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Fairchild

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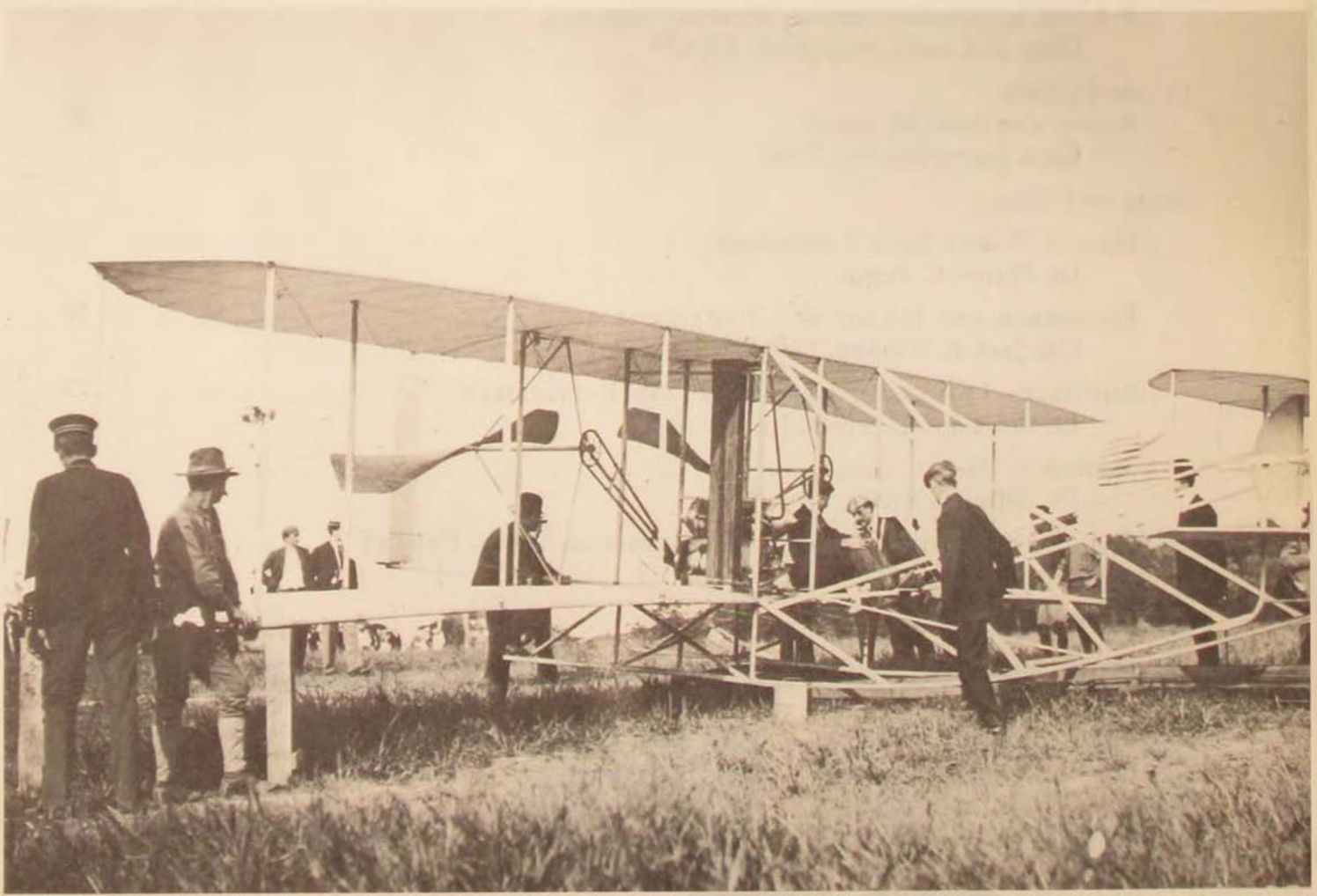
the cover

Ordinarily *Air University Review* probes beyond the individual and the organization to consider the idea and its impact. But perhaps on the occasion of our silver anniversary this spring we may be granted an exception as we pay respect to our own founding patron and the father of Air University, General Muir S. Fairchild (1894–1950), seen here in Richard L. Seyffert's portrait of him that hangs in Air University's Fairchild Library, named in his honor. For more on our twenty-fifth anniversary see page 10.

THE EVOLUTION OF AIR WARFARE

MAJOR GENERAL ROBERT N. GINSBURGH MAJOR EDD D. WHEELER

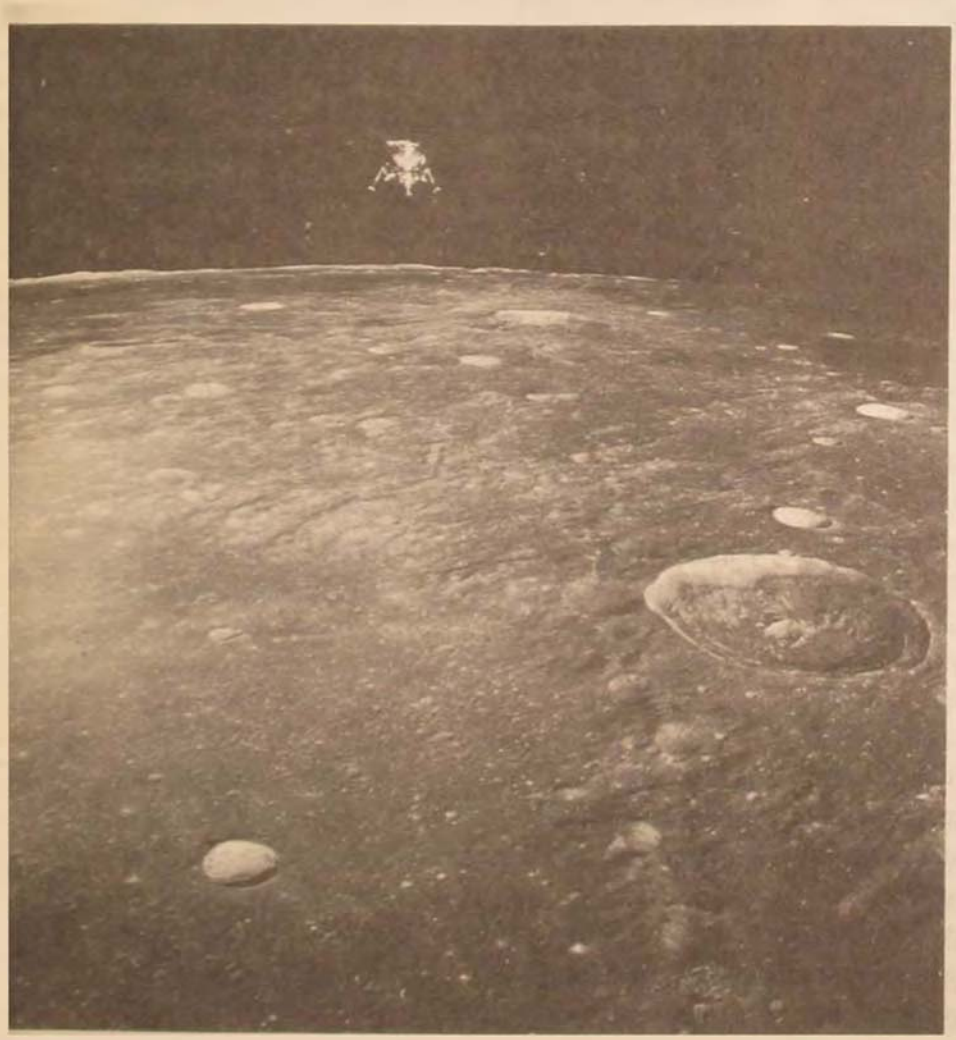
IT HAS BEEN SAID wisely that the world is a scene of changes. Yet, in scanning the history of land and naval warfare, one finds it remarkable how slowly the changes evolved. Twenty-five hundred years ago the Greeks marched into battle to the slow music of flutes. In World War II, the British mounted their ground attack at El Alamein to the slightly more stirring music of bagpipes. In both cases the soldiers walked into battle. Similarly, some naval practices have changed little. Athenian seamen of the fifth century B.C. perfected



ramming and boarding tactics, thus influencing the British as late as 1911 to build battleships with ram bows.

The history of air warfare has been less barnacled by convention. Of course, this is true partly because its history is relatively short. More important, though, it is true because air power is a creature of change, especially as change is realized through technology. The effect of technology on warfare is the subject of many pale clichés, and we hope not to repeat them here. What we would like to do is to assay the changes wrought in the evolution of warfare, particularly air warfare, by examining five of its rudiments: *strategy, tactics, command and control, weaponry,* and *mobility.*

By looking at each of these factors, one can see air power as having added several new dimensions to warfare. The changes can best be described as revolutionary rather than



evolutionary in nature. So great has been the impact of these changes that they have affected our lives both in war and peace—and in the indeterminable region between war and peace that is one of the hallmarks of the modern era.

strategy

The army's traditional approach to strategy has been to defeat the enemy on the battlefield. This objective has been uppermost in land commanders' minds since ancient times. It recently was given colorful expression in Vietnam by an Army colonel, who urged his men to find the enemy, "then pile on." Likewise, the historical naval objective has been to close with and defeat the enemy's main battle fleet. Admiral Dewey sought out the Spanish squadron at Manila Bay for just that purpose. The Air Force, too, has held essential in warfare the destruction of opposing air forces. For example, in preparation for the invasion of Fortress Europe, General Arnold declared to the commanders of the Eighth and Fifteenth Air Forces: "My personal message to you—this is a *must*—is to *'Destroy the Enemy Air Force wherever you find them, in the air, on the ground and in the factories.'* "[1]

Arnold's directive is telling, for it mirrors a major change in strategic thinking. It reveals that the defeat of the enemy is to be achieved in areas besides the field of battle. The objective of air strategy is to defeat enemy forces both in and beneath the skies. Thus, air power is, as Douhet affirmed fifty years ago, "the offensive weapon *par excellence*."[2] It is pre-eminently an offensive weapon not only because it can attack land and naval forces almost at will but also because it can circumvent them and strike directly at the enemy's capacity to wage war by destroying his industrial, logistical, and administrative centers. If demanded, the cutting edge of air power could even be laid against the very threads which hold a culture together as a viable society. Herein lies its most awesome power and its greatest use as a deterrent force.

During the First World War, Churchill said of Admiral Jellicoe that he was the only man who could lose the war in a single day—or, as Jutland was actually fought, in a single night. The same can be said today of air commanders of major powers, except the stakes are now not merely losing a war but losing a civilization. It was Charles Lindbergh who, even before the atomic age, said:

> Aviation has, I believe, created the most fundamental change ever made in war. It has abolished what we call the sense of warfare. It has turned defense into attack. We can no longer protect our families with an army. Our libraries, our museums—every institution which we value most, is laid bare to bombardment.[3]

The gravity of this statement, made more grave by the passage of the last 35 years, is enough to fill us as airmen not only with a deep sense of vigilance for our country but with an abiding sense of responsibility to civilization as well.

The modern naval arm also possesses this profoundly strategic capacity, although perhaps on a somewhat reduced scale. Interestingly, however, the navy derives almost all its potency as a strategic offensive force from air power, that is, from carrier-based aircraft and submarine-based missiles. Without its air and missile arms, the power of today's navy, like that of past navies, would be limited largely to the coastline.

tactics

For land and naval warfare, what is written large is also written small; and tactics, like strategy, has evolved at a snail's pace. In 216 B.C., Hannibal fought a battle of annihilation at Cannae and won a victory over the Romans through use of the double envelopment. The Russians haplessly failed to learn the meaning

of this lesson, for 2100 years later at Tannenberg they suffered a catastrophic defeat by falling prey to an almost identical maneuver. In our own century, the parallels between the tactics of near trench warfare in Korea and those in Europe during the Great War are striking. One writer even observes that the only two significant tactical innovations in Korea were "the combat helicopter and the revival of infantry body armour."[4] Of those two, only the helicopter can be regarded as true innovation, for use of armor can be traced back at least forty-five centuries.

Naval tactics also have been slow to change. The hit-and-run tactics employed against the Spanish Armada were not too different from those used against Mark Anthony at Actium, although in the 1600 years between those engagements the sail had replaced the oar and the sword had largely given way to the cannon. More recently, the battle for Leyte Gulf in the Second World War saw the U.S. fleet execute successfully the "crossing the T," a tactic owing much to the genius of Lord Nelson and the early nineteenth century.

Tactics in the air, however, have experienced revolutionary development. The first significant application of air power was the balloon, which was used for reconnaissance in the ancient quest for the high ground. Incidentally, the evolution of air power in America has been quite as fortuitous as many events in our history. Had it not been for the personal interest and foresight of two Presidents, the air role might have been established much later; and having been established, it might have enjoyed a considerably less meteoric development. President Lincoln impressed upon an unbelieving Union Army the tactical value of military balloons, and Teddy Roosevelt's robust fascination with the Wright brothers' experiments gave the necessary impetus to military aviation in this country several years after Kitty Hawk. Thus, the wisdom in Billy Mitchell's opinion that "changes in military systems come about only through the pressure of public opinion or disaster in war"[5] might be modified to account for the value of influential supporters at the highest levels of government.

At any rate, with the coming of powered flight in the first decade of this century, events moved slowly at first, then rapidly. Within months after the start of World War I, airplanes were used for reconnaissance and "regulation of artillery." Airmen soon were flying in close and blazing away at air or ground targets with hand weapons. But matters did not stay that simple for long. Machine-guns were mounted, flying formations improvised, and by 1917 as many as 100 planes were engaging in single aerial battles. In the great Somme offensive a year later, the Allies launched almost 2000 planes in support of their drive. Even so, the decision—or, more accurately, the indecision—at Somme came in the mud rather than in the air. The war ended before air power could be decisively proven in tactical situations, but the air had become an area of battle no less than the ground and the sea. The idea of air supremacy and strategic bombing as decisive factors in warfare had been born and would be developed in the postwar years by pioneers in several countries, notably in the United States by the Army Air Corps leaders.

World War II and later conflicts witnessed the greatest tactical changes in the evolution of air warfare. In a general sense, air tactics added the new dimension of vertical assault to the traditional modes of warfare. Further, as it grew toward full and equal partnership with the other services during the Second World War, the air arm dissolved the neat compartmentalization of tactics (and strategy) into land and sea operations. Warfare became three-dimensional.

In a specific sense, to list only the most obvious examples, air power enabled the "so few" of the Royal Air Force to win the Battle of Britain, helped prevent numerically inferior U.S. forces from being overwhelmed in Korea,

and in both Korea and Vietnam has permitted U.S. ground and naval forces to operate free from the ravages of enemy air attacks. Progress in the evolution of air tactics has allowed large bodies of ground forces, covered and supplied from the air, to fight their way out of enemy entrapments. More significant even, as seen in an important lesson of Vietnam, properly conceived air tactics can prevent such an envelopment from ever occurring.

Without attempting a cumbersome catalogue of achievements, one can say, prosaically perhaps yet revealingly so, that air tactics have evolved so fast and so far as to change utterly the face of warfare. The complete decisiveness of air tactics allowed the Israelis to win the Six Day War in 1967. Indecisiveness about the employment of air tactics is one reason we associate the Bay of Pigs with the word "fiasco." Yet we do not make euphoric claims for the absolute efficacy of air tactics in warfare. For example, the defenders of Dien Bien Phu doubtless could not have been saved in the last days of the siege by conventional air tactics using conventional weapons. They might have been saved, however, if the French had possessed greater air power in Indochina and had brought it to bear in force before the final death spasms of the siege. By that time, an eleventh-hour move by aircraft from American carriers was hardly the answer. But certainly the defense of Khe Sanh is instructive on this point. Because of American air power, that Vietnam outpost, rather than proving another Dien Bien Phu, provided the chance to attract and kill more than ten thousand of the enemy. This lesson—the need to employ air power in force, in time, and at points of our own choosing—holds special meaning today, as the Air Force assumes the residual-element role in protecting our forces as they withdraw from Vietnam.

command and control

The third element to be considered has been discussed widely since the term became familiar in the days following the Cuban missile crisis. Actually, the concept of command and control can be traced back at least to the time of Alexander the Great, who had an elaborate communications system of battlefield messengers and signaling procedures using smoke and fire. His chief methods of command, though, were by voice, trumpet, and spear movement. The Mongols later made their contribution by introducing black and white signal flags. Field telegraph was used extensively during the Civil War; yet military communications remained generally crude up to the time of the Second World War. This fact is remarkable in light of the veritable revolution that took place in communications during the late nineteenth century: within twenty years, Bell invented the telephone, Marconi the wireless telegraph, and Edison the radio vacuum tube. Despite these advances, however, communications were notoriously poor during the Spanish-American War, and even into the 1930s U.S. officers were required to know semaphore. Use of messengers and signal flags was standard practice at the outbreak of World War II.

Today, it is well known that command and control extends "from the White House to the American servicemen in the remotest corners of the world."[6] Not so well known are the implications of this system. They are immense. Imagine, for instance, the meaning to history had President Madison been able to notify General Jackson at New Orleans that battle with the British was unnecessary, since peace had been declared two weeks earlier. The result would very likely have been no Jacksonian era.

The implications of modern command and control systems are no less staggering. When the President can communicate directly and almost instantaneously with U.S. forces in the field, the way is paved for experiencing great advantage—and under some circumstances great harm. Advantage can come from removing decision-making power from the heat and

irrationality of the trouble spot, where actions might tend to be precipitate, to a place where the problem can be studied by experts, in perspective and the cool of reason. Such an approach is essential in situations that might easily lead to an undesired confrontation. However, harm can also be the bitter fruit of such practice. This is especially likely when too much psychic distance is achieved and the experts are so far removed from the focal point of action that they lose touch. We do not necessarily learn to "tell the dancer from the dance" by leaving the ballroom.

In any event, the speed of communications in the command and control system has deeply influenced our national policy. The use of air power, already attractive for its speed, flexibility, and range, is made even more attractive when it can virtually be brought to bear on crises as they begin to develop. A case in point is President Johnson's response to the situation in the Dominican Republic. Having received a series of urgent cables from the American Ambassador, the President was able to discern at once the urgency of the moment. His response was, of course, to land Marines from the fleet offshore and later to airlift in military forces to protect American lives and property in the face of violence and disorder. Within days the government was convinced that the revolution had been subverted by Communists—a matter that became a disputed point of fact. The President later credited U.S. intervention with allowing the revolutionary leaders to return to prominent roles, thereby lessening chances for a Communist take-over.

"Time," the great commanders Wellington and Nelson agreed, "is everything." The wise and decisive use of time is a chief justification of command and control. Through this system the President is given time to comprehend the situation and judge the appropriate action. This being done, he can communicate his decision to his commanders at the speed of light. If, however, the decision is to be implemented, the command and control system must be made survivable to the lowest echelon. One of the main tasks today is to concentrate on this problem of survivability. It will avail us nothing to be able to turn on bulbs at the speed of light if the lamp itself is destroyed.

weaponry

Destruction in warfare is a direct function of weaponry. Man's first weapon was probably the stick or club, which was quite effective at close quarters but obviously limited in range. Major advances in range and destructive power came with the rock, the sling, and the bow and arrow in the late Stone Age. One could now strike out many yards and, if a good shot, inflict casualties as quickly as he could reload. Still, change in ground weaponry was slow, and it was thousands of years later at Crécy (1346) before the bow came into its own as a decisive instrument of war. The English longbow had an effective range of 250 yards and could be fired about as quickly as any weapon to appear until the time of the Gatling machine gun some 500 years later.

The twentieth century has witnessed a rapid increase in ground firepower, but the weapon range of the individual soldier is still scaled in hundreds of yards, while artillery reaches out thousands of yards. The modern army attains farthest extension through its air arm, with use of the helicopter. Although the helicopter's range is measured in hundreds of miles, it, like land weapons, is highly vulnerable to attack from the air and ground.

By way of comparison, the range of our strategic aircraft and missiles is intercontinental, leaving no point on the earth's surface inaccessible to them. And their destructive power is many times greater than that of the largest conventional artillery piece.

As for naval weaponry, the dominant vessel for 2100 years was the galley, which was essentially nothing more than a troop carrier. Even long after the advent of gunpowder and

the broadside cannon, destruction at sea was achieved mainly by the ramming and boarding of seaborne armies. Well into the nineteenth century the most common weapon for sailors was the sword or cutlass. The appearance of the torpedo, the rifled cannon, and the ironclad marked significant advances in naval weaponry. But the greatest advances came in this century with widespread use of the submarine, which conceptually dates back to sketches by Leonardo da Vinci, and the more modern aircraft carrier. The German U-boat offensive very nearly took Britain out of World War I, while Pearl Harbor will always serve as a grim reminder of the destructive power of the undetected carrier. Both these weapons continue to pack a lethal offensive punch; today, however, we think of the aircraft carrier and the ballistic missile submarine as weapons of aerospace warfare as well as naval warfare weapons.

It is difficult to guide a discussion of air weaponry between the Scylla of triteness and the Charybdis of panic. In popular thought, the subject is usually reduced to talk of "nuclear holocaust" and "the bomb." This approach, of course, is not new. As Noble Frankland observes, "Bombing has throughout its history evoked a powerful emotional response and about it . . . people have tended to prefer to feel than to know."[7] We must pierce this fog of language and emotion if anything substantial is to be said.

Two facts clearly concern the evolution of air weaponry. First, the capacities of offensive air vehicles have increased faster than those of the defense. In the early days of aviation, slow-moving dirigibles and aircraft were relatively easy targets for faster aircraft—and at low altitudes, even for ground fire. Between the world wars came the promise that "the bomber will always get through," and in World War II most of them did. Even in the disastrous raid on Schweinfurt, about 70 percent of the bombers penetrated to the target. The advent of missiles and nuclear weapons has vastly complicated the task of the defense. In order to save the defended target, it is necessary to destroy *all* the attacking vehicles. If the attack is massive and executed by sophisticated aerospace weapons, the defense's task is close to impossible.

This is not to say that air defense has become superfluous—only exceedingly difficult. For now, the crest of technology is being ridden by the offense. But technology, whose hallmark is radical and sudden change, might unexpectedly alter the present tide at any time. To save ourselves from such an undertow, the defensive guards must be kept on duty.

The second point concerning air weaponry relates to its vast potential destructive power. It has evolved from the hand bomb, to the high-explosive "block buster," to the nuclear "city buster." Nuclear weapons, as the wise affirm, "have not radically altered the trend of international politics";[8] but their immense destructiveness has altered the trend of warfare. Advances in air weaponry have made the idea of nuclear war so terrible that it is thinkable only after declaring it unthinkable. Even so, the dreadful potential of air weapons and our years of nuclear advantage did not bring us peace. We can only hope that the time of nuclear parity will not bring us war. The potential destructiveness of air weapons must be kept precisely that—a *potential.*

mobility

The last element to be discussed, that of mobility, can be treated with appropriate dispatch. Land and naval forces have always shared a common range of speed. Until fairly recent times, the unopposed army or navy could push forward at three to five miles per hour. With mechanization and various forms of the internal combustion engine, this figure has been raised perhaps tenfold. In the last 5000 years of recorded warfare, then, man has learned to move between points A and B

in two and a half hours rather than in an entire day. Yet he remains encumbered by two immutable facts. First, speed and maneuverability are inhibited by an opposing force, especially for surface forces, which must operate on a two-dimensional plane. Second, the laws of nature dictate the medium in which these forces move. Soldiers do not walk on water, and ships do not steam over hill and dale. Thus, terrain and the opposition allowing, armies have access to only 30 percent of the earth, leaving the rest of the surface and the ocean depths to the navy.

Both nature and technology have been kinder to air mobility. Nature allows us a medium, the atmosphere, which impinges upon every point of the earth's surface. In a purely theoretical sense, that medium projects outward to the regions of near and deep space. The regions of space do not necessarily represent Air Force domain, but they do represent infinite stretches in which infinite maneuverability might be exercised. Space is not our private ocean, but it is the abstract sea upon which we border and the vast approach which is ours to guard. For this task, the greatest possible mobility is required.

Technology has given air forces great mobility. The Wright brothers' "Flyer" attained a speed of 30 miles per hour. The fastest modern jet craft has increased that figure by almost a hundredfold.

Although our overall air mobility is great, we need ever to improve it. Like Lewis Carroll's figures, we must go faster in order to stand still. This is especially true since the adversary who wants to remove us permanently from Wonderland can be as unreasoning as the Mad Hatter.

IN CONCLUSION, we would leave you with these three thoughts. First, air power is potentially decisive. Its flexibility can permit the necessary concentration of effort and firepower either in support of friendly surface forces or as an independent thrust against hostile surface forces. Air power can control the air as well as deny land and sea forces control of the earth's surface. Because of this potentially pervasive power, the Air Force acts as one of the nation's primary deterrents against both limited and general war.

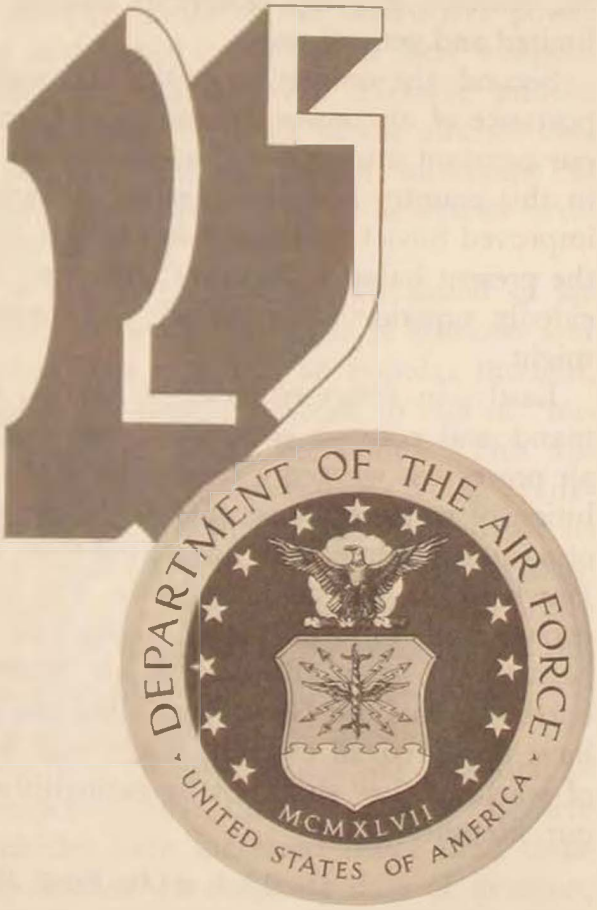
Second, the unique capacities and vast importance of air power demand that it receive our constant attention and vigilance, not only in this country but also abroad. A radically improved Soviet tank or cruiser would not tip the present balance of power; however, a decidedly superior Soviet missile or antimissile might.

Lastly, in terms of strategy, tactics, command and control, weaponry, and mobility, air power has worked a revolution in the evolution of warfare. In seventy years, the space of a single lifetime, man has soared from Kitty Hawk to the Sea of Tranquility. Yet, in the evolution of warfare, at least, things will never be tranquil again. Because of air power, to borrow from Lord Grey, new lights and ideas have appeared all over the traditional modes of warfare; they shall not be extinguished in our lifetime.

Office of Air Force History

Notes

1. Quoted in Robert F. Futrell, *Ideas, Concepts, Doctrine: A History of Basic Thinking in the United States Air Force, 1907–1964* (Maxwell AFB, Alabama: Air University, 1971), Vol. 1, p. 139.
2. General Giulio Douhet, *The Command of the Air*, trans. Sheila Fischer (Rome: Rivista Aeronautica, 1958), p. 13.
3. Charles A. Lindbergh, "Revolutionary Changes Wrought by Aviation," *Air Corps News Letter*, 20 (February 15, 1937), p. 13.
4. "Tactics," *Encyclopaedia Britannica*, 1963 ed.
5. Quoted in Wesley F. Craven and James L. Cate, *The Army Air Forces in World War II* (Chicago: University of Chicago Press, 1948), Vol. 1, p. 24.
6. "Can Vulnerability Menace Command and Control?" *Armed Forces Management*, July 1969, p. 40.
7. Noble Frankland, "The Combined Bomber Offensive: Classical and Revolutionary, Combined and Divided, Planned and Fortuitous," in *Command and Commanders in Modern Warfare* (USAF Academy, n.d.), p. 283.
8. Raymond Aron, *On War*, trans. Terence Kilmartin (New York: W. W. Norton and Co., 1968), p. 3.



Anniversary Reflections

In a memorandum of 27 February 1947, Major General Muir S. Fairchild, then Commanding General of Air University, first formulated what were to be the guiding principles for a "journal of Air Power." Soon thereafter, so that it could be put into the hands of Air University's first graduates, the *Air University Quarterly Review* was born with the Spring issue of 1947. Thus, with this present number, twenty-five years and some 106 issues later, *Air University Review,* direct descendant of that first *Quarterly Review,* completes a quarter of a century of publication.

Much has changed through the years, of course. Perhaps most noticeably, the little blueback *Quarterly* gave way in 1963 to a larger, more attractive format, with a shorter title, *Air University Review,* published on a bimonthly basis. Early

in its history the *Review* went hemisphere-wide with Spanish and Brazilian Portuguese editions for distribution in Latin America. Yet despite these and many other changes, the *Review* continues to follow—perhaps with surprising closeness—that early mandate from General Fairchild:

> This journal of Air Power will not be just another news-magazine, nor is it intended as a periodical of interest only to the Air University. Rather, it will be a professional publication in the highest sense of the word and will reflect not only the high scholastic standards and educational accomplishments of the Air University, but also—and more important, perhaps—the best professional thought concerning global concepts and doctrines of air strategy and tactics.
>
> Thus, in certain respects, the *Air University Quarterly Review* will be an extension of the concepts and doctrines developed at the Air University and which underlie its program of instruction.

We have found this a tenable editorial philosophy, one that frees us from overconcern with much day-to-day trivia and enables us to extend our range and grow with our parent institution, Air University. That the guideline has more than parochial effectiveness is attested by the fact that for the last fifteen years we have been designated "the professional journal of the United States Air Force."

Another tradition of the *Review*—and one that has been a source of strength for the publication and of particular gratification to the editors—has been the continuing support of many fine writers and aerospace thinkers. Two from the long list of contributors who have been published in our pages more than once appear again in this anniversary issue: Brigadier General Noel F. Parrish, USAF (Ret), who, starting with Volume 1, Number 1, has made almost a dozen contributions to our pages through the years; and Major General Robert N. Ginsburgh, USAF, who has written for us several times since 1964. (Both generals are former commanders of Aerospace Studies Institute, of which the *Review* was a division for about a decade.)

General Parrish's contribution in this issue constitutes another departure from our norm: we reprint an article—his first *Review* article, written when he was a colonel and a student in the new Air Command and Staff School, just as it appeared in that prototype journal of air power. We feel that the article still has remarkable impact and immediacy these twenty-five years later and think you will agree. Perhaps, from time to time as space allows, other still-cogent articles from our past will be reprinted—not for their curiosity but rather for their continuing usefulness.

Meanwhile, on with our second quarter-century.

The Editor

New Responsibilities of Air Force Officers

Colonel Noel F. Parrish

Colonel Noel F. Parrish

IN THE WORLD now shaping itself around us, the Air Force officer is destined to play an increasingly important role. This is true whether that world is heading for peace or war. Even if the peace we now enjoy should endure for a period beyond all dependable prediction, it must continue for years as a strange and restless peace such as this nation has never experienced.

In the past our nation has made severe and almost impossible demands upon its military men of all ranks who have remained in uniform beyond the end of hostilities. It is commonplace in every nation to observe that the soldier is a hero in war and forgotten in peace; but our own nation, during its recurrent dreams of perpetual peace, has always more than forgotten its professional soldiers.

Middle-aged Air Force officers can well remember when their appearance in large numbers was sufficient to cause alarm as well as annoyance everywhere but in the "army town" --San Antonio, and perhaps San Francisco when the fleet was not in. The flight of more than three or four military pilots to one city on the same day was considered a reckless invitation to public comment. The only exceptions were the duly authorized and duly infrequent maneuvers, which provided sufficient unfavorable comment in themselves. As for Washington, the source of all military authority, Army pilots were requested when flying there to carry civilian clothes for street wear, lest representatives of the people be reminded of their existence.

It is not surprising that military airmen not timid by nature had a strong tendency toward over-expressing themselves once they were "safely" in the air, and too often flew with a deliberate daring and bravado which was the

direct antithesis of, and compensation for, their conduct on the ground. Some can recall the extreme cases, the quiet men who expressed themselves seldom and inadequately in words, but frequently took to the air with a strange light in their eyes and a passion for disturbing not only people but even cattle and sometimes such things as sailboats, with the utmost technical skill. The decline of anonymous exhibitionism in recent years is not due to more stringent regulations, since the law of gravity was always the severest of all, but to the increasing dignity of the airman as a member of modern society.

Those men who achieved a certain dignity and too often a defiant death in attempts to demonstrate human mastery of the mysteries of flight were greater in number than those who dared to challenge the attitude toward flying, and particularly military flying, of men on the ground. The exhilarating struggle with the forces of nature, dangerous as it was, gave a man a kind of release from the pettiness of jealousy and fear. But for a man to identify himself on the ground as a military airman, and openly to proclaim his aspirations and convictions in words as well as in action, was to invite the bitterest personal attacks upon himself; attacks which too often provoked bitterness in return.

The most disturbing feature of these attacks was the fact that they came from the conservative and tradition-loving civilians, otherwise his most tolerant friends, and from his brothers-in-arms. If the airman wrote or spoke about the things he knew, such as the development of his new profession and the application of its principles, he was branded by one faction as threatening to scrap the country's dependable defenses and by the other as threatening to destroy all other nations. In their haste to discredit him, the same individuals often tried to combine these contradictory arguments by describing him as a harmless crank and, in the same breath, as a ruthless destroyer. Shunned by progressives and damned by conservatives, the handful of military airmen who founded our present Air Forces were encouraged mostly by each other.

THE CONSTRAINT of expression by Air Corps officers was not merely social and theoretical. It was a matter of military discipline. The arguments advanced by General Mitchell were not exclusively his own, nor did he differ significantly from other leading military airmen except in his argumentative manner and uncompromising attitude. He was by no means the only officer effectively silenced by the outcome of his case. Other air officers who wanted to remain in the service and hoped someday to be able to influence its policies became almost secretive concerning their ideas on new methods of warfare. Some demonstrated an interest in more traditional matters and even managed to develop an affection for horses, a characteristic which was considered in old Army circles as the one indispensable attribute of a truly military man. Prior to the late 1930's, only the boldest and most tactless Air Corps officers allowed themselves to be heard beyond the next room when discussing anything of importance to the nation. There was a period when it seemed that even the Air Corps chiefs were self-effacing to a degree detrimental to the men they represented.

Small wonder that the Air Forces of today have few senior officers skilled in the use of words. Captain H. H. Arnold, one of the most irrepressible of the pioneers, managed to keep in practice by writing air stories for his children and, later, books of a more or less inspirational nature for boys and young men who absorbed his enthusiasm and overlooked the careful vagueness of his statements. Behind the scenes, he and others fought many battles that made for progress. Such small-scale projects as the pioneer flight of a few bombers to Alaska in 1934 were carried out despite relentless opposition and criticism which immediately branded the achievement as a "stunt" intended to mislead the public concerning the feasibility of long-range military aviation.

But it was only beneath the surface that progress was achieved. Air Corps officers, greatly outranked and outnumbered, were unable to gain recognition for their warnings and proposals at top-level, and progress at that level was much slower than was demanded by awakening public opinion. As the divergence between advancing public opinion and slow

official progress widened, Air Corps officers were in an increasingly delicate position. Opposition to their efforts became more desperate. The Baker Board report of the late 1930's was really more reactionary for its time than the Morrow Board of the early 1920's had been.

The recommendation of the Baker Board, which tried to limit aviation to three-hundred-miles range, seems comic today, but it was far from comic to the military airmen who had to go on trying to build Air Power despite the throttling effect of such a policy. The achievements of a quiet but determined little group of Air Corps officers, in the face of unrelenting official opposition and disapproval, still seem miraculous even to those who watched them work. They had little support except a vaguely sympathetic public that had no idea who they were or how to help them. Yet when necessity arrived ahead of all prediction, they suddenly built the world's greatest long-range striking force.

The repression of all so-called "radical" expression among military men seems strangely illogical in a time like the present, when the *Army Ordnance Association Journal* will print and defend an article urging early preparation for an invasion of Mars in order to use it as a base for a "surprise" invasion of another country. But it must be remembered that the twenty years of peace, expected to last forever, dictated a policy of deliberate and enforced obscurity for all military men. Mere survival was an accomplishment in 1932, when the nominating convention of a major political party boasted of having reduced the nation's armed forces to the status of a domestic police force. There was nothing to do but take cover. It is not surprising that top Army officers, straining to keep their own heads down out of sight, became somewhat nervous when any officer, even a restless Air Corps officer, raised his head over the horizon or his voice above a whisper. The only way to survive was to impersonate a domestic policeman patrolling his own side of the ocean. Air Corps officers had to keep in line like the rest.

Ground and air officers alike stubbornly carried out their duties among a people hoping and trying to believe that all officers were as useless as their saber chains. It was a

weird, almost furtive existence, like that of firemen trying to guard a wooden city whose occupants pretended it was fireproof. In such an atmosphere of unreality, officers sometimes felt a little ghostly and bewildered, and turned to the affectation of imported uniforms and mannerisms, the imitation of the well-to-do, and horse culture. These psychic manifestations of a sense of social uselessness appeared in a surprisingly small number of officers. Most plodded grimly along, stubbornly reminding themselves and each other that they were real, after all, and that the things they were doing were necessary. They continued to believe the maneuvers they repeatedly planned were important and worth carrying out. The steadiest leaders steered a sane middle course. Colonel George C. Marshall painted his own house, planted his garden, and tried to improve the welfare of his few men and their families on Sullivan's Island just as conscientiously as he now tries to establish world peace.

The sudden emergence from complete obscurity of such accomplished world leaders as Marshall, Eisenhower, Arnold, and Bradley was certainly one of the greatest and most fortunate near-miracles of the recent war. Perhaps no war in history, certainly no war in American history, has produced an equal number who could rise so suddenly to such heights of responsibility. The proved capacity of the great leaders of this war to continue their leadership into the period of peace is equally remarkable, and almost unique in American history.

It is now obvious, therefore, that the handicaps of extremely limited activity, indifference, and neglect did not prevent the United States Army from producing top leaders of unquestioned ability almost on demand. Undoubtedly, good fortune played a great part in this, but the fact remains that the nation received a tremendous amount of quality from a pitifully small quantity of officer personnel. It is true that the situation in the junior grades was less favorable. Obviously, where the amount of responsibility to be distributed was so limited, no great number of officers could actually learn to share it. But we can say that somehow, despite the fact that for twenty years the nation seemed not to care very much about its Army or the men in

it, many of those men managed to live for a long while in shadow and at the same time learn how to step, without stumbling, into the spotlight's glare.

ALL PRECEDENT indicates that the time has now come for military men to recede into the shadows again. All past examples teach them to avoid unnecessary contacts, keep quiet, and practically go into hiding. Once or twice a year they might, according to precedent, venture away from post headquarters to make some statement or take some action effective beyond the local luncheon club, but any public influence would necessarily be either apologetic or defiant, since it would be something about which nobody wanted to think. Our military men who served during the 1920's and 1930's are old hands at this. Most of them, no matter how painful the adjustment, know how to go on performing duty in a nation apparently becoming ashamed of the existence of men in uniform. They could soon teach even the younger officers to conform in the same manner and, for the sake of the whole group, to give the appearance of dozing in dreamless and planless hibernation.

But this will not happen. For the first time in American history peace is not being taken for granted. There are many reasons why this is true. Principally, there are the technological advances in transportation, communication, and weapons that make the old dream of isolation completely ridiculous. There is the emergence of ideological as well as national conflict. These and other reasons need not be discussed here. The most startling development, from the standpoint of the Army officer as a man, is the fact that he is suddenly required as an organizer, supervisor, and advisor in many fields of activity, some of them far-removed from all that was once considered the limited province of the military.

It is suddenly taken for granted that education, public health, industry, research, trade, transportation, and other major functions in America must be consciously geared to the requirements of national defense. While the theoretical relationship of Army officers to both governmental and private agencies which were formerly exclusively civilian

is not yet clear, the working relationship has already begun. Of course, civilian specialties and skills have been absorbed by the Army at an equally astounding rate. The net result is a kind of marriage between military and civil pursuits which, for better or worse, cannot be dissolved.

World War II was far from total, even in Germany, despite the free use of the word. But it provided just a taste of what total war might be like. Since we are convinced we can avoid total war and defeat only through national strength, it follows that this strength must be achieved through a kind of total mobilization for peace. This involves all elements of our national life and it certainly includes the military. Since the military element of our national strength is now recognized as the shield behind which all others must develop, it is inescapable that we Americans are now, for the first time, a military people.

This is an amazing thing to most Americans. Some will refuse to accept it, but most simply will not comprehend it for some time to come. It is contrary to tradition and incompatible with custom, but it is fact. And no one can be more amazed by the necessarily militant character of our present American civilization than the United States Army officer, since no one was more conscious of its idyllically peaceful character in the past.

This new participation of the military in all important aspects of our national life is desirable because it is necessary, and it will result in a much higher level of military preparedness than could be achieved otherwise. But it will make entirely new demands upon the character and ability of the permanent officer. In the past, after putting out the fire like a good fireman, he has always gone quietly back to the fire-house and resumed his drill, observed principally by relatives, small children, and visiting dignitaries. But this fire, although diminished at present, is obviously not out, and the officer is now called upon to help fireproof the building. It is a good assignment, but it is not an easy one.

The old system is inefficient, frustrating, and wasteful of ability. It was not pleasant to be banished from the

minds, if not the hearts, of one's fellow countrymen; to work with no tools; to plan with no cooperation. It required patience, devotion, self-encouragement and, for a few unfailing leaders, long-range vision and an undismayed consecration to the cause of the national welfare. But for the great majority of peacetime officers, it did not require the rapid increase in knowledge, versatility, and breadth of understanding demanded by the new role of full-time consulting architect for a whole nation's future.

THE NEW demands made upon officers of the Air Force will perhaps require the greatest change in manner of performance. Just six years after pre-war policies which deliberately placed the Air Forces in a position subservient to the Infantry in Army organization and function, we find that only complete autonomy for the Air Force can guarantee against an almost equal degree of subservience on the part of the Infantry. Officers of the old Air Corps had to fight against traditionalism every time they tried to make a forward move. Officers of the new Air Force find themselves the heirs of a new tradition which takes progress for granted. The old timers (of ten years ago) could always be depended upon to do more than expected. Their accomplishments have gained them such recognition that they and the younger men now following them are expected to do almost anything.

Rightly or wrongly, the American public now looks to the Air Force and the scientists to protect the nation from sudden destruction. It is the greatest military responsibility in world history. Never before have the people of this nation feared sudden destruction, or invasion, or even another war. Now there is apprehension concerning both the immediate and distant future. No longer protected by broad oceans, no longer defended by strong allies, our people feel exposed for the first time, and alone for the first time. They will lean heavily upon their longest and swiftest striking arm, and they will depend to a great degree upon the officers of that arm to provide them with the sense of security necessary for the prevention of panic and despair.

Rome did not depend upon the broadswords of its legionaries, nor Britain upon the guns of its fleet, more com-

pletely than America and certain other nations now depend upon the bombs of America's airmen. The situation is an appalling one, and the responsibility is overwhelming. To provide a sense of security sufficient to allay exaggerated fears without jeopardizing the flow of funds necessary to make that security real is a task which now appears impossible.

Officers of the Air Force are no longer shielded by their pre-war lack of prominence. They can no longer depend upon being regarded as reserved, obscure, professional men doing a strictly professional job far removed from public prying and relatively immune to personal criticism. Their official lives are no longer their own. Their supposed weaknesses as well as their proved strength may be aired in the press. Their failures will not pass unnoticed. Writers of columns will mention many of them frequently, both to damn and to praise. An uneasy nation cannot be expected to take it for granted they are doing the job well at all times, and the expenditure of large percentages of the national income may often become a political issue. Differences of opinion between officers, differences of method, even differences of personality, may be of some interest to the general public at times. The sensitive soul, the retiring personality, and the exclusive spirit will be increasingly difficult to maintain in the Air Force. Its officers, as they succeed to positions of greater influence and broader contacts, will necessarily become accustomed to the give-and-take which is traditional in American public life, but has never before been encountered in peacetime American military service.

THE PRESENT is a period of recuperation from past efforts and bewilderment in the face of new problems, but the enormity of those new problems is in itself a disturbing guarantee that they will produce severe differences of opinion among our people. What military means and measures will most effectively render the nation safe from the constant threat as well as the constant danger of attack? Our foreign policies are now taking shape and the mystery of these

maneuvers absorbs the national interest. Once the commitments of policy are established, the focus of attention will shift to the principal means by which we hope to back up those policies or to prevent disaster if their peaceful purpose should fail. These are of course military means.

Such military means must produce, both in this nation and abroad, the conviction that they are effective, or we shall have no peace. The making and implementation of military plans which are both effective and impressive is a job for military men. This peace, to paraphrase von Clausewitz, is really a continuation of war by other means. The best we can hope for is that the present stalemate between the hope of peace and the fear of war will last long enough for some circumstance or method to develop which will produce a stable world situation. To Clemenceau's meritorious statement that war is too serious a business to be entrusted to generals, the American public is already discovering a grim rejoinder: This peace is too important and uncertain to be entrusted entirely to civilians. Military considerations will have a dominant influence not only upon our international policies in the field of politics, but also in the fields of finance and trade. We may expect that the bitter controversy already surrounding our State Department will begin to appear around our military planners and advisers in the near future.

Scientists have suddenly become an indispensable military requirement, a fact which is just as confusing to the scientists as to many military men. The habitual boldness of Air Force thinking and the completely experimental nature of the Air Force's past activities have resulted in some very satisfactory partnerships, but peacetime circumstances will make these working relationships somewhat more difficult. Competent research men are often apprehensive of efforts to guide their thoughts or restrict their actions, to a degree which is difficult even for an autonomy-loving Air Force officer to understand. A very high percentage of scientific research and development potential of this nation is being diverted to meet military requirements, and there are not enough scientists to go around. Business men and

industrialists are already disturbed, and not without reason.

The military will not dominate the scientific field by edict or even by law. But the huge funds which must be appropriated for scientific work on new weapons and military devices, small as these funds seem in the light of needs, will necessarily upset what might be called our scientific economy. This research must somehow be directed without being hampered, coordinated without being limited, and supervised without the appearance of meddling. Many Air Force officers will be involved in the achievement of these delicate and difficult aims, from the top research staff sections down to squadron engineering officers who will be testing and adapting increasingly more new equipment.

A new kind of tact will also be necessary in the relationship between the Air Force and other elements of national defense. So far, efforts to appropriate various Air Forces for short-range operations and purposes have been defeated. And the airman still may have a battle on his hands to prove that the air age is not a mere flash in the blue, already burned out, with rockets filling the skies and all of us digging in again.

Scientifically, however, those who do not appreciate the true value of Air Power see it primarily as ground-to-ground transportation, as a means of getting a little closer to the enemy. In their conception, the Air Force would perform a function not unlike that of the Parisian taxicabs at the first battle of the Marne.

Some Air Force officers in the top brackets, let it be said to their undying credit, have already worked toward the development of pilotless aircraft, and have predicted the day when guided and target-seeking missiles may replace the pilot's present domination of the skies. Their bold predictions, however, did not envisage missiles restricted to the concept of short-range artillery and old-fashioned wars of position. Missiles which are no more than large-caliber artillery will certainly not replace aircraft of longer range and greater accuracy, particularly if these same aircraft will be required to bring the missiles within reach of one another. Such planning, which leaps forward in order to

look backward again, would limit Air Power, not by the old method of tying it down to a supporting role, but as with Mark Twain's celebrated jumping frog, shortening its jumping range by feeding it buckshot in the form of missiles to be landed for re-launching rather than dropped for destruction.

The invasion-from-Mars-by-rocket plan is a better one for the purpose of confusing the issue, because it is most likely to maneuver a thoughtless Air Force officer into the position of a reactionary. Let no one say that such an invasion is impossible or even improbable, even though we have yet to fire a rocket more than two hundred miles or develop a satisfactory guided missile. Air Force officers, following the example of leaders who have already embraced science and technology as an ally rather than as a threat, need have no fear of progress in any field provided they keep pace. Certainly, despite the love most flying officers feel for beautiful and efficient machinery, none of them have yet shown evidence of an emotional fixation upon airplanes similar to the peculiar passion for four-legged animals which once afflicted large and influential portions of the American Army to such an extent that flying officers were actually required, as recently as the 1930's, to go about wearing horse-boots and riding breeches.

AMERICANS will expect a continuation of bold and realistic thinking and planning on the part of our Air Force officers despite all vested interests, including their own. Officers of the Air Force who are familiar with its history are forewarned by experience against the type of so-called military thinking which is nothing more than rationalizing to justify preoccupation with the previous.

The unfortunate fact is that we have not yet really advanced very far into the air age. Not even the Air Force is yet airborne, nor is it likely to be for a long time to come. Only a tiny percentage of our commerce, even of our urgent commerce, is yet carried by air. Mails are still delivered mostly by the iron horse, and sent to foreign shores by boat. We are still largely governed and controlled by a generation which regards the airplane as a surprising

and miraculous invention. Technology has shown us the possibilities, but most of them are yet to be realized. Actually, the air age is little farther advanced than was the automobile era when the airplane was invented in the early years of this century. Officers of the Air Force will be in position to advance this age more rapidly, for the benefit of national strength and welfare. Often they will work and plan through it into the future, and even participate in the awesome beginnings of the atomic age, but they can hardly delude themselves that the world or the nation, or even its military strength, is yet airborne to any great degree.

The achievement of such a goal has become a problem of education more than anything else, and it will require a knowledge of the newest and most effective educational methods. All citizens, including some in the Army and Navy, must be educated to understand that the nation has the resources for a vast expansion of its world-wide aviation potential. World economic and political conditions demand such expansion. Its achievement can be brought about only by the influence of those enthusiastic about air possibilities. Such possibilities require scholarly presentation.

The Air Force has never boasted a high percentage of scholars. Ground Force and Naval officers, on a percentage basis, have excelled in this respect. There are, of course, reasons. If the cockpit of a World War I airplane had provided General Mitchell all the facilities for lengthy writing that Admiral Mahan found on his commodious battleships, perhaps the General could have marshaled an equally imposing attack of rhetoric and of historical example to weight his arguments; and they might have been equally successful to the benefit of the nation.

Air activities have most often attracted men of active rather than literary leanings, and the more methodical minds have been needed for technological application. But with the coming maturity of Air Power, the need for scholarship in interpreting it is imperative.

Wider reading and broader humanitarian contacts for Air Force officers, leading to a better understanding of politics as the science of government rather than a dreaded interference, are highly necessary. Similarly, a more complete understanding of labor and its aspirations is a prerequisite for effective industrial planning and coordination on the part of men who habitually think only in terms of management and control. A diminution of petty racial and sectional prejudices and superstitions is likewise necessary in order to avoid the blundering creation of unnecessary antagonisms in national as well as international dealings. Dogmatism and limited understanding cannot help to unite the nation in the coming years of crisis. Air Force leaders will necessarily become concerned with the breadth as well as the vigor of their opinions. If the younger men can retain the vitality and determination of the Air Corps pioneers and at the same time develop the urbanity and erudition necessary for the more varied demands now made upon them, their achievements will be equally impressive.

A NATION no longer dominant in available resources, hopelessly outnumbered in manpower, and lacking a strong ally in a world disturbed and shaken, has only one recourse. That recourse is the maintenance of its world leadership in material achievement and the spirit of freedom. The development of its most envied accomplishment and the most distinctive symbol of its might and aspirations, its military and commercial Air Power, can be the most convincing demonstration of influential strength and the most effective means of tying together a disintegrating world. This development must demonstrate excellence of equipment, efficiency of organization and function, and the irrepressible spirit that has characterized our air adventure since it began. Air Force officers and their almost indistinguishable allies in other positions of military and civilian leadership will necessarily become effective agents in the promotion of this most hopeful program for the security of the nation and the peace of the world.

On the Balance of Forces and Materiel Support

OF HORSES AND HORSESHOE NAILS

LIEUTENANT COLONEL EDWARD STELLINI

A little neglect may breed great mischief; for want of a nail the shoe was lost; for want of a shoe the horse was lost, and for want of a horse the rider was lost, being overtaken and slain by an enemy, all for want of a little care about a horse-shoe nail.

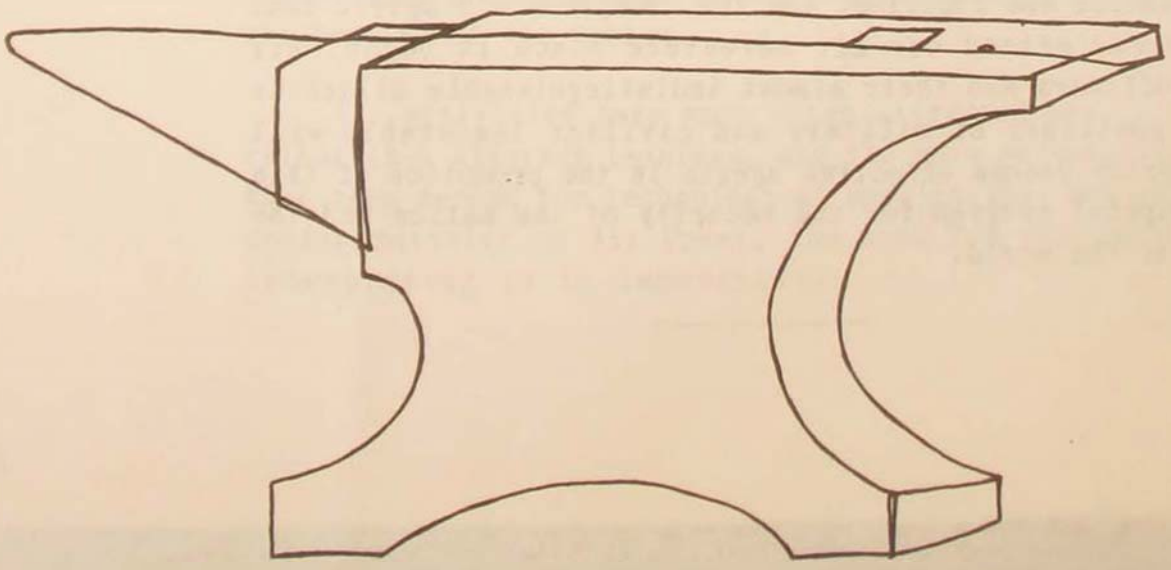
BENJAMIN FRANKLIN

ONE DAY last April, while I was sitting in my study filling out my income tax return, my five-year-old walked into the room, obviously bored and looking for something to do. After scanning the bookshelves and assorted curiosities, he zeroed in on a hand-carved fighter model that serves as a reminder of the good old days when flying was my game.

I could have predicted his next remark: "Dad, can I play with your plane?" I explained to the little guy that the model cost lots of money and is only for "looking at."

After some brow-furrowing thought, he asked, "Who buys the real airplanes?" I looked at the partially completed Form 1040 on my desk and decided he would never understand that explanation, so I told him that all the daddies chipped in to buy them.

Then he asked what those long, round things were under the wings. I told him



that they were the bombs that the airplane drops on the bad guys. I expected him next to ask who the bad guys were, but instead he asked, "Who buys the bombs—the mommies?"

I told him that some of the money that the daddies chipped in was used to buy the bombs. I thought the next question was quite perceptive, coming from a five-year-old: "How do the daddies know how many airplanes and how many bombs to buy?"

I explained that we counted how many airplanes we could buy with the money collected and that, instead of buying just airplanes, we spent enough money to buy enough bombs so each airplane would have its share.

This "clear and simple" explanation obviously satisfied him because he said, "Oh!" Then, "I think I'll go and play now, Dad."

Before getting back to the tax return, I wondered if he really understood. Even if the method we use to balance forces and the materiel support for those forces was straightforward to a five-year-old, it certainly is not to the analysts, planners, and decision-makers in the services and the Office of the Secretary of Defense (OSD).

In 1970 the Secretary of Defense asked the Secretary of the Air Force a question much the same as the one my son asked me. He wanted to know how the Air Force planned to balance the forces and the materiel support. Part of the chain reaction to that question involves work now being conducted by the Office of the Assistant Chief of Staff for Studies and Analysis. The purpose of the work is to develop an improved method for determining the proper mix of ordnance to stockpile in Europe, Asia, and the continental United States for use if deterrence fails and we must fight a conventional war. A primary criterion is that all the air-to-ground sorties we would expect to fly in such a war must be *adequately* loaded with ordnance, external fuel tanks, and electronic countermeasure (ECM) pods. After arriving at the ordnance stockpiles, we must develop a procurement plan by which the dollars to be spent for forces and war readiness materiel are in the "proper balance" for whatever budget level is established for tactical air forces.

In this article I shall discuss the complex problem of balancing forces and materiel support. First, I shall put the problem in historical perspective; then put the microscope on one corner of the problem, to show how the solution is sensitive to assumptions made at various levels of analysis; and, finally, discuss the pros and cons of two alternative approaches to working the specific part of the problem being analyzed.

No attempt will be made to pass judgment on which approach is best. I shall only try to furnish some illumination on the complexity of problems dealing with a major force issue: balancing forces and materiel support.

Historical Perspective

In a series of lectures presented in 1965, Charles J. Hitch, Assistant Secretary of Defense (Comptroller), did three things: (i) traced the evolution of the "defense problem" over the course of U.S. history under the Constitution; (ii) described the purpose and function of the "programming" system installed in the Department of Defense (DOD) in 1961; and (iii) discussed the application of operations research and systems analysis to the problem of defense decision-making with regard to the choice of weapon systems and the allocation of resources among alternative forces and programs. In these lectures he noted that it was not until 1961 that the full powers of the Secretary of Defense to run the Department on a unified basis were actually used. Although unification had occurred almost eighteen years earlier, according to Mr. Hitch the only significant unification that existed in 1961 was in three areas:

> 1. Unified commands had been created in all overseas theaters and for continental defense. . . .

> 2. Joint contingency plans for the use of existing forces had been prepared by the Joint Chiefs of Staff for many contingencies. . . .
>
> 3. Finally, the civilian Secretaries had taken control of the over-all level of the defense budget and brought it into line with the fiscal policy of the administration. The primary method of so bringing the defense budget into line, used by all the Secretaries before the present incumbent, was to divide a total defense budget ceiling among the three military departments, leaving to each department, by and large, the allocation of its ceiling among its own functions, units, and activities. The Defense Secretaries used this method because they lacked the management techniques needed to do it any other way.[1]

The President would indicate the general level of defense expenditures that he felt was appropriate to the international situation and his overall economic and fiscal policies, and the Secretary of Defense would do his best to allocate the dollar amount to the services. The services would then allocate their share of the budget among their respective functions, units, and activities. Additional requirements that could not be accommodated within the ceiling would be included in an "addendum" budget. The combined service budgets were then reviewed by the Secretary of Defense in an attempt to achieve balance.[2]

a new approach to defense decision-making

During the final years of the Eisenhower administration, a number of economists and defense analysts associated with the RAND Corporation began to take a hard look at how decisions on strategy, technology, and economy were being made in the Department of Defense. This research resulted in the classic volume, *The Economics of Defense in the Nuclear Age,* which included an intensive examination of the question, "How much should we spend for defense?" It also provided the basis for a new approach to making decisions on defense spending, which is now being used throughout DOD: The Planning-Programming-Budgeting System (PPBS). Also included in this book is a lengthy dissertation on the mathematics of maximization by Dr. Alain Enthoven.

In January 1961, John F. Kennedy began his term as the new Commander in Chief of the armed forces. Within the next few weeks he announced the new military strategy of "flexible response," patterned after the theory expounded by General Maxwell Taylor in *The Uncertain Trumpet,* and appointed Robert S. McNamara as Secretary of Defense. McNamara then appointed Mr. Hitch as his comptroller and Dr. Enthoven as Hitch's assistant for systems analysis; later the Systems Analysis Office was given greater importance, and Enthoven became an Assistant Secretary of Defense.

a return to the budget-limit approach

In January 1969, eight years after the Kennedy-McNamara era began, Richard Nixon became the new Commander in Chief. Since taking office President Nixon has strengthened the policy-formulation procedure by revitalizing the National Security Council (NSC). This has led to a number of formal studies called National Security Study Memoranda (NSSM), which have provided a clearer delineation of strategies and alternatives than existed before. The net effect has been a better basis for policy guidance.

Over the next several months Dr. Enthoven and most of the other key people in the Office of the Assistant Secretary of Defense for Systems Analysis (OASD/SA) resigned their positions—perhaps for political reasons, but probably, to a large extent, because of the lesser part to be played by this office under the new Secretary of Defense, Melvin Laird. This lesser role came about as a result of strong pressure from certain elements in Congress. In 1968 and 1969 the Chairman of the House Armed Services Committee, Representative

Mendel L. Rivers, had called for the complete abolition of the Systems Analysis office, but the Senate Armed Services Committee did not go along with this proposal. As a compromise, the new Systems Analysis office is now charged only with "evaluation and review" of forces designed by the Joint Chiefs of Staff (JCS) and the services and will "not put forward proposals of its own." [3]

After leaving OASD/SA, Dr. Enthoven and one of his former assistants, Dr. K. Wayne Smith, published a documentary aptly entitled *How Much Is Enough?* The book begins with a chapter on what was wrong with the Defense Department when Dr. Enthoven arrived on the scene and ends with a chapter on what the authors feel is wrong with the way it appears things are going under the new administration. For example, they feel that, because of the new passive role to be taken by OASD/SA, "the ability to recruit and retain first-rate talent will inevitably suffer, and an important force for the national interest in defense programs will be lost." [4] In general, the book is well written and must reading for any serious student of defense decision-making. However, one should also read the other side of the story to get a balanced picture. (An excellent critique of the book may be found in a recent issue of the *Armed Forces Journal.*) [5]

In the final chapter Enthoven and Smith express their views on the return to a budget-limit approach to defense decision-making. They are concerned that the services will be allowed to determine how they will apportion their fractional share of the defense budget and how OSD will make its review:

> While we hope that the OSD review will be effective—and reflect substantial participation by the Secretary of Defense and his staff—at this writing it is not clear that it will be. The theory seems to be. "We'll give the Services broad guidance and review their implementations." It will be interesting to see how many "prestige items" replace needed but unglamorous military capabilities in the Service budgets.[6]

They go on to say that "the initiative for shaping the strategy and the forces is no longer in the hands of the Secretary of Defense and his staff." [7] In summarizing their case they say that most major defense program issues transcend individual service programs:

> . . . decisions on the number and kind of tactical air forces that the Air Force should deploy depend on comparable decisions with respect to the Navy and Marine Corps tactical air forces. More importantly, they depend on national policy with respect to the number and kind of limited war contingencies that the United States should be prepared to meet and the speed or readiness which one should be able to meet them with.[8]

The authors state that the JCS is supposed to integrate interdependent service parts of the problem but that the JCS, being a committee, does not act that way. Instead it "staples together Service requests" or, if forced to make hard choices, tries to "negotiate a compromise." The Secretary of Defense, they say, should insure that there is no unnecessary duplication in glamour areas and underfunding in other areas.[9]

In closing, the authors make this warning:

> More Presidential guidance on strategy and budgets earlier in the annual planning cycle and more Service responsibility for making the hard choices can be valuable additions to the Defense Department's management system. But they must be additions to the system; they cannot be substitutes. For if the pattern of carving up the budget by Service fractions and turning the pieces over to the Services to spend as they see fit were to persist, within a few years, as the logic of the overall shape of the defense program erodes, as the readiness of the general purpose force deteriorates, . . . one can be sure that the expressions of legitimate dissatisfaction will increase.
>
> It happened in the 1950's. The lessons learned then and applied in the 1960's should not have to be relearned in the 1970's.[10]

participatory management and the new PPBS

During the past two years the new administration has been making an intensive review of our national security policy. From this review, new concepts, including the Nixon Doctrine and the policy of realistic deterrence, have emerged. The strategy of realistic deterrence emphasizes the need to plan for the optimum use of all military and related resources available to meet the requirements of Free World security. To achieve these goals, a number of changes have been made both in the overall philosophy of decision-making on defense matters and in the management tools established to carry out the decisions.

In the early days of the previous administration, Secretary McNamara had introduced the PPBS decision-making process, which relied heavily on analytical input, option analysis, and trade-off analysis (with the analysis inputs originating, for the most part, at the OSD level—OASD/SA "proposed" and the services "opposed").

Under Secretary Laird, the old PPBS has been retained; but now it is the services that are proposing, while OASD/SA—acting in an advisory capacity to the Secretary of Defense—is working with the services to insure that the hard choices on program decisions are being made within the fiscal constraints established. This decentralization in the decision-making process is called "participatory management."

As a tool for making these program decisions, a systematic approach called "economic analysis" has been established by the OSD Comptroller. Economic analysis involves the following sequence of tasks:

- Deciding on the objective, and then searching out all alternatives for achieving that objective.
- Determining, and explicitly stating, comparable costs and benefits for each alternative. Costs and benefits should include the intangibles as well as the tangibles.
- Comparing the alternative costs and benefits so as to identify the most efficient, or effective, alternative in terms of achieving the objective.[11]

The PPBS established during the Hitch-Enthoven years has undergone a number of changes under the new administration. This management technique, which is a system for establishing, maintaining, and revising the Five Year Defense Program (FYDP) and the DOD budget, requires that Program Objective Memoranda (POM) be submitted in prescribed format by the Secretaries of the services. In the POM's the Secretaries recommend the total resource requirements within the parameters of the published Secretary of Defense fiscal guidance for their service. They are also required to show the rationale used in arriving at their planned expenditure levels for the 5-year period of the next FYDP update. This rationale must show how the balance in forces and materiel support was achieved.

planning guidance

In guidance for the FY 73–77 Defense Program, the specific objectives of deterrence are spelled out. For example, for strategic nuclear forces, "sufficiency criteria" are discussed. For theater conventional forces, the objective is to maintain those ground, air, and naval forces which, in conjunction with those of our allies, will deter a theater war through a capability to cope with major conventional conflict involving the potential enemies if specific forms of aggression occur.

The guidance specifies the budget-dollar targets (fiscal guidance categories) for each service and defense agency and, within these organizations, the targets for major mission forces (strategic, land, tactical air, naval, and mobility); other missions (intelligence and security, communications, R&D, and support to other nations); general support; and miscellaneous costs. Except for those fiscal categories and subcategories for which the dollar

amounts are not to be adjusted, each service has the option of making dollar adjustments within its portion of the budget pie.

Guidance is also given for planning the materiel support for the forces within fiscal constraints. Tactical air munitions currently available and in development offer major improvements in effectiveness. This improved effectiveness offers the potential to increase significantly the productivity (target kill capability) of those tactical air sorties which we would allocate to the air-to-ground role. Within any total tactical air funding level, force effectiveness can be changed by varying the allocation of resources between sortie capability and the quantity and quality of the air munitions procured for the stockpile.

The services (Navy, Marine Corps, and Air Force) must ensure that there is a "balance" between programmed tactical air forces and air munitions war reserve procurement; this balance should be chosen so as to yield the maximum target kill capability for the tactical air force dollars, plus some reasonable allocation of general support costs to tactical air forces, which each service plans to spend.

Now that I have described the framework in which the business is conducted, let us take up the concern expressed by Dr. Enthoven in the final chapter of *How Much Is Enough?* i.e., Will the services, left to their own devices, really elect to allocate their respective shares of defense dollars properly between "horses and horseshoe nails"? I shall consider this issue as it relates to the balance of tactical fighter forces and the air munitions stockpile to be procured to support these forces. This stockpile of weapons, called war readiness materiel (WRM), represents about 90 percent of dollar expenditures in the materiel support category. I shall state the problem as I envision it and discuss two sides of the issue. Since the purpose of this article is only to provide some visibility on a current major force issue, I shall not attempt to prescribe the alternative that represents the most beneficial solution in terms of the overall objective of balancing forces and materiel support.

Analysis of the Problem

There are presently available and in development a variety of air-to-ground weapons that have a wide range of target kill capability. The unit costs of these weapons range from about $200 (general purpose bombs) to nearly 100 times that amount (guided weapons). Some of these weapons have wide applicability to target types, while others are optimized for specific target types (e.g., hard-point, mobile targets).

Development of the best mix of munitions to stockpile as WRM is accomplished in two steps:

Step 1. Select the preferred weapon for each target type, using the cost-effectiveness criterion: *least dollars per target kill.* Our model for doing this is as follows:

$$\text{Minimize } C_{ti} = S_i\,(C_s + C_i)$$

where
- C_{ti} = total cost to kill the target using weapon type i (i is a variable for all weapons that have a kill capability against the target; these are called candidate weapons.)
- S_i = sorties, loaded with weapon type i, required to achieve the specified damage level against the target, i.e., to kill the target
- C_s = cost of a combat sortie
- C_i = cost of a sortie load of weapon type i.

Note: The candidate weapon that produces the lowest C_t for a given target is the preferred weapon for that target.

Step 2. Allocate sortie loads of these preferred weapons to the various target types

expected to exist in the conflict theater so that all potentially available air-to-ground sorties are used up in some specified conflict duration (which is established for in-theater stockpile planning purposes).

The first step requires that we suboptimize by selecting a preferred weapon for killing each target type at the *lowest total cost* which equals the *sorties required to kill the target* times the *combined cost of the combat sortie and the ordnance carried on that sortie.* In the second step, we optimize the allocation of air-to-ground sorties available to achieve maximum target kill potential in the theater. It is in the first step that our assumptions about balancing forces (sortie capability) and materiel support (ordnance stockpile) bear on the problem. Specifically, the problem is one of choice in assumptions to be made in computing the *cost of a combat sortie* (C_s). We can make two alternative assumptions about the cost of a sortie: Case A and Case B.

Case A. Here we make the assumption that the cost includes the cost of operating and maintaining the aircraft before, during, and after the combat mission *plus* the fractional cost of replacing the aircraft due to expected attrition.

Case B. In this case we make the assumption that the cost includes the cost of procuring, operating, and maintaining one aircraft during the prewar (peacetime) period, amortized over the number of sorties expected to be flown by that aircraft during a war of given length.

The difference in sortie cost using these two assumptions is significantly large. In Case A, the sortie cost would be bracketed by the cost of the ordnance carried on the sortie (lower when carrying high-cost, high-effectiveness weapons and higher when carrying bombs). In Case B, the sortie cost would be from about 2 to 50 times as great as the ordnance cost.

To make the distinction clearer, let us use realistic numbers to show the magnitude of costs and the assumptions for each case.

Case A: Combat sortie cost

$$C_s = C_m + (C_r \times A)$$

where C_m = combat sortie operations and maintenance (O&M) cost
C_r = aircraft replacement cost
A = combat sortie attrition rate (includes an expected terminal attrition rate for the candidate weapon type against the target type plus an enroute attrition rate).

Let the value of C_m=\$3000. If we use an attrition rate of 10 losses per 1000 sorties flown (.010) and a replacement aircraft whose procurement cost is \$3 million, the per combat sortie cost is \$33,000. We use aircraft replacement cost in selecting preferred weapons because we want to finish the war with as large a residual force as possible. The underlying rationale is that the major portion of the cost of using a specific weapon type against a target is reflected by that fraction of the force which we might be expected to lose using one weapon type as opposed to using another.

In this case, we spread total system cost (procurement and peacetime O&M costs) over all sorties, peacetime and combat. Implicitly, this *allocates most of the tactical air costs to deterrence* rather than to combat sortie capability.

Case B: Combat sortie cost

$$C_s = \frac{C_p + C_m}{S_c}$$

where C_p = aircraft procurement costs (excluding aircraft no longer in production)
C_m = sortie O&M cost (assume prewar time of 5 years)
S_c = expected number of combat sorties to be flown during the war (based on a given sortie rate, attrition rate, and length of war).

Let the value of $C_p = \$3$ million, and the value of $C_m = \$6$ million. For a short war of about 3 months, about 60 combat sorties can be expected from a tactical fighter. Therefore, the combat sortie cost is $150,000.

In this case, we allocate *all tactical air costs to the potential combat sortie capability,* represented by the assigned aircraft on D-day, and input *no value to the deterrent effect* of maintaining visible tactical air forces. The implication is that deterrence is important but should not be considered as an integral part of the preferred weapon selection process. Deterrence should be taken into account as follows:

- Select an air munitions stockpile that yields the maximum target kill capability per dollar spent for tactical air capability (both forces and weapons).
- At a "higher level of analysis," arrive at the proper balance between sortie capability and number of "optimum" sortie loads that should be stockpiled for several levels of expenditure.
- Determine which level of expenditure buys the right amount of deterrence. If that level is above the tentative amount established for tactical air, divert funds from other programs that are judged to have less military worth.

In this case, the high-cost, high-effectiveness weapons would be more prevalent, and we assume that this greater kill potential has some deterrent capability.

The use of these two costing methods will often result in the selection of different preferred weapons. In Case A, where the ordnance cost is in the "neighborhood" of the sortie cost, ordnance cost accounts for a significant part of the total cost to kill the target. In Case B, where a relatively high sortie cost is used, the cost of the ordnance carried, regardless of type, is usually far exceeded by the sortie cost in the total cost calculation. Consequently, the high-cost weapons are usually selected as preferred because they generally are also the most effective. These relationships are shown graphically in Figure 1.

The Issue and the Arguments

Now let's assume that there is some tentative budget level specified in the fiscal guidance within which trades between aircraft and ordnance (WRM) procurement are to be made. The dominant issue to be addressed is whether we should spend future dollars on all the aircraft planned in the current FYDP, the associated O&M for those aircraft, and enough ordnance to load the planned wartime sorties, or whether we should spend a greater portion of those dollars than otherwise on a stockpile of weapons with much greater kill potential, at the expense of some of the planned force.

Case A argues that the number of aircraft planned for procurement in the current FYDP is *not a variable* which depends on the fractional war-fighting capability that these aircraft contribute. Instead, the cost of procurement and O&M of forces during peacetime goes toward providing a visible deterrent to war *and* war-fighting capability in case of war.

The cost of losing an airplane during a war is equal to the cost of replacing that aircraft, since we desire to have a maximum residual force at the end of the war for continued deterrence or for a war-fighting capability in the next war (perhaps in another theater).

Case B argues that, although deterrence is important, we should make trade-offs as though war-fighting capability is the only objective, and after the fact we should let the decision-makers at the highest level decide if the mix of forces and ordnance to be procured would buy us "enough" deterrence. Presumably, if it was decided that the mix did not furnish enough deterrence, we would spend more dollars for both forces and ordnance (maintaining a balance between the two). The question is whether or not we can

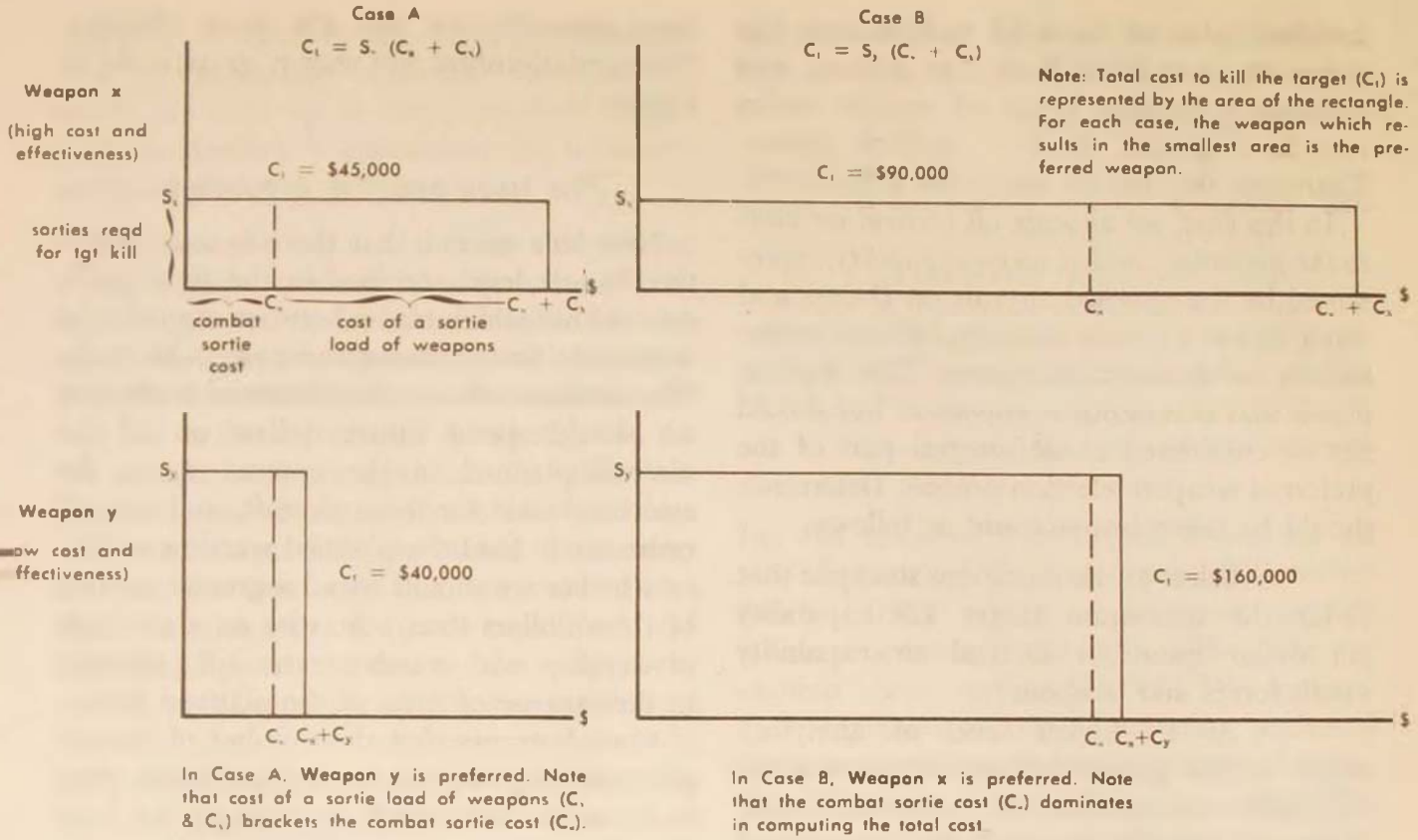


Figure 1. An example showing the difference in total cost to kill a target and the selection of preferred weapons for alternative methods of computing the cost of a combat sortie

determine how much deterrence is enough and, if we need more, whether we can, and should, reallocate proposed dollars from defense programs other than tactical air. (The decision-maker is the Secretary of Defense, who would have the authority to make trade-offs across service budget lines.)

On this basis, Case B proceeds to charge off the entire systems costs of all aircraft to the number of sorties that can be expected to be flown during a war. Although our strategy guidance states that our primary objective is to deter war, none of the systems costs of our forces are charged explicitly to deterrence. This approach tends dramatically to inflate the cost of a combat sortie, particularly when we use this cost to compare and select preferred weapons.

The assumptions outlined above are shown graphically in the accompanying benefit-cost diagrams (Figures 2 and 3). In these figures the assumption is, for comparative purposes, that we have a fixed amount of dollars ($Y) to be spent on tactical air forces.[12]

Case A: pros and cons

Figure 2 shows Case A. The *costs* include $X for aircraft procurement and O&M, and $M for WRM over some time period prior to D-day. $X is considered fixed, i.e., I assume the Air Force will spend $X for aircraft procurement and O&M over the prewar time period and that we will spend whatever is necessary for WRM using aircraft replacement cost and expected attrition as the key factors for computing the combat sortie cost. If $X + $M exceeds $Y, we will either make

up the difference from other Air Force programs or buy less-expensive munitions. The *benefits* include:

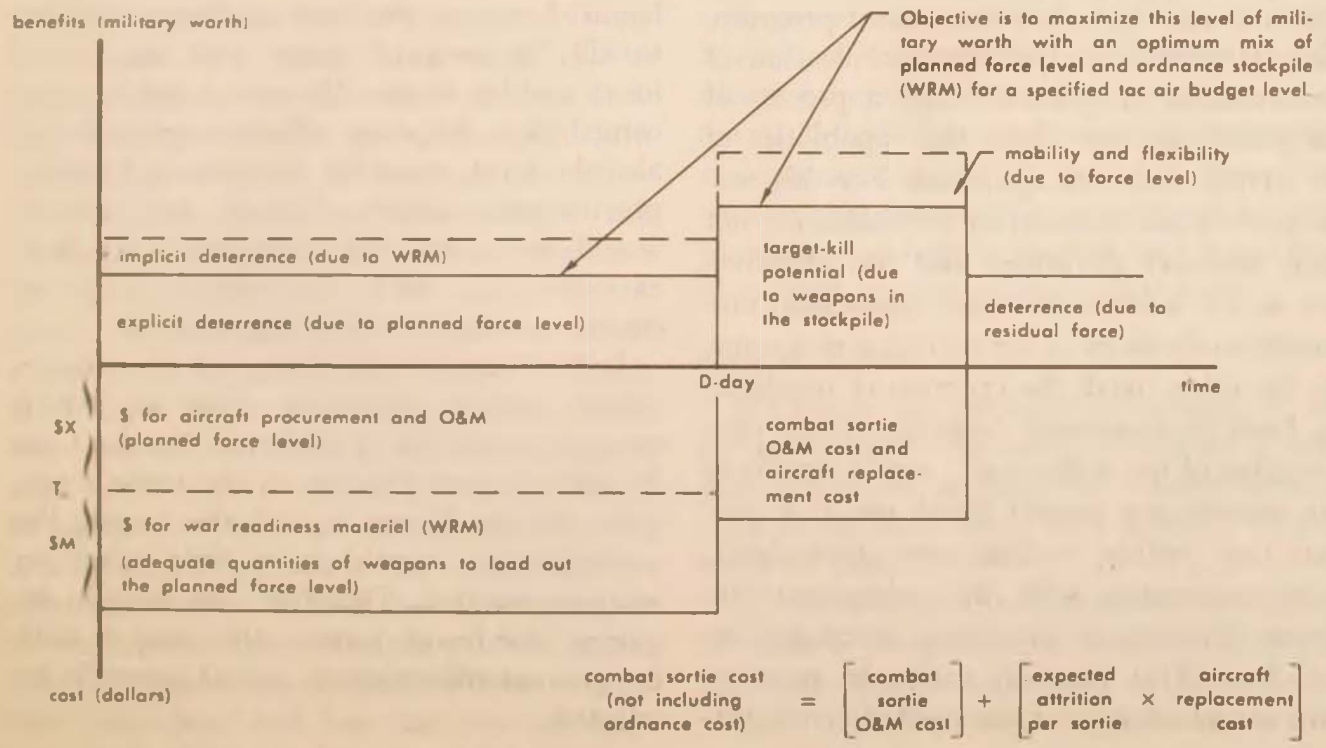
• The deterrence that accrues from the mix of forces and ordnance procured. Here one must differentiate between "explicit" (visible) deterrence and "implicit" deterrence. In this case, the deterrence that accrues from "aircraft parked on the ramp" is a much more credible deterrence than that which accrues from the enemy's knowledge that we plan to stockpile a mix of munitions including large numbers of "improved" weapons.

• The potential target kills achievable during the war (war-fighting capability).

• The mobility and flexibility of tactical air forces (the ability to move swiftly from one target to another and the ability to use a fighter for air-to-ground attack on one sortie and for air-to-air attack on the next). Although these characteristics would apply to a force of any size, it is often argued that mobility and flexibility increase at a faster rate than force size, i.e., the marginal aircraft contributes increasing returns.

The primary advantage we would derive from using the Case A costing method is that it would result in a larger force than would exist if we used the Case B method for any given expenditure level. This larger force level would provide greater explicit deterrence. The importance of this "show of force" was noted recently in an article in *Pravda* by Vasily Shestov, a Soviet disarmament specialist. He stated that there would be little chance for agreement in the Strategic Arms Limitation Talks (SALT) unless there were some concessions on the 500 U.S. fighters deployed in Europe. Secretary Laird's reply indicated that our fighters were part of the NATO force just as Soviet aircraft are part of the Warsaw Pact force and that our fighters should be discussed in the context of balanced

Figure 2. Case A: *benefit-cost factors considered in computing the cost of a combat sortie*



and mutual force reduction, not in SALT.[13]

Although a lower USAF tactical fighter force level would not necessarily result in fewer aircraft deployed in Europe, it could mean that fewer fighters could be augmented to Europe after hostilities began, as well as lower peacetime deployment in other areas.

The major fault with the Case A costing method is that its use would result in a stockpile of weapons having somewhat less total kill potential than the stockpile resulting from the Case B method. We would be giving up some measure of effectiveness for some of the intangible benefits we would obtain from forces-in-being.

Making a decision as to the preferred weapon requires sound judgment since aircraft force levels and ordnance stockpiles are not truly interchangeable. Force levels are the result of the interplay of a large number of factors and compromises, including national policies, budget priorities, and changing mission emphasis. An aircraft force is built up over a long period, changes relatively slowly, and represents a large investment. The ordnance program is a comparatively small (though still large) investment. Ordnance programs may influence the aircraft program, but in the final analysis the optimization of the ordnance program is really a process of suboptimization in which the capabilities of the aircraft fleet are optimized. For this reason aircraft and nonnuclear munitions are not really trade-off quantities, and cost effectiveness is not a single measure applicable universally to decisions in the munition programs. On the other hand, the criterion of maximizing force air-to-ground capability (with consideration of the dollar cost), which translates into maximizing targets killed per U.S. aircraft lost (within realistic cost constraints), is in consonance with the suboptimization process inherent in procuring munitions for the fleet. This decision rationale provides some insurance against unexpected contingencies, as the munitions program may be modified on a shorter time scale. The availability of high potential-kill, low U.S. attrition munitions will save losses in aircraft so that force levels are protected during periods of severe demands. This will provide time for the buildup of aircraft production rates.

Case B: pros and cons

Figure 3 shows Case B. The *costs* include $Y for aircraft procurement, O&M, and WRM over some time period prior to D-day. Initially, Y is considered to be a fixed amount. If, at a higher level of analysis, it is decided that the combination of force level and WRM does not provide adequate deterrence, the value of Y would be increased at the expense of other Air Force or other services' programs. The *benefits* over Case A include only the increase in potential targets killed during the war (war-fighting capability).

The primary advantage in using the Case B costing method is that it would result in a stockpile of weapons with greater kill potential than the stockpile resulting from the Case A method. During a war, the commander of a fighter wing would select weapons from his bomb dump on the basis of their capability to kill the assigned target with the fewest losses and/or sorties. He would not be concerned that the most effective weapons are also the most expensive weapons in terms of procurement dollars. Instead, his concern would be to kill the target with the least exposure, i.e., least time within range of enemy AAA and fewest sorties required.

In the Case A method, the cost of ordnance would have a significant effect on which weapon is selected as preferred. In the Case B method, since the cost of the sortie dominates the total cost to kill the target, the ordnance cost would have little effect on weapon selection. Therefore, the weapon requiring the fewest sorties—the weapon with the greatest effectiveness—would normally be selected.

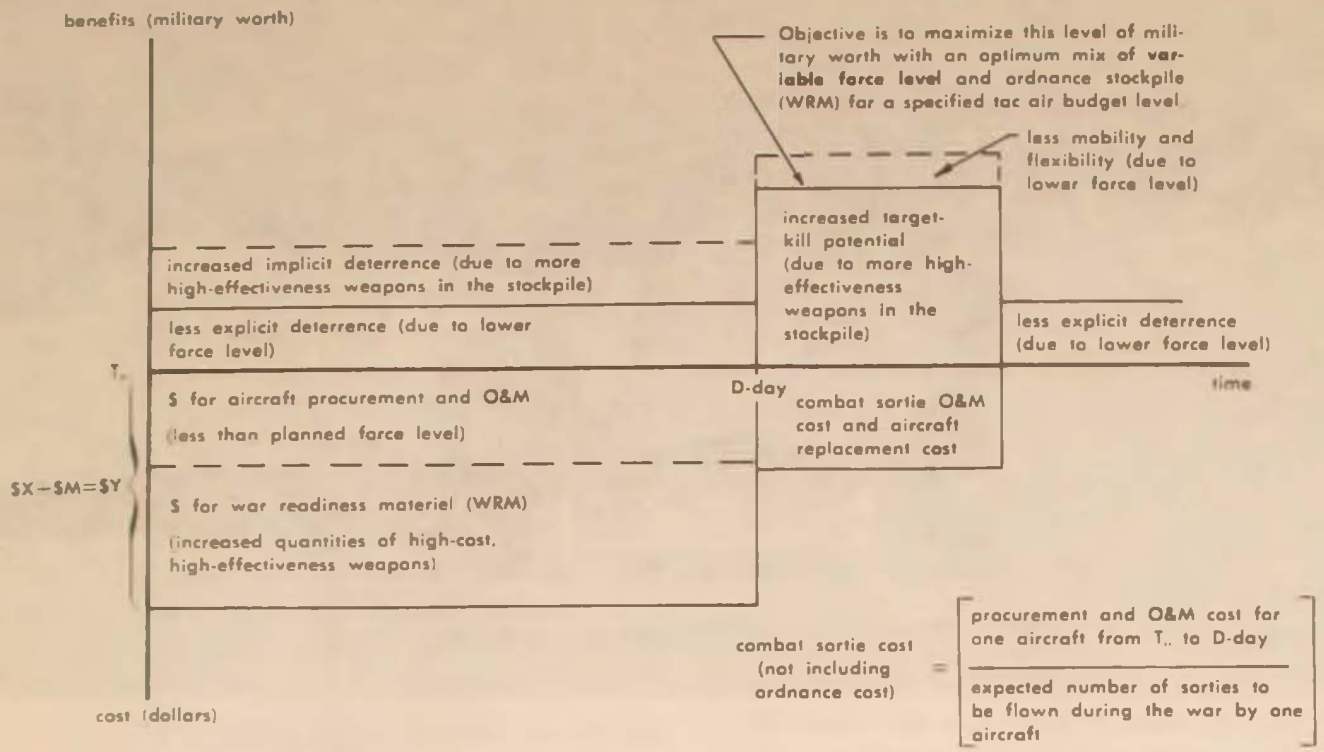


Figure 3. Case B: *benefit-cost factors considered in computing the cost of a combat sortie*

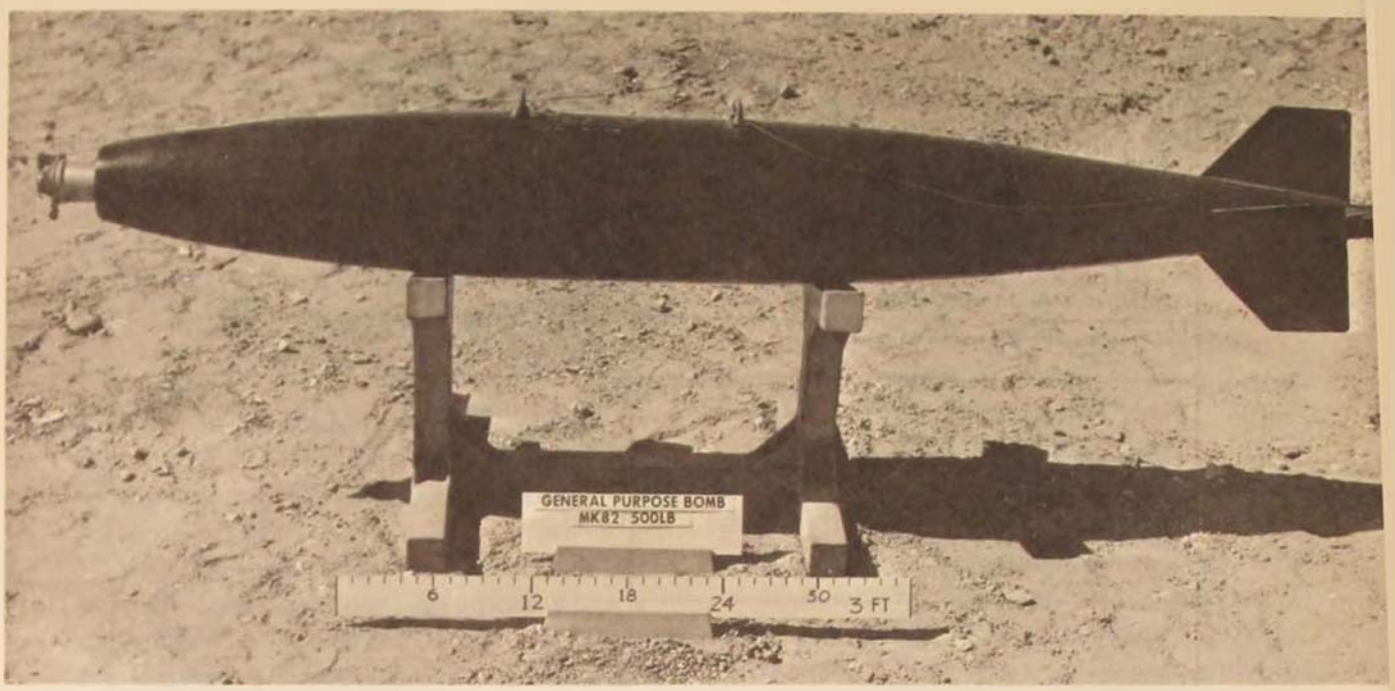
The major disadvantage in using the Case B method concerns the assumptions we must make regarding time. We must assume the period of time from T_o (the present) to D-day to compute the prewar O&M costs of the average fighter. We must also estimate how long the conflict will last to compute how many sorties a fighter can be expected to fly.

In addition to these disadvantages, this method would result in a lower force level than if we used the Case A method for any given level of expenditures because we would spend more on ordnance. From this lower force level we could expect lesser explicit deterrence. If we had perfect knowledge of how much explicit deterrence was necessary to prevent a potential enemy from starting a war, and if we knew how many fighters were required to achieve that deterrence, we would have no force/stockpile trade-off problem. We would simply build a fence around that force level and buy the best ordnance we could afford. In that event the trade-off would be between the ordnance stockpile and resources other than tactical forces. In fact, however, we do not know the force level that will deter our potential enemies or what amount of military worth we accrue by substituting improved munitions for aircraft, in terms of both increased implicit deterrence and increased target kill potential. Therefore, we can only assume that any reduction in our planned force level will result in a lower level of explicit deterrence than exists now.

levels of analysis

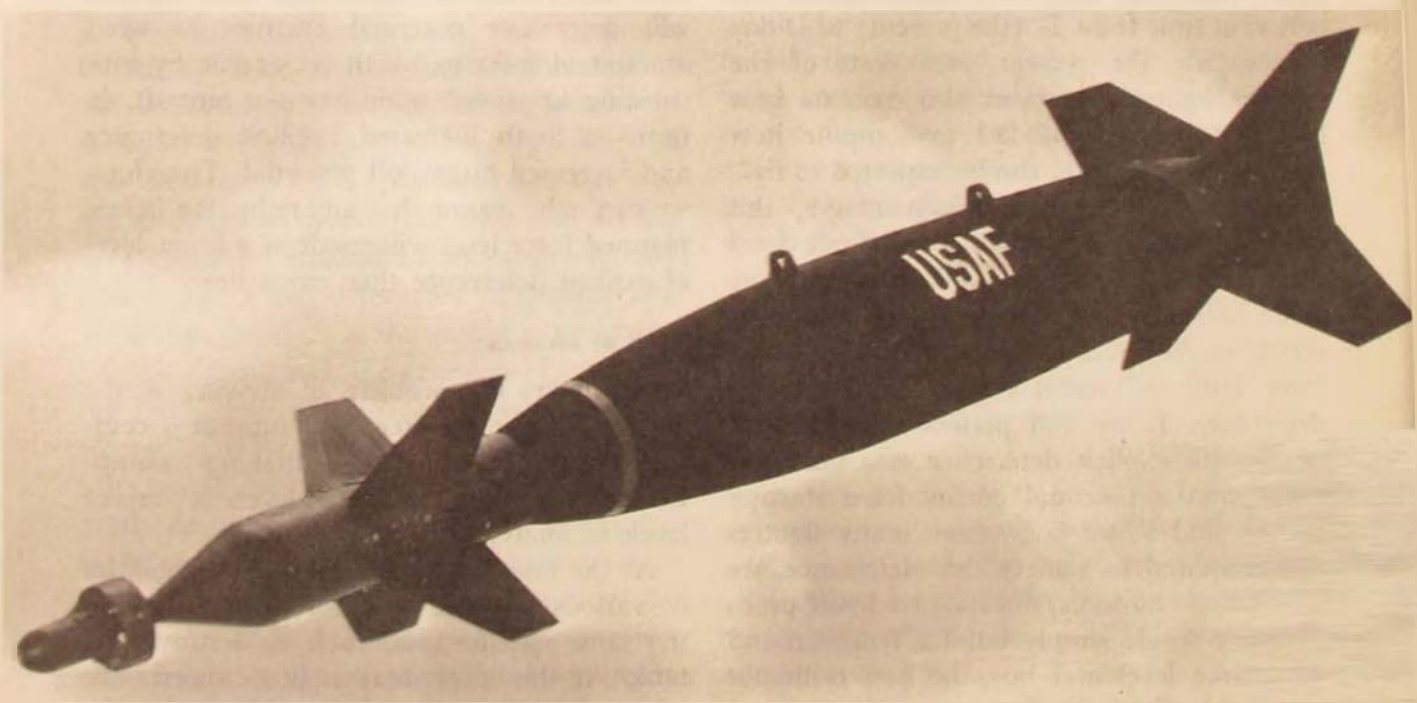
What makes the problem of arriving at the proper balance in forces and support a complex one is the necessity of making assumptions which may affect force levels at various levels of analysis.[14]

At the *task level,* we assess the capabilities of various weapons and forces in achieving the same specific task, such as destroying a tank. At this level there is little uncertainty other than that associated with the prob-



The Old and the New

The MK-82 is a 500-pound general purpose bomb developed in the 1950s and used extensively in Southeast Asia. . . . The MK-84 laser-guided bomb is a 2000-pound guided weapon that became operational in 1968. It consists of the body of a 2000-pound general purpose bomb, a laser guidance kit, and movable tail fins. The effectiveness of this weapon is significantly greater than the older, unguided version of the MK-84.



ability formulas used in estimating the number of weapons required to kill a target.

At the *situation level,* we assess the conflict situation in terms of a specific military objective. We must take into account joint and/or combined operations and consider interacting factors such as geography, time, enemy actions, attrition, and logistic support. All these increase the degree of uncertainty about coming to the right level and mix of forces and kinds of ordnance we should stockpile. At this level some of the criteria we should use in evaluating force levels are mobility, survivability, responsiveness, and flexibility.

At the highest level, the *national policy level,* the unquantifiables are assessed. In addition to the deterrent capability of the force under consideration, these criteria also should be considered:

- *Versatility.* How effective would the force be in a variety of military and politico-military situations and crises?
- *National acceptability.* How readily will the force be accepted domestically, in terms of both the level of Defense spending and the implication that the force will be used to support our foreign policy?
- *International acceptability.* How readily will the force be accepted as credible by our allies and our potential enemies?

At this level of analysis, a high degree of uncertainty exists; and judgments on the size of the force needed must be made in terms of all the national resources available.

But the task of balancing the force and the materiel support is not addressed only at the national policy level. It is first addressed at the lowest level of analysis, i.e., at the task level. As we have seen in the discussion on how to compute the cost of a combat sortie, we must make some basic assumptions that will impact on the force-support balance.

The problem is quite obviously a complex one. It requires some decision-making even at the "nuts and bolts" level. What apparently has concerned Dr. Enthoven is that, because of the new "participatory management" philosophy established by Secretary Laird, the services may opt to hold the line on force levels at the expense of materiel support—putting the emphasis on the horses rather than the horseshoe nails.

Whether this emphasis is good or bad for the United States, I cannot say. At the present time there is no way of quantifying the intangibles, such as the value of mobility and flexibility of a given force, and the amount of forces needed to insure deterrence. Until we can quantify these and other factors in the same way we now quantify war-fighting capability, the solution to the problem of balanced forces and support must necessarily be left to the collective judgment of the service and OSD decision-makers working together in a spirit of cooperation.

Hq United States Air Force

Notes

1. Charles J. Hitch, *Decision-Making for Defense* (Berkeley and Los Angeles: University of California Press, 1965), pp. 17, 18.
2. *Ibid.*, p. 24.
3. Alain C. Enthoven and K. Wayne Smith, *How Much Is Enough? Shaping the Defense Program, 1961–1969* (New York: Harper & Row, 1971), p. 334.
4. *Ibid.*
5. Benjamin Schemmer, "How Much Is Enough? Tells a Lot . . . But Not Enough," *Armed Forces Journal,* 1 February 1971, pp. 36–42.
6. Enthoven and Smith, p. 335.
7. *Ibid.*
8. *Ibid.*
9. *Ibid.*, pp. 335, 336.
10. *Ibid.*, pp. 336, 337.
11. Department of Defense Instruction 7041.3, "Economic Analysis of Proposed Defense Investments," 26 February 1969.
12. The benefit-cost diagrams in Figures 1 and 2 are illustrative only. They do not take into account time factors such as present value of investments and inflation. For more on the effect of these considerations on force level planning, see Major John D. Johnston, *The Impact of Discounting, Inflation and Residual Value on Life Cycle Costs of Weapon System Acquisition* (Washington: United States Air Force, Assistant Chief of Staff, Studies & Analysis, May 1970).
13. "Won't Discuss Bombers At Talks, Laird Says," *Washington Evening Star,* February 4, 1971, p. A-5.
14. For a detailed discussion on criteria to be considered at various levels of analysis, see E. S. Quade and W. I. Boucher, eds., *Systems Analysis and Policy Planning: Applications in Defense* (New York: American Elsevier, 1968), pp. 388–417.

GENERAL ROBERT E. LEE AND MODERN DECISION THEORY

LIEUTENANT COLONEL HERMAN L. GILSTER

ONE of the classic campaigns in the annals of military history was waged at Chancellorsville, Virginia, in May 1863 between the Army of the Potomac, led by Major General Joseph L. Hooker, and the Army of Northern Virginia, commanded by General Robert E. Lee. During the campaign, Lee, with a force approximately half the size of Hooker's, repulsed the North's advance into Virginia and achieved a strategic victory that has been studied by students of military art throughout the world. However, today's critics of the quantitative-oriented decision tools being used by our military services say that this battle would never have transpired if these same tools had been used then.[1] They feel that under the present decision-making process Lee would not

have met Hooker's advance but instead would have retreated to southern Virginia or even into North Carolina. Contrary to that course, Lee decided to give battle, and he won a brilliant victory.

The question to which we must address ourselves, then, is this: Was Lee's decision to fight based strictly on native intuition—leaving quantitative analysis nothing to offer—or could it be rationally justified by using modern decision techniques? This article argues that there are decision tools in-being today that can be used to support Lee's decision. Whether Lee applied such tools, either consciously or subconsciously, is not known, but we do know that he was no stranger to the science of numbers. Douglas Southall Freeman, who spent over twenty years studying the life of the great Confederate commander, declared: "His mind was mathematical and his imagination that of an engineer."[2]

Lee's background supplies ample evidence to confirm this evaluation. He graduated second in the class of 1829 from West Point, which was at that time primarily an engineering school. So proficient had he been in the field of mathematics that he was appointed acting assistant professor to instruct other cadets when he was only a second-year student. After graduation he entered the Corps of Engineers, and subsequent years found him working on engineering projects throughout the United States. It is doubtful if a person as familiar with numbers as Lee would not either explicitly or implicitly have quantified at least partially the alternatives open to him at Chancellorsville.

In the following sections the reader will find descriptions of three decision tools that could have been applied by Lee to support his decision to fight at Chancellorsville. These tools are the Lanchester equations, Bayes' theorem, and the von Neumann-Morgenstern utility theorem. Before these decision tools are outlined, however, a brief description of the battle of Chancellorsville may prove useful.

The Battle of Chancellorsville

Probably the most comprehensive and unbiased study of this battle appears in *The West Point Atlas of American Wars,* edited by Colonel Vincent J. Esposito, former Professor of Military Art and Engineering at West Point.[3] The following description draws heavily upon that fine work.

In April 1863 the newly appointed commander of the Army of the Potomac, General Hooker, with 118,000 men, faced General Lee's Army of Northern Virginia, approximately 60,000 strong, across the Rappahannock River at Fredericksburg, Virginia. On the 29th and 30th Hooker moved approximately 73,000 troops on a wide flanking movement across the Rappahannock to the vicinity of Chancellorsville to attack Lee from the rear. To hold Lee in position, Major General John Sedgwick, U.S. Army, with the remaining 45,000, maintained his position opposite Fredericksburg. (Figure 1a) Although Hooker's units were in position on the 30th, he awaited further reinforcements and did not advance from the vicinity of Chancellorsville until the first of May.

By this time Lee had interpreted Hooker's strategy. Leaving Major General Jubal Early, C.S.A., with 10,000 men to face Sedgwick, Lee moved his units toward Chancellorsville. The first clash occurred the afternoon of the first, and Hooker, apparently having lost his courage, gave up the initiative and recalled his much larger force to Chancellorsville into a defensive position.

That night Lee and Lieutenant General "Stonewall" Jackson, aware of Hooker's hesitancy, conceived a daring plan. Lee would maintain his position with approximately 17,000 men and demonstrate against Hooker's front, while Jackson would take the remaining force, using Major General Jeb Stuart's cavalry as a screen, and turn the enemy flank. (Figure 1b)

The movement took the better part of the

next day, but shortly before sundown Jackson struck Hooker's exposed flank. The battle raged during the night until the Federal Army gave way before Jackson's thrusts. The sensation of victory that Lee felt, however, must have been more than overshadowed by the loss of Jackson, who had ridden too far forward in reconnoitering the Union positions and had been shot by mistake when returning to his own lines.

On the third of May, Hooker again failed to take the initiative against Lee's split army, and although he was wounded later in the day by cannon fire, he would not relinquish command to his subordinate. By sundown Lee had united his separated units and was pushing Hooker back against the Rappahannock. But Lee's troubles were not over. Earlier that day Sedgwick had attacked at Fredericksburg, overrun Early's weak position, and was marching toward Lee's rear.

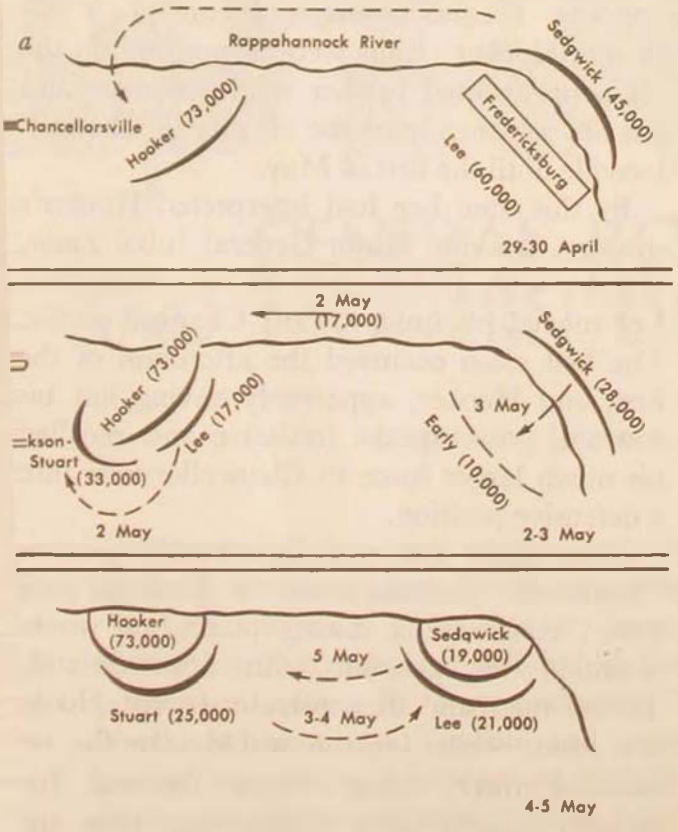


Figure 1. The battle of Chancellorsville

Again counting on Hooker's hesitancy, Lee reversed his field, leaving Jeb Stuart with 25,000 men to face Hooker's 73,000, and marched the remaining units toward Sedgwick's advancing army. Another flanking movement, using Early's remaining force, proved successful, and the morning of the fifth found Sedgwick back across the Rappahannock. (Figure 1c)

Lee, determined to crush Hooker, again reversed his field. But Hooker had had enough. On the sixth of May he withdrew his forces across the river before Lee could accomplish this objective.

The Lanchester Equations

A rather mathematical approach to the problem of battle decisions was provided by Frederick Lanchester in his article, "Mathematics in Warfare."[4] He derived two basic equations relating numerical strength and another constant, which he called "fighting value," to total strength. These equations can be adapted to the present analysis if we let "fighting value" represent the aggregate of all factors affecting the battle other than numerical strength.

Lanchester assumed that the number of men killed or incapacitated per unit time during a battle is directly proportional to the strength of the opposing force. This can be shown mathematically as:

$$\frac{db}{dt} = -rK_r \qquad (1)$$

$$\frac{dr}{dt} = -bK_b \qquad (2)$$

in which b and r represent the numerical strengths of the Blue and Red forces, respectively; t is time; and K_b and K_r are the fighting values of the two units.

If $K_b = K_r$, the battle depends entirely on the numerical strengths of the two forces. If Blue has twice as many men as Red, the ensuing battle is as depicted in Figure 2a. When

Red's force has been completely annihilated, Blue will have 866 men remaining.

Incidentally, this also shows the value of concentration. If Red originally had 1000 men and separated them into two armies, and each gave battle in turn, Blue would have 866 men after destroying the first Red army—enough easily to defeat Red's second force, all other things remaining equal.

If the values K_b and K_r are not equal, then these, too, must be considered in equating the total strengths of the forces. For the condition of equality, losses must be proportional to numerical strengths:

$$\frac{db}{bdt} = \frac{dr}{rdt} \tag{3}$$

Substituting in equations (1) and (2):

$$\frac{-K_r r}{b} = \frac{-K_b b}{r}$$

or

$$K_r r^2 = K_b b^2 \tag{4}$$

In words, the total strengths of the two forces are equal when the squares of the numerical strengths, multiplied by the fighting values of the units, are equal. This is what Lanchester called the "n-square Law."

The effect of concentration versus separation of forces has already been mentioned. Lanchester also gave a mathematical relationship for the aggregate numerical strength of the separated forces. (Figure 2b) Let the numerical values of the Blue and Red forces be represented by lines b and r. In an infinitesimal interval of time the change in b and r will be represented by db and dr in the relationship:

$$\frac{db}{dr} = \frac{r}{b}$$

or

$$bdb = rdr \tag{5}$$

Since in the "n-square Law" we are interested in the squares of the strengths, we here note what happens to the change of the area of b^2 and r^2 when the increments db and dr are subtracted. The change in b^2 is $2bdb$ and the change in r^2 is $2rdr$. According to equation (5) these are equal, so the difference between the two squares is constant.

$$b^2 - r^2 = \text{constant}$$

If the constant is represented by r_* then

$$b^2 = r^2 + r_*^2 \tag{6}$$

r_* represents numerically a second Red army of the strength necessary in a separate action to place the Red forces on equal terms with the Blue force. Graphically, Red's total numerical strength is the hypotenuse of a right triangle, the legs of which are the two separate forces. (Figure 2c)

Now if Lee had had available Lanchester's equations (4) and (6), he could have mathematically verified his decision to fight. First, let us compare the K values. The battle of Fredericksburg, which was the last engage-

Figure 2a

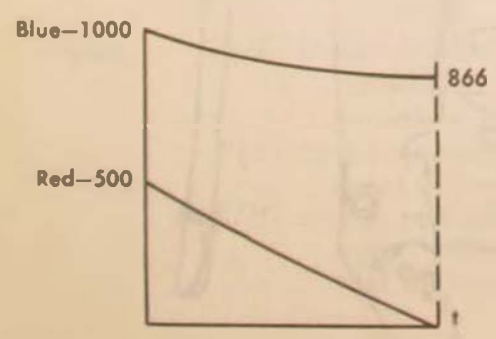


Figure 2b

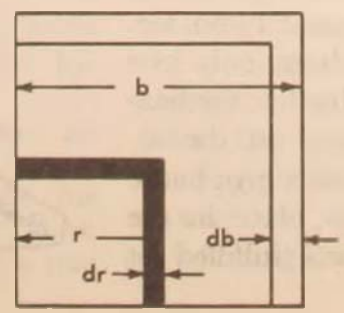
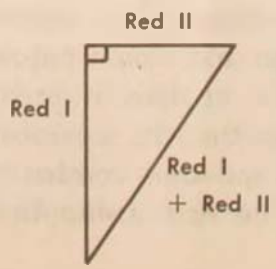


Figure 2c



ment between the two armies, provides a starting point. The numerical strengths and losses of the Northern forces were both twice that of the South. Accordingly, equation (3) is satisfied, and there existed an equality in the total fighting strength of both sides. By equation (4),

$$K_s(1)^2 = K_n(2)^2$$

or

$$\frac{K_s}{K_n} = \frac{4}{1}$$

Lee had a four-to-one advantage in "fighting value."

At the time of Lee's critical decision, Hooker had divided his army into two forces. One force of approximately 45,000 men under Sedgwick was left to contain Lee, while Hooker, with 73,000 men, effected a flanking maneuver to attack Lee's rear. In the meantime, however, Lee had left 10,000 men in place under Early to face Sedgwick and took 50,000 men to meet Hooker's main thrust. According to equation (6), the proportional numerical strengths were then:

$$n^2 = (73)^2 + (45)^2 = 7354$$
$$s^2 = (50)^2 + (10)^2 = 2600$$

Using these values in equation (4) for Chancellorsville, the total fighting strengths were:

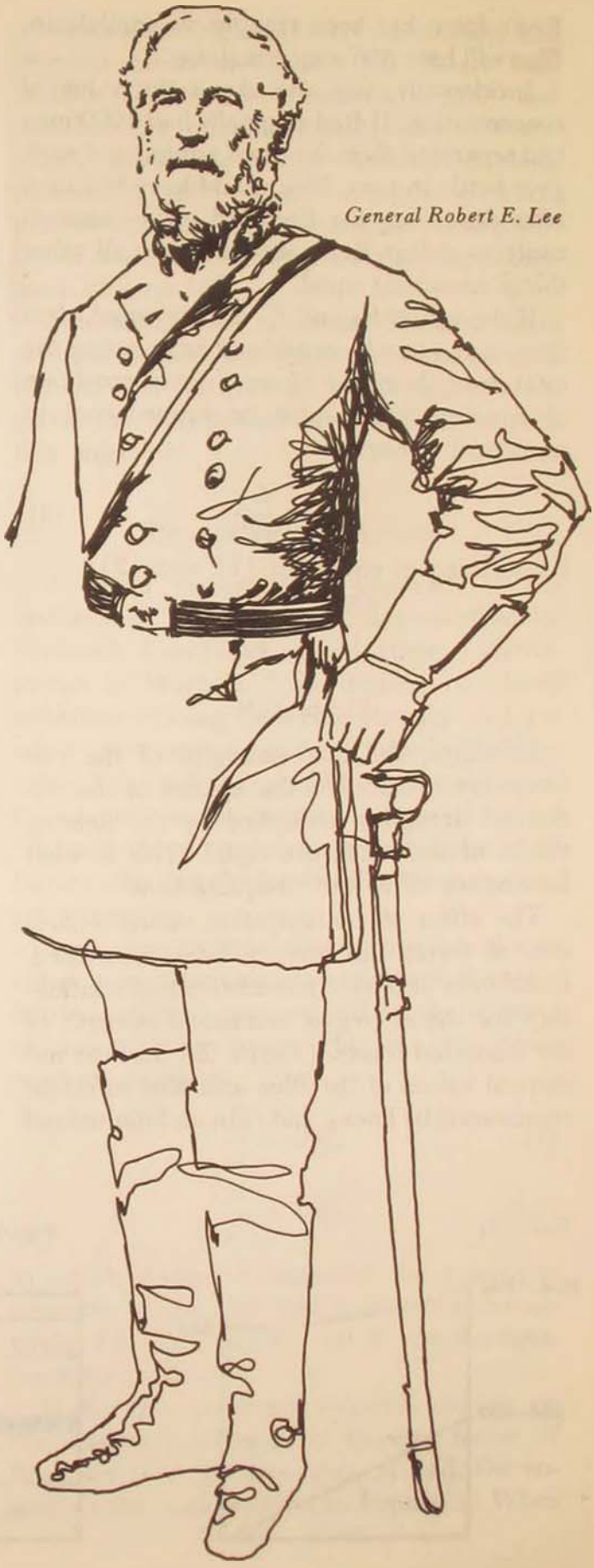
$$K_n n^2 = 1 \times 7364 = 7364$$
$$K_s s^2 = 4 \times 2600 = 10{,}400$$

and

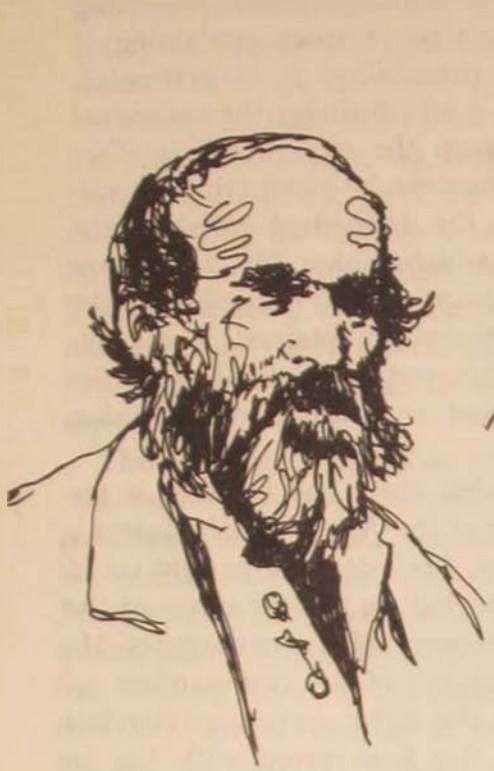
$$K_s s^2{}_s > K_n n^2{}_n$$

Lee's total strength was greater than Hooker's!

I hesitate to push this approach too far. The K values were derived from only one campaign and would require further verification. The analysis is predicated on the assumptions that the separated forces give battle in turn and that combat takes place in the open. The first assumption was fulfilled at



General Robert E. Lee



Major General Jubal A. Early

Major General J. E. B. Stuart

Lieutenant General Thomas J. ("Stonewall") Jackson

Chancellorsville, but the second might prove difficult to verify. The approach does show, however, that the Lanchester equations, even if indiscriminately applied, could be used to support Lee's decision.

Bayes' Theorem

Bayes' theorem can be utilized to refine any hypothesis that Lee might have held about defeating the Northern forces. One version of this theorem takes the form

$$P(H/E) = \frac{P(E/H)\ P(H)}{P(E)}$$

where $P(H)$ = the previous or *a priori* probability that the hypothesis is true

$P(E)$ = the probability that an event will occur

$P(E/H)$ = the probability that the event will occur given that the hypothesis is true

$P(H/E)$ = the post or *a posteriori* probability that the hypothesis is true, given the event has occurred

If Lee had placed a certain *a priori* probability on the hypothesis that he could defeat the Northern army, and if the probability of winning a battle, given that the hypothesis was true, was relatively high whereas the normal probability of winning was relatively low, then given the past event—the battle of Fredericksburg (or better yet, eleven wins in thirteen encounters)—his *a posteriori* probability of the hypothesis would be greater and more meaningful than his *a priori* probability.

For example, let us say Lee placed a .3 probability on the hypothesis that he could defeat the Union force. If the probability of winning at Fredericksburg, given the hypothesis was true, was .6, and a normal probability of winning at Fredericksburg was .2, then

Major General John Sedgwick

$$P(H/E) = \frac{.6 \times .3}{.2} = .9$$

His *a priori* probability of winning was .3, but with the use of additional information (past events), this probability increased to .9. He would now have greater faith in his original hypothesis that he could defeat the Union army and might therefore decide to meet Hooker's advance.

The Von Neumann-Morgenstern Utility Theorem

Professors John von Neumann and Oskar Morgenstern have shown that under certain circumstances it is possible to construct a set of numbers for a particular individual that can be used to predict his choice in uncertain conditions. Briefly, this theorem states that if an individual can rank three commodities in an order of preference, say $A>B>C$, then in a choice between a certain prospect containing B and an uncertain prospect containing A and C with a probability, p, of getting A, there is a value p which makes the individual indifferent between the two prospects. Two of the commodities can be given arbitrary values, and once the individual provides the probability, p, which makes him indifferent between the two prospects, the value of the third commodity can be obtained. These values will then have certain cardinal properties that can be used to evaluate the decision process.

Napoleon stated that "the General is the head, the whole of the Army."[5] If Napoleon's maxim is correct, Lee's decision to fight could have been predicated on a comparison of the high-level commanders of the two armies. He did know a majority of the commanders on both sides. Of the eight corps commanders under Hooker, five had served with Lee in the Mexican War and two had been cadets at West Point when Lee served as superintendent of that institution from 1852 to 1855. Aligned against these commanders, Lee had the following men who would play a significant role in the coming battle: Jackson, the trusty lieutenant who had more than proved himself in previous campaigns; Stuart, the dashing cavalry officer who had highly impressed Lee as a cadet at West Point; and Early, an 1837 classmate of Hooker and a veteran of the Mexican War.

That Lee had definite opinions about the abilities of his enemy is apparent from the letters of that day. Previously, when McClellan had been replaced as commander of the Army of the Potomac, Lee expressed sorrow that his old associate of the Mexican War would no longer oppose him: "We had always understood each other so well. I fear they may continue to make these changes till they find someone whom I don't understand."[6] When Hooker replaced Burnside as commander of the federal forces, Lee accepted the change with complacency. In his personal letters, how-

ever, he jested mildly over the apparent inability of Hooker to determine a course of action.[7]

Contrasted with this rather low opinion of the opposition leader, we find this lofty estimate of Jackson's capabilities: "Such an executive officer the sun never shone on. I have but to show him my design, and I know that if it can be done, it will be done. No need for me to send or watch him. Straight as a needle to the pole he advances to the execution of my purpose."[8]

This intimate knowledge of the opposing commanders and definite opinion of their capabilities belong in Lee's calculus. Given this, he could have used the von Neumann-Morgenstern utility theorem to establish a quantitative comparison of the leadership abilities of both sides. As an example, let us say that Lee would rate the three commanders, Hooker, Jackson, and Stuart, in the following order: Jackson>Stuart>Hooker. We now set any arbitrary value for Jackson, say 100, and Stuart, say 90, and then determine at what probability, p, Lee would be indifferent between the certain prospect of getting Stuart and the uncertain prospect which, if selected, provided the probability, p, of getting Jackson.

Certain prospect = Uncertain prospect

Stuart = Jackson or Hooker with the probability, p, of getting Jackson

$$90 = 100p + \text{Hooker}\,(1 - p)$$

Let us say that at $p = .8$, Lee is indifferent between the two prospects. Then:

$$90 = 100 \times .8 + \text{Hooker} \times .2$$

$$\text{Hooker} = \frac{90 - 100 \times .8}{.2} = 50$$

Numerical values of the capabilities of the other commanders could be derived in the same manner. These values could then be aggregated to give a rough quantitative comparison of Lee's view of the opposing leadership abilities. This comparison would provide an important input to the decision-making process.

Major General Joseph Hooker

THIS ARTICLE describes how three modern quantitative tools could have been employed by General Robert E. Lee to aid in the critical decision facing him on the eve of the battle of Chancellorsville. This survey of decision tools is certainly not exhaustive—there are others that one could utilize. There are also other inputs that belong in Lee's calculus, such as the "super" image of Lee that had been created, the effect of the recently issued Emancipation Proclamation in hardening Southern resistance, and the comparative morale in the two armies.

The point to be emphasized, however, is that any tool, quantitative or otherwise, which aids the decision-maker in his choice, not only should but must be employed. If that choice is among a number of alternatives, however, systematic quantitative analysis will prove essential in delineating clearly the basic relationships and interactions between the many di-

verse factors that the decision-maker must consider. It will prove even more essential in the military than in the business world, where the forces of competition working through the price mechanism furnish a reliable guide to planning. In matters of national security no such mechanism is available.

This does not mean that sound judgment has been replaced by the computer. As far as I can determine, no one has ever advocated the exclusive use of mathematical tools in the determination of policy. Surely this was not the theme of the Hitch and McKean book, which had such a powerful impact upon defense strategy:

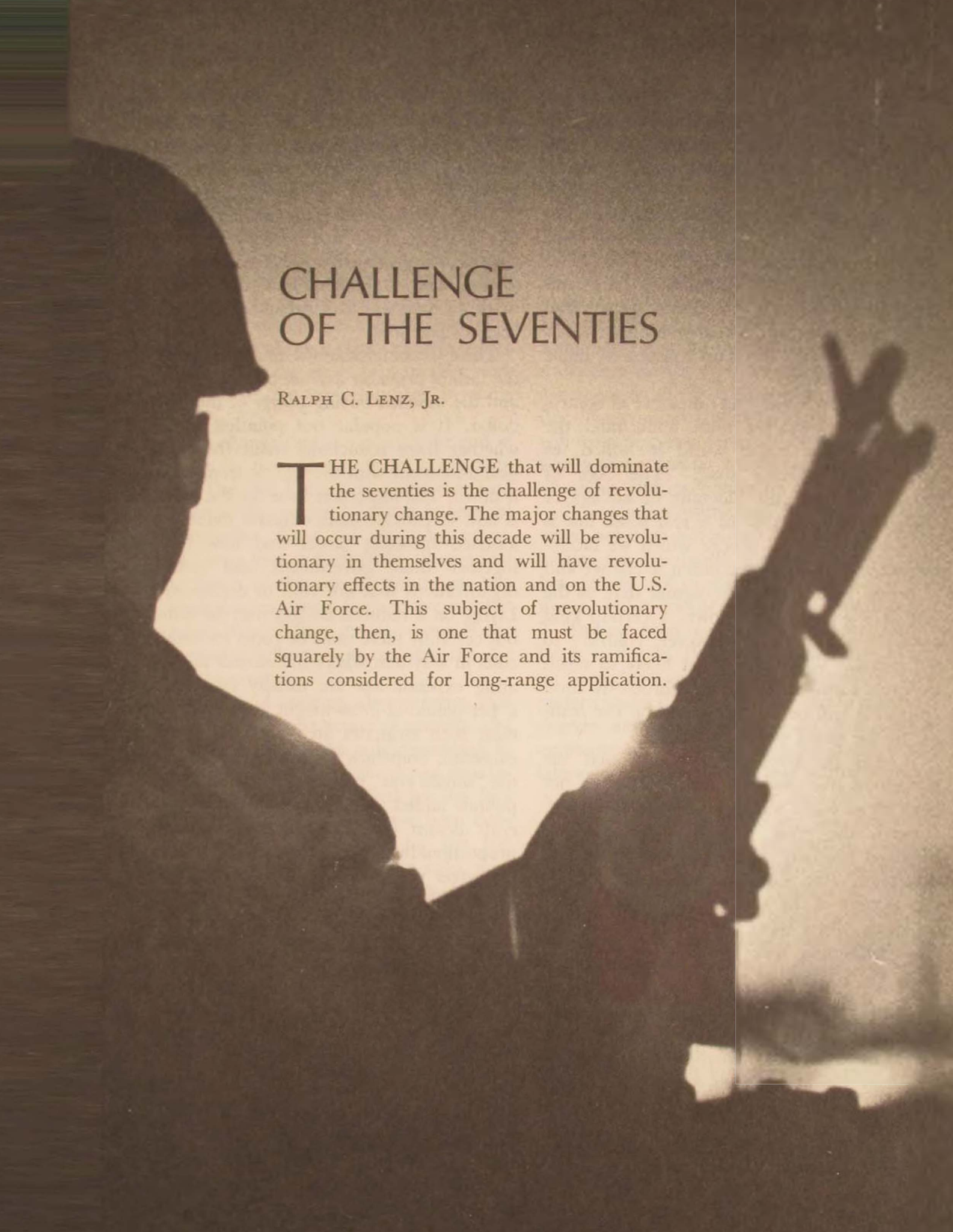
> Economic choice is a way of looking at problems and does not necessarily depend upon the use of any analytical aids or computational devices. . . . Where mathematical models and computations are useful, they are in no sense alternatives to or rivals of good intuitive judgment; they supplement and complement it. Judgment is always of critical importance in designing the analysis, choosing the alternatives to be compared, and selecting the criterion. Except where there is a completely satisfactory one-dimensional measurable objective (a rare circumstance), judgment must supplement the quantitative analysis before a choice can be recommended.[9]

The responsibility of decision still rests with the commander. Quantitative analysis does not relieve him of that responsibility, but it can make that responsibility less formidable.

Hq Pacific Air Forces

Notes

1. One such view was expressed by Colonel Francis X. Kane in "Security Is Too Important to Be Left to Computers," *Fortune*, April 1964.
2. Douglas S. Freeman, *Lee*, abridgement by Richard Harwell (New York: Charles Scribner's Sons, 1961), p. 115.
3. Vincent J. Esposito, ed., *The West Point Atlas of American Wars*, Vol. I (New York: Frederick A. Praeger, 1959), pp. 84–97.
4. Frederick W. Lanchester, "Mathematics in Warfare," *The World of Mathematics*, Vol. IV, edited by James R. Newman (New York: Simon and Schuster, 1956), pp. 2140–46.
5. Esposito, p. 91.
6. Freeman, p. 268.
7. *Ibid.*, p. 285.
8. *Ibid.*, p. 292.
9. Charles J. Hitch and Roland N. McKean, *The Economics of Defense in the Nuclear Age* (Cambridge: Harvard University Press, 1960), p. 120.



CHALLENGE OF THE SEVENTIES

RALPH C. LENZ, JR.

THE CHALLENGE that will dominate the seventies is the challenge of revolutionary change. The major changes that will occur during this decade will be revolutionary in themselves and will have revolutionary effects in the nation and on the U.S. Air Force. This subject of revolutionary change, then, is one that must be faced squarely by the Air Force and its ramifications considered for long-range application.

We are concerned primarily, of course, not with revolution in the streets but rather with revolutionary changes in thinking and technology and their seemingly limitless potential for the future.

As far as possible, we of the Air Force want to be in control of our response to these changes, rather than be controlled by them. We do not want to be buffeted back and forth at the hands of others but rather wish to set our course and to change it on a reasonable basis, within the duly constituted limits of national policy.

If we are to achieve any measure of control over our destiny, we must understand the changes in the larger world in which we operate. A popular song, "The Age of Aquarius," notes the dawning of an age of change and of peace. In a real sense this is the nature of the challenge which we face—the necessity of accommodation to change and to peace. I think we all recognize that, as the war in Vietnam winds down, a certain kind of peace will prevail. However, contrary to the popular view, this is not likely to result in some utopia of worldwide brotherly love. Instead it will be a peace based on the realities of the world power situation.

It may be noted from history that the periods of real peace in the world have not been those when military power was absent. Instead, the great periods of peace have occurred precisely when military power was dominant. *Pax* Romana was supported by the strength of the Roman legions, and peace collapsed when those legions became weak. *Pax* Britannica was possible when Britain ruled the waves.

One may postulate that a third world war would already have occurred were it not for the awesome power of nuclear weapons. Peace exists as a result of power, not in the absence of it.

The armies of Europe were not strong at the beginning of World War I, and Hitler started his excursions with a minimum of real strength, impressive only in contrast to the weakness of French and British forces. Certainly the 100,000-man U.S. Army of the 1930s did not lead us to peaceful neutrality in World War II.

Therefore, in writing about a change from war to peace, I am not doing it with a view toward a less powerful Air Force but rather toward the accommodations that must be made to maintain and strengthen our peacekeeping potential.

These accommodations must be made in the face of probable defense budget reductions and the lessened buying power of the defense dollar. It is popular but pointless to argue whether these reductions result from public disillusionment with the war or from winding it down. The important issue for the seventies is how to provide more effective defense with lessened spending power and how to hold together those government and industrial organizations that are vital to defense needs. Living on a reduced budget may be difficult, but certainly there must be room for reducing costs in a system where investment and operating expenditures are usually estimated on a per-pound-of-gross-weight basis and where most such estimates are either borne out or exceeded. Somehow we must get a handle on the "should cost" equation, so that a thousand pounds added to the gross weight of an aircraft design does not automatically add a proportionate amount to all expenditures.

Budget pressures and all-volunteer defense forces will bring changes in the Air Force which we can only speculate about today. These changes will not be easy to take, but, like bitter medicine, they may ultimately make us feel better.

The draft, by providing a ready source of apparently cheap manpower, led us to a labor-intensive work force. With all-volunteer forces we will be looking much more closely at the real cost of Air Force manpower, since the costs will approach "free market" conditions and be paid directly. There should be

little doubt that we will move toward more automation and become more capital-intensive in our operations, just as industry and agriculture have done when faced with rising labor costs. The move from labor-intensive operations in industry and agriculture created severe dislocations and brought about widespread social changes. We should not expect the impact to be any less in defense operations, and it would be well to reread the history of the changes in industry and agriculture for lessons in societal change which might help us as we move to a smaller work force with machines replacing men in many jobs.

Another change that comes with the end of every war is the change from combat to training. The Air Force now faces this kind of change as the war in Vietnam is brought to a conclusion. Since we are more accustomed to wars that end abruptly, the gradual phasing down of the war in Southeast Asia may mask this transition from active combat to training. Nevertheless, it will be one of the most pervasive influences in molding the Air Force of the seventies.

The routine of training always seems dull in comparison with the action of combat, and it is difficult to sustain the public's interest in a training Air Force. The difficulty of sustaining public interest is intensified by the fact that the citizens of the U.S. have been concerned with war continuously for the last thirty years—World War II, the cold war, Korea, and Vietnam. Now we must consider that this concern may shift to peace, in the same way that the U.S. was preoccupied with peace and internal concerns in the twenties and thirties.

An equally great danger lies in the fact that the veterans of the last war usually provide the training for the next, and at least sometimes they fall into the trap of being well prepared to refight the last war but poorly prepared to cope with the next.

We must be sure that Air Force training in the seventies prepares us to defend the national interest in all foreseeable contingencies and is not oriented solely to the type of combat which we know best from recent involvements.

Of great importance in this training will be the use of simulators. The need for simulators in training is not new, but the capability for adequate simulation is. Combat commanders of the past used sand tables to plan and develop battle tactics, and the lack of a three-dimensional simulation capability and scales suitable for air war has hampered the development of air combat strategy and tactics. The combat commanders of this decade will train on computer-based simulators realistically encompassing a wide variety of combat situations and environments.

Training is a prime task for the Air Force when not engaged in combat, and the capabilities for simulation developed during the last decade will provide the basis for the Air Force of this decade. It is significant that 75 T-29s have been replaced by 52 ground simulators and only 19 aircraft in the Air Force undergraduate navigator training system. This pattern seems likely to be repeated in different degrees and in different ways—but always emphasizing the use of computer-based simulators—in all the many areas where training is necessary.

The next ten years will see the phase-out of the World War II generation. Endless statistics can be cited to document the magnitude of this change in numbers of people retiring, proportions of various age groups, and so forth. These statistics, although useful in measuring the extent of change, are far less important than the nature of the change.

As one example, not since the first part of World War II have our ground forces operated without the advantage of air superiority. Few of our Korean and none of our Vietnam ground troops have ever seen an enemy airplane. Naturally our planning and preparation for future conflicts will be affected when

the last memory of enemy air power is gone.

Also, not since World War II have we experienced conditions of decisive victory on a large scale. Perhaps the experience of total victory is not necessary or relevant to the future, but certainly such experience has guided our thinking and attitudes during the last twenty-five years. When this experience is gone, it is difficult to predict the changes in viewpoints and concepts about the need for, and meaning of, winning victory in combat.

Furthermore, with the passing of the World War II generation will go the personal knowledge of the trials and difficulties encountered in creating the Air Force. Already, in fact, the 1930s' struggle to wrest control of air power away from the ground forces is fading from memory. A strong and separate Air Force is taken for granted as a result of the experiences of the last quarter-century.

I am not suggesting that all the experiences of the past are useful or applicable to the future but rather that we may expect significant changes as the post-World War II class takes over. We may anticipate these changes to some degree by taking a closer look at differences between the experiences of the World War II generation and its successors.

All these changes, and others that will come during the seventies, will bring about corresponding changes in our institutional structures. Indeed, the more revolutionary the change, the more sweeping will be the change in organizational structure. The longer we live with any organizational pattern, the more comfortable we feel with that particular structure, and often we reach the point of feeling that the existent structures are the best or the only possible institutional patterns to achieve our objectives.

Increasingly in the seventies we may expect that these comfortable patterns will be exposed to the test of relevancy. Unless we provide valid evidence that our present organizations serve the changing needs or lead in modifying these organizations or in creating new ones, we will find others forcing unpalatable changes down our throats.

Let me review briefly some of these comfortable institutions, without suggesting in any way that they need to be changed, but only that they are being or will be challenged by others.

First, we have the set of institutions whose basic posture was derived from the lessons learned in World War I, namely, the National Guard, the Reserve Forces, and the ROTC. We should not let current attacks upon these institutions force us into the position of defending concepts based on World Wars I and II mobilization needs; rather, we should insure that the functional concepts for these organizations meet the needs of the future.

Next, we have those institutions and concepts created by the men who molded the Air Force following World War II. Through the genius of General Henry "Hap" Arnold, we have the basic Air Force operating command structure of Strategic Air Command, Tactical Air Command, Aerospace Defense Command, and Military Airlift Command, which with only minor modifications has served so well for the past quarter-century. Additionally, General Arnold created the Scientific Advisory Board and enlisted the academic community in wholehearted support of the Air Force. Again as a result of General Arnold's initiative, the great complex of facilities of the Arnold Engineering Development Center was built at Tullahoma, Tennessee.

Our debt to General Arnold includes his concept and support for the "X" series of aircraft—a concept which gave us supersonic flight and which might have provided many further aeronautical advances had it not been abandoned after the brilliant successes of the X-15.

General Curtis LeMay, as a result of his World War II experiences, fostered the use of operations analysis to improve strategic bombing capabilities. The concept and reality

of SAC serving as the strategic deterrent throughout the cold war period also must be credited primarily to General LeMay.

To General Bernard Schriever and his military-industrial team we owe the reality of the Atlas, Titan, and Minuteman. The Air Force Systems Command developed as a logical extension of the total systems concept used in these ballistic missile programs. This concept is so basic to the Air Force way of life today that it is difficult to realize that AFSC's tenth birthday was celebrated just a year ago.

The Air Force has been well served by these institutions and their creators. The future will not permit us to rest on the laurels of these men—indeed, the seventies will drive us hard to refresh the organizational structure where possible and come up with new ideas where the old no longer serve well. Much of the organizational structure within the industrial half of the military-industrial complex has a similar background and also will be subject to change in the seventies.

The greatest forcing factor for change will be new technologies. The Air Force will not be able to cope with other changes without a strong foundation of technology. These changes have been left until last for two reasons: first, partly because they are usually our first concern and we become so engrossed in the marvels of new machines that we do not find time for the other concerns; and second, partly also because any one article can touch on only a few of the technical changes and hint at their effects. However, it is possible to identify a few examples of the major changes.

What will terminal homing weapons do to the Air Force? Enemy surface-to-air infrared homing missiles already have created the need for infrared suppression in aircraft and engine design. Air-to-air terminal homing weapons are causing a reappraisal of air combat tactics and will have even greater impact as we develop simulators and techniques for effective training in their use.

We are just beginning to assess the effects of our own air-to-ground terminal homing bombs and missiles. As we look at all the targets which the Maverick and other homing weapons can kill, we will be forced to consider the impact of this capability on our aircraft payload requirements, on combat tactics and force structure, and on the training required for effective use of this capability.

Much has been written about concepts for remotely piloted aircraft weapon systems, but little has been said about the effects which these weapons may have on the Air Force. We may start with the premise that remotely piloted vehicles (RPV) will work nicely in those situations where the loss rates of manned aircraft would be prohibitive. As someone has said, "Remotely piloted vehicles are utterly fearless." Fortunately, RPV's will be assigned to some jobs that are now done by manned aircraft.

In 1954 we counted our strategic bombers in the thousands, and we had no intercontinental ballistic missiles. Now we count such missiles at more than a thousand, and our bombers in the hundreds. Although RPV's may not produce such a marked change, some observations may be drawn from this experience with ICBM's.

First, manned aircraft will have to do their jobs better in order to stay competitive with RPV's. Manned aircraft will have to have better survivability, more effective weapon delivery, and reduced costs. Paralleling strategic deterrence, planning will need to consider a force structure mix including both RPV's and manned aircraft. Within any given budget level, it is axiomatic that this means fewer manned aircraft than would be the case without RPV's. Battle strategy, tactics, and planning will change and become more complicated, to accommodate the differences between RPV and manned aircraft roles and capabilities. Air Force training for RPV's may rely much more upon the growing capabilities of simulators, since RPV operations do not

involve a seat-of-the-pants feel for flying.

Possibly more important than any of these tangible changes will be the effect of RPV's on Air Force morale, traditions, and institutions. This problem cannot be swept under the rug but must be defined and solved just as carefully as the technical difficulties.

To exemplify this problem, several questions may be asked. What if all heavily defended targets are assigned to RPV's? Will real pilots be happy flying "model airplanes"? What will happen to the traditions of bravery, self-sacrifice, and teamwork when the "hard jobs" are assigned to the RPV's? Will the conflict between RPV operations and manned aircraft resemble the Navy conflict over battleships versus aircraft carriers?

Terminal homing weapons and remotely piloted vehicles offer only two examples of the effects which technological change may have on the Air Force.

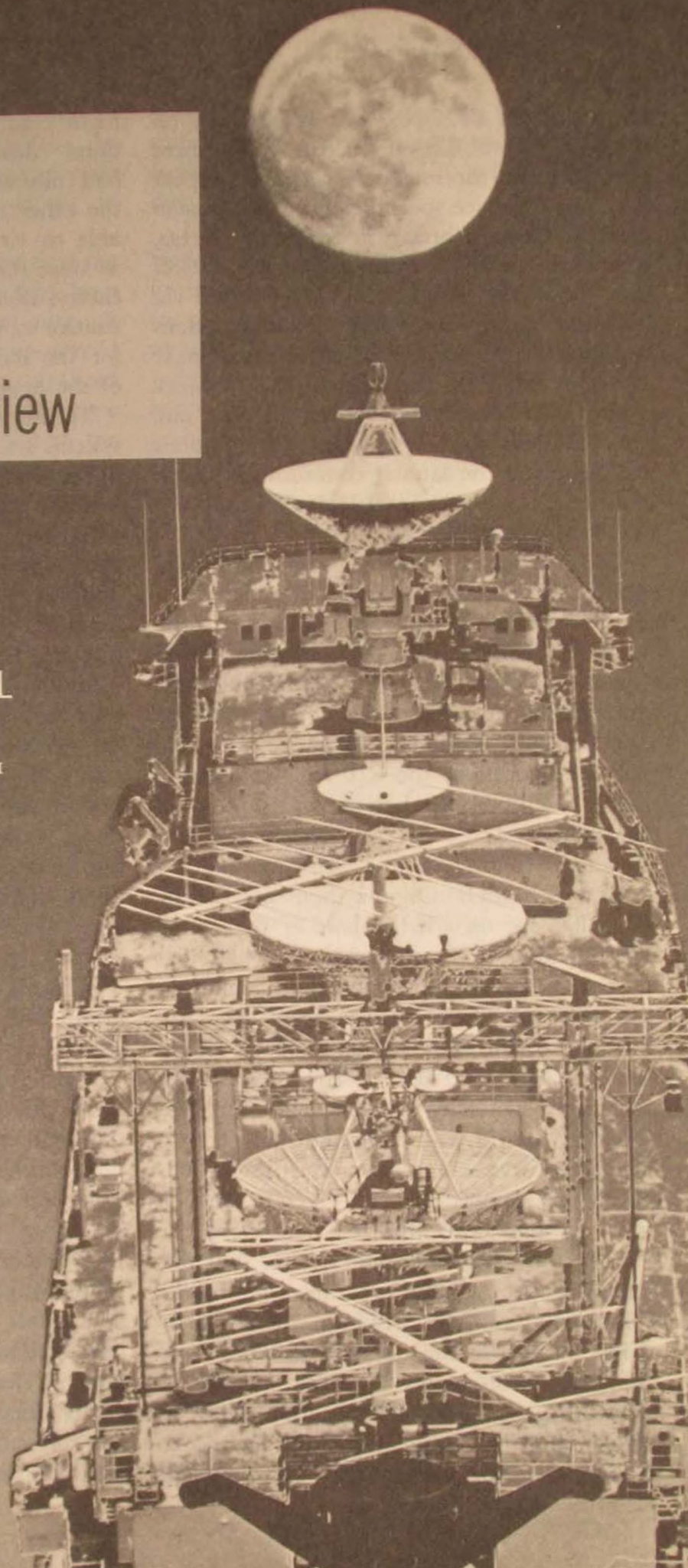
Each technological advance will force some change upon the Air Force, and in most cases the change will be greater than expected. To meet the challenge of the seventies, we must anticipate the changes which will occur, prepare our plans in advance, and control situations by acting before the problems have time to develop.

Hq Aeronautical Systems Division, AFSC

Air Force Review

A LOOK AT APOLLO GROUND SUPPORT CONTROL

Captain Richard J. Stachurski



"ALL STATIONS, this is Network on Net Two. Lift-off, one three, plus three two, zero zero decimal seven eight. I repeat . . ." As the voice speaking from the Mission Control Center (MCC) in Houston, Texas, begins the second transmission, the lift-off time for another Apollo mission is relayed via landline, microwave, and communications satellites to the worldwide stations that make up the Manned Space Flight Network (MSFN) of the National Aeronautics and Space Administration (NASA). Simulations are complete, the launch countdown is over, and the remote stations settle down to support the long lunar mission.

The principal elements of NASA's ground support system are the 85-foot antenna stations at Madrid, Spain; Honeysuckle Creek, Australia; and Goldstone, California. These stations are supplemented by a tracking ship, four instrumented aircraft, and eight 30-foot-antenna land stations located around the globe. In addition, the 210-foot antenna of the Jet Propulsion Laboratory station at Goldstone and the 210-foot antenna of the Australian Commonwealth Scientific and Industrial Research Organization at Parkes, Australia, are used in support of the actual lunar landing and extravehicular activities whenever possible. Voice and data communications to all these stations from MCC are routed through the Goddard Space Flight Center in Maryland and subsequently through subsidiary switching centers at Canberra, London, Madrid, and Honolulu.

The elaborate communications system employed in support of each Apollo mission makes possible a centralized control of the manned space flight ground systems that was unknown during earlier programs. During the Gemini program, for instance, the majority of the stations in the tracking network were connected to MCC only by voice and 60- or 100-word-per-minute teletype circuits. To analyze mission data, it was necessary to deploy teams of vehicle and crew systems flight controllers to the various tracking stations. Although the Flight Director at MCC had ultimate mission responsibility, he and the other flight controllers at MCC were not able to view vehicle data in near real-time as were the remote station controllers. Thus, each station became a kind of semiautonomous control center, and the ground system was, for the most part, under the direct control of the deployed controllers.

Technical assistance on the Gemini ground systems was provided to the flight controllers by permanent station personnel and by a team of ground system specialists located at MCC. The group at MCC, known as the Network Support Team (NST), consisted of experts in command (transmission of control functions to the space vehicle), telemetry, tracking, remote station data processing, documentation, and station scheduling. With the exception of the tracking controller, who conducted C-band beacon handovers, the ground system experts exercised no direct control of the ground system. Their role was purely that of an expert staff. It is interesting to note also that the NST members were not permanently stationed at MCC; they were specialists who were normally stationed at Goddard Space Flight Center or the Air Force Eastern Test Range. The NST was only an ad hoc group, organized and deployed to MCC during actual mission periods.

During the initial stages of the Apollo program, NASA made several major changes in the flight control system that had been developed during the Mercury and Gemini projects. First, a decision was made to exercise control of future missions directly from the MCC. Flight controllers would no longer be deployed to the Manned Space Flight Network stations. The MSFN stations and their associated communications would henceforth serve as a medium for mission command and control, rather than as a series of semiautonomous control centers. Second, NASA decided to discontinue deployment of the NST to Houston

during mission periods. Instead, a group of ground support specialists designated as the Instrumentation Support Team (IST) would be developed and permanently based in Houston.

Actually, the first of these changes was not a new idea. The MCC in Houston had been built with centralized mission control in mind, but lack of adequate communications forced the adoption of the somewhat decentralized system used during Gemini. But by the time the Apollo control system was developed, the idea of truly centralized control became practical because sufficiently reliable, high-capacity data circuits were then available.

The creation of the IST was largely motivated by the desire to have the ground support team available for integrated training with the vehicle and crew systems flight controllers during the entire premission simulation period. This kind of integrated training was thought to be particularly required because the upcoming Apollo missions would be more complex and difficult than any flown during the Mercury and Gemini periods.

The IST developed for the support of Apollo is the central element in a system of ground support control that differs radically from the Gemini system. The members of the IST are actively engaged in configuring and operating the MSFN ground systems rather than simply advising on technical aspects of the system. The IST collects and coordinates flight control data requirements, translates these requirements into ground system configurations, and then monitors and controls the receipt of the mission data. The way in which the IST functions in controlling the flow of data through the Apollo ground system can best be described by briefly outlining the functions of each operating position.

Like the NST, the IST positions were developed on a functional basis. Thus, each IST shift operating during an Apollo mission is made up of a team leader and his assistant, three command controllers, two telemetry controllers, two tracking controllers, two communications controllers, an air-to-ground controller, and specialists in scheduling and documentation.

The IST team leader, the network controller, has operational control of all the ground systems supporting a mission except for the Real Time Computer Complex (RTCC) at MCC. The functions of the RTCC have been judged to be so complex and critical that a special computer supervisor, assisted by a team of software specialists, is responsible for this system. Both the network controller and the computer supervisor report directly to the Flight Director, who has overall responsibility for the mission.

The principal tasks of the network controller during an Apollo mission fall into two broad categories. The first category includes those tasks associated with supervising the execution of the nominal ground support plan. This plan is prepared premission and provides a detailed timeline, which shows how available ground support resources are to be allocated in support of mission data requirements. A typical task in this area is the supervision of interface testing prior to a remote station's support period, to ensure that the station is properly configured per the ground support plan.

The second broad category of network controller tasks involves replanning of ground support when the mission does not proceed according to the nominal plan. This replanning may be done on a long-term basis or on a very immediate basis. Apollo 13 provided the most striking example of the long-range or extensive replanning activity when the explosion of an oxygen tank forced abandonment of the original mission plan. Consequently, new view period tables and tracking assignments for the ground network had to be generated on a continuing basis throughout the mission.

In contrast to this type of activity, which covered many days, replanning of ground

support may also be done on a real-time basis. This type of activity is probably familiar to operations personnel in all fields as the cause of well-remembered moments of sheer terror. Usually decisions of this kind are necessitated by failure in the ground system that must be immediately corrected. A classic example occurred during the critical translunar injection burn of Apollo 11. Command computer problems onboard the tracking ship *Mercury* forced the network controller to decide on a late handover of transmitting responsibility from the tracking ship *Redstone* to the *Mercury*.[1] The handover was held until the last moment, until imminent loss of signal by the *Redstone* forced the issue. When the switch was finally made, *Mercury* experienced numerous signal dropouts, and the metric tracking data were virtually useless. Once again a decision was made to carry out a contingency handover to the Hawaii tracking station, which had just acquired the spacecraft signal. This whole process covered a time span of approximately three minutes.

During those hectic three minutes and in similar situations, the network controller, as IST leader, has final responsibility for the actions taken to alter the ground support configuration. But since the network controller is backed up by a team of specialists, all his decisions are based on the advice of his team members, and in most cases the decisions are implemented by the IST member. The contingency station handovers required during the Apollo 11 flight, for instance, were actually executed by one of the IST command controllers who has responsibility for control of the station transmitter on and off times.

Before we discuss the functions of the various IST system controllers in more detail, one special duty performed by the assistant team chief, known as the assistant network controller, is worth noting. As his title implies, this team member aids the network controller, with whom he shares a console, in carrying out the overall task of controlling the ground support system. In addition, the assistant network controller has particular responsibility for the operation, configuration, and troubleshooting of the supporting systems within the MCC. This responsibility includes every system within the control center except the RTCC, which is under a separate supervisor. Thus, the individual supervisors of the display, telemetry, power, and communications systems within MCC report their status and configuration to the assistant network controller, who then can monitor the internal configuration for consistency with the overall plan of operations for the ground system. The assistant network controller effectively serves the IST as an expert on the MCC portion of the overall Apollo system, and the sight of flickering lights or blank displays has been known to accelerate his pulse rate greatly, especially during a launch.

The other IST controllers also have some excitement in their own areas of responsibility. The telemetry controllers, for example, lead a hectic life. They must see that vehicle system performance measurements and flight crew biomedical parameters are successfully received by the ground stations and transferred to Houston for subsequent processing and display. Since most of the critical phases of an Apollo mission involve multiple vehicles, the telemetry controllers must be certain that the various vehicle data streams are handled according to the priority established for that phase. They must also be certain that the proper combinations of vehicle measurements for that phase are shipped to MCC, since communications limitations prohibit the transfer of all the measurements available at any given time. Finally, the telemetry controllers must make certain that the data suffer no degradation en route from the remote station to the end display device at MCC.

The command controllers are responsible for data going in the opposite direction, from MCC to the spacecraft via a ground station. Data transferred from MCC include commands

for controlling the remote station computers, commands for controlling vehicle functions, and updates to the spacecraft computers. The command controllers must ensure that the data are successfully transferred to the remote computer, properly formatted for transmission to the space vehicle, and then transmitted. If, after transmission, the spacecraft does not verify data receipt, the command controllers must work with the vehicle flight controllers to determine the reason for the rejection of the data.

Besides telemetry and command data, the IST is responsible for tracking data. The tracking controllers monitor the flow of S-band and C-band tracking data from the remote stations to the Houston RTCC, where they are finally used in computing trajectory solutions. The tracking controllers also make certain that the stations are provided with the pointing information they need to acquire each spacecraft they are assigned to track. Like the other IST controllers, the tracking controllers troubleshoot system problems, keep Network advised of their system status, and recommend alternate configurations whenever required.

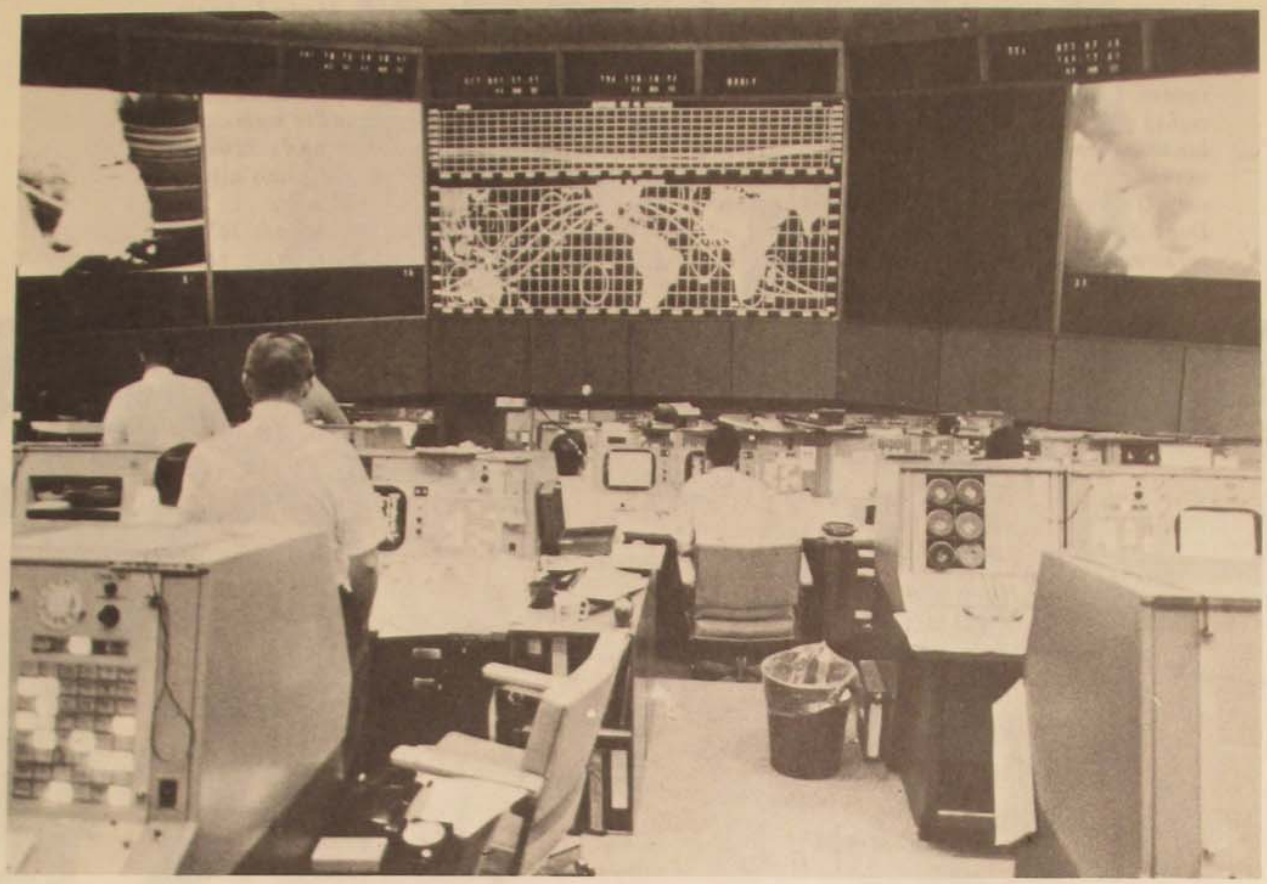
In addition to their specific system-oriented function, the tracking controllers perform a second function that is a fundamental element in the Apollo ground support control plan. Ground support, as pointed out earlier, is planned in great detail before the mission ever lifts off. The gathering of requirements for this plan and the matching of MSFN resources against the requirements are carried out primarily by the IST tracking controller group at Houston. Once a mission countdown begins, the tracking controllers, working under the supervision of the network controller, become the chief instrument for executing the support plan. They gather last-minute requirements changes from the various vehicle and crew systems flight controllers and alter the basic plan accordingly. When the plan has been updated (once per shift or as required by mission deviations), the trackers use it to prepare a Site Configuration Message (or SCM, as it is known to MSFN controllers worldwide).

From a ground support point of view, the SCM is probably the most important message generated at MCC during an Apollo mission. An SCM is sent to each ground tracking station prior to the start of its view period. The message contains all of the basic information required to set up the station for the next spacecraft pass. This information includes the vehicles to be tracked, the tracking mode, i.e., transmit or receive only, carrier on and off times if the station is to transmit, and the required configuration for transmitting biomedical data. The SCM is transmitted by teletype to each station, and it can be updated by subsequent messages or by voice instruction if the situation requires. The accuracy and timeliness of the SCM are fundamental concerns in assuring successful ground support for a mission, and the role of the tracking controllers in achieving this success is clearly a large one.

Successful mission support depends also on the functioning of the ground communications system that links the remote stations with MCC. The voice and data circuits in this system are the responsibility of IST members who, logically enough, are designated communications controllers. Working with a communications manager at Goddard Space Flight Center, the MCC communications controllers must set up and check out the required circuit configuration for each mission phase. If failures occur, they must move immediately to restore service by using spare circuits or lower-priority circuits.

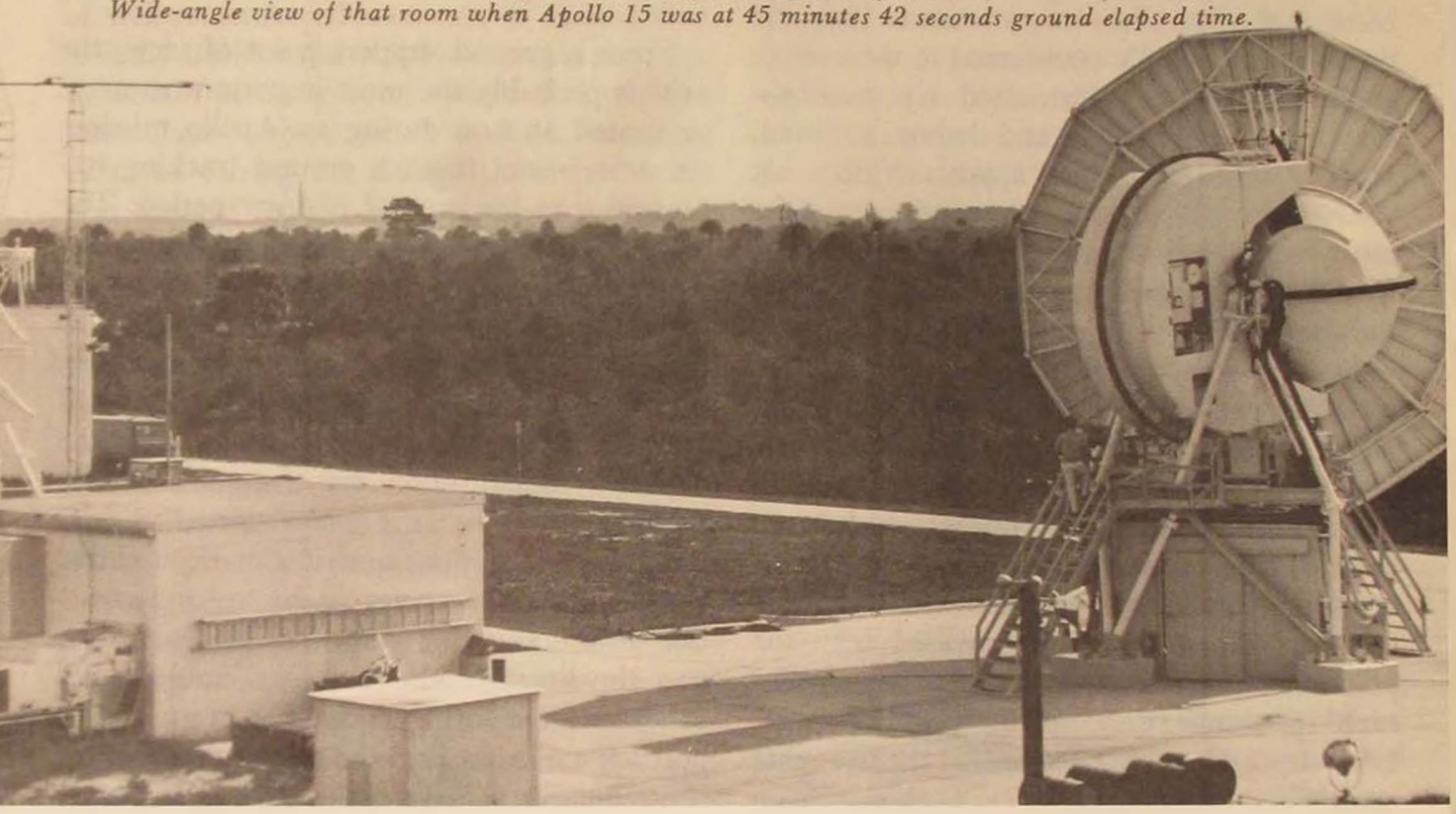
The highest-priority circuit during any Apollo mission is the one assigned the air-to-ground function. Maintenance of uninterrupted voice communication with the ground crew is considered so important that a special air-to-ground communications technician position was created to ensure this function.

Continued on page 66



Apollo Ground Support

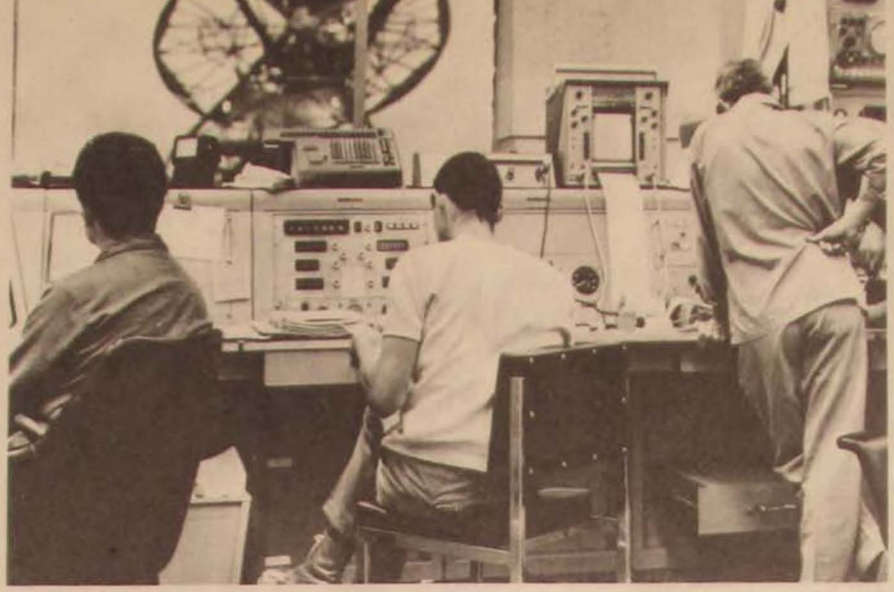
Apollo 15 lifts off atop a Saturn V, as seen in the distance from the S-band site that monitors its prelaunch conditions and tracks it during the earth orbital phase. . . . From Goddard Space Flight Center, Greenbelt, Maryland, the Operations Director and staff direct support activities of the worldwide complex of stations. . . . Throughout an Apollo mission, the Goddard Realtime Computing Center evaluates and displays mission data. . . . Activity is continuous in the Mission Operations Control Room (right) at the Manned Spacecraft Center, Houston, Texas. . . . Wide-angle view of that room when Apollo 15 was at 45 minutes 42 seconds ground elapsed time.

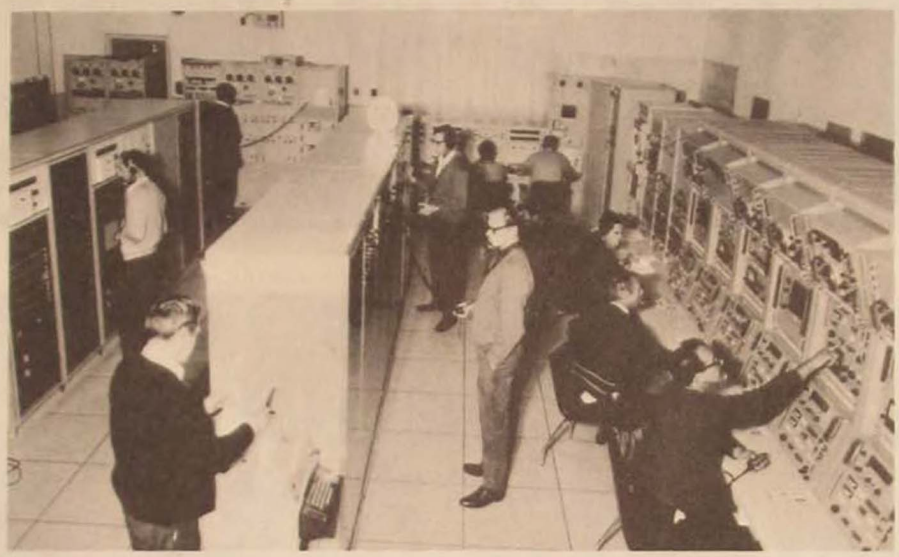


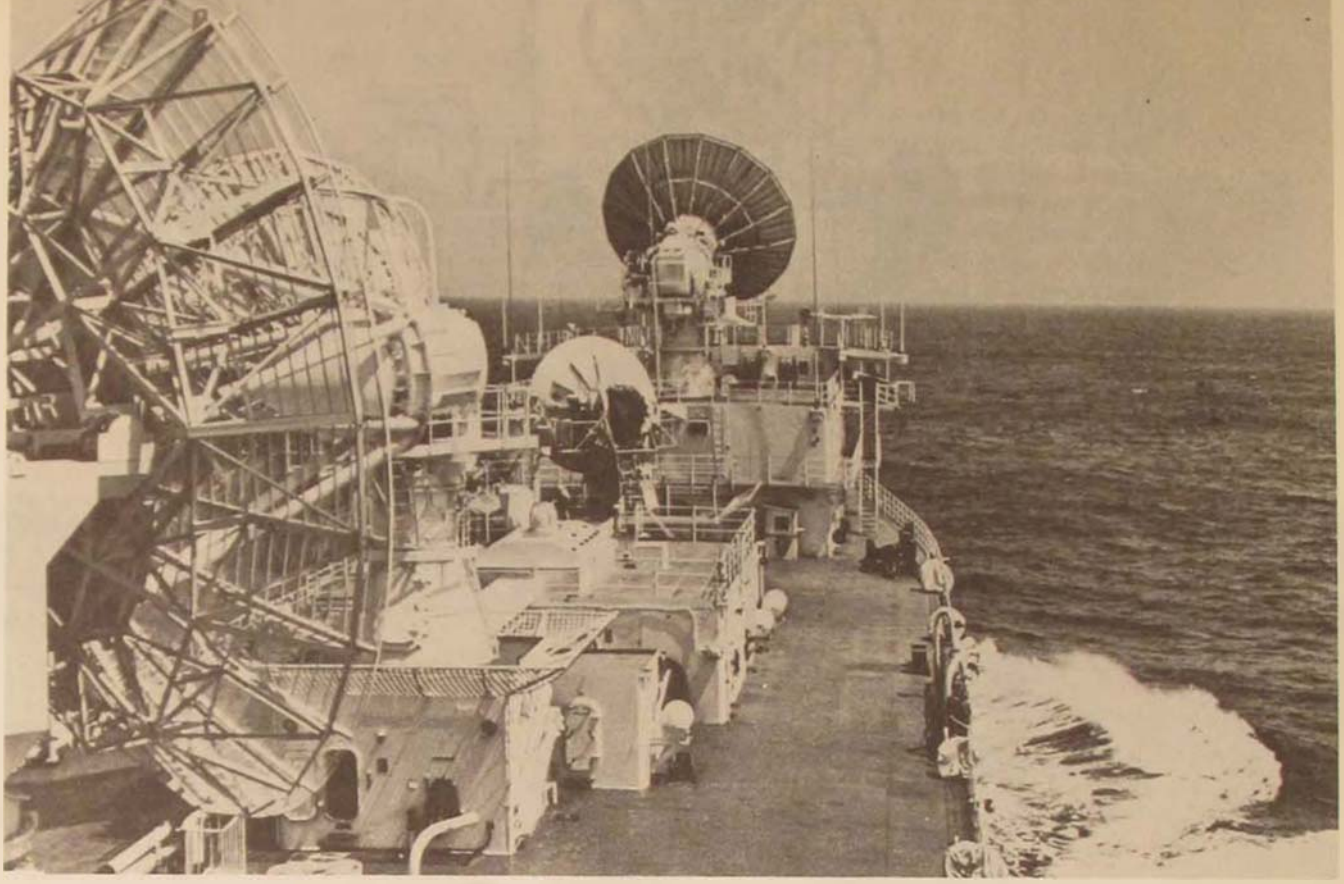
Goddard Space Flight Center's Operations Control (left) and Realtime Computing Center (above)

NASA's Deep Space Network

Near Canberra, Australia, is one of the 85-foot antennas in NASA's Manned Space Flight Network, located at 120° intervals around the earth so that at all times one of them will have a direct view of the spacecraft. . . . Engineers at the station outside Madrid, Spain, (right and below) prepare to track the lunar orbiter launched 10 August 1966 from Cape Kennedy. . . . The Madrid station keeps in two-way touch with spacecraft at lunar distances. . . . A 210-foot antenna in the Mojave Desert near Goldstone, California, (bottom right) provides tracking data and receives telemetry from and sends commands to unmanned lunar and planetary spacecraft. . . . Tricone feed system at center of Goldstone's 210-foot antenna dish allows quick alternating between tracking and use for radar and radio astronomy. This antenna has picked up and amplified weak signals from 250 million miles. . . . The Deep Space Instrumentation Facility, of which Goldstone is part, sends commands to and receives scientific data from spacecraft traveling hundreds of millions of miles from earth.

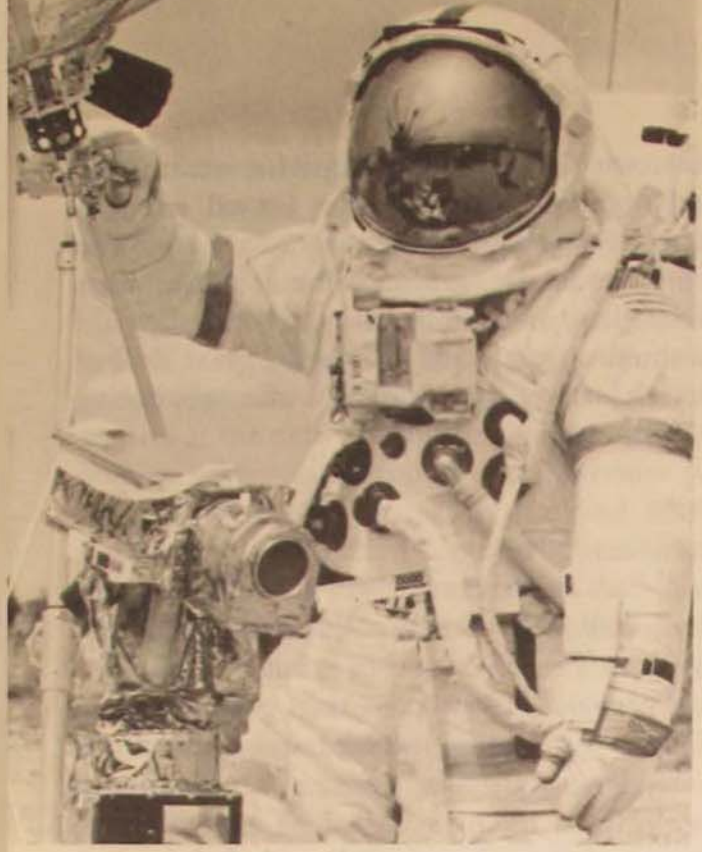


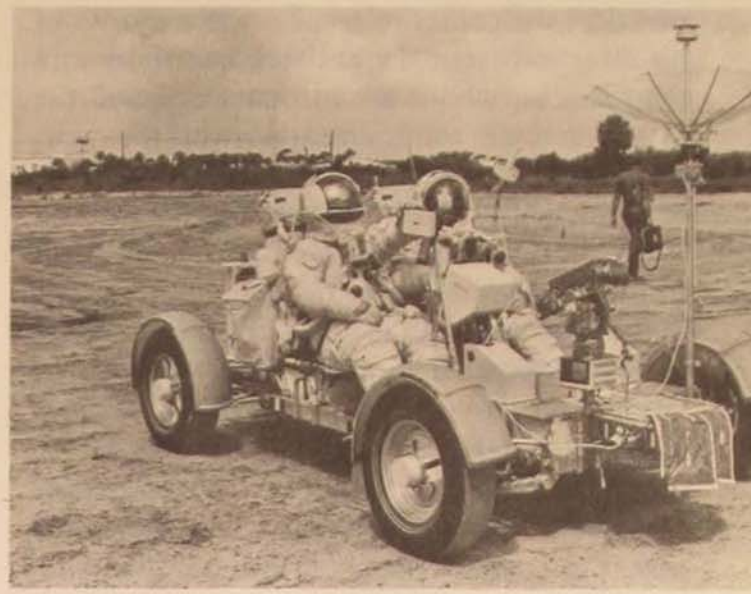


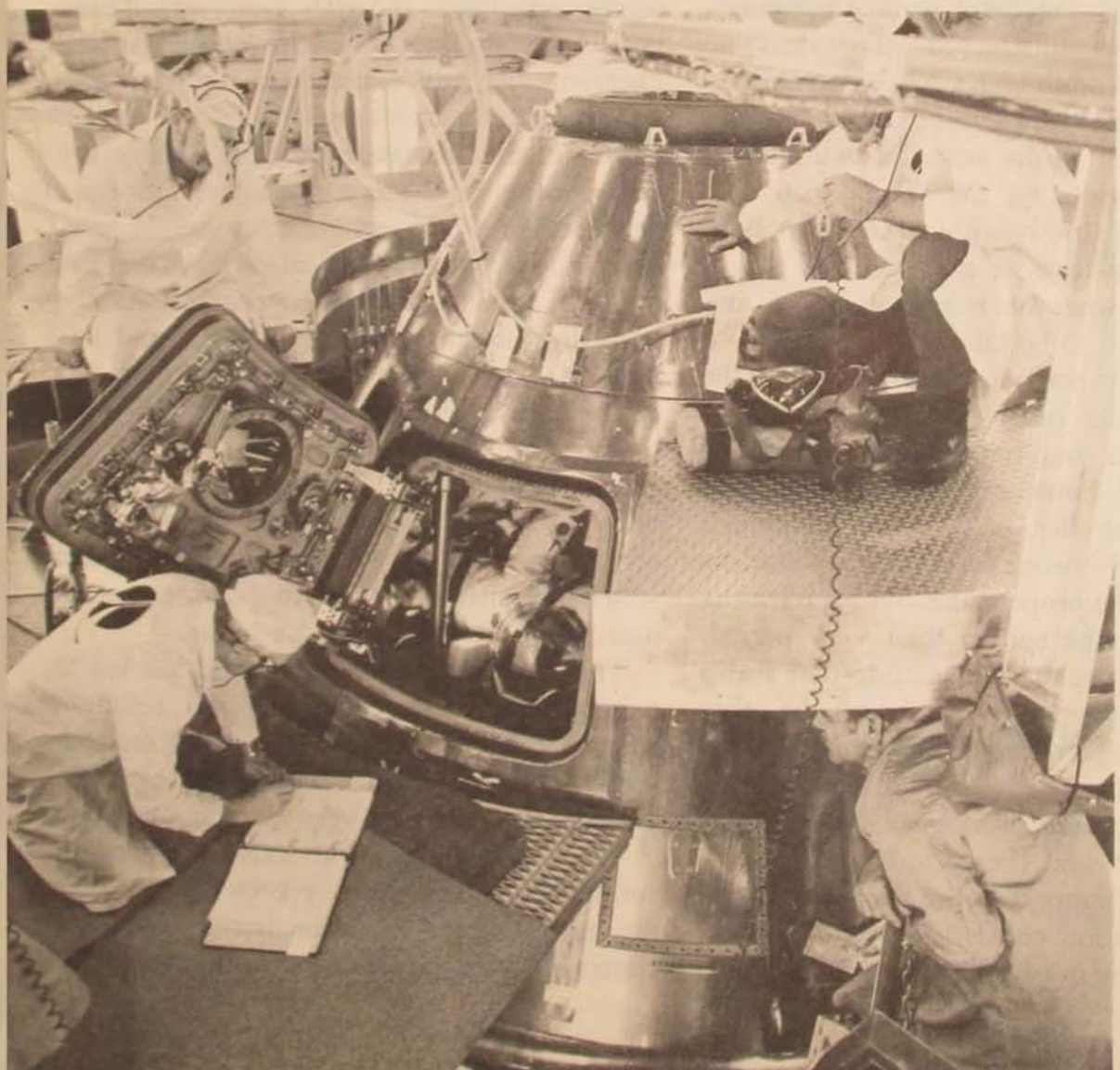


Vanguard/ARIA and Premission Simulation

USNS Vanguard *plows through the Atlantic, its space-tracking and communications antennas ready to tune in earth-orbiting and lunar-bound spacecraft. NASA's sole sea-going link in its Manned Space Flight Network,* Vanguard *plays a major role in experiments involving globe-circling satellites. . . . Overflying* Vanguard *is ARIA (Apollo Range Instrumented Aircraft), which, with the world's largest steerable antenna in its nose, provides two-way voice and data relay between Apollo and Mission Control Center, Houston. . . .* Vanguard's *central control . . . the high-gain antenna on the Lunar Roving Vehicle (LRV) that Apollo 15 used (facing page) . . . a training model of the LRV on a simulated lunar surface at the Kennedy Space Center . . . the Command Service Module of Apollo 15*







This technician, who uses the call sign "comm tech," is theoretically an assistant to the communications controllers. However, in practice, the comm tech takes the majority of his direction from the network controller and the CAPCOM, who is an astronaut assigned the task of actually communicating with the crew. The life of a comm tech can be a difficult one, not only because of the high priority of the voice link but also because of the great flexibility of the air-to-ground system.

For instance, the system can be set up to allow the CAPCOM to hold a two-way conversation with crewmen on the lunar surface while the crewman orbiting in the Apollo command module does not hear the CAPCOM's part of the conversation at all. If the CAPCOM wishes to speak to the command module pilot, he uses a separate path, and this conversation is not heard by the lunar-surface crewmen. It is sometimes difficult to tell "who's on first," and the comm tech's job is demanding, especially since air-to-ground configurations are not included on the SCM. To assure direct control and flexibility, the comm tech controls his system strictly with voice instructions rather than by teletype message. He has to know exactly what he is talking about and who is supposed to be talking to whom.

The two IST positions that remain to be discussed are not nearly as hectic as that of the comm tech, but both these positions involve essential housekeeping functions. The scheduling controller, as his title indicates, is responsible to Network for calling up stations to support at the proper time and for releasing the stations at the end of their view period. The scheduler also maintains up-to-date status on the MSFN systems, for use by all the other IST members in planning or replanning ground system support.

The great amount of message traffic generated by the IST and the various stations providing ground support is the responsibility of the documentation controller. The documentation controller must screen incoming traffic, distribute it to the appropriate controllers, and maintain reference files for all essential messages. Outgoing messages also require some handling and filing. The documentation controllers, unlike most of us, are actually paid to shuffle papers, and they get a great deal of practice, handling some 4000 messages during a normal mission.

THESE, then, are the positions that constitute the Apollo Instrumentation Support Team, a team that is the focal point for preparing and executing ground operations in support of manned space flight missions. How well does the IST system of control work? One might simply look at the team's record of success and answer that the system works very well indeed! However, if the Apollo system is to provide lessons for future programs, its advantages and disadvantages must be clearly examined.

One of the principal advantages of the IST system of ground support control has been its flexibility. Throughout the Apollo program, the MSFN has been called on to support multiple vehicles and flight systems. As the need arose to support these vehicles and systems, the IST was able to take the requirements of the various vehicle and system flight controllers and translate them into an effective ground support plan. The IST, in effect, provides an interface between the various flight controllers and the ground support system which permits the MSFN to provide coordinated support for multiple vehicles.

The flexibility of the IST system has led to a good deal of specialization and resultant efficiency. Vehicles and crew systems controllers have been able to concentrate their attention almost exclusively on the operation of their own system. The various spacecraft controllers have effectively been able to take the MSFN bus and leave the driving to the IST controllers. On the other hand, the specializa-

tion allowed by the IST approach has provided a reserve of controllers who are thoroughly familiar with the ground system and can respond rapidly to contingencies.

One further advantage of the Apollo ground control system as it presently exists is the centralization of overall ground system control at the network controller position. This position serves as a kind of clearinghouse for information on the status of MCC and MSFN systems. When a failure occurs, the remaining resources can be rapidly evaluated and allocated to minimize the effect of the failure.

On the negative side, the IST system, since its beginnings, has been plagued by problems involving clouded lines of authority and responsibility. The individual IST controllers are often caught between the proverbial "rock and a hard place." To provide effective support, they must respond rapidly to the requirements of individual flight controllers. But, at the same time, they must operate under the supervision of their own team leader, who has to coordinate their individual activities and meet the overall ground support objectives. Obviously, the requirements of the individual flight controllers and the overall mission priorities do not always mesh, and then a compromise must be devised or a ruling sought from the Flight Director. This situation, although undesirable, has never seriously jeopardized mission support. It has resulted, of course, in more than one exchange of heated words, and these exchanges are likely to continue, since the only solution seems to be strict supervision by the network controller of all IST activities. The idea of this kind of supervision has generally been rejected by the controllers involved because of the inherent sacrifices in response time and flexibility.

Despite this difficulty, the IST system has indeed worked well. Until such time as programs like the proposed space shuttle provide a large degree of spacecraft independence from ground support systems, the IST approach might well be considered for use in any program, manned or unmanned, that requires extensive ground support.

Aeronautical Systems Division, AFSC

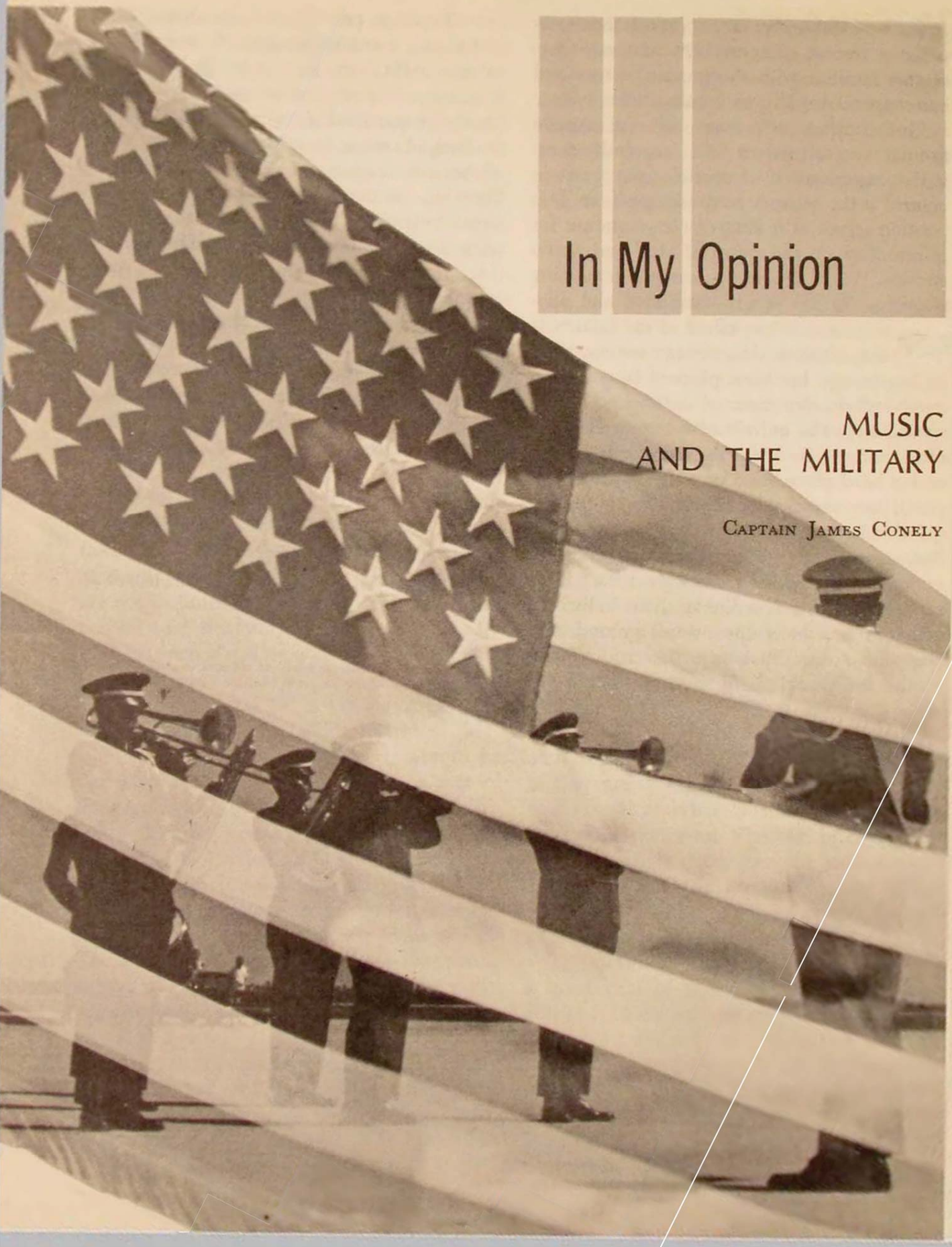
Note

1. The tracking network for Apollo 11 included four ships, *Mercury*, *Redstone*, *Huntsville*, and *Vanguard*. Only the *Vanguard* is still active.

In My Opinion

MUSIC AND THE MILITARY

CAPTAIN JAMES CONELY



MUSIC is a frill. Everyone knows that. But what is significant is not that it is a frill but that no one anywhere in the world lives without some form of it. Surely, then, it must have power and meaning, a great deal of which must affect the military.

Music, however, is obviously not going to help anyone fly the F-4C or any other aircraft. Music is not going to send men to the moon. Music is not going to release POW's. Music is not going to win the war in Vietnam.

When people insist on this kind of application, they are guilty of misplaced emphasis. The importance of music to the military is *not* whether it can win a war, but that doesn't mean it isn't important to the military at all.

There is no question that music affects people, however. Puccini's *Madame Butterfly,* now one of the most popular of operas, was jeered openly by the audience at its first performance in 1904. In 1913 Stravinsky's *Rite of Spring* created a near riot, with shouting and throwing, presumably because the music seemed so unusual and dissonant and the subject of the ballet somewhat provocative for that day.

As recently as 1969 a Washington audience was visibly roused by a performance of "Deserts" by Edgard Varèse, a piece for orchestra and electronic sounds recorded on tape. The concert was given by the Boston Symphony Orchestra in staid, old Constitution Hall, and those who liked the piece were so openly opposed by those who disliked it that again there was a stormy response to music.

Twelve years before, in 1957, the Westminster Choir from New Jersey sang a concert in Prague, Czechoslovakia, to an audience that was enthusiastic in its applause until the choir sang, "The God who gave us life gave us liberty at the same time," Thomas Jefferson's words in Randall Thompson's musical setting called *The Testament of Freedom.* At this point there was silence. Later the choir was told that the silence of the audience was not in reverence but rather in fear of reprisal by their government if they showed favorable response to the performance.

Hitler knew the power of music and used it to great advantage at Nazi rallies. Wagner was his favorite composer, and pieces like the "Ride of the Valkyries," when played for a considerable time before a rally, so stirred the people they were ready to fight for any cause Hitler advocated.

Thus there is no question that music affects people. The question instead is, Since it does, can the military afford to ignore it? Everyone knows, of course, that the military doesn't completely ignore music. The most obvious and direct use of music is for drills and ceremonies. There is so much of this that there is an élite, handpicked corps of about thirty-five commissioned officers in the Air Force alone who are on full-time duty as professional musicians in positions of band commanders.

At one time music was in fact a way to get into the Army under age. A hundred years ago and earlier, if you were too young to carry a weapon and had a burning desire to be in uniform, you could still join the Army by playing a fife, bugle, or drum to keep cadence for marching troops or relay commands by playing bugle or drum calls. This was a useful and necessary activity at that time.

Today's ceremonies are formal and impressive, and many people, both military and civilian, regard them as essential, perhaps even sacred. I recall playing in a military band and once hearing a general officer say, "There's nothing so stirring as seeing men march to band music." Not everyone would agree with him, but a significant number of people do agree.

Four years ago an Air Force Academy graduate, after joining the faculty, filed a formal suggestion that marches and patriotic music be played over the public address system between classes, to engender patriotism in

In recognition of the universality of music, the Air Force Academy offers courses that broaden the cadets' understanding of music and enhance their general familiarity with man's achievement in the humanities.

cadets and also cause them to move faster from one class to another. The suggestion went through all the proper channels but was finally rejected because his assumptions were ultimately found to be doubtful; what is most interesting, though, is that he regarded music to be that influential in a military environment.

If music really is that influential, then where and when is its influence useful or even necessary? Consider entertainment. This is where some people say we should not waste time or money on music. After all, they remind us, music is not going to win any war, and we should therefore save the money spent on such frills.

Entertainment is important, and it is important for exactly the same reasons that some people say we should not spend money on it. It provides the break that everyone must have from time to time in order to keep on with his job. And it is significant that music universally provides by far the largest portion of pure entertainment. It is everywhere—radio, TV, banks, commissaries, dentist offices—even nonmusical movies have musical soundtracks: *Easy Rider, Midnight Cowboy, Love Story,* and so on.

No one can say just how important music is for different people. Chris Mead, only one of thousands of Vietnam veterans returned home, was interviewed by *Newsweek* about his experiences and expectations (29 March 1971). Among other things, the report says he spent $291 of his $524 coming-out pay on an eight-track stereo-radio and a dozen cartridge tapes. Mead is reported as saying, "Now I'll have to go to work right away to get some wheels. *But I have to have music to*

get my head back to where it was. I want some peace of mind."

In another place at another time a special service engineer in communications sings with the Classic Chorale in Denver because it keeps him "from going nuts." In still another instance, Mike Reid, defensive tackle for Penn State not long ago, says, "Music is the most important thing in my life." This college football star of national fame says he knows he looks more like a piano mover than a piano player, yet he was a music major and is a talented pianist. For all that football is to him, it is music that gives meaning to this and everything else in his life.

For precisely this reason music is taught at the Air Force Academy, the only service academy to offer music courses both as electives and as partial fulfillment of certain academic majors. Cadets are given this chance to develop their understanding of all music and thereby increase their capacity for this kind of diversion, not being limited only to what they have always known but in fact expanding these limits to include other kinds of music. One cadet has said that his music course enabled him to understand rock better and enjoy it more. Curious, perhaps, yet what is important is not the choice of music but what he finds it can do for him.

Numerous instances can be cited. In 1968, not too long after he became commander of military forces in Vietnam, General Creighton Abrams was interviewed by a reporter who was somewhat surprised when he heard a Mozart quartet on the record player. General Abrams began conducting with his cigar and then said, "You know, I seem to find the patterns and solutions to the problems of this war in music." However much inclined we may be to doubt him, we cannot deny his experience. It is, to be sure, a purely personal experience, but it is nevertheless very real.

Clearly, then, music does have power and meaning that is significant to mankind and to the military. But in addition to these rather subjective reactions, there is more that is of potential military use yet less obvious.

For example, George Milstein, a New York horticulturist, has determined that music helps plants grow. "The secret," he says, "is a high frequency sound that blends right in with the music. I believe that the sound waves cause the plants to keep their pores open longer and wider, allowing a greater exchange with the air around them." So once a day for forty-five minutes he plays music for his plants, and he has been so successful that he now has produced a record called "Music to Grow Plants By."

This, of course, has nothing to do with the military, but it suggests that there may be uses of music that might have military applications. To cite a rather grim example, certain frequencies can kill. Specifically, a sound wave at 7 Hz (much too low to hear) can penetrate the soft tissues of the body, cause them to vibrate sympathetically, and if it lasts long enough the result can be death. Another example: a 37-Hz tone, roughly D in the bottom octave of a piano keyboard, can crack a wall if it is loud enough. The military implications of these examples need not be mentioned.

But of course music does not have to be destructive, nor need it be superficial. Indeed, its greatest potential is not as accompaniment for ceremonies or as entertainment for diversion or in its ability to affect people or in some destructive property it may have. Rather music's great potential is in humanitarian uses. If these were capitalized on, the military could better adapt to the different cultures it finds itself in, and the result might very well improve the effectiveness of its operations.

Music reflects the lives and thoughts of people so much that if one studies their music he can better understand the people themselves. The spirit, feelings, and thought patterns are all revealed in music. For example, Oriental people think in languages which when written are constructed basically

from pictures, and it is no accident that their music is also pictorial; it is always about something one can see, feel, or think about. By contrast our written language is purely abstract, and much of our music is also purely abstract—symphonies, sonatas, concertos, and so on.

The power of this whole idea was illustrated by an Air Force Academy cadet who, with no previous background in music, wrote in a paper, "I have come to realize that music, when one understands it, is representative of a society as a whole."

The military serves in many different assignments around the world. In working directly with people in Vietnam, or Turkey, or Africa, or wherever, how much more effective we will be if we understand the people as well as the military operation. Music is not the only way to get to know them, of course, but for many people it is the easiest and most direct way.

More than two thousand years ago Plato said in his *Republic* that those who are responsible for leading and protecting a nation must be trained in music as well as physical fitness and certain academic skills, because to omit music would leave a man unresponsive and insensitive to others, and specifically he would be uncivilized, violent, and ignorant. Perhaps this is extreme, but, if one listens to public feelings about the military, the similarity of today's attitudes and Plato's is striking. Is it not possible that there may be some truth to this after all?

One of the great benefits of music is that it is an experience of vastly different creative ideas. The person who thoroughly understands music understands also that there are valid ideas different from his own. He is not bound to traditional rules simply because they are traditional. Hence, it is possible for him to free his imagination to cope with diverse patterns of thought and situations. He can respond intelligently to ideas alien to his own because he has some capacity to understand the differences.

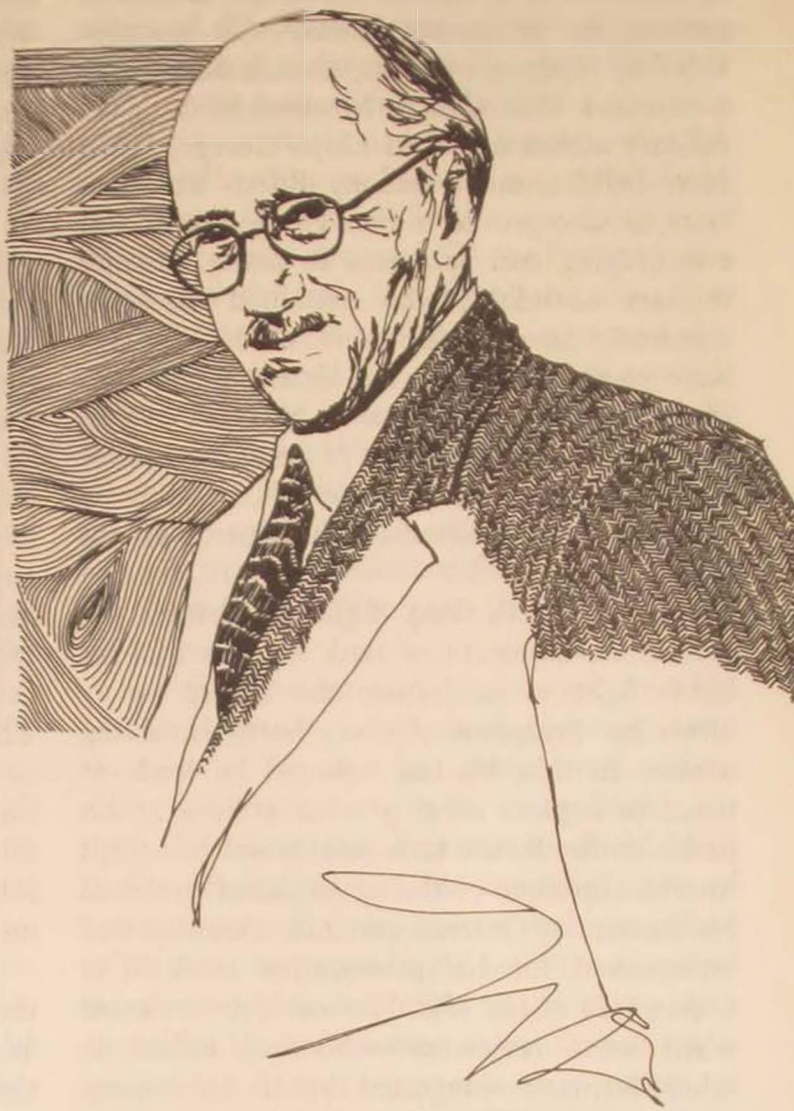
The ideal officer is surely one who, among other attributes, thinks creatively, who is flexible, who understands that there may be different ways to do the same thing and that sometimes one way is not necessarily better than another. Again, music is not the only means toward achieving these qualities, but clearly its potential can be very real and significant.

The extent to which music and its properties can be used to achieve military goals has never been fully investigated. The present uses at most are superficial and largely "extracurricular." The thought that more substantial uses might be possible occurs to very few people.

Yet an expression so universal in its use and so powerful in its effect must surely have greater possibilities than we have allowed it. At the least it would seem almost necessary to research the question to find out exactly what the military potential of music really is. Music may never be God's Holy Authorized Answer to the military, but neither will any other single field. Still, it is entirely possible that music can be used both directly and indirectly to help the military do its job better.

United States Air Force Academy

Books and Ideas



LIDDELL HART'S LAST TESTAMENT

Dr. Forrest C. Pogue

CAPTAIN Basil Henry Liddell Hart (1895–1970) dominated the field of military history for almost forty years. (Not until his declining years did he become Sir Basil, so that the title did less to ennoble him than he did to ennoble the captaincy that he held when he retired from the British Army in 1927, on account of ill health caused by wounds.) While he had to share historian honors for a period with his old friend "Boney" (Major General J. F. C.) Fuller, he at length outdistanced all his contemporaries and ended at the head of the field.

Sir Basil's book on the Great War, published in 1930 and revised in 1934, helped fix the opinions of a generation of readers on mistakes in leadership, strategy, and tactics in World War I. With the mastery of detail and the flair for phrase that he developed as an officer and a military correspondent, he laid down judgments on that conflict in a way which few could successfully dispute. With basically only one continent to cover and with much of the story focused on the success or failure of British arms, he had a command of the subject that is occasionally obviously lacking in this book.†

Between the wars, he developed his theories

†B. H. Liddell Hart, *History of the Second World War* (New York: G. P. Putnam's Sons, 1971, $12.50), xvi and 768 pages.

of armored warfare, his views on means of overcoming the strong defenses that are provided by modern weapons, and his battle with a cautious War Office. Meanwhile, he gave military advice to David Lloyd George, Leslie Hore-Belisha, and Anthony Eden. Then, as later, he also proved to be a gracious host and encouraging correspondent to many younger military historians, who remained his great admirers. Several reviewers of his *History* have chosen to praise his kindness and hospitality and to pay tribute to his great overall contribution to the field of military history rather than to assess some of the definite omissions and questionable judgments of this study.

Liddell Hart's long fight in Britain for greater development of tank warfare and his bitter fight to modernize the British Army affect his treatment of every battle involving armor. In this, his last volume, he tends at times to neglect other ground actions in his desire to discuss the tank battles and to accept uncritically some of the unvarnished praise of his theories by German generals whom he had interviewed for his provocative book, *The Other Side of the Hill*. He was quite irritated when some reviewers—who had talked to other Germans—suggested that his informants had wanted to gain the friendship of an influential writer.

Unlike Fuller, a more brilliant but extremely erratic historian who sometimes let his political prejudices confuse his analyses of strategy and tactics, Liddell Hart stays close to operational history in this volume. He seldom seeks in ideologies the explanation for idiocies or blunders. He was always aware that simple human weakness played a key role in some battles. In his book on the First World War, he tells of a fatal delay in pushing an important breakthrough because the hungry and thirsty soldiers tarried to sample food and drink in billets they had overrun. In this volume, he underscores the wonderfully human reaction of one German lieutenant who, though bent on dashing through the Ardennes to complete the rout of the beaten Americans, stopped for several hours of "dalliance" with an American nurse, "blond and beautiful." "Battles are not always decided in the way that the military textbooks teach," concluded Sir Basil.

One of the few points at which Liddell Hart essays the type of political censure that marks the dark musings of General Fuller concerning the follies of the Western democracies, whose softness and money-mindedness he found lacking in the more virile Germans and Italians, is in the conclusion that much of the blame for World War II lay in the encouragement the Germans and Italians "had long received from the complaisant attitude of the Western Powers coupled with their sudden turnabout in the spring of 1939. That reversal was so abrupt and unexpected as to make war inevitable." This partial adoption of A. J. P. Taylor's softening of the verdict of history on the war guilt of *der Führer* reflects Liddell Hart's disgust with government leaders who spurned his advice.

To a great degree, the author has followed the pattern of his book on the First World War in concentrating heavily on ground actions. In this volume, he has written a perceptive chapter on strategic bombing and indicated the importance of the Navy, but a check of the table of contents shows considerable disproportion in his treatment of the contributions of the various services. His chapter on strategic bombing draws heavily on Webster and Frankland's views of the air war. He is especially critical of British unpreparedness for the air attacks they should have expected and Bomber Command's early unpreparedness to do precision bombing. Airmen will find his overall treatment of the air story spotty. His index lists General Eaker once, General Karl(!) Spaatz once, Doolittle twice (both for the famous Tokyo raid), and Brereton and George Kenney not at all. He is not pursuing an anti-American bias—since

he has many good things to say for the U.S. Air Forces—but he fails to find space for many top commanders in either the American or British air forces. Air Marshal Coningham, for example, whose air force supported Montgomery in North Africa and Europe, is also among those missing from the index.

On the 1944 period, Liddell Hart backs Sir Arthur Tedder's transportation plan. For the last nine months of the war, he notes that the American idea of aiming to hit Germany's weak points "was more sensible than that of trying to ensure that every bomb hit something, and somehow weaken Germany. It also avoided the increasing moral censure that Harris' policy was to attract."

There is excellent coverage on the fall of France—where proper mention is made of the ineffective use by the French of the weapons they possessed—and on some phases of the Russian campaigns. Still Liddell Hart's bias concerning tanks comes through. He is fascinated with Rommel to the extent that the space devoted to the desert fighting threatens to exceed that given to all the Russian campaigns. He is not as biting in his judgments of Montgomery's activities in North Africa as is Correlli Barnett, but he admits that the British commander should have made greater use of his opportunities.

Churchill receives heavy pummeling for his decision to intervene in Greece, an action which Liddell Hart feels led to near disaster for the British in Africa, and for his failure to strengthen Singapore because of his interest in the fighting in the desert. "Thus Rommel indirectly produced the fall of Singapore—and as much by the personal impression he made on a personality-minded Prime Minister as by his potential threat to the Nile Valley and the Suez Canal."

On the Pacific fighting, Liddell Hart clearly follows the American historians. Although he fails to list Louis Morton's key volume, *War in the Pacific: Strategy and Command,* the narrative shows the influence of that book. He writes briefly but clearly of the conflicting views of MacArthur and Nimitz concerning the best way to defeat the Japanese. His story of Midway is excellent, indicating a considerable debt to Morison, which is acknowledged.

It is refreshing to find the author declining to accept Chester Wilmot's conclusions on Mediterranean strategy. Of the beauties of a campaign through the Ljubljana Gap into Austria he declares: "It was a remarkably optimistic view of the possibilities of speedily overcoming the series of mountain obstacles between Italian Venetia and Vienna, with their many potential delaying positions—and the more optimistic in view of the repeated repulses that the Italians suffered there during the First World War even in the initial approaches."

For the most part, American commanders and strategy get a fair share of praise from the author. He also has greater reservations about Montgomery than do many British authors. Especially does he stress the Field Marshal's overcaution and his annoying habit of insisting that all of his battles went according to plan. In his exceedingly brief treatment of *Anvil,* in which he tends to go along with American views, however, the author virtually ignores the bitter arguments that ensued in the summer of 1944. And the fighting in southern France is covered in only a few lines, in which the names of Devers and Patch do not appear.

In one particular, Liddell Hart allows his long advocacy of continued pursuit to deprive him of the balanced judgment that he shows so often in the book even in dealing with matters that he has criticized. Thus we find him stating flatly that the "war could easily have been ended in September 1944." In this he follows arguments by Ingersoll, Robert Allen, Patton, and Montgomery, while brushing aside Bradley's more careful view and the disagreement of de Guingand (Montgomery's chief of staff) with his superior. The author here has taken at face value assur-

ances by some of the German generals he interviewed that they were beaten, and he has downgraded other weighty evidence (which he sometimes cites) stressing the greatly overextended state of the Allied armies at the end of August 1944. Interestingly enough, he denies Montgomery's claim that he could have broken through on his front if he had been given all the support he desired and concludes that it was Patton who could have made the drive succeed.

Overall, the book affords the reader an excellent summary of key campaigns of the war by a military expert who has seen many of his theories tested on the battlefield. It is not as good a study of World War II as the one which he provided on the earlier conflict. Yet it is the best one-volume account we have at present and perhaps will remain so for years to come.

Lexington, Virginia

EMERGENCE AND IMPACT OF A BEHEMOTH

Colonel Jack L. Watkins

PRIME MINISTER TRUDEAU once likened the geographic and economic juxtaposition of Canada and the United States to being in bed with an elephant. "When the elephant turns over," the Prime Minister stated, "the reverberations are far-reaching." The defense establishment of the United States, in its relationship to this nation, bears a striking resemblance to Mr. Trudeau's whimsical analogy. The defense establishment is truly a behemoth in nature. That the establishment has had far-reaching impact on our total society is an accepted fact. The nature and depth of this impact is the subject of Adam Yarmolinsky's recently published study written under the aegis of the Twentieth Century Fund.†

Attempting to assess a subject with such

†Adam Yarmolinsky, ***The Military Establishment: Its Impacts on American Society*** (New York: Harper & Row, 1971, $10.00), xiv and 434 pages.

deep and subtle implications as the military establishment and its impact on society would tend to exceed any one writer's scope. Hence Yarmolinsky appropriately determined the impossibility of single authorship. No single individual could bring to bear the incisive knowledge and expertise to address the complexities of this multifaceted subject adequately. Its nearly thirty varied and anonymous writing styles and orientations help make the book an especially interesting potpourri.

The essays are not credited directly to individuals, although all the authors appear to be well qualified in their respective areas. A sampling of essays and presumed authors indicates the balance attempted. Morris Janowitz worked in the area of social impact, while the subject of the media and political processes is treated by such distinguished individuals as Philip Geyelin, Robert Manning, and James Phillips. Authorities of equal stature contributed to the topics of the military justice system, the scientific and educational community, and, in fact, virtually every aspect of American society in which the far-reaching reverberations of the military establishment could be felt. While one could hardly expect total objectivity from those who participated, valiant and largely successful efforts in this direction are apparent.

One feels no compulsion to start at page one and proceed by the numbers. Rather, each reader will be drawn initially to an area of his own particular interest. Whatever his personal interest, the reader will certainly find a treatment of the subject. Under the major area headings—"The Rise of the U.S. Military Establishment," "The Weakness of Countervailing Power," "The Uses of Military Power," and "The Impacts of the Military Establishment"—there are twenty-four essays, plus "Conclusions." From this veritable smorgasbord the reader is free to choose, and disappointed he will not be.

If there is a major shortcoming of this analysis of the military establishment, it is Yarmolinsky's general lack of historical perspective. He sees the behemoth only in its current state, not as it once was or as it evolves to needs expressed. For example, the military establishment is often appraised in terms of the unpopular Vietnam War in which we are now involved. Frozen at a point in time and viewed through the eyes of the poll-takers, the conflict is a horror without redemption. However complex, when placed in historical context the Vietnam War is understandable, perhaps even a noble undertaking. The point is that the military establishment as it exists today, like all other institutions, did not come about in a week, a month, or a year. Neither is it now, nor has it been, the product of a master plan written by a conspiratorial group of men. Rather, the military establishment as we know it emerged over a period of years in response to specifically perceived needs of the nation at the time.

If a single theme pervades the essays, it is that social stresses arise out of the uneven rates of change in different sectors of society. The three decades that embrace the massive growth of the defense establishment are typified by an exponential thrust in the area of the military establishment but a cultural lag in its acceptance by the rest of society.

Inherent conservatism on the part of that segment of society charged with the awesome responsibility of insuring national survival necessarily limits and constrains change. The unequal rates of change or cultural lag between the military and other sectors of society create the boundary-layer effect of turbulence, separation, and a resultant chasm that now seems to exist between the two groups. This phenomenon is apparent in each of the chapters of the book. The attenuating effect of this cultural lag has been that the total military establishment now stands largely separated and condemned in the minds of many in the rest of society.

Yarmolinsky sums up this "gap" when he

quotes De Tocqueville's conclusion following a much earlier look at America's military establishment: "The remedy for the vices of the Army is not to be found in the Army itself, but in the country."[1] "By and large," Yarmolinsky adds, "the American people get the kind of military establishment they deserve." (p. 419)

The book is a valid depiction of how the services are viewed by a significant constituency at this time. It is vital that the military know how others see it, not necessarily as a mandate to change but as a point of departure to bridge the ever widening gap between the military and the rest of society.

The book is not reassuring. At a time when our nation is having difficulties at home and abroad, we really need reassurances that, while not all is good, neither is all bad. Perhaps the time is right to re-examine our institutions from the standpoint of others' perceptions—not from the standpoint of a desire to change but rather from the standpoint of a conscious attempt to understand, to communicate with, and to carry forth the military's message to the nation which it serves quite well.

Yarmolinsky seems to fall short of the book's stated purpose—". . . understanding the military and determining how best to direct it toward democratically determined national goals." (p. xii) The cited "democratic goals" to which the military is to be directed create a wide area of ambiguity, which is not adequately treated. Typical is a reference to Vietnam in the discussion of "How Much Is Enough," which comprises the book's conclusions:

> An important lesson of Vietnam that is gradually emerging in the American consciousness is how little military force can accomplish in the Third World where the writ of United States sovereignty does not run. (p. 413)

Before agreeing, some readers might want to insert a modifier: "military force *improperly used*." Such items, while mildly irritating, tend to serve notice on the reader of the writer's perspective without seriously detracting from the value of the work. Yarmolinsky sets the stage for a subsequent shortcoming when he states in his Introduction:

> This book does not concern itself with the nature of the military establishment generally, nor, except incidentally, with its history. Rather, it is concerned with the impacts of this massive, powerful, and pervasive organization on American society, and with the extent to which and the ways in which the society is affected and shaped by military purposes. (p. 3)

Perhaps of greater importance is the book's message that seems to be a clear mandate for change in the future. Society's desire to alter that which it does not understand or that which it finds unpleasant is a reality with which all military professionals must learn to live and, more important, to manage. The military establishment must again become, in the minds of the people, the true and trusted servant of our founders' conception.

Adam Yarmolinsky has undertaken a monumental task, and the product could well become a work of classic stature. While imperfect in some respects, his book is the closest approach yet to describing the defense establishment elephant and its societal influences. It is unqualifiedly the most significant contribution thus far in this decade toward an understanding of that infinitely complex, barely manageable, and unparalleled phenomenon—the defense establishment.

Hq Air Force Reserve Officers Training Corps

Note

1. Alexis de Tocqueville, *Democracy in America* (New York: New American Library, Mentor Edition), Book III, Chapter 49, p. 279.

SHERMAN—LEADERSHIP GROWTH ON THE BATTLEFIELD

LIEUTENANT COLONEL LAUN C. SMITH, JR.

AFTER the Civil War, General William Tecumseh Sherman said in a speech at West Point that he had often been asked which books had taught him the secret of leading vast armies. He told the cadets that he was not aware that he had been influenced by any books. Then he went on to explain that he had had knowledge of the terrain of his battlefields, gained from earlier experiences in the areas, and therefore he felt no need to look back to the great strategists of the past for examples.

Professional military men fully recognize the need to study the strategies of the past. So did Sherman. In addition to being one of the great military leaders in American history, he was an educator. Further, as an ardent historian he constantly admonished his subordinates that the lessons of the past could be applied to the present and future.

Sherman had most of the innate prerequisites for outstanding leadership, including intelligence, tenacity, compassion, loyalty, fierce personal pride, a burning patriotism, the professionalism of the dedicated soldier, the ability to plan well, personal integrity, and almost unbounded energy and ambition. In spite of these traits plus his early recognition of the total nature of the Civil War, historians have tended to relegate him to a subordinate level in the ghostly military hierarchy—beneath such leaders as Ulysses S. Grant, Robert E. Lee, John J. Pershing, and Douglas MacArthur. Apparently the historians cannot overlook his inadequacies as General of the Army after the Civil War, when his apolitical attitude permitted politicians to run roughshod over him in reducing the military to a skeleton force barely capable of containing Indian uprisings in the West.

Professor T. Harry Williams, in delivering the Harmon Memorial Lecture at the Air Force Academy in 1960, said, "In the last analysis, the only Civil War generals who deserve to be ranked as great are Lee for the South and Grant and Sherman for the North." Sherman was not a great leader at the beginning of the war, although he possessed the ability. But he grew in leadership and command much more rapidly than any other commander on either side.

When Sherman said what he did to the cadets at West Point, he was trying to impress upon them not the idea that books have no

value but that one must study, learn, adapt, and progress on the battlefield as well. That he did this himself there is no doubt, and Professor James M. Merrill has written a new biography that does an outstanding job of substantiating Sherman's growth as a leader in combat.†

Merrill's primary source materials included some previously undiscovered family papers, which he has used to shed a different light on Sherman in a thoroughly engrossing portrait. While making no startling claims in Sherman's behalf, the author has shown him to be a considerably more compassionate, strong, and fair leader than the harsh, ruthless, unappealing man that history has made of him. In fact, Merrill hints that much of Grant's strategy up to the time he assumed command in the East was really Sherman's thinking.

A West Pointer, Sherman graduated sixth in the class of 1840; excessive demerits prevented his holding the third-place position he had earned for scholarship and leadership ability. His early career was for the most part uneventful. He fought in the war with Mexico but afterward resigned from the service because he could not support his family on the pay of a lieutenant.

His talents proved unsuited to civilian leadership and enterprise, although he did have some success as manager of a banking establishment in San Francisco. While there, during the banking crisis of 1854, his sense of responsibility to former army acquaintances nearly bankrupted him. He had invested more than $100,000 for friends still in the service, and many of these investments became worthless when some of the banks failed. It was a point of honor with Sherman to repay in full those who had trusted him. He drained his own savings to do it, but as a lifelong result his integrity was unquestionable, particularly by military superiors or subordinates.

After a succession of jobs around the country, Sherman moved to New Orleans in 1859 as superintendent of a new military institute (which later became Louisiana State University). While there he began to demonstrate the qualities that were to lead him to military greatness.

With the Presidential election at hand, tempers were short, and the Southern leaders were making preparations for war—at least they were talking about it. Sherman wanted it well known where he stood on the issues of the day, for he had already been approached by Southern friends about the possibility of his assuming command of some Southern troops. In 1860 he wrote to one of these Southerners: "I think Southern politicians are almost as much to blame as mere theoretical abolitionists. . . . The true position for every gentleman North and South is to frown down even a mention of Disunion. . . . The laws of the States and Congress must be obeyed, if wrong or oppressive they will be repealed." (p. 137) This is an early expression of the tremendous importance Sherman placed on loyalty to one's country—a loyalty that he also extended in great measure to his superiors and subordinates later.

Sherman tried to warn his associates, in both North and South, of the terrible consequences if civil war should erupt. To one he wrote, "Disunion and Civil War are synonymous terms. . . . It would be war eternal, till one or the other were conquered." (p. 137) A short time later (December 1860), in a discussion with one of his faculty, Professor David J. Boyd, Sherman said, "Boyd, you people of the South don't know what you are doing! You think you can tear to pieces this great Union without war! But, I tell you there will be bloodshed, and plenty of it!" (p. 150)

Then, on Christmas 1860, he wrote to his

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†James M. Merrill, *William Tecumseh Sherman* (Chicago: Rand McNally & Co., 1971, $10.00), 444 pages.

superiors in Louisiana, "I will do no act, breathe no word, think no thought hostile to the government of the United States." (p. 150) And he made it clear that as soon as the State of Louisiana should secede from the Union his association with the institute would be terminated. Through all of this can be seen another attribute of leadership—the ability and the will to express one's opinions openly, succinctly, and unwaveringly. No one ever doubted Sherman's motives or misunderstood his intent.

That Sherman was recognized by the Louisiana cadets for his leadership is evident in the words of one of them: "He was fluent and eloquent when he spoke. . . . Upon one and others he made the impression of an ardent, powerful man, governed by duty and a sense of devotion to his country and humanity." This is not the Sherman that many historians have depicted. It is also significant that many of his students and friends from Louisiana remained his friends for life, even after his part in the Union's defeat of the South.

When Sherman returned to the North in 1861, he was appalled at the lack of preparation for war. Northern optimism that the war would be of short duration disturbed him, for he knew that the South was united and already recruiting the best officers available. He told his brother John, "The North just don't care a damn, you politicians have got things in a hell of a fix, and you may get them out as best you can." (p. 155)

He was further upset by Lincoln's initial call for 75,000 volunteers, knowing it would never be enough. He wrote, "The first movements of our government will fail and the leaders will be cast aside. A second or third set will arise, and amongst them I will be, but at present I will not volunteer as a soldier or anything else. If Congress must, or if a national convention be called, and the Regular Army be put on a footing with the wants of the country, if I am offered a place that suits me I may accept. . . . The time will come when Professional knowledge will be appreciated, when men that can be trusted will be wanted, and I will bide my time." (p. 156) To him, then, military leadership was a professional thing, and only professionals should be permitted to lead troops. General Henry W. Halleck did, however, convince him to take a command soon after the war started.

As the Civil War was joined, then, Sherman had already demonstrated most of the qualities of a good leader. He had not yet been tried in combat, however, as the commander of a force of any size, and this combat inexperience caused him much grief in the early stages of the war. He committed the same mistakes as others—he was too cautious and tended to overstate his needs while overrating the ability of the enemy.

In November 1861 Sherman so overestimated the military posture of the enemy in Kentucky that even General Halleck began to question whether he was ready for such a large command. Sherman asked to be relieved of his command, stating, "If anybody can do better than I for God's sake let him. I prefer to follow not to lead, as I confess I have not the confidence of a leader in this war." (p. 180)

This early inadequacy left Sherman a highly distraught man. He had a keen mind, and he permitted what he foresaw could happen in the long run to temper his decisions of the moment. The result was natural—caution and overestimation—and for a while his confusion was interpreted as insanity by the newspapers. But what Lincoln, Grant, and Halleck saw in Sherman to a higher degree than in others was a fighting, conscientious general.

Halleck gave him some subordinate staff jobs and watched him carefully until certain that he was ready for command. When the time came, he was assigned to command the District of Cairo (Illinois), a part of Grant's rear zone in the West. Sherman fully realized the confidence his superiors had in him, and

as he helped them plan the strategy of new campaigns, his own confidence was restored.

He really began to demonstrate military leadership at Shiloh in April 1862, where his attention to detail kept his scattered troops in some semblance of order. His bravery and outstanding leadership saved the day for the Union forces, and Grant, who had always respected Sherman's capacity to think and plan clearly and directly, began to see in him the trusted leader that he was rapidly becoming.

As Sherman gained confidence, his men reflected it, and when the war ended his army was probably the finest fighting force of the entire war. His troops were well trained and always well provisioned, and their morale was nearly always good. He delegated responsibility and authority and never lost sight of the need for logistical security and central control. As a result, discipline was never a real problem for him. After Shiloh, Grant held few planning sessions without Sherman, and the two of them planned the final campaigns of the war. When Sherman detailed his plan for a march from Chattanooga to Atlanta, Grant objected at first but finally consented and submitted the plan to the President for approval. (p. 244)

By this time Sherman was a supremely confident commander. He was cheered by his men, not because he was a flamboyant individual—physically, he was one of the least impressive generals of the war—but because he had led them successfully through Mississippi and Tennessee. They respected him for his professionalism, which included an ever present regard for the welfare of his troops and a sincere concern for the people who lived in areas conquered by his army.

One thing his men learned above all: when he established an objective, he planned his maneuver so well that he never lost sight of the ultimate goal. In short, his men were confident that, once started, they would arrive. And after the Tennessee and Mississippi campaigns, they had no doubt that they would arrive at their destination victorious. This was much in evidence and certainly was a contributing factor to his successful marches to Atlanta, Savannah, and then through South and North Carolina. Sherman was probably as close to being the complete leader during these marches as any commander has ever been.

Military leadership stems from many sources, including the handling of civilians in combat areas. During the campaign in Tennessee Sherman wrote to Grant that the people of the South "cannot be made to love us, [but] they can be made to fear us." (p. 207) At Memphis, for example, he worked tirelessly to rehabilitate and care for the people. But when guerrillas operated against his troops with the tacit support of the people, he did not hesitate to use harsh measures. He wrote to Grant: "It is about time the North understand the truth. That the entire South, man, woman, and child is against us, armed and determined." (p. 206) He then ordered the town of Randolph burned and also decreed that for every gunboat fired on by Confederate guerrillas ten families were to be expelled from Memphis. Thus was revealed the basic leadership attributes that impress friend and foe alike: recognize the situation for what it is, be fair, but act in the interests of the war objective at all times. This was Sherman to the end.

According to Merrill, Sherman was ahead of his time as a military strategist. He clearly understood that the resisting power of a democracy depends more on the strength of the people's will than on the strength of its armies. And although his concept of collective responsibility violated all the accepted rules of warfare at the time, he very effectively sapped Confederate morale by destroying the enemy's ability to supply its armies and by terrorizing civilians when it suited the purpose of his objective and they would not otherwise cooperate.

Sherman's marches through Georgia are so well known that little new can be written about them. As noted, by this time he had established himself as a great leader with both his superiors and his men. Secretary of the Navy Gideon Welles wrote in February 1865 that Sherman was proving himself a great general who undoubtedly had greater resourcefulness and a more prolific mind than Grant and perhaps as much tenacity if less cunning and selfishness. (p. 287)

In response to critics who cast Sherman as cruel and ruthless, Professor Merrill makes an excellent point: in offering surrender terms to the South's General Joseph Eggleston Johnston, Sherman restored to the South a large measure of the status quo of the prewar days. (p. 291) This clearly demonstrated that Sherman's concept of war was purely strategic, not vindictive. The fact that the terms of surrender were not acceptable to the Union had no bearing on Sherman's attitude. To him, "The South is broken and ruined and appeals to our pity. . . . To ride the people down with persecution and military exactions would be like slashing away at the crew of a sinking ship." (p. 335)

A good leader is able to lead the opposition. The South after the war, while always mindful of the destruction Sherman's forces wrought, nevertheless did recognize the man for what he was. In considering Sherman as a Presidential candidate after the war, the *Montgomery* (Alabama) *Mail* carried the following lines: "The South will gladly meet him on half-way ground. . . . We can see in him and his well developed character a moral force that . . . will bear down on all opposition and rescue the people from the untold difficulties and dangers that surround them." (p. 339)

So, Sherman did grow as a leader. Ineffectual at the start, he was acclaimed by almost everyone at the end—his own men and those of the other side as well.

He did have his problems, though, and not all of them were strictly military. Civilian newspapermen had been permitted into the battlefield area over his protests. Thomas A. Knox, a *New York Herald* correspondent, actually revealed some of Sherman's strategy, and Sherman was upset that he had been able to ferret it out in the first place, let alone release it to his newspaper. Sherman brought charges against Knox and finally won in a War Department action to have Knox removed from the battle area. Lincoln left the matter to Grant's decision. Grant backed Sherman, and Knox was removed. This is a clear demonstration of recognition by a civilian President that the battlefield is the command of the general, whose decisions should prevail. The leadership lesson in this case, of course, lies in the determination of the commander to assume his responsibility and fight for it, which Sherman did. The problem of the integrity of the press and press censorship still, however, badgers military commanders today.

The remainder of Merrill's book does not show Sherman as the strong commander he was during wartime. For example, he considered Indians inferior to whites, and this affected his actions during the postwar campaigns against the Indians. His greatest problem, however, was his inability to work successfully with politicians, and he steadfastly refused to become involved in politics. At a time when the Army needed a General of the Army who would fight to maintain the stature of the military forces, Sherman only grumbled and failed to act competently.

Merrill's book should be on the shelves of professional military men. Not only does it read like a novel but it is well researched and loaded with tips on military leadership that apply today as they did during Sherman's time.

Maxwell AFB, Alabama

AIRMEN AT WAR

Dr. Alfred Goldberg

NO MATTER what the psychological climate at any given moment, people remain fascinated with the spectacle of men at war. Even in periods of strong revulsion against war and militarism, such as the 1920s and 1930s—yes, and the 1970s—the popular appetite for historical, literary, and film depictions of war shows no sign of diminishing. The human dimension of war, particularly in the military leaders, ever excites public attention, curiosity, and inquiry.

The war in Vietnam and publication of the Pentagon Papers have focused public attention on the men who make or influence decisions about war and peace. Once more we are made stunningly aware that the most complex politico-military problems center on man and his relationships to his fellows. To analyze and understand the how and why of what happens in wars is a most difficult kind of study because man is chiefly responsible for all of it.

In a recent study, the author, Allen Andrews, seems not to recognize the true complexity of the task he undertook: to examine the relationship between certain air leaders of World War II and the war they fought.† The seven men he portrays were indeed movers and shakers, and we would do well to look at them more closely and try to understand them better, for we have not dispensed with their kind or the institutions of which they were a part.

This is not a thesis book; rather it is a series of loosely related portrayals. There is no central thesis other than "to enquire of the marshals how efficiently they discharged their commission," and the closing pages are merely a brief résumé of some of the salient features of the air war. The effort to present the war as a matching of skills between professional leaders does not come off. The author is unable to follow Liddell Hart's precept that "it is only possible to probe into the mind of a commander through historical examples." But modern air war on the scale of World War II in Europe is entirely too complex—and the decision-making process too diffused and unknowable—to provide comprehensive insights into the minds of the commanders.

Still, the human dimension is ultimately the *deus ex machina* of warfare, and we cannot understand war if we simply view it as the play of great impersonal forces in which men are beings without free will. It is important for any society to inquire into what manner of men are those who lead them in warfare. Here we are concerned with some of the men who commanded the great air fleets of World War II in Europe. Of the seven "air marshals" chosen, four were British —Portal, Tedder, Dowding, and Harris; two American—Arnold and Spaatz; and one German—Goering. Actually, Spaatz is almost ignored, and most of the focus is on Goering, Arnold, Portal, and Tedder. The treatment of individuals is uneven in terms of space, depth, and perspective, and only Arnold and Goering, particularly the latter, emerge as personalities.

Hermann Goering receives the fullest treatment, undoubtedly partly because more has been written about him than the others and because Andrews has chosen to view the

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†Allen Andrews, *The Air Marshals* (New York: William Morrow & Company, 1970, $6.95), 299 pages.

German side of the war almost exclusively through his focus on Goering. It would have been more valuable to examine also the role of some of the other German air marshals who actually ran major segments of the air war for substantial periods of time, such men as Kesselring, Jeschonnek, Peltz, Sperrle, and Von Richthofen.

Even though Goering was commander in chief of the Luftwaffe and more responsible than anyone else for the creation and destruction of the Luftwaffe, he was not a professional in the sense that the other air marshals were. He did not exercise long-term direction of strategy or operations as did the others, and when he did step in to take over direction of some air operation he usually did more harm than good to the German cause. Both Goering and the Luftwaffe fell increasingly into disrepute with Hitler, the High Command, and the German army when it became evident that Germany could not escape severe air attack and damage from the Allied bombers. Albert Speer, who had ample opportunity to know and observe Goering during the war, described him as "like a bankrupt who up to the last moment wants to deceive himself along with the creditors." For a firsthand portrait of Goering the unscrupulous schemer in action, it is more rewarding to read Speer's *Inside the Third Reich.*

Hap Arnold is known to Andrews chiefly from Arnold's own book, *Global Mission.* There must be some suspicion that Arnold receives as much attention as he does in order to give some balance to a book that is written by a Briton chiefly about Britons. Andrews accepts the book's version of Arnold and events at face value without any attempt at critical analysis from internal evidence. Thus the treatment of Arnold tends to exaggerate his role in the strategy and direction of the air war. His invaluable and dedicated contribution to the building of the U.S. Army Air Forces comes through clearly, but his role in the air war in Europe—exercised remotely, chiefly through Spaatz—does not.

Unfortunately there is no full-scale biography of Air Chief Marshal Sir Charles F. A. Portal. This is regrettable because Andrews is unable to present a meaningful portrait of this great war leader, although he tries to give him his due, which was very great indeed. Of all the British chiefs of staff, he was the most trusted and respected and the best liked by American leaders. As Chief of the Air Staff of the Royal Air Force from 1940 through 1945, his physical proximity to the fighting forces and the theater of operations afforded him an opportunity for daily firsthand observation and familiarity with the air war that was denied Arnold. Through most of the war, Portal was the central figure in the formulation and direction of Anglo-American air strategy, a prime mover in initiating and prosecuting the air offensive against Germany.

Sir Arthur Tedder, who did write a good book about his war experiences—*With Prejudice*—is disposed of by Andrews, with some generalities about the importance of his role, in a few pages towards the end of the book. Indeed, the last year of hostilities, when Tedder exercised a great deal of influence on the course and direction of the whole air war, both strategic and tactical, is disposed of in little more than twenty pages. Tedder deserves most of the credit for securing the adoption in 1944 of the plan for the bombing of the French and Belgian railways in the period immediately preceding the Normandy landing: he persisted and prevailed in the face of opposition from Churchill and the British War Cabinet. He deserves to be included at the top of any listing of air leaders of World War II. In this book he is insufficiently celebrated.

Sir Hugh Dowding and Sir Arthur Harris, both air chief marshals, are presented on an even smaller stage, despite their being central figures in momentous events—the Battle of Britain and the air offensive against Germany. They were men of vision, if not visionaries, but neither received a full measure of recog-

nition from the nation they had served. Dowding became the victim of intraservice politics, and Harris of higher politics. By the end of the war, Churchill had lost his enthusiasm for RAF Bomber Command's campaign against German cities, and "Bomber" Harris was permitted to fade quietly away. Still, for nearly four years Harris was a powerful and aggressive principal in the shaping and conduct of the air war in Europe. Dowding's time at stage center was much briefer but no less significant.

Andrews is clearly uninformed about Spaatz's stature and the significant part he played in planning and directing the air war against the European Axis between 1942 and 1945, perhaps because there is no biography and Spaatz has never published his memoirs. As the major American air commander in Europe during these years, he was indeed Arnold's alter ego, had Arnold's complete confidence, and exercised a degree of initiative exceeding that of any other overseas American air commander during the war. He was the peer of Portal, Tedder, and Harris in the European Theater and had a sound working relationship with them, especially Tedder, with whom he had previously worked closely in the Mediterranean Theater for more than a year.

Contrary to the allegations of some historians and observers of the war in Europe, Spaatz was fully aware of and genuinely responsive to the needs of the ground forces in the OVERLORD campaign. Once the major decisions were taken, he cooperated effectively with Eisenhower and Tedder in making the American strategic air forces, both bombers and fighters, available for air operations in support of the ground campaigns. For more than two months before D-Day on 6 June 1944, the American heavy bombers participated in the bombing campaign against the French and Belgian railroad systems and other targets in preparation for the landings. For three months or more after D-Day the heavy bombers continued to devote most of their efforts to support of the ground forces, flying tens of thousands of sorties in interdiction and close air support operations. This enormous effort was, of course, at the expense of the bombardment of strategic targets in Germany.

Spaatz strongly defended this diversion of the bomber effort against critics, including some of his own subordinates, who regarded it as unjustified and unnecessary. In spite of the urgings and pressures of some of his own commanders and staff officers, Spaatz persisted in regarding all of the U.S. air forces in Europe, including the strategic bombers, as part of the overall resources that had to be available to the Supreme Allied Commander, General Eisenhower. Unlike Harris, a prima donna who initially opposed and then reluctantly permitted RAF Bomber Command to participate in the OVERLORD campaign, Spaatz was a team player. He had independent views and judgments and fought for them, but he did not permit service interests, parochialism, or personal preferences to obscure the larger objectives. All this should be part of any portrayal of Spaatz.

Unfortunately, Andrews offers nothing new about the history of the air war between 1939 and 1945. His book is based almost entirely on secondary sources, and not all of these are the best that were available. The 39 works cited in the book are really too skimpy a list to enable more than a superficial exposition and appraisal of the six years of air war in Europe. Many of these books are purely reference works or tangential to the subject, touching on the air war only minimally: for instance, Keering's *Contemporary Archives*, G. M. Gilbert's *Nuremberg Diary*, and Douglas M. Kelly's *22 Cells in Nuremberg* and *Anschluss Transactions*. Only about half the works are primarily concerned with the air war. More than 40 percent of the 153 footnotes are from three sources: Webster and Frankland, *The Strategic Air Offensive*

against Germany 1939–1945; Winston Churchill, *The Second World War;* and Henry H. Arnold, *Global Mission*, and it is likely that Andrews is even more indebted to these three works than the footnotes indicate. It is perhaps equally significant that Andrews failed to use some of the most important basic works bearing on the subject, including the U.S. Strategic Bombing Survey and the British Bombing Mission Survey.

The proportions of the book are uneven in its coverage of the war. About half is devoted to the prewar years and the first year of the war—the Polish and French campaigns and the Battle of Britain. The 1942–1945 period is covered in 55 pages, including the British and American strategic bombing campaigns and OVERLORD. Thus the air war is viewed only partially and selectively, and the selection does not seem to be consistent or systematic. The chief criterion appears to have been the ready availability of sources that could provide some accounts linking one air marshal or another with places or events of the air war. In short, the author is too much the prisoner of his sources, and the result is an erratic, disproportionate, inadequate work.

All these strictures on sources, proportions, handling of material, and quality of documentation are in accord with other aspects of the book, leading to the conclusion that it does not make a serious contribution to either history or biography. It is, rather, an interesting popular account of some of the leaders and highlights of the air war in Western Europe. I hope the future will produce a work worthy of the theme.

Arlington, Virginia

QUO VADIS, DOMINE: SYSTEMIC ANALYSIS OR DEVIL-THESIS?

Dr. George W. Collins

HOW can man cope with the endless escalation of nuclear terror? Where has he erred? Where lies the responsibility for the present insecurity? What are the solutions? These questions are not by any means new or unique. Authorities and pseudoauthorities of virtually every discipline and profession have produced such a spate of material on the cold war for nearly a generation that we beg, like the Irishman engulfed in the darkness of the raging storm, "Please Lord, more light and less wind!"

The arguments advanced in the three books here considered are illustrative of the varied methodologies and conclusions. The writers, who have excellent credentials pertinent to their topics and who have published other works of this genre, dramatize the Soviet-American confrontation as the heart of the matter, just as most others have done. Nevertheless, their assumptions, assessments, and solutions, in the quest for understanding, often differ radically.

Two of the writers, Anatol Rapoport † and George H. Quester,†† believe an understanding of the troubled years since 1945 and of international relations in general is best achieved through mathematical, modular, "systemic" analysis that recognizes the importance of economic considerations. Professor Quester, of Cornell University and formerly a member of the Center for International Affairs at Harvard, explains that his analysis rests upon a rational economic bias, that he views the arms race not as "a string of aimless and blundering accidents" but as a series of deliberately planned steps by both superpowers. Rapoport's methodology appears very similar. Educated in Europe and America and now teaching at the University of Toronto, Professor Rapoport wishes to project a system governed by laws in which "the decisions sum into a grand 'resultant force' whose magnitude and direction derive from the nature of the system and from its interaction with other systems. . . ." Despite this apparent agreement as to scientific, rational principles, there are fundamental differences in their views. Quester is concerned with the "objective environment" (the reality?) in which statesmen and strategists formulate their decisions. Rapoport, however, emphasizes that it is not the reality but the perceptions of reality that are important. In an argument reminiscent of Plato's parable of the cave, he insists that, as with those prisoners, the perceptions the "Big Two" have of themselves and of each other are more important than the reality of international relations.

Another approach to modern international affairs is that presented by James E. McSherry, formerly of the State Department's Bureau of Intelligence and Research, whose interpretations are predicated on the importance of the

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†Anatol Rapoport, *The Big Two: Soviet-American Perceptions of Foreign Policy* (New York: Bobbs-Merrill, 1971, hardcover $6.95, paperback $2.95), 249 pages.

††George H. Quester, *Nuclear Diplomacy: The First Twenty-Five Years* (New York: Dunellen, 1970, $10.00), xxi and 327 pages.

ideological issues and on the role of individual national leaders.† His writings are akin to the "great man" school of historiography and perhaps reflect a modern echo of Von Holst's "devil-theory" of war. McSherry discovers the origin and outcome of international crises in the deliberate policies of President John F. Kennedy and Premier Nikita Khrushchev.

Each of the three writers recognizes the crucial nature of the Berlin and Cuban questions in the Soviet-American confrontation. The American determination to remain in Berlin was dramatically expressed by the 1948 airlift, and controversy over that city has recurred several times. Later, the missile question in Cuba was another matter: not a lengthy dispute but an incident which, if not swiftly resolved, threatened to end in nuclear holocaust. An examination of the treatment of those two episodes affords considerable insight into the writers' views of the origin and nature of the cold war.

IN THAT RESPECT Rapoport is a severe critic of American policy. While he argues that both the Soviets and Americans have "perverted" their revolutionary ideals and have swung increasingly toward "realist" views of international relations, he apparently believes that the shift has more adversely affected American foreign policy.

In its perception of the Soviet Union as an evil state espousing world Communism, the United States, according to Rapoport, failed to appreciate how the reality of Soviet interest had changed. The professor insists that Stalin's primary concern in the organization of the postwar world was security. Therefore, he lost interest in the expansion of Communism and sought a sphere of influence only to consolidate the Soviet Union and his own power. Rapoport minimizes the ambitions of the U.S.S.R. beyond that sphere of influence and declares that Stalin's demands (e.g., for a voice in the disposition of Italian colonies) were made solely for bargaining purposes. Not only had the Soviet appetite for expansion abated but, he declares, Stalin feared other Communist states and, therefore, by 1948 had abandoned his efforts to impose a Communist unity on Germany.

Despite his recognition of the importance of the Berlin question, Rapoport believes that it was really a false "issue." The city lacked economic or strategic importance, nor was it the cultural or political heart of the German nation in quite the sense of either Paris or Moscow. It was not the reality but the *perception* of the city that was important; "the real object of the struggle was not about Berlin but about who was going to have his way about Berlin." That conception of the Berlin matter is important for an understanding of Rapoport's conclusions. The United States, in its perception of international relations, was motivated by what he defines as a "Clausewitzian" view, a "realist" appraisal that depicted the world arena as one of sovereign nation-states thirsting for power and dominance. Success was reckoned by imposing one's will upon the other; thus the most vital national force was military capability. Therefore, although a stalemate had been reached in Europe by 1948, American policymakers continued to project that contest of will, and after Stalin's death they rejected Soviet efforts to settle the cold war. Rapoport maintains that the United States should have accepted the Soviet declarations of satisfaction with their own deterrent strength as evidence of their good intentions. Unfortunately, the belligerency of John Foster Dulles and the decision to rearm West Germany pressured the U.S.S.R. toward a more forceful policy.

Later, when the Berlin question again came to the fore under Khrushchev, Rapoport attributes no malice to his policy. Instead he

†James E. McSherry, *Khrushchev & Kennedy in Retrospect* (Palo Alto, California: Open-Door Press, 1971, $8.95), 233 pages.

insists that the Soviet premier provoked the issue in order to resolve the cold war. Khrushchev was determined to solidify his position in Russia, and he staked everything on a policy of coexistence. Seizing the initiative after the 1961 Vienna meeting with Kennedy, he resumed atmospheric nuclear testing, erected the Berlin wall, and forcefully declared his intention to sign a treaty with East Germany by the end of the year. For success he required *some* concession from the West, but unfortunately, rues Rapoport, America stood firm, and Khrushchev, forced to retreat in Germany, turned to Cuba as his last resort.

As with Berlin, Rapoport holds that the missile sites were not the real issue in the Cuban question. He denies that the missiles had any military purpose, contending that they were worthless for the strategic defense of the U.S.S.R. and of no offensive value in any Soviet war with America as they would be the first targets destroyed. Instead they were a political measure intended to force American retreat elsewhere. As such they represented a last desperate effort of Khrushchev for some concession to convince the Russians that coexistence was a feasible policy. Why else, asks Rapoport, were they constructed without concealment?

Throughout Rapoport's account, the emphasis is on the mistaken American perceptions of itself, of Russia, and of international relations. He believes that American policy is formulated by an arrogant, antidemocratic *de facto* elite (the familiar military-industrial bogeyman), whose decisions lead to conflict. The impetus to American aggressiveness resides, as Lenin's systemic analysis of imperialism states, not in diplomatic intrigue or ideological conviction "but in the dynamics of capitalist economics," which, together with the absolute imperative of "power" and "will" in its Clausewitzian approach, has placed national reliance upon military strength as the basis of foreign policy.

DIAMETRICALLY opposed to this interpretation is the account of McSherry. Where Rapoport in virtually every instance is able to exonerate or condone Soviet tactics, McSherry declares that it was Khrushchev's blatant hostility that forced American reaction. For example, rather than accept the argument that Khrushchev's moves in Berlin were indicative of his shaky authority at home, McSherry maintains that after Marshal Zhukov had been shunted aside in 1958 the premier's position was secure and that by 1961 he had already taken on a "father image." The motivations for Khrushchev's initiative in Berlin and Cuba came not from insecurity but from his success at home, which encouraged him to unwarranted aggressiveness abroad. McSherry believes that the Soviet leader, sensing irresolution in the youthful Kennedy, moved to destroy American credibility in both Europe and the Americas as a dramatic way to shift the balance of power.

While Rapoport criticized American policy for failing to grant any concessions, McSherry insists that significant concessions were made in Berlin, including acceptance of the wall and a more restricted military and diplomatic entry into the city in 1961, as well as troop reductions there two years later. Yet those actions brought no indication of Soviet readiness to discuss mutual resolution of the existing antagonisms seriously, and the only way to relieve Soviet pressure proved to be through forceful countermeasures. When Khrushchev saw that he had achieved all he could at the time in Berlin without unduly risking war, he then shifted attention to Cuba, believing that if he could demonstrate American unwillingness to face Soviet encroachment there the reward would be equivalent to an American surrender in Berlin. Once he saw the United States respond only weakly to the movement of Soviet troops and bombers to Cuba and to the signing of a Soviet-Cuban treaty providing a port for servicing Soviet

trawlers, he decided on the installation of missiles in Cuba. In fact, McSherry concludes that on the whole Kennedy gave ground too easily and that in the Cuban missile crisis he erred in accepting Khrushchev's first offer without insisting on an easing of Soviet pressure elsewhere.

THESE single-sided interpretations are quite different from the restrained writing of Quester, who accepts that both superpowers may have been dissatisfied with their policies but felt trapped in "a game-theoretic prisoner's dilemma." He accepts, as does Rapoport, the conclusion that the Soviets had long been uninterested in German unification. Nevertheless, he views the Berlin confrontation initiated by Khrushchev from a broader perspective than either Rapoport or McSherry. Admitting that Khrushchev's gambit was regarded in America as evidence of his interest in undermining American credibility, he also suggests that the Soviets were greatly concerned about the weakness of the East German regime and the possibility of its collapse.

It was into that troubled atmosphere of 1961 that Khrushchev interjected his warning that local wars could escalate into general conflagrations, meanwhile affirming his support of wars of national liberation. While his warning may have been intended as an acceptance of the status quo, his other comment seemed to presage a new wave of worldwide Soviet commitment. Quester appreciates the difficulty of formulating policy to cope with this "carrot and stick" approach of the Soviets. There was no assurance that they would not go ahead with the threats to blockade Berlin, and the tank-to-tank confrontations there made it apparent that the prestige of the new American President, as well as the fate of Berlin, was at stake. The result was an escalation of military force on both sides. Forty thousand American troops were sent to Berlin, B-47 aircraft slated for withdrawal from the strategic fleet were retained, and the NATO powers supported the United States in building up conventionl forces in Europe. At the same time the Soviets built up their forces and conducted Warsaw Pact war games for the first time. In addition, Khrushchev resumed nuclear testing (mentioned by Rapoport), pointed out the capability of Soviet missiles against Western Europe, and revealed new prototype bombers. The situation finally cooled as both sides gave ground. The United States accepted the wall and no longer exercised the right of entry into East Berlin without submission to East German passport control, while the Soviets settled for those concessions and made no further moves toward an East German treaty.

Again with Cuba, Quester demonstrates a greater capacity for conceding right and wrong on both sides. In reviewing a variety of possible reasons for Soviet deployment of missiles abroad, he makes no effort to unravel the mystery of motive but passes on to what he considers the more critical question of timing: Why was Khrushchev in such haste to build the bases? Noting, as does Rapoport, the lack of preparations for air defense or camouflage, he asks whether Khrushchev was merely impatient, or indifferent—not expecting the United States to react, or inviting discovery in anticipation that it would lead to American concessions elsewhere? Unfortunately, while Quester raises that question, he does not answer it.

What Quester finds most difficult to understand is the dramatic reaction in the United States, for he, too, concludes that the missiles presented no serious military threat. The answer, he believes, lies in American politics: the Kennedy administration's strident insistence on unquestioned nuclear superiority meant that it could not accept the missiles. That adamant position was the result of both the campaign pledges of 1960 and the warnings against "offensive" weapons issued in the

weeks preceding the crisis. Whatever the motivations of Soviet and American policy, Quester observes that world opinion supported the United States, taking the installation of the missiles as unwarranted nuclear proliferation.

WHAT can our judgment be of these three studies? Are there inherent advantages in "systemic analysis," or do other methods afford greater understanding? Why is it that supposedly authentic scientific studies result in such different conclusions? Where are the rational "laws" that should have led to a "true" interpretation of the problems of the cold war? I am reminded of one who computerized the Battle of Gettysburg and of his satisfaction that when the program was run the North won once again, thus affirming the accuracy of his game analysis. But I am tempted to believe that, had his program proclaimed the Confederates victorious, he would have been equally pleased, only then he would have argued that the results clearly identified where Lee had erred in 1863.

The arguments of Rapoport are not convincing. One wonders why he has ignored some of the evidence that suggests alternative motivations and would lead to very different conclusions. His single-minded attack on American policy is excessive in light of his own assumptions that both the U.S. and the U.S.S.R. have perverted their idealism and substituted realistic appraisals of international relations; that both governments are tyrannies controlled by antidemocratic elites hand-in-hand with the military. Yet, most peculiarly, out of that common background Rapoport projects a constant pattern of American aggressiveness and Soviet defensiveness. Moreover, he is at times unduly sardonic, as in his comments on the hero role of Kennedy during the missile crisis, or in his statement that the crisis "gave the American military the opportunity to enjoy the thrill of their lifetime."

As for Quester, his analysis may appear more satisfying because it is less partial or emotional and deals more fully with both sides of the questions. Yet how "rational" is his account? It hardly seems realistic to seek the "environmental factors" and yet dismiss "ideological fanaticism" as possibly unimportant. Moreover, must international relations be modeled on American political changes? With the exception of the final chapter, Quester's organization of material is based upon the consecutive Presidential administrations. For example, chapter one, "The U.S. Monopoly: 1945–1949 [Truman's first administration]"; chapter two, "The Monopoly Eliminated: 1949–1953 [Truman's second term]"; etc. Would it not have been equally rational and meaningful for Quester to construct his model around Soviet changes in leadership? And how might that have affected the conclusions? Furthermore, with the restriction of data because of security and other reasons (Quester, for example, finds it necessary to conjecture the levels of nuclear weapons stockpiles, a critical factor in evaluating nuclear capability) and limited Soviet information, it would seem extremely difficult to construct a model properly evaluating American and Soviet potential and intention. Louis Gottschalk once defined the historian's objective as "verisimilitude"—the meaningful re-creation of the past from all available evidence and inference.[1] On the other hand Rapoport states that individuals oversimplify perceptions in complex situations requiring decision-making. Perhaps the goal of verisimilitude requires a subtlety that is beyond the reach of a modular, systemic approach.

For many, the problem of data collection precludes definitive judgments. McSherry, however, would disagree, as he maintains that sufficient information is available from official statements, press releases, and "leaks" for accurate analysis of American and Soviet foreign policy. That, however, is debatable. The Society for Historians of American Foreign Rela-

tions is among those dissatisfied with the inaccessibility of much American archival material, and it is campaigning for more rapid declassification of documents, hopefully after no more than ten years of secrecy. McSherry's account also is disappointing in that he, like Rapoport, presents so one-sided a conclusion. They only differ as to which side is always in the wrong. Furthermore, his patronizing style is annoying. While it is invariably "President Kennedy" or at least "Kennedy," it is never "Jack"; on the contrary, only too often is Khrushchev familiarly dealt with, as in the following constructed quotation (another undesirable feature): "'OK, young fellow,' Nikita Sergeyvitch must have thought . . . 'you want a military base—you'll get a military base. Let's see what you do about it!'" Such inventions are unacceptably boorish.

What hopes do these analysts have for the future? What policy recommendations do they offer? Implicitly, of course, Rapoport and McSherry predict little change in the confrontation (be that either of "will" or of ideologies). For America, Rapoport suggests unilateral disarmament along the lines proposed by Charles E. Osgood, although no immediate Soviet response should be expected. Nevertheless, the United States should continue to disarm as an expression of faith until ultimately the Soviets do join in. But Rapoport has no faith that such a solution will be adopted, and he gloomily predicts continued escalation and war. Only revolutionary changes of the social foundations of the American and Soviet systems can remove the power-motivated elites, and he believes that the dissent within the United States may be indicative of the disintegration of this society.

Both Rapoport and Quester are concerned with the dangers of nuclear proliferation, declaring that only the active cooperation of the U.S. and the U.S.S.R. can halt that development. Both sides must avoid mutual insult, and even the slightest makeshift rapprochement must be applauded. Even so, Rapoport is critical of those within the U.S.S.R. who attack Soviet leadership and seek more intimate relations with the U.S. as a counterforce against Mao's China. McSherry, on the other hand, is not plagued with any uncertainty. Ignoring the fact that Cuba may have been a "Pyrrhic victory for America," considering the development of Soviet offensive capability which followed,[2] he insists that all that is needed is steadfast resolution against any Soviet advances. McSherry applies that argument to Vietnam, stating that had the United States displayed determination the war would have ended in 1968 but that unfortunately the "liberals" undermined that position.

While these accounts, like much previous writing on the cold war, are not definitive, there is much of value here. In particular, Rapoport's chapter "The Legacy of Clausewitz" is excellent for serious students of international relations.[3] And Quester's discussion of America's nuclear capability in the immediate postwar years is equally valuable. He has ably drawn upon the *Bulletin of the Atomic Scientists,* and he questions the relationship between doctrine and capability, citing the superior defensive ability of air power afforded by radar, jet interceptors, the proximity fuse, and, most important, the limited stockpile of nuclear weapons. The relatively few weapons available by no means could guarantee success through nuclear warfare. Not until 1951 had the arsenal grown to substantial size, yet, with the B-47 only coming into operation, effective delivery by B-29 and B-36 aircraft remained questionable. Furthermore, while the nation may have proclaimed its deterrent nuclear strength, Quester observes that the air strategy provided for both nuclear and conventional bombing and that the targets were primarily industrial and communications centers. Thus, by implication, the targeting system denied the probability of swift nuclear victory but was programmed for a war of attrition.

In conclusion, the merits of these books lie in areas somewhat peripheral to their main arguments (probably less so for Rapoport). We may expect that they will ultimately be used as are the studies of Sidney B. Fay, Bernadotte E. Schmitt, and others who closely examined the cause of World War I; that is, not as the definitive analysis but as important for understanding the intellectual conceptualizations of the twenty-five years since the end of the Second World War.

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Notes

1. Louis Gottschalk, *Understanding History: A Primer of Historical Method* (New York: Alfred A. Knopf, 1963), pp. 46–48.
2. The quotation is from Charles Yost, "A Letter to a Soviet Friend," *Life*, September 24, 1971. For elaboration of this conclusion see Major William T. Wilson, "A New Vitality in Soviet 'Defense' Posture," *Air University Review*, XX, 5 (July-August 1969), 78–86.
3. An earlier and more detailed examination of that subject and philosophies of war can be found in Rapoport's introduction to *Clausewitz On War* (Baltimore: Penguin Books, 1968), pp. 11–80.

The Contributors

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AWARD

The Air University Review Awards Committee has selected "Strategic Bombing and Changing Times" by Colonel Albert P. Sights, Jr., USAF (Ret) as the outstanding article in the January-February 1972 issue of *Air University Review*.

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