building blocks on which our future progress largely depends.

Our space-age building blocks are not necessarily hardware items. In fact, in the best sense of the term, they are the foundations for progress which run the gamut of our national resources. In our lexicon a building block is anything that makes a real contribution to the structuring of our space future. But it is in the context of hardware that the building-block principle is best illustrated, and the Air Force Titan III program is a current and good example.

In the course of our discussion we have considered the proof that experience brings to the need to equip ourselves with launch vehicles of adequate capacity and flexibility in view of the military missions pending. We have also proposed that we may reasonably project a need for multiple launch capabilities to meet military requirements for numerous satellites on orbit and for repetitive launches. Further, we have examined the necessity to reduce costs and improve reliability.

By the nature of its design and functional intent, carefully delineated during an exhaustive program-definition phase, the Titan III standardized space launch system will reflect the following characteristics: an almost immediate reaction time, a capability to support frequent and multiple launch requirements, great mission and payload flexibility, a high degree of repeatability, and a high order of maintainability. Payload capabilities for the system will range from 5000 to 25,000 pounds, and mission capability will include low-altitude elliptical orbit by direct injection, low-altitude circular orbit, low-altitude circular orbit with transfer to another orbit, synchronous orbit, and deep space trajectory to escape.

These alternatives are possible because the Titan III is designed as a "workhorse" system that will be available in two configurations. The first is the "core" configuration, consisting essentially of a modified Titan II booster, suitable for payloads of less than 6000 pounds. The second, or "C" configuration, combines the Titan II core with two solid-propellant motors for a total thrust in excess of two million pounds, capable of lofting payloads as large as 25,000 pounds to low earth orbits.

Furthermore the Titan III will be man-rated and in consequence will have a capability to support the manned as well as the unmanned systems now anticipated for the near future. Emphasis in the Titan III development cycle, now well under way, is on engineering competence, but no technical breakthroughs are required.

The significance of Titan III as a building block has been well summarized by Under Secretary of the Air Force Brockway McMillan:

> The essence of any military capability . . . is readiness, responsiveness to command, and adaptability to the changing needs of policy or the fickle fortunes of war. If space vehicles are ever to support military missions in the same sense that air vehicles, ground vehicles, and marine vehicles now do, they must be capable of flexibility during the mission.

Such flexibility, I submit, must originate with the launching system before on-orbit flexibility, as from a maneuvering spacecraft, can ever be obtained. Time may be as critical a factor at launch as it surely will be in space.

Titan III, of course, is not the only building-block space-oriented project in which the Air Force is engaged. The solid-booster development program managed by the Space Systems Division, in which two major contractors are now working, is aimed ultimately at a demonstration firing of a 260-inch-diameter motor capable of six million pounds of thrust. In the process, we will develop a 156-inch segmented demonstration motor that has particular military significance, since it represents the largest-size motor that can be built at existing sites and shipped by rail or truck.

We have noted earlier that building blocks are not all hardware. Progress toward space operations is built also on launch, test, and tracking facilities, the industrial competence, scientific initiative, operational dexterity, and management effectiveness that pervade our national effort.

Perhaps management is not so much a building block as it is the "mortar" that holds the myriad elements of our growing space structure together. Everyone in the Air Force who is attuned to the changing tempo and shifting patterns of military acquisition responsibilities recognizes that the magic word in the commendation or condemnation of systems progress is *management*. It is a word that has been given new meaning, new life, and new force in consonance with the growing consciousness that management is a major factor in the difference between what is good and bad in the definition and evolution of our defense systems. Yet there is no denying that whether viewed as patron saint or whipping boy, management is, as someone has put it, the "cardinal art of getting things done through people." In that light, it has taken on a paramount importance in the structuring of our national defense posture.

Certainly the ever more stringent demands imposed upon the military establishment, in terms of both time compression and quality of product, have served to focus greater responsibility on those in positions of management authority. These are the people depended upon to make decisions, and we live in an era when decisions *must* be made on a timely basis. The Air Force concept of systems management was devised primarily as a means of enabling us

On 21 May 1963, President John F. Kennedy presented the Group Achievement Award to Major General Ben I. Funk, who received it on behalf of the Air Force Systems Command's Space Systems Division for its role in "managing the development and launching of the Atlas booster used in the space flight missions of the United States in Project Mercury." Vice President Lyndon B. Johnson, who read the citation, and many other government and military leaders attended the event held in the White House rose garden.

to make timely decisions with reasonable assurance that those decisions are correct.

In retrospect, it is probably apposite to say that systems management was not so much a conscious effort as a necessary adjunct to the philosophy of concurrency.* In the early Fifties, when the urgent need for a ballistic missile became apparent, a review of the time schedules characterizing existing weapon systems made it obvious that management procedures would have to be overhauled. Development cycles were becoming excessive. The B-47, for example, took 7.75 years in development; the B-52, 9.4 years; the early guided missile systems such as the Navajo and the Snark, 9.5 and 13.7 years respectively, to enumerate just a few of the more successful projects.

To reverse this trend, the sequential development technique was replaced by the concurrency principle. But in order for concurrency to work, three preconditions had to be met. First, authority and responsibility had to be concentrated in a single agency so that firm management control could be exercised. Second, that agency had to reflect great technical competence and demonstrate high management confidence in the technical decisions reached. Third, timely decisions at high levels had to be given on matters that fell beyond the purview of the program managers. These three fundamentals pointed the way to systems management. In turn, systems management has become characterized by precise points of contact, clarity of authority, and clearly delegated responsibility.

It is important to recognize that systems management in the Air Force has not, per se, replaced functional management. Rather, it has given new interpretation and organization to

*For an exposition on the subject, see the article, "Concurrency," by Maj. Gen. O. J. Ritland in *Air University Quarterly Review*, XII, 3 & 4 (Winter and Spring 1960-61), 237-250.

functional levels of responsibility. In other words, systems management becomes the process of bringing together under a common design, with greater centralized control, those functionally similar activities within the military/industrial organization.

To better appreciate the necessity for a systems approach to management, it is well to remember that the Air Force challenge in 1953–54 was not simply to produce a new type of airplane by building on already-familiar disciplines of development and production. Instead, we were embarking on a new approach to weaponry and attempting through a single all-out effort to produce an entirely new system possessing capabilities never before demonstrated. To transform the V-2 type rocket into a true intercontinental ballistic missile was equivalent in magnitude to building a 707 jetliner with the Wright brothers' airplane as the prototype.

Concurrency telescoped lead times considerably. The Thor intermediate-range ballistic missile became operational in 3.3 years from the date of contract signing, and inside of 4 years Thor missiles were operational in Britain. The Atlas reached operational status in 5.2 years, the Titan in 5.8 years, and the Minuteman in 4 years.

As I have implied, systems management can work only when the system program director is given responsibility, as well as commensurate authority, and is provided ready access to all the resources he needs to do the job.

To a large extent systems management, as formulated during the development days of the ballistic missile, is still in effect in the space programs we are conducting. In fact, in a bigger sense, systems management concepts are at the root of the organizational structure of the Air Force Systems Command. Yet we have made changes and variations, compromises and accommodations, in our management outlook and methods. As a manager, I consider modifications productive, for we must be as progressive in our managerial capabilities as we are in the manipulation of technologies, if neither of these is to become a "frozen" asset.

The Air Force is engaged in a vast and challenging enterprise aimed squarely at developing and maintaining this nation's pre-eminence in the broad and diverse aspects of space applications. As I stated at the outset, I believe that space will prove to be a dynamic and revolutionary element of national power.

But in working toward the realization of that prophecy, we recognize that we must take care to ensure that space is used *for* us, not against us. And this will depend in large part on how ably we manage and how wisely we use our resources, how efficiently and productively we acquire and apply experience, and how nobly we implement the fruits of our learning to the betterment of human welfare.

Most important, we in the Air Force must do our utmost to keep space an "open end" adventure. For if we do not succeed in our efforts in fulfillment of our ideals and our national obligations, another nation may "close the loop," and then not only may we find ourselves second in space but—perhaps—we may find one day that we are not first on earth.

This is the substance of our real concern, the essence of our military appraisal of the spectrum of space.

Space Systems Division, AFSC

Notes

1. Address before the American Ordnance Association, Washington, D.C., 9 May 1963.
2. From an article in *Combat Crew*, official SAC magazine, June 1963, p. 4.
3. Kavanau, address before the Space Seminar of the U.S. Information Agency, Washington, D.C., 17 April 1963.
4. Address before the U.S. National Committee of the International Scientific Radio Union, Washington, D.C., 29 April 1963.
5. Kavanau, *op. cit.*
6. As quoted in the *Air Force Information Policy Letter*, 1 June 1963, p. 3.
7. Speech at Dallas, Texas, 24 April 1963.

LIMITED-WAR RESEARCH NEEDS IN LOWER-LEVEL CRISIS MANAGEMENT

The Practitioner's Viewpoint

Colonel Robert A. Shane

RECENT trips to various combat commands and discussions with key staff officers assisting in the decision-making process reveal an urgent need for some serious thinking as to the research required to support a more effective crisis management process for a lower-level, limited war. This paper accents the "command" portion of "command and control," and research suggestions are pointed toward "soft-ware" background aspects of a command center as opposed to electronic gadgetry requirements. Limited war only is considered, although admittedly there is a strong interaction with general-war situations. Crisis management for situations such as the United States periodically encounters (e.g., Lebanon, Berlin, Taiwan, Laos, Viet Nam) are divided here into two phases: initial and follow-on. The initial phase commonly finds a high-level echelon managing the crisis and providing general guidance to the lower echelons. The follow-on phase, including the down-to-earth implementing events, seems to fall upon the shoulders of lower-level echelons of command. An examination of past crises points up the fact that the lower-echelon management of a crisis has a much greater bearing on the ultimate outcome than is normally credited.

With the advent of data processing, computer systems, and ingenious management techniques, many of us have perhaps somewhat forgotton the feel of how a lower-level combat commander and his staff really manage a crisis situation in a limited-war category. This paper is devoted to bringing to light areas of research which, if exploited, could greatly assist commanders in managing such situations more effectively. Let us definitize what might be considered a typical "lower level," since research suggestions will be centered about this level of crisis management.

From participation in recent conferences on both limited war and the decision-making aspects of command and control and information systems, it is apparent to me that great emphasis is being placed on the higher decision-making levels of crisis management, and rightfully so. For purposes of clarification, in this particular paper the dividing line between higher and lower levels of crisis management is considered to be the numbered Army (Eighth), numbered Air Force (Fifth), numbered Fleet (Seventh)—all key tactical implementing echelons. It is recognized that within each echelon of command there are higher and lower levels as well. However, no major effort will be made to differentiate between levels within a generalized lower echelon of command. Perhaps some will believe the dividing line to be at too high or too low a level. Suffice it to say that it is representative as a basis for considering the research needs outlined below. Except for data systems, communications-oriented expertise, and some research efforts by human-factors personnel, there seems to be little in the way of a full-scale research program to define, analyze, and aim at solving limited-war, lower-level, real-life problem areas in crisis management. Such a program is urgently required at an early date. While admittedly "strategic" crisis management in the initial phases of a situation may be receiving top attention at the higher levels, a need exists for research effort related to the perhaps equally important tactical management decision points, over and above those accomplished by human-resources analysis of ultra-low-level units such as an individual aircrew or similar Army and Navy units. Therefore all references in this paper will be made in the context of a lower-level crisis management environment, including headquarters in a range extending from a "numbered Air Force" high to a "wing" level low.

Research Areas Related to Crisis Management

The following research areas are not discussed in any particular order of priority. Rather they reflect those areas which spontaneously came to mind in kaleidoscope fashion while reviewing various limited-war experiences of the past and anticipated events of the future. Ten basic areas are identified. The suggestion of such an all-encompassing research program is not meant to imply that military commands and staffs as now constituted are inefficient. On the contrary, the writer takes an intense pride in having served in both command and staff capacities in two of the services at "lower-level" echelons. However, human frailty, organizational circumstances, and generally difficult situational environments create a call for help to which only qualified researchers can respond.

As a prelude to the more detailed explanation of these ten basic research areas, a series of characteristics has been identified as generally applicable to a composite of lower-level personnel engaged in crisis management in an environment oriented to limited war. (This particular subject in and of itself might be a likely candidate for research.) Some of these characteristics, interestingly enough, can easily change for any single individual transferring from lower to higher-level assignments, much in the fashion of a chameleon.

Drive to act rapidly
Impulsiveness
Intense feeling for combat personnel
Impatience
General aggressiveness
Initial coolness to civilian participation
Great attention to details
Willingness to work to break point
Reluctance to accept help from outside
High *esprit*
Acceptance of leadership other than formal structure

multiple objectives

Being human, commanders and staffs at the lower level have multiple objectives. Quite often these goals are in conflict with one another and in fact can be quite incompatible. They can delay and/or reduce effective crisis management. Unfortunately, several of the less dominant goals are of a subconscious nature, and superficially the individual involved may profess following only the expected or stated goals of the group to which he is assigned. But in fact one of his hidden objectives may be the more dominant of his goal spectrum and thus may continually affect his decisions and recommendations for decision, and quite innocently.

To illustrate within one service, personnel may unconsciously bias decisions in favor of airborne operations, in which they are more qualified and have greater faith, as opposed to armored and mechanized ground operations, which from a cold-blooded analytical viewpoint may be more favorable to the situation. As between services or on a United States forces overall basis, but at the task force planning level, similar multiple objectives can be found wherein the objectives related to the overall task force are successfully or unsuccessfully tempered by the objectives an individual has been conditioned to accept somewhat automatically in his own service, e.g., use of carrier aircraft versus tactical mobile strike forces, or, more subtly, the mix of such forces in limited war. Finally, where alliances and other than United States personnel are involved, national objectives often conflict with alliance military operations even at the lower level. Personnel so engaged must exercise considerable thought discipline to maintain an even keel between the various objectives they are to follow if they are effectively to serve both their own nation and the alliance as a whole.

future planner vs. current operator

This is an interesting area which finds two types of individuals who on the surface seem oriented somewhat differently but who trade jobs on numerous occasions. Today's future planner is tomorrow's wing commander, and vice versa. The study of the interface between the two groups is important, since the operations man eventually participates in the executing decision, hopefully utilizing the planner's pre-established situational framework. Limited reading of plans by the current operator in precrisis periods somewhat nullifies the potential value of plans when a crisis arises. This is sometimes caused by the high security classification of plans and the full-time employment of operations people on precrisis "fire fighting." There is also a delicate shading of detail versus flexibility in the plans themselves. In one case too much detail confines the utilization of the plan to situations which may not exist in the actual crisis. In another case, plans are so loosely written that the operations man feels that little or no guidance has been provided. A conservative estimate would be that advance plans are followed to an extent ranging between 50 and 70 per cent when applied to actual crises. Seventy per cent would be a high goal. The importance of research lies in the transition from the planning phase to the operations phase of an actual crisis. Being a more deliberate thinker, the planner is quite often slow to respond to an operational situation; the current operator responds too quickly at times, as the emergency arises. A conflict thus arises at the decision point. Efforts wherein the planners have continued into the operations phase rather than moving ahead to plan the next stages of the situation have more often than not "come a cropper."

definition of organization and responsibility

This particular subject is closely related to the "command" portion of "command and control." During the precrisis period, permanent military units may have jurisdiction over certain missions and geographical areas. The situation of a task force operating in the area of a permanent unit during a crisis must be organizationally clarified in advance of such operations and quite clearly defined. Differences in rank between various command echelons must be considered in planning the crisis management environment prior to the crisis. Theoretically, the responsible unit has authority, but it is realistically quite difficult for a colonel with designated authority to manage a major general not having such authority. Situations could arise, if not preplanned, in which multiple, rather than integrated, decision centers were established on an ad hoc basis. Precrisis organization sometimes creates such situations. Thus an overseas air base group may be geographically responsible for its base, for support of all tenants, and for new deployments at its location, while the combat echelon of the wing to which it is assigned is in actuality deployed to other bases, receiving support from other air base groups, foreign elements, and/or provisional support units. The overall situation of the wing to which both types of units belong calls for the closest scrutiny from an organizational, cross-telling aspect. Therefore organizational structuring becomes a vital feature and should be more definitively researched for various potential limited-war crises.

peacetime vs. wartime modes

The units participating in limited-war crisis management basically have two modes of operation: one in peacetime to get ready for war operations and one in wartime to execute such operations. At first blush one might presume that there is little difference between the two modes except for the live action of the wartime situation. This is unfortunately not true. Peacetime-conditioned staffs are often pressed into service to augment wartime staffs which have been manned on a peacetime basis. Peacetime readiness crisis management is a much more common occurrence than a crisis involving the employment of forces in war. Exercises help bridge the gap, but there is a conflict between the two. Certain supplies and equipments are highly restricted to war. Jobs change for many personnel when peacetime conditions change to war. Manning tables are made generally on a peacetime activity basis or at best are filled on that basis. Flying hours and other training requirements are high in peace and reduced in war. Thus an interceptor force is likely to fly a great deal more in peace to be ready for war and to hold more on alert in war, utilizing available flying for combat sorties rather than training. The transition from peace to war conditions in limited-war situations often involves a critical limbo period of stepped-up alert, based on advance warning of an impending crisis. This period becomes the scene of a tremendous upsurge in administrative traffic, external advice, and a hybrid peace/war situation as far as crisis management is concerned. For example, in such limbo periods it is not unusual to find that a basically peacetime-readiness oriented staff officer such as the director of supply in a tactical air force is holding down an augmentation position as logistics officer in an operations center. This situation is caused by the center's being short of its personnel complement required to operate properly on a full-scale basis, 24 hours a day, for extended periods in overseas tactical areas.

1964 vs. 1974

Decision-making lower-level operating staffs continually point out the need for a generous share of research on close-in problems as well as on those academic solutions to many undefinitized problems which might possibly occur ten years hence. Current problems tend to be dull and tedious to solve. They require early, concrete recommendations, and if the recommendations are wrong, the error soon becomes apparent. Research for far-out periods is perhaps intellectually more interesting, and since partial solutions can be legitimately rendered via the excuse of the time period involved, the analyst can more easily consider his work as correct until proved right or wrong some day in the future.

There must be some equitable and necessary share of research for 1964 as opposed to 1974. What the proportion of short-term to long-term research should be appears uncertain. This is a subject in itself which researchers might profitably examine.

lower-level understanding of external political/sociological factors

How much should lower levels be familiar with political/sociological factors external to their group? Such levels are basically combat-oriented, and it is questionable just how much knowledge is required for effective crisis management in the area of the externally related social sciences. The transfer of strategic and limiting factors related to this area from higher to lower levels could doubtless be improved. The general run of lower-level personnel in the United States are usually not as familiar as they might be with the politics and sociology of both enemy and friendly forces and peoples occupying the limited-war areas with which they may be concerned. They are relatively less well informed than similar lower levels in parallel commands of allied forces. Such factors can be extremely important, as in the case of joint rules of engagement developed with a host nation, where a crisis will be jointly managed in accordance with those rules. Sub-optimization of certain combat decisions might be avoided by early consideration of external political/sociological impact. How far to go in this regard at the lower level seems a subject worthy of some research.

communications gap

People in various trades or various phases of a trade tend to develop a special language over a period of time in communicating the peculiarities of their trade. In the military, lower levels have not only differing semantics but differing interpretations of the same data in comparison with higher levels. Differences between services at the same level are also quite frequent, as when an Air Force man interprets a Navy message. It seems pretty certain that the lower level will not learn the higher level's language. Furthermore the lower level will probably not learn the language of the researching psychologist. At best, the planners and operators will eventually learn each other's language by constant interchange of assignments, but only over a period of years. In a particular study that I monitored calls were received on the same day from three fighter units and three consulting psychologists, all complaining of an inability to communicate with the other group. I acted as "interpreter," but interpreters are not always available. From the aspect of crisis management, the various languages of information system specialists, communicators, command/control analysts, decision theorists, and higher-level professional staff writers must be translated to the understanding of the lower level. Failure to do so will broaden the communications gap and jeopardize the management phase of limited war at the point where operations are made successful or headed for failure.

turnover of lower-level personnel

Personnel turnover rates generally appear higher as one approaches the lower echelons of command. There is a basic horizontal movement of personnel due to the larger number of units in a state of flux at the base of the organizational pyramid. Lower levels involved in limited war are often in overseas areas, some with short-tour billets, without dependents. This situation requires rapid training in crisis peculiarities and frequent repetition. Personnel rotations leave a gap for varying periods while replacements are being obtained. This calls for development in depth of a crisis management capability. A smaller number of qualified staff personnel experienced in crisis management and extremely familiar with limited-war concepts is available at the lower levels than at the higher levels. A lesser number of permanently assigned civilian analysts is available at the lower levels, and the turnover of these analysts is higher than at the upper levels. Requirements for crisis management must be geared to these turnover rate factors. Either requirements must be lowered and rates improved, or new solutions must be derived from research programs on the subject.

stress at lower levels

The stress at lower levels is closely related to the characteristics of lower-level command and staff personnel listed earlier. The direct control over lives and expensive equipment is felt keenly by people in this environment. The immediacy of results and the frequent proximity to the actual limited-war scene provide a constant source of urgency. The details of lower-level situations force the personnel to work extremely long hours. Pressure is received from top and bottom. Combat units require continual positive instruction. Higher levels continually provide absentee advice and suggestions, require stepped-up frequency in reporting, and want extensive detail. Briefings of outsiders seem endless and sometimes appear concentrated at this level. Add to all this the fact that many of the personnel involved are far from their families, amidst poor living conditions, with little chance to relax during long periods of stepped-up alert, and the ingredients of stress are all at hand.

case history data bank

It would seem that great value could be obtained from the development of a case book recording useful highlights of past limited-war crisis management situations and related actions, especially at the lower levels. Much material has been analyzed in this fashion at top echelons, but a data bank in the form of lower-level case histories dating back as far as is practical does not seem to exist. It is envisioned that such a bank would include an analysis of the situation, a chronology of events, a summary of lessons learned, related recommendations for the future, and a section on personal interviews with participants. Command historians have many of the scattered facts, and operations analysts have documented segments, depending upon their individual interests and assigned responsibilities. After participating in the documentation of a partial case history of the Taiwan situation, I am firmly convinced that such an effort on a broader scale would be quite rewarding.

Grandstand Advance Quarterbacking

The lower-level crisis management area requires the advice and skill of research personnel who are prepared to move forward beyond the realm of armchair strategy often prevalent at more nebulous higher levels (especially in centrally controlled general-war situations). The reams of theoretical paper available on the strategy of crisis management bring to mind the scholarly nonplaying student of above-average intelligence who critiques his college's football squad in advance of the approaching game (as well as after it) but has little understanding of the practical, key details of actually playing the game and solving on-the-spot crises during its course.

Undoubtedly a mature senior student with a decent, well-rounded background in the social sciences and with a flair for analysis could produce a fairly credible paper of the "armchair-strategy" variety if required to submit a term thesis on the subject of "Limited-War Crisis Management at the National Policy Level." But in implementing the tactical execution and control phase of an actual limited-war situation where success or failure depends on effective, down-to-earth crisis management in the field, it is very doubtful that our young scholar or even some of our more learned strategists can cope with situations calling for "trade" experience. It is in this area that research rather than expert opinion is required and required soon.

Briefly to conclude, let me make a plea for a modest but increased research effort to assist the lower levels of limited-war crisis management. This effort should be increased both in quantity and in tempo. The subject is not a glamorous one, and it is hoped that this paper in its own small way may create some new interest in the minds of the many researchers now actively engaged in other phases of limited-war analysis.

Burbank, California

ORIGIN OF THE LACONIA ORDER

DR. MAURER MAURER AND
LAWRENCE J. PASZEK

IN THE war crime trials at Nuremberg following World War II, Admiral Karl Doenitz had to defend the so-called "Laconia Order" in which he had prohibited German submarines from aiding or rescuing survivors from the ships they sank. The order was being used by the prosecution to help support a charge that Doenitz had violated the rules of warfare. In his defense, the former commander of the U-boat fleet said that the order was the direct result of an incident which had occurred in the South Atlantic on 16 September 1942. He explained that, "in spite of flying a large Red Cross flag," one of his U-boats was bombed while engaged in rescuing survivors from a torpedoed British ship, the *Laconia*.[1]

The story of the sinking of the *Laconia* by *U-156*, Lieutenant Commander Werner Hartenstein commanding, is well known from various published works, including Doenitz' *Memoirs*, as well as from the proceedings of the International Military Tribunal at Nuremberg.[2] With three other U-boats and a submarine tanker, *U-156* had sailed from France in August for operations off Cape Town, South Africa. On Saturday evening, 12 September, when *U-156* was approximately 900 miles south of Freetown and 250 miles northeast of Ascension Island, Hartenstein sighted and sank the White Star liner *Laconia*, which the British Admiralty was using as a transport. Before she went down, the liner sent two radio signals, one at 2022 hours on the 600-meter international wave length and the other six minutes later on the 25-meter band, reporting that she had been torpedoed at 04° 34′ South latitude, 11° 25′ West longitude.[3]

Hearing shouts in Italian, Hartenstein picked up some of the people from the *Laconia* and learned that the British ship had been carrying 1800 Italian prisoners of war. Later, in interrogating the *Laconia's* navigation officer, the Germans learned that in addition to the Italians and a crew of 463 the liner was carrying 268 British service personnel, 80 women and children, and 160 Poles who had been guarding the Italians. According to the navigator, two torpedoes from *U-156* had hit compartments occupied by the Italians, and many of the prisoners had gone down with the ship.[4] Discovering his allies among the survivors, Hartenstein immediately began rescue operations and reported the situation to his superiors. Doenitz ordered the submarines to take aboard

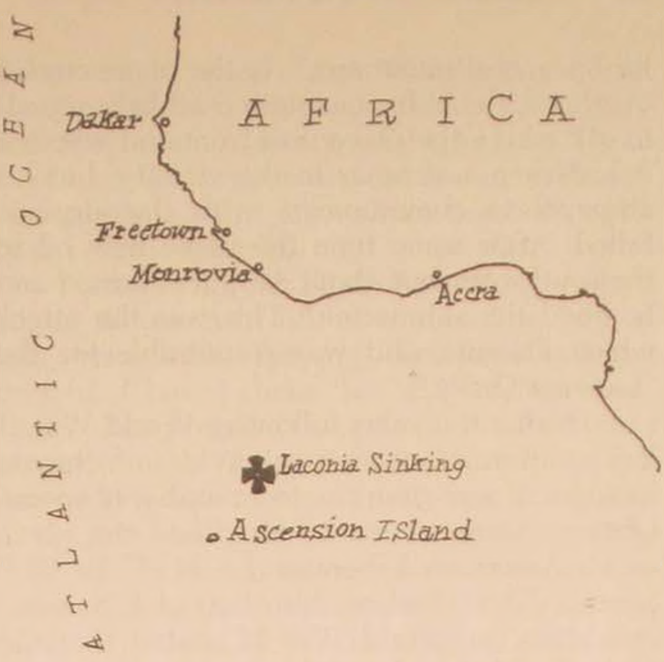
The authors are grateful for the assistance provided by Brig. Gen. Robert C. Richardson III, Col. James A. Ronin, and Col. Willard W. Wilson, of the USAF; Lt. Comdr. John R. Hoover, Assistant U.S. Naval Attaché in London; Dr. E. Taylor Parks of the Historical Office, Department of State; Mr. Sherrod East and other personnel of the National Archives and Records Service in Washington, St. Louis, and Kansas City; and Capt. S. W. Roskill, historian of the Royal Navy.

as many survivors as possible without interfering with the ability of the U-boats to submerge, for the safety of the submarines was not to be endangered in order to carry out rescue operations.[5]

Later that night Hartenstein informed Doenitz that *U-156* had picked up 193 persons, including 21 British, and that there were hundreds of others in the water. In this radio message the U-boat captain suggested diplomatic neutralization of the area. A little later, at 0400, he announced, by means of radio messages sent in English on the 25- and 600-meter bands, that if he were not attacked he would not interfere with any ship coming to the aid of the survivors. Meantime Doenitz had ordered two other submarines, *U-506* and *U-507*, to proceed to the area and help with the rescue work. He also requested the assistance of an Italian submarine, the *Cappellini*, and asked the Vichy French to send warships from Dakar to meet the submarines and take on the survivors.[6]

During Sunday the 13th, *U-156* was busy fishing people out of the water and placing them in lifeboats. On the 14th, after learning that the French were sending ships, Doenitz ordered the submarines detailed for the Cape Town operations to go on, but *U-156* was to remain. On Tuesday the 15th, *U-506* and *U-507* joined *U-156* in the rescue work, and on the following day the *Cappellini* arrived in the area.[7]

Hartenstein had received a report of an unidentified steamer in the vicinity, and he apparently expected it to respond to his message offering immunity from attack to ships that would help rescue the survivors. He also had been informed that there were no airplanes on the British island of Ascension but that the Allies had planes at Freetown.[8] Thus far, however, the submarines had carried out their rescue operations without assistance or interference from the Allies.



The Laconia *was sunk on 12 September 1942, approximately 250 miles northeast of Ascension Island and 900 miles south of Freetown.*

On the morning of Wednesday the 16th, the U-boats were collecting and bringing together lifeboats and rafts in preparation for the rendezvous with the French ships the next day. *U-156* had aboard 110 survivors—55 Italians and 55 British, including 5 women. Some of the survivors were below, but many were on deck, and others were in lifeboats which *U-156* had in tow. At 0925, as he was preparing to pick up another lifeboat, Hartenstein saw a four-engine aircraft with American markings approaching him. He immediately covered the forward gun of *U-156* with a large Red Cross flag to indicate the nature of his mission and

The *Laconia* affair has long been of interest to students of naval history and international law, but the details concerning one important facet of the story were lost for many years among the voluminous records of U.S. air operations in World War II. In fact it was not until 1959 that USAF historians began a systematic search for information that would dispel the mystery of the American bombing plane that had been involved in the incident. This search, which indirectly resulted from the publication of Admiral Doenitz' *Memoirs* extended over four years before the historians were able to locate and obtain all the information required for this fully documented report on the U.S. Air Force role in the *Laconia* affair.

his "peaceful intentions." As the plane circled overhead, the U-boat captain used light signals to ask where the plane was from and whether it had seen a steamer in the vicinity, but his attempts to communicate with the airplane failed. After some time the plane flew off to the southwest, but about 1030 it returned and bombed the submarine.[9] This was the attack which Doenitz said was responsible for the "Laconia Order."

During the years following World War II lack of information concerning this unfortunate incident of war gave rise to a number of speculations. Hartenstein had identified the plane as an American Liberator (B-24).[10] In 1956 Samuel Eliot Morison, historian of U.S. naval operations in World War II, stated that the plane had come from the American base on Ascension Island, but in 1959 the U.S. Navy was attempting to identify the plane as one operating from Freetown.[11] A number of naval authors—American, French, British, and German—sought to clarify the incident, but details of the attack by the B-24 on *U-156* remained shrouded in mystery.[12] On 4 August 1963, however, the London *Express* quoted Brigadier General Robert C. Richardson III of the U.S. Air Force as saying that he had commanded the squadron on Ascension where the B-24 was based temporarily on 16 September 1942 and that he had ordered the attack. Unfortunately the reporter who interviewed the General played up the sensational side of the story rather than the conditions under which the attack was made.[13]

Richardson, then a captain, arrived on Ascension in August 1942, when the U.S. Army Air Forces opened an air base on the British island. Construction of the base had been proposed late in 1941 by the AAF's Ferrying (later Air Transport) Command to provide a refueling stop for military aircraft flying the southern ferry route from the United States to Brazil and then across the South Atlantic and Africa to the Middle East. After the United States entered the war in December 1941, the proposal was quickly approved, the plans were drawn, and permission to use the base was obtained from the British. At the end of March 1942 two Army transports, escorted by two cruisers and four destroyers, arrived at Ascension with men, equipment, and materials for construction. Work began on 13 April, and on 14 August the permanent garrison arrived to take over the operation of the base.[14]

The planning, construction, and operation of the base were veiled in secrecy, but the Army feared that such activity could not be hidden forever from the enemy. Dependence upon shipping to bring in equipment, supplies, fuel, food, and all the other necessary items made the base vulnerable, for German submarines and surface raiders were active in the South Atlantic and Vichy France had a number of warships at Dakar under the control of officers who were reported to be pro-German. The enemy could put the American base out of commission by sinking tankers and supply ships. Or enemy submarines or surface vessels might shell gasoline storage tanks and other vital installations, such as the plants required to convert seawater into drinking water for the troops. Furthermore the Army was aware that neither Britain nor the United States could spare naval ships to provide a constant guard over the sea-lanes and prevent the enemy from shelling the island. There also was a possibility that the Germans, with the collaboration of Vichy France, might send planes from African bases to bomb Ascension. Or they might land troops to sabotage military facilities or even try to capture the island.[15]

Fearing then that the enemy would discover the activity on Ascension and attack the island, the U.S. Army made elaborate plans for defense of the base. The construction job was assigned to combat engineers who not only were equipped to build an air base but were armed to protect themselves and their site. For added security, the Army sent along an antiaircraft battery, which went into action for the first time on 15 July, a few days after the runway was ready for emergency landings. With orders to fire on any unannounced airplane that came within range, the battery opened up on a small biplane that flew over the field. The gunners scored three hits as the engineers quickly placed machinery and vehicles on the runway to prevent a landing. Then the plane was identified as friendly, the obstructions were removed, and a Swordfish from H.M.S. *Archer* landed. The pilot had been sent to drop a message at the British cable station on Ascension, but when he saw the runway he decided to land. The plane had three shell holes in its skin, but the pilot, who had not been injured, was able to take off two hours later to return to his ship.[16]

Work progressed rapidly, and without interference from the enemy, as the engineers constructed roads, barracks, a hospital, water and electrical plants, gasoline storage tanks, gun emplacements, ammunition dumps, radar sites, and radio towers. In the interest of security, great care was taken in camouflaging the various installations.[17]

While the engineers worked, the units for the permanent garrison were being formed at various camps and bases in the United States. These units sailed from Charleston, South Carolina, aboard the *James Parker* on 26 July and arrived at Ascension on 14 August. Three days later Richardson arrived from the United States with a flight of medium bombers to be based on the island.[18]

Planes flying the South Atlantic route had begun to use Ascension for refueling late in July, before the Ferrying Command had any personnel based there, but a Ferrying Command detachment of 2 officers and 22 men arrived on the *James Parker*. To support and defend this detachment and its operations, the Army provided a task force of approximately 1700 officers and men under the command of Colonel Ross O. Baldwin, an Infantry officer. About one third of the members of this force were assigned to AAF Composite Force 8012, commanded by an Air Force colonel, James A.

Mid-ocean airdrome, with landing strip blasted through the sides of Ascension's volcanic cones

The parking ramp at Wideawake Field welcomed all types. Here, from left to right, the C-47, B-26, B-17, B-26 and B-25 undergoing work on vertical stabilizers, and C-54. In the background a B-24 takes on fuel.

Ronin. The largest AAF unit was the 1st Composite Squadron, commanded by Captain Robert C. Richardson III. This squadron, made up of 30 officers and 219 men, had two flights of pursuit planes (18 P-39D's) and the flight of medium bombers (5 B-25C's). Ronin's force also included a signal warning detachment to operate two radar sets, as well as personnel for air base, weather, and communications functions.

The largest unit of the task force was the 3d Battalion (less two rifle companies) of the 91st Infantry Regiment. The ground forces also included two artillery batteries, a searchlight platoon, and personnel for medical, quartermaster, and ordnance activities. In addition to rifles and side arms, the ground forces had 200 submachine guns, 28 .30-cal. machine guns, 12 .50-cal. machine guns, 4 37-mm antitank guns, 4 81-mm mortars, 4 155-mm guns, and the 4 37-mm antiaircraft guns that had been sent in with the engineers, plus 2 5.5-inch naval guns which the American task force took over from the British detachment on the island. The U.S. Navy did not send patrol planes until much later, but 29 Navy men were attached to the Army task force to operate small craft for rescue work and for patrolling the harbor.[19]

Baldwin's intelligence officer, Major Walter C. Buethe, believed that by mid-September the enemy was aware of the presence of U.S. Army forces on Ascension. In his opinion a bombing attack was not likely because of the distance from enemy air bases, and shelling by surface raiders was not probable after the 155-mm guns and radar were in operation. The greatest threat, he believed, was from enemy submarines, which might shell the island or land small parties of men to sabotage gasoline storage facilities or other vital installations. Richardson agreed in general with this estimate. He was not concerned about enemy aircraft, but he thought that the enemy might try to destroy the gasoline tanks, which were very vulnerable to attack from the sea. The main function of Richardson's squadron therefore was to patrol the sea around the island, to detect and destroy any enemy submarines and surface raiders in the area, and to protect Allied ships in the vicinity of the island. Although the squadron had been supplied with bombs and depth charges for antisubmarine warfare, it had no special training or equipment for such operations.[20]

By 20 August 1942 the 1st Composite Squadron was ready for operations. Patrols were scheduled daily, and some aircraft were kept constantly on alert at the base, which had been named Wideawake Field for wideawakes (sooty terns) that claimed the island in great numbers. In a readiness test conducted on 27 August, a P-39 on alert was able to take off in less than three minutes, and a B-25 got away in ten.[21]

During the first three weeks of operations, through Saturday, 12 September, the day the *Laconia* was torpedoed, the 1st Composite Squadron flew 64 sorties within a radius of 250 miles of the island without sighting a single target. On 3 September, however, the men of "A" Battery at Southwest Bay, thinking they heard the engines of a U-boat and saw a craft submerging just off shore, had fired at it. Fortunately, the gunners either were poor shots or were too excited to aim accurately, for the target turned out to be a P-39 which they had not seen land on the water. Returning from a routine patrol, Lieutenant Ben Herbert Smith had ditched his plane when the fuel system failed. The P-39 sank almost immediately, but Smith, who was not injured, got out and floated in his Mae West until he was picked up a crash boat.[22]

Search and patrol missions from Ascension were entirely under the direction of Air Force personnel, for Baldwin, the task force commander, was not consulted on matters relating to air operations. Whenever the 1st Composite Squadron had planes out, at least one of the key Air Force officers—Ronin, Richardson, or Captain Willard W. Wilson, Ronin's operations officer—was always readily available at the base. Through the control tower, he could communicate by radio with pilots on search and patrol missions. The Army's radio station on Ascension, WYUC, also received some reports of submarine sightings from Allied ships in the South Atlantic. All the radio equipment had not yet been installed, and WYUC was not in communication with either South America or Africa. The American task force, however, used the British cable for communication with South America and the United States and used the British radio on Ascension, ZBI, for communication with Freetown, where the Royal Navy collected and correlated data on submarine sightings and directed movements of Allied ships in the South Atlantic. A British liaison officer attached to the U.S. task force passed on to the Americans submarine sightings and other intelligence data he received by radio from Freetown.[23]

Neither WYUC nor ZBI picked up the *Laconia's* signals on Saturday 12 September or Hartenstein's messages on the following morning, when he asked ships to come to the rescue of the survivors. In fact it appears that no British station or ship read the *Laconia's* signals. Freetown, however, evidently received the message that Hartenstein sent in English, but the British were suspicious that the Germans might be setting a trap for unwary merchant ships. At any rate, the Americans on Ascension did not learn of the sinking of the British liner until Tuesday the 15th.[24]

The 15th was a busy day at Wideawake Field. At 0700 four A-20's and a Stratoliner, the latter carrying a British admiral and his party, took off for Accra. En route one of the A-20's sighted two submarines at 04° 40′ South, 11° West. While circling for a better look, the A-20 was fired on, but not hit, by the boats. The Stratoliner, which was in the vicinity but was flying higher, above the clouds, picked up the A-20's radio report of the incident and relayed it to WYUC. Within ten minutes after receiving the message, the 1st Composite Squadron had two B-25's on the way to the area.

Two hours later, at 1210, the British liaison officer gave the Americans a message which either was garbled or indicated that Freetown's information was faulty, for the message said that the *Laconia* had been torpedoed only a few minutes earlier, at 1145 on the 15th, at 05° 05′ South, 11° 30′ West, a considerable distance from the spot reported by the British liner. The message indicated that the *Laconia* had carried 700 passengers, but there was no mention of German submarines being engaged in rescue operations or of Hartenstein's call for Allied ships to assist with the rescue work.

Neither the B-25's dispatched to the scene of the attack on the A-20 nor the other planes which flew search missions that day had any luck in spotting the enemy. That night, in a message delivered at 2200 to the Americans on Ascension, the British asked the 1st Composite Squadron to assist with rescue efforts being

The operations building was on a hill overlooking the runway. Sandbags took account of the possibility of U-boat shellfire.

Flight-weary aircrews bedded down in camouflaged tents pitched on the cinder desert against the volcanic hills.

directed from Freetown. There were few Allied ships in that part of the South Atlantic because warships and merchantmen were being assembled for the invasion of North Africa and because shipping had been routed farther west to avoid the greater submarine menace along the African coast. A merchant ship, the *Empire Haven*, was nearby, however, and H.M.S. *Corinthian* was at Takoradi. They were being sent to aid the survivors from the *Laconia*, and Freetown wanted Richardson's squadron to provide air cover for the operation.[25]

The spot where the *Laconia* had gone down was so far from Ascension that a B-25 from Wideawake would be able to remain in the area for less than half an hour. A plane with longer range was needed, and as it happened there was one at Wideawake on the night of 15 September. It was a B-24D Liberator of the 343d Bombardment Squadron, which recently had moved across the South Atlantic en route to the Middle East for service in the battle against Rommel's Afrika Korps. On the way over this four-engine bomber had been separated from other planes of the squadron when it was delayed by mechanical trouble. Now it was at Wideawake, and it was pressed into service.[26]

Loaded with depth charges and bombs, the B-24 took off at 0700 on Wednesday, 16 September, and headed northeast. The pilot was Lieutenant James D. Harden, and his crew included Lieutenant Edgar W. Keller, bombardier, and Lieutenant Jerome Perlman, navigator. These men, all of whom were flying their first combat mission, were members of the 343d Squadron, but the copilot, Lieutenant Raymond J. Ford, belonged to Richardson's 1st Composite Squadron.[27]

At 0930 Harden spotted a submarine—*U-156*—towing two lifeboats and approaching two more at 05° South, 11° 40′ West. While the B-24 circled overhead, its crew saw the U-boat pick up the other two lifeboats and continue on its course. They also saw that the submarine had a white flag with a red cross. Using a signal lamp, the crew challenged the U-boat to show its national flag, but none was displayed. The submarine, however, blinked light signals which could not be read clearly but which were thought to be "German Sir." After 40 minutes, Harden gave up the effort to communicate and headed southward.[28]

The radio operator on the B-24 soon established contact with WYUC at Wideawake Field, reported the sighting of a submarine towing four lifeboats, and asked what to do next. As Colonel Ronin says, "It was a good question." It could be answered in only one of two ways: return to base, or attack. There were no friendly submarines in that part of the Atlantic, and the Americans, who as yet had no word of the rescue work being conducted by German U-boats, had received no instructions against interference with such operations in that area. Richardson carefully weighed the alternatives. He had a responsibility for providing the protection that Freetown had requested for British ships going to the rescue of the survivors. If he ordered Harden to come in, he not only would jeopardize the safety of British ships but would leave the submarine free to continue its destruction of Allied shipping. Further, such an order would mean abandoning an important and legitimate military mission that had a chance of successful accomplishment. On the other hand, an order to attack would place in jeopardy the lives of some of the survivors. Harden had to have an answer soon. He could not remain in the area much longer and still have enough fuel to get back to Ascension. After conferring with Ronin, Richardson issued the order: "Sink sub."[29]*

*In a letter to the authors on 13 November 1962, General Richardson said, "I made the decision, as I recall, in consultation with Colonel Art Ronin." Later, on 1 February 1963, General Richardson wrote, "I think that I made it [the decision] after consultation with Colonel Ronin. Ronin or Wilson may have made it—we were all three working together." Kemmet's article in the *Express* on 4 August 1963 quoted General Richardson as saying, "I gave the order to bomb the *Laconia* survivors." Commenting on the article, General Richardson said, "They [the *Express*] took it upon themselves to emphasize the 'I' factor, although I took pains [in the interview] to point out that although it was my organization, and partly my decision, others were involved. I don't mind assuming full responsibility." Colonel Wilson, the operations officer, does "not recall our ordering an attack although it is possible we did issue such an order." In a letter of 15 November 1962 Colonel Ronin wrote, "I told the B-24 commander to attack," but in reviewing a draft of this note on 12 October 1963 he said that his previous statement gave "the impression that I was in direct contact with the B-24 commander, which I was not. I believe that Richardson was in contact with him from the Command Post and actually passed the order as he says. However, at that time I could have out-voted him if I had not concurred in the bombing." Looking back over twenty years, both General Richardson and Colonel Ronin believe that, in the light of the information they then possessed and of the conditions as they understood them, the decision to attack was the right one.

Upon receiving the signal, Harden turned back northward and soon found the U-boat. Following is the account of the attack as reported by the pilot of the B-24:[30]

> Upon returning to position, life boats had moved away from sub. One pass dropping three depth charges was made, one hit ten feet astern, and two were about 100 and 200 yards. Made three more runs and bombs failed to fall. This was fixed and a final run was made at 400 feet. Two bombs were dropped one on either side, not more than 15 or 20 feet away. The sub rolled over and was last seen bottom up. Crew had abandoned sub and taken to surrounding lifeboats.

The log of *U-156* describes the attack as witnessed from the submarine:[31]

> Aircraft of similar type approached. Flew over, slightly ahead of submarine, at altitude of 80 meters [about 250 feet]. Dropped two bombs about three seconds apart. While four life boats in tow were being cast off, the aircraft dropped one bomb in their midst. One boat capsized. Aircraft cruised around for a short time and then dropped a fourth bomb 2-3,000 meters away. Realized that his bomb racks were empty. Another run. Two bombs. One exploded, with a few seconds delayed action, directly under the control room. Conning tower vanished in a tower of black water. Control room and bow compartment reported taking water. All hands ordered to don life jackets. Ordered all British off the boat. Batteries began giving off gas. Italians also ordered off (had no escape gear to give them).

The people in the lifeboats saw the attack from still a different view. One of the boats reached the Liberian coast on 10 October, four weeks after the *Laconia* was sunk. During that time 52 of the 68 persons in the boat had died. The 16 who reached land safely (15 British and 1 Pole) had suffered terribly. It is no wonder that they were confused as to the chronology of events. Here is their story as reported by the American chargé d'affaires in Monrovia:[32]

> About four o'clock on that afternoon [Sunday, 13 September, according to the report] an American Liberator bomber appeared and, although the submarine displayed a Red Cross flag, the bomber launched seven depth charges one of which fell near a lifeboat, completely destroying it and drowning all passengers, who were Italian prisoners. Two others fell about three yards on either beam of the submarine, the explosion lifting it from the water and obviously caused damage.. The submarine continued on the surface for about a mile and then submerged, throwing all of the survivors from the deck into the water. Many of these were drowned by suction, but the remaining life boats were able to pick up a few.

U-156 had not been sunk, as Harden and his crew believed, but it had sustained considerable damage. Shortly after 1100, Hartenstein returned to the lifeboats and transferred to them the remaining passengers he had aboard. He then submerged and headed westward. So far as he was concerned, the rescue operation was ended. That night, when Doenitz was informed of the attack on *U-156*, he directed *U-506* and *U-507* to continue rescue work and hand over the survivors to the French ships that would arrive the next day. Meantime the U-boat captains could retain Italians aboard, but all other survivors were to be transferred to lifeboats. Warning the captains to beware of attack, Doenitz instructed them not to seek protection under the Red Cross flag but to keep their boats ready to submerge instantly.[33]

While the B-24 was on its way back to Ascension, Lieutenant Richard T. Akins, pilot of a B-25 of the 1st Composite Squadron, reported at 1025 that he had sighted lifeboats and rafts at 05° 10′ South, 11° 10′ West, just a few miles south and east of where Harden and his crew had bombed *U-156*. That afternoon Richardson flew out to the area and found some lifeboats. He also saw the *Empire Haven*, which he directed toward the boats. An hour later Captain Virgil D. Holdsworth in another B-25 reported that he had spotted lifeboats at 4° South, 12° West.

That night a message from Freetown indicated that French warships from Dakar were headed south, but there was nothing in the signal to indicate that their mission was to assist in rescuing survivors from the *Laconia*. The men on Ascension were sure that if the enemy had not previously discovered the presence of American forces on the island, he knew it now as a result of the bombing of the submarine. Assuming that the Vichy warships were on their way to Ascension, the men prepared to defend the island. As the historian of the 1st Composite Squadron wrote, "arrangements were made for an American Reception —*the powder was dry.*" The tension that night was heightened when the radar picked up a surface target 40 miles to the northeast. For an hour and a half the radar followed the track as the target moved to a position 14 miles southeast of the island. Then contact was lost. Major Buethe believed that the radar had picked up a submarine engaged in a reconnaissance of the island and that contact had been broken when it submerged.[34]

At 0720 on Thursday, 17 September, Harden and his crew were off again in the B-24. They reached the search area at 0905 and began flying a square pattern. At 1030 they sighted a submarine two miles ahead and to the left at 04° 51′ South, 12° 22′ West. Increasing his speed to 200 miles per hour, Harden went in for the attack. The boat crash-dived, and its conning tower and deck were awash when the B-24 passed over. The bombs failed to release, so Harden went around and made a second pass 45 seconds later. This time two 500-pound demolition bombs and two 350-pound depth bombs fell in train, two landing astern of the submarine and two hitting directly on top. When Harden came back over the spot, the crew saw an oil slick. For 40 minutes the plane circled the area, but no further results were observed. Harden then headed back to base, the crew believing that they had sunk the submarine or at least badly damaged it. But they were wrong. *U-506*, which then had more than a hundred survivors aboard, escaped without damage.[35]

In nine other sorties flown by the 1st Com-

American-built Baltimore light bomber (Martin A-30) lands at Ascension on its way to North Africa and the RAF's Western Desert Air Force.

posite Squadron on 17 September only Akins had anything significant to report—at 1500 he saw eight people on a raft at 03° 25′ South, 13° 10′ West. When he went back to the same area the next morning he found four empty lifeboats, all in good condition. There were oars in the boats, and Akins thought that there also was food. At the time he had no idea that the people might have been removed by the warships from Dakar. One of the French ships, a small vessel which was making 22 knots on a zigzag course northward, was sighted later that morning by Lieutenant J. A. McClellan at 03° 45′ South, 13° 15′ West.

That afternoon at 02° 56′ South, 13° 35′ West, Lieutenant Philip Main sighted two French ships headed northwest at 17 knots. Reporting by radio from his B-25, Main received instructions to identify the vessels if possible but not to attack unless fired upon. At 1500, Wideawake queried Freetown concerning the status of the French vessels. The British reply, received at 1700, was to shadow but not to interfere with them, for, the message said, "it appears that they are searching for Italians from *Laconia.*" This evidently was the first time that the Americans on Ascension had received any information concerning the rescue operations which had been undertaken by the German U-boats and the Vichy warships.[36] The cruiser *Gloire* and the sloop *Annamite* had arrived in the area the previous day. Now *Gloire* was on her way back to Dakar with more than a thousand survivors taken from *U-506* and *U-507* and from lifeboats and rafts the French had found. The following day another French sloop, the *Dumont d'Urville,* met the *Cappellini* and took on 42 survivors, who subsequently were transferred to the *Annamite* and taken to Dakar. The British apparently had broken off their rescue efforts after realizing that the French had sent ships to pick up the survivors.[37]

Meantime, on the 17th, Doenitz had issued the directive that was to become known as the "Laconia Order." Addressed to all commanding officers, it read in part as follows:[38]

> No attempt of any kind must be made at rescuing members of ships sunk and this includes picking up persons in the water and putting them in lifeboats, righting capsized lifeboats and handing over food and water. Rescue runs counter to the rudimentary demands of warfare for the destruction of enemy ships and crews.

The "Laconia Order" had a prominent place in the Nuremberg proceedings which resulted in Doenitz' being sentenced to prison for ten years. In the trial, however, the order lost most of its value to the prosecution when Fleet Admiral Chester W. Nimitz testified that in the war with Japan the U.S. Navy had followed the same general policy as was set forth in the German admiral's directive.[39]

The B-24 which attacked *U-156* and *U-506* never flew another combat mission. The plane crashed in Palestine on 18 October 1942 while Harden and his crew were on their way to rejoin their squadron in the Middle East. None of the men were injured, and when Harden returned to duty he turned in a report of his operations from Ascension Island. On the basis of that report, the American commander in the Middle East awarded Air Medals to Harden and the other members of the crew for the destruction of an enemy submarine on 16 September and for the probable destruction of another on 17 September 1942.[40]

Hartenstein, having survived the attack by the B-24, continued operations and sank two more ships before returning to base on 16 November 1942. The U-boat captain perished on another voyage, when *U-156* was sunk by U.S. naval aircraft east of Barbados on 8 March 1943.[41]

Aerospace Studies Institute

Notes

1. Office of United States Chief of Counsel for Prosecution of Axis Criminality, *Nazi Conspiracy and Aggression* (Washington: USGPO, 1946), II, 57; VIII, 657-662. Adm. Karl Doenitz, *Memoirs, Ten Years and Twenty Days* (Cleveland: The World Publishing Company, 1959), 255-264. Lt. Comdr. Alex A. Kerr, "International Law and the Future of Submarine Warfare," U.S. Naval Institute *Proceedings,* LXXXI, No. 10 (Oct. 1955), 1105-1110.

2. Doenitz, *Memoirs,* 255-264. *Nazi Conspiracy,* II, 829-830; VII, 57; VIII, 657-662; Supp. B, 577-579. International Military Tribunal, *Trial of the Major War Criminals* (Nuremberg, 1947-1949), XI, 24-39. Also see, for example, Capt. S.

W. Roskill, *The War at Sea* (London: H.M. Stationery Office, 1954-1956), II, 210-211; Comdr. David D. Lewis, *The Fight for the Sea* (Cleveland: The World Publishing Company, 1961), 221-226; Leonce Peillard, *U-Boats to the Rescue* (London: Jonathan Cape, 1963), 21-83; Friedrich Ruge, *Sea Warfare, 1939-1945* (London: Cassell, 1957), 232-233.

3. Doenitz, *Memoirs*, 255; Log of *U-156* for Sept. 12-17, 1942, extracts in *Trial of War Criminals*, XI, 31-32.

4. Statement of *Laconia's* navigation officer, as reported by Schacht, commanding *U-507*, in *Trial of War Criminals*, XI, 27-28.

5. Log of *U-156*, *loc. cit.*, 32; Doenitz, *Memoirs*, 255-256.

6. Log of *U-156*, *loc. cit.*, 32-33; Doenitz, *Memoirs*, 256-257.

7. Log of *U-156*, *loc. cit.*, 33-35; Log of *U-507* for September 13-17, 1942, extracts in *Trial of War Criminals*, XI, 25; Doenitz, *Memoirs*, 258; Peillard, *U-Boats to the Rescue*, 173.

8. Log of *U-156*, *loc. cit.*, 33, 37.

9. Log of *U-156*, *loc. cit.*, 36-37.

10. Log of *U-156*, *loc. cit.*, 38.

11. Samuel Eliot Morison, *History of United States Naval Operations in World War II* (Boston: Little, Brown, 1947-1962), X, 57, note 6; Memo Routing Slip, HQ USAF (AFCHO) to USAF Hist. Div., Oct. 29, 1959.

12. See, for example, Lewis, *Fight for the Sea*, 225; Peillard, *U-Boats to the Rescue*, 17; Capt. S. W. Roskill, "Mystery of U.S. Plane's Attack," *The Sunday Times*, Feb. 1, 1959; Ruge, *Sea Warfare*, 232-233.

13. The tone of the article, written by Gerald Kemmet, was set in the heading: "I ordered bombing of survivors."

14. WD AG Ltr. 210.68 (12-6-41), Dec. 6, 1941; Inspection of Airfield Site, Ascension Island, report by Lt. Col. Philip Kemp, *et al.*, to Chief, Ferrying Command, Jan. 2, 1942; R&R, CO, Ferrying Command, to C/AC (B&G), Jan. 8, 1943; Memo for Col. Walker, by Col. H. L. George, AWPD, Jan. 8, 1942; R&R, AWPD to A-3, Jan. 13, 1942; R&R-2, A-3 to AWPD, Jan. 17, 1942; R&R, AWPD to A-2, Jan. 20, 1942; R&R-2, A-2 to AWPD, Feb. 3, 1942; Directive, C/AS to AWPD, Jan. 27, 1942; Memo for C/S, by Col. H. A. Craig, AWPD, Feb. 2, 1942; Memo for G-3, by Brig. Gen. L. T. Gerow, WPD, Feb. 5, 1942; WD AG Ltr. 580.81 (1-17-42) MCS-G, Jan. 20, 1942; WD AG Ltr. 580.81 (2-3-42) MCS-G, Feb. 5, 1942; Ltr., C/S to Chief, NavOps, Feb. 3, 1942; Memo for C/S Army, by H. R. Stark, Chief, NavOps, Feb. 6, 1942; Ltr., W. C. G. Cribbett, RAF Delegation, to C/AC, Feb. 8, 1942; State Dept. to Embassy, London (Msg. 304), Jan. 26, 1942; Embassy, London, to SecState (Msg. 445), Jan. 30, 1942; Embassy, London, to SecState (Msg. 463), Jan. 31, 1942; State Dept. to Embassy, London (Msg. 398), Feb. 2, 1942; Embassy, London, to SecState (Msg. 568), Feb. 2, 1942; W. F. Craven and J. L. Cate, *The Army Air Forces in World War II* (Chicago: University of Chicago Press, 1948-1958), I, 319-331; H. H. Arnold, *Global Mission* (New York: Harper, 1949), 241, 288-289.

15. A-2, The Strategic Position of Ascension Island, Feb. 3, 1942; AWPD, Protection of Air Routes from Brazil to Africa, to the Near East and the Far East for Ferrying Aircraft, [Feb. 1942].

16. WD AG Ltr. 370.5 (2-14-42) MSC-C-5, Feb. 15, 1942; 1159th AAFBU, History of Ascension Island, Dec. 1941-Feb. 1944, 31.

17. 1159th AAFBU, History of Ascension, 11-24. The officers who inspected the island and selected the site for the base in December 1941 recommended "maximum passive protection of [the airdrome] through camouflage and dispersion [of facilities]." Kemp, Inspection of Airfield Site. Robert A. Lovett, Assistant Secretary of War for Air, said he wanted "all possible protection" for the base. He suggested "ample camouflage, smoke protection, [and] underground installations where possible." Memo for Record, by Maj. Charles M. Taylor, AWPD, reporting conversation with Lovett, Feb. 3, 1942.

18. 1st Composite Squadron, Historical Review, 1b-18b; 1159th AAFBU, History of Ascension, 8.

19. WD AG Ltr. 370.5 (4-30-42) MC-E-M, May 2, 1942, with subsequent amendments; troop list for *James Parker*, appended to 1st Composite Squadron, Historical Review. In directing the Air War Plans Division to prepare the plan for the base, Brig. Gen. Carl Spaatz, Chief of Air Staff, said the plan should include "adequate defense." Memo for Col. Walker, by Col. H. L. George, AWPD, Jan. 8, 1942. Secretary of War Henry L. Stimson ordered that "adequate protection" be provided. WD AG Ltr. 580.81 (1-17-42) MSC-G, Jan. 20, 1942. Assistant Secretary Lovett wanted the garrison to be well armed, for he felt that "we must be prepared to hold this place against possible attack." Memo for Record, by Maj. Taylor, Feb. 3, 1942. Brig. Gen. Robert Olds, CO, Ferrying Command, recommended anti-aircraft artillery and a squadron of pursuit planes to guard the airdrome. R&R, CO, Ferrying Command to C/AC (B&G), Jan. 8, 1942. A-3 wanted a squadron of medium bombers in addition to the squadron of pursuit which had been recommended by Olds. R&R-2, A-3 to AWPD, Jan. 17, 1942. A-2 suggested that if naval planes were based on Ascension to patrol between the island and Africa, they could minimize the loss of planes which ran into trouble while flying the South Atlantic route and could reduce the submarine menace to Allied shipping in the area. A-2, The Strategic Position of Ascension, Feb. 3, 1942. Adm. Harold R. Stark, Chief of Naval Operations, with the concurrence of Adm. Ernest J. King, Commander-in-Chief, U.S. Fleet, requested that facilities be provided by the Army for a squadron of naval patrol planes. Memo for C/S Army, by H. R. Stark, Chief, NavOps, Feb. 6, 1942.

20. Composite Force 8012, S-2 Report No. 5, Sept. 19, 1942; Richardson to Maurer, Feb. 1, 1963; 1159th AAFBU, History of Ascension, 30.

21. 1st Composite Squadron, Historical Review, 18b; AAF Composite Force 8012, Intelligence Summary for week ending Aug. 29, 1942.

22. AAF Composite Force 8012, Intelligence Summary for week ending Sept. 5, 1942; 1st Composite Squadron, Historical Review, 19b.

23. Richardson to Maurer, Feb. 1, 1963; 1159th AAFBU, History of Ascension, 35-36.

24. AAF Composite Force 8012, Intelligence Summary for the weeks ending Aug. 29, Sept. 5, Sept. 12, and Sept. 18, 1942; Roskill, "Mystery of U.S. Plane's Attack," *loc. cit.*

25. AAF Composite Force 8012, Intelligence Report, Sept. 15, 1942, and messages attached thereto; Richardson to Maurer, Aug. 26, 1963; Roskill, "Mystery of U.S. Plane's Attack," *loc. cit.*

26. 343d Bombardment Squadron, History, Feb. 3, 1942-Feb. 19, 1943; Richardson to Maurer, Nov. 19, 1962, and Feb. 1, 1963; Interview of Lt. Col. Edgar W. Keller, by Maurer, Oct. 29, 1962. The serial number of the B-24D was 41-11897.

27. AAF Composite Force 8012, Intelligence Report, Sept. 16, 1942; Composite Force 8012, S-2 Report No. 5, Sept. 19, 1942, and attached Report of B-24 Mission, Sept. 16, 1942; Harden to Baldwin, Sept. 22, 1942; Richardson to Maurer, Nov. 13, 1962, Feb. 1, 1963, Aug. 26, 1963, and Oct. 11, 1963.

28. Report of B-24 Mission, Sept. 16, 1942.

29. AAF Composite Force 8012, Intelligence Report, Sept. 16, 1942; Richardson to Maurer, Nov. 13, 1962, Feb. 1, 1963, Aug. 26, 1963, and Oct. 11, 1963; Wilson to Maurer, Dec. 4, 1962; Ronin to Maurer, Nov. 15, 1962, and Oct. 12, 1963.

30. Report of B-24 Mission, Sept. 16, 1942.

31. Log of *U-156*, *loc. cit.*, 37.

32. Chargé d'Affaires to SecState (Despatch No. 818), Oct. 17, 1942.

33. Log of *U-156*, *loc. cit.*, 37; Log of *U-507*, *loc. cit.*, 29.

34. AAF Composite Force 8012, Intelligence Report, Sept. 16, 1942; Composite Force 8012, S-2 Report No. 5, Sept. 19, 1942; 1st Composite Squadron, Historical Review, 20b; 1159th AAFBU, History of Ascension, 29-30.

35. Report of B-24 Mission, Sept. 17, 1942; AAF Composite Force 8012, Intelligence Report, Sept. 17, 1942; Composite Force 8012, S-2 Report No. 5, Sept. 19, 1942; Doenitz, *Memoirs*, 260.

36. AAF Composite Force 8012, Intelligence Report, Sept. 18, 1942; Composite Force 8012, S-2 Report No. 5, Sept. 19, 1942; Log of *U-507*, *loc. cit.*, 30.

37. Peillard, *U-Boats to the Rescue*, 192-215; Gerhard Hummelchen and Jurgen Rohmer, "Vor Zwanzig Jahren," *Marine Rundschau*, LIX, No. 5 (Oct. 1962), 313; Admiralty, Naval Intelligence Division, Weekly Intelligence Report No. 134, Oct. 2, 1942; American Consul, Casablanca, to SecState (Telegram No. 772), Sept. 30, 1942; Roskill, "Mystery of U.S. Plane's Attack," *loc. cit.*

38. *Nazi Conspiracy*, VII, 100; Doenitz, *Memoirs*, 262-263.

39. Interrogation of Fleet Admiral Chester W. Nimitz, in *Trial of War Criminals*, XI, 108-111; "Professional Notes," U.S. Naval Institute *Proceedings*, LXXII, No. 7 (July 1946), 1004-1006.

40. 343d Bombardment Squadron, History, Feb. 3, 1942-Feb. 19, 1943; United States Army Forces in the Middle East, General Order No. 1, Jan. 1, 1943.

41. Chief of Naval Operations, *German, Japanese, and Italian Submarine Losses, World War II* (Washington: USGPO, June 1946), 5; Bodo Herzog, *Die deutschen Uboote 1906 bis 1945* (München: J. F. Lehmanns Verlag, 1959), 219.

THE CHANGING MANAGEMENT ROLE OF THE MILITARY DEPARTMENTS RECONSIDERED

Part I: Administrative Discretion vs. Constitutional Duty

Captain Gerald Garvey

THE DOMINANT characteristics of post-World War II American defense are (1) an ever accelerating trend toward centralization of power in the Office of the Secretary of Defense and (2) functional reorganization of the military departments.

These trends have given rise to sustained public debate. One sees in the popular press, for example, frequent allusions to a "conspiracy" theory of the Department of Defense. This theory holds that the recent trends reveal "monarchical" ambitions on the part of the DOD leadership[1] and that their effect is to reduce the traditional influence of the uniformed services and, worse, to subvert their traditionally high-level military expertise. On the other side, the "savior" theory has equally sanguine advocates.[2] This theory holds that the ascendancy of civilian control under the McNamara leadership marks an altogether salutary revolution: that this revolution satisfies the demand for economy by bringing new techniques (such as "cost analysis" and "program packaging") to the solution of modern defense problems and that it lives up to the best American political traditions because vigorous and centralized civilian control ensures that the military will remain "on tap, but not on top."

military contribution to the debate: administrative discretion vs. constitutional power

Among the by-products of the "Great DOD Debate" have been claims that the "military voice is dangerously weak" and that the Secretary of Defense has muzzled the military.[3] The facts are to the contrary. Indeed, the very openness of these claims constitutes their own refutation. Scarcely a month, or even a week, passes in which the military voice fails to gain public hearing through columnists like Hanson Baldwin of the *New York Times*[4] or through uncamouflaged rehearsal of the military departments' grievances in specialized magazines like *Aviation Week*[5] or *Air Force* magazine. The best—and surely the bluntest—expression of what has (perhaps unfortunately) come to be recognized as "the military view" appeared in the following statement by Colonel William G. McDonald in the *Air University Quarterly Review:*

In their cumulative impact and direction, these

> . . . moves have served to increase and to concentrate management control over military department activities by the Secretary of Defense. Thus they can be visualized at once as a parallel reflection of and a basis for the more conspicuous changes heralded by amendments to the National Security Act. The Pentagon is *not* "the same old place," and a fundamental question now must be answered: "What is the role of the military departments?"[6]

But the very forthrightness of this formulation of the "fundamental question" hides a crucial difficulty. The difficulty—and it is, incidentally, the difficulty of the debate over the military departments in general—lies in the ambiguity of the word "role." Does "role" refer primarily to the power of the military departments *over* subordinate units? Or does it refer to their responsibility *through* the Secretary of Defense to the superior echelons of American government—to the Congress and to the President?

Power and responsibility are by no means necessarily opposite sides of the same thing. Each can be broken down into two further distinct components: into constitutional power and responsibility, which concerns the legality or legitimacy of governmental policies, and into administrative power and responsibility, which refers to the amount of ministerial discretion that an official can exercise when implementing policy.

Every controversy over the power of an appointive official—and the "Great Debate" over the role of the military departments vis-à-vis that of the Secretary of Defense certainly is this—must sooner or later come to terms with this distinction between constitutional and administrative responsibility. The reason is simple. An administrative official can act "in his best discretion" only to the extent that his constitutional responsibilities permit and only with respect to such matters as those responsibilities include.

This, indeed, is the very meaning of the phrase "a government of laws rather than of men." And it leads to one of the fundamental principles of American government: that "discretion" is to be minimized, as nearly as possible, in the activity of nonelective officials. Broadly speaking, there are two ways in which this minimization is accomplished: by imposing duties on officials from above and by maintaining the right of an official's subordinates to check his actions from below. (The clearest example of minimizing discretion from below is the right of any citizen to appeal for redress of grievance over the head of any functionary who he feels has been guilty of unjust or improvident action.) Or, to put the whole matter in concrete terms, the conflict between the military departments and the Office of the Secretary of Defense (OSD) which is implicit in the current DOD debate does not turn on the question *whether* the Secretary of Defense has been permitted too much discretionary power. It rather involves how Secretarial discretion in these premises is to be minimized. Is it to be primarily through legislative imposition of duties on the Secretary, in other words, narrowing his discretion by Congress' telling him how, when, and where he may use his powers? Or has OSD received a sort of "constitutional blank check" by virtue of the highly controversial 1958 National Security Act amendments—subject, however, to the military departments' duty to "keep the Secretary honest" in the execution of his vast powers by informing higher echelons when, in their opinion, Secretarial actions are unwise or inexpedient?

The truth of the matter would seem to be that, in practice, the military departments' functions of participating in the system of constitutional checks as well as in the system of administrative policy-execution have to be performed simultaneously. Thus if OSD gives an administrative directive to the military departments, they in turn incur the responsibility to carry out the order with efficiency, dispatch, and loyalty. As a recognized authority on the subject, Professor Barton Leach of the Harvard Law School has put it: "If the Secretary of Defense says to the JCS 'Make me a budget with a ceiling of 13.5 billions,' the JCS should loyally produce the best budget at that figure." However, in a consultant's memorandum for the Air Force, Professor Leach continued, "Nothing should ever stand in the way of [the Joint Chiefs'] telling the Secretary or the President or the Congress that such a budget is inadequate

. . . and that risks of providing less are such-and-such."[7] The distinction implied in this opinion is vital. The directive to prepare a given budget represents an exercise of administrative power, the imposition of a duty on the service chiefs, which duty is, of course, to be carried out in the manner directed and not in the manner in which the service chiefs, in their own discretion, might otherwise see fit to carry it out.

But notwithstanding the OSD's authority to prescribe administrative duties for lower-echelon officials, there remains the question of maintaining a constitutional check on the manner in which the Secretary of Defense fulfills the higher duties that have been imposed on him. To ensure Secretarial compliance with Congressional mandate, the service chiefs retain their right to give expert advice; they constantly confront their constitutional responsibility to keep the highest civilian authorities properly informed, in accordance with the general rule that no administrative power can be permitted to be exercised with such "discretion" as would amount to the contravening of a higher constitutional responsibility. Indeed, the principle that any administrative order presupposes constitutional authority is so basic that it has received official recognition—and receives periodic formal review by all military personnel—in the Uniform Code of Military Justice.[8]

What emerges from all these considerations is the fact that the administration of American defense is confronted at every turn with what might properly be termed "the constitution of American defense." This is the decisive consideration, the consideration which means that no proper appraisal of the changing management role of the military departments nor any soundly conceived debate over DOD administrative policy can result except within the broad perspective of these departments' constitutional roles and constitutional responsibilities.

the constitution of American defense

What is a constitution? By any definition, a constitution is a means of determining that certain types of exercise of governmental power are legitimate and that other types are not legitimate. In a formal sense, the word "constitution" in American usage refers to a written instrument. For American government as a whole, the constitution in this sense embraces the 3500-odd words, together with its subsequent amendments, which "We, the people" enacted as the supreme law of the land in the Federal Constitution of 1787. But the American preoccupation with written instruments has not been confined to the Federal level of government. Each state has a written constitution too. Every corporation has a written charter. And it is the same with respect to the basic law of any executive department, such as the Department of State or Department of Defense. In every case the constitution of such a department is a statute passed by Congress which sets forth the purposes, the legal jurisdiction, and the organizational outlines of the agency.

Thus, in the formal sense, the constitution of American defense is the National Security Act of 1947 as amended.[9] While the National Security Act is subordinate to the Federal Constitution, in that it was passed pursuant to powers devolved on Congress by the latter instrument, it is nevertheless to be interpreted in terms of the same canons of constitutional exegesis which prevail when the Supreme Court construes the national Constitution itself. The most important rubric in this connection flows directly from the fact that a constitution normally has to do only with the legitimacy of power. In other words, it only gives permission to do such-and-such or thus-and-so and does not give orders.[10] Yet for certain purposes it is the exception to this rule that has prime significance for the constitution of American defense. This is especially the case where executive powers—the powers of the President and of his delegate, the Secretary of Defense—are concerned.

The best example comes from the theory on which President Lincoln acted after the Federal garrison at Fort Sumter fell to the Confederates. That was the occasion on which the term "war powers" passed into the official vocabulary of American constitutional scholarship, and therefore it is of immediate interest in a consideration of the constitution of American defense. It was also the occasion of Lincoln's assumption of extraordinary Presidential powers under the combined provisos of his role as commander in chief and of his constitutional duty to "take care that the laws be faithfully executed."[11] Lincoln interpreted the commander-in-chief clause of the Constitution as having conferred on him a wide range of discretion in the control of military forces—discretion which he forthwith exercised to the hilt by constantly interfering in the conduct of field operations during the early years of the Civil War and which he equally manifested by assuming a much more passive commander-in-chief role after Grant was given command of the Union Armies.

By contrast, an altogether different (and at the time an altogether novel) view of the "take care" clause was discernible in Lincoln's message of 4 July 1861. ". . . no choice was left," Lincoln asserted, "but to call out the war power of the government." Then, pointing to the Presidential oath to "take care that the laws be faithfully executed," he continued:

> The whole of the laws which were required to be faithfully executed, were being resisted, and failing of execution, in nearly one-third of the States. . . . are all the laws, *but one*, to go unexecuted and the Government itself go to pieces, lest that one be violated?

Lincoln's answer was, of course, a categorical no, on the significant ground that his "official oath [would] be broken, if the government should be overthrown" through his inactivity.[12] Clearly, the reasoning was that the "take care" clause left the President very little discretion as to *how*, and absolutely no discretion as to *whether*, he should discharge his role as ultimate guardian of the laws. In other words, the "take care" clause translates an ostensible area of governmental discretion into an area of mandatory duty.

This exception to the general rule—this fact that constitutional power is sometimes to be equated with the imposition of a duty rather than with the permitting of a certain range of discretion—has major significance in connection with the Department of Defense.

In the last analysis, all objections to the centralizing and functional trends in the Office of the Secretary of Defense boil down to the charge that the Secretary of Defense has exercised the powers conferred on him by the National Security Act in an unwise manner or with an inordinate (that is, with an "unconstitutional") amount of discretion. Yet it is obvious that the nature and validity of these objections must change if OSD powers in fact belong to that special class of powers which are equivalent to constitutional duty rather than to the class which merely lays broad guidelines for administrative discretion. Do the pivotal clauses in the constitution of American defense—the National Security Act as amended—belong to the former or to the latter category?

"interservice functionalism": Secretarial powers on the President's side of DOD

The place to begin when seeking an interpretation of Congressional intent in the various amendments to the 1947 National Security Act is President Eisenhower's defense reorganization message of 1958. The President flatly declared that "all doubts as to the authority of the Secretary of Defense" had to be settled once and for all. Congress promptly took the exhortation to heart by writing into the 1958 amendments provision for vastly increased centralization of power in OSD. Eisenhower in his message further asserted that the defense establishment must now recognize that separate land, sea, and air warfare are gone forever; that all combat forces must henceforth be "singly led and prepared to act as one, regardless of service."[13] In short, functional reorganization of the hitherto separate services was no less pressing an imperative of modern defense than was centralization.

The manner in which Congress responded to the President's argument for functional reorganization is quite as important as the bare fact that functionalism did receive formal recognition in the 1958 amendments. Actually Congress went even further in the direction of functionalism than President Eisenhower requested. Not only did it perfect the trend toward "interservice functionalism" that had been a notable feature of the operational side of DOD since the early 1950's. Congress also laid the basis for a second post-1958 DOD characteristic: "supraservice functionalism" on the support or staff side of the military establishment. It would be helpful to consider each of these two developments in turn.

The philosophy behind the first development—interservice functionalism—yields to concise enough description. The theory holds that all strategic forces perform a single function: that of maintaining the Free World deterrent. All European forces, regardless of whether they use ships or planes or tanks, contribute to one and the same function of supporting NATO. Similarly with respect to forces in Alaska, in the Atlantic and the Caribbean, and in the Pacific. And an analogous commonness of mission for all tactical forces establishes the reasoning behind the new United States Strike Command (USSTRICOM). The idea is that all troops participating in a single theater of operations, or contributing to one common mission, should be organized on an interservice basis under unified command.

The phrase "under unified command" is crucial. This principle logically establishes the further principle that, because the specified and unified commands (SAC, STRICOM, Pacific Command, etc.) have interservice functions, they should report not to the Secretaries of the individual services but rather through the Joint Chiefs of Staff to the Secretary of Defense. In this light it can be seen that functionalism was conceived in such a way as automatically to complement—indeed, to cause—acceleration in the trend toward centralization of power in OSD. By the same light, the difficulties in a position which approves of functionalism yet disapproves of centralization, or vice versa, come clearly into view.

There is a second and equally crucial corollary. In theory, interservice functionalism had two dominant features: it applied to *all* operational combat forces, yet at the same time it applied *only* to combat forces. The logical upshot was a complete, mutually exclusive division of labor between operational and nonoperational units. The 1958 statutory implementation of this division of labor put the military departments on the resource side of DOD in the status of mammoth staff agencies. By law, the Secretaries of the Army, Navy, and Air Force lost all command over operations and were charged exclusively with the classic staff responsibilities of training, supporting, and providing general administration for their respective forces in the unified and specified commands.[14]

The most significant result is that the dichotomy between "line" and "staff" is no longer merely an *administrative* maxim for division of labor within the overall defense organization. Rather, the Congressionally prescribed division of labor between combat and support elements sets up the line/staff dichotomy as an organic, *constitutional* feature of the organization of DOD itself. This in turn had the effect of clarifying the distribution of constitutional power and responsibility in American defense. It structurally separated the resource side of DOD from operations. It set up the military departments as separate units to perform separate functions—the functions of raising and supporting armies, providing and maintaining navies, and so forth, which flow directly from the "war powers" of Congress.

The original question now re-emerges. How was the authority that the 1958 amendments putatively devolved on the Secretary of Defense to be exercised in his "direction, authority, and control" of the Department of Defense? Was power given to him in the form of discretion or of duty? For that matter, to what extent was *any* new power given to the Secretary himself?

The fact is that a far smaller ambit of discretion accrues to OSD, in the context of the National Security Act amendments, than is frequently supposed. The provision for unified commands on the line or operations side of DOD, for example, reads as follows:

> With the advice and assistance of the Joint Chiefs of Staff *the President, through the Secretary of Defense,* shall establish unified or specified combatant commands for the performance of military missions . . . (Emphasis supplied.)[15]

The salient point is that it is the President—*not* the Secretary—who gains recognition of the independent constitutional power to create new operational organizations. This is of course as it should be; and the foregoing passage from the statute is therefore to be interpreted as neither more nor less than Congressional notice of the President's supreme and wholly autonomous power over actual military operations by virtue of the commander-in-chief clause of the Federal Constitution. The same principle, moreover, concludes the point of immediate interest: namely, that ostensible exercise of administrative discretion by the Secretary of Defense in the area of operations is not meaningful in terms of his independent powers. Rather, any discretion in this connection comes from a delegation of power from the President.

"supraservice functionalism": Secretarial powers on Congress' side of DOD

On the resource or staff side, the Secretary has, if anything, even less independent discretion than on the operations side, but for a different reason. Matters of appropriation and provision unquestionably belong within the jurisdiction of Congress by Article I of the Constitution, not within that of the President.[16] This contrast is explicitly highlighted in the National Security Act amendments. In the nonoperational areas the law lays specific duties on the Secretary himself, which duties and powers are to be exercised *under Congressional direction rather than by "the President, through the Secretary of Defense."*

According to the 1958 amendments, "Wherever the Secretary of Defense determines it will be advantageous to the government in terms of effectiveness, economy, or efficiency, he shall provide for the carrying out of any supply or service activity common to more than one military department by a single agency or such other organizational entities as he deem appropriate."[17]

At this point the wording in the statute becomes crucial. In Title 10 of the U.S. Code, in which the immediately relevant portions of the law are to be found, the word "shall" is imperative.[18] This word is used both generally—to describe the Secretary's overall duties—and also in regard to specific actions, as in the provision that ". . . the Secretary of Defense shall take appropriate steps (including the transfer, reassignment, abolition, and consolidation of functions other than major combatant functions) to provide in the Department of Defense for more effective, efficient and economical administration and operations and to eliminate duplication."[19] The amendments then underscore Congressional primacy in the resource management area by adding the statutory proviso that contemplated changes be reported to the national legislature, which retains a veto power, prior to implementation.

As if to allay any possible misunderstanding regarding the degree of consolidation envisioned for functions common to all military departments, Representative John McCormack offered the following clarification on the floor of the House, known as the McCormack Amendment to the National Security Act:

> These activities include procurement, warehousing, distribution, cataloging and other supply activities, surplus disposal, financial management, budgeting, disbursing, accounting, and so forth, medical and hospital services—transportation—land, sea and air—intelligence, legal, public relations, recruiting, military police, training, liaison activities, and so forth, and was an estimated 66⅔ percent of the military budget.[20]

The unmistakable mandate was for an active and vigorous Secretary of Defense, whose area of responsibility in this regard was equally unmistakably coextensive with Congress' own power over the military establishment. In brief, *the 1958 amendments embodied the philosophy that, if Congress was responsible to the taxpayers on one side, the Secretary was to be the agent of Congress on the other,* charged with overseeing "effective, efficient and economical" application of the power of the purse in *all* areas of American defense policy.

The second major kind of functionalism in DOD, supraservice functionalism, evolved as the direct result of Congress' mandate to the Secretary of Defense. Whereas the operational functions went to joint organization on the "line" side of DOD, functions common to all services on the "staff" side increasingly came to be controlled, and in many cases actually performed, in OSD, or at least at a supraservice level. Supraservice functionalism gave birth to the Defense Atomic Support Agency, the Defense Communications Agency, and the Defense Intelligence Agency—the so-called "super agencies" which operate at a level between the unified commands and the Joint Chiefs of Staff. The Defense Supply Agency, a fourth child of the same concept, reports on all procurement and logistics in the Department of Defense directly to the Secretary.

Another manifestation of supraservice functionalism appeared with the establishment of the Office of Director of Defense Research and Engineering. The DDR&E, as the occupant of this office is called, monitors all research and development in DOD and is first in legal precedence among the Assistant Secretaries of Defense.[21] The fact that his office also has the potentiality of being foremost in terms of *actual decision-making power* was early dramatized by its decisive role in the successive OSD rejections of Air Force recommendations on the B-70 supersonic bomber, on its later reconnaissance configuration, and on the Skybolt missile and in rejection of the Air Force–Navy recommendations on the TFX fighter.

Parallel developments occurred in the strategic planning area with the formation of the Office of Assistant Secretary for International Security Affairs (ISA). The ISA charter establishes this office as a central supraservice agency for reviewing and coordinating the strategic implications "of programs of force structure, weapons systems and other military capabilities" and "such other functions as the Secretary of Defense assigns."[22] Indeed, by virtue of recent changes in the combat commands, in DDR&E, and in ISA, it can be said that functionalism in one form or another has become nothing less than the official watchword of American defense operations, research and development, and strategic planning. What of the fourth major area, that of budgeting and management policy?

the Comptroller, military departments, and civilian control

Actually, it is in the area of resource management per se that functionalism is most marked. It is in this area that the trends of the early 1960's have been most clearly in conformity with Congressional mandate and have most decisively reinforced the corollary trend toward centralized OSD control.

During the 1950's the DOD Comptroller acted more or less as a fiscal watchdog and *more rather than less* responsively to "external" influences such as Congress and the Bureau of the Budget. This role is easily explained, especially as regards the Comptroller's notably close liaison with the legislature. After all, the public purse jingles more loudly in the OSD/Comptroller's office than in any other Government agency; and Congress, with the power (and the responsibility) of the purse, has always maintained a corresponding interest. But more significantly, the nature of the comptrollership during the decade between 1949 and 1959 reflected the forcefulness of the man who occupied the post during that period, Mr. Wilfred J. McNeil. McNeil "was unique among the higher leaders of the Defense Department," Professor Samuel P. Huntington of Harvard University has written, "in that he performed the same job for all of the first five Secretaries of Defense. It is not surprising that he was labeled the 'virtually indispensable man' of the Pentagon."[23]

Then came the transfer from the Eisenhower to the Kennedy Administration. With this change came the shift in philosophy that kicked off the "Great DOD Debate" in the first place. Now in the Comptroller's office was Mr. Charles Hitch, previously of the RAND Corporation and coauthor of *The Economics of Defense in the Nuclear Age*.[24] Assistant Secretary Hitch made haste to institutionalize in DOD that book's central idea, "program packaging." The principal effect of program packaging was to substitute "positive economics"—in the sense of scientific study of the ratio of defense costs to defense payoffs—for willy-nilly "economy" or "dollar control" or equally vague, and essentially sloganeering, shibboleths like "fiscal responsibility." Military demands for more, more, and more defense goods, as well as opposing pleas for less, less, and less defense expenditure, must yield to hardheaded economic analysis. Hitch has been quoted as saying that modern defense questions of the type encountered in the planning of broad-scale strategy "require an analytical approach, an ability to think in abstract or conceptual terms."[25] *Business Week* commented, "In effect, [Hitch] has put to work in the Pentagon the economists' tools of analysis. The aim is to increase the marginal effectiveness of every military program—up to the point where the marginal cost of doing that would exceed the gains."[26]

In a word, Secretary Hitch replaced intuition with analysis. In doing so he disproved the thesis that had prevailed during Wilfred McNeil's incumbency. It now became apparent that no single person was "indispensable," provided that the functions he performed could be shredded out for systematic treatment through depersonalized efficiency-maximizing analytical techniques.

But there was also an obverse side to the picture. Formulation of military requirements and capabilities could no longer be parceled out among the three great staff agencies, the military departments. Inevitably requirements and capabilities for performing various missions had to be balanced against total costs, not merely against service costs. By an equal bureaucratic inevitability, this led to the formation of a new office under the Comptroller and *over* the military departments, that of Deputy Assistant Secretary for Programming. No longer could the Comptroller function as a mere watchdog, responsive primarily to the fiscal demands of Congress and the Bureau of the Budget. Perforce, through the Office of Programming he reached into "internal" DOD areas, into areas hitherto jealously guarded by the military departments. Indeed this followed necessarily from Mr. Hitch's avowed aim of "bridging the gap" between military planning and programing on one hand and sound financial management practices on the other.[27]

But in order to build a bridge one must first secure a bridgehead. The Comptroller's bridgehead was the assumption by that office of the right to program force levels and requirements along functional lines. As Hitch and McKean expressed it in their book:

> The first step in trying to improve our choice of program sizes is probably to put budget figures into categories that more nearly correspond to end-product missions [i.e., into functional categories]. . . . A budget designed to show the approximate costs of such missions would naturally have to cross departmental lines.[28]

The aforementioned *Business Week* article has correctly described the effect of it all: "The result has been the greatest degree of military unification yet, and a speedup in the standardizing and consolidating of military operations at all levels."[29] The fact—the perhaps unfortunate fact—is that the point where "crossing" of departmental lines becomes outright destruction of departmental lines is not altogether clear. All that really *is* clear is that the program-package procedure was the proximate cause of an unprecedented degree of OSD control over the departments' statutory job of supporting their forces in the unified and specified commands.

The Comptroller thus "pulled the bung" on the military departments, which now found themselves, like the proverbial cask, tapped and drained from both ends—their control over operations going laterally into interservice unified commands, and their responsibility for staff and policy support being evacuated upward to the supraservice analysts in the Office of Programming.

civilian control: rise of the "civilian general staff"

One final point remains for consideration: the implication of supraservice functionalism for civilian control.

The whole purpose of the analytical, as opposed to the intuitive, approach to decision-making is to provide the most accurate information regarding the relative efficiency of different alternative policies. Systems analysis, game theoretic techniques, operations research

—these and all the other arcane tools of the modern "civilian general staff" have as their sole object to increase the ability of a decision-maker to conclude that alternative *X* is in fact more efficient than some other alternative *Y*. To invoke once again the jargon of social science: the analytical approach permits questions of efficiency to be answered in terms of "positive science." Thus if certain goals or ends or policies are given, then the facts themselves, after they have been treated in an impersonal and scientific manner by the well-schooled "technipol," will clearly point out the best means to achieve these goals.

These considerations supply the key to the question of the extent of OSD discretion. On the one side, the Secretary of Defense is left little or no discretion in determining the goals or ends of his policies. *These goals are explicitly given to him in the mandatory words of the 1958 National Security Act amendments.* On the other side, insofar as the best techniques of economic analysis are applied to determine the factual advantages and costs of alternative DOD policies, these same techniques ideally result in a depersonalization of the processes of deciding which *means* should be adopted to satisfy Congress' intent.

But it is also evident that a highly specialized type of expertise was needed to reduce Secretarial discretion and to depersonalize the defense policy process in the manner described. Nor did the services claim any appreciable ability to supply the new competence—the competence of the professional cost analyst, of the professional operations researcher, of the professional "defense intellectual"—which was imperatively required to fulfill the intent of Congress. The truth is that the services themselves had long avowed their *in*ability to supply this type of expertise by sponsoring "think tanks" like the very RAND Corporation from which (with not a little irony) so much of the technical manpower for DOD would later come. Moreover the long-standing Congressional prohibition against a single chief of staff, against an armed forces general staff, and even against a joint staff numbering more than a few hundred officers[30] legally precluded the military from becoming the focus of centralization at the highest echelons.

If the starting premise of functionalism in the Comptroller's office looks to depersonalization of the decision-making process, the conclusion squints in just the opposite direction. Efficient administration, in view of the admitted default of the military to supply needed specialized competence in the early 1960's, necessitated the creation of a "civilian general staff." And long-standing statutory prohibitions on military ascendancy to a "power elite" status legally ratified this development. The upshot was that depersonalization in the sense of substituting analysis for intuition led automatically and altogether defensibly, from both the administrative and the constitutional standpoints, to a vastly increased personalization of the DOD policy process in terms of civilian control.

How does this development square with the overall American constitutional tradition? What does it portend for the military departments' specific constitutional responsibilities in the future?

a constitutional viewpoint on the changing management role

Of the two perspectives from which the changing management role of the military departments can be considered, it is the constitutional point of view, not the administrative, which provides the widest range of insights into DOD trends. For the two themes underlying both of the administrative trends (centralization and functionalism) are constitutional both in their nature and in their justification.

One theme is civilian control—civilian control, moreover, which has increased in step with the increases in the size of the American defense establishment that have been rendered necessary by the modern preparedness imperative. (The justification for this development, incidentally, will receive more detailed analysis in the continuation of this paper.)

Of more immediate interest in connection with the great debate over DOD policy is the conclusion in regard to the second theme. It is that, paradoxically, the new administrative activism in OSD has occurred because of a signal decrease in the constitutional power (in the sense of a decrease in administrative discretion) of the Secretary of Defense. In the same sense it can be said that the analogy of the cask tapped at both ends applies as much to OSD as it does to the military departments. Secretarial discretion in determining the ends of American security policy has been limited considerably by Congress. Thus the mandatory grants of power in the 1958 amendments may be regarded as possible harbingers of an active reassumption by Congress of its historic primacy in all nonoperational areas of American defense. And the Secretary's vigorous compliance with the 1958 Congressional mandates has similarly reduced his discretion in determining the means whereby security objectives are to be achieved, this through OSD's adoption, to an unprecedented degree, of the decisional tools of matter-of-fact positive science.

The relevant constitutional theory goes far to clarify the debate over DOD administrative policy. The "conspiracy" theory, which holds the McNamara administration guilty of usurpation, overlooks the fact that the real variables in the transfer of power from the military departments to OSD were not personal motive or "monarchical" designs but rather the economic principle of division of labor (the line/staff dichotomy) and the constitutional principle of civilian control. At the same time, the "savior" theory does no greater justice to the historical record than the "conspiracy" theory does to American constitutional doctrine. Final approval of centralization and functionalism came in 1958—from Congress in the express words of the National Security Act amendments, not from the President or from DOD. And it came, moreover, at the behest of the Eisenhower, not of the Kennedy, Administration.

United States Air Force Academy

Part II, "Civilian Control, the Preparedness Power, and the Twilight of Congress," will appear in the following issue.

Notes

1. See Hanson Baldwin, "The McNamara Monarchy," *Saturday Evening Post*, 31 March 1962, pp. 8-9.
2. See, for example, Theodore H. White, "Revolution in the Pentagon," *Look* magazine, 23 April 1963, pp. 31-44.
3. Gen. Thomas D. White, USAF (Ret.), "The Military Voice is Dangerously Weak," *Newsweek*, 31 December 1962, p. 10.
4. A case in point is Hanson Baldwin's column, "The Skybolt Affair," *New York Times*, 26 December 1962, p. 4.
5. "Pentagon Civil-Military Tuition Increases," *Aviation Week and Space Technology*, 15 October 1962, p. 26, and other sources cited therein.
6. Col. William G. McDonald, "The Changing Management Role of the Military Departments," *Air University Quarterly Review*, XIII, 4 (Summer 1962), 55.
7. W. Barton Leach, letter to Dr. Murray Green, Research & Analysis Division, Department of the Air Force, 9 October 1963.
8. U.C.M.J., Section 90, par. b.
9. See 50 U.S.C. 401 and 10 U.S.C. 123-125, 131-137, for relevant portions of revised 1958 amendments.
10. See the words of the Supreme Court in the following cases: *Gibbons* v. *Ogden*, 9 Wheat. 1, 197 (1824); *Lochner* v. *New York*, 198 U.S. 45, 57 (1905); *Trop* v. *Dulles*, 356 U.S. 86, 103 (1958).
11. U.S. Constitution, Article II, Sections 2 and 3.
12. *The Collected Works of Abraham Lincoln*, IV (Rutgers edition, 1953), pp. 427-430.
13. Full text appears in the *New York Times*, 4 April 1958, p. 6.
14. Capt. John C. Ries, USAF, "The Unification of the Armed Services," unpublished Ph.D. dissertation, University of California, Los Angeles, 1962. This work covers the background. See Chapter X and especially p. 275.
15. 10 U.S.C. 141, e.
16. U.S. Constitution, Article I, Section 8.
17. 5 U.S.C. 171, c (6); repealed and re-enacted in substance, 10 U.S.C. 125, a.
18. 10 U.S.C. 101. See par. 28.
19. 5 U.S.C. 171, a (c) (1); repealed and re-enacted in substance, 10 U.S.C. 125, d.
20. 104 *Congressional Record*, Part 8, p. 11,033.
21. 5 U.S.C. 171, c (b) (1); repealed and re-enacted in substance, 10 U.S.C. 135, c.
22. See "Department of Defense: Brief of the Organization and Functions," Administrative Services Division, Office of Administrative Assistant to the Secretary of Defense, April 1962, pp. 9-10.
23. Samuel P. Huntington, *The Soldier and the State* (Cambridge, Mass.: Belknap Press, 1957), p. 439.
24. Charles Hitch and Roland McKean, *The Economics of Defense in the Nuclear Age* (Santa Monica: The RAND Corporation, 1960).
25. "Planners for the Pentagon," *Business Week*, 13 July 1963, p. 75.
26. *Ibid.*, p. 80.
27. Quoted by McDonald, *op. cit.*, p. 48.
28. Pp. 54-55.
29. P. 80.
30. 50 U.S.C. 401; 10 U.S.C. 143, a.

LESSONS FROM COUNTER-INSURGENCY OPERATIONS

Colonel David L. Evans III

COUNTERINSURGENCY has more direct identity with political factors, has more difficulty with objectives, and is influenced more by the total environment than any other form of military conflict. It must deal with nasty, brutish business, in which every case is likely to be different and for which neat and tidy rules are apt to be meaningless, or at best applicable only in general terms. Military training alone does not adequately prepare military personnel for the conduct of successful counterinsurgency operations. The application of force is fundamental in COIN, but, in addition, the employment of knowledge and arts from other fields also is required if the problem is to be solved. At every echelon in the field the intellect and the humanities are just as important as technology and firepower.

In the initial stages of an insurgency the insurgent forces, their organization, support, and even their objectives are frequently difficult to identify. Government forces may be attacked and widespread terrorism launched by the insurgents. Nevertheless there is a tendency on the part of political leaders to ignore or discount the presence of an insurgency in their country as a reflection on their leadership. This failure to recognize an insurgency permits the movement to gain momentum and popular support, discredits established political leadership, and makes the government's task to meet the insurgency even more difficult. New leadership and new policies to meet the challenge may be required. For example, the Huk insurgency in the Philippines was not contained until Magsaysay gained popular support, overcame corruption and lethargy, and undertook an enlightened and dynamic campaign to eliminate the threat, which he did with classic success. Motivation of government leaders to meet the insurgency with resolution may be required from an outside power, e.g., the Truman Doctrine with respect to the Greek insurgency of 1948 and 1949.

political factors

Once a government recognizes the need for counterinsurgency operations and they are launched, they are singularly marked by political restraints. There are understandable reasons for these controls. First, an insurgency is most likely to develop in a state which is not highly developed and centralized and in which the various ethnic groups and factions have not been assimilated. Consequently, determined actions by a leader to quash the insurgents may not be supported by factions vying for his position.

Second, there is the question of how loyal the nation's police and armed forces will be to a leader embarking on determined COIN operations. A leader will be extremely reluctant to delegate authority to conduct operations, even at the platoon level, if that authority is misused and directed in a manner to embarrass the central government. History abounds in military leaders who were politically ambitious and used their authority, delegated or assumed, to their own political ends. The loyalty of military leaders to central authority is seldom absolute. There is no question of military loyalty in the recent histories of most Western powers (exceptions include the French OAS during De Gaulle's resolution of the Algerian problem), but the professionalism that embodies loyalty in military and police forces is difficult to develop in nations still in the process of resolving their national identity. Military loyalty was a source of great strength to Magsaysay in the Philippines. In Egypt the armed forces themselves were insurgents against King Farouk in 1952 so that Farouk had no chance to counter the coup d'état with force.

In the Republic of Viet Nam (RVN), loyalty investigations on military personnel selected for technical training in the United States are difficult, and the delays in filling quotas have adversely affected the military capabilities of the Vietnamese armed forces. After some disgruntled Viet Nam Air Force pilots bombed the Presidential Palace in Saigon on 27 February 1962, orders were issued limiting the types of air ordnance the VNAF could employ against the Viet Cong, and each taxiway leading from the parking apron to the runway at VNAF airfields was encumbered with a gate and a guard. Who was guarding the guards is unknown. The manpower expended on measures to improve loyalty and the limitations on air ordnance merely detracted from capabilities, already strained, for employment against the Viet Cong.

A third reason for political restraints on COIN operations has already been touched on, namely, the difficulty of identifying insurgent forces. Intelligence may not be available on who, specifically, the insurgents are, what groups they are from, or even where they come from. They probably wear no uniform or distinguishing insignia. They may attack villages, kidnap young men for indoctrination, collect taxes, and then melt into the countryside. Pursuit by police or military forces may be fruitless. Out of frustration, military operations could be launched against unidentified and innocent people. If not identified as insurgents, the casualties inflicted by any operation could be very damaging to the central government, alienating popular support. Total and indiscriminate repression of insurgents—as the French practiced it in Madagascar in 1947 and the Russians in Hungary—does not solve political issues; it only delays them. Care must be exercised, therefore, to develop adequate intelligence on the insurgents and to mount deliberate operations against them only. The shotgun technique will be counterproductive.

Despite care in the selection of targets and the development of tactics against insurgents, the very nature of COIN warfare (mobility, hit and run, ambush, night operations, etc.) will result in casualties to innocent people. The insurgents do not care, but the government must ensure that controls are established to keep losses to the innocent at a minimum. Political controls exercised at the national, provincial, and district level will compound military planning difficulties, affect timing, and limit the flexibility of military forces to react effectively to situations created by the insurgents. Experience has shown that this will be particularly true in the early stages of accelerated COIN operations. Once the pattern and strategy of COIN operations have been established, trust has been gained in the armed forces (a couple of victories will do wonders in this regard), and liaison and communications systems have improved, political control will diminish to a workable level. It never diminishes enough, however, to provide military leaders with the tactical freedom exercised in more traditional wars against a more identifiable enemy.

Fourth, when insurgent successes create a crisis in the likely tenure of the central government and outside assistance is required, additional political restraints come into play. To preclude direct involvement by the power providing the assistance, an indirect label is placed on all assistance, which usually takes two forms: professional advice and materiel. There is good reason for labeling outside assistance as indirect: it is the authority of the established state that is being challenged, not the authority of the outside power providing the assistance. In the Republic of Viet Nam direct military involvement by U.S. military forces probably could eliminate the Viet Cong insurgency in relatively short order (assuming that Red China would not intervene directly, in turn). However, such direct U.S. intervention would place the RVN government in an untenable position—without face, without substance, with the reputation of an impotent vassal, and with the basic political problem still unresolved.

The central objective of COIN operations in RVN is to establish an environment of national stability that will permit the orderly attainment of healthy political ideals and economic development. The central government of the established state being challenged—not the assisting power—has the final responsibility for the conduct of COIN operations. When the government fails to bear its responsibility, when it loses control and sight of its objective, only then does an outside power have good cause to intervene directly. When this does happen, the political problem has changed, and a much different game has to be pursued. The indirect label on outside assistance to a central government is required, therefore, to provide substance to the conduct of COIN operations and create assets that will be valuable in both the short and long term.

The military factors peculiar to the conduct of COIN operations by the U.S. are numerous, but COIN does not impose an entirely new or distinctive set of problems and concepts over and above those encountered in wars higher on the intensity scale.* As in other types of wars, COIN military operations must establish an environment for and contribute to more effective operations in nonmilitary areas.

peculiarities of COIN

Certain military factors are peculiar to COIN operations. Most importantly, we can expect that the vast majority of COIN operations by the U.S. will be conducted in an allied environment. U.S. personnel will be injected into the various levels of the local military establishment. Although a Military Assistance Advisory Group (MAAG) may have operated for years in the country to develop, equip, and train the local armed forces along lines similar to U.S. military concepts, the local armed forces will have largely retained their own procedures, organization, and basic national characteristics. We may try, perhaps subconsciously, to mold the armed forces of a new and developing nation to our likeness, but it is virtually impossible to do so. The basic resources, the heritages, and the problems are simply different. U.S. military advisers must adjust themselves individually and personally to this allied environment. The objective is not to conduct operations for the allied nation but to advise, recommend, persuade, perhaps cajole and charm its leaders at the various echelons to do things in the most effective way. The American propensity for "taking charge" and "pressing on" to an objective that may be fairly obvious must be subjugated and impatience curtailed. The adviser is a purveyor and a salesman for the professional way to conduct COIN operations. As a professional he must be capable of intellectual flexibility. He must gain intimate knowledge of the political personalities and factors of his assigned region, its geography, climatology, ethnic factors, economic patterns and problems, history and hatreds—plus, of course, the enemy.

It is highly probable that in most COIN situations the U.S. will deploy a military capability, in addition to advisers, to augment the local armed forces or to fill a void. For ex-

*The comments and observations herein have been prepared with all services in mind. If significant factors vital to Army, Navy, and Marine Corps COIN operations have been ignored, it has not been by design.

ample, radar coverage and a tactical air control system, complete with communications, was a prime requirement in the Republic of Viet Nam during December 1961. This radar coverage had to be installed by U.S. personnel and integrated into the Vietnamese structure. Initial operations, particularly in the technical aspects, had to be conducted by U.S. personnel because of a shortage of qualified Vietnamese personnel. But the radar system was an integral part of the Vietnamese structure, and an aggressive in-country training program was established. The technique of "training while operating" has proved to be very effective in this instance, as elsewhere. But success depends upon convincing the allied military forces of the real value of the military capability the U.S. may have deployed, enlisting their eager participation, identifying the system as theirs, and in training them to use it effectively. Here again, in the operational support area, the American tendency to take complete charge must be subjugated and allied forces utilized to the maximum of their capabilities. Ideally, after a period of training, U.S. personnel should be withdrawn and the deployed equipment left completely in allied hands.

An obvious peculiarity of COIN operations is their relatively small scale. The enemy is elusive, and his general tactic of hit and run by units seldom larger than company strength increases his elusiveness. A map depicting areas under firm, friendly control, day and night, most probably will look like a bad case of measles. Offensive operations against the insurgents may be planned and conducted with admirable precision, only to find that the enemy simply is not there. In COIN operations there is no neat main line of resistance. Areas believed to contain insurgent concentrations and supplies can be swept clean and very little of the enemy found.

All these frustrations add up to an unusual requirement for intelligence. Intelligence is vital to all military operations, but in COIN it is difficult to come by. In addition to standard techniques, ingenious methods of collection are required. Intelligence processes must capitalize on in-country systems and exploit local capabilities. Intelligence, not chance, is the key to contacting the enemy, and without contact military operations cannot contribute significantly to the defeat or attrition of the enemy. Intelligence must unveil tactical opportunities and, most importantly, must provide a system of target selection and identification with acceptable reliability. By doing so, intelligence will resolve a very acute political problem already discussed.

The final peculiarity of COIN operations to be mentioned is the difficulty of measuring the success of these operations. How do you know who is winning? The insurgent knows that he has won when the central government collapses and political authority (partial or complete) passes or is given to him. In most COIN operations, as in Viet Nam, the counter forces will be conducting a campaign of attrition. Insurgent casualties may be counted and prisoners interrogated, but the enemy may carry away his dead, and prisoners may be so ignorant or so indoctrinated as to be of minimal value. The number of insurgent attacks (categorized by size, intensity, and location) may be calculated and trends established. Weapons captured, weapons lost, and friendly casualties may also be compiled for statistical analysis. Geographical area controlled is still another index. Reports may be received of enemy malnutrition, lack of medical supplies, and shortages of weapons and ammunition. These may be followed by other reports that Communist governments are increasing assistance to the insurgents. The point is that success can be measured, more often than not, only by subjective judgment. The insurgents probably will never be entirely eliminated—there are still Communist terrorists in Malaya and a few Huk bandits in the Philippines.

military factors

Frequently unpublicized in COIN operations are those military factors which have to be considered in any military undertaking. Those vital problem areas that must be adjusted to the COIN situation include logistics, communications, air defense, tactical reconnaissance, and command relationships. Although the scale of COIN operations may be small and their nature primitive, effective control and conduct of COIN operations demand the development of a degree of sophistication not likely to have existed in the country prior to the commitment of U.S. assistance.

Logistics. Logistics is obviously a key element. In Southeast Asia logistic support has been provided efficiently by adding extensions to the considerable logistic system already in-being in the western Pacific. In other areas of the world, such as Africa, COIN operations may require the establishment of a complete logistic system from major sources of supply in the U.S. or Europe.

Within the country or area of COIN operations, logistics can be a problem of major proportions. The existing system will be only as good as the economy of the country and therefore may be inadequate to handle the increase imposed by military operations. In the Mekong Delta area of Viet Nam there are thousands of miles of canals but only a few miles of roads; in other areas of Viet Nam where there are good roads, large segments of them are subject to insurgent attack and control. The deployment of U.S. military capability to provide an in-country logistic system has been required in Viet Nam and is likely to be a requirement in future COIN operations. This requirement will be primarily airlift, to operate in and out of marginal airfields. Thousands of passengers and tons of cargo will be carried—paratroops, families, the sick and wounded, ammunition, rations, chickens, pigs, and other items (some odoriferous) peculiar to the society and forces being served.

Special COIN forces and weapons will place new and unforeseen burdens on existing logistic systems. Consumption of POL will multiply, and distribution problems will be compounded by the tactical situation. New equipment and weapons may be introduced which heretofore had not been in the theater. New and expedited supply channels must be established for unique equipment and spare parts that may be in short supply worldwide. Our logistic systems have generally done extremely well in recent experiences, but only as a result of laborious accommodation.

Communications. Another vital area is communications. Communications in and out of the country of COIN operations may be inadequate, requiring additional, more reliable systems. Within the country or area, point-to-point communications, which are absolutely necessary to the successful conduct of COIN operations, probably will be totally inadequate at the outset of any real challenge posed by insurgents. One of the first manifestations of U.S. assistance in any COIN situation should be the determination or provision of adequate tactical communications facilities of high reliability and redundancy.

Communications entails more than point-to-point voice and teletype systems. Air-ground communications—airfield control towers and systems for aircraft to communicate with outposts, ground units, villages, and even district political chiefs—will add immeasurably to operational effectiveness. Air navigation aids, such as mobile ADF, VOR, TACAN, and GCA, will probably be required to augment limited in-country resources. Even ground power generators may be necessary to ensure dependable power when it is not available from domestic sources. Finally, a complete radar system may be necessary for air traffic control, all-weather operations, and air defense.

Air Defense. An air defense capability in COIN operations is one that might normally be considered superfluous. It is submitted, however, that tactical fluidity in COIN demands that an air defense capability at least be arranged for, if not deployed. To be without air defense could provide the enemy, and the Communist power supporting him, an opportunity to make moves to turn the course of the war. There is nothing in the rules of insurgency that would preclude the enemy's acquisition and use of an air strike capability or his use of aerial resupply. Communist airlift of equipment, supplies, and personnel into Laos in 1962 made a very significant contribution to the Pathet Lao successes that have, so far, resulted in the neutralization of Laos. Enemy air commitment need not be large or sophisticated to be effective. His air strikes may be only in the form of harassments, but their political and morale effects on the population of a developing nation may be very significant and particularly damaging. In COIN operations a modest air defense capability can be extremely valuable in several respects: to assist in establishing air traffic control and contribute to air superiority; to deter the enemy from embarking on any air operations; and, if he does, to meet the enemy incursion without delay, thereby minimizing its effectiveness.

Reconnaissance. From the beginning of any threatened or real insurgency, there will be a requirement for tactical reconnaissance. As a prime system for collecting reliable intelligence, reconnaissance may be employed to assist in the initial U.S. decision whether or not to commit forces, advice, and materiel. After COIN operations are undertaken, with or without other U.S. assistance, a continuing tactical reconnaissance operation is likely. Tactical reconnaissance can serve as a manifestation of U.S. interest and may be the only U.S. military commitment. U.S. tactical reconnaissance forces have a professionalism and a readiness that is not normally available in the forces of a nation where insurgency is threatened or in process. A military assistance program may resolve much of this deficiency for certain friendly nations. Nevertheless, for the present, the burden of tactical reconnaissance efforts falls on the U.S.

Command Relationships. Finally, U.S. COIN operations impose special problems on command relationships which are seldom highlighted to such a degree in wars of higher intensity. In COIN operations day-to-day military activities have a direct and interlocking relationship to political, economic, psychological, and other activities. Inaccurate maps, ill-defined borders, and hypersensitive neighboring countries (which may be neutral or even an insurgent sanctuary) may result in operational restrictions to avoid overflight of certain areas. Even if the personalities are capable, a usual MAAG organization will not suffice to exercise operational control of units committed to support or conduct COIN operations. There may be a provincial desire to overcentralize command channels and make a COIN operational commander directly responsible to the Joint Chiefs of Staff, thereby circumventing any unified commander in whose geographical area the operation otherwise falls. Interest in COIN operations may be inordinately high level, and more than adequate guidance may be forthcoming for the conduct of COIN operations. Nevertheless there is no reason why regular command channels should not be followed and the technique of a subordinate unified commander or joint task force employed to control the U.S. military effort.

There may be special U.S. forces and capabilities deployed to assist or conduct COIN operations. In the early phase of an insurgency, or when it is threatened, U.S. Army Special Forces and USAF Air Commandos may be the only forces committed—to train, organize, and motivate local armed forces in the most effective measures of COIN operations. If the insurgency increases in intensity and additional forces are required, however, the heaviest requirement will probably be for more traditional forces, such as helicopter companies, troop-carrier squadrons, communications and logistics units, and tactical fighter units. A great strength inherent in the in-being forces of the U.S. and in most of the forces of our allies is their adaptability for employment in a variety of situations. This versatility is sometimes overlooked, and efforts are expended to create at high costs and with minimal planning special units to perform special tasks, when these special tasks could be undertaken with relative ease by a unit already in existence and operational. It is recognized that there will be special situations, as in Viet Nam, which dictate a throwback to certain weapons and equipment long since phased out of the inventory. But this should neither set the pattern for the future nor preclude the use of existing units and recognition of their flexibility. In fact, use of existing units will provide a commander a much better capability to sustain any COIN operation; his training, support, personnel, standardization, flying and ground safety, and, above all, his control and staff problems will be minimized.

Command relationships also encompass problems of unilateral service interests and roles and missions. There is a tendency for these issues to become emotionally charged. COIN situations present opportunities for one service to "prove" or to "test" its concepts, but such activities have no place in the area or command if they interfere in any way with the conduct of the COIN operations. U.S. service rivalries in the field cannot help involving allied forces, and it is doubtful if they will understand or appreciate the issues. A French general has stated that French military successes in Algeria, aside from the ultimate political solution, were achieved "thanks to the teamwork between Army, Air Force, and Navy. I think this is the main lesson. Each one can keep his own uniform, but if you don't work as a real team there is no hope at all."

Paramilitary Missions. In the area of social, economic, and psychological COIN operations, military forces also play a vital but less-known role. Medical services and evacuation can be instituted in remote areas where they have never been known before. The military logistic system can be employed in harvest collection and food distribution, thus contributing to the economic viability of a developing ally. Allied personnel can be influenced to treat their civilian population with respect and without arrogance. When the people are made to recognize that their armed forces and police are their protectors and not their oppressors, national identity and goals will have been enhanced, attitudes against the insurgents will have been strengthened, and probably significant intelligence sources opened.

MILITARY OPERATIONS in a COIN environment cannot be expected to be simple and forthright. No other type of war poses such a difficult and elusive enemy, such frustrating restraints, and such interlocking relationships with political, social, and economic factors at every echelon in the field. Military objectives will be abstract, and progress toward objectives may be difficult to measure. There probably will be no victory or formal surrender to mark an end to COIN operations, however successful. The conduct of COIN operations is the lowest order of warfare and will be without traditional glory, but no less necessary if free societies are to be protected and maintained.

Cambridge, Massachusetts

Air Operations in Viet Nam

EMPLOYMENT OF TACTICAL AIR POWER IN COIN OPERATIONS

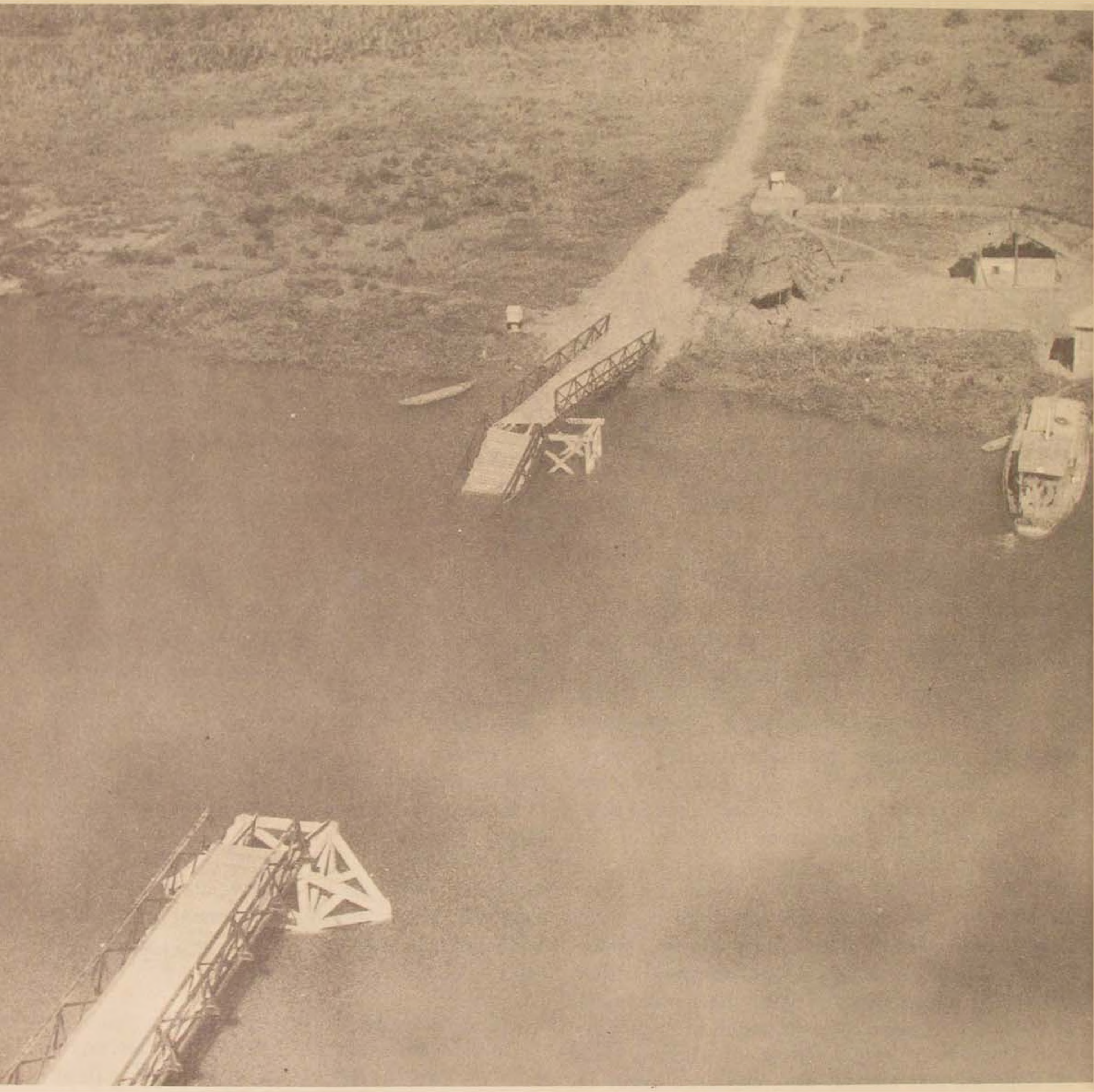
Lieutenant Colonel Andrew J. Chapman

Many excellent works have been published on counterinsurgency and guerrilla warfare in which the strategy and tactics of insurgent forces have been clearly defined. Generally speaking, however, the material is directed toward ground operations, which would lead one to believe that air power, at best, has only a minor role. Nothing could be further from the truth, as the operations in Viet Nam attest.

The war in Viet Nam by no means furnishes all the answers on the roles of tactical air power in coin warfare, but it does afford many valuable lessons. One of the principal lessons learned is that the classic roles associated with the employment of tactical air power are unchanged in coin warfare. The roles of air superiority, interdiction, close air support, and tactical reconnaissance apply in coin operations just as they do in any other form of armed conflict. Of equal importance among the lessons learned is that employment of tactical air power must be governed by many new rules of engagement which may be far more restrictive than any previously experienced. While we have always recognized the need to be flexible in our tactics, we can expect even greater demands for a flexible response because of sociopolitical considerations.

Primary in counterinsurgency operations is the necessity of winning the minds of the populace, both pro and con, and of separating guerrilla forces from the local population. The separation must be not only a physical separation but also a separation of sympathies if permanent results are expected. This principle was ultimately and effectively put into practice by the Second Panzer Army after a difficult winter in the Desna River region.

> It must be emphasized that in order to wage an effective antiguerrilla campaign the responsible leaders must be well acquainted with not only the physical aspects of the enemy force, but also they must fully understand the psychology of the indigenous population. This knowledge will enable them to establish a policy which the population will recognize not only for its effectiveness, but, what is more important, for its humane and just considera-



The government flag still flies over this small, remote Vietnamese outpost. The use of tactical air power and night flare aircraft has saved dozens of similar forts during heavy attacks by the Viet Cong.

> tions of the welfare of the local inhabitants. Guerrillas will starve without the support of the people.[1]

As this principle is applied to the employment of tactical air power, the utmost care and discrimination must be exercised in the selection of targets. Every precaution must be taken to guard against creating antagonism in the minds of the local population by the way tactical air power is employed. The need is to defeat the enemy, and air is the best way. Air and control inherently provide a discriminatory capability in the selection and destruction of targets.

In Viet Nam total air supremacy permits government forces the security and freedom of movement they now enjoy on the ground. It has already been demonstrated historically that air superiority is necessary before ground forces can take the initiative. In this respect COIN operation is no different from any other type of warfare. Without air superiority heliborne assaults would stand little chance of ever reaching the objective area, and airborne operations during daylight hours would be equally subject to complete failure. Therefore in COIN operations it is necessary to have in-being the capability to meet and defeat a potential air threat, even if it does not exist immediately following the outbreak of hostilities. The total air power, including SAC and TAC potential along with other strategic forces, forms part of the overall umbrella under which all forces operate freely.

The interdiction role in COIN operations does not differ, as far as principles and objectives are concerned, from any other interdiction operation. The difference that does exist is in the type of targets as compared to those of World War II and Korea. In the Vietnamese situation a truck convoy sometimes becomes a string of oxcarts or maybe an elephant. A storage or supply depot is a thatched or mud structure, and a concentration of troops may be no more than 20 or 30 guerrillas in their base camp deep in the jungle.

One of the major problems is to identify these targets and capture or destroy them. Positive identification of guerrilla forces before they fade away or merge with the population is very difficult. They inevitably wear native dress and are not readily identified as guerrillas. These factors make positive control of air strikes of the utmost importance to ensure that friendly people are not attacked.

Tactical air reconnaissance is one of the methods employed to locate suitable interdiction targets. Skilled photo interpreters can identify well-used trails leading into jungle areas where storage depots and training camps are located. This form of intelligence, coupled with ground information, pinpoints the enemy position. After information is verified and the strike request correctly processed, the mission is flown.

The process may seem involved, but it must be remembered that in this form of warfare there is no clearly defined bomb line. The battle area is fluid; it shifts and moves with the insurgent forces. Then, too, as pointed out earlier, there might easily be other considerations that would preclude an air strike on a particular target.

Many times it is not technically feasible for ground forces to mount an operation in known enemy areas. For example, in certain jungle or mountain areas it is impossible at times even for heliborne forces to get into an objective area. In some places two battalions of infantry may be swallowed up by the dense jungle, and enemy ambushes can easily eliminate a column of troops. Under these circumstances air strikes against known enemy positions in their so-called safe areas produce highly effective results. The British in Malaya exploited this tactic and were able to keep the insurgents constantly moving. To deny guerrillas a safe area is a serious blow to their effort. Like any other military force, they require rest and training areas as well as a place to regroup their forces. It is well known that an effective guerrilla force depends in large measure on high morale within the unit and that the destruction of their supplies can have a devastating effect on guerrilla morale. As their hardships increase their morale decreases in proportion, and more and more of those impressed into the ranks of the insurgents seek opportunities to defect. Interdiction has produced just these results in Viet Nam.

In general the close-air-support role functions along conventional lines in COIN operations, but some new twists have been added. Guerrilla forces will not normally stand and fight if they know they are outnumbered but will usually disperse and attempt to escape. Conventional ground forces are usually unable to cover all possible avenues of escape, but tactical aircraft directed by an airborne forward air controller can effectively do so. This tactic has been employed time and again in Viet Nam with excellent results.

Close air support at night for remote outposts or fortified villages is another method in which tactical air power is employed in Viet Nam. Working with a flare aircraft, the strike aircraft lends the added firepower needed to defeat the attackers or at least make them break off their attack. This application of tactical air power has meant for many outposts the difference between being saved and being overrun by the Viet Cong.

Truck convoys, trains, and even shipping on inland waterways are prime targets for guerrilla forces. Ambush of a convoy can produce valuable arms, ammunition, and supplies for the insurgents. However, strike aircraft covering a convoy inhibit guerrillas from initiating an attack. Should they be bold enough to attack, their chances of escape are practically nil, and knowing this explains why the Viet Cong have never attacked a convoy that was being covered by tactical aircraft.

Vietnamese Air Force pilots and USAF advisers prepare to man T-28 fighter-bombers for air strike missions in support of ground units engaging Communist Viet Cong forces.

There are many examples of Viet Cong respect for and fear of tactical air power. The case of Ap Bac, where tactical air was not used by ground forces, demonstrates Viet Cong potential when not confronted by tactical air/ground prestrike.

Another highly effective application of tactical air power in COIN operations is the use of aircraft equipped with loudspeakers to broadcast surrender appeals. This practice is not new to guerrilla warfare. The same tactic was used in the Philippines and in Malaya. Broadcasting surrender appeals over an enemy position that has just been struck by tactical aircraft can produce positive results.

An important fact to be considered in COIN operations is that guerrilla forces are usually made up of people indigenous to the area. The presence of foreign troops can easily produce an adverse reaction among the local population. As pointed out by Lieutenant Colonel Luis A. Villa-Real in his article "Huk Hunting":

> Foreign troops are certain to be less welcome among the people than are the regular armed forces of their own government. Local populations will shelter their own people against operations of foreign troops, even though those they shelter may be outlaws. For this reason, native troops would be more effective than foreign forces in operations against native Communist conspirators. It would be rare, indeed, if the use of foreign troops would not in itself doom to failure an anti-guerrilla campaign.[2]

In this respect there is an obvious advantage in using aircraft in antiguerrilla operations that require the use of foreign troops. Unlike ground forces, aircrews are not necessarily brought into close contact with the local population. The danger of alienating local people is thus greatly lessened by the avoidance of direct contact.

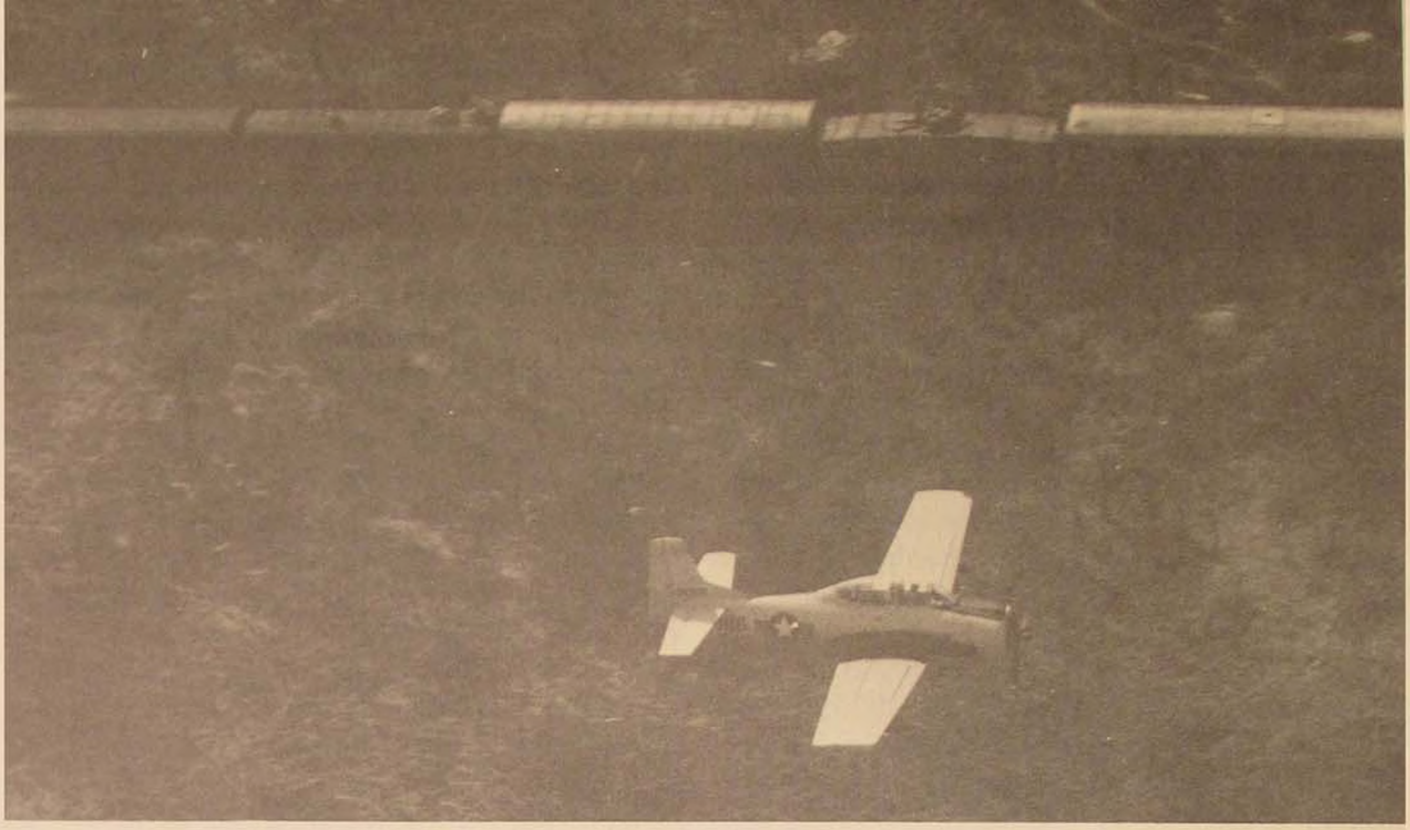
The operation in Viet Nam has reaffirmed one of the basic points in air doctrine: that the most economical and effective method of employing air power is by centralized direction and control. Time and again in Viet Nam there has been a need to shift air force resources to meet the needs of a changing tactical situation. The only way this could be done in a timely manner with the force required was through centralized direction and control. Even in a small COIN operation it is absolutely imperative that the top commander know where his air forces are at all times and know what can be made immediately available to meet his requirements. Also the decision-making process must not be impeded by layers of authority that must be penetrated before it is possible to react.

The tactical air control system in Viet Nam, patterned after the USAF concept, is proving itself by providing the flexible response necessary in COIN operations. The response certainly can be speeded up, though this acceleration is directly related to the problem of communications. We have always considered the ground request as belonging strictly to the ground forces. Perhaps in the future we might consider the possibility of relaying ground requests for air support over the communications net of the air liaison officer and forward air controller.

There are many facets to be considered in COIN operations concerning the types of weapons to be employed. It is necessary to be flexible enough to do the job regardless of what local conditions may dictate. Political factors as well as military may play a large part in determining what weapons will or will not be used. One of the most important things to know is the type of targets encountered in COIN operations. Normally they are soft targets, light structures and personnel. Weapons therefore must be of the type most effective against these targets.

In jungle areas and in mountainous terrain heavy general-purpose bombs and white phosphorous have proved very effective. The bombs should be fuzed so that they will penetrate the jungle canopy and burst near the jungle floor. Delay fuzes, mixed with instantaneous fuzes, will deny the enemy use of an area and even discourage his return. In open areas, such as rice paddies or mangrove swamps, fragmentation bombs and guns designed on the Gatling principle are needed. Rockets are an effective (though a very expensive) weapon against personnel, but they are not always effective against light structures. The high velocity of rockets at times results in their going right through bamboo or grass structures without exploding.

Weather, terrain, and of course the type and



A Vietnamese Air Force T-28 flies aerial escort through Viet Cong-infested territory. Prior to tactical air escorting of government supply trains, most rail shipments were raided by guerrilla forces.

A T-28 bombs and strafes a target pinpointed as a Viet Cong staging area by VNAF Forward Air Controller aircraft.

intensity of enemy ground fire have a great deal of influence on weapon delivery techniques. There is positive evidence that the Viet Cong have come to fear tactical aircraft and that they have taken definite steps in developing countermeasures. Even though they possess only crude weapons and few that are automatic, they have the capability of directing lethal, accurate fire at low, slow-flying aircraft. It should be kept in mind that the survivability factor of our aircraft is inversely proportional to the time spent tracking a target.

Skip bombing methods should be accompanied by suppressive fire, either by the attacking aircraft or by supporting aircraft. A level-bombing and glide-bombing capability is needed to offset weather and terrain factors that might prevent a dive-bombing attack. Smoke screens used in tests to screen helicopter landings have proved very effective. They can also be employed to screen airborne assault landings or paradrops.

Much of what has been covered may not appear to be new or revolutionary in the employment of tactical air power. Basically there is not too much change, for the principles already proved are being proved again. There are minor differences in tactics, however, as a result of the local situation.

There are applications of tactical air power that need to be studied, and additional emphasis is needed in the area of the entire weapon system for COIN operations. The fact that the enemy may attempt to shoot down an aircraft with a bow and arrow does not in any way diminish the need for a first-line aircraft. Outdated equipment may serve as a stopgap or interim solution, but new developments are needed in the face of a continuing threat.

As stated earlier, the operation in Viet Nam will not provide all the answers to COIN operations for any service. The lessons we have learned should be studied with the experience we have developed to determine their future application. We must consider seriously the question of air superiority and be assured that we are able to meet any potential threat from the air in a COIN operation. Should an enemy ever be capable of mounting a substantial air effort from a safe area, as in the Korean War, ground operations, including heliborne assaults, would need to be seriously reevaluated.

Interdiction of the enemy's resources will continue to be a major role for tactical air power, for it is by interdiction that the battle is carried to the enemy in a way that reduces his capabilities the quickest. We must continue to concentrate on a close-air-support capability and on weapon systems that will get to where they are needed in the minimum time possible. Finally, we must strive to keep the system we have for centralized direction and control working at peak efficiency to ensure immediate response of tactical air power wherever and whenever it is needed.

JAOC, Tan Son Nhut Air Base

Notes

1. Ernst von Dohnányi, "Combatting Soviet Guerrillas," *Marine Corps Gazette*, Vol. 39, No. 2 (February 1955), pp. 50-61.

2. Lieutenant Colonel Luis A. Villa-Real, "Huk Hunting," *The Army Combat Forces Journal*, Vol. 5, No. 4 (November 1954), p. 36.

TACTICAL AIR COMMUNICATION NEEDS IN VIET NAM

CAPTAIN RUDOLPH JOGANICH AND
1ST LIEUTENANT GABRIEL A. PONS

Our original plan was to be lowered by rope from an H-34 to the Mohawk crash site; however, two H-34's had already crashed in trying to hover over the dense mountain jungles. Rescue officials decided the risk was too great so we were lowered at Mang Buk, a small mountain village near the crash site. Space was limited, but we had to set up radio communications to coordinate rescue operations. An American and a Vietnamese were somewhere in the jungle, and our task was to get them out before the Viet Cong got to them.

SO READS an extract from an American Contingency Communications Team's official mission report dated 20 March 1963 in the Republic of Viet Nam. There are many similar reports on file in Viet Nam, all pointing to the same thing—a need for communications in remote areas. Communications where none existed before. Communications where ingenuity, determination, and plain guts are the programmer's status codes. Communications where new concepts of deployment and equipment requirements are born every day.

In their defense and counter operations against the Viet Cong insurgents, the Vietnamese air and ground forces maintain contact through a central tactical air control system.* The backbone of the communications system, a tropospheric scatter network, is not without limitations, so that a fresh look at communications equipment needed in guerrilla warfare as fought in Viet Nam or any similar locale may well be in order.

Under existing concepts of close air support, the ground units make known their need for air support to the parent division headquarters. Here the request for close air support is evaluated and either approved or denied. At this level an Air Force air liaison officer (ALO) is assigned to advise the division commander on the tactical application of air power. In addition, the ALO acts as the coordinator for air sorties allocated by the Joint Air Operations Center (JOAC) or the Air Support Operations Center (ASOC) to the various Army units. Once aircraft are en route to the targets, they are directed in to targets by a forward air controller (FAC), who is with the ground units that originally requested the air support. The FAC must have totally reliable communications back to his ALO and ASOC and with the aircraft he is directing. Without such communications the mission is hopelessly lost. In Viet Nam the jobs of the ALO and FAC are complicated by language barriers, noncompatibility of ground and airborne equipments, and by the cumbersome multichannels in the ARVN Air Request Net before approval for close air support is given. It is under these conditions that close air support must be flown.

In guerrilla warfare, the fact that operations are conducted in remote areas away from fixed facilities requires that there be a communications link between the last fixed facility and the area of operation. To do its job, the ancillary communications system must be designed accordingly.

- Terrain demands that the system be man-packed.
- The hit-and-run tactics of guerrilla war demand that the system have a reaction capability of minutes.
- The system must have complete flexibility to operate in all standard frequency environments.

*See "Tactical Air Control in the VNAF," *Air University Review*, September-October 1963.

In Viet Nam the terrain ranges from swampy rice fields in the south to mountain jungles in the north, and roads are scarce in both. This fact limits the effectiveness of vehicle-mounted systems. The FAC working with ground units must be able to carry his own system with him under any terrain conditions. In actual rescue missions in Viet Nam, bulky radio equipment had to be carried for hours through dense jungles so that communications could be established from the crash site. Here time was of prime importance.

The reaction capability of organizations with the prime mission of providing mobile air/ground communications is too slow to keep up with Viet Cong hit-and-run tactics. Communications packages must be in the hands of the users and immediate field commanders for quick deployment to whatever area demands support. A depot located hundreds of miles from the operation area causes too much delay. By the time the equipment is loaded, flown to the combat area, set up, and on the air the Viet Cong has long since gone. Or the downed aircraft has been stripped of its premium ordnance and armament and perhaps a crew member left dead.

The nonstandard configuration of radio systems in different service aircraft and ground units is also a problem. It is paramount that any communications system be capable of the rapid interchange of information with any or all units, airborne or ground. Transmission of plans, changes to them, or a means of bypassing cumbersome air-request channels demands a point-to-point capability. The control, coordination, and direction of aircraft require an air/ground environment, FM, VHF, and UHF, depending on the airborne configuration.

The three general design criteria lead to thoughts of existing on-the-shelf equipment. There is none with all three features of portability, ease of operation, and an all-environment capability in an "all-in-one" package. There are existing equipments that provide some of the desired features, but these either are too cumbersome for field deployment or require a maze of support items. In Viet Nam a quick-reflex, point-to-point, single-sideband radio capability is available with an excellent transceiver unit, but the set was designed to sit on a ham operator's desk. The unit itself weighs about 60 pounds, but the support antenna system and power unit weigh about 400 pounds.

The entire concept of a contingency communications capability is to provide any user in a tactical environment with a reliable communications package that can be taken anywhere by one man. The equipment must be flexible enough to cope with any requirements for radio contact within a 75- to 100-mile radius for point-to-point contact and for all air/ground requirements up to 25 miles. To fill this bill the equipment must take the form of a single unit, be back-pack, and operate in the FM, VHF, UHF, and HF single side bands. The user must be able to go on the air with a minimum of installation and respond to any change in environment by turning a knob or flipping a switch.

The requirements which have become obvious in Viet Nam are applicable to any similar situation anywhere else in the world. The military/civilian teams of designers and users must think in terms of a back-pack set for use under the most adverse conditions. Transistors, printed circuitry, and efficient lightweight power packs must be incorporated into design. And again, modern technology must create efficient systems to be used in primitive environments worldwide.

THE NATURE OF guerrilla warfare has generated requirements for a new communications capability in the form of new equipments and concepts of use. The tactical air control system needs a highly portable communications capability to provide reliable communications to the lowest levels. The concept of contingency communications must be employed to provide an immediate response to any needs of the operator in a tactical environment. The lack of present resources to provide this response must be corrected in the form of an "all-in-one" radio set. When these points are accepted and translated into hardware, then the tactical air control system will be able to extend itself to the remotest village or outpost in need of close air support, in Viet Nam or anywhere else in the world.

1964th Communications Group

RECONNAISSANCE IN COIN

LIEUTENANT COLONEL W. C. PORTER AND
MAJOR W. G. VON PLATEN

AIR POWER, to be effective in the guerrilla war now going on in Viet Nam—or indeed in any counterinsurgency war of the future—depends upon the collection of accurate and timely combat intelligence regarding the insurgent forces. This critical need must be met through aerial reconnaissance, both visual and photographic, and supplemented where possible by human, documentary, or other technical intelligence data.

In the past, aerial reconnaissance involved a variety of sophisticated equipment and aircraft searching out readily identifiable targets or activities. Large industrial complexes, lines of communications, military storage depots, military training areas, airfields, and a defined ground order of battle were the usual targets. Many collection devices were used to gain information about the enemy for the purpose of launching a strike force to disperse or destroy his warmaking potential.

Today in Viet Nam, however, we are faced with a different type of enemy—Viet Cong guerrilla bands, widely dispersed, operating from few, if any, significant installations. The Communist Viet Cong travel by night in small groups, dress like the local inhabitants, and hide out in swamps, jungle forests, or in small, remote villages where they commingle with the local populace. As a matter of fact, in the vernacular of U.S. officers and men acting as instructors and advisers to the Viet Nam Air Force, "It's impossible to tell the good guys from the bad."

Although the Viet Cong have established arms

Vietnamese Air Force reconnaissance pilots pay close attention to remote structures, possible supply storage points in Viet Cong-controlled territory.

factories, hospitals, training areas, and base camps, seldom are these installations more than a few simple structures, widely dispersed and usually well hidden in densely foliated regions. The problems inherent in gathering adequate, accurate reconnaissance data under these circumstances are obviously manifold. Jungle cover and rapid movement of guerrillas make positive target identification extremely difficult. For instance, in the Republic of Viet Nam the jungle canopy is at three levels: tops extending to 200 feet; a middle level at about 50 feet; and a ground cover of bamboo, mangrove, or other scrub brush, high enough to provide a hiding place for men. Visual and photo reconnaissance usually disclose jungle, rice paddies, villages of thatched huts, or small groups of people. The resulting difficulties in reconnaissance make maximum precautions necessary to avoid inflicting casualties on friendly forces.

Since the more conventional enemy targets for aerial reconnaissance do not exist in Viet Nam, the principal targets must necessarily be the insurgents themselves and their immediate support. Aerial surveillance has forced the Viet Cong to modify their resupply activity. No longer are jungle trails, way stations, and rest camps safe areas because aerial reconnaissance has provided a means for detecting immediately any change in the environment. Increased and improved aerial surveillance, together with the increased strike capability of the Republic of Viet Nam Air Force, is making it more and more difficult for the Viet Cong to hide their activities. They are being forced to move continually from site to site to prevent discovery.

Thus it has developed that the basic photograph in counterinsurgency reconnaissance is the area-coverage, large-scale vertical. The target area for such reconnaissance may be identified as the result of an insurgent proclamation of control over an area, by the high incidence of sabotage and armed attacks, by the need to locate and evaluate suitable helicopter assault landing or paradrop areas, or as the result of a requirement to confirm intelligence from another source prior to air-strike decision. Large-scale, vertical, area reconnaissance is complemented by visual crew reconnaissance, which is invaluable in photo interpretation. Handheld, crew-operated cameras can add oblique support to the basic vertical photography.

Because of the "jack-in-the-box" tactics employed by the insurgents, each aircrew on a tactical mission can contribute to the critically essential reconnaissance mission. Their visual sightings are also effective and relatively cheap supplements to the intelligence gained from the basic reconnaissance vehicles. Care must be exercised, however, to ensure that casual reconnaissance of low value does not overtax the capacity of the reconnaissance technical resources.

The selection of a single reconnaissance vehicle to provide effective intelligence support for COIN operations is complicated by a number of factors. The extent of air opposition, while not applicable to the present situation in Viet Nam, must be considered in future COIN operations. Moderate to severe ground fire from small- to medium-caliber weapons discourages the use of relatively slow reciprocating-engine aircraft for large-scale photography. On the other hand higher performance aircraft require elaborate support and a ground environment that is not readily available and could be developed only at great cost. The cost might well exceed the resources of the counterinsurgency force. The all-important requirement for timely intelligence and quick reaction may dictate operation from austere bases in forward areas. These and other factors—climate, terrain, technical capability of the COIN force—require careful evaluation and may result in selection of more than one reconnaissance vehicle.

Progress made toward resolution of the numerous reconnaissance problems cited results in a steady flow of vital and rewarding intelligence on film which must be subjected to processing and interpretation.

Here again, timeliness and accuracy are paramount. And again, factors come into play similar to those which complicate efforts to establish a comprehensive and effective tactical reconnaissance program. The reconnaissance technical function, pressed for time, must correctly assess evidence produced by photography. It is immediately apparent that standard photo-interpretation techniques and the skills painstakingly acquired in a modern technological environment do not apply. There are few conventional reconnaissance products for examination. The photography to be in-

Rice paddies and vegetable patches offer tempting rewards for the raiding Viet Cong. Daily air patrols by VNAF pilots help spot insurgent groups and warn villages of enemy troop movements.

terpreted is basically unfamiliar and offers only the smallest clues when compared with ordinary photo interpretation.

An underdeveloped nation is certain not to possess at the outset a reservoir of trained photo interpreters. Indigenous photo interpreters can, of course, be trained. Once trained, their ability to recognize and identify specific local cultural minutiae is a decided advantage. For example, they might recognize the erection of a hut on stilts in an area where stilts are not customary as the only indication of the establishment of a support area by an extraneous insurgent support element. They might further provide an indication of the origin of the element. A peculiar silhouette or an odd rigging seen in photography of junks or sampans might lead to the identification of a logistic support system that could be interdicted by air power.

As we have said, reconnaissance aircraft may be required to operate from austere forward bases, near and in close support of forward ground tactical commanders. Reconnaissance technical functions must be readily accessible if the timeliness gained by forward location is to be used to advantage. The reconnaissance technical unit must have virtual "flyaway" mobility. This, it has been demonstrated, can be accomplished through the use of specially designed and equipped trailers with independent sources of power. Jungle areas normally provide immediate access to the abundant water supply required, but desert operations would obviously pose a problem.

In areas where insurgency can be expected to occur there will probably be a seriously underdeveloped communications capability. Moreover the insurgents will seize every opportunity to disrupt the communications that do exist. In the early days of our operations in Viet Nam, for example, the RVN government was forced on many occasions to rely upon light aircraft to relay vital intelligence from point to point. Nevertheless the intelligence produced by reconnaissance must be furnished to air and ground tactical units as rapidly as possible. Visual sightings should be relayed quickly to tactical commanders and airborne assault aircraft under certain conditions, e.g., rail and road patrol, air cover for operations, and aerial assault under forward air control. The foundation, then, of a sound relationship between combat intelligence production through aerial reconnaissance and the responsive use of air power is effective communications. Therefore to complete the tactical reconnaissance/combat intelligence cycle, an effective

Visual aerial reconnaissance includes isolated hamlets in sections virtually sealed off by Viet Cong forces. Heavily wooded terrain around the villages and cultivated land sometimes overrun affords excellent hiding places for Viet Cong insurgents who strike by night and hide by day.

and secure communications system must be developed.

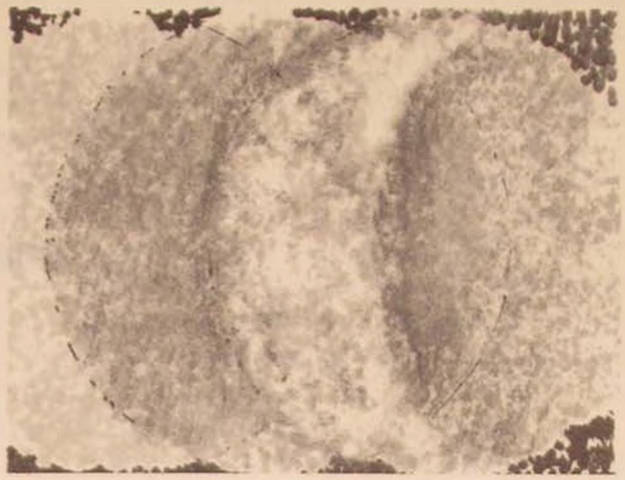
Adequate reconnaissance enables COIN forces to deny supply routes to insurgents and discourage concentrations such as depots, hospitals, training compounds, and headquarters activities. It permits operations to seek out and destroy insurgent forces, large and small, and to disrupt their command and control. It provides warning of and capability to destroy airlift operations in support of insurgents. It permits COIN forces to develop and implement effective offensive air operations and provides a means whereby the effectiveness and economy of those operations can be studied and evaluated.

Headquarters Pacific Air Forces, after more than two years of observation of the insurgency in the Republic of Viet Nam, has steadily improved the capacity of COIN tactical reconnaissance, reconnaissance technical activities, and communications in support of COIN operations. The capability of the armed forces of the Republic of Viet Nam in all these areas has also been dramatically advanced.

Improved air operations have contributed significantly to a reduction in Viet Cong enthusiasm; a strengthening of the will of the populace, particularly of the villagers; a lessening of Viet Cong recruitment capability; and a diminishing logistic support to the Viet Cong. These are the elements which are essential to victory by counterinsurgency forces in the military phase of counterinsurgency. They are dependent upon effective tactical reconnaissance for success.

Hq 2d Air Division and Hq PACAF

The Science Frontier



THE LUNAR SURFACE

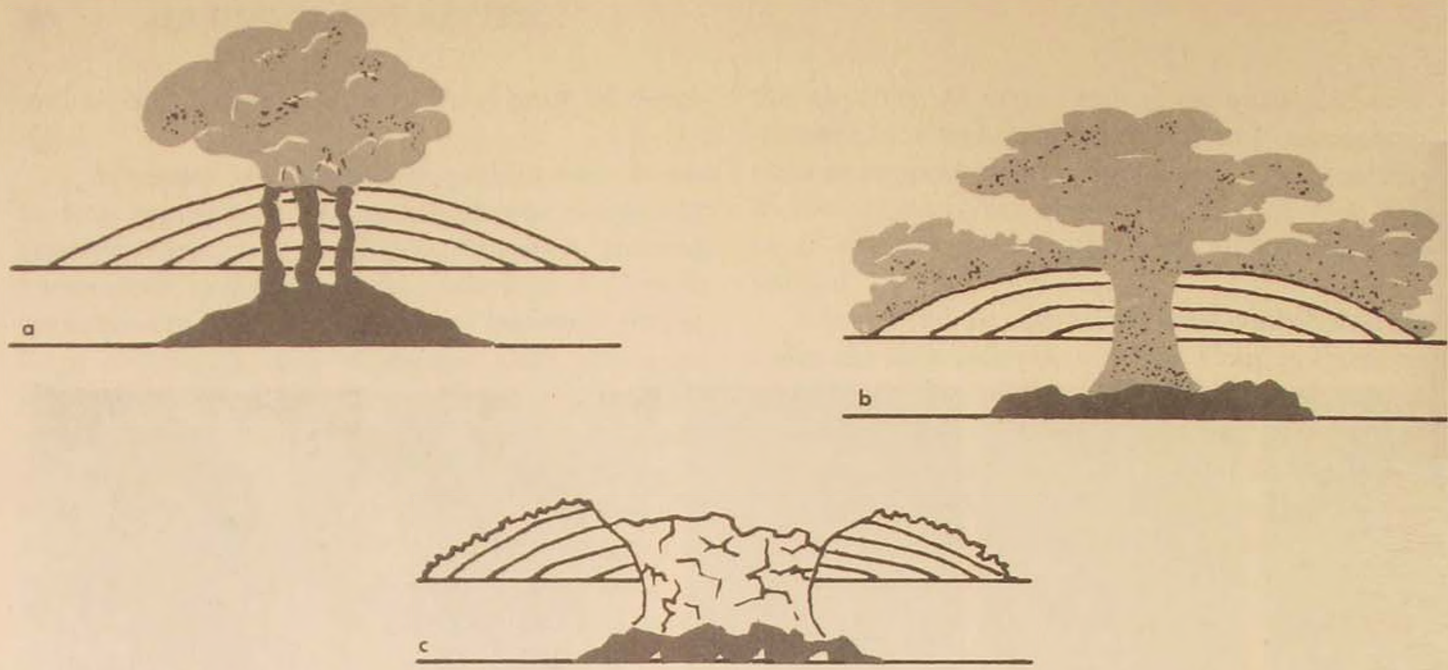
DR. JOHN W. SALISBURY

PROBABLY no other subject has had so many misconceptions and oversimplified generalizations applied to it as the lunar surface. Current thinking among laymen and professionals alike is all too greatly influenced by artists' drawings of jagged mountains, flat plains, and bubble-helmeted spacemen. With many of our ideas originating from an artist's pen, it is little wonder that an aura of uncertainty pervades discussions of the design of the Apollo vehicle and the functions of the Apollo crew on the moon. It would, however, be overly pessimistic to infer that we have no knowledge at all to inform these efforts. On the contrary, despite controversy over many points, areas of general agreement are continually broadening. Still, the lunar environment is nothing if not complex, and easy generalizations simply do not apply. Thus it is necessary to understand the origins and history of the major lunar surface features in order to appreciate fully the character of the lunar surface.

origin of lunar craters

The origin of lunar craters has been a controversial subject for many years. Two main theories are current, one supporting an internal volcanic origin and the other an external origin by meteoritic impact.

Volcanic craters on earth typically are small, cup-shaped depressions on top of a volcano. Clearly the majority of lunar craters are not of this type. On the contrary they are broad, shallow depressions surrounded by low rims of debris. Although not common, similar features called calderas are present in some volcanic regions on earth. Calderas are produced when molten material is blown from beneath the surface, emptying a lava reservoir and fracturing the overlying rock. The overlying rock collapses into the empty chamber to produce a depression surrounded by a ring of expelled debris, as shown in Figure 1. Subsequent volcanism may produce new cones on the caldera



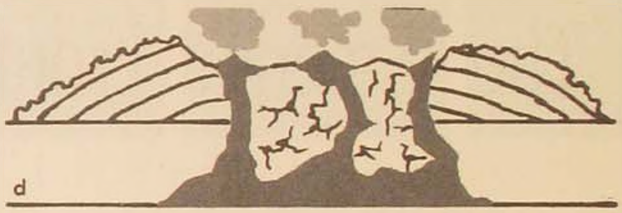
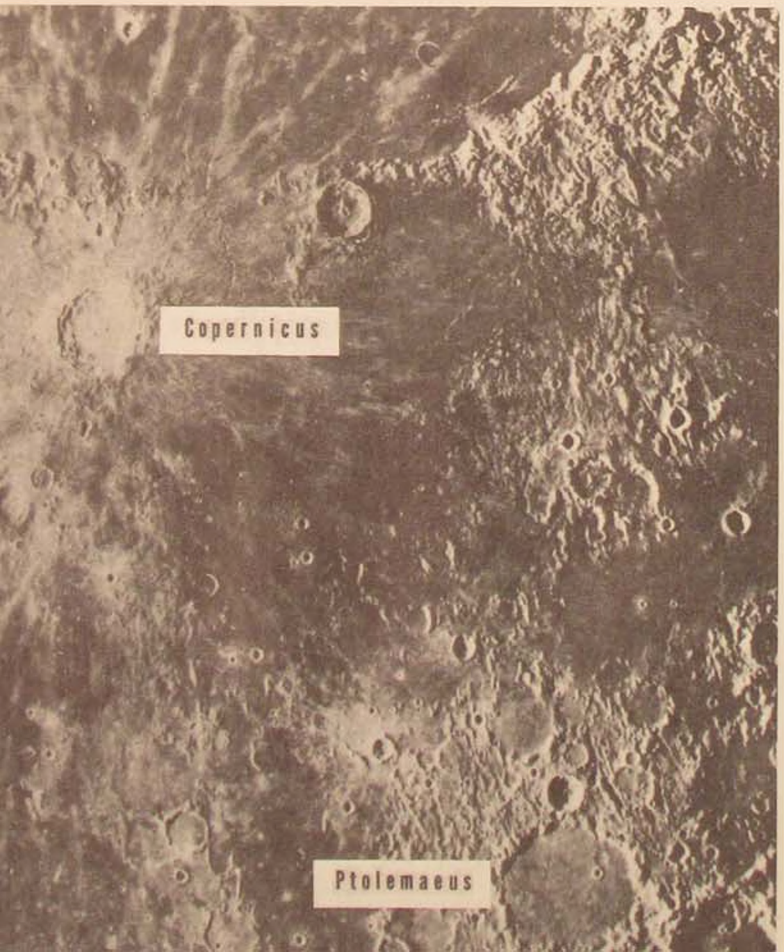


Figure 1. Caldera formation (after J. Green, 1960)

Figure 2. Crater Copernicus, 56 miles in diameter, and crater Ptolemaeus, 90 miles in diameter (Mount Wilson Observatory photograph)



floor. A comparison with the photograph of a portion of the lunar surface (Figure 2) shows that many features of lunar craters are roughly compatible with a caldera origin. Examination of the crater Copernicus, for example, shows ejected debris obviously present in and around the rim of the crater and spread out over the surrounding area for many miles in the form of bright rays. The central peaks within the crater are particularly suggestive of volcanic action.

Although many features of Copernicus suggest a volcanic origin, the form of this and most other lunar craters is more consistent with an impact origin. Controversy continues because many of the features satisfy either theory of origin. The one feature most suggestive of an impact origin is the near-circular outline of virtually all lunar craters. This shape is characteristic of hypervelocity impact craters, which maintain a circular outline even at low angles of impact. Calderas, on the other hand, are frequently irregular in outline, their shape strongly controlled by pre-existing crustal fractures and modified by subsequent volcanism. This is not to say that the shape of meteorite craters is not affected at all by the structure of the rock in which they are formed. On the contrary, a vaguely polygonal outline is common for meteorite craters on earth as well as on the moon. The question is one of degree, as meteorite craters are much less affected by the underlying rock structure than are calderas.

To say that most lunar craters are of impact origin should not be taken to mean that all lunar craters are formed in the same way. Figure 2 shows, for example, the contrast in form between the craters Copernicus and Ptolemaeus. Ptolemaeus lacks a marked rim of debris, but it does have a definite polygonal outline and flat floor. There apparently has been subsidence or foundering of the crater walls along crustal fracture zones to produce the outline and filling of the bottom of the crater with ash or lava flows to produce the flat floor. Thus, whereas Copernicus is an excellent example of an impact crater, Ptolemaeus is just as good an example of a caldera. The impact of a large meteorite would probably also establish a zone of weakness in the crust, so that the cause of the caldera could have been meteoritic. Consequently, we are faced with the possibility of two processes operating at different times to produce one crater. In fact there seems to be a complete spectrum of crater types from impact to pure volcanic. Hence it would be the height of folly to stoutly defend a single origin for all lunar craters as some scientists on both sides of the crater controversy have done. As is usually the case in any long-standing argument, there is right on both sides. Nonetheless, by far the majority of craters were apparently produced by impact.

origin of the maria and highlands

Because the dark, relatively smooth areas on the moon were thought by early astronomers to be seas, they were given the general Latin name "maria." Current theory regarding their origin holds that they are seas of lava or volcanic ash. A dissenting opinion held by some researchers is that they are seas of dust eroded from the rugged highlands by micrometeoritic impact and radiation damage. This dust hypothesis has found little support in the scientific community but has received such wide popular circulation that it appears necessary to counter it here.

The chief weakness of the dust hypothesis is the inadequacy of the postulated means by which the dust could have been transported from the highlands to the "ocean" basins. Supporters of the dust hypothesis have called upon electrostatic charging of dust grains by solar radiation to lift them by mutual repulsion, thus permitting dust grains to migrate downhill. It has been demonstrated that this charging is not sufficiently strong to accomplish the lifting of particles, although a small particle put in motion by micrometeoritic impact will tend to have its duration of flight extended by an electrostatic cushion. When a dust particle finally strikes the surface at a sufficiently low velocity so that it does not rebound, however, it will stick fast, as has recently been demonstrated in laboratory experiments conducted by the Air Force in a simulated lunar environment.

An examination of the physical features of the moon also bears upon the validity of the dust hypothesis. Local depressions in the highlands as well as the ocean basins would obviously accumulate dust if downhill transport took place on the scale envisioned under the deep-dust hypothesis, but this does not occur. The presence of a dark flat floor in a crater such as Ptolemaeus would indicate a dust filling with only the walls of the crater acting as a drainage area. If this were possible, then all craters of similar size and age should have similar flat floors, but they do not. Thus, on the basis of both laboratory and physical evidence, one can discount the theory of maria composed of dust, which also eliminates the concept of dust hundreds of feet deep. But, as will be pointed out later, local concentrations of dust up to three or four feet deep should commonly occur.

Although the maria are currently thought to be volcanic features, some doubt persists as to their exact nature. Many researchers believe that this volcanism has taken the form of lava flows, others that it has taken the form of ash flows. Because an ash flow is no more than a lava flow literally blown to bits by gas pressure, there is little difference in origin between the two. There is, however, a difference in form and character of the resulting deposits. A lava flow may be vesicular or bubble-filled near its top but generally

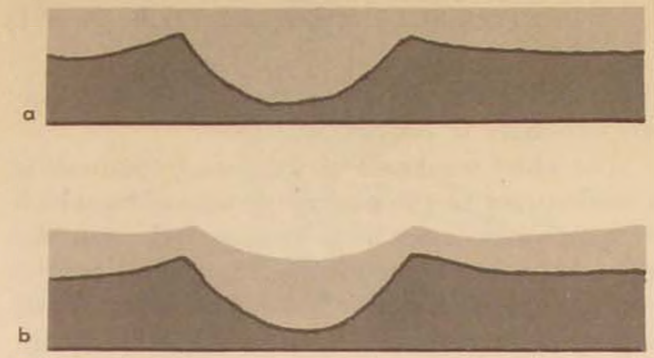


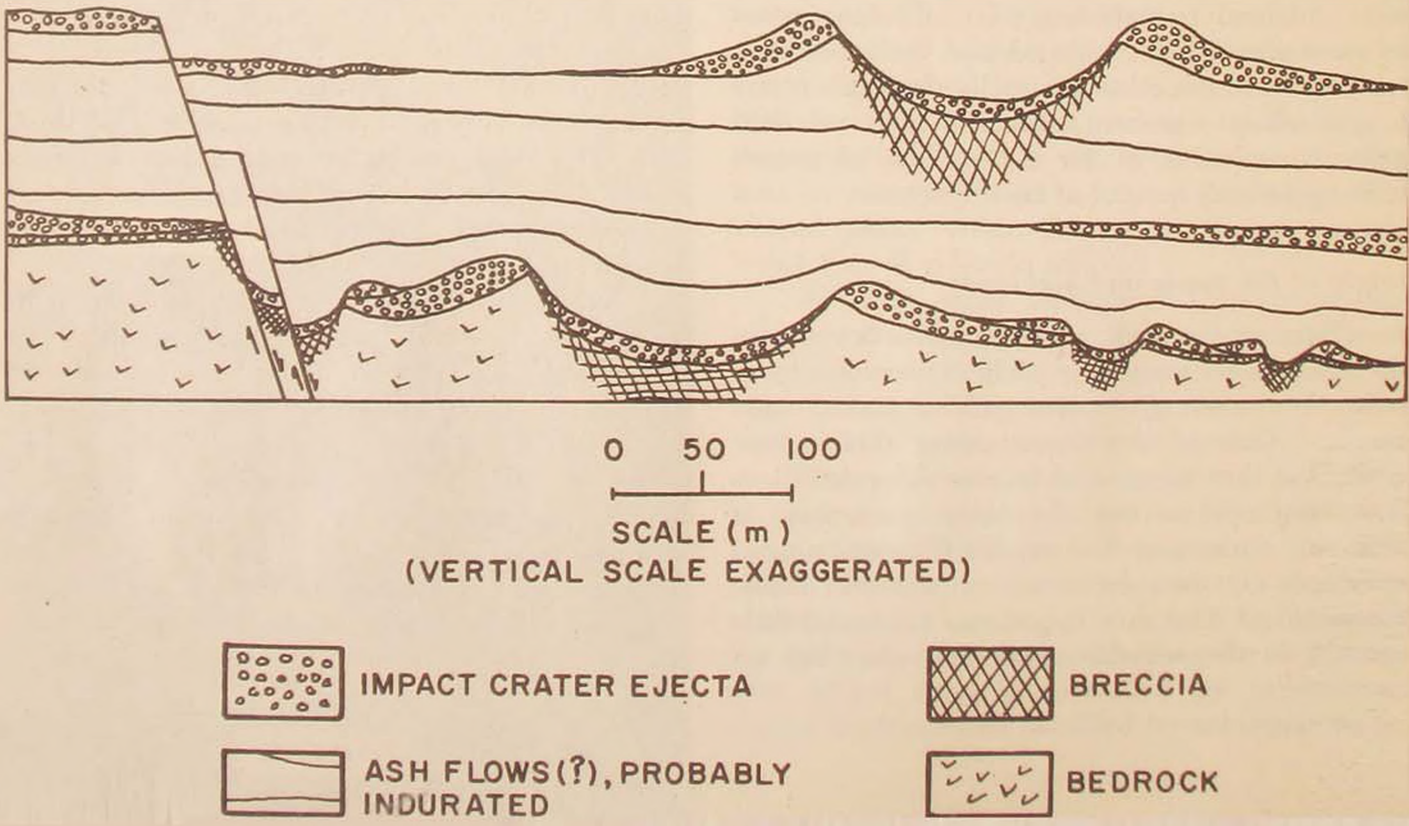
Figure 3. Reflection of underlying topography as a result of volume decrease of an ash layer

forms a hard, dense rock a few feet below its surface. An ash flow may be composed of loose material near its top but is generally sintered into a hard, low-density, porous rock below a depth of a few feet.

There are good reasons for suspecting that the maria may be covered with ash flows, rather than lava flows, although the reasons are not totally convincing. First, the maria do not appear to have any flow fronts or steep terminations as would be typical of lava flows. Second, where pre-existing craters are covered, they are reflected in the topography of the flow surface, indicating a significant volume decrease after deposition. This process is illustrated in Figure 3, in which the surface of an ash flow is shown immediately after deposition (a) and then after a 30 per cent decrease in volume of the layer as it compacts under the influence of gravity (b). The thicker portions of the flow suffer a greater change in elevation than the thinner portions because, with a constant percentage volume decrease, the thicker the layer the greater the total change. Such a marked volume change does not take place in lavas, indicating the presence of ash flows over the ghost craters. This is not to say that there are no lava flows at all, nor that a single ash flow covered a particular mare. It is more likely that the maria were covered by a series of ash flows, possibly mixed with lava flows and significantly separated in time. Figure 4 shows what is envisioned as a cross-section of a typical mare. Note that the flows have been lightly cratered by relatively recent impacts. These have produced local rubble layers, which may be several thousand feet thick in the vicinity of a major crater such as Copernicus but which must thin rapidly to discontinuous patches in intercrater areas.

In contrast to the maria, the highlands have evidently had a much simpler history. The lunar

Figure 4. Cross-section of a typical mare



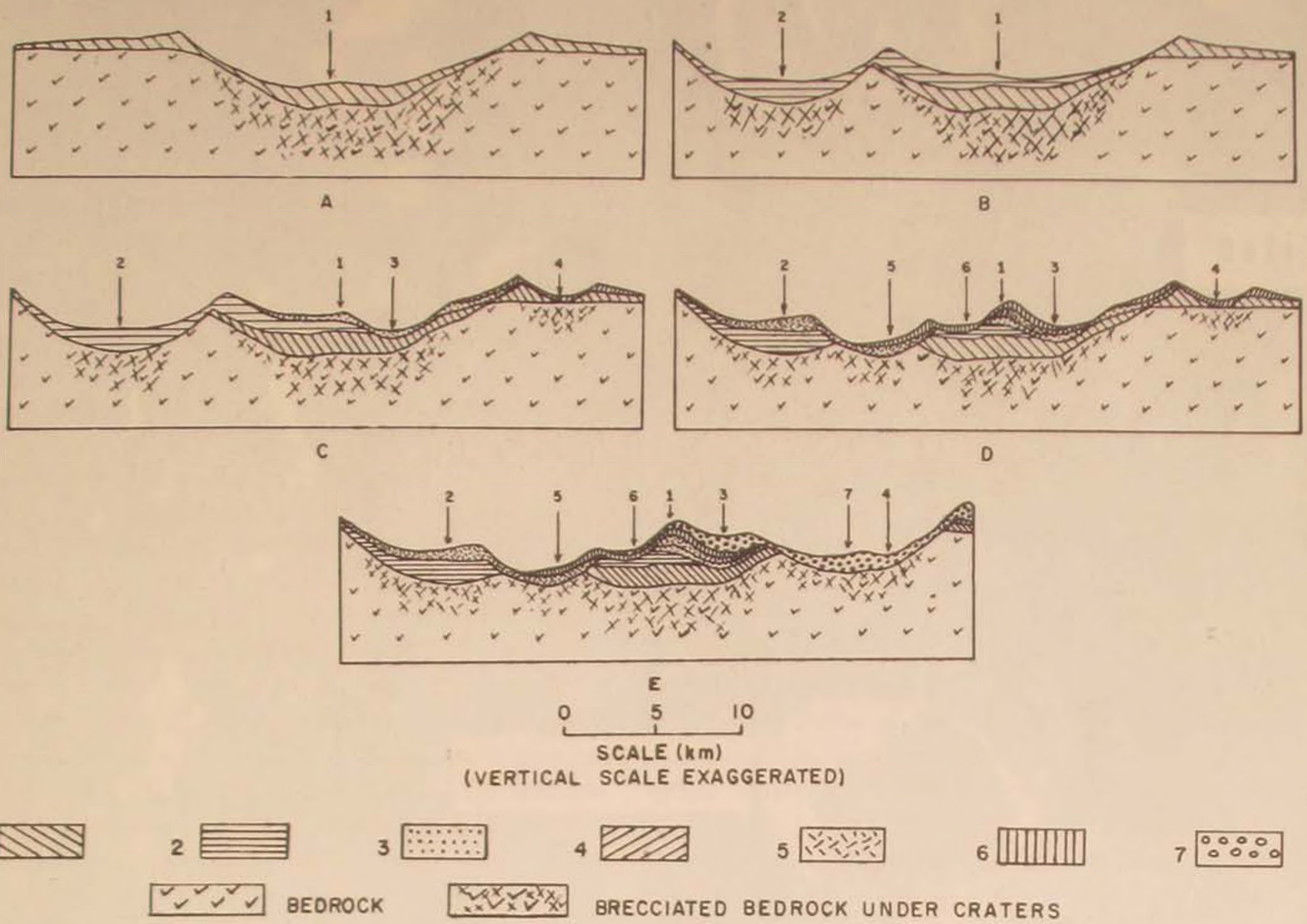


Figure 5. Cross-section of typical highlands terrain showing creation of simplified lunar subsurface structure by meteoritic impact. A single crater with its associated debris is shown in A, and a second crater is created beside it in B. In C, two smaller craters (3 and 4) have penetrated the debris of the older craters, and in D two overlapping craters (5 and 6) have added to the complexity of the structure. A final large crater (7) has destroyed most of the crater 4 in E. Actual lunar structure will be even more complex. Negative accretion would change the thicknesses of the layers, but not the essential structure. (Key: 1-7, debris symbols for each of seven consecutive meteorite craters.)

crust appears to have been subjected to a long history of bombardment by meteorites and comets, leading to the formation of a complex rubble layer composed of overlapping, discontinuous lenses of debris, like those shown in Figure 5.

The thickness of this rubble layer varies greatly, most of it being concentrated in and near crater rims. Considering the volume of rubble produced by highlands craters, however, one can reasonably assume an average rubble depth of at least 90 feet in intercrater areas. Rubble depths of 275 feet for the rims of craters one mile in diameter should be common, and many thousands of feet of rubble should be present around major impacts.

lunar surface roughness

When it is realized that the surface of the highlands is entirely covered with rubble ejected from meteorite craters and that the surface of the maria is partially so, it is usually assumed that the lunar surface must be very rough. Unless closely investigated, lunar surface roughness becomes another subject upon which it is easy to make erroneous judgments.

One of the first mistakes generally made is the failure to specify the scale at which roughness is being described. Clearly, yard-scale roughness is different from mile-scale roughness, and each is important for different reasons. Fortunately, mile-

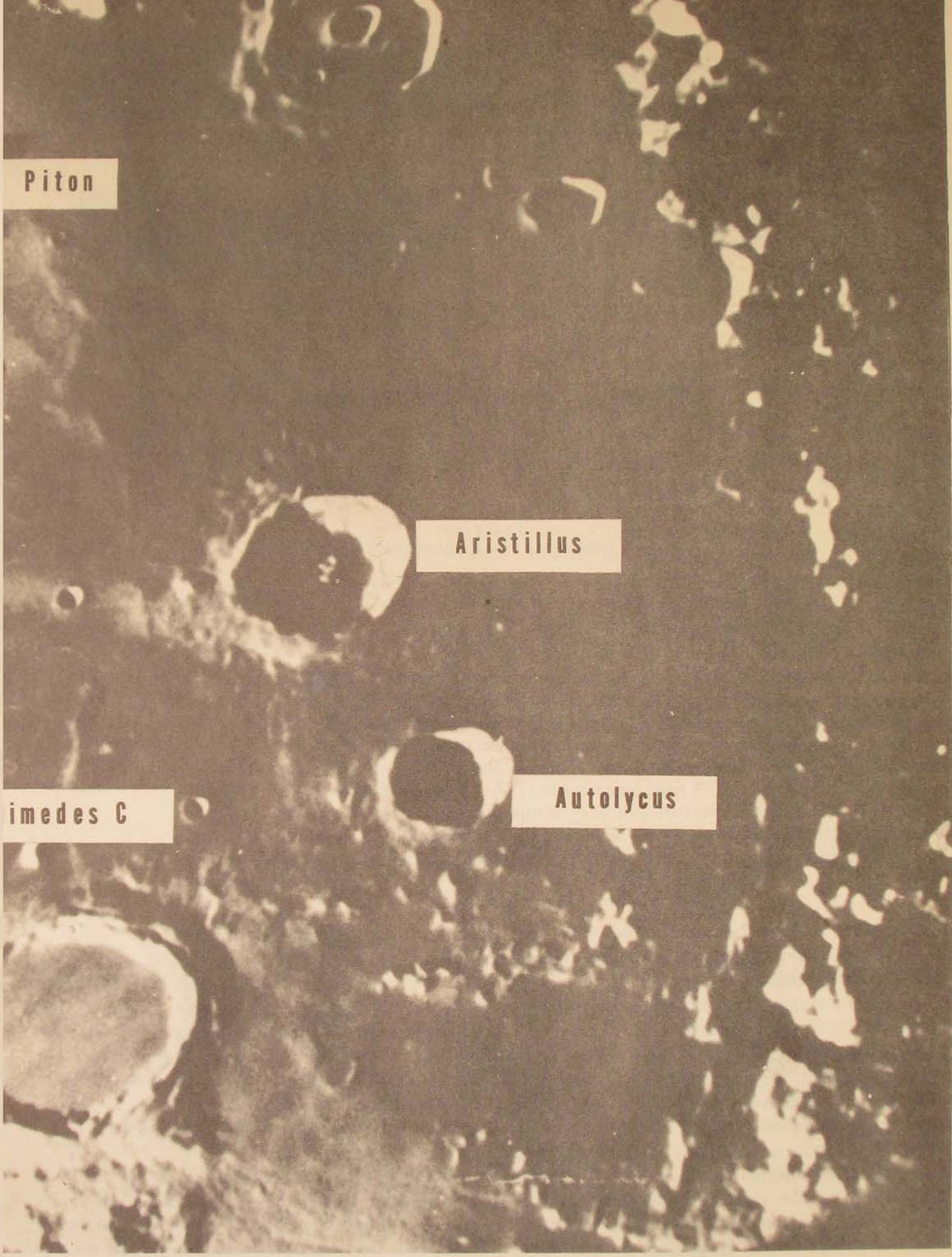


Figure 6. Eastern portion of Mare Imbrium (Pic du Midi Observatory photograph)

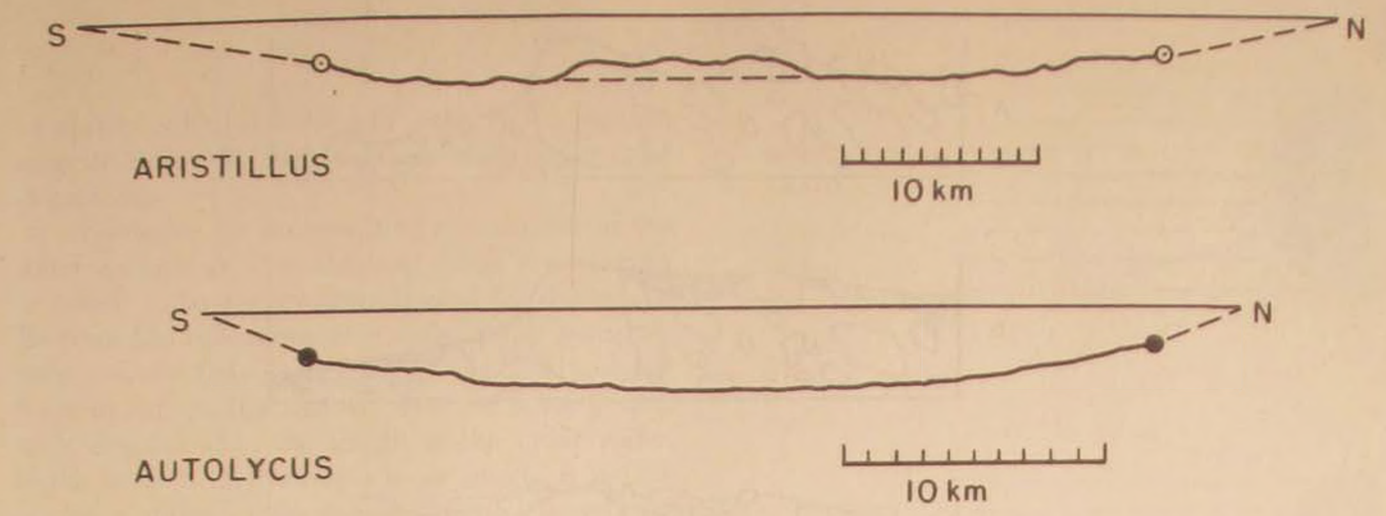


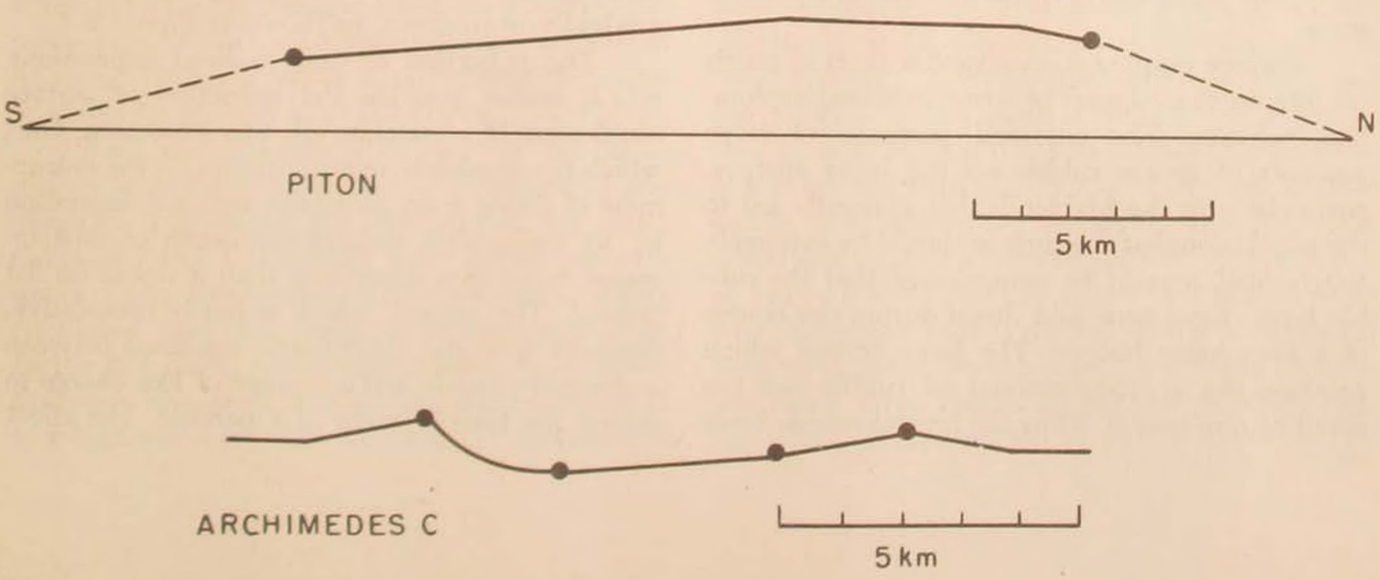
Figure 7. Cross-sections of the craters Aristillus and Autolycus (from Kopal et al., *AFCRL Research Note 67, 1961)*

scale topography can be observed directly, and direct observations leave little room for argument —though they do leave plenty of room for misconceptions. The most common misconception is that the highly cratered highlands are rugged terrain on a mile scale and that lunar craters in general are steep-sided features. This is far from true for the large craters, as is illustrated by Figures 6, 7, and 8. The craters Aristillus and Autolycus, for example, appear in Figure 6 to be deep and cup-shaped. Actually, as is shown in Figure 7, they are shallow, bowl-shaped features with relatively flat slopes. Figure 8 shows that Piton, which appears to be a needle-sharp peak in Figure 6, is actually a low ridge.

The source of the illusion of steepness for these features is shadow exaggeration. The photograph was taken at a very low sun angle near the lunar sunset, and the long shadows thrown by gentle features make them appear rugged.

It must be noted, on the other hand, that the small crater Archimedes C does have a steep slope on its western side. As a matter of fact, the average inner slope angle of small craters (those less than 15 to 20 miles in diameter) is better than 30 degrees. Since smaller craters comprise the vast majority of all craters, such steep slopes are common. Yet the percentage of the surface area covered by these steep slopes is very small. Thus we can arrive at a somewhat complex statement

Figure 8. Cross-sections of the small crater Archimedes C and the mountain Piton (from Kopal et al.*)*



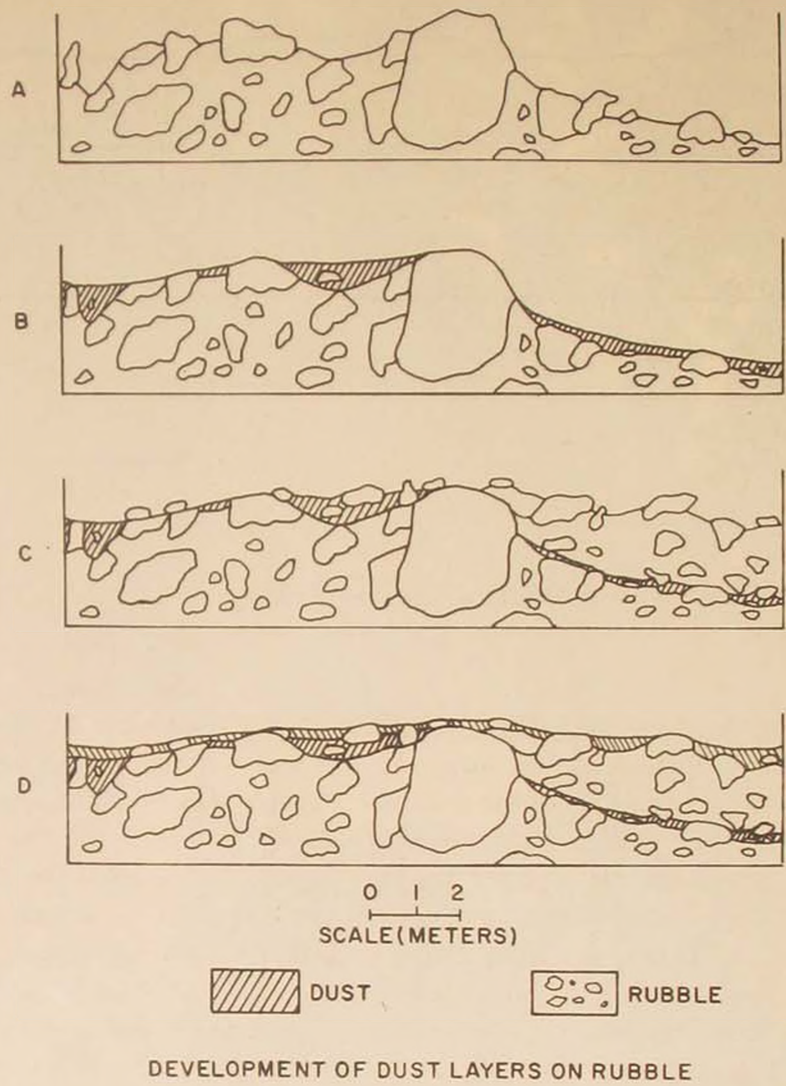


Figure 9. Erosion of rubble layers to reduce relief

of lunar surface roughness on a mile scale: the moon's surface is not as rugged as it appears, since the major features do not have steep slopes; but steep slopes are common on smaller craters, although they cover only a small percentage of the surface area. Hence the generalization is usually made that the moon is relatively smooth on a mile scale.

Surface roughness on a yard scale is of greatest interest to designers of space suits and exploration vehicles. The assumed presence of large amounts of coarse rubble on the lunar surface, particularly in the highlands, has generally led to the conclusion that the surface should be extremely rough. Still, it must be remembered that the rubble layers have been laid down during the course of a long lunar history. The large craters which produce the greatest amount of rubble are the result of rare events. Thus the typical rubble layer has been exposed to the lunar environment for millions of years. Over this great span of time, the impacts of countless micrometeorites have acted as a potent erosion mechanism. The fine debris or lunar "dust" produced by these impacts has tended to collect in local depressions, armoring them against further erosion while high points are gradually worn down, as shown in Figure 9.

The collection of dust in local depressions, which makes possible the reduction of surface roughness, is a function of two processes. One, which is completely nonspeculative, is the entrapment of debris from an impact within a depression by its walls, thus making the depth of dust increase faster in a depression than it would on flat ground. The second, which is partly speculative, depends upon the electrostatic repulsion between a charged particle and a surface of like charge to extend the time of flight of a particle. The effect of gravity will always tend to make such a particle migrate downhill, thus preferentially filling local depressions.

Evidence for the resulting smoothness of the lunar surface is also obtained from the manner in which radar waves are reflected by the moon. Because the reflections of a radar pulse come almost entirely from the center of the disk and not from its edges, the surface must be smooth at a scale equivalent to the length of the radar wave. If the surface of the moon were rough, it would act as a diffuse reflector, and approximately as much energy would be reflected from the edges of the disk as from the center, as can be seen in Figure 10. Diffuse reflection does occur at the wavelengths of visible light, which is why the full moon is equally bright over the whole disk. Thus there is a change from smoothness to roughness somewhere between the scale of the shorter radar wavelengths (about an inch) and optical wavelengths (less than a micron).

It should be pointed out here that, like the mile-scale measurements, the yard-scale measurements do not indicate complete smoothness. They are usually taken to mean an average surface gradient of 1 in 10. In places where a recent rubble layer has been laid down, such as that around the crater Copernicus, the surface is a great deal rougher. Recent craters as large as Copernicus are rare, but smaller craters a few hundred feet in diameter should be relatively common, even on the maria—i.e., within a radius of 2 or 3 miles of the typical landing site. The maximum size of a block ejected from such a crater is about 15 feet in diameter. Thus the rubble layer surrounding the crater should have significant relief on a yard scale. Yet as with the mile-scale steep slopes, the percentage of the total lunar surface area covered by rough rubble layers is small, so that the moon is generally referred to as smooth on a yard scale.

Since the smoothness of most of the lunar surface is made possible by the collection of fine debris in depressions, the character of this material is of interest. Although scare stories concerning a loose, treacherous dust have been widely circulated, they are probably highly inaccurate. In the first place, recent experiments have shown that rock fragments, like metals, stick together at ultrahigh vacuum. This adhesion is demonstrated

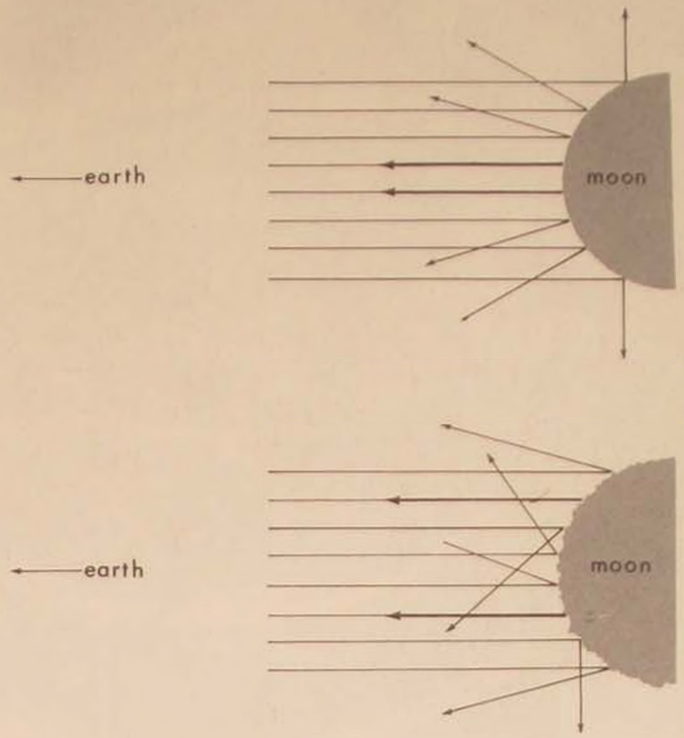


Figure 10. Reflection of radar from a smooth moon and from a rough moon

for a fine powder in Figures 11 and 12. Figure 11 shows the result of sifting powdered basalt rock in air onto a circular sample holder three inches in diameter. It is evident that the powder particles do not appreciably adhere to one another or to the sample holder. Figure 12 shows the effect of ultrahigh vacuum on the behavior of the same rock powder. Note that the powder particles cling to the thin wires, build up thickly on the edges of the aluminum foil rectangle, and generally coat the surface of the entire sample holder. This clear demonstration of marked high-vacuum adhesion indicates that a dust layer on the moon, which has effectively no atmosphere, should not be loose. It may, however, have a rather high porosity, and the points of contact and sticking between grains may be few, making it a highly crushable material of low bearing strength. On the other hand, seismic shocks from impacting meteorites and the occasional mixing in of a layer of slightly coarser debris of sand- or even gravel-size material should compact the typical dust layer and give it a significant bearing strength, probably on the order of that for wet snow. Even deep dust pockets should not, in any event, exceed a yard or two in depth.

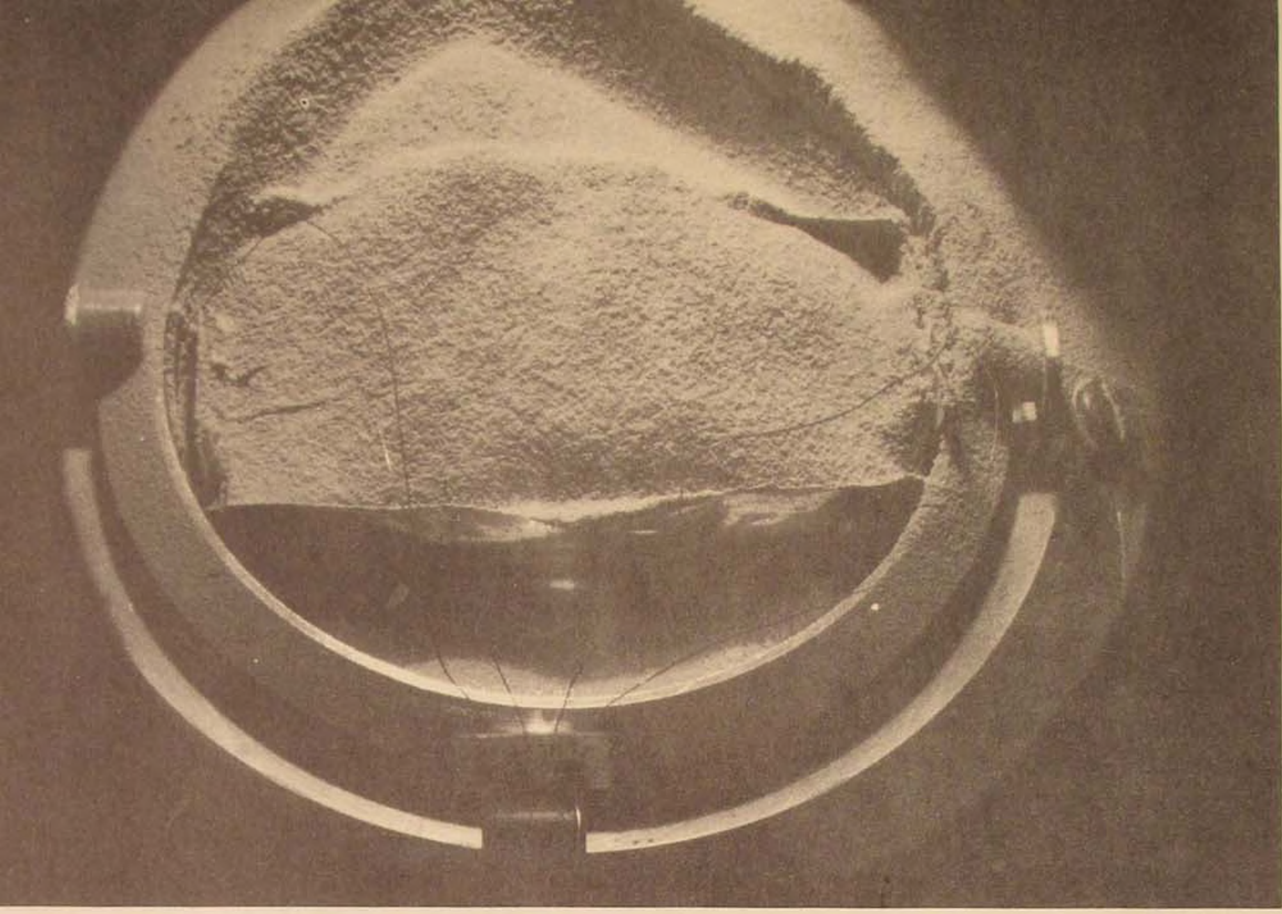


Figure 11. Basalt powder sifted in air

Figure 12. Basalt powder sifted at 10^{-10} mm Hg

lunar composition

The composition of the moon is a subject on which very few data are available. The low lunar density indicates that the moon as a whole must have fewer heavy elements (presumably metals) than does the earth. This does not indicate what the composition of the surface materials may be, because the low density could be accounted for solely by the lack of a metallic core such as the earth is generally thought to have.

The existence of the dark maria and lighter highlands does show that the lunar crust is made up of at least two different kinds of rock. The darkness of the maria and the fact that they form low basins as if their density were greater than that of the highlands suggest that they are what geologists refer to as "basic" rocks. These are rocks, such as basalt, which form ocean basins and great lava fields on earth. The highlands would then be composed of "acid" rocks, which are rocks like granite that form most of our terrestrial continents.

If the small glassy meteorites called tektites are actually pieces of the moon knocked off by meteorite impact, then their acidic composition confirms the theory that at least some part of the lunar crust has this sort of composition. To assume that it is necessarily the highlands portion is putting a great deal of faith in speculation. The dark color of the maria could, after all, have been produced by radiation damage and have nothing to do with the original color of the rocks. The topographically low position of the maria could also be due to a concentration of dense material beneath the surface, which might have a composition quite different from that of the surface materials.

The most important aspect of the lunar composition question is that melting of the crust has evidently taken place. This means that a mechanism exists whereby rocks or minerals of a particular composition may be concentrated in one place. In particular, the probability of volcanism suggests the release of volatiles from the rock during melting.* The principal volatile released should be water, and it is possible that this material might be trapped and concentrated in favorable locations. It might be found as ice in permanently shadowed zones on the surface of the moon, where the temperature is so low that ice can persist almost indefinitely, even in vacuum. Subsurface ice might also be present, since the subsurface temperature is between −4° and 58°F. The most likely sort of water deposit would be composed of hydrated minerals, which can hold their water of hydration even at maximum lunar surface temperatures (266°F).

*The Russian astronomer Kozyrev observed the release of a fluorescent gas from the crater Alphonsus in 1958. Two Air Force cartographers on a lunar charting assignment recently noted ruby-red spots in and around the crater Aristarchus. Explanation of these events in terms of active volcanism is probably sensationalizing the data, but they do show that the moon is not a completely inactive body.

engineering implications of the lunar environment

The first point to be made in a discussion of the engineering implications of the lunar environment is that this environment is alien. By definition this means that the strangeness of the environment and its unfamiliar effects on men and machines are beyond our ready comprehension. Still, it seems to be our nature to ignore this fact and to conceive of men and machines operating on the moon much as they do on earth, with the slight difference imposed by lack of a convenient air supply. Such an approach is extremely misleading. Little is known as yet concerning environmental effects, but what is known indicates that the lunar surface in indeed an alien and hostile place.

Vehicle designers, for example, face many handicaps. The surface roughness on the average is not great, but extremes of roughness are common and placed at random on the surface. Even a small bump may be a hazard in the low-gravity lunar environment because a lightweight vehicle will literally take off when driven over it, even at very low speed. It is also difficult to turn a vehicle under low-gravity conditions without turning it over.

The bearing strength of the surface is a critical factor in vehicle design, and, unfortunately, the moon offers quite a variety of conditions. Where lava flows have occurred, it is probable that lava caverns have been formed. These features occur when a hard crust forms over the lava and molten material flows out from underneath it. Lava caverns constitute a definite collapse hazard, although they might also be used as ready-made shelters.

The rubble layers offer no collapse hazard, but the deep pockets of dust between boulders require design compensations. Yet because of high vacuum adhesion these design compensations should be no more extreme than those for a vehicle which will traverse wet snow on earth.

Dust adhesion may be an advantage when bearing strength is considered, but it is a definite disadvantage in other ways. When micrometeorite impacts kick up little clouds of dust or when rocket exhausts kick up big ones, any particles that strike the surface of a vehicle will tend to stick to that surface. Thus portholes, mirror surfaces, and camera lenses may become obscured, and the efficiency of solar cells or heat-radiation panels may be destroyed.

The covering of heat-rejection panels with dust is one of the most serious problems that could confront a traversing vehicle or lunar base. People and machines generate a great deal of heat. On earth this heat is dissipated through conduction to our atmosphere, but on the airless moon it must be radiated to space. Radiation is a very poor way to reject heat in the first place, but an insulating layer of dust upon the radiator panels would make it impossible.

Other problems which we have yet to appreciate fully face the engineer in the design of a lunar base or lunar vehicles. For example, what would be the effect of the lack of atmospheric scattering of sunlight on perception of hazards blanketed in shadow? Yet despite the difficulties involved in coming to grips with an alien environment, the effort may be repaid in unexpected ways. Should deposits of water be available on the moon in the form of ice or hydrated minerals, the extraction of this water and its electrolysis to hydrogen and oxygen would provide a lunar source of rocket fuel. Use of the moon as a refueling station for interplanetary exploration would save a significant percentage of the direct cost of these missions. Thus conquering the lunar environment may turn out to be not only an exciting adventure but also an economic necessity.

In any event the mounting volume of data and rapidly broadening areas of agreement among lunar scientists are carrying our knowledge of the lunar environment out of the domain of rank speculation. Overly simple generalizations and extreme views that have been used to describe the lunar environment in the past are no longer accepted by engineers and are no longer justified by the facts in hand.

Air Force Cambridge Research Laboratories

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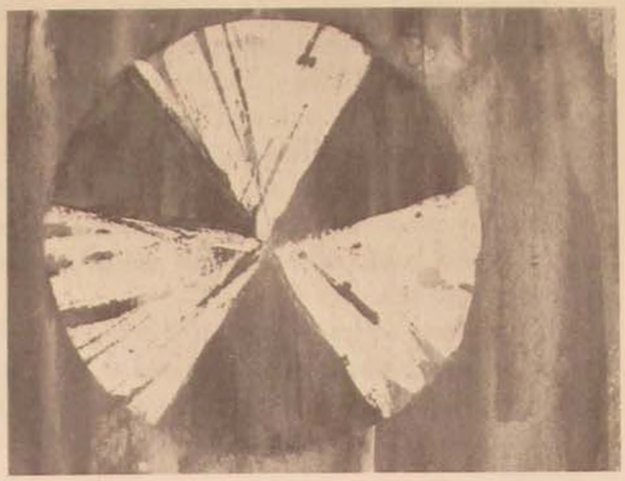
In My Opinion



THE CASE FOR FALLOUT SHELTERS

MAJOR GENERAL DALE O. SMITH

WHY IS THERE such a hue and cry *against* fallout shelter? It would seem that if any device, within reason, could give us another real chance for survival, we should welcome it. Of course, if the second chance were such a slim one as to make the effort seem fruitless, we shouldn't waste our time or money. But even a slim chance is worth considering when life is at stake.

Mr. Hanson W. Baldwin made a convincing case *against* fallout shelters in the *Saturday Evening Post* of 31 March 1962. He pointed out correctly that you could get almost any answer you wanted by postulating the kind of nuclear attack that would make your answer valid. Then he assumed the worst possible situation: a 100-megaton groundburst digging a crater 350 feet deep and a mile in diameter in solid granite. "And if nice, solidly built shelters hundreds of feet deep saved one from blast, the searing heat and exhaustion of oxygen caused by the fire storm would trap most of the survivors within a radius of 20 to 60 miles." Certainly there is no point in building a simple shelter if one is sure a 100-megaton bomb will strike his own city, although it can't be stated categorically that a deep shelter, if sealed and insulated with its own oxygen supply, would not provide a safe haven. John Glenn survived in a small capsule heated to over 6000 degrees, and of course in an oxygenless environment. Moreover, nuclear submarines stay submerged for months.

When flying B-17's over Europe in World War II, I wore a flak suit. This was an uncomfortable apron and vest made of heavy metal plates. I knew this flak suit would not protect me from a direct hit by flak or fighters, nor from a mid-air collision or explosion. It would hardly protect me from spinning in. But it just might have protected me against flying pieces of stray metal from shell casings. I never heard of anyone in my group objecting to the flak suits because they couldn't provide more protection.

Same for parachutes. Few flyers object to wearing them. I've seen men falling with their chutes on fire. Nor do parachutes provide protection against take-off accidents. But the limitations of the device haven't caused its elimination. In many thousands of instances parachutes have provided flyers with another chance at saving their lives.

Commercial aviation has rejected parachutes. It was claimed by some that parachutes were not good for business. If they didn't frighten the passengers, they at least reduced payload. The same reasoning was applied to seagoing vessels in early times, and ships would still be without lifeboats if a public incensed by repeated sea tragedies hadn't passed laws enforcing the use of lifesaving equipment at sea.

I live two miles from the Pentagon, which would be as vulnerable a location as one could expect in a nuclear war. And I have "war-gamed" my situation to decide whether or not to build a shelter.

Let's suppose on one Sunday evening while watching TV with my family the program is interrupted with: "Flash. Red Alert. Red Alert. Enemy intercontinental missiles have been detected by BMEWS. At least two will strike near Washington within 15 minutes."

What do I do? I am head of a family. I am a military man. They look to me for guidance.

Case #1: *No shelter*. Like Mr. Baldwin, I didn't think the expense and effort were worth the candle. But *now* the missiles are en route, and I must do *something* to protect my family. The house is a firetrap. It will burst into flames and be crushed by the blast. We would be trapped in the basement. Best to get outside, but behind something to protect from flash and radiation. Dig a slit trench! In ten minutes' time? Not much of a chance. Because of a fatalistic attitude toward shelters, I have left myself and family with almost no second chance.

Perhaps it would be best to follow the directions published in the Department of Defense—Office of Civil Defense booklet H-6, *Fallout Protection*, (December 1961). Run to the basement and make what protection I can with boxes and trunks in a corner, hoping that the house won't burn down around us. A slim chance indeed, but our only one. I herd my family downstairs and frantically begin to construct our jury-rigged shelter, praying all the while that the missiles will miss by many miles.

Case #2: *With shelter*. In our spare time my boys and I have dug a deep hole in our back yard. It is baffled and timbered like a mine. There are air vents and a hand-operated air blower. Also, we have installed oxygen tanks and masks. We expect that we might have to dig our way out, so inside are shovels, picks, and crowbars. Maybe we'll be trapped there, but at least we have a fighting chance. Perhaps the fireball of a 100-megaton bomb will roast us, but I doubt it. Our chances of being several miles from ground zero are good, and heat doesn't penetrate deeply into the earth. A few inches below a glowing charcoal campfire the earth is cold. Our oxygen supply will outlast any fire storm. And I don't think a cratering groundburst will be planned by the enemy when an airburst will do so much more damage. So I doubt if our hole will be caved in, other than the entrance.

The attack comes. We wait a few hours after the last shuddering shocks to let the outside fires subside and the air return. Then we clean out our air vents. After that we sit tight for two or three days to allow the fallout to lose its potency. Then we widen our escape route and look out. If our Geiger counter gives a safe reading, we come out and begin to build a surface shelter from the ruins. There won't be many survivors to compete for the scraps that are worth using. Few had built shelters like ours. Life will be grim. But we'll be alive and we'll have a fighting chance.

It isn't a happy prospect, but it's a darned sight better than Case #1. Panic is the inevitable consequence for those who have no plan of action for an emergency. Even if the missiles miss, a population that has fought tooth and nail for the limited public shelter space will probably be badly mauled in any event.

But the argument that shelters would cause the enemy to think we are preparing for a first strike and thus would invite him to launch a preemptive strike is one of the most tortured bits of reasoning ever attempted. In the first place, we *and* the enemy know the *limits* of shelter protection. Passive defenses do not warrant such a degree of confidence that anyone should think we would be safe from a retaliating attack if we launched the first blow. But more important, we never felt compelled to launch a first attack when we had a nuclear monopoly with no nuclear retaliation possible. Our rival was so little concerned then about our capability that he entered on several aggressive adventures, and we let him get away with it. Why would he think, now that he *can* retaliate, that we would strike him first today?

Joint Strategic Survey Council

A DECLARATION OF INDEPENDENCE FROM THE STATISTICAL METHOD

Colonel Garland O. Ashley

When in the course of human events the jargon and methods of a professional group become unmasked, their embarrassing mental unclothing sometimes becomes a rather sorry spectacle. The unclothed status galls them who have been unmasked. It is natural for such a professional group to feel impelled to strike out and try to snatch back some type of mental protective covering. In addition, being unmasked makes the group exposed somehow want to get revenge, too, here on this earth, upon those who have so premeditatively and unceremoniously snatched away a professional protective covering.

We are, to a large degree, in precisely that professional state, and a distortion of statistical methods has been largely the tool that did it to us.

As much as we may feel impelled to yield to the possibilities for revenge, a yielding to them would only compound a problem which has now possibly become already far too vexed. But, in an earnest trust that it may not be past time for us to restudy those mathematical techniques which have been used to unmask our profession, may we now take a steady stand on an individual and personal declaration of independence from the much-vaunted statistical method? It might keep us from becoming further AOCP (Airmen Out of Commission—Panic) and from sustaining any further inroads by the statistical method and its proponents.

It may be an awful and shattering commentary on how most of us got taught arithmetic—or failed to learn about it sufficiently somewhere—that at this stage arithmetic with a verbally clouded twist or two has become a near-sacred domination and almost unquestioned power over us, our daily lives, our weapon systems, and almost the whole warmaking potential. Yet it seemingly has. Thus it is well past time to consider a personal declaration of independence from the too-often-unquestioned use of the statistical method. We need to help create a rational, steady personal revolt from its absurd tyrannies over each of us. In my opinion, a former stimulation of enough of it has become now altogether too much of it. And so I think it is time to stop our individual contribution to this shoddy and self-defeating charade.

To declare our personal independence from the present tyranny of the statistical method, wherein you can hardly now ask the time of day before someone flashes a bar chart at you, we need to understand clearly and have no more doubt about six principles.

• Numbers are a small tool of thought, modest and important and useful, but numbers must not be allowed to become a master of thought.

• Numbers stand as symbols for things, but they are *never* the things they are frequently set to stand *for*, as if the number and the thing were the same.

• Numbers are not a magic, except to a few disoriented mentalities that know so little of numbers that there is a trembling when it becomes necessary to balance a checkbook. And, in corollary, *skill* at numbers is not a mental magic, nor is that skill necessarily transferable when other disciplines of thought are required.

• Statistical methods have a jargon designed specifically and with studied calculation and forethought to keep the methods obscure to "outsiders." Please make no mistake about this fact.

• Decisions based solely on numerical appraisals of any problem are *precisely* that and ONLY that: decisions based on numbers. Hence, since numbers may stand for or represent only those parts of a problem which are countable, and since numbers cannot *be* the problem, decisions based solely on numbers DO NOT SOLVE problems. Such decisions have only solved equations.

• Finally, by an effort of will, men can free themselves from that tyrannous crutch of a vaunted safety and security of being right—in arithmetic—but grievously wrong about what the arithmetic is said to represent or "prove."

Stated this way, bluntly—and I acknowledge that they may be stated much too bluntly for many tastes—nevertheless stated this way these principles are self-evidently correct and indisputably right. There can be no honest equivocation about them, except by word-merchants whose objective is to throw sand into others' eyes.

Yet, ponder the principles for a moment. How many times in the last month have you unwittingly neglected to note one or two of them—or all of them—in making, or in evaluating, a presentation?

Our own indictment?

If you neglected to note these principles in *making* a presentation, you were a numerical propagandist, even if inadvertently. Your presentation was a manipulation which used numbers for other purposes. Disclaiming this quiet truth even in a very loud voice will not make it any less true.

If you neglected to note these principles in *evaluating* a presentation, you were a numerical pushover. Hence, although there may be little justification to the unmasking which we have experienced at the hands of those whose forte is the statistical method, failure to evaluate the process correctly is adding a bit more. A habit gets formed.

The statistical method has become used in altogether too many inappropriate and wholly inapplicable places in our professional life. It has become a stampeding tyranny. Accordingly, it is way past time for our personal and individual and professional self-sponsored declaration of independence from it.

Let the words sound in our minds once more, then, each time we see some trumped-up chart, or a windy graph of any sort, or any arithmetical expression of any problem which purports by innuendo to do more than it can do. Let the words begin to form as we dig statistics apart for what they really are. Instead of being lulled by them much longer, let the words form—"When in the course of human events it becomes necessary . . ."

Or shall we stand about, professionally unmasked, with all the shameful alternatives which shall continue to flow from that undignified status, indignant and frustrated without quite sensing why?

Have you had enough yet? Or have you become numb to it all?

Numbness is a usual preamble to the loss of other powers—of sanity, of professional self-respect, and of true rather than statistical war power.

Or are you yourself an embryo statistical manipulator who is just practicing up so he can get *his* chance?

Well?

North Springfield, Virginia

Air Force Review

EXPLOSIVE ORDNANCE DISPOSAL IN THE AIR FORCE

CAPTAIN S. STEINER

IN THIS ERA of high energy yields, planning and preparation must be concerned with the unexpected. But why the unexpected? Military and commercial requirements for the high energy yields associated with explosives and nuclear materiel have always recognized and emphasized the need for safety in the manufacture, handling, transportation, storage, and use of explosives. We are, however, fully aware of the tenets of "Murphy's Law," which states that any given possible situation will come to pass; if it can happen, it will happen. This is particularly applicable to operations using explosives. Thus the furtherance of a positive and dynamic safety program by the military departments also includes the capability to respond to those situations where materiel of an explosive nature is creating a threat to our well-being. We call this EOD, for "explosive ordnance disposal."

EOD is generally defined as the capability required to nullify the latent hazards existing in explosive material which, because of unusual circumstances, now presents a threat to personnel, installations, or materiel. The skilled specialist, the EOD man, is paramount in providing this capability.

The word "explosive" has literally been blown up. For EOD, it encompasses all the destructive devices manufactured in peacetime for wartime operations. As such, it ranges from the shells used in small-arms weapons to the largest weapons or munitions dropped from aircraft or launched as missiles. It includes such materiel as nuclear devices, chemical and biological warfare agents, the explosive bolts and switches used in aircraft egress systems, and related or similar items, for commercial or for military use.

An adjunct of EOD is the "rendering safe procedure," commonly referred to in the trade as

"RSP." This operation is normally performed so that ultimate disposal action can be safely completed. Depending on the situation, an RSP may be comparatively safe and easy to perform or immensely hazardous, detailed, complex, and time-consuming. The formal definition of an RSP is "the application of special explosive ordnance disposal tools and techniques to prevent an unacceptable detonation."*

Historically, the need for this particular art was recognized during the early phase of the Battle of Britain. More problem areas arose then from bombs in an unexploded condition than from those whose energy had already been expended. The damage caused by an exploded bomb could be repaired, whereas the threat was ever present with the one that had not exploded.

The British Army organized and trained within the Royal Corps of Engineers a number of Bomb Disposal Squads to cope with this threat. Since approximately 10 per cent of the German bombs did not explode on impact, these squads were hard put to keep up with the workload. And an immediate workload existed, for those areas subjected to bombing attacks—factories, railroad yards, military installations, public utilities, residential areas—were often closed down and evacuated until the bombs were removed. The Germans developed unique and clever fuzing systems to further the cause of the unexploded bomb (UXB) and harass the disposal man in his attempt to safe it. For a while it seemed that a personal battle was being fought between the German designers of bomb fuzes and the British Bomb Disposal Squads. For every unexploded bomb, the questions arose (particularly in the minds of the bomb disposal crew): "Is it a dud? Or is it a time-delay bomb?" And for each of these questions arose other questions: "If it's a dud, will our actions create a vibration sufficient to start it once again on its lethal intent?" "If it's a time-delay bomb, when is it set to go off?" But the main question and doubt centered about, "If it starts ticking, can we run fast enough to get the devil out of here ? ? ?" In spite of the obvious advantage of the German bomb-fuze designers, the British, through trial and error and their persistency and courage in the face of high losses, developed the tools, techniques, training, communication network, and organization necessary to cope with their lethal problem.

Upon our entry into the war and consequent orientation on the problem of the UXB, it was apparent that our military forces needed a bomb disposal organization somewhat like that of the British, taking advantage of their experience. A small number of Army volunteers attended the British Bomb Disposal School, returned to the United States, and established the training program at Aberdeen Proving Grounds that furnished the experts required for our wartime effort. Rather than tell a long war story, suffice it to say that our troops, though sustaining a high casualty rate, performed courageously and admirably.

With the reduction of our military forces during the period 1946 to 1950, so went our bomb disposal organization. At the beginning of the Korean conflict, the function was revitalized, and the name "Explosive Ordnance Disposal (EOD)" was adopted in lieu of "Bomb Disposal" to ensure encompassment of all new munition developments.

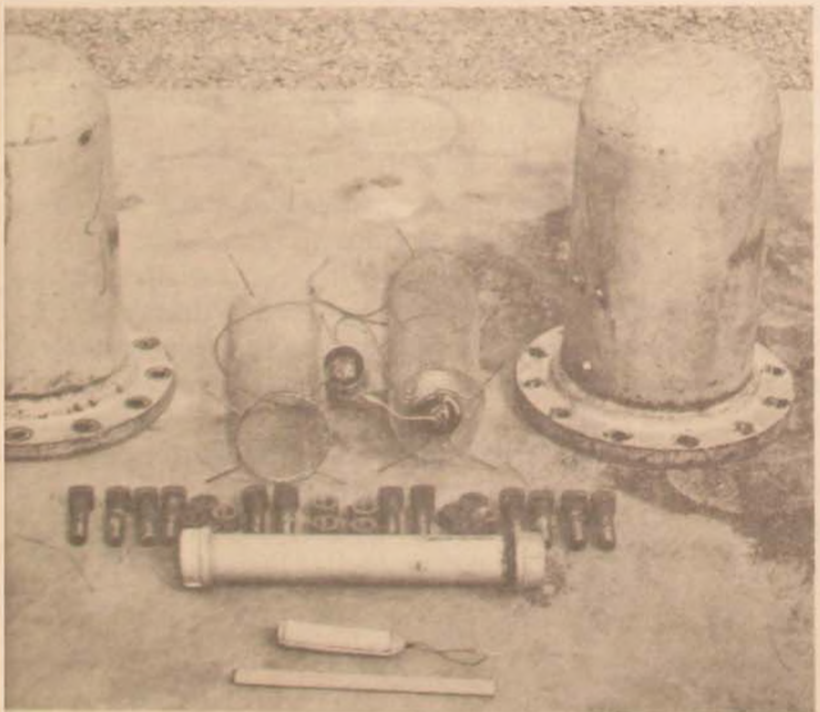
Since a program for EOD in conjunction with the training of underwater divers had been retained at the U.S. Naval Powder Factory (now U.S. Naval Propellant Plant) at Indian Head, Maryland, it became the focal point for schooling the EOD personnel required by all the services. Though the logistic features and methods of delivery of explosive material may differ among them, when explosive ordnance is subjected to other internal or external forces, regardless of when or where found, it still possesses that same death-dealing characteristic. For this and other reasons, it was decided to assign the Department of the Navy the responsibility for conducting all basic, advanced, and refresher training in common-type technical explosive ordnance disposal, including atomic weapons disposal. Although the school is Navy-operated, the Air Force and Army provide selected and highly qualified instructor personnel for its staff. As a result, all EOD personnel in the Defense Department establishment have, as a minimum, the basic ability and knowledge to cope with any type of explosive ordnance encountered.

*There are instances where the disposal action permits detonation of the explosive in place. Such detonation is referred to as "blow in place" or "blow in situation."

EOD Aids Civil Authorities

In February 1963 civil authorities of Oklahoma City requested military assistance for the removal and disposal of two homemade bombs clandestinely stored at a local chemical plant. They were removed to Fort Sill for analysis and destruction.

The bombs contained potassium chlorate, aluminum powder, mercury, magnesium, and other unidentified ingredients that the inventor, who claimed his product was "thermonuclear fissionable," steadfastly refused to divulge. The larger bomb —approximately 48 inches long, 10 inches in diameter, and weighing 300 pounds— was initiated by a powder-filled photo-flash bulb in a can also filled with photo-flash powder. After exploding it, the Army reported that it had a damage area potential of a quarter of a mile. The smaller bomb—approximately 16 inches long, 3 inches in diameter, and weighing 18 pounds—was initiated by what appeared to be an electric squib or small blasting cap.



There are provisions, however, in the Joint-Service regulation which authorize each service to conduct such specialized training as is peculiar to it. Thus it is possible and legal for the Navy to further train its qualified diver personnel on the detailed procedures in safing under water such munitions as mines, depth bombs, and torpedoes, and for the Air Force to expand the schooling of its EOD technicians at disaster control schools so as to emphasize the peculiar requirements encountered in wrecked aircraft or missile site operations.

All Air Force personnel entering into the EOD program must be volunteers who thus willingly expose themselves to the intensive, exacting, and demanding program of training for 19 weeks at the U.S. Naval EOD School. In addition to the vast array of munitions used by the United States military forces the curriculum includes details of the explosive armaments of foreign nations. To facilitate the training process in covering the conventional munitions, a system has been adopted which classifies them along the general lines of method of delivery. These munition classifications give the basis for courses in placed munitions (land mines and booby traps), projected munitions (artillery, rockets, grenades), dropped munitions (bombs and fuzes), conventional guided missiles, and underwater ordnance recognition. Other vital subjects covered in course work are applied physical principles, explosive fillers and filler disposal, chemical and biological fillers and filler disposal, destruction of ammunition, use of tools and equipment, access and recovery, photography and radiography, and aircraft explosive hazards. The eight-hour classroom session is, more often than not, augmented with an additional two to three hours in the study hall at night, for the details taught are included in the almost daily examinations.

At the end of 12 weeks of training in the classroom and at the demolition area, the class is airlifted to Eglin Air Force Base, Florida. Here classroom theoretical knowledge is applied in practical exercises and problems on ranges where live weapons have been dropped. The fact that there have been no accidents on the range is indicative of the students' attitude during the training. Those whose attitude and ability were once in question either met the Evaluation Board and changed for the better or were washed out.

The reward for successful completion of the first 13 weeks of maximum effort is to permit the student to enter the ensuing 6-week phase of training, which encompasses all facets of nuclear weapon disposal. Though the classification of weapons is much the same, the student has reached the stage where components and procedures for each system are taught by Mark and Mod number. The concept behind the school curriculum is: "We teach it—you remember it." Attendance at study hall after duty hours, though not mandatory, is certainly necessary—for once again the Evaluation Board, which considers marginal students, reviews the study-hall attendance roster. The decision of the board is influenced by the student's actions to overcome his weak subjects. But although he is given every chance to improve, he graduates only if he can measure up to the expected standards. The school is designed to produce people who can serve as live experts rather than dead heroes.

Graduation day, a sigh of relief, and the Air Force EOD man is ready for duty with his organization, either as a member of a base EOD element or of a numbered EOD squadron. His activities from now on will generally be specialized within the sphere of Air Force requirements and operations. To understand his role as an Air Force EOD technician, let us first explain and differentiate the EOD responsibilities of the services so as to correlate his needs within the total military program.

First, each service is operationally responsible for providing EOD support on its own installations and for those other situations wherein it had physical possession of the system at the time of the first event leading to the incident.[1] Thus the Air Force has EOD responsibility for any incident occurring due to its operations. Regardless of location, "physical possession" is the paramount factor in determining ultimate responsibility.

Second, the Navy has operational responsibility for the disposal of explosive ordnance that is discovered within the oceans and contiguous waters up to the high-water mark of seacoasts, inlets, bays, and harbors.

Third, the Army has responsibility for disposal of all explosive ordnance not specifically assigned as a responsibility of the Air Force or Navy. This provides the EOD coverage for the entire U.S. land mass, less Air Force or Navy installations, which may be subjected to enemy munitions saturation.

Finally, each service (including its military installations) is charged, regardless of assigned operational responsibilities, to take immediate emergency measures within its capability to neutralize, prevent, or limit possible damage or injury from explosive ordnance pending assumption of control by the responsible service.

These divisions of responsibility have been adhered to by the services and the EOD man in the field, in both theory and actual operations. The excellent cooperation and working agreements among the troops in the field have contributed to the success of the arrangement.

Though it may appear that there is a redundancy of resources in view of the locations of military units, each service has its basic EOD mission in its own distinct area of concern. It must be emphasized that the military organization is a force in-being and in-place to support operations during periods of international tension or actual warfare. Under these conditions of greatly expanded operations, each service will be fully committed to support heavy-workload situations within its own sphere of responsibility. The lengthy training period required to produce an EOD specialist dictates that planning, organization, and resources must be oriented to accomplish wartime missions. Further, each technician necessarily becomes more skilled and practiced in the rendering-safe procedures on the weapons and systems used by his own service than on those of the other services.

The Air Force approach to discharging its assigned EOD operational responsibilities has been to organize its resources on the basis of immediate emergency action and backup support or augmentation as required. This provides the required coverage for those air bases where an incident has a greater probability of occurring and also for those situations of Air Force responsibility happening off base. This Air Force program is applied similarly on a worldwide basis, with minor organizational variations tailored to suit the needs of overseas Air Force commands.

Each major air command controls its own operational EOD program to ensure that every air base with an assigned tactical mission, or engaged in special munition activities, has developed a capability to take initial emergency actions to cope with explosive accidents or incidents on or near its installation. The unit providing this capability is referred to as an "EOD element" and is usually manned by three to five technicians. Approximately 145 Air Force bases maintain an EOD element.

The duties of a member of an EOD element may vary slightly from base to base. In general they include immediate response and EOD action for accidents on or near the base, disaster control activities, standby for aircraft landing with hazardous cargo aboard, operation of the demolition range, disposal of unserviceable munitions, related ammunition inspection and surveillance functions, maintenance of the assigned EOD equipment, and training.

With the exception of training, these duties, computed on an Air Force-wide basis, account for the annual expenditure of approximately 60,000 man-hours. Records indicate that in a year's time the EOD elements complete action on about 1800 to 2000 requests for assistance encompassing some facet of their assigned duties. Approximately 20 per cent of these requests emanate from off-base local law enforcement agencies in connection with the discovery of explosives.

Equipment authorizations are established for the elements to satisfy their overall EOD requirements and those responsibilities peculiar to the base mission. Every effort is made to ensure availability of only the proper and required equipment to do the job. To burden a small unit with excess equipment would only decrease its mobility and add to the task of maintaining tools. To avoid any possible confusion when the bell rings for action, the equipment is packaged, marked, and prepositioned on an alert vehicle. The communication system for alerting an EOD element is by means of telephone and/or radio inclusion in the crash alarm circuit net.

Since the operation of the Air Force and its bases is conducted in strict accordance with safety regulations, standing operating procedures, and good common sense, the EOD man is not often called upon to utilize his skills operationally. He therefore has time enough to pursue a training program that will enhance his technical ability to perform effectively whenever accidents do occur. As a result of the local training program,

USAF explosive ordnance disposal personnel and Governor Bill Daniel examine ordnance found in "Explosive Clean-up Campaign of Guam, 1962."

Some more results of the first four days of the clean-up campaign. Approximately 70,000 items were eventually recovered.

the EOD man is expected to be (1) expertly proficient in all munition systems and aircraft explosive devices employed at his base and at bases in the immediate vicinity, (2) thoroughly and completely proficient in all nuclear munition systems, (3) highly proficient in all munitions handled by his command, and (4) generally knowledgeable as to all other munitions and where to find the details of their handling. To aid the element in its training program, there are Job Training Standards, Air Force Unit Training Standards, an On The Job Training (OJT) Package, Air Force Technical Orders, and Ogden Air Materiel Area (OOAMA) Airmunitions Letters which provide the informational material for the entire program.[2]

Training exercises and operational readiness inspections, simulating nuclear-weapon accident situations, are more the rule than the exception. These do much to coordinate the actions of the EOD element with the other participating units of the Disaster Control Team. Since the element is classified as a nuclear weapon unit for the purpose of capability inspections, failure to achieve a satisfactory rating would prohibit the unit from performing any peacetime functions involving war reserve bombs or warheads. At the time of this writing, we are pleased to report that EOD has always reacted most favorably. With emphasis and direction, this will continue to be the case.

If the description of the base training program has created the illusion that this activity is performed under ideal circumstances or in an atmosphere of modern classroom facilities with all the latest training conveniences, let us hasten to puncture this bubble. The "classroom" is usually some section of the administrative or supply area that is used by the EOD element. More often than not, conference rooms cleared for discussion of classified material have to be scheduled far in advance to accommodate formal discussions of classified procedures.

Practical training usually consists of two phases: (1) operations involving the use of high explosives on the demolition range and (2) dis-

assembly and assembly of training weapons or "over-the-shoulder" viewing of operations conducted by technicians on other types of weapons. Naturally this kind of training is limited by the availability of a demolition range and training weapons among the base assets. If these facilities are not available locally, arrangements are usually made with the nearest military installation possessing them so that the program can be pursued. Such handicaps are often overcome by the initiative of the EOD personnel. Another type of EOD training, Unit Proficiency Evaluation Program (UPEP), is available to personnel of the element, as discussed later.

Operational EOD support for those Air Force situations occurring off base, or augmentation for accidents beyond the emergency capability of the base EOD element, is furnished in the United States and Europe by detachments of a numbered EOD squadron. In the Pacific, this type support is provided by two mobile EOD teams. The need for these organizations is best expressed in the following statements reflecting the criteria of the Air Force Explosive Ordnance Disposal Program: (1) It must comply with the force-in-being concept and ensure maximum utilization of resources. (2) It must be geared to cope with numerous accidents/incidents of Air Force responsibility on a widespread scale during peace or wartime conditions. (3) It should provide for manning and/or support of bases activated or used under war or war-posture conditions. (4) It must provide from its existing resources an additional EOD support capability for an increase in the airborne alert and for new weapon concepts (e.g., aerospace programs involving nuclear devices). (5) It must be capable of rapid reaction and response to assure the public that the Air Force has recognized the essential requirement for being able to cope with accidents or incidents resulting from the transport of munitions. (6) It should not be overly dependent on any one type of transportation facility. (7) It must be able to operate in accordance with established priorities in the event of communication failures and lack of direction from command.

"EOD is their business"

Our operating organization in the United States and for the North American Continent is the 2701st EOD Squadron, a unit of the 2705th Airmunitions Wing, at Hill Air Force Base, Utah. Together with its strategically dispersed detachments, the squadron is capable of rapid response to accidents occurring anywhere in the United States, Alaska, and Canada, responsibility being assigned by geographic area. The squadron headquarters as well as each detachment is able to further deploy two fully equipped six-man teams and still maintain an EOD element capability at its host base. This team concept results in a capability to act on 20 off-base situations at any one time. Each EOD detachment is located within a 500-mile radius of the air bases it supports and can respond by either air or ground transportation. During the Cuban crisis of fall 1962 the squadron's capability to cope with emergency requirements was recognized. The squadron augmented the EOD capability of some of the tactical operating commands' bases, was prepared to effectively support the accident potential resulting from greatly expanded Air Force operations, and could have provided a temporary capability at non-EOD-manned dispersal bases.

Although primarily organized for wartime or war-posture operations, the EOD Squadron effectively utilizes its resources in peacetime. Peacetime functions include response to munition accidents or potential accidents, standby for munition movements, disposal of unserviceable and hazardous munitions, maintenance of equipment, range decontamination, training, and support for USAF operations such as "Full Scope," "Silk Hat," and other projects utilizing munitions. On a yearly average, squadron personnel act on about 500 requests for assistance in which some type of explosive hazard is involved. Approximately 33 per cent of these incidents results in operations off-base, such as explosive recovery in the vicinity of aircraft crashes, monitoring aircraft suspected of being contaminated with radioactive matter, investigating homemade bombs and rendering them safe, removal of explosive material from public and private property, and rendering other technical assistance to local law enforcement agencies.

Other disaster control functions such as radiation detection and monitoring for large-scale operations and emergency procedures surrounding nuclear reactor accidents are an added responsibility of EOD squadrons in the United States and Europe and the EOD mobile teams in the Pacific.[3] Since these organizations are in the command alerting channels for accident or disaster type situations, the additional functions can be effectively absorbed within existing resources, ensuring an Air Force capability to cope with the unexpected.

The range decontamination program ensures that bombing and gunnery ranges in excess of operational and training requirements are returned to public domain, or other agencies, in a safe and explosive-free condition. This becomes a formidable program in light of the advanced techniques in bomb drop scoring, increased use of overwater ranges, and other means of weapon-drop training, all of which require less ground space and consequently release Air Force real estate for other uses or other owners. The land must be searched and all explosive hazards removed prior to Air Force relinquishment. Over the past nine years the EOD Squadron has cleared approximately three million acres of such land. Future range-decontamination programs envision a workload of approximately a quarter of a million acres a year.

The squadron has to be expertly proficient in all aircraft munition systems and ground-launched missile systems. Training therefore is of utmost importance and consideration in the daily routine of the squadron and its detachments. Superimposed on the training schedule is the Unit Proficiency Evaluation Program (UPEP), a combination training and testing program held at Hill AFB, which emphasizes unit or team operations rather than individual knowledge. This continuing program is designed to increase the proficiency of EOD detachments by giving additional practice in and standardization of procedures employed in nuclear weapon accident situations. It further provides a means of evaluating the operational capabilities of each squadron detachment on a semiannual basis. The program encompasses much physical work with all the training weapons—tearing them down and putting them together—identifying components and their hazards, some theory, and many practical exercises. Sometime during the week-long course the team must react to a "Broken Arrow" problem simulating a nuclear weapon accident complete with damaged weapon, simulated radiation and explosive hazards, and the questioning attitude of evaluators posing as officials in charge. To all concerned, it's no game and is treated seriously, for all know that the next call may be the real thing. The detachment works with its own equipment and is in a fully alert and operational status during the entire training period. The critique of the exercise reveals any deficiencies in the EOD team and brings to light any deficiencies in the procedures, techniques, and equipment that the man in the field has to use on a practical basis.

European Theater. Most USAF installations in the European area are a direct responsibility of Headquarters United States Air Forces in Europe (USAFE). In line with this centralized jurisdiction, EOD is organized to provide complete EOD service for the entire area from within the resources of one organization, the 7410th EOD Squadron. The squadron operates from 5 main locations throughout Europe and maintains an in-place capability at 34 bases. At each main location a numbered detachment is responsible for geographical area support and controls the operations, training, and replacement of personnel within its subordinate

Explosive Ordnance Disposal personnel, using underground search equipment, hunt for explosives in a marshy area. The munitions were jettisoned by an F-84 during an emergency.

numbered detachments. These subordinate detachments are responsible for base EOD functions. The squadron and its detachments also perform monthly airmunitions and explosives surveillance surveys of USAFE facilities.

Pacific Theater. Headquarters Pacific Air Forces (PACAF) retains overall responsibility for direction and control of the EOD mission in the Pacific theater. EOD capability is maintained at 20 bases, and additional support is provided by two mobile EOD teams. The mobile teams have a built-in cadre factor to deploy to newly activated bases and to support forces involved in areas of military unrest.

The equipment authorization of an EOD team is slightly expanded over that of a base element in order to enable self-sufficiency in off-base operations and to consolidate and minimize equipment resources that are required only in support of disaster control or emergency operations. Since the EOD team may be involved in any type of munitions incident, its equipage is established on the basis of having the necessary wherewithal to complete any mission. It has greater capability for detecting and determining the extent of radioactive contamination resulting from nuclear weapon or reactor device accidents or incidents than does a base element. Its equipment is packaged, marked, prepositioned, and planned for movement by either air or ground transportation.

Responsibility for the consolidation of all facets of the USAF EOD program has been delegated to the 2705th Airmunitions Wing of the Ogden Air Materiel Area, Hill AFB, Utah. The program is managed by the Explosive Ordnance Disposal Branch, Explosives Safety Division. In this capacity the branch develops management guidance, coordinates Air Force requirements, maintains liaison with the other services, ensures the EOD portion of logistic support for all weapon systems, and in general serves as the staff agency to provide complete technical support for and evaluation of the USAF explosive ordnance disposal mission. Thus the efforts of a single Air Force manager can resolve the diverse EOD problems of the different aerospace programs.

THE AIR FORCE explosive ordnance disposal program, then, is manned by well-trained and dedicated volunteer personnel who find this work both challenging and stimulating. It is operationally organized to respond promptly and effectively with the necessary resources to nullify any latent explosive hazards that may exist. It copes with numerous situations on a widespread scale, supporting all weapon and space concepts. It is managed as an Air Force entity in relation to and coordinated with the programs of the other services. Finally, it will operate effectively under peace, internal-tension, limited-war, or general-war conditions without significant change.

2705th Airmunitions Wing

Notes

1. A Joint-Service agreement in regulation form: AFR 136-8, AR 755-1300-6, OPNAVINST 8027.1A, NAVMC 2513.
2. JTS 46131/71; AF UTS 110-27; OJT Package 46131/71; AFTO's 11A-1-100-(X) AML's 136-4-(X) and 136-11-(X).
3. AFR 355-7, Response to Accidents Involving Nuclear Weapons and Materials.

RAAF AT BUTTERWORTH

SQUADRON Leader F. L. McMahon of the Royal Australian Air Force sends the following information about Base Butterworth in Malaya and also comments on the cooperation of our allies in overseas military operations.

I am a Royal Australian Air Force officer serving on exchange duty at Kelly AFB, Texas. I have read your November-December 1963 issue and would like to comment on one small section of General Milton's article "Air Power: Equalizer in Southeast Asia."

On page 6, General Milton states, and I quote, "The Far East Air Forces of the RAF have two splendid air bases, Butterworth in Malaya and Tengah in Singapore . . ." I would like to point out that the Royal Australian Air Force (RAAF), not the Royal Air Force (RAF), occupies the base at Butterworth, and an RAAF Airfield Construction Squadron built the airstrip. The RAAF has fighter and bomber squadrons at Butterworth, and no permanent RAF units are based there. RAAF Base Butterworth is commanded by an RAAF air commodore, and, except for local purchase items, the base is supplied from Australia by RAAF C-130 aircraft and sea transport. Thus it is an Aussie base in every sense of the word.

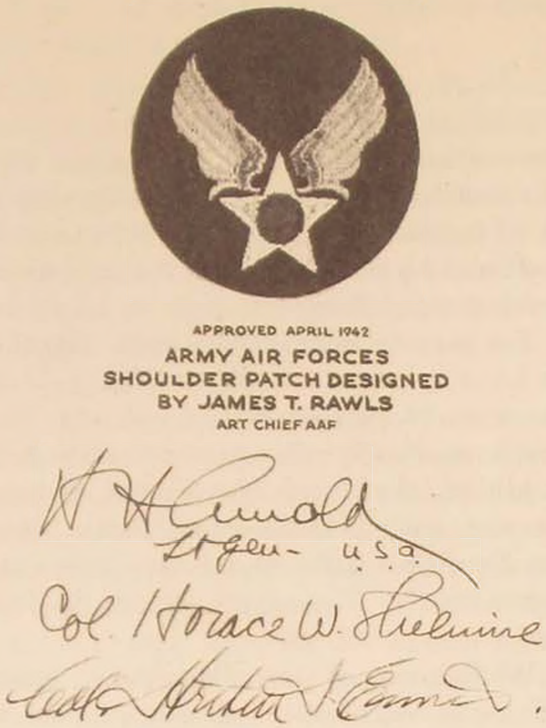
You may be interested to know also that the RAAF has a squadron of F-86's at Ubon in Thailand. As your SEATO partner, we moved into Thailand almost immediately after you did early in 1962. In addition, along with the United States, Australia sent army personnel into South Viet Nam about December 1961 to act as advisers and instructors to the Vietnamese Army. As far as I know, they are still there.

Whilst many of your allies, like Australia, are small, their contributions to the various mutual security pacts are nevertheless important. Perhaps they deserve a little recognition now and then in publications such as yours if for no other reason than to make your readers aware of the contributions being made in the defense of freedom by smaller nations.

AAF SHOULDER PATCH

HUNDREDS of thousands of men and women have proudly worn the Air Force shoulder emblem, but relatively few know the story of its design.

In 1942 Lieutenant General H. H. Arnold wanted a distinctive shoulder patch for members of the Army Air Forces. He assigned the task of designing the insignia to Mr. James T. Rawls, artist and member of his staff. Rawls chose the motifs for the insignia—a pair of wings and the Air Force identification star—and combined them in every conceivable arrangement. But General Arnold promptly refused each design as it was presented. Apparently the general had no firm



idea of what he wanted, but he was sure of what he did not want. This is the more interesting in view of the fact that it was General Arnold's design, submitted in 1917 when he was a major, that was selected for the first Air Force pilot wings. Incidentally, General Arnold did not realize that it was his design that had been picked for the Silver Wings until 1943, when he was asked by Robert D. Erwin, heraldic consultant, AAF, to review an article, "Silver Wings," that Erwin had written for the *National Geographic Magazine.*

Eventually Rawls felt that he had exhausted every possibility. Then one morning a fellow worker, Mr. Oliver Townsend, noted a photograph of Prime Minister Churchill giving his famous "V for Victory" sign. He turned to Rawls and said, "Jim, why don't you put the wings this way?" This was the one design that Rawls had not tried on General Arnold, so he immediately made a sketch. When he presented it, General Arnold said at once, "That's just what I wanted."

Thus the AAF shoulder emblem was born.

Lieutenant Colonel Harmon H. Harper

NEW RADAR ANTENNA

THE Office of Aerospace Research has announced the development of a radar antenna design that when operative will be 100 times more sensitive than the world's largest and most powerful radio telescope at Arecibo, Puerto Rico. It will be 10,000 times more sensitive than the 84-foot radio/radar telescopes now widely used in radio astronomy research. This multiplate antenna, designed by Dr. Allan Schell of OAR's Air Force Cambridge Research Laboratories, will be used as a space surveillance and tracking radar system and as an extremely powerful radio telescope.

Theoretical work began in 1960 at Cambridge Research Laboratories, Hanscom Field, Massachusetts, and construction of a test section covering an area 70 by 120 feet was completed in 1962. A year's evaluation of the test section has resulted in quantitative data verifying the predicted performance characteristics of the full-size antenna.

The projected multiplate antenna would consist of some 5000 flat metal plates, each 20 by 20 feet, arranged in four elliptical areas around a 1000-foot tower. The tower supports a servo-controlled platform that holds the feeds for 25 beams. Each plate is adjustable in height and orientation so as to redirect energy from an arbitrary direction to a focus with the correct phase. A computer is used to determine the proper tilt angle and center height of each plate.

The multiplate antenna idea resulted from the need for greater antenna gain and resolution, which can only be achieved at a specified frequency by providing a larger collection area. Engineering and economic considerations limit the size of movable dishes to about 300 feet in diameter. These limitations were overcome with the Arecibo antenna by having a 1000-foot stationary hemispherical reflector in a natural depression, but with a loss of some scanning capability.* A very important feature of the new multiplate antenna is that it can be built to any size. Its sensitivity by comparison with the Arecibo reflector is pointed up by the fact that if both were focused on an object 15,000 miles away the minimum cross section seen by Arecibo would be about 1/10 square yard whereas that by the multiplate antenna would be 1/1000 square yard. The flatplate antenna can discern details of the moon's surface with an angular resolution of one minute of arc.

Studies are continuing to determine optimum plate size from the standpoint of economy and performance, tower stability, and the antenna control system to move and align plates with respect to the tower for scanning.

Office of Aerospace Research

*The Arecibo telescope is described by Brig. Gen. Benjamin G. Holzman in "Basic Research in the Air Force," *Air University Quarterly Review*, XIV, 1 and 2 (Winter-Spring 1962-63), 62-65.

The Contributors

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CAPTAIN GERALD GARVEY (USAFA; Ph.D., Princeton University) is a member of the faculty at the Air Force Academy and teaches a special course for seniors in American defense policy. He is coauthor of a book of readings on American constitutional law, to be published soon under the title *Corwin on the Constitution: Essays in American Constitutional History*. His forthcoming work entitled *The Constitution of American Defense* will be an elaboration of the trends outlined in his two *Air University Review* articles.

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LIEUTENANT COLONEL ANDREW J. CHAPMAN graduated from pilot training in January 1944 and subsequently was a flight instructor, an operations officer, and commander in tactical fighter units, serving in the 18th Fighter Group, 86th, 20th, and 4th Fighter Wings. In July 1962 he was assigned to the 2d Air Division in the Republic of Viet Nam, where he was Air Liaison Officer to the 5th Infantry Division and later USAF Strike Plans Officer, Joint Air Operations Center. He has recently been assigned to the Office of the Inspector General, Hq Tactical Air Command. Colonel Chapman is a graduate of the Air Tactical School and the Air Command and Staff College.

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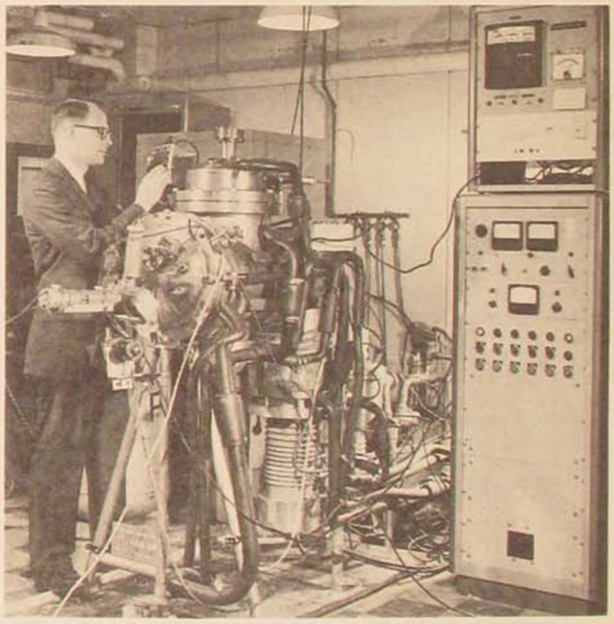
MAJOR GENERAL DALE O. SMITH (USMA; Ed.D., Stanford University) is Air Force Member, Joint Strategic Survey Council, Joint Chiefs of Staff. During World War II he commanded the 384th Bombardment Group (B-17) in the European Theater. After graduating from the Air War College in 1948 and receiving his doctorate in 1951, he served on the Air War College faculty and in 1952 became Director of Education, Hq Air University. In 1954 he was assigned to the staff of the Operations Coordinating Board. During 1956 he was Chief, Policy Division, Plans Directorate, DCS/O, Hq USAF, and in 1957 he was sent to Saudi Arabia as Chief, U.S. Military Training Mission, and Commander, 2d Air Division (USAFE). In 1958 he was assigned as Commander, 313th Air Division, Okinawa, and in 1960 as Commander, 64th Air Division (ADC), Stewart AFB, N. Y. He was Special Assistant to the Joint Chiefs of Staff for Arms Control from 1961 until his present assignment in 1963. General Smith is the author of *U.S. Military Doctrine* (1955), and his articles have been published in numerous magazines and in *Impact of Air Power* edited by Eugene Emme and *The Wild Blue* edited by John F. Loosbrock and Richard M. Skinner.

COLONEL GARLAND O. ASHLEY (M.A., University of Maryland) is Executive to the Senior USAF Member of the Weapons Systems Evaluation Group, Office of the Secretary of Defense. During World War II he served in the CBI Theater in combat engineering and as Freight Control Officer for operations over the Hump. Subsequent assignments have been as Chief, Research and Lecture Section, Air Tactical School, Tyndall AFB, 1948-1950; Director of Instruction, Squadron Officer Course, Maxwell AFB, 1950-1952; Director of Psychological Warfare, 582d Air Resupply and Communications Service Wing, 1953; instructor, NATO-USAREUR Atomic Weapons School, Oberammergau, Germany, 1954-1956; with the Deputy Inspector General for Training and Education, Hq USAF, 1957-1959; and as Chief, Strategy Branch, Cold War Plans, Hq USAF, 1960-61. Colonel Ashley's writings have been published in many service and national magazines.



DR. JOHN W. SALISBURY (Ph.D., Yale University) is Chief, Lunar-Planetary Research Branch, Space Physics Laboratory, Air Force Cambridge Research Laboratories, Office of Aerospace Research. He joined the scientific staff of AFCRL as a lieutenant in 1959 after receiving his Ph.D. in geology. He left the service in 1962 but remained at AFCRL in a civilian capacity. Although his branch conducts research on both lunar and planetary environments, his specialty is the lunar environment. Dr. Salisbury has written many scientific papers in this field and is coauthor of the recently published study, *The Lunar Surface* (1964).

S. STEINER is presently designated a supervisory ammunitions inspection specialist and employed as Acting Chief, Explosive Ordnance Disposal Branch, Explosives Safety Division, 2705th Airmunitions Wing, Ogden Air Materiel Area. Commissioned in 1942 from the Ordnance Officer Candidate School, he served with the Air Force 1915th Ordnance Ammunition Company in the European Theater until 1945. From 1950 to 1956 he commanded Army ordnance disposal units in the zone of interior and Korea. He was Chief, Range Services Division, White Sands Missile Range, New Mexico, from 1956 until his retirement as a captain, AUS, in 1958.

ATTENTION

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