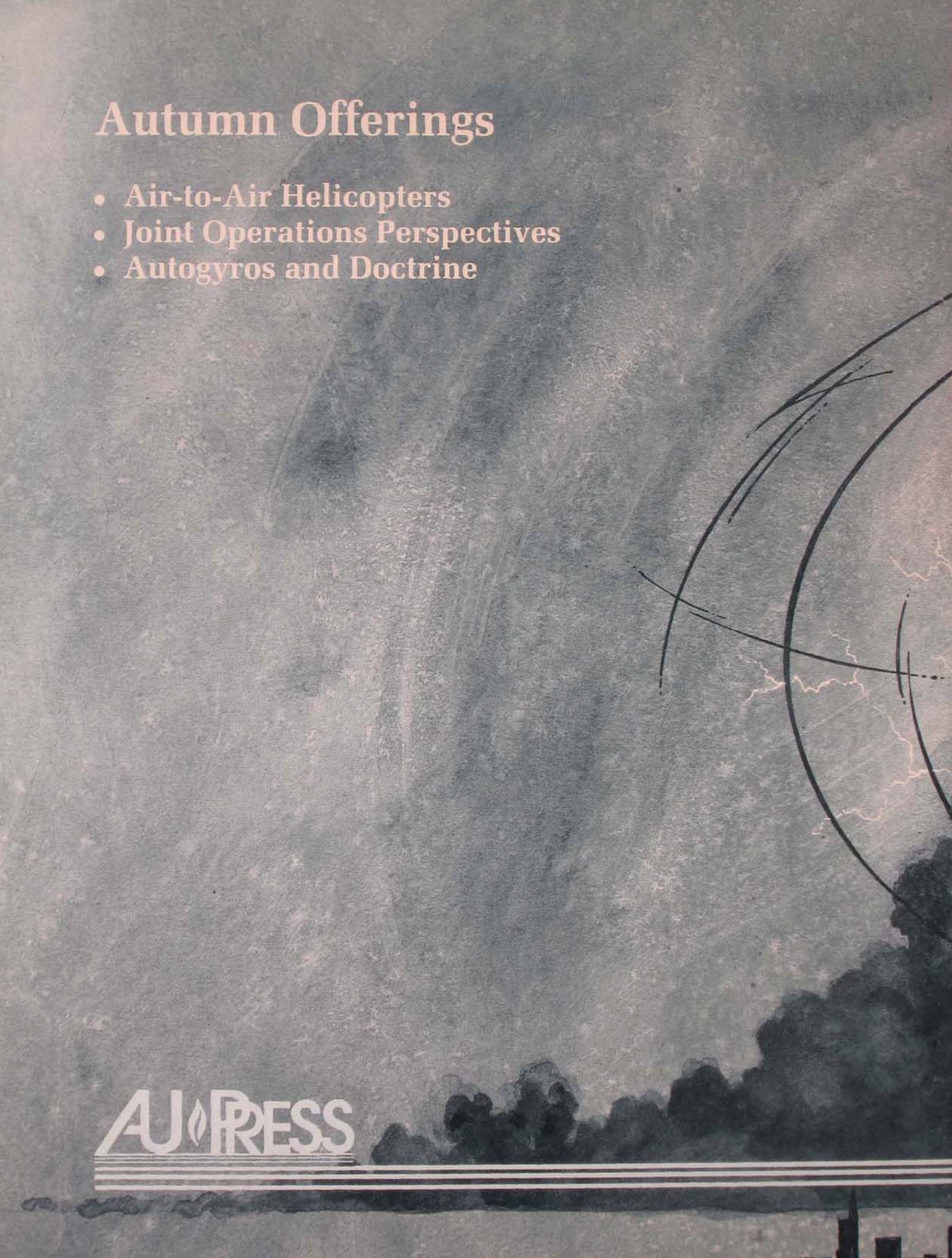
Autumn Offerings

- Air-to-Air Helicopters
- Joint Operations Perspectives
- Autogyros and Doctrine



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EDITORIAL

What follows is a comment on a previous editorial, too lengthy to print in "Ricochets," and more appropriate as a guest editorial. The authors are gentlemen of wide military experience and scholarly stature. Colonel Fabyanic is generally recognized as a strategic thinker, an author, and as the "Father of the Airpower Research Institute," the current home of the Airpower Journal. *Lieutenant Colonel Baucom, still on active duty, serves on the staff of the Strategic Defense Initiative Office and is a past editor of the* Air University Review.

Mayday! Mayday! Mayday!

A Rejoinder to Col Keith Geiger's Position Update (*Airpower Journal*, Winter 1987–1988)

IN THE inaugural issue of *Airpower Journal*, Gen Larry D. Welch identified warfighting as the new journal's focus. In the spirit of Project Warrior, its aim would be "to increase our understanding of the application of air power in combat." Hence, the new journal would speak less of management, system acquisition, and resource allocation and more of leadership and warfighting; and one of its key objectives would be "to hear from and encourage the warrior-scholar."

In the Winter 1987–88 issue, the editor set out to provide a "position update" that would sharpen the focus suggested by General Welch. He began by reaffirming that the journal's target was "the effective application of combat power," the realm of "operational art." With this we have no quarrel. However, fire-warning lights immediately flashed when the editor asserted that the "professional journal of the United States Air Force" could "leave aside questions of whether or not military power should be applied and concentrate on how best to apply it."

This is a grave error, for one of the fundamental truths about war is that political ends and military means cannot be neatly isolated in separate compartments. Yes, the issues raised by their interconnections are complicated, and yes, American military officers—particularly Air Force officers—have seldom been comfortable thinking about them. But the hard fact is that political ends and military means are inseparable parts of an organic whole. And if Air Force officers cannot find the complexities of matching ends and means discussed in the *Airpower Journal*, then where will they read about them?

Here is an illustration to drive home the substance of our objection. Let's suppose that sometime in the not-too-distant future one among us becomes chief of staff and is called to the Oval Office to discuss a major national security crisis with the president. The president's first question to his top air power adviser is whether or not we should commit forces and fight.

"I don't know, sir," he replies.

"Can we achieve the political objectives I have defined by the use of military force?" asks the president.

"Don't know, sir," the air chief replies.

"Well, if we do commit forces, are the means you might employ consistent with my objectives?"

"Don't know, sir."

"General," a now vexed president asks, "what do you know?"

"How to apply air power effectively, sir!"

Does this hypothetical conversation sound farfetched? It shouldn't. Not all that long ago, quite a few of us spent some time in Southeast Asia. Those of us in blue suits were there to apply air power effectively. Our experience illustrates clearly the danger of attempting to separate means and ends in war.

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ricochets

Letters to the editor are encouraged. All correspondence should be addressed to the Editor, Airpower Journal, Walker Hall, Maxwell AFB AL 36112-5532. We reserve the right to edit the material for overall length.

OOPS!

A number of our sharp-eyed readers noted errors in aircraft captions from the Spring 1988 issue. On page 10 we identified the aircraft as Yak fighters when in fact they are Ilyushin IL-10s. On page 52 we identified a Sopwith Pup as a Sopwith Camel. Our thanks to these readers for correcting us.

TAKING OFF THE BLINDERS

The last paragraph of your editorial ("Blinders, Too, Are Made of Leather," Spring 1988) speaks to "dual-tracking" only in passing as "another discussion." This is not another discussion. This is the crux—not specialist versus leader. You are addressing only the tip of the personnel pyramid, but these aren't the people leaving. The people at the base of the pyramid are leaving. And they don't aspire, to broader leadership. They want to fly.

Lt Col J. Karn, USAF
Maxwell AFB, Alabama

In the current issue you ask for comments. I have some regarding your editorial.

I am disappointed. You began the *Journal* with some thoughts of freedom and professionalism. I thought I saw promises of great things ahead and some indication that conjecture and intelligent disagreement would be welcome and published. But now you "down" those pilots who disagree with "the way things are."

Your editorial in the current issue does you no service. You offer no solutions to what has been a significant problem for years. You seem to say in your final paragraph, "Like it or leave!" My impression is that you feel there's a moral or intelligence lapse if a pilot doesn't want to do things other than fly. You downgrade a great many strongly motivated people with your party-line text.

Why can't the Air Force accept the fact that many pilots and navigators want only to fly. They want only to be the best damned airmen in the air! They don't want to be chief of staff or even wing commander. Why can't the Air Force recognize this and create a means by which these capable people could be used for long careers without doing anything but fly?

They could be military people without being commissioned or without being enlisted through creation of a new class of military members. These would be aircrew members who would be able to be paid increasingly more money, without added rank or grade, as they acquired and demonstrated more essential air-fighting/air-support skills. Some outlet for commissioning could be provided for those few who, after some years of experience, decide they really would like to be military officers vice military aircrew members.

Obviously, a problem exists or we wouldn't see all the comments of concern from top-level military people, high-level appointed officials, and members of Congress.

While I have not been personally involved in the problem, having retired many years back, I have been involved in some studies of the problem. I know from surveys that aircrew personnel have for these many years complained about added duties, PME, getting a master's degree, serving in staff positions, absence of personal input to assignment decisions, and so forth. Yet, over these years the standard Air Force response has been cosmetic and downplaying. The foolish idea of the leather jacket as an incentive for aircrew members to stay in service is clear evidence of a failure to understand the problem and to work to solve it.

Your editorial in the senior Air Force military journal does nothing to help. Had I known you were going to address this problem, I would have expected you to rationally outline the problem and perhaps offer some solutions. Instead, you

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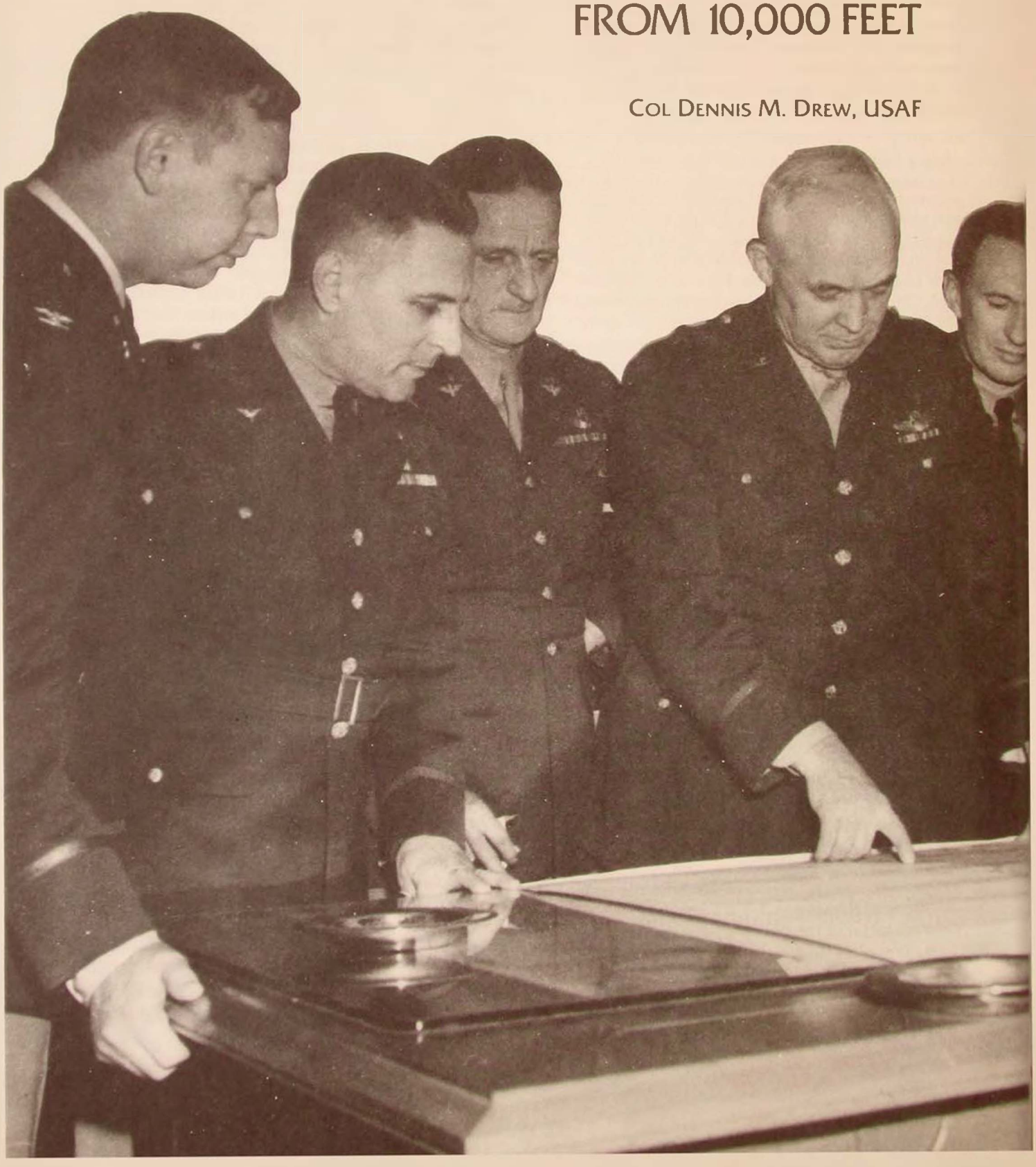
JOINT OPERATIONS

THE WORLD LOOKS DIFFERENT FROM 10,000 FEET

COL DENNIS M. DREW, USAF



BUZZWORDS are an occupational hazard in the military. But the latest buzzword—*jointness*—is more than just the newest fashion soon to be of interest only to military lexicographers. Rather, jointness signifies the realization that in modern warfare there are no such things as discrete air, land, and sea wars. The notion of jointness represents the historical truth that neither air power nor land power nor sea power wins wars by itself. The widespread adoption of joint themes and attitudes provides hope that we realize that how we employ our force structure is at least as important as the force structure itself. It also provides hope (faint as it may be) that we realize service parochialism is both anachronistic and dangerous.

We must temper our euphoria, however. Even if the millennium arrives and service parochialism disappears, there will remain significant barriers to true jointness in our military operations. These problems stem from fundamentally different worldviews held by soldiers, sailors, and airmen, creating honest differences over how warfare should be conducted. Rather than parochial differences, these divergent views are natural phenomena.

True jointness—in spirit and in fact—can come about only after we understand our different worldviews and their consequences. With that understanding, it may be possible to build effective joint doctrine—a joint "theory of victory" that amalgamates different worldviews and applies them appropriately to various kinds of armed conflicts.* Attempting to devise joint doctrine before soldiers, sailors, and airmen understand themselves and each other may be an exercise in futility.

It is particularly important that airmen understand the sources and nature of their own worldview and how it contrasts with those held by soldiers and sailors. Air power, the most recent addition to military arsenals, is almost always poorly understood (even by airmen) because it is so new, and it has the least amount of evidence to buttress its claim to validity. As a result, airmen tend to be at a disadvantage in any joint doctrinal arena. The world does look different from 10,000 feet, but is the perspective from on high better or simply different?

*Credit for defining doctrine as a "theory of victory" goes to Larry E. Cable in *Conflict of Myths: The Development of American Counterinsurgency Doctrine and the Vietnam War* (New York: New York University Press, 1986).

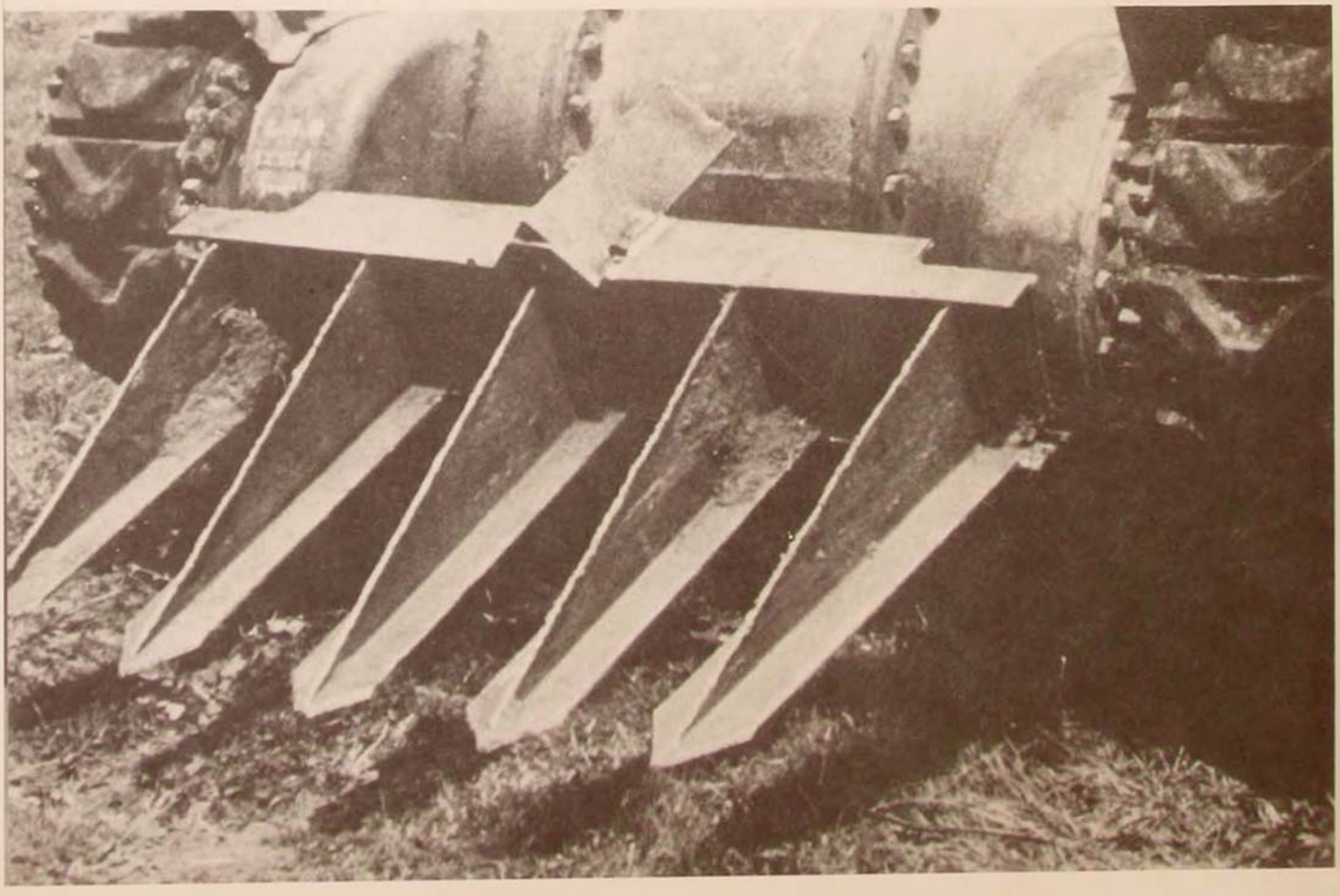
Worldviews Defined

The nature of a military force determines its doctrinal worldview. The discussion that follows is certainly oversimplified but remains instructive.[1]

A Soldier's View

Armies are confined and constrained by the harsh realities of geography that limit their speed and maneuverability. Moreover, in war their central problem is often immediate because the enemy is right in front of them. As a result, the soldier's worldview is sharply constrained, often limited to the immediate problem. Two examples illustrate the point. It is now clear that the commanders of the cross-channel invasion of Western Europe in June 1944 were more worried about the initial lodgement on the shores of

The Army perspective. Soldiers accustomed to land warfare can be more concerned with immediate problems than with the long-range view. Because World War II commanders were determined to find a good invasion point, they selected Normandy despite the hedgerow country directly behind it (above).

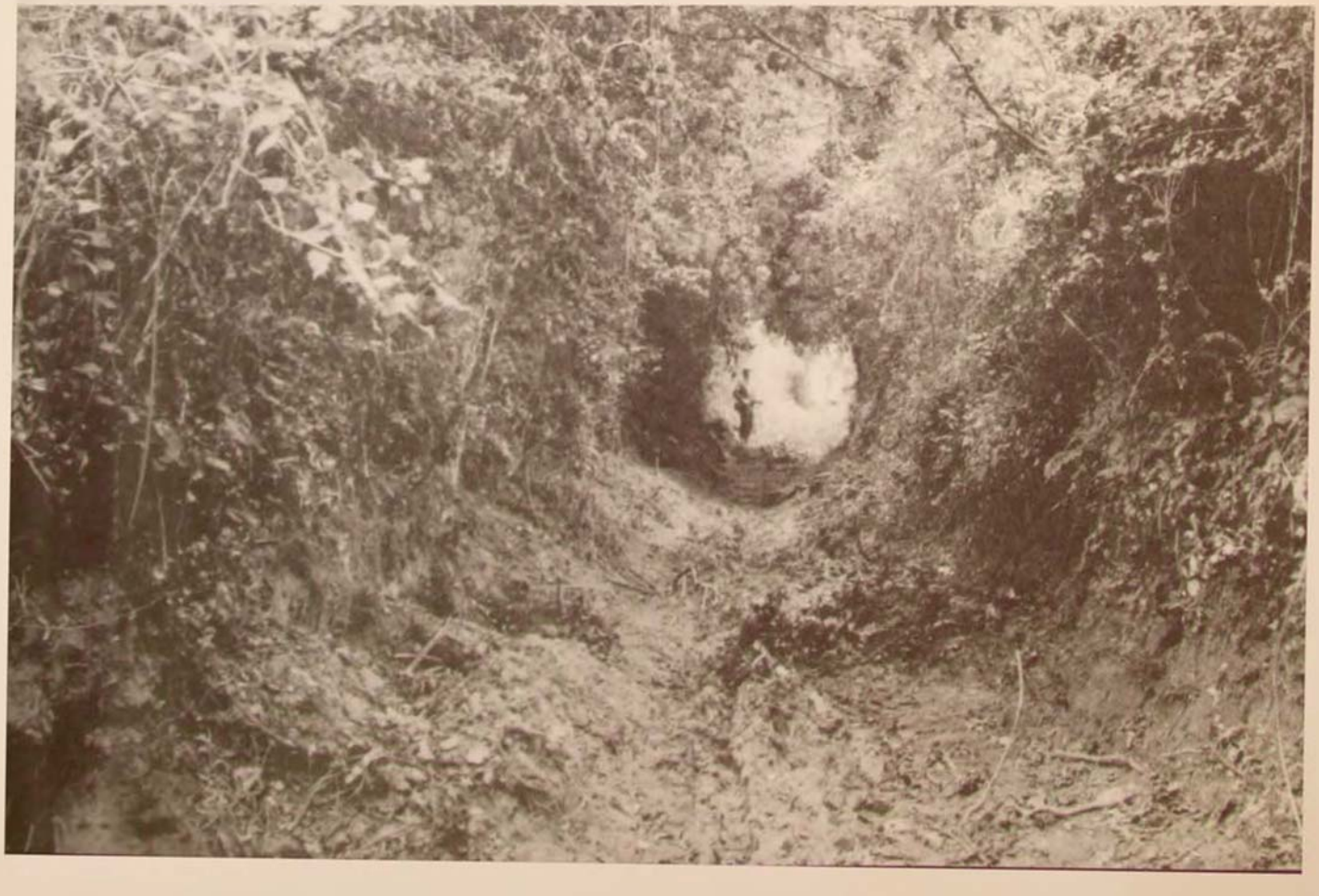


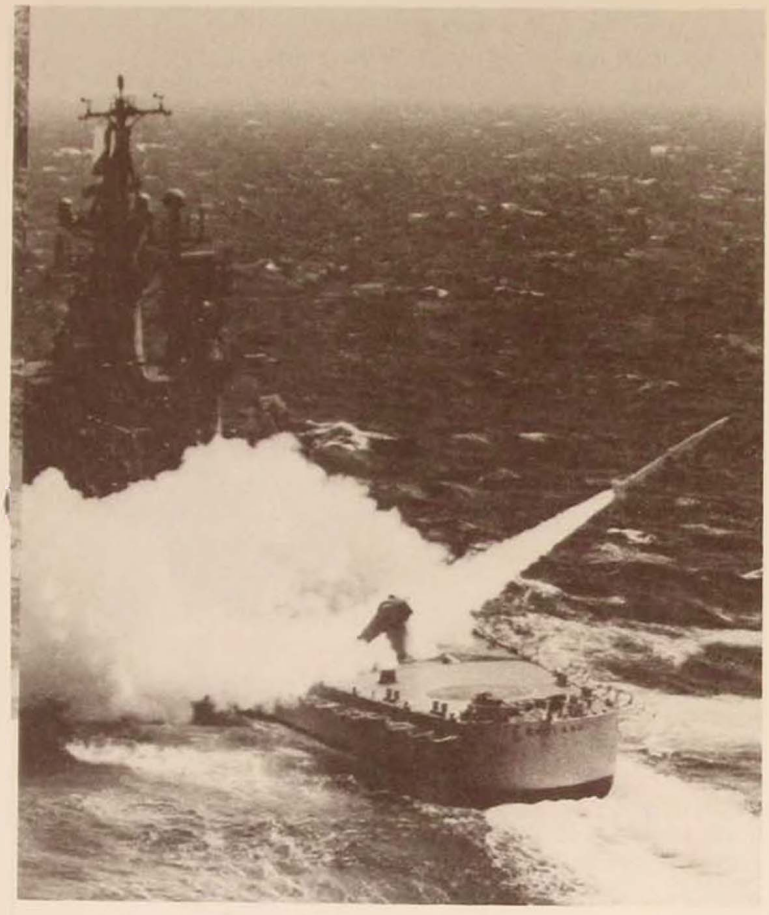
France than about the subsequent breakout from that lodgement and offensive drive toward Germany. Although the Normandy beaches offered favorable conditions for the amphibious assault and subsequent force buildup, the hedgerow country behind the beaches was just about the worst imaginable terrain for subsequent breakout operations—a fact illustrated in the bloody yard-by-yard struggle that ensued from the landings on 6 June until the breakout at Saint-Lô on 25 July. In short, planners and commanders of the Overlord operation (a group dominated by ground soldiers) were worried more about the immediate landing problem than about the problems of subsequent operations.[2]

A second example is much more recent and involves US Army doctrine. In the mid- and late 1970s, Army operations doctrine was based on the concept of "winning the first battle," a focus centered on the immediate problem facing ground commanders in the field.[3] The doctrine clearly had the unstated purpose of meeting the Warsaw Pact threat in Western Europe and assumed that early defeats would persuade the Pact to reevaluate aggressive intentions.

Although the midseventies version of Army doctrine reflected the traditional soldier's worldview, more recent Army doctrine is much less constrained. Hailed as a revolution in Army thinking, so-called AirLand Battle doctrine emphasizes "looking deep" behind enemy lines and attacking Soviet follow-on forces before they can influence events on the front lines.[4] Although much less constrained than previous Army doctrine, the AirLand Battle concept still focuses on the immediate and near-term time frames and the proximate geography of the campaign area.

The hedgerows were so thick that special hedgerow cutters (opposite page) had to be installed on the tanks to cut pathways for troops (below).





The Navy perspective. The Navy tends to see warfare in terms of force projection (immediately below) and sea control (below). Modern weapons (left) keep opposing naval forces beyond visual range, thereby broadening the Navy's view of warfare.

A Sailor's View

The sailor's worldview is much less constrained than that of the soldier, a phenomenon originating in the nature of the environment in which naval forces operate. Naval forces are constrained only by the shorelines of the great oceans, a constraint now somewhat mitigated by the range of naval air power. Rather than contending with mountains, rivers, forests, and a myriad of other terrain features, naval forces have an almost unrestricted ability to maneuver on a featureless battlefield that covers most of the planet's surface. Moreover, the problems naval forces face are often less immediate; that is, the enemy's navy is rarely in the immediate vicinity opposing every movement. Historically, a major naval problem has been to seek out and find the enemy fleet so it could be engaged in battle, a luxury rarely enjoyed by ground forces.[5]

The global reach and concerns of naval forces provide seamen with a very broad worldview. In conflict, sailors think less about battle (except when directly engaged) and more about the war as a whole. This viewpoint is reinforced by the nature of naval forces. Sailors are the stewards of extremely expensive warfighting assets, assets so expensive they can be regarded only as national assets rather than just weapons or weapon systems. Capital ships represent enormous investments and require a great deal of time to produce. At the same time, they can be lost in a matter of seconds. The consequences of this situation were well summed up in Winston Churchill's statement about Adm John R. Jellicoe at the battle of Jutland in World War I. Churchill observed that when Jellicoe took the British battle fleet to sea on 31 May 1916 to meet the German high seas fleet, he could have lost the war in a single afternoon.[6]

Although the naval worldview is less constrained when compared with that of ground forces, it remains limited because naval forces are constrained. The world's shorelines define limits beyond which ships simply cannot sail. Unlike the broad oceans, narrow waters and sea-lane chokepoints also constrain naval forces. Thus it is that the great naval powers have sought control of vital chokepoints such as the Strait of Malacca, Gibraltar, the Dardanelles, and more recently the Strait of Hormuz. Further, there has always been a question of the extent to which naval power can influence the course of a continental war, particularly one fought in the central portions of the Eurasian landmass. Although the advent of naval air power has mitigated this question to some degree, it remains unanswered, as evidenced by the ongoing debate over the US Navy's so-called maritime strategy.

An Airman's View

Airmen do not face the same geographic limitations as those encountered by either soldiers or sailors. The worldview of airmen has been limited only by the capabilities of their equipment and has expanded, over time, as capabilities have expanded. Additionally, in the global expanse in which air power operates, enemy forces are often even more distant than enemy forces on the high seas. On the other hand, the closing speeds that opposing air forces achieve can make the airman's problem nearly as immediate as the soldier's problem.

The result of this situation is a global but time-sensitive worldview. This perception, in turn, has traditionally led airmen to think not only in terms of war rather than in terms of specific battles (similar to the sailor) but also in terms of immediate effects (similar to the soldier). Thus we find much of the developmental work in air power doctrine during the 1930s concentrating on the use of air power to win wars quickly by striking hard at what airmen called the enemy's "vital centers," targets that land and sea forces could not strike directly.[7]

Airmen also use assets that fall in the middle ground between the national assets used by naval forces and lesser assets used by ground forces. Aircraft (even relatively primitive aircraft) are very expensive and thus scarce resources compared to tanks, artillery pieces, and rifles. However, aircraft pale in comparison to a navy's capital ships.

Although aircraft are more time consuming to produce than are the tools of a soldier's trade, it takes far more time to produce a ship of the line. Further, although air power has proven invaluable in direct support of surface forces in battle, the advent of nuclear weapons makes air power capable of winning or losing a war in an afternoon (at least as we envision nuclear war).

Center of Gravity Conflicts

Differing worldviews naturally lead to differences of opinion between soldiers, sailors, and airmen over an enemy's "center of gravity." The center of gravity is a Clausewitzian notion of the critical element or elements of a nation's warmaking power upon which everything else depends.[8] One could refer to it as the key to victory. Air power pioneers such as Gen Billy Mitchell used the term *vital centers*.[9] In the modern informal vernacular, the center of gravity might be called the "golden screw" that holds everything together for the enemy.

Joint operations and joint doctrine founder on the differing views of an enemy's center of gravity. How wars are waged and campaigns conducted depends ultimately on one's view of this critical element, for the ultimate aim of strategy is to attack the enemy's center of gravity and thus destroy his capability to wage war.

Soldiers tend to take a very traditional view that the enemy's army itself is the center of gravity. Soldiers hold the view, sometimes referred to as the Continental school of thought, that lasting victory can be achieved only by defeating and destroying the enemy's armed forces, occupying his territory, and controlling his population. In short, the immediate problem for the soldier—the enemy army—is also the ultimate problem and the source of the enemy's ability to resist.

The Air Force perspective. Airmen tend to concentrate on "vital centers." Air power uses weapons capable of causing devastating damage. This destruction can affect a nation's ability to wage war—a result of the bombing of Wesel, Germany (left)—or it can support more limited objectives like the assault on Saint-Lô, France (below).

Sailors tend to look beyond the deployed forces of the enemy. Although control of the seas requires the neutralization of the enemy's fleet, this action is an intermediate objective rather than the ultimate objective. Control of the high seas and narrow chokepoints allows naval forces to disrupt an enemy's foreign trade, cripple his economy, blockade his ports, and thus destroy the economic basis of his power to wage war. Further, control of the seas allows one to project power ashore and thus control events there. In short, the naval worldview regards warfare more in terms of an economic struggle while realizing that hard combat at sea and ashore may be required to bring the enemy to heel.

Airmen, at least in the United States and Great Britain, have taken the broadest and most abstract view of warfare. Airmen have traditionally regarded deployed armies and navies as manifestations of an enemy's strength rather than the source of strength. To traditional airmen, the real source of enemy strength is found in the enemy's industrial capability to produce the wherewithal of modern warfare. If this industrial capacity is destroyed, according to airmen, the enemy's ability to resist militarily will collapse. Unlike armies that must fight their way through enemy armies to the source of the adversary's power and navies that attack the enemy's economic power indirectly with slow pressure, air power can attack the critical element quickly and directly. Or so the airmen postulate. One pioneer philosopher of air power, the Italian Giulio Douhet, even speculated that armies and navies would become passé.[10]

Both soldiers and sailors have a considerable historical basis for their theories of victory. Air power, however, has a short and checkered history, and thus airmen have less empirical evidence upon which to base their doctrinal beliefs. Worse, the history of air power, particularly in the United States, is rife with unfulfilled promises made by airmen who saw the potential of air power but were unable to fulfill that potential. Thus, it is worth discussing just how the air power theory of victory evolved in this country.

The Development of Air Power Doctrine

Air power is a product of the machine age. As men first learned to fly in heavier-than-air powered craft, war was rapidly becoming mechanized. World War I revealed the extent to which industrial capacity is essential to military capability. Tanks, battleships, submarines, trucks, and airplanes could not be produced by cottage industry nor could the billions of artillery shells and bullets used by the massive armies on both sides from 1914 to 1918. In many respects, World War I illustrated that war had become a battle of factories, a contest of industrial production.

Airmen will admit (if pressed hard enough) that air power did not play a decisive role in World War I. The war had more effect on air power, given the rapid changes in aircraft and their use during the conflict, than air power had on the war. However, even with the relatively primitive aircraft available during that war, airmen realized that the view from aloft was qualitatively different from the view on the ground.

From high above the earth's surface, it was clear that with the proper equipment air power could be used strategically (and independently) to strike the enemy's sources of production, targets later codified by Billy Mitchell as the enemy's vital centers. It was also clear that air power could strike at the enemy's supplies and replacements on their way to the front lines long before they could influence the course of battle on the ground. The deeper behind enemy lines these interdiction strikes were made the better, for targets were more concentrated, and the effect at the front was all the more comprehensive.

In essence, the view from 10,000 feet revealed far more options for airmen than were available to soldiers. Although the army was limited by terrain and the enemy

force deployed to its front, air power could strike almost anywhere, limited only by the available technology and often inadequate air defenses. But options had to be chosen carefully because aircraft and trained crews were scarce resources compared to the kinds of equipment and skills used by surface forces.

At the heart of the conflict between soldiers and airmen is the matter of options and the priorities assigned to those options. Soldiers focus on the immediate problem—the enemy army. They fear that air assets will be wasted on targets that have little impact on this problem. Further, soldiers worry that even if the airmen are correct about the enemy's center of gravity, quick enemy success on the ground will present airmen with a fait accompli. Airmen believe precious air assets can more profitably be used to strike deep behind the enemy army at the source of its power. In essence, airmen fear that diverting valuable air assets to the army's immediate problem of winning a battle will squander air power's ability to strike more valuable targets that could win the war.

These sorts of almost irreconcilable differences were at the heart of the argument for an independent air force. They remain as the foundation for the central tenet of US air power doctrine (first expressed in the 1943 version of Army Field Manual 100–20, the so-called Magna Charta of American air power) that air power must be centrally controlled by an airman.

Is the View Better from 10,000 Feet?

Soldiers, sailors, and airmen each believe they have an accurate view of the world and thus adhere strongly to the warfighting doctrines that eventuate from those views. Airmen, as mentioned earlier, have the least amount of empirical evidence to buttress their case. Whereas soldiers and sailors can point to an enormous store of experience over the centuries, airmen must content themselves with somewhat conflicting evidence limited to the twentieth century. It is clear, for example, that in World War II strategic bombardment of German and Japanese vital centers was a decisive factor in the Allied victory. It is also true that even though airmen would like to take the credit for the triumph, much hard fighting on land and at sea was required for Allied forces to prevail in both theaters. On the other hand, it is nearly impossible for soldiers and sailors to deny the importance of strategic bombing and air interdiction efforts in defeating Germany and Japan.[11]

Following World War II, air power's true believers maintained that air power had not been *the* decisive weapon because of inadequate equipment and diversions of air effort away from strategic attacks in order to support ground and naval operations. Moreover, the advent of nuclear weapons and intercontinental bombers to deliver them promised to fulfill the prophesies of the pioneer air power advocates.[12] However, the political realities of war in the nuclear era (so-called limited war) and warfare in third world countries that have almost no strategic targets have now tempered the claims for air power's decisiveness.

What has emerged from our experience is the lesson that, although very different, the view from 10,000 feet is not necessarily any better than the view from ground level or sea level. Much depends upon the circumstances of the conflict at hand. It is also clear that in almost every case land, sea, and air forces can act synergistically—in fact, must act synergistically—to achieve victory. The evidence that service parochialism is anachronistic and dangerous keeps mounting, giving rise to the long overdue emphasis on jointness. Unfortunately, the basic barriers to jointness—divergent worldviews—remain. How then do we achieve jointness in spirit and in fact?

Achieving Jointness

Almost any impartial observer will admit that the US military has not done well in

achieving jointness. True, there is a significant record of successes in certain joint operations. But it would not be inaccurate to say that these successes have been achieved in spite of differing worldviews rather than because of an integration or convergence of worldviews. The parochial battles between the services have been both legion and legendary, ranging from Billy Mitchell's fight with the Army in the 1920s through the so-called revolt of the admirals in the late 1940s and the convoluted command arrangements in Southeast Asia in the 1960s and 1970s to the continuing budget battles and competing strategies of the 1980s. Within the last decade, agreements at the highest service levels to work closely on certain issues have been hailed as significant breakthroughs toward jointness but in reality offer embarrassing evidence of past shortcomings.

The most recent wrinkle is the drive to produce joint doctrine, a movement that is long overdue and at the same time sadly premature. It is overdue for reasons made obvious in this article. It is premature because there is little evidence that even those on joint staffs fully understand and appreciate the different worldviews held by the various services, much less their consequences. It is particularly premature for the Air Force because our own doctrine is in such a muddle there is some doubt we can adequately articulate and defend the basic tenets of air power.[13]

Successful jointness and joint doctrine will come about only when soldiers, sailors, and airmen understand and appreciate the sources and implications of their own views and the views of their counterparts. Only after such understanding is achieved is there any real hope of synthesizing these views into rational joint theories of victory, theories that will differ depending upon the circumstances of the conflict in question.

The need to achieve this understanding places a double burden upon anyone who aspires to senior staff and leadership positions in the military. Not only must the individual learn all there is to learn about the art of warfare as waged in the air or on the ground or at sea, but also the individual must endeavor to "get inside the heads" of his brothers-in-arms from the other services. How can this be done?

One obvious solution is to continue ongoing programs of exchange duty assignments and professional military education exchanges at sister service schools. Although profitable, these programs affect only a few fortunate officers.

A second option is to tailor the curricula at the services' professional military education institutions to attack the problem. This option has three implications. First, subjects dealing with the art of warfare would receive greater emphasis, a change that would deemphasize other subject matter unless the limited available time is increased. Second, within the revised curricula more attention must be given to the combat history and doctrine of the sister services and to how the services can and must act in concert. Third, school faculties must have a greater representation from sister services to construct and present revised curricula.

Although professional military education seems to be a convenient and bureaucratically tidy solution to the problem, it is an incomplete solution. In the final analysis, the responsibility of military professionals to understand their profession is a personal matter. There are only two ways to learn about warfare. One is to experience war firsthand. Fortunately, the American military has not had to face such experiences too frequently. Moreover, personal experience is just that, personal, and thus almost always narrow, limited, biased, and without analysis.[14] The second way to learn about war is through vicarious experience, that is, the study of military history. It is no accident that many of the "great captains" of military history were also avid students of the subject.

With these proposals in mind, it appears prudent for the services to devise programs to facilitate and encourage the personal study of military history among their officer

corps. Such programs might include well-thought-out recommended reading lists, graduated by depth and breadth of analysis, building one upon another to provide over a period of years a comprehensive study of military history; easy access to all recommended readings through specially stocked collections at installation libraries; a shift in installation-level off-duty courses of study toward degree-granting programs in fields dealing with national security and military affairs; and a system of rewards for officers who study fundamentals of their profession. This last point, appropriate rewards, may be the most important because motivation will be a problem.

The Hidden Payoffs

The most obvious benefit of programs emphasizing the art of war rather than service-peculiar subjects is broader understanding that will increase our ability to produce viable joint doctrine, improve our ability to operate successfully in the joint arena, and help to eliminate service parochialism. With luck, we might even produce another great captain. But there are also hidden payoffs.

Officers who study military history will find there is little that is new under the sun, at least conceptually, and may well find in the musty corners of the past useful insights about contemporary military problems. Perceptive students will also find that their brothers-in-arms from other services face most of the same kinds of problems both in peace and in war.

Perhaps most important, the student of military history will find that there is little variation in warfare, whether on land, at sea, or in the air. For example, many classical naval maneuvers have their conceptual counterparts in the classical maneuvers of ground forces and the basic missions of air power.[15] It will be disturbing and enlightening to airmen when their studies demonstrate that the only unique characteristic of air power is elevation above the earth's surface—all other characteristics (speed, range, flexibility, etc.) are different only in a relative sense. Finally, it will become obvious to the student of military history that soldiers, sailors, and airmen have much to learn from each other. □

Notes

1. For a more complete exposition on differing worldviews, see John M. Collins, *Grand Strategy* (Annapolis: Naval Institute Press, 1973).

2. Russell Weigley makes this point with considerable vigor: "By concentrating almost all their planning effort on the assault and the immediately following buildup, the planners neglected a maze of troubles awaiting behind the French shore. The greatest trials of OVERLORD . . . were to appear when the invaders plunged inland . . . in the region of Normandy called the Bocage." Russell F. Weigley, *Eisenhower's Lieutenants* (Bloomington: Indiana University Press, 1981), 35.

3. US Army Field Manual 100–5, *Operations*, 1 July 1976.

4. Ibid., 20 August 1982. In particular, see chapter 7. Also see the 5 May 1986 edition of the same manual, particularly chapter 2.

5. The best layman's guide to naval views and strategy remains Bernard Brodie's *A Guide to Naval Strategy* (New York: Praeger, 1965).

6. As quoted in Geoffrey Bennett, *The Battle of Jutland* (London: David and Charles, Ltd., 1980), 41–42.

7. For a somewhat expanded and documented discussion of the development of air power doctrine, see the author's *Cadre Paper* entitled "Rolling Thunder 1965: Anatomy of a Failure" (Maxwell AFB, Ala.: Air University Press, October 1986), 14–27.

8. Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1976), 595–96.

9. See especially his testimony before Congress shortly after his court-martial and resignation. This testimony is quoted, in part, in Robert F. Futrell, *Ideas, Concepts, Doctrine: A History of Basic Thinking in the United States Air Force 1907–1967* (Maxwell AFB, Ala.: Air University, 1971), 28.

10. Giulio Douhet, *The Command of the Air*, new imprint (Washington, D.C.: Office of Air Force History, 1983), 1–33.

11. The best evidence of strategic bombing results is found in the United States Strategic Bombing Survey. A new imprint of the summary volumes is now available. *The United States Strategic Bombing Survey: Summary Reports*, new imprint (Maxwell AFB, Ala.: Air University Press, 1987).

12. In 1957, for example, Secretary of Defense Charles Wilson told the Congress, "There is very little money in the budget

. . . for the procurement of so-called conventional weapons . . . [because] we are depending on atomic weapons for the defense of the nation." Quoted in Futrell, 232.

13. For an expanded discussion of the Air Force doctrine problem, see the author's article "Two Decades in the Air Power Wilderness," *Air University Review*, September–October 1986, 2–13.

14. Frederick the Great believed that experience was of little value to the military leader unless the experience was examined and analyzed: "A mule who has carried a pack for ten campaigns under Prince Eugene will be no better a tactician for it. . . ." Jay Luvaas, ed. and trans., *Frederick the Great on the Art of War* (New York: The Free Press, 1966), 47.

15. A superior short essay with illustrations on the classical maneuvers of ground warfare can be found in David G. Chandler's *Atlas of Military Strategy* (New York: The Free Press, 1980), 12–13. When compared with descriptions of the tactics used in naval fleet actions (e.g., Nelson at Trafalgar) and the descriptions of the missions of tactical air power (e.g., close support, interdiction, etc.), the conceptual similarities are striking.

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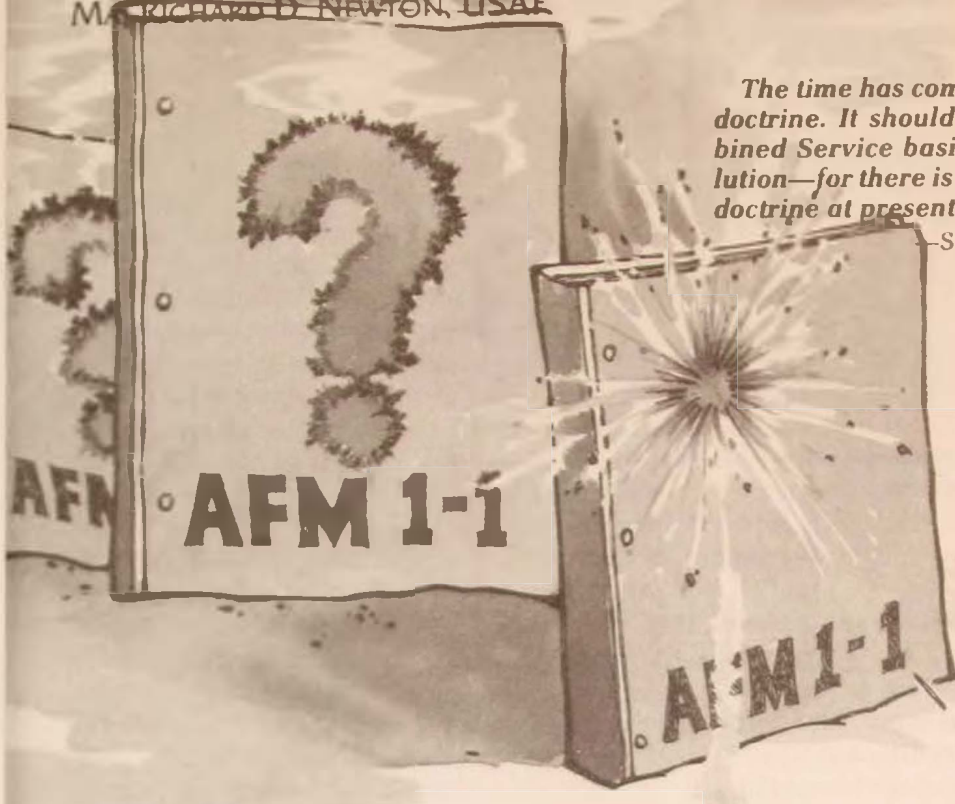
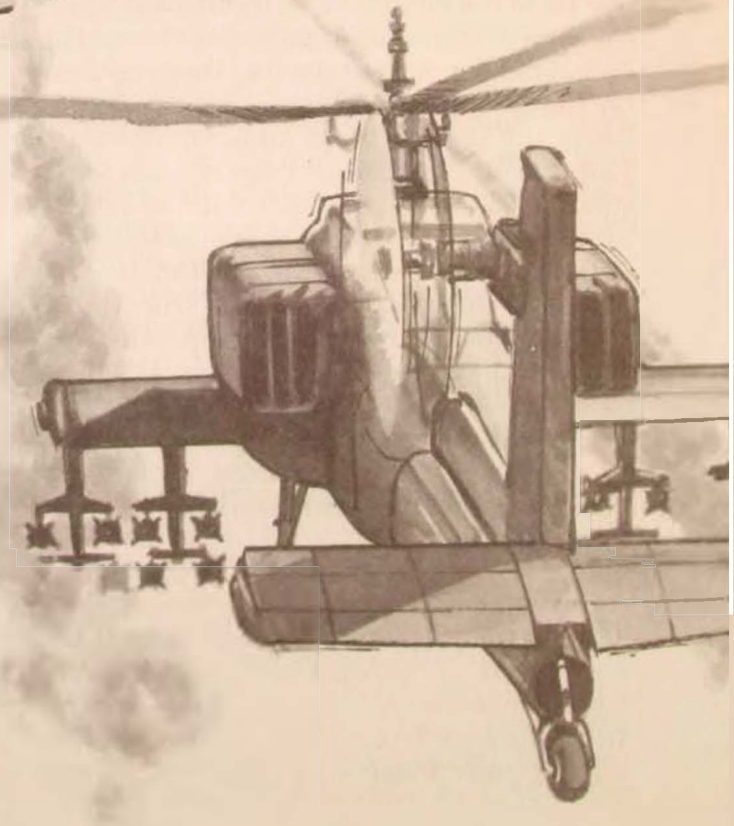
A QUESTION OF DOCTRINE?

MAJ RICHARD D. NEWTON, USAF



The time has come for a fresh revision of the doctrine. It should be undertaken on a Combined Service basis, to produce an agreed solution—for there is a dangerous discordance of doctrine at present.

—Sir Basil H. Liddell Hart, *Strategy*



QUITE a bit has been written lately concerning air-to-air combat between helicopters. The theme common to these writings suggests that the US Air Force is ignoring or avoiding the responsibility for this counter-air mission. Given the history of Air Force protectionism with regard to issues involving roles and missions, its lack of operational participation in the air-to-air helicopter business seems surprising. This author believes the Air Force has a doctrinal obligation to address this latest change in the character of aerial warfare. It is no longer feasible for the Air Force to concentrate exclusively on the high-altitude, fixed-wing aspect of the air-to-air problem. The air-to-air environment has expanded into the realm of the low and slow movers, es-

pecially in the forward battle area. The Air Force appears unwilling to adapt its doctrine, training, and equipment so that it can enter into this new type of aerial combat.

Department of Defense (DOD) Directive 5100.1, *Functions of the Department of Defense and Its Major Components*, assigns counterair operations to the Air Force as one of its primary missions. Air Force Manual (AFM) 1–1, *Basic Aerospace Doctrine of the USAF*, expands upon the DOD directive by explaining how the Air Force views its role and intends to accomplish its assigned primary missions. Air-to-air combat (one aspect of counterair) is one of those assigned missions.[1] The growing threat to traditional Army helicopter missions—aerial fire support and combat assault—from a new generation of Soviet helicopters specifically designed for air-to-air combat is forcing Army aviation to enter the counterair mission area.[2]

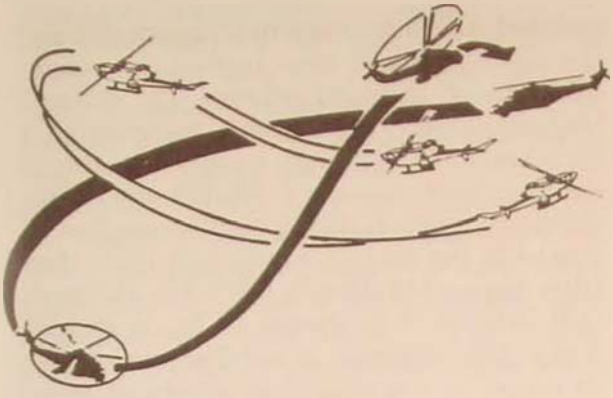
AFM 1–1 further states that the reason we fight the counterair battle is to protect friendly forces, ensure freedom to use the aerospace environment, and deny the use of the air to the enemy.[3] Our traditional ties to the Army have caused us to devote considerable resources to protecting those soldiers on the ground from enemy air threats. As too many good ground commanders have found, control of the air does not guarantee success, but failure to control it makes winning awfully difficult. Air Chief Marshal Sir Arthur Tedder once said, "The outstanding lesson of the late war [World War II] was that air superiority is the prerequisite to all war winning operations, whether at sea, on land, or in the air."[4]

When the Army began duplicating the Air Force's capabilities in close air support (CAS) and tactical airlift early in the Vietnam War, the Air Force did in fact defend its assigned missions. The Johnson-McConnell Agreement of the midsixties attempted to sort out the problem. However, the solution was based on equipment rather than assigned roles and missions. In general terms, the Johnson-McConnell Agreement assigned most fixed-wing close air support and tactical airlift missions and equipment to the Air Force, while nearly all responsibility for rotary-wing aerial fire support and assault airlift went to the Army.[5]

Are we paying for the shortsightedness of the Johnson-McConnell Agreement today? At the time, dividing responsibility for equipment was an easy, though perhaps not the best, solution. Helicopters, until the recent past, were simply an enhancement of Army fire support mobility—like trucks or artillery but capable of limited forays into the air. However, that was before the advent of air-to-air helicopter combat. Few people foresaw the changes in helicopter combat capability that are occurring today. As technology changes the character of aerial warfare, doctrine becomes less clear, and the solutions from 20 years ago do not work as well as they once did.

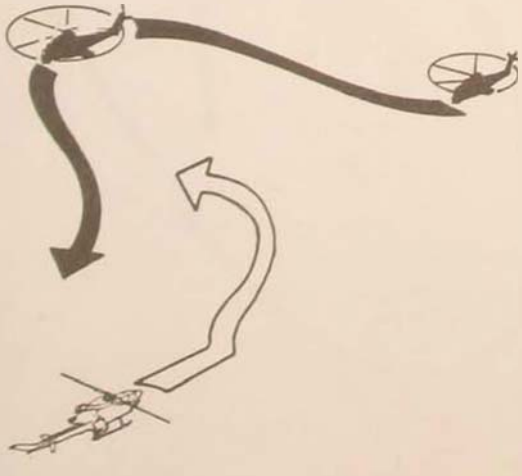
Doctrine is a continually evolving entity. According to AFM 1–1, "Doctrine . . . applied rigidly and inflexibly has often degenerated into dogma and consequently failed."[6] The purpose of doctrine is to provide basic guidelines for the employment of forces—in our case, aerospace forces. Likewise, it also directs us as we organize, train, and equip aerospace forces. Army doctrine and operational thought appear to be changing to meet the new threat to Army aviation and ground forces. It appears that Air Force doctrine is stagnating as it avoids change to its traditional fixed-wing missions. This type of attitude kept the horse cavalry as a combat arm during the interwar years and into World War II. It is frightening to think that the Air Force might be going the way of the horse cavalry by failing to adapt to new technology.

As we've said, the Air Force's basic doctrine states that the "goal in air warfare is to gain freedom of action in the air environment."[7] "The most precious thing an air force can provide to an army," said Gen William Momyer, "is air superiority, since this gives the ground commander the ability to carry out his plan of action without interference from an enemy air force."[8] If Soviet technological advances are denying the



Countermaneuver to the high yo-yo

Army freedom in the air just above the battlefield, is it not the Air Force's responsibility to counter this new aerospace threat? If one believes that the purpose for tactical air forces is to provide ground troops the freedom from aerial interference so that they can take and hold ground, then the answer has to be yes, even in the face of shrinking budgets. Gen Carl "Tooey" Spaatz promised General Eisenhower in 1946 that the Air Force would "maintain a Tactical Air Command to supply the Army's air power needs."[9] General Spaatz also told Lt Gen Elwood "Pete" Quesada, the first commander of Tactical Air Command, "that he had made this promise and he didn't want to be let down by a half-assed implementation of it."[10]



Countermaneuver to the pitch-back attack

Since 1947 the Army has generally relied on the Air Force to provide its air-to-air protection. We now face a new threat to Army ground-attack helicopters in the form of Soviet air-to-air helicopters. The Army believes the best way to counter these helicopters designed specifically for air-to-air combat is with another helicopter.[11] Army aviators developing helicopter air-to-air doctrine and employment tactics at the Army Aviation Center at Fort Rucker, Alabama, believe that present-day fighters are only marginally competitive against an air-to-air helicopter.[12] It seems that the Office of the Secretary of Defense agrees with this assessment, having directed the Army to fund an air-to-air capability for ground-attack helicopters in its fiscal year 1990 Program Objective Memorandum.[13] Those Army assets must now delay their primary role of "tank-busting" and concentrate on the defensive counterair mission (until now an Air Force mission) in order to gain the air superiority they need before they can kill tanks.

Countermaneuver to the horizontal scissors

Will the Army have to relearn and is the Air Force ignoring what we both learned the hard way during the 1942 North African campaigns, specifically, that air assets are best employed when controlled by a centralized air commander? After the invasion of North Africa, air forces were attached to and controlled by the ground-force commanders. These ground commanders used "their" airplanes primarily for CAS before

Counter-countermaneuver to the horizontal scissors

obtaining air superiority. Consequently, German fighters were able to concentrate on the small formations of American air defenders maintaining "umbrellas" over the ground forces and effectively remove any ability to provide either CAS or air defense for the troops.[14]

Although he has the best of intentions, the ground commander can be expected to keep control of his assigned air assets and apply them to the mission he understands best—fighting the land battle. Part of the reasoning used to justify our separation from the Army was the belief that an air commander centrally controlling air forces can exploit the inherent flexibility and mobility of aircraft to maximize combat power. We found in North Africa that the ground commander, with a small number of aircraft assigned to him, was unable to capitalize on the full potential of air power. Army helicopters belonging to the ground commander are likely to be similarly misused during today's air battle, as were our P-40s in North Africa in 1942.

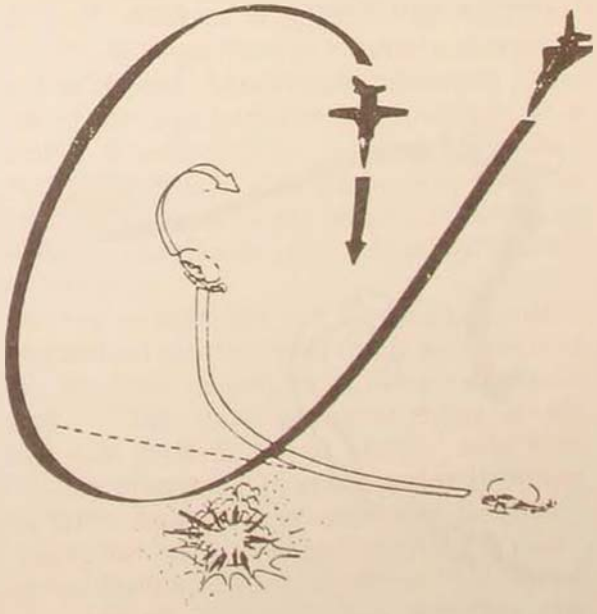
Effective doctrine must constantly evolve in order to meet the ongoing challenges confronting a nation. Gen Henry H. "Hap" Arnold once observed that

> national safety would be endangered by an Air Force whose doctrines and techniques are tied solely on the equipment and process of the moment. Present equipment is but a step in progress, and any Air Force which does not keep its doctrine ahead of its equipment, and its vision far into the future, can only delude the nation into a false sense of security.[15]

We can infer from both General Arnold's comment and our past history that if we are saddled with a doctrine that cannot change, the Air Force will have to face the consequences of shortsightedness. Dr Richard Hallion recently stated that "doctrine must function in the present, be appropriate for the near term, possess flexibility and adaptability to meet changing conditions, and be rooted in the past."[16] Present air-to-air doctrine seems too deeply rooted in the past, still fighting Bolo Sweep or living in MiG Alley. Our doctrine is not flexible enough to adapt to the changing nature of aerial warfare.

To be fair, however, one must consider the limitations placed upon the Air Force's ability to meet the new challenge. Doctrine in a pristine sense—free from such constraints as economy, geography, or national policy—has the luxury of being absolute. In other words, it can afford to be idealistic in its outlook. Doctrine in a pragmatic sense, though, is shaped by the same forces that mold national character—it cannot be divorced from economic or political realities.

Equipping and training aerospace forces to fight the high-and-fast air battle is an enormous drain on the total defense budget. Recently announced force structure adjustments designed to meet congressionally



Maneuver against a vertical attack by a fighter

mandated budget reductions attest to the fact that there are not enough dollars to cover all our needs.[17] Although the Air Force leadership is forced to make hard decisions, perhaps they have put too many "eggs" into the high-and-fast "basket." Because war is very much a combined arms effort, sharing the counterair mission with Army helicopters is probably a valid budgetary decision, but it sidesteps the doctrinal question once again. It still leaves ultimate control of counterair assets with the ground force commander.

The Army is developing "swing-role" attack helicopters that, like Air Force swing-role F-16s, will have to fight and win the air battle before they can support the land force commander. The terminology appears to be in a doctrinal "gray area"—seemingly rooted in a turf battle—that both services find difficult to address. Helicopters designated as swing-role types still "belong" to the land force commander (just as F-16s doing CAS belong to the air component commander). It is impossible to expect one aircraft—helicopter or fighter—to be in two places or perform two missions at the same time. One of the great lessons of the Battle of Midway was the fatal error committed by the Japanese when their swing-role attack airplanes changed from ship-attack bombs and torpedoes to ground-attack fragmentation and incendiary bombs. When the Japanese patrol aircraft finally found the American fleet, there was no time to change the bomb loads back and avert disaster.[18] Swing-role sounds appealing on paper, but history shows it can be fatal.

What is the conclusion? Doctrinally and historically, if helicopters are dedicated to offensive and defensive counterair, they should be Air Force assets. The need for air assets dedicated to the mission of air superiority was a lesson learned at great cost in

Helicopters are no longer just airborne trucks. The time has come to devote our attention to the possibility of air-to-air helicopter operations and to the development of appropriate doctrine.

World War II. This approach would free Army helicopters to concentrate on the ground battle and perform the aerial fire-support mission as originally intended. The helicopters in the Air Force inventory today, though, are just a small portion of those existing in 1966 when the Johnson-McConnell Agreement was signed. The few remaining vehicles are mostly optimized for combat rescue and special operations and are ill suited for air-to-air combat. Conceivably, the Air Force would have to purchase its own air-to-air helicopters, whereas the Army is now merely adding the extra mission to those helicopters already committed to ground attack.

Determining the responsibility for counterair will require extensive give-and-take from both the Army and the Air Force, but it can (and should) be done. Air Force assumption of the mission will be difficult and expensive, but doctrinally it makes sense. If an American air-to-air helicopter is the best technological counter to the Soviet helicopter threat, then creating an Air Force helicopter counterair capability is a "cleaner" solution. It assigns Air Force assets to the counterair mission under Air Force command and control.

The Air Force justified its separation from the Army in 1947 by challenging traditional doctrinal concepts. Had we not done so, it is possible we would still be in the Army Air Corps with our air forces controlled by ground commanders. In 1983 the Air Force and the Army exhibited the spirit of cooperation that is required to solve this issue. That effort spawned the Army and Air Force Chiefs of Staff Joint Force Development Process (JFDP) initiatives, an action that permitted evolutionary doctrinal concepts and attempted to avoid traditional service parochialism. We seem to have lost that spirit of questioning and innovation, having gone the way of most bureaucracies by avoiding changes and settling into comfortable patterns.

The potential for future doctrinal conflicts is substantial, especially as new technologies further obscure the distinction between a helicopter and an airplane. Just as we are now revisiting issues supposedly settled by the Johnson-McConnell Agreement, so can we expect to see them again unless we resolve the doctrinal question. The Air Force and the Army must confront this problem, if not now, then certainly in the near future. We need to examine both ourselves and the implications for our future with a critical eye. Countering the air-to-air helicopter threat is part of the Air Force's doctrinal counterair obligation. Relying on the Army because it already owns most of the helicopters is ducking the issue. Air-to-air combat that ensures ground troops the freedom to fight without aerial interference is an Air Force mission—we have a responsibility to do our job. □

Notes

1. AFM 1–1, *Basic Aerospace Doctrine of the USAF*, 1984, 3–2.
2. Maj Lawrence E. Casper, "Helicopters with Air-to-Air Capability Needed," *Army* 37, no. 9 (September 1987): 14.
3. AFM 1–1, 3–3.
4. Gen William Momyer, *Air Power in Three Wars* (Washington, D.C.: Office of Air Force History, 1983), 111.
5. Richard G. Davis, *The 31 Initiatives* (Washington, D.C.: Office of Air Force History, 1987), 20.
6. AFM 1–1, A–1.
7. Ibid., v.
8. Momyer, 158.
9. Davis, 9.
10. As related by General Quesada in *Air Superiority in World War II and Korea*, ed. Richard H. Kohn and Joseph P. Harahan (Washington, D.C.: Office of Air Force History, 1983), 65.
11. David Harvey and Don Toler, "Air-to-Air Combat: The Army Weighs Options," *Rotor & Wing International* 21, no. 5 (April 1987): 26–30.
12. This statement is based upon their experience participating in air-to-air combat tests, during which attack helicopters armed with air-to-air missiles were paired against state-of-the-art fighter airplanes. While part of this claim may be fighter pilot bravado, there is a wealth of material in assorted trade journals that supports it.
13. *Inside the Pentagon*, 23 October 1987, 1.
14. Momyer, 40.
15. AFM 1–1, *Functions and Basic Doctrine of the USAF*, 1979, 4-11.
16. Richard P. Hallion, "Doctrine, Technology, and Air Warfare," *Airpower Journal* 1, no. 2 (Fall 1987): 26.
17. Secretary of the Air Force Office of Public Affairs message, February 1988, unclassified.
18. Samuel Eliot Morison, *The Two-Ocean War* (Boston: Little, Brown and Co., 1963), 153.

THE OPERATOR-LOGISTICIAN DISCONNECT

COL GENE S. BARTLOW, USAF

You will not find it difficult to prove that battles, campaigns, and even wars have been won or lost primarily because of logistics.

—Gen Dwight D. Eisenhower

OPERATORS and logisticians often do not understand each other. Logistics may be the least understood element in war planning. This article is an effort to foster mutual understanding through education.

The Issue

A communications disconnect or gap exists between our operations commanders and our logisticians. Often our "operators" do not understand the play of logistics in warfare, and our "loggies" do not understand the operations planners' and commanders' estimates of the situation or concepts of operations. When each function operates narrowly to the exclusion of the other, we are courting disaster. "If a commander understands the play of logistics, then he or she can factor some logistics realism into plans and concepts without actually working on or solving particular logistics barriers (a fouled-up pipeline, depot, or what-have-you)."[1]

However, the commander often simply does not know and does not appreciate the logistician's concerns. The "ops" types are usually able to practice their wartime skills in the execution of realistic exercises in peacetime, as is done in Red Flag training. But does the loggie have a chance to practice realistic scenarios? Usually the only opportunity is a shortened, simulation-laden, command post exercise using a simple status board and paper shuffling. We have our combat aircrews, but where are our combat logisticians?

Air Force logisticians often have the reputation of being the people who always tell the operational commander why his or her plan will not work. In fact, the logistician is seldom perceived as a positive go-getter. Why is the logistician held in such low esteem? One very important reason is that he or she is often not aware of (or educated in) a methodology for effectively approaching

the problem presented by the operational commander. Logisticians (and some operators) are frequently not prepared to handle fluid operational-level situations because their education and experience have not prepared them to compare the scenario they face to a principle or historical precedent. The result is the quick "no" answer rather than the more optimistic "Sure, let's try to figure a way to do it."

In an article in the *Air Force Journal of Logistics*, Lt Col William T. McDaniel, Jr., addressed this same concern:

> Realistic logistics training is marginal at best. Most joint and Service exercises begin after deployment and end well before sustainment becomes an operational constraint. The magnitude and complexity of a major force deployment or sustainment have not been rigorously tested in either a field training exercise (FTX) or command post exercise (CPX). . . . The real danger of these training inadequacies is that commanders do not fully appreciate the impact of logistics on operations. And, logisticians will be unable to assist the commander because they have not been educated to handle the enormous detail of a major operation at the theater and global level.[2]

The Air Force is currently teaching logistics management, not wartime planning. This orientation may be appropriate for peacetime administrative tasks, but it is inappropriate for combat units and fighting commands. Rear Adm William S. Sims noted in an address to the Naval War College in 1919 that "an officer may be highly successful and even brilliant, in all grades up to the responsible positions of high command, and then find his mind almost wholly unprepared to perform its vitally important functions in time of war."[3]

The official Air Force approach could be equated with MBA-style management. Officers and NCOs often do not take advantage of the full range of military educational opportunities open to them. Unfortunately, the Air Force community has forgotten about the historical perspective of wartime logistics planning.

Why a Disconnect?

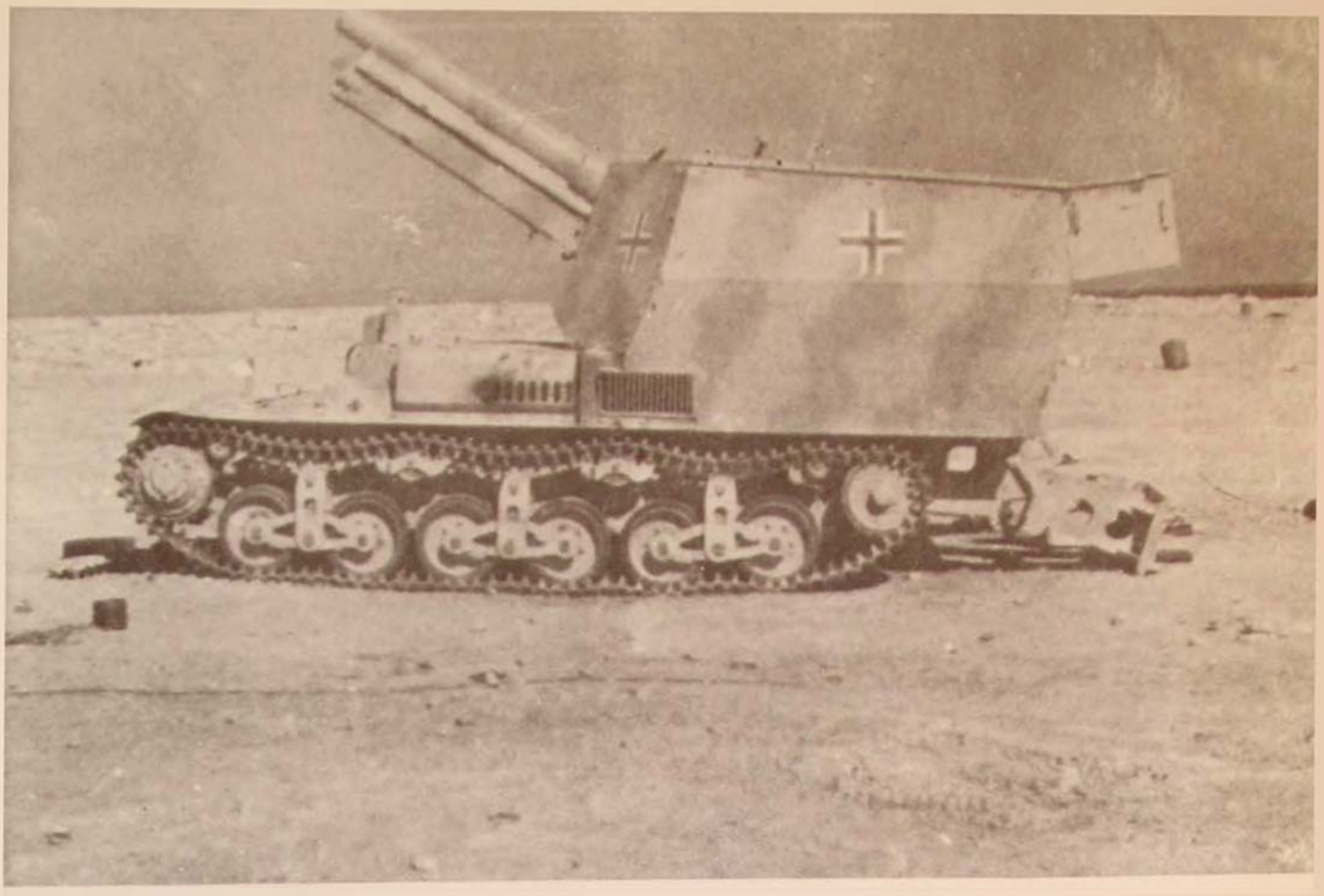
Frequently, the missing link—both in the mutual understanding between operator and logistician and in education—is the knowledge of what historically has and has not worked and why. Missing is the conceptual framework required to think through the potential pitfalls in developing a line of communications to support wartime operations. Also missing is the essential understanding between operators and logisticians.

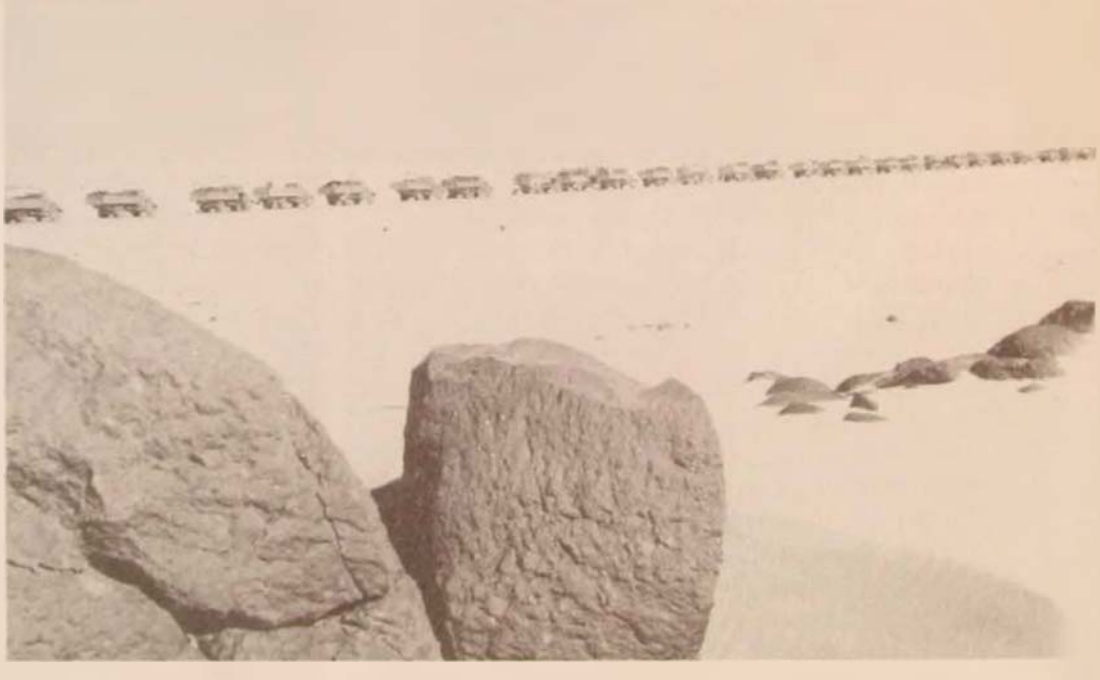
This missing link is very often reflected in the boilerplate or cookbook approach taken by our operators and logisticians in writing war plans. There is neither in-depth thought of the principles of logistics nor the conceptual understanding of the relationship of logistics to strategy and tactics. Development of this thought process must be taught to logisticians and operators in an environment designed to elicit innovation, conceptual thought, and adaptability. They must learn to make a distinction between how to think (education) and what to think (training) in support of our combat logistics requirements.

This critical thought process can perhaps best be learned through trial and error during an actual war, obviously not a practical solution. Attempts are made in operational commands to activate this thought process during major command post exercises. However, failure to learn in this environment is normal because participants train in accepted and preplanned scenarios.

The *Final Report of Army Service Forces, July 1947* stated that "for the most part, Army schools and the War Department General Staff in peacetime planned, trained for, and studied combat operations. To a great extent the Army neglected the logistics problems of operation. This was a deficiency that proved to be costly."[4]

The study of logistics has often been neglected by operators and logisticians alike. Who was the world's greatest logistician and why? What was the critical error of the D-day invasion of Normandy? Can the av-





The importance of logistical support was clearly demonstrated in North Africa during World War II. At the height of German efforts, Rommel received only 10 percent of his fuel needs. Consequently, his Afrika Korps often had to abandon otherwise fully operable field equipment such as this 150-mm assault gun (top). Americans expended much effort in North Africa to meet the fuel and ammunition needs of combat units. Long convoys helped sustain these units by trucking supplies to the front (above).

Port facilities were constructed and adapted to supply the needs of the Allied forces during the Normandy invasion. At right, a Coast Guard LST (landing ship, tank) unloads its cargo of British trucks and armor onto a Rhino ferry. Inadequate logistics support was a key factor in the failure of the Allies to inflict a decisive defeat on the Germans before the close of 1944.

erage Air Force operator or logistician discuss the logistics problems faced by General Lee in the 1863 Gettysburg campaign or by Napoleon in his 1812 invasion of Russia?[5]

Would the average operator or logistician agree that the world's greatest logistician was Albert Speer, Hitler's armaments minister in Germany during World War II?[6] Speer continued to produce and distribute military supplies and equipment in increasingly greater quantities during each year of a long war ("tripling armament production by July 1944 while reducing the number of workers per unit produced by nearly 60 percent . . . [and increasing] synthetic fuel production . . . by 90 percent")[7] despite laboring under the most intense strategic bombing campaign ever inflicted upon any nation up to that point in history.

"Know the enemy and know yourself." That statement by the great military sage Sun Tzu illustrates the long-recognized need to study military art and, particularly, that of the enemy.[8] What does the average logistician or, for that matter, the average operator know about Soviet logistics principles and combat systems? Perhaps the operations and logistics war-planning communities have yet to study the issue adequately.

Soviet logistics is based on a tightly controlled supply-push model, with ammunition and fuel claiming first and second priorities, respectively. For example, Soviet fuel pipeline regiments can "lay field pipe in 10-meter quick-connect sections at a rate of 2 to 3 kilometers per hour. Once installed, a single pipeline can deliver 75 cubic meters of POL [petroleum, oil, and

The remains of a German convoy in France show the vulnerability of a logistical tail (right). Supplies that do not reach combat troops cannot affect the outcome of battle. The Germans adapted their industry to wartime conditions and increased production until nearly the end of the war. At far right is an aircraft engine factory in Italy. The factory was located in a seven-mile tunnel complex to protect it from Allied bombing.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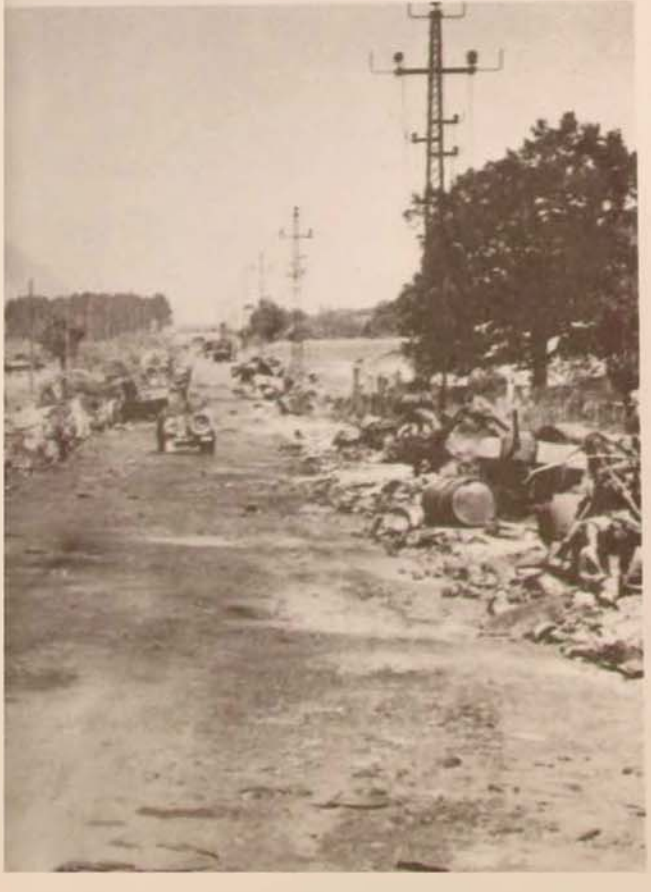

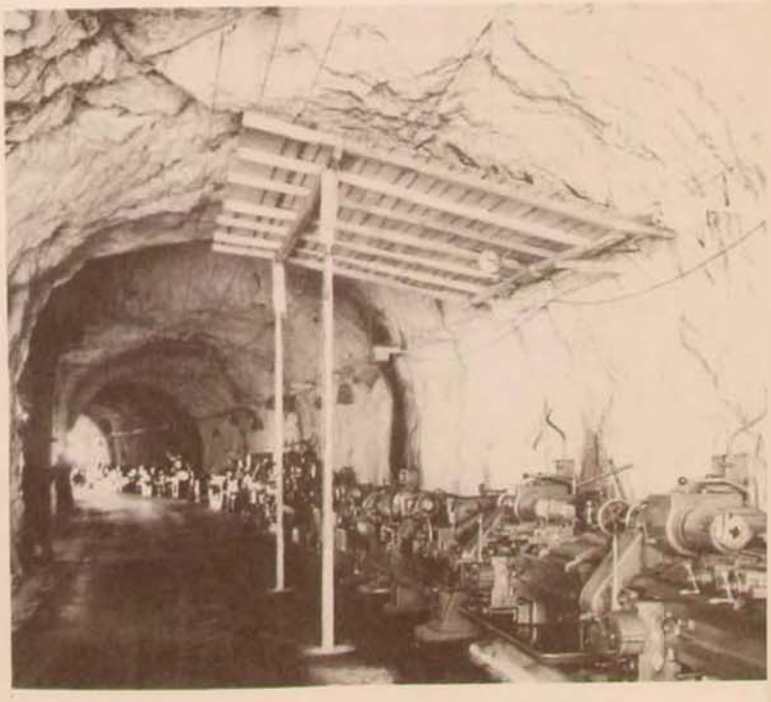

Logistics in Vietnam. Most supplies were brought in by ship and transferred to trucks (right). Tactical airlift distributed this material throughout the country (above). Because modern warfare rapidly expends supplies, an understanding of the impact of logistics on combat operations is essential to prewar planning.

lubricants] per hour to virtually any distance, as long as sufficient booster pump stations and pipe sections are available."[9] Does the United States have a similar pipeline-laying capability? Do we need one? When combat logisticians and operators participate in the logistics requirements process, are they aware of the enemy's capabilities and principles, and have they thought about the full implications? Do we have a formal course of study in Soviet logistics?

Programming and planning logistics for war may be the most complex element in the operational art of war, perhaps even more difficult than strategy and tactics. Ernie Pyle, the World War II war correspondent, wrote in 1944 of logistics: "This is not a war of ammunition, tanks, guns, and trucks alone. It is as much a war of replenishing spare parts to keep them in combat as it is a war of major equipment."[10] Again, in order for the operator to understand how the logistician works through these problems, it is important for him or her to gain a perspective of the principles and process of logistics.

The Historical Perspective

Unless we understand the events of yesterday, the difficulties of today are distorted, and the successes of tomorrow may be delayed indefinitely. Operators need to understand basic logistics from the historical perspective in order to avoid repeating the errors of the past. Our operators' ignorance of logistics could lead to serious shortfalls in combat sustainability. From a historical perspective, that critical error of World War II mentioned earlier may be the most important logistics lesson available. This story is told by Col Harold L. Mack, US Army, Retired—the logistics planner who personally developed the lines-of-communications plans for Operation Overlord (the Normandy invasion). The following passage, extracted from an Air Force logistics management study, reveals the primary military objective of the operation:

> What's not well known about Operation Overlord is that the direct military objective of Overlord was neither strategic nor tactical, but *logistical*. The primary objective of the plan read: "To secure a clear *lodgement* on the continent from which further offensive operations *can be developed*." Since it was clear the war would be a battle of industries, we had to be able to rapidly deliver our industrial output to the front lines.
>
> The primary need, then, was for *port* facilities. The Normandy location was selected because of physical characteristics and its *location between two major port groups*—Cherbourg and South Brittany. Until ports could be taken, refitted, and opened, the beach had to handle the influx of troops and supplies.[11]

Colonel Mack relates:

> There can be little question that a shortage of gasoline and ammunition, and other supplies, was primarily responsible for our failure to inflict a decisive defeat on the Germans before the close of 1944.[12]

He further states that

> after months of planning, it became evident that, based on the original Overlord plan . . . we could not land and move enough tonnage to meet the demands of the various armies on their combat missions. The facilities, particularly the railroads and ports which would be captured . . . had not the capacity to enable us to move the tonnage needed to supply the armies in the field. . . .
>
> I was always intrigued by the possibility of utilizing the excellent ports and railroads on the southern coast of Brittany fronting on the Bay of Biscay. Quiberon Peninsula, jutting out into the bay, seemed to offer excellent beaches for the landing of supplies because it could be approached from different directions in any kind of weather. One of the best freight railroads in France ran along the coast and, straight from there, east to Paris and Germany.[13]

A major change in Overlord would thus be required. "It involved the capture of Lorient, either the capture or isolation of Saint-Nazaire, and the reduction of the German installations on the islands facing the coast—a combined military and naval operation of major proportions." After many strategy meetings the plan "then was

changed to include the capture of Quiberon Bay. . . . The operation was given the code name Chastity and was a very closely guarded secret."[14]

The Chastity mission was assigned to Gen Omar N. Bradley's 12th Army Group. For various reasons, General Bradley and his subordinate, General Patton, relegated the logistics plan to a low priority:

> As a result, Lorient and Quiberon were not captured; the Chastity plan of supply was never put into operation, and, although St. Malo and Brest finally were captured, they proved to be completely useless from a logistical standpoint. . . .
>
> While General Bradley planned classical campaigns, slow and methodical, General Patton displayed a quality of original thinking, improvising, hitting hard and fast, and anticipating in advance the enemy moves. General Patton later wrongly claimed, however, that the indications were that it was a deliberate withholding of gas from his army by higher authorities. He was wrong in this respect. There just wasn't enough to go around. . . .
>
> Unfortunately for all concerned, his genius was curtailed and his victorious advance stopped because of the initial failure to carry out the Chastity plan, needed to keep him supplied. By September 1st, his army was short of everything—gas, rations, blankets, winter clothing.[15]

General Bradley "underestimated the logistical need for obtaining the use of Quiberon Bay and the railroads running east from there. These were most costly mistakes."[16]

It was the combat operators who failed to give logistics a coequal status with strategy and tactics. Or, as Rear Adm Henry E. Eccles pointed out, "Strategy and tactics provide the scheme for the conduct of military operations; logistics provides the means therefor."[17]

Logistics thus became a critical factor in one of the most important military campaigns of the World War II European theater. There are many historical lessons to be learned in logistics; we must learn and never forget them.

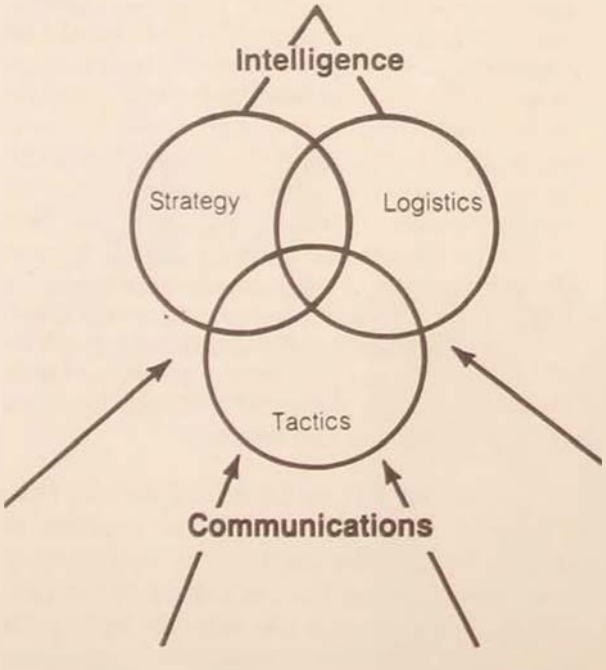

Figure 1. The Structure and Relationship of the Military Factors of War

A Framework for Understanding

The classic logistician's lament is that operators don't listen. The different experiences of operators and logisticians constitute one important reason for this situation. The disconnect is not a new one, as is shown in the following passage from the *Army Logistician:*

> Logisticians are a sad embittered race of men, very much in demand in war, who sink resentfully into obscurity in peace.
>
> They deal only with facts, but must work for men who traffic in theories.
>
> They emerge during war because war is very much fact. They disappear in peace because, in peace, war is mostly theory.[18]

The solution to the operator-logistician disconnect is through increasing mutual understanding. Although the two are faced with different tasks on a daily basis and thus find the need to develop different solution methodologies, each has the same mission. Without that mutual understanding, they are unlikely to succeed.

Admiral Eccles, a noted author on modern combat logistics, writes the following about the operational-logistical relationship:

> [The operational commander] should retain cognizance and authority throughout the entire range of his responsibilities. He should avoid the common tendency of some commanders to concern themselves almost entirely with the so-called "operational" matters (either strategic or tactical) at the expense of concern over those logistical matters which form the very basis for "operations." In other words, once a commander thinks of the strategic, logistical, and tactical elements as individual or isolated matters he has lost his perspective.[19]

He has put this relationship in the form of a chart that considers the critical elements of war planning and execution, strategy, tactics, and logistics coupled with the communications and intelligence interface (fig. 1). According to Admiral Eccles, "In the field of military planning, for instance, it has been found that at the highest level of military thinking it is not always possible nor desirable to distinguish between what is strategic and what is logistic."[20]

An important basis of mutual understanding involves the operator's knowledge of how the logistician approaches a problem and thinks through the task. The following discussion provides a macroperspective of modern combat logistics planning for the layman or novice war planner.

Logistics can be thought of as a continuum, as an open-ended support concept from industry to combat. Consider the spectrum of logistics as illustrated by figure 2. Logistics provides the means to create and sustain combat forces and is the bridge between the national economy and the operation of combat forces. In an economic sense, it limits the combat forces that can be created; in an operational sense, it limits the forces that can be employed.

Logistics, strategy, and tactics must be studied in equal depth. It is only after both the operator and logistician become familiar with past military campaigns, including those seemingly trivial or accidental elements, that they can begin to understand *why* things happened the way they did.

Maj Gen Jonas L. Blank, in his study of logistics and strategy, makes the following ob-

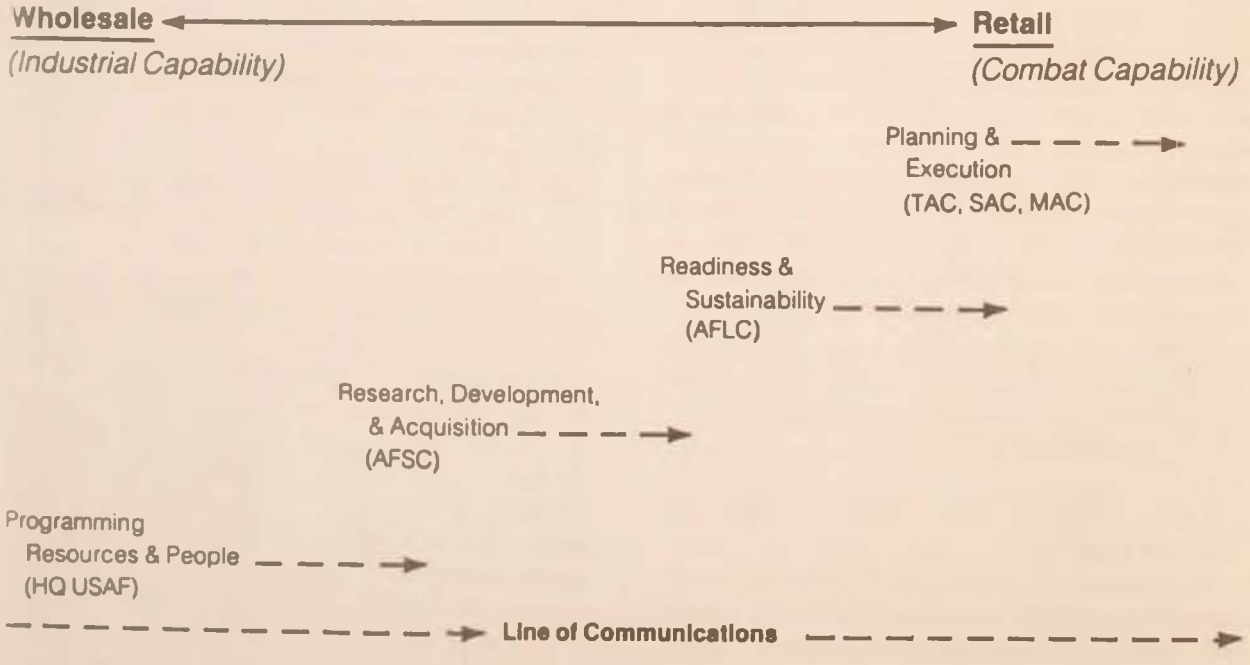

Figure 2. The Spectrum of Logistics

servations about the campaign in North Africa during World War II:

> The Germans frittered away their early gains after coming to within an eyelash of making the Mediterranean a German lake. Again, brilliant tactical execution [by Gen Erwin Rommel] was undone by inadequate logistics support. Only about 10 percent of Rommel's fuel requirements for his tanks was delivered during the critical days when the fate of North Africa hung in the balance. What he needed could have been delivered. This was proved the next year when German equipment and supplies poured into Tunisia in response to the American landings in Africa, but by then it was too late. Field Marshal [Albert] Kesselring, the German commander in chief in Italy, and Rommel disagreed on many aspects of the North African campaign. They did agree, however, after it was over, that it was primarily a logistics battle and that their promising opportunity for decisive victory evaporated because transportation had been badly planned and clear organizational channels for logistics support had never been established.[21]

Quite frequently, seemingly trivial events were actually very important, even critical, and what seemed to be accidental occurrences were actually the natural result of the campaign. An ongoing historical analysis should become the basis for the development of logistics theory, doctrine, and the associated principles of logistics. As Admiral Eccles has stated, "The search for comprehensive theories is the best way of shedding light on these [logistics] problems and of developing the understanding of principles and of cause and effect relations which may guide the responsible men who must choose among conflicting ideas."[22]

James A. Huston, in his book *The Sinews of War: Army Logistics, 1775–1953*, wrote about the principles of logistics. A few of them are summarized below:

- First with the most: And be there with the *best* if possible.
- Dispersion: Storage and other logistical activities should be dispersed and multiple lines of communications used when possible.
- Feasibility: Strategic and tactical plans depend on logistical feasibility; logistical plans depend on the national economy, availability of resources, and limitations of secondary logistical requirements.
- Timing: This principle is relative to the objective and is the key to all logistics, whether high-level procurement or tactical supply.
- Unity of command: Control of logistics is essential to control of strategy and tactics. A single authority, identical with command authority, should be responsible for logistics.
- Forward impetus: The impetus of supply is from the rear forward. An automatic supply system should exist that frees forward commanders of details without impairing their control of their own logistics.
- Information: Accurate, current information is essential to effective logistical planning and to supply distribution.
- Relativity: All logistics is relative to time, place, and circumstances; logistical factors are relative since there are always "opportunity costs" in every decision made.[23]

These principles are interrelated and in some cases are scenario dependent. For example, if all communications are open in the battle area and information is flowing freely, the principle of forward impetus would not be applicable, in that only specifically required materiel should be pushed to the operational base.

The experience of the past must be conveyed to developing professionals through the theory of the present. The Air Force has only recently addressed the concept of logistics principles, called combat support principles in chapter 3 of the 1987 edition of Air Force Manual (AFM) 1–10, *Combat Support Doctrine*.[24] These new principles are a "proven basis for deciding on a reasoned course of action."[25] The following eight principles cited in AFM 1–10 are somewhat different from Huston's. The debate over principles has only just begun:

- Objective: Know what you want to do before you do it and keep reminding everyone until it's done.
- Leadership: You are the single most important factor in achieving military victory.
- Effectiveness: Do only those things that improve combat capability.
- Trauma/friction: Understand: War is hell! (What Clausewitz referred to as "friction in war" describes why things naturally go wrong in war. . . . Friction is bad weather during the Battle of the Bulge, contagious panic in France in 1940, an empty prison at Son Tay, or a dominant characteristic of the Iranian rescue mission. Clausewitz considered friction to be the central factor that distinguished real war from theoretical analyses.)
- Balance: Get the right thing in the right amount to the right place at the right time.
- Control: Never lose contact with your resources.
- Flexibility: Create aerospace forces that can operate in any combat environment.
- Synchronization: Combat power equals the combination of combat operations and combat support.[26]

These principles are actually a litany of the lessons distilled from the experience of warriors. The debate should continue over which lessons from past conflicts should constitute basic principles and thus contribute to Air Force doctrine. The list is incomplete. This debate can best continue through a dialogue among experienced warriors and new members of the war-planning community.

A logistician must be concerned about virtually everything bearing on operations. The chart on logistics planning and execution (fig. 3) is a decision matrix used in combat logistics problem solving. It provides structure and can assist in the development of concepts for applying principles and theory in judging logistics feasibility and effectively executing a plan. This chart can be the vehicle by which the logistician derives the logistics objectives from the overall operational mission objective.

Lt Col G. T. Raach, US Army, writes of a concern for logistics structure:

> For many years, the notion has been perpetuated [by the layman (nonlogistician)] that logistics estimates are little more than moderately complicated exercises in basic mathematics. Several generations of logisticians have calculated short tons of dry cargo, gallons of fuel, stockage objectives, order-ship times [mobility flight times] and transportation time-distance factors. This data is of value in the preparations of the [logistics] estimate [of the situation], but it is not the estimate itself.[27]

The data merely provide background to give the logistics planner some idea of the requirements of the force and the support capability. The information does not tell the planners how best to employ the available logistics assets. The logistics planner must determine this by examining the figures and then asking, "So what?" The answer to that relatively straightforward question is all too often elusive because the logistics estimate lacks a guiding structure.[28]

Colonel Raach explains that

> the structure used in the operations estimate is composed of a number of doctrinal factors. The logistics estimate structure should be similar in form, with factors extracted from logistics doctrine [or principles, as applicable] as the components. These tenets, lifted from the essential axioms of logistics, provide a framework within which to evaluate either tactical courses of action from a logistics standpoint . . . or concepts of support.[29]

How would a logistician use this planning and decisionmaking chart (fig. 3)? First, he or she should use the left column's list of issues to analyze the mission and circumstances and then develop the logistics concept of operations, particularly keeping in mind the principles of logistics. Moreover, the logistician and operator must coordinate their actions by means of an estimate of the situation, considering possible options and courses of action. They must also determine the development of the

best solutions for each of the elements listed in the left column of figure 3.

Most operational commanders have been taught the classical use of the estimate of the situation as a methodology for analyzing the options to mission accomplishment. Not well understood is the complementary need of the logistician to structurally develop a logistics estimate of the situation and apply those findings to the mission. This need can perhaps be better understood by way of a historical example.

During the planning of the Japanese invasion of Midway in 1942, Vice Admiral Nagumo estimated the situation as follows:

> 1. The enemy fleet will probably sortie to engage once the Midway landing operations are begun.
>
> 4. The enemy is not yet aware of our plan, and he has not yet detected our task force.
>
> 5. There is no evidence of an enemy task force in our vicinity.
>
> 6. It is therefore possible for us to attack Midway, destroy land-based planes there, and support the landing operation. We can then turn around, meet an approaching enemy task force, and destroy it.
>
> 7. Possible counterattacks by enemy land-based air can surely be repulsed by our interceptors and antiaircraft fire.[30]

In this situation Admiral Nagumo was wrong about each element of the estimate. His error resulted in what some historians describe as one of the greatest sea battles of the modern age. The US Navy had a general idea of where Nagumo's fleet was, when he planned his attacks, and what his objectives were, and our fleet was closing on his as his estimate was being written. Nagumo's losses were staggering. The Japanese defeat at Midway led to a complete turnaround in the course of the Pacific war and the eventual mastery of the sea by the US Navy. The lesson to be learned is that an accurate estimate of the situation, both operational and logistical, is critical to success.

By using the center column list of planning factors in figure 3, one can analyze the logistical support calculations—a step that is critical to the later judgment of feasibility. Determining how requirements are designed is important in the development of planning factors. Erroneous analysis and

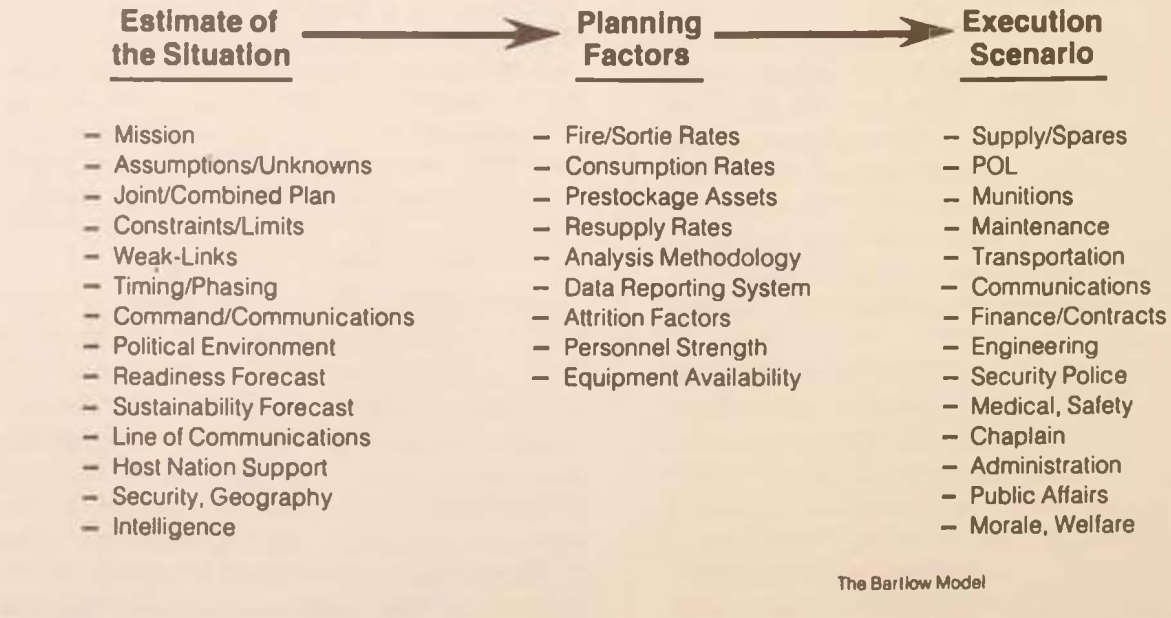

Figure 3. Logistics Planning and Execution

faulty methodology for development can become a weak link in the logistics plan.

The right column, listing entries related to scenario execution, reflects an analysis of the ways, means, and requirements. One can use this data to place the procedural and feasibility information into the various logistics annexes of a war plan. Occasionally, the logistics planner will erroneously use only the third column as the source of analysis and attempt to determine requirements and concepts from a microperspective.

The chart is only a tool for highlighting and guiding the thought process; it is certainly not the sole vehicle for war plan development. It is scenario dependent and must be used in conjunction with the essential principles of logistics, the applicable strategy and tactics, and the lessons of history.

Colonel Raach maintains that

> through this framework, we are able to give additional meaning to the quantitative elements of our data base. . . . The factor framework allows us to combine calculations with logistics doctrine in support of maneuver forces. This synthesis ensures that optimum use is made of austere resources to satisfy force requirements. Logistics units are organized, positioned and given missions which maximize efficiency and minimize risk. Concepts of support become more precise. In the final analysis, we have determined not only what must be done but also how best to go about it.[31]

The following statement by Admiral Eccles gives us a valuable guide for the study of logistics: "The objective of a logistics effort is the creation and sustained support of combat forces."[32] Data on combat sustainability and the credibility of the reporting logistician are critical to the effectiveness of the information given to the operations planner and commander for their analysis of strategy and tactics. Both the operator and the logistician need a highly reliable and efficient way of analyzing combat mission sustainability, as well as a prompt and effective reporting system.

The importance of information to the logistics equation can be illustrated by another historical example:

> Within three weeks after the start of the Korean War, the backlog of top-priority shipments had built up to more than could be airlifted in two months. More than half the requisitions received from Korea were listed as top priority and designated for air transportation. Yet our air cargo capability could accommodate only a small fraction of that amount. Flooding the supply system with top-priority requisitions was self-defeating. Cargo jammed aerial ports of embarkation and sat there for months, although it could easily have been delivered in less time by surface transportation.
>
> Two years after the start of the Korean War, an Army general inspected the port of Pusan. He reported that, despite prolonged hard work, one-fourth of the supply tonnage stored there had still not been sorted out. As supply personnel did not know what these supplies were, obviously they could not be issued.[33]

There are many reporting and analysis systems available. One that has been used to good effect by the author involves reporting base-level information to the operational commander through charts or graphs (fig. 4). This illustration shows that missions

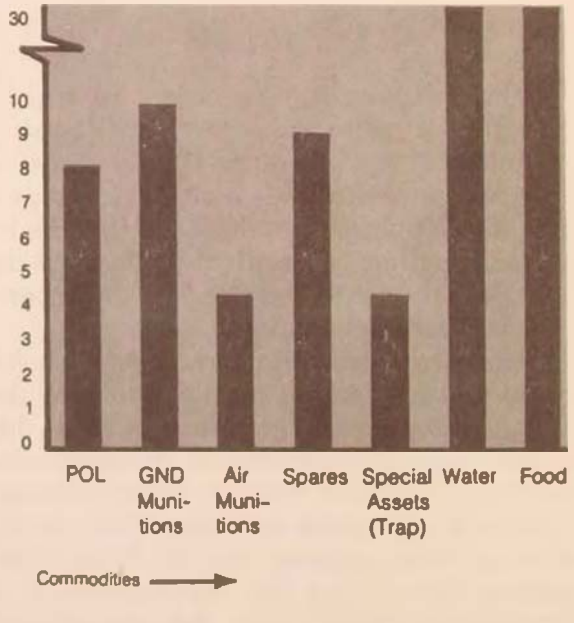

Figure 4. Readiness and Sustainability Combat Analysis

could be flown for only four more days in the tasked configuration, due to the lack of air-to-air munitions. Selection of the critical categories is mission and scenario dependent. This chart is simple and readily understood. It is a means by which both operator and logistician can gain a mutual understanding. Such a reporting device can become the core of an ongoing logistics estimate of the situation.

An important point to remember is that operations and logistics are truly inseparable. The logistician must develop a special trust and confidence in the operational commander to ensure that logistics concerns are given a fair and equitable hearing when strategy and tactics are discussed.

This special relationship is cultivated by a continuing demonstration of integrity and credibility on the part of the logistician. This attitude leads the commander to believe that the logistician will always provide a clear and honest picture of mission supportability. Trust, integrity, and credibility are best demonstrated to the commander by three simple standards: (a) say what you mean, (b) do what you say, and (c) help when it hurts.

Summary

Talented people (operators *and* logisticians) have made gross errors in logistics planning and execution simply because they lack an educated, historical perspective. It is essential to understand that the logistics function is a critical element of the operational art of war for both the commander and the logistician.

There are several improvements the Air Force can implement to alleviate both the operator-logistician communications disconnect and the deficiencies of formal education. An obvious remedy is a greater use of logistics concepts and doctrine in available facilities such as the Air Force Wargaming Center, the Air Force Institute of Technology (AFIT), and the professional military education schools. As noted in the *Air Force Journal of Logistics*, AFIT has recently expanded its course capabilities in teaching combat logistics and war planning through professional continuing education courses.[34] Oftentimes, however, these courses are optional. This effort is noteworthy, but more needs to be done.

We must foster mutual understanding and communications between operators and logisticians. The Air Force now faces the challenge of improving its educational resources and elevating the mutual understanding of its people to a higher plane. □

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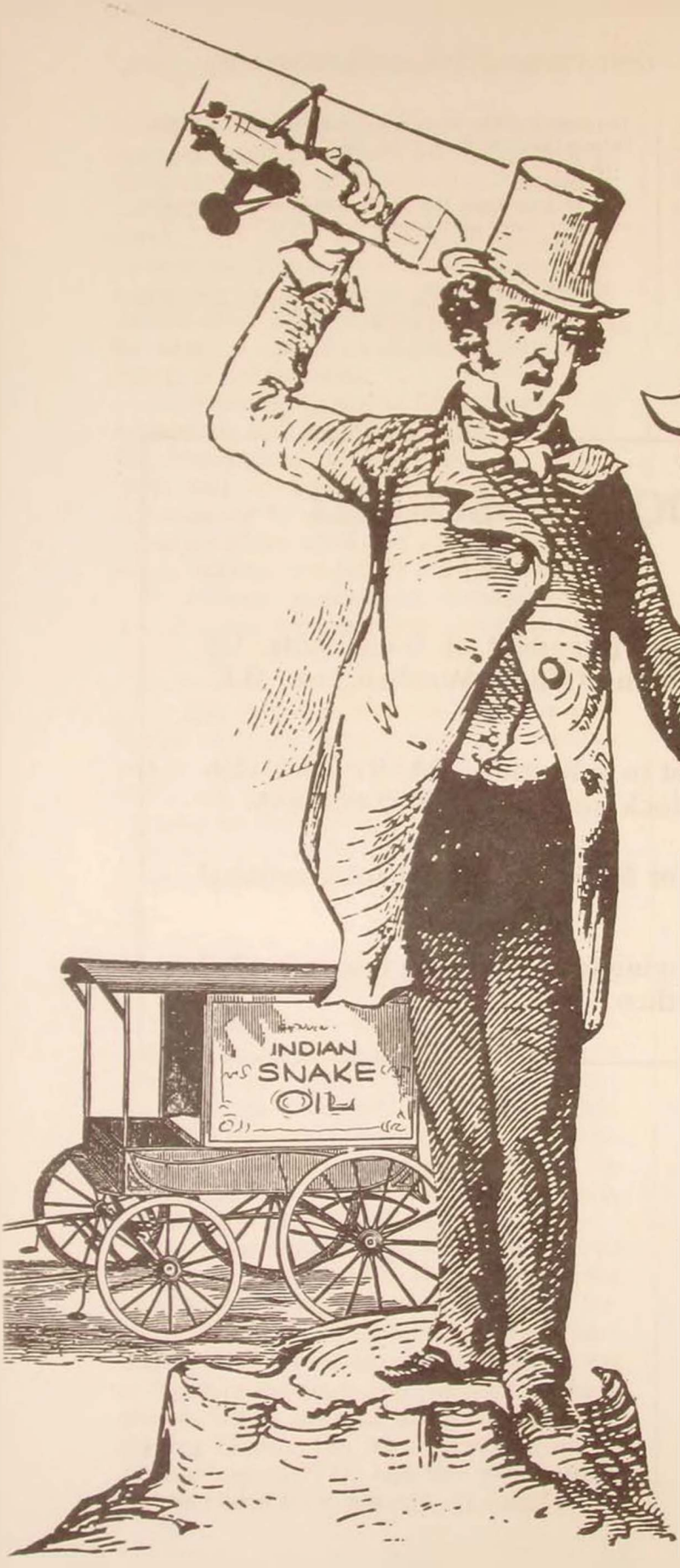


When the final record of aviation's genesis is written three names are likely to be emblazoned therein with a glory transcending all the rest. These three are Lilienthal, Wright, and de la Cierva.

Lilienthal made the first real start, the Wrights made the first real success, and Cierva the first real transmutation of their work whereby flight became accessible to all.

Thomas R. Reed
"Señor Don Juan de la Cierva y Cordoniu"

OF AUTOGYROS AND DINOSAURS

Lt Col L. Parker Temple III, USAF

WHO WAS Cierva? The explanation of why Cierva is not a household name holds a message for today's Air Force. The process of acquiring superior weapons is in trouble. Since the Air Force advocates and acquires its own proposed weaponry, we both "sell" *and* buy. All too often, what is sold is not bought. Advocacy—or selling the need for a weapon within the planning, pro-

gramming, and budgeting system—ignores the particulars of buying an allegedly superior weapon and evaluating how it will fit into the Air Force's concept of employment. Unlike the snake oil salesmen of old, the modern Air Force not only must sell its medicine but also must take it. Overselling a proposal may diminish the Air Force's ability to meet the challenges of the future.

This essay does not address the formal array of acquisition regulations, organizations, and responsibilities. Nor does it challenge the need for superior weaponry. The thesis that victory favors the side that uses superior arms is based firmly on the history of wars and weapons and is not in question here.[1] Rather, this is an account of how we may err in making proposals that compete for increasingly scarce budget dollars.

The essay discusses selling and evaluating proposed, superior weapons and the crucial role of doctrine in this process. It examines the military history of what may be the archetypical, oversold, proposed, superior weapon—the military autogyro. Much of the history of the autogyro's selling and evaluation is applicable to acquisition of the superior weaponry that is essential to the modern Air Force.

Weapons Advocacy and Selling

New weapons do not just happen. They must be sold before they can be bought. After the military identifies a need, it submits proposals for new weapons to the scrutiny of civilian evaluation. All proposals must be advocated before Congress and the American public in such a way that the need is verified. If funding is to be secured, the need for any new system must be clearly greater than that for other systems. The constant danger of this competition is the possibility of overselling, which jeopardizes the basic intent of the process of acquiring superior weaponry.[2] Overselling is dangerous because it creates expectations for a weapon that can neither be built nor delivered. Overselling can produce more than embarrassment to the service; it may result in the loss of some other truly superior weapon whose advocates were not as successful in the selling process.

The military should not ignore innovation but must remain objective about superior weaponry that allegedly contributes to our national defense. Objectivity during advocacy should be based on sound doctrine. Basic doctrine is the starting point for evaluation.

Superior Weaponry and Doctrine

Superior arms are not merely technologically better than others; superiority also applies to the doctrinal context that supports the selling and evaluation of the weapon.[3] Somehow, we must assure ourselves that the weapon that is bought is in fact superior. Just as doctrine provides a basis for selling a proposed, superior weapon, so does a doctrinally based evaluation tell us if the weapon fulfills expectations.

There are three basic means by which proposed, superior weaponry can meet the requirements of existing doctrine. First, a proposed weapon may fit existing doctrine exactly. This situation occurs when current trends are extended along conventional lines. Improving the speed, range, and flexibility of modern fighters would be doctrinally correct; in other words, these changes would produce a good fit of weapon and doctrine.[4] Second, some proposals may require a logical extrapolation of doctrine. Technological advances offer previously unavailable capabilities that do not fit current doctrine but can be accommodated by extension. The development of the helicopter is an example. Third, a new capability may emerge that is totally unaccounted for in doctrine, which requires a serious revision and rethinking of principles. This reconsideration of doctrine should have

occurred in the Army when aviation began to evolve.

Successful advocacy to ensure the nation's security requires choosing superior weaponry and establishing an appropriate "doctrine or concept of tactical or strategic application . . . to be performed by any given weapon."[5] Weapon and doctrine must be synergistic, for if they are incompatible the weapon will not fulfill expectations. The autogyro is an example of a proposed, superior weapon that was oversold and out of step with the doctrine of the times.

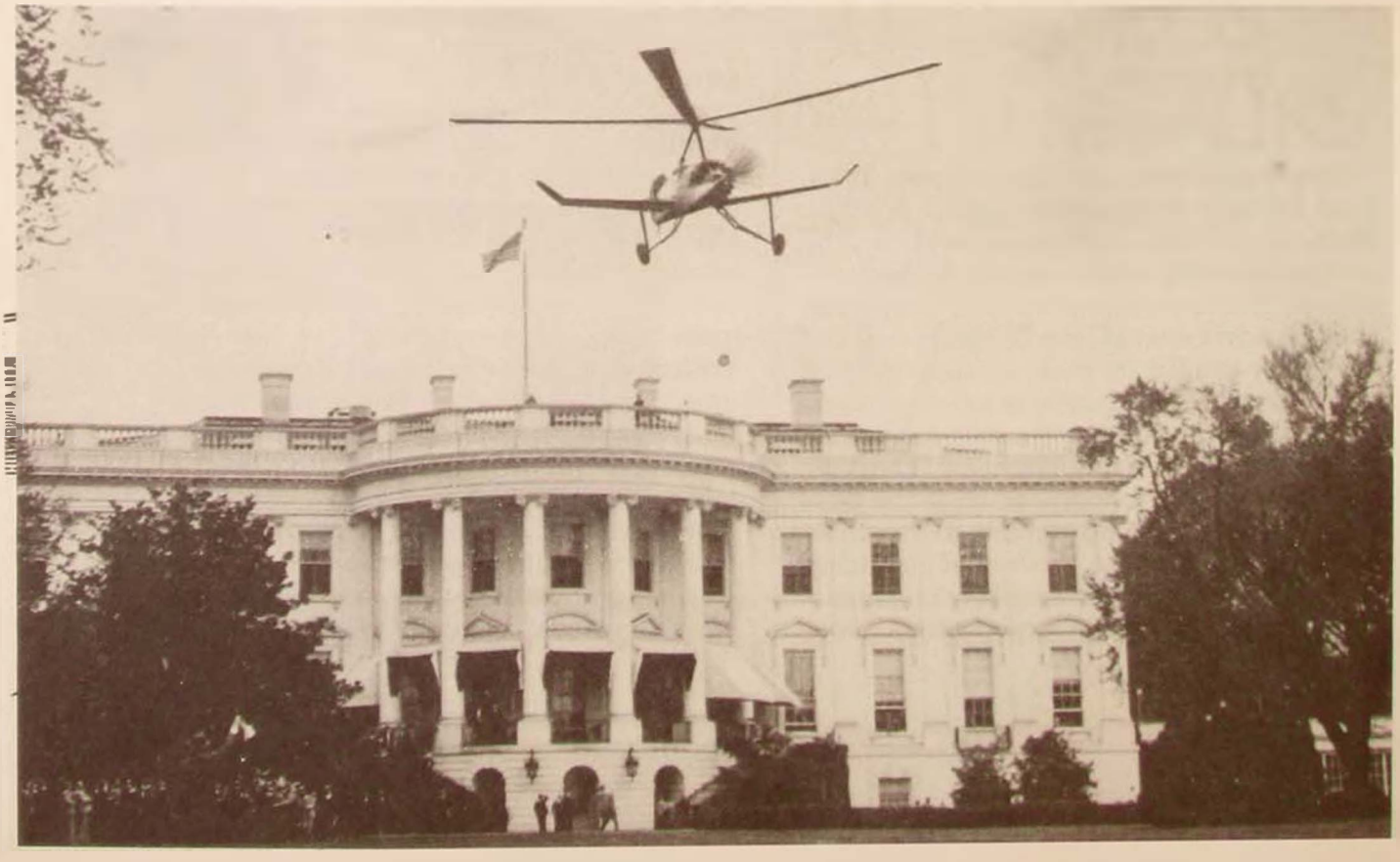
The Autogyro and Its Selling

The history of the autogyro reflects the means by which the past enlightens the present:

> It is for any student of war . . . a never-ending exercise, in reading of some older problems and how they were handled, to make adjustments to later times. . . . Some ideas and admonitions are immediately recognized as still pertaining today, others as being useful only for the better understanding of military . . . history.[6]

Don Juan de la Cierva y Cordoniu, inventor of the autogyro.

James G. Ray pilots a Pitcairn autogyro over the White House grounds in ceremonies awarding the Collier Trophy to Harold Pitcairn for autogyro development, 1931.



The autogyro (above) was powered by a free-spinning rotor and a conventional aircraft propeller. Unfortunately, it was so unstable that a good many of them ended up like the one shown at left.

The autogyro was an air vehicle supported by a large, unpowered, wind-milling propeller and driven forward by a conventional motor-driven propeller. The autogyro anticipated and supposedly had more useful features than the helicopter, an aircraft many individuals considered unworkable.[7] However, on 29 September 1907 at Douai, France, an uncontrolled, manned helicopter ascended about two feet.[8] By 1922 Louis Brennan of Great Britain had a helicopter that hovered for several minutes and flew 20

In the 1930s the US Army tested the autogyro, and the Marine Corps used it during operations in Nicaragua. After Cierva's death in 1936 the autogyro quickly lost popularity. By World War II the helicopter had replaced the autogyro as the US Army's rotary wing vehicle. On the facing page is a rescue helicopter in Burma, 1945.

to 30 yards at a height of five feet.[9] In the United States Dr George de Bothezat developed a helicopter for the Army that was capable of up to two minutes of flight.[10] This progress was not satisfying to people who envisioned more dramatic and practical vertical takeoff and landing capabilities. Because of the greater initial success of the autogyro in the late 1920s, work on contemporary helicopters came to a virtual standstill.[11] Brennan's funding abruptly ended, and de Bothezat's helicopter was dropped in favor of autogyro development.[12]

Don Juan de la Cierva's first successful autogyro (his fourth machine) flew on 9 January 1923 after he had worked four years on the design.[13] Within days he flew a two-and-one-half-mile closed course and by 1928 had crossed the English Channel.[14] The autogyro flourished in the early to mid-1930s in part due to the long-standing and frustrating inability to produce a true helicopter but principally due to its inventor's great energy and abilities as a salesman, diplomat, innovator, and enthusiast.[15]

Cierva created the autogyro to eliminate the major problems of aircraft safety and viewed his invention as a replacement for all conventional aircraft.[16] Although safety was important in his time, it was insufficient reason to justify replacement of conventional aircraft by autogyros.[17] Cierva needed a more compelling vision of the future, so he outlined features that supposedly made it the ideal vehicle for military service:

1. unobstructed view downwards,
2. low minimum speed,
3. ease of control over mobile targets,
4. ability to land easily at night and in fog,
5. stability in bumpy air,
6. comparative invisibility (the rapidly rotating windmill gave a degree of invisibility not possible with fixed-wing airplanes), and
7. ease of control, thereby reducing pilot work load.[18]

Observers with military experience who were convinced by Cierva's vision even before military evaluation trials touted other selling points:

1. altering the outcome of future dogfights,
2. improving the coordination of air and ground forces,
3. reducing dependence on fixed-base operations,
4. providing battlefield reconnaissance immune to enemy defenses,
5. improving aircraft safety,
6. increasing bombing accuracy,
7. rescuing wounded soldiers,
8. avoiding the vulnerabilities of large aircraft carriers by dispersing autogyros to any ship with a landing platform, and
9. replacing the observation balloon.[19]

Harold Pitcairn flew the first American autogyro in Philadelphia on 19 December 1928.[20] In 1931 the Pitcairn Autogyro Company built a Cierva-designed machine, the XOP-1, for US Navy shipboard tests.[21] Also in 1931 President Hoover presented the Collier Trophy to Pitcairn for his work in "making practical application of the autogiro."[22] Two months before actual trials of the XOP-1, Rear Adm W. A. Moffett, chief of the Navy Bureau of Aeronautics, announced, "There can be no doubt but what the development of the autogiro is the outstanding achievement in aviation during the past year."[23]

The US Marine Corps evaluated Pitcairn's machine in combat conditions in Nicaragua. Redesignated OP-1, marines used it during the US incursion there in the 1930s. Testing it as a replacement for airplanes flying out of small fields and as a rescue craft for wounded soldiers revealed some limited uses.[24] USMC Capt Francis P. Mulcahy's 22 November 1932 report to Headquarters US Marine Corps said its chief value was inspecting small fields recommended by ground troops as landing areas.[25]

In March 1935 Wing Comdr R. A. C. Brie, chief pilot of the Cierva Autogiro Company of Great Britain, became the first person to take off from and land on a warship other than an aircraft carrier—the Italian cruiser *Fiume*.[26] The US Army was also interested; the Kellett KD-1, which flew at the Philadelphia Airport on 9 December 1934, became the Air Corps YO-60, used in the 1930s.[27]

By 1935 the armed forces of the United

States, Italy, Spain, the Soviet Union, Germany, France, Great Britain, and Japan had either tested or ordered autogyros.[28] They reviewed its capabilities within the context of their own doctrines of air warfare. For instance, the Soviet Union developed some models for leaflet dropping, antisubmarine warfare, and aerial combat. The Germans developed a submarine-based observation autogyro. The Japanese developed a version for antisubmarine warfare and aerial bombing.[29] With the apparent exception of the Soviet fighter, all saw combat in World War II.

Nevertheless, autogyro development ended quickly. On 9 December 1936 Cierva died in an airline accident.[30] A report of Cierva's death suggested the loss of enchantment with the vehicle by that time:

> Cierva's place in history cannot be predicted yet . . . but the greatness of his fame will depend entirely on the future of the autogiro. . . . Unless its speed and useful load can be considerably increased it cannot compete with the airplane, and just now the prospects of doing either are not bright.[31]

The popularity of the autogyro had been disproportionate to its actual capabilities and mostly attributable to Cierva.[32] His purpose in the latter half of his life had been to sell the machine, and he single-mindedly pursued revolutionizing aviation with the machine he felt solved all of aviation's major problems: "The demonstration of his machine was no less a task for Señor Cierva than its building."[33]

Although he was the world's foremost innovator of autogyro technology, Cierva never solved its handling problems or made good on his claims of a $2,000 cost per vehicle or a seven-ton payload.[34] All three Kellett Army autogyros were so difficult to fly that they were soon destroyed. To complete test trials, the Army had to order seven replacement machines.[35] Cierva's own test pilot crashed so often that he refused to fly for Cierva any longer.[36] Cierva underestimated the cost per vehicle by an order of magnitude and overestimated its payload by three orders.[37] The Air Corps Advanced Flying School cited limited carrying capacity as the first and most serious deficiency, saying it "has limited the radio and other observer's equipment, and precluded carrying defensive armament."[38] Innovation alone had not assured superior weaponry.[39] After Cierva died, interest waned faster than it had grown after the first autogyro flight.

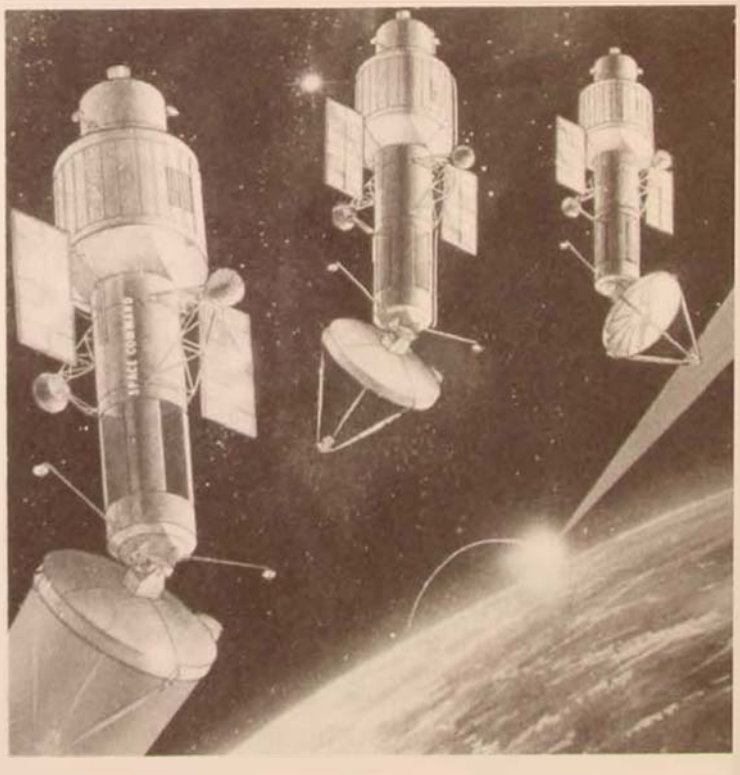
Helicopter work had continued on a small but eventually productive scale. In France Louis Brequet built the first successful helicopter in 1934.[40] Within three years of Cierva's death, many countries had workable helicopters, but it is arguable that the helicopter killed the autogyro.[41] The military autogyro trials, begun before the first helicopter flew, were so disappointing they might have led to abandoning the aircraft in any case. The failure of the autogyro was in part due to problems with the vehicle itself. More significant in the demise of the military autogyro, however, was the overly optimistic advocacy and lack of a disciplined doctrinal evaluation of its military utility.

The Autogyro and Doctrine

Doctrine that does not allow for the advances of technology and capability serves no one well. Doctrine is not an immutable set of principles.[42] It is shaped from lessons learned through experience and must be revisited to ensure that the appropriate lessons were learned.[43] Its two main goals are to show decisionmakers how experience can illuminate future needs and to provide a basis for guidance and discussion concerning common problems.[44] Consequently, it "provides the rationale for favoring one weapon system over another."[45] It also serves "as a background for . . . operations, tactics, techniques, and procedures of employing . . . forces."[46]

Popular publications in the 1920s and 1930s carried accounts of autogyro developments. Articles written under pseudonyms by military authors allowed a public doctrinal debate that yields some interesting insights. The specifics, which centered on the machine's slow speed and upward-

Weapon systems like the F-111 (above) have often been sold as being all things to all people. With weapon systems becoming increasingly expensive, we must carefully consider the true capabilities of each new system and its doctrinal implications.



firing defensive guns, are not as important as the essence of the argument: whether the autogyro fit into current doctrine.

An article that sparked considerable reply was about one particularly desirable feature: at speeds below which an airplane would stall, an autogyro remained stable (though descending), a phenomenon similar to hovering. It had some capabilities that could not be matched by pursuit planes of the day. The author, writing under the pseudonym "D/IOI," included a tantalizing reference to an autogyro that could turn at speeds as low as five miles per hour. He asked, "Is this what we have been waiting for all these years? Full control over the whole range of speed—and what a range! It looks suspiciously like it."[47]

Doctrine held that the tighter an aircraft could turn, the better it could dogfight.[48] When a fighter with a turn radius of 300 yards met an enemy aircraft that pivoted in 30 yards, the latter had an obvious advantage.[49] The autogyro seemingly had all the elements of a superb dogfighting vehicle. D/IOI therefore argued that the autogyro required a radical revision of those parts of current doctrine that did not favor the aircraft.

On the other hand, pursuit pilots knew that speed meant survival. Responding to D/IOI, "Merlin" explained that although an autogyro could theoretically outturn a fighter while almost pivoting, a lack of speed had its disadvantages. Slow, descending autogyros had no evasive capability. Furthermore, airplanes of the time generally had guns that fired off-axis in any hemisphere—it was accepted, it worked, and doctrine accounted for this kind of self-defense. The problem of firing through the windmill propeller was similar to the problem of firing through airplane propellers that had been solved in World War I, but no one could solve the windmill problem. This matter was considered a serious shortcoming.[50] Thus, autogyros were vulnerable to attack from above, a point of considerable concern.[51] It was a sitting duck for a fast fighter. Merlin postulated a scenario in a future war wherein the World War I sport of balloon-strafing had been replaced by gyro-strafing.[52] In other words, tactics could overcome the autogyro's advantages. Merlin took the position that the autogyro was simply another aircraft and should be evaluated on the basis of existing doctrine.

Merlin had accurately described the autogyro's vulnerabilities, implying they outweighed the advantages. He correctly used his experience to show that the autogyro's lack of speed, like Excalibur of his namesake's era, was a double-edged sword. Merlin erred by considering only what was possible with current offensive tactics. He did not see that a reasonable extension of doctrine, allowing for different defensive tactics, might change the evaluation of the autogyro.

Instead of viewing the problem as an "aerialist," Royal Army Maj R. Hilton, a ground officer with some flying experience, tried to be evenhanded. His experience in World War I taught him that machines with autogyro-like capabilities met needs arising from the coordination of air and ground forces. Hilton felt that doubts about the autogyro as a machine of war were based less on utility than vulnerability. But the method of employing the autogyro determined whether it would be vulnerable. He correctly pointed out that "at this stage of development prejudice might easily damn the whole idea without a fair trial. . . ."[53]

With considerable doctrinal vision, Hilton described how an autogyro might be best employed for ground support. Critics had postulated that autogyros would fly high over the enemy lines like World War I aircraft; however, Hilton said that flying low over one's own lines was best. In sound doctrinal fashion, he cited an incident to illustrate that an R.E.8 reconnaissance aircraft concerned with attack from above should fly at low altitude:

> On the 8th [of] August, 1918, an artillery machine (R.E.8) was attacked over Proyart by five Fokker biplanes. The observer was badly wounded and could not continue firing his gun. The pilot could only occasionally get his

> front (fixed) gun to bear on an enemy machine owing to the inferior power of maneuver of the R.E.8 as compared to the 1918 Fokker. The fight therefore became a rather one-sided affair, the British machine being unable to reply at all to the fire of the five single-seaters. Finally, the R.E.8 escaped from this awkward situation by gradually losing height till pursuers and pursued were just missing the tops of trees along the banks of the Somme. After a few minutes of dodging about among the trees the pursuers drew off to a safer height, and saw their quarry fly off down the river, keeping below the level of the banks and crossing the lines at about twenty feet![54]

In the R.E.8's do-or-die situation, such tactics were necessarily dangerous, but Hilton explained that the autogyro could safely perform this maneuver because of its lower speed and thus offset some of its vulnerabilities.

As tactics change with time, experience, and new development, so must precepts about what works best.[55] If doctrine were to speak only about experience, it would be useless in developing new weapons or employing new tactics. The example of the "nap-of-the-earth" tactics derived from the R.E.8's escape shows that doctrine must consider new tactics in resolving speculative matters. Without actual autogyro combat employment, there could be no doctrine were it not for the ability to extend current thinking.

Doctrinal extension does not have to be lunacy. Overselling a partial solution to a problem leads to folly or failure or both. The autogyro did not demand a complete revision of doctrine because it was not the revolution in aviation that its inventor and others claimed. But it was just as clearly not a continuation of current practice. The R.E.8 episode suggested that an extension of doctrine would have been appropriate in evaluating the autogyro. This extension was not considered, however, because people had high expectations for this seemingly revolutionary aircraft. In a Darwinian survival of the fittest caused by its creator's overselling, the autogyro was supplanted by the helicopter and consequently joined the dinosaurs as a historical curiosity.

The Autogyro and Weapons Advocacy

The role of a weapons advocate in any age carries great responsibility. It combines the need for a firm understanding of doctrine, engineering, and technical matters with a balanced assessment of what is and may be possible; it requires the ability to make a clear distinction between reality and potential. Many people who felt strongly about the autogyro found that it is one thing to act as an advocate and quite another to be a responsible advocate.

The autogyro demonstrated that vertical-flight machines could be useful but not to the extent that they should replace conventional aircraft.[56] The autogyro was neither airplane nor helicopter, but advocates made the mistake of trying to sell it as a combination of the two. The overselling of this limited military vehicle led to its demise and inhibited development of the helicopter. The fact that helicopters eventually developed superior capabilities may cause us to overlook the possibility that the autogyro might have had a place in military aviation if it had been properly sold and evaluated in an extended doctrinal context. The focus should have been on employing an autogyro to take advantage of its capabilities while minimizing its vulnerabilities.

The visionaries zealously predicted capabilities they no doubt expected to achieve someday. These individuals made their claims so often that they became accepted as reality and served to inflate expectations even more. Consequently, when the autogyro failed to live up to these unrealistic expectations, the disappointment was such that it was dropped altogether. There was no interest in pursuing its actual—though limited—capabilities. The fall of the autogyro was exacerbated by the unnecessary and misleading attempts of these advocates

to suggest that it satisfied all or most of the needs of future military aviation. A proper doctrinal evaluation might have helped put the autogyro in perspective and might possibly have improved military operations.

The Autogyro and Us

People today think of autogyros in much the same way they do dinosaurs: they have seen pictures but have never really touched one. Thus, autogyros lack a sense of immediate reality. Nevertheless, the lessons learned from the autogyro about the relationship between weapons advocacy and doctrine are not fossils fit only for archaeologists; they still apply.

We must continue to be wary of any concepts that are oversold by their advocates.[57] We are reminded that advocates who sold the F-111 promised that it would be the fighter of the future for both the Air Force and the Navy.[58] Other examples from the past 15 years include the development of the fighter that could not be shot down, armed with the missile that could shoot down any fighter,[59] and the space shuttle that could meet everyone's launch needs. Although these systems are extremely good, they are not as good as their advocates claimed. None of them live up to all the promises of their overzealous advocates. Failure to live up to exaggerated claims has subjected these and other vital systems to unwarranted and unproductive criticism.

The military must justify the need for all new weapons before Congress and the American public. This system of advocacy can lead to overselling, as was the case with the autogyro. If one were to reread this essay and substitute the names of current or planned weapon systems for the autogyro, the overly optimistic claims would sound disturbingly familiar. We must remember that just as the autogyro stymied the helicopter, so may some oversold weapon systems prevent us from developing others of equal or greater importance.

Advocacy is essential, but no more so than using adequate doctrine as the foundation for realistic expectations and evaluation. Doctrine does more than merely guide weapon employment and illuminate potential; it "defines the roles and missions of the service, the scope and potential capabilities of its weapon systems."[60] Doctrine must allow for acquiring the best weapons, anticipating reasonable changes in the character of war, eliminating shortcomings without introducing new limitations, and taking the process of implementation from initial advocacy right through to final application.[61]

The idea that the experience of the R.E.8 could be doctrinally extended to a new vehicle or a new situation is still quite relevant. We constantly revise and update our basic aerospace doctrine, which includes doctrine associated with "strategic aerospace offense, at all levels of conflict."[62] Were it not for the ability to extend doctrine through the use of appropriate historical lessons learned, some doctrine would be impossible to write unless we experienced actual nuclear combat.

Yet after 30 years of operating space systems in peace, crisis, and conflict, and gaining considerable detailed experience sufficient to write valuable doctrine, we have not codified our experience into an adequate space doctrine.[63] Application of basic air doctrine may not be appropriate since space forces are not the same as air forces. Nor is simple extension of basic doctrine likely to prove adequate. Speed, range, and flexibility—the characteristics of air forces—do not serve space forces well and cannot be increased without eventually encountering physical and practical limitations.[64] Just as in the case of the autogyro and possibly that of early Army aircraft, the Air Force stands the chance of improperly evaluating both space systems and service roles and missions in space unless its doctrine is explicit and relevant.

We should learn the lessons of history and pay close attention to particulars because no two situations are ever exactly

alike. We should use these lessons to anticipate the future and prepare ourselves for the changing character of war. If we do not do so, then in the eyes of history we shall join the autogyros and the dinosaurs. □

Notes

1. I. B. Holley, *Ideas and Weapons* (Washington, D.C.: US Government Printing Office, 1983), 10.

2. Charles W. Cook, "The Genie Is Alive and Well," address to the tenth annual Aerospace Power Symposium, 11 March 1986.

3. Holley, 10.

4. Air Force Manual 1–1, *Basic Aerospace Doctrine*, 16 March 1984, 2–2.

5. Holley, 10.

6. Bernard Brodie, "The Continuing Relevance of *On War*," introduction to Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1984), 57.

7. Chester L. Morris, *Pioneering the Helicopter* (New York: McGraw-Hill Book Company, Inc., 1945), vii. The 1937 edition of the *Encyclopaedia Britannica* says that a helicopter is "extravagant of power. In the light of modern knowledge, one horsepower cannot be expected to lift more than about 15 lb. The whole of the power of a modern commercial aeroplane arranged as a helicopter would be needed merely to sustain it, leaving nothing to raise or propel it."

8. G. Apostolo, *The Illustrated Encyclopedia of Helicopters* (New York: Bonanza Books, 1984), 8.

9. "Aeronautical Briefs," *Aviation* 12, no. 13 (27 March 1922): 378.

10. Apostolo, 10, and Robert A. Hasskarl, Jr., "Early Military Use of Rotary-Wing Aircraft," *The Air Power Historian* 12, no. 3 (July 1965): 75.

11. Apostolo, 10, and Hasskarl, 75.

12. Apostolo, 10, and "The Improved Autogyro," *New York Times*, 20 September 1928. This editorial and other articles in various publications repeatedly tried to clear up the mistaken impression that the autogyro and the helicopter were the same. That misconception grew until it contributed to the difficulty of finding funds for real helicopter research and development.

13. Juan Cierva, "The Autogiro—Its Future as a Service Aeroplane," *Journal of the Royal United Service Institution*, May 1928, 698. Cierva explains that in 1918 a severe accident after stalling a conventional airplane led him to search for the means of stall prevention that was eventually incorporated in his invention. See also Warren R. Young, *The Helicopters* (Alexandria, Va.: Time-Life Books, 1982), 56.

14. Apostolo, 12. See also "Helicopter Rises 81 Feet," *New York Times*, 11 February 1923; "Autogiro Hailed as Plane of Future," *New York Times*, 2 December 1930; and "'Autogyro' Flies from London to Paris," *Baltimore Sun*, 18 September 1928.

15. "W. Wallace Kellett," *U.S. Air Services* 25, no. 9 (September 1940): 24–28. Cierva was able to enlist capable and ardent supporters, not the least of whom were Pitcairn and Kellett in the United States.

16. Thomas R. Reed, "Juan de la Cierva," *U.S. Air Services* 22, no. 1 (January 1937): 12.

17. "Autogiro Is Able to Land Upon Almost Any Backyard," *New York Times*, 24 February 1929. The issues of flight safety and the invulnerability attributed to the autogyro were sources of considerable debate. Thomas Carroll, test pilot for the National Advisory Committee on Aeronautics, asserted in the *Times* of 16 November 1930 that "the element of personal safety is governed, in the autogiro, in a ratio of about 10% piloting skill to 90% inherent aerodynamic safety. It would be practically impossible to overstate my optimism for this style of flight." However, a few crashes early in the autogyro's history and several crucial ones in its military testing served as much as any factor in discrediting such claims. These accidents were due to the difficult handling of the autogyro, which brought into question the validity of previous claims.

18. Cierva, 699.

19. See H. L. Lewis, "The Military Value of the Autogiro," *U.S. Air Services* 17, no. 10 (October 1932): 36; Lt Col G. P. Lawrence, "Ambulances Take to the Air," *U.S. Air Services* 18, no. 6 (June 1933): 16; "Ships Can Carry Autogiros to Spot Submarines," *Scientific American* 161, no. 6 (December 1939): 339; and *Observation Aviation* (Headquarters, Air Corps Advanced Flying School, 1938), 12.

20. "Pitcairn to Manufacture the Autogiro in America," *U.S. Air Services* 14, no. 3 (March 1929): 56.

21. "Navy Buys Autogiro to Try on Warships," *New York Times*, 23 January 1931.

22. *U.S. Naval Institute Proceedings* 57, no. 8 (August 1931): 1119.

23. Rear Adm W. A. Moffett, remarks upon presentation of the Collier Trophy to Harold Pitcairn, 22 April 1931.

24. Lt Col Victor Dallin, "National Guard Autogiros," *U.S. Air Services* 24, no. 5 (May 1939): 27. Brig Gen T. E. Rilea, president of the National Guard Association of the United States, said the National Guard needed at least one autogyro in each state as an emergency vehicle. Maj Gen E. C. Shannon of the Pennsylvania National Guard said the autogyro would replace the observation balloon.

25. *U.S. Naval Aviation, 1910–1980*, NAVAIR Publication 00-80P-1, 161. The less than encouraging results of the trials were not due to any shortcomings of the aviator Mulcahy. While in Nicaragua he earned the Nicaraguan Medal of Distinction and Cross of Valor (see *The Marine Corps Gazette*, March 1934). As a sidelight to the history of the XOP-1, Lt A. M. Pride first flew the XOP-1 from the USS *Langley* on 23 September 1931.

26. *U.S. Naval Institute Proceedings* 61, no. 3 (March 1935): 438.

27. Joseph N. Kane, *The Pocket Book of Famous First Facts* (New York: Pocket Books, 1970), 29. See also Apostolo, 16.

28. "Autogiros and the Future," *The Fighting Forces* 12, no. 2 (June 1935): 158; *U.S. Naval Institute Proceedings* 60, no. 8 (August 1934): 1175; 60, no. 7 (July 1934): 1024; 58, no. 8 (August 1932): 1235; and *U.S. Air Services* 18, no. 1 (January 1933): 46.

29. Norman Polmar and Floyd D. Kennedy, Jr., *Military Helicopters of the World* (Annapolis, Md.: Naval Institute Press, 1984), 61–62, 103, 147. Some German submarines towed autogyros and used them to spot enemy shipping over the horizon without being detected. The Japanese used some copies of their Kellett autogyro for antisubmarine work.

30. "British Air Crash Kills Cierva and 13," *New York Times*, 9 December 1936. It was ironic that Cierva died in the crash of a fixed-wing airliner. The *Times* reported that "his distrust of the modern airplane . . . led him to regard patronage of airlines as an emergency measure."

31. Reed, 12.

32. Polmar and Kennedy, 2.

33. "British Air Crash Kills Cierva and 13," *New York Times*.

34. "Autogiro Is Hailed As Plane of the Future," *New York Times*, 2 December 1930. Cierva predicted a 7-ton payload and speed of 200 mph for his autogyros, which at the time flew at 115 mph with a gross weight of 3,500 pounds. Compare "Navy Buys Autogiro to try on Warships," *New York Times*, 23 January 1931. The Pitcairn XOP-1 was sold to the Navy at a cost of $29,500 per copy, far in excess of Cierva's earlier prediction of $2,000 per copy for a two-place autogyro, made in the *Times* of 20 September 1928.

35. Hasskarl, 77.

36. *U.S. Air Services* 10, no. 12 (December 1925): 47. In one of the earliest military tests, Capt F. T. Courtney flew a Cierva machine at Laffan's Plain, England, in late 1925 and crashed due to a design flaw in the rotor attachment assembly and the aircraft's poor handling qualities. In February 1927, *Flight* reported that Courtney crashed another autogyro near Hamble, England, and broke his ribs. Afterwards he refused to fly for Cierva.

37. Hasskarl, 77. Fixed-wing observation planes were costing the Army about $30,000 compared to the $40,000 to $50,000 per Kellett autogyro. The useful payload of an autogyro was about 50 pounds more than crew weight.

38. *Observation Aviation*, 12.

39. T. C. Hone and M. D. Mandeles, "Interwar Innovation in Three Navies: U.S. Navy, Royal Navy, Imperial Japanese Navy," *Naval War College Review* 40, no. 2 (Spring 1987): 80; and Col D. M. Drew, "Technology and the American Way of War: Worshiping a False Idol?" *Air Force Journal of Logistics* 11, no. 1 (Winter 1987): 21.

40. Hasskarl, 77, and Willis L. Nye, "Pitcairn-Cierva C.8," *American Aviation Historical Society Journal* 11, no. 4 (1966): 278. The depth of the depression is cited as another reason for the demise of the commercial versions. Young agrees that the depression was influential. Neither of these sources explains how the military autogyro's failure was a result of the depression.

41. Apostolo, 16–20.

42. Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1984), 140–41.

43. Maj L. Parker Temple III, "How Dare They Tamper with the Sacred Functions of the Horse Cavalry?" *Air University Review* 37, no. 3 (March–April 1986): 25.

44. Maj Gen I. B. Holley, Jr., "The Role of Doctrine," *Air Force Journal of Logistics* 10, no. 1 (Winter 1986): 9.

45. I. B. Holley, Jr., "An Enduring Challenge: The Problem of Air Force Doctrine," *The Harmon Memorial Lectures in Military History*, no. 16 (USAF Academy, 1974), 2–3.

46. Gen Charles A. Gabriel, foreword to Air Force Manual 1–1, *Basic Aerospace Doctrine*, 16 March 1984, iii.

47. D/IOI, "One, Two, Three . . .?" *The Fighting Forces* 10, no. 3 (August 1933): 253.

48. Lewis, 36. Attributed to "no less an authority than Capt. Lewis A. Yancey [who] has expressed the opinion that the autogiro could be essentially superior to existing pursuit planes for fighting purposes. Captain Yancey has on three occasions offered to make a flight of about one hundred miles between given points and so maneuver his autogiro that it would be impossible for a standard pursuit job to photograph him with a camera gun." There is no record of anyone accepting his offer.

49. D/IOI, 254.

50. Synchronizing upward firing guns with the variable rate of the unpowered windmill's rotation would have required a technology far in advance of that of the 1930s.

51. Merlin, "One, Two, Three . . .? (a Continuation)," *The Fighting Forces* 10, no. 5 (December 1933): 508–9. Merlin did not know of the capacity problem that would have prevented carrying defensive armament. See also Capt F. T. Courtney, "Inst.Ae.E. House Dinner," *Flight* 19, no. 15 (14 April 1927): 229. (See note 36 for Courtney's qualifications.)

52. Merlin, 508–09.

53. Maj R. Hilton, "The Alleged Vulnerability of the Autogiro," *The Fighting Forces* 11, no. 3 (August 1934): 231.

54. Ibid., 234.

55. Col Kinzie Edmunds, Foreword, *Military Review*, 1 June 1940.

56. *U.S. Naval Institute Proceedings* 51, no. 5 (May 1925): 854. "The whole idea of this machine is still in its infancy, but it may contain the germ of a great and fundamental improvement. . . ."

57. Cook, "The Genie Is Alive and Well."

58. Robert J. Art, *The TFX Decision: McNamara and the Military* (Boston: Little, Brown and Company, 1968), 33.

59. This example derives from remarks of Gen Robert T. Marsh, commander of Air Force Systems Command, when discussing the establishment of a formal program of review for weapon systems and their advocacy.

60. Holley, "An Enduring Challenge," 3.

61. Holley, "The Role of Doctrine," 9.

62. AFM 1–1, 3–2.

63. Temple, passim. The author acknowledges the existence of the Air Force Space Doctrine, AFM 1–6, which does not fit the criteria for doctrine as outlined in "Functions of the Horse Cavalry" and the present essay. It contains little information about space experience and even less doctrine.

64. Ibid. This essay discusses the inapplicability of current doctrine.

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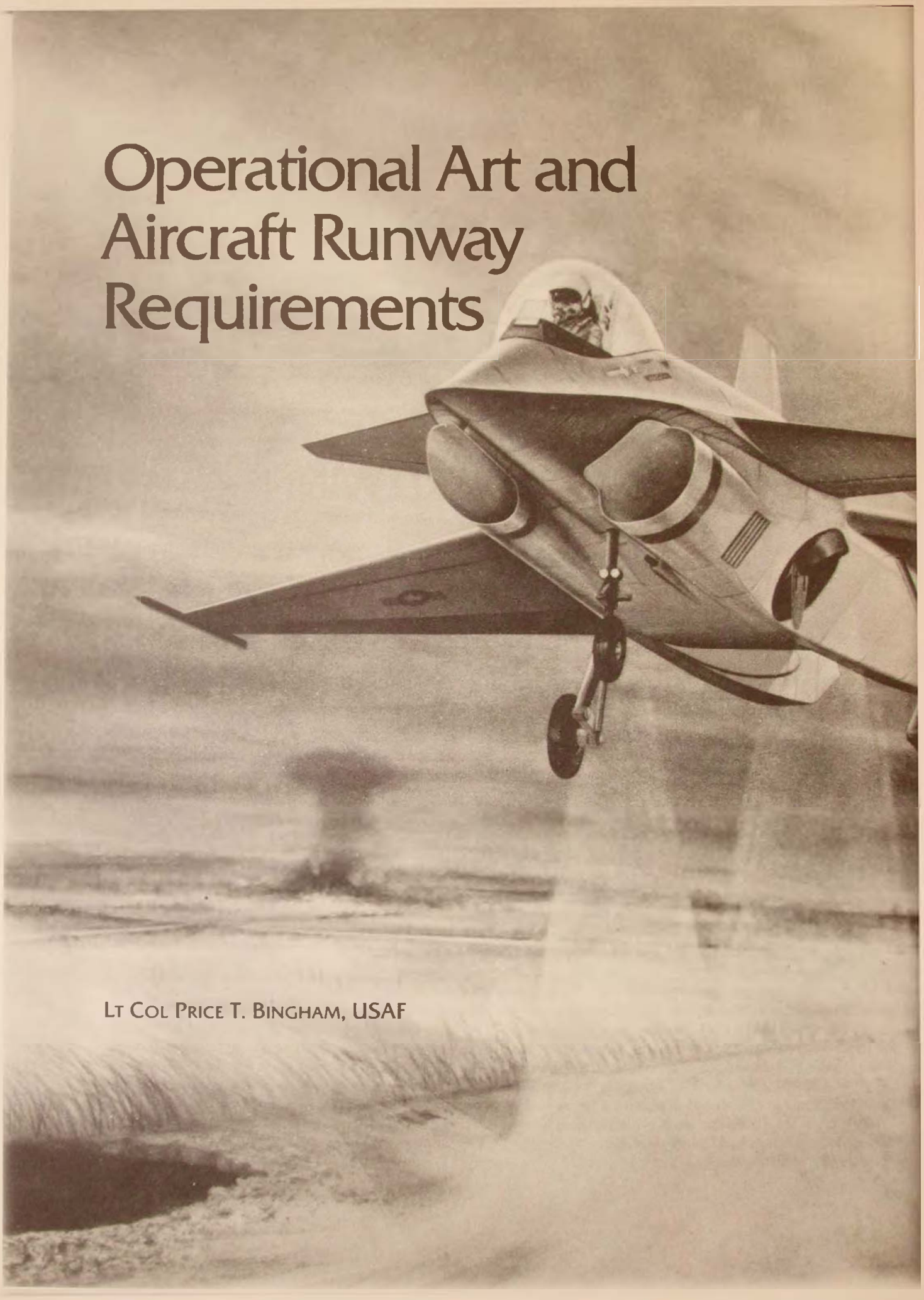
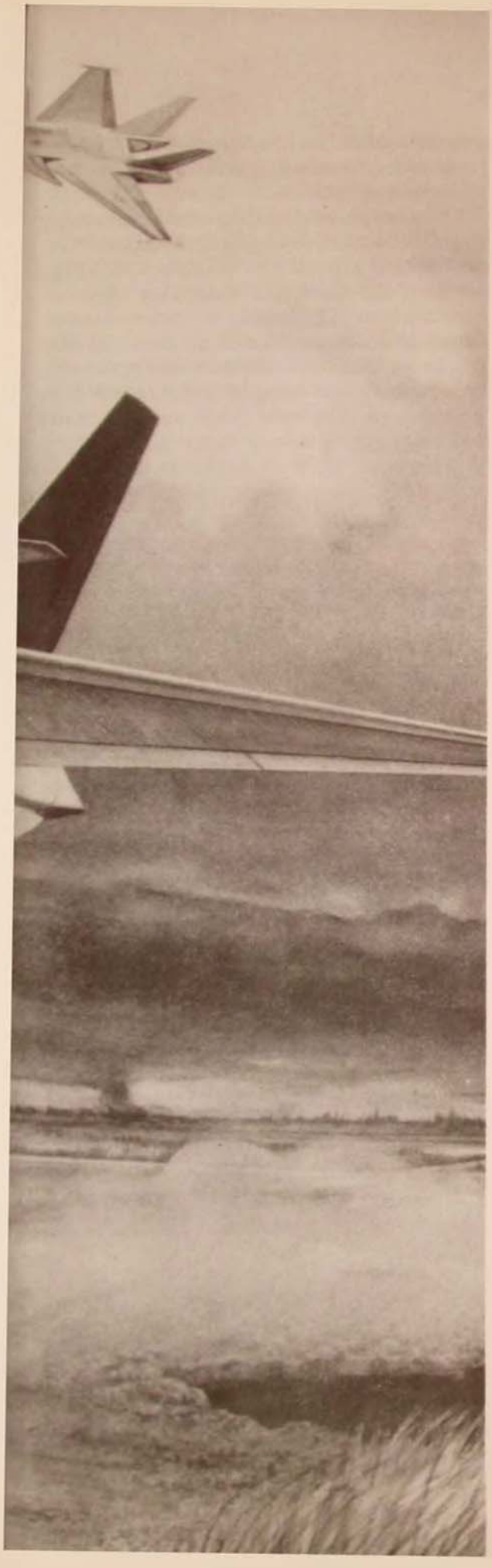


Lt Col Price T. Bingham, USAF



The availability and operability of air bases during a campaign is, to a large extent, determined by runway requirements for fighter/attack aircraft.

A COMMANDER exercises operational art to achieve strategic goals through his design, organization, and conduct of campaigns and major operations.[1] In designing and organizing a campaign, a commander uses movement to provide his forces with the advantages (surprise, concentration, and position) that will give them the best opportunity to win engagements and battles. Likewise, in conducting a campaign, a commander continues to use movement in order to exploit the opportunities provided by the outcome of individual engagements and battles.

While it may not always be fully appreciated, the exercise of operational art is not confined to the movement of ground and naval forces. Operational art also involves the use of air bases to move air power so aircraft—especially fighter/attack aircraft—can fly enough effective sorties when and

where they are needed to help win a campaign. By examining the importance of air bases to the exercise of operational art, this article will show why aircraft runway requirements are the key to the availability and operability of air bases during a campaign. It will also show why we must choose between two different approaches for reducing aircraft runway requirements. A choice is necessary if we want to make it easier for a commander fighting a campaign to use air bases to move his fighter/attack aircraft.

The availability and operability of air bases during a campaign is, to a large extent, determined by runway requirements for fighter/attack aircraft. When aircraft have very demanding runway requirements (length, width, hardness, and smoothness), it is likely that fewer suitable air bases will be available in a theater. If the number of air bases available is small, their importance to a campaign is likely to grow, making them more lucrative targets and increasing their operability problems.

Of course, availability and operability problems created by aircraft runway requirements are not the only ones afflicting an air base during a campaign. Aircraft maintenance, the supply of fuel and munitions, and command and control can also create serious difficulties. These problems, however, should often be easier to solve. To understand why this is so, we need only

The P-38 (below) had a relatively long combat range, making it a valuable asset in the South Pacific campaign of World War II when it had to cover long distances from available bases to target areas. Aircraft such as this P-47 (right) moved to forward operating bases as soon as they were available to support the advancing ground forces. This technique demanded units that were highly mobile and able to adapt quickly to the changing combat environment.

compare what is needed to solve the latter problems to the large number of people and immense quantities of equipment, construction material, and transportation resources that are required to build a runway (let alone taxiway and ramp space) for our current fighter/attack aircraft. Unfortunately, an even more important reason is likely to be apparent only during a campaign, when we will be able to see clearly the value of time required to build or repair runways.

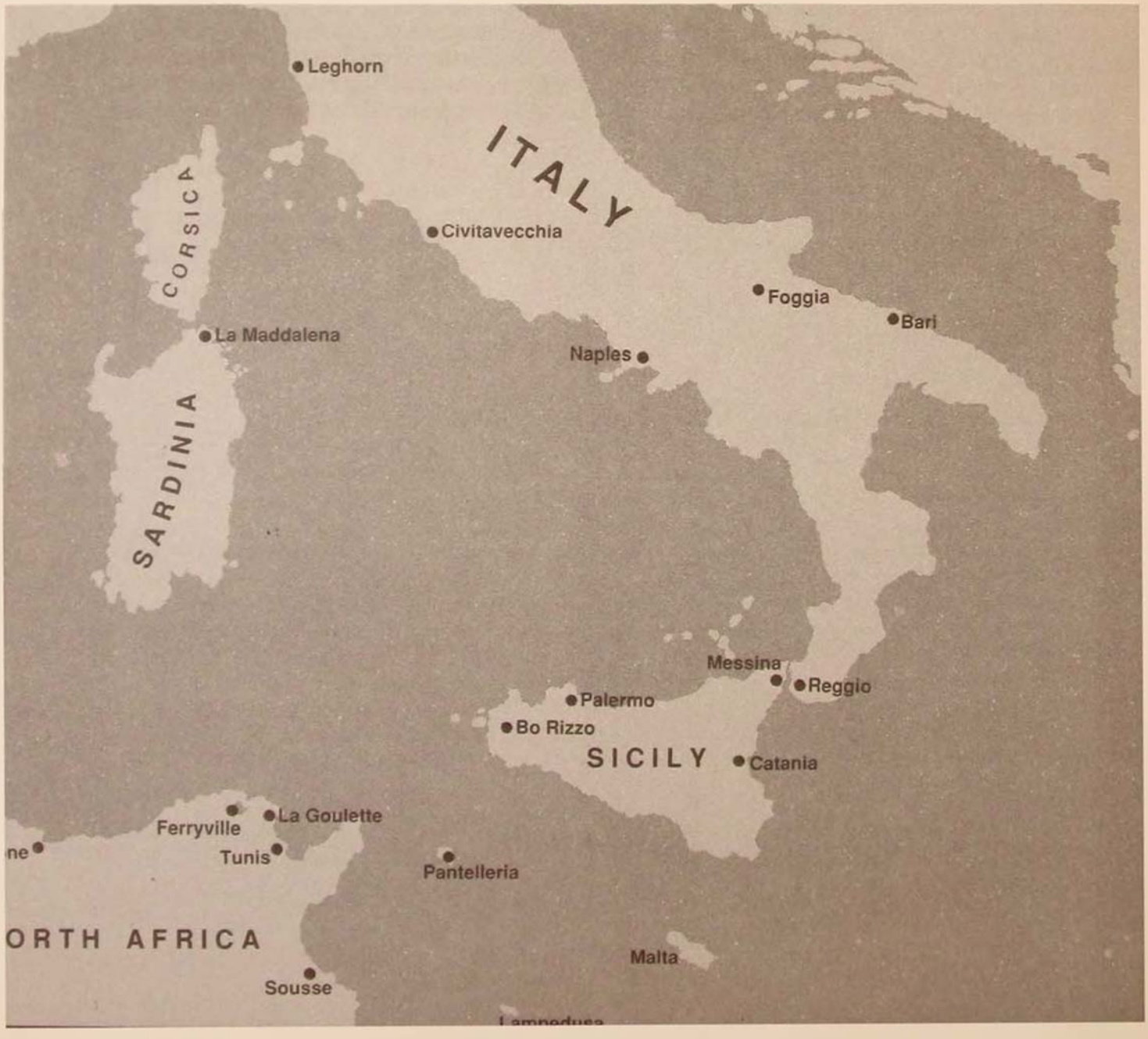
When runways require great amounts of resources and time to build or repair, not only are fewer suitable bases likely to be available but also these bases will probably not be located where the sorties they generate can most effectively contribute to a campaign. This situation is especially true if the campaign involves the rapid movement of surface forces. The location of air bases is extremely important because the distance between a base and the enemy can influence the effectiveness of a fighter/attack aircraft sortie in a variety of ways. If the distance is great, it takes longer to fly a sortie, thereby reducing the number of sorties that a given force structure can fly. Distance also reduces the responsiveness of sorties flown from a particular air base, which can be of critical importance in a fluid battle. Responsiveness can be increased by airborne alert but at a cost of reducing the number of sorties flown.

Airborne alert and/or the need to fly a great distance can also reduce an aircraft's tactical (airborne) performance. Both situations increase an aircraft's fuel requirements, which usually reduce the amount of munitions it carries, its persistence when engaged in combat, and, quite possibly, even the ability to exploit its maximum airspeed (due to the danger of fuel exhaustion). Distance between a base and the enemy is

an especially important concern if the threat is such that our aircrews must fly at low altitudes and high airspeeds where fuel consumption is greatest.

Air refueling (depending on the location of the refueling track in relation to the target) is one way we can reduce some of the tactical handicaps caused by the distance between a base and a target. But air refueling increases the complexity of command and control and makes employment more predictable, especially when used frequently. In addition, tanker aircraft require bases with considerable ramp space and long runways. While it is possible to design an aircraft whose tactical performance remains adequate after flying a long distance, the cost of this approach can be high. Such a design may call for larger, heavier, and more complex and expensive aircraft, which are often vulnerable and difficult to produce and maintain.

If we have only a relatively small number of bases, most of which are located well to the rear, our campaign (particularly its air aspects) is likely to be predictable. Furthermore, fewer available bases often means that more aircraft must be concentrated at each location in order to generate a given number of sorties. If a campaign's success



depends on the sorties generated by just a few bases and if each base contains a large number of assets (aircraft, support facilities, runways, taxiways, etc.), these bases will be lucrative targets. It follows that an enemy would be more likely to attack these bases. As an enemy increases his effort to attack our air bases, operability problems will quickly intensify. To appreciate how aircraft runway requirements could affect air base availability and operability in a future campaign, we need to begin by examining past campaigns.

World War II

The distances between air bases (or locations suitable for air bases) and the location of enemy forces explain why air base availability and operability were so important in planning, organizing, and conducting our campaigns in the Pacific theater during World War II.[2] Solving the problem of air base availability by either seizing an air base or a location where one could be quickly constructed was usually one of the first objectives in a campaign, as we can see in our decision to invade Guadalcanal.[3] Once we possessed the air base on Guadalcanal, its continued operability—despite Japanese air, land, and naval attacks—proved to be a major factor in our eventual success in that campaign.

Air bases also played an important role in determining which aircraft were most effective. Early in the war in the Pacific, the distances between our bases and the enemy made the long-range P-38 Lightning a very popular aircraft with Gen George C. Kenney, Gen Douglas MacArthur's air commander.[4] Unfortunately, compared to most single-engine aircraft of the time, the P-38 was much larger, more expensive, and more difficult to produce quickly in large numbers.

The invasion of Sicily was a classic example of having to select invasion points based on the need to secure airfields as soon as possible. The distance from North Africa made it necessary to secure airfields on outer islands in order to support the main operation.

The relatively limited range of our fighters helped make air bases an important factor in our Northwest African campaign. Gen Henry H. Arnold noted that during the initial landings, "The precious few airfields were not targets for our bombs but immediate objectives on the ground [for our invading ground forces]. Until they were secured, our planes would not be able to operate."[5] Later, after we lost the race of Tunisia, wet weather turned the runways on most of our bases into quagmires. Our nearest all-weather base—at Bone, Algeria—was some 120 miles from the fighting (fig. 1). Moreover, as Maj Gen James H. Doolittle noted, the lack of suitable bases within reasonable range of the enemy meant he could employ at one time only about a third of the 600 aircraft at his disposal.[6] In contrast, the Germans had two all-weather air bases only 20 to 25 miles from the fighting.[7] This basing advantage of the Germans does much to explain our poor performance in the air during this phase of the campaign.

The air base advantages in this campaign were not all on the German side, however. British bases on Malta, despite intense German air attacks, played a key role in the ability of Allied air power to interdict Axis lines of communication across the Mediterranean. The effectiveness of this Malta-based air power in limiting the amount of supplies that reached North Africa contributed significantly to the defeat of the Axis at El Alamein and later in Tunisia.[8]

Our subsequent effort to seize Sicily provides still more evidence of the important role of air bases in a successful campaign. As in North Africa, we chose sites for amphibious landings in Sicily so our forces could capture bases quickly. Before we invaded, however, it was necessary to capture the bases on the islands of Pantelleria and Lampedusa. We needed these bases because single-engine fighters operating out of North Africa did not have the range to provide effective support for our landings in

With the increased sophistication of jet aircraft came the requirement for bigger and more improved airfields. At times aircraft such as these F-80s (right) were forced to operate from Japan because suitable bases were not available in Korea. On the other hand, the venerable F-51 (above) was able to operate under very austere conditions much closer to the fighting, making it a more reliable asset.

Sicily and because bases on Malta could not support the required number of aircraft. To help make the landings a success, we also used our bombers to make heavy air attacks on German bases in Sicily, Sardinia, and Italy. By reducing German air base operability, these attacks seriously hindered the ability of enemy fighters to interfere with the invasion.[9]

Similar basing considerations continued to dominate our plans for landings in Italy and Northern France. Recognizing that the Germans could be withholding fighters to oppose the invasion of Normandy, we attacked all German air bases within a 150-mile radius of Caen. Our objective was to force the Germans to operate from bases that were as far from Normandy as were our bases in England.[10]

Although we had an extremely large number of fighter-bombers based in England, our commanders knew that the distance to Normandy from English bases would severely limit the effectiveness of these aircraft. Drawing on their experience in previous campaigns, the leadership of the Ninth Air Force made invasion plans based on the idea that "to a tactical air force mobility on the ground is what flexibility is in the air. Fundamental to the mobility of a

tactical air force is the provision of airfields where, when, and of types required by the tactical commands and administrative elements most effectively to carry out their respective tasks." To this end they organized, trained, and equipped Ninth Air Force units to move individually or collectively at a moment's notice.[11]

Putting its plan into action, Ninth Air Force engineers quickly began building bases in France soon after the initial landings. By D-day plus five (D + 5) Ninth Air Force had three fighter-bomber airfields under construction on the Omaha beachhead and one on Utah. By D + 16 Ninth Air Force had five fighter-bomber groups (equivalent to today's wings)—each with about 72 aircraft—based in Normandy. Eight days later, nine all-weather airfields were completed, and seven others were under construction.[12]

By 31 July 1944, 17 fighter groups of the Ninth Air Force were fully operational from bases in France, supporting 19 American divisions. One of these groups was the 405th, whose P-47 "Thunder Monsters" began arriving at strip A-8 on 11 July 1944. The 826th Engineer Aviation Battalion had built the runway at A-8 in only one day using American prefabricated bituminous surfacing (also called Hessian Matting). Besides

the runway, A-8 had 75 hardstands for the 405th and 36 hardstands for British Mosquito night fighters that arrived in early August. At first, A-8 was so close to the fighting that the 405th had to make its takeoffs to the east, toward Utah Beach.[13]

The Ninth Air Force continued to emphasize basing mobility as our forces advanced across Europe. For example, to remain near the ground battle during August and September 1944 when Allied armies were making a rapid advance, eight fighter-bomber groups moved to new bases two times; one unit, the 354th, moved three times.[14] Yet, despite its great efforts, Ninth Air Force still had trouble building bases fast enough to keep up with the Third Army's rapid advance during this period.[15]

Korea

Air bases continued to play a crucial role in our campaigns during the Korean War. When the rapid advance of invading North Korean forces made bases at Kimpo and Suwon unavailable, we had no air bases left in Korea whose runways were suitable for the high-performance F-80C Shooting Star. Consequently, we were forced to fly F-80s from bases on Kyushu in Japan, a situation that imposed the same kind of handicaps that had applied to our fighters based in England during the Normandy invasion. Aided by the recall of World War II vintage F-51 Mustangs from storage and by the Air National Guard, however, we were able to field a fighter-bomber that could use the runways that were still available in Korea. Unlike the F-80, the F-51 could operate from short, rough surfaces like the 3,800-foot clay and gravel runway at Taegu. The advantage this ability gave us, despite the F-80's superior airspeed, was apparent when Brig Gen Edward J. Timberlake—deputy commander of Fifth Air Force—noted that "one F-51 adequately supported and fought from Taegu Airfield is equivalent to four F-80s based on Kyushu."[16]

To a large extent, similar basing considerations were the key to the effectiveness of the air support and protection from enemy air attack that our ground forces enjoyed in Korea. Thanks to our frequent air attacks, we usually were able to keep Communist bases in Korea inoperable for all but light aircraft. As a result, Communist fighters were generally confined to areas like "MiG

During the Vietnam War, runway construction took a number of months. This fact gave the enemy even more incentive to attack the few existing airfields. Arresting gear, shown here stopping an F-100, is one way of shortening landing distances, but it has numerous drawbacks.

Alley" that were within range of their sanctuary bases in China. By the same token, our ability to provide effective support to UN ground forces, particularly during their advance out of the Pusan perimeter, depended on how quickly our engineers could make bases in Korea like Kimpo and Suwon operable.[17]

Southeast Asia

When we introduced ground forces into South Vietnam, once again air base availability and operability was the initial objective. As our involvement increased, it soon became evident that there were not enough suitable air bases to support the number and type of aircraft we wanted to employ. Moreover, the location of those bases that were available seriously delayed the responsiveness of many sorties. To make more bases available—especially where they would reduce the time it took a fighter to reach a target—we undertook the construction of additional bases at Cam Ranh Bay, Phan Rang, Phu Cat, and Tuy Hoa.[18]

Examination of the construction of Tuy Hoa is important for what it reveals about trends in our ability to quickly build bases

suitable for our fighter/attack aircraft. During World War II, one reason for Ninth Air Force's mobility was that it possessed the resources needed to build or repair bases quickly, even "in the most forward areas under enemy observation and fire."[19] The Ninth also possessed aircraft like the P-47 and P-51 that could use short, rough, easy-to-build runways. In Korea the shortage of engineers and heavy equipment proved to be a "grave deficiency" that had to be overcome before Fifth Air Force could base F-51s—let alone high-performance jets—on the peninsula.[20] By the time we were fighting in Vietnam, our continued emphasis on improving airborne performance (especially airspeed) had resulted in our fighter/attack aircraft needing runways that were longer, harder, smoother, and cleaner; ramps; taxiways; and more elaborate maintenance facilities. Unfortunately, we had not proportionally increased our engineer capability. To fill the urgent need for air bases, we were forced (and were able) to use civilian contractors to build Tuy Hoa.

The plan we developed allowed the contractor (who was selected on 13 May 1966) to use a 700-man, multiskilled work force augmented by 600 Vietnamese laborers. After an intensive effort, the contractor finished a 9,000-foot aluminum matting runway on 12 November 1966, *five months* after his advance party had arrived in the theater. In late December—after completing interim facilities including petroleum and ammunition storage, communications, navigation aids, utilities, and roads—the contractor began work on a 9,500-foot concrete runway, finishing on 28 April 1967—*almost a year* after contractor selection.[21] Later, Air Force engineers added aircraft shelters to provide protection from Vietcong mortar and rocket attacks.

Vertical takeoff and landing aircraft, such as the Harrier (top left), would increase the number of available airfields for forward operations as well as allow operations from damaged runways. The MiG-29 Fulcrum (left) has large, low-pressure tires suitable for use on temporary runways.

Except for these attacks, sometimes involving sappers, the enemy never posed much of a threat to the operability of our bases in Southeast Asia. In contrast, when our self-imposed restrictions were lifted during Linebacker II, our air attacks against North Vietnamese air bases soon ensured that their air force posed little threat.[22]

Future Campaigns

Recognizing the influence that runway requirements for fighter/attack aircraft had on air base availability and operability during past campaigns, we must now determine whether these requirements are likely to have a similar impact in the future. Given the nature of the Soviet threat, there are powerful reasons why we should believe that the runway requirements of our aircraft will be an even more important factor in future campaigns than they were in the past.

We find one reason for this belief in one element of an offensive that Soviets call the air operation.[23] The Soviets recognize that a successful offensive depends on air superiority. After studying our strengths (particularly the caliber of our aircrews and the nature of our aircraft technology) and the extent of our weaknesses, the Soviets have apparently decided that the best way to gain air superiority would be to fight our Air Force when it is *on the ground* rather than in the air.[24] They seem to believe that this plan is most feasible if they use a combined arms approach to overwhelm our defenses.

More than likely, a Soviet air operation would simultaneously employ a variety of methods (involving missiles, aircraft, and special-purpose troops) and munitions (instant, delayed, unitary, and bomblet), making a surprise attack on our air bases and other essential facilities in mass and in depth. Success, in Soviet eyes, would depend on whether our aircraft could fly the large number of effective sorties at the right place and time that are likely to be needed to gain and maintain the necessary degree of air superiority, *let alone* perform effective

ground attack. Even if a relatively large portion of our aircraft survived on the ground but could not get airborne at the times and in the numbers needed to win key engagements and battles, their air operation would be a success. This would be due to the fact that our potentially superior airborne tactical performance would not materialize and would thus be irrelevant to the outcome of the campaign.

Yet the air operation is not the only reason our aircraft runway requirements may be vital to the outcome of future campaigns. The Soviet offensive is also designed to achieve high-tempo, mobile, ground operations that will penetrate our rear area quickly and deeply. If Soviet forces are able to carry out this operation, they would soon put many of our air bases at risk, as was the case during North Korea's 1950 invasion of South Korea.

Besides using a rapid advance to threaten our air bases, the Soviets are prepared to repair captured air bases quickly and, if necessary, build new ones. Their purpose would be to reduce the distance between their bases and the leading ground elements of the offensive. They consider their ability to operate from frontline runways to be a major advantage. In contrast, they believe our aircraft are "too heavy and sluggish" to be based near the front—a factor that causes our reaction time to be too slow to "meet the norms."[25]

Further indications of the importance that the Soviets assign to securing advanced bases are evident in exercises like *Zapad*-81 and their incursions into Czechoslovakia and Afghanistan.[26] (One expert has written that to help secure advanced bases, the Soviets normally include an airfield engineer battalion in a tank army's order of march.[27]) In case of a war in Europe, the Soviets have already ensured that they will have plenty of air bases nearby. In East Germany alone, they have built at least 27 large- and 13 medium-sized airfields, most with aircraft shelters. Besides these airfields, they have also prepared standby forward air bases and equipped highways to serve as runways.[28]

Unlike our approach to fighter/attack aircraft design, the Soviets ensure that most of their aircraft assigned to theaters of military operations (TVD) are capable of using temporary gravel runways. For example, the MiG-29 Fulcrum has large, low-pressure tires, a nose gear set aft to keep from spraying gravel into the intake, and an auxiliary inlet system to reduce the probability of foreign object damage.[29] Looking to the year 2000, the commander of the Soviet air force (VVS), Marshal of Aviation Aleksandr Yefimov, also emphasized that operations of the VVS should not be affected by runway damage. He stated that "much attention is being given to developing short take-off and vertical landing aircraft capable of operating from damaged airstrips."[30] The ability of Soviet aircraft to use gravel runways means Soviet engineers should be able to quickly build runways close to the ground battle and rapidly repair any damage to these runways. This capability could be especially important if we were involved in a war with the Soviets in Southwest Asia where there are relatively few suitable air bases.[31]

Reducing Runway Requirements

To help counter this growing Soviet threat, we must improve our air base availability and operability. If the past is any guide, an effective way of doing this would be to reduce the runway requirements of our fighter/attack aircraft. Should we take this approach, we must devote most of our attention to reducing landing-distance requirements. This emphasis is necessary because technological advances—especially higher-thrust engines—that have significantly reduced takeoff rolls have not had much effect on reducing the runway specifications (length, width, strength, and smoothness) needed by our fighter/attack aircraft to recover at a base.

Differences between a fighter's acceleration during takeoff and its deceleration when landing help explain why runway

availability is more critical for landings than takeoffs. Due to their high thrust-to-weight engines, modern fighters can accelerate on takeoff much more quickly than they can decelerate when landing.[32]

Aircraft velocity is another reason that runway requirements for landing are more demanding than those for takeoff. A pilot begins a takeoff at zero velocity, yet if he is landing an aircraft like the F-15 Eagle, he approaches the runway at approximately 135 knots.[33] This difference in velocity leads to a number of problems, especially if a pilot is attempting to land in darkness, during periods of poor visibility, or on a damaged runway. First, high approach speeds during landing make it far more difficult for a pilot to find the runway. High speed also makes it vital for a pilot to learn the runway's condition (damaged, wet, or icy) before landing.[34] Knowing the exact location of runway damage is important because a pilot must determine where it is safe to touch down. Even this information may not be enough because the references a pilot normally uses when landing are likely to make it very difficult to "overfly" a damaged portion of the runway, especially at night or in poor visibility.

High speed, especially when combined with the effect of winds, makes it more difficult for a pilot to line up with the runway for landing than for takeoff. High speed also makes it more difficult for a pilot to touch down as close as possible to the beginning of the usable runway, let alone do this at the ideal airspeed.[35] (In contrast, it is easy to make sure a takeoff begins precisely at the end of the usable runway.) The relationship between airspeed and difficulties in landing becomes even more apparent when we realize that the occurrence of accidents for land-based aircraft increases by the square of the approach speed.[36]

During a future war—especially one with the Soviets—aircraft losses resulting from accidents during high-speed landings have the potential of becoming a much more serious factor than they have been in the past.[37] The use of systems such as low-altitude navigation and targeting infrared system for night (LANTIRN) adds to the problem because it increases the probability that we will be attempting more landings in darkness and marginal weather. Finally, the small size of our force structure and our limited-production capacity make us less able to tolerate losses from landing accidents than we could in past wars.

Compounding these problems is the possibility that many accidents in a future war will be due to fuel exhaustion or to fatigue. That is, pilots already fatigued by the stress of combat are more likely to be attempting to land under marginal conditions to avoid fuel exhaustion. In peace, we can avoid these dangers by ensuring that pilots are well rested, allowing landings only in favorable weather conditions at suitable fields, and by requiring a conservative fuel reserve. Unfortunately, these measures are unlikely to be satisfactory in war because they would seriously interfere with our ability to fly large numbers of effective sorties in marginal conditions when air power may be needed most.

Reducing Runway Requirements for Landing

We should be able to decrease the dangers associated with landing and, more important, increase air base availability and operability by reducing the runway landing requirements of our fighter/attack aircraft. However, to reduce these requirements we must choose between two different methods. One method involves quickly stopping the aircraft *after it touches down*. The other focuses on reducing an aircraft's speed *before it lands*.

Attempting to quickly stop an aircraft after it lands presents a number of problems. It does little to reduce the difficulties involved in finding a runway, learning its condition, accurately lining up the approach, or ensuring that an aircraft lands as slowly as possible at a desired point on the

runway. Attempting to solve the last problem by making unflared "carrier" landings imposes a significant weight penalty, requires stronger, smoother runway surfaces, and prevents using the flare to reduce touchdown speed.[38] Improvements in fighter/attack aircraft wheel brakes have so far been insufficient to shorten stopping distance significantly. Moreover, brakes are even less effective when weather reduces a runway's coefficient of friction. High-drag devices like drag chutes can help; however, they are dangerous to use in high crosswinds and are less effective when an aircraft—like the F-15—lands at a relatively modest airspeed.[39]

Arresting gear is another way to stop a landing aircraft in a short distance, but there is an obvious risk if the gear is not functional or if an aircraft fails to engage and is unable to take off and try again. Even if the engagement is successful, it can take at least two minutes to reset the gear, making the runway unavailable—if only briefly—for more takeoffs or landings. If several aircraft attempting to land are in danger of running out of fuel or if aircraft must be scrambled immediately, this delay could cause serious problems.[40]

Thrust reversers provide still another way of reducing runway landing requirements. Unfortunately, these devices are expensive, add as much as 850 pounds to aircraft weight, and introduce maintenance problems. They can also lead to an engine's ingesting loose ground material (likely to be present on a damaged runway) and may degrade an aircraft's directional stability during a landing roll.[41]

The other method is to reduce an aircraft's speed before it touches down. One way to do this is by increasing the lift of the wings in order to reduce the aircraft's stall speed. Lift can be increased by varying the sweep of an aircraft's wings or by increasing the camber of its wings through the use of leading-edge devices and flaps. Unfortunately, both of these procedures are complex and add to an aircraft's weight and cost. Worse, because these procedures depend on wind-over-the-wing to provide lift, their ability to reduce landing speed is limited—principally because lift varies as the square of airspeed. For example, even the highly modified short takeoff and landing (STOL) and maneuvering technology demonstrator (SMTD) F-15 is expected to have a final-approach speed of approximately 119 knots—only 16 knots slower than an unmodified F-15.[42]

Another way to reduce speed is by using jet thrust rather than aerodynamics to provide lift. The AV-8B Harrier II demonstrates the advantage of this method because its design allows a pilot to use vectored thrust to stop and sustain the aircraft *while it is still in the air*. Consequently, a pilot flying an AV-8B can land the aircraft vertically with an approach speed of zero knots forward velocity.[43]

A vertical landing capability produces a number of important advantages. In order to land, for example, a pilot needs a surface only a little larger than the aircraft. Moreover, this surface can be fairly soft and rough, and it does not matter whether it is wet or icy.[44] By making a wide variety of surfaces (such as taxiways, roads, and even parking lots) suitable for landings, vectored thrust greatly reduces the probability that a pilot will need to divert because a runway is unavailable. In war, this capability could mean that far fewer aircraft would be lost due to either fuel exhaustion or landing accidents. Perhaps just as important, landing vertically has the potential to reduce or even eliminate most of the safety problems caused by high velocity during approach and touchdown.[45]

The advantages of vectored thrust are not confined to landings. If a runway is used only for takeoffs, sortie-generation rates and responsiveness are improved because takeoffs are not subject to delays caused by aircraft recoveries. Using a runway only for takeoffs also has the advantage of eliminating any danger of a landing aircraft colliding with one taking off—a possibility that becomes more likely when communications and visibility are poor. Used on takeoff, vec-

tored thrust can shorten takeoff rolls to between 500 and 1,500 feet (depending on gross weight); even a vertical mode of launch is possible.[46] (Although vertical takeoff limits the amount of fuel and munitions an aircraft carries, this capability would be particularly useful in two situations: (1) "flushing" to avoid being caught on the ground by an attack and (2) repositioning aircraft that landed away from the base, perhaps because the base was under attack or because they were low on fuel.) Vectored-thrust aircraft should also have better range/payload characteristics than comparably sized conventional aircraft because the weight handicap caused by a large fuel reserve could be eliminated.[47] When used in combat maneuvering, vectored thrust can improve an aircraft's agility and deceleration capability, further improving its mission performance.[48]

Despite these advantages, fighter/attack aircraft capable of using vectored thrust to make vertical landings currently have a number of limitations. Designs generally are for relatively small aircraft like the AV-8B, which is comparable in size to the F-16. Considerations of weight and center of gravity are very important and can constrain aircraft design. Another problem of design involves providing enough air to the engine at low airspeeds and in hover. For this reason, the AV-8B has large intakes that create a large signature and produce drag, which limits its maximum airspeed. Due to the increased thrust requirements, vertical-landing, vectored-thrust aircraft will be incapable of supersonic airspeeds until a satisfactory plenum-chamber-burning engine is available. For attack aircraft, however, the lack of supersonic airspeed is not a serious deficiency because they cannot afford the fuel consumption demanded by supersonic speed—especially when carrying air-to-surface munitions and operating at low altitudes.

Conclusions

Clearly, we must reduce the runway requirements of our fighter/attack aircraft so we can enhance a commander's ability to exercise operational art by using air bases to move his air power. To determine which approach is best for reducing a particular aircraft's runway requirements, we must use a campaign perspective when assessing the potential combat contribution or value of that aircraft. A campaign perspective is necessary because this is the *only* way we can see the truly immense influence that air bases (and runways) have on a fighter/attack aircraft's actual combat capability. Consequently, we must reexamine the tools (such as simulations and exercises) we use to evaluate a current or proposed fighter/attack aircraft's performance to see how well these tools apply a campaign perspective, if at all. For example, applying a campaign perspective means that a simulation's validity as an assessment tool depends on whether it can show how air base availability and operability influence an aircraft's tactical (airborne) performance. Similarly, if an exercise is to be valid, air base availability and operability can no longer be taken for granted. To be reliable assessment tools, both simulations and exercises must pay special attention to the availability of engineers, construction equipment, transportation, and building materials in a theater. These factors will affect our ability to quickly build or repair the number and type of runways required by a specific type of aircraft. Nor can these simulations and exercises be considered valid if they ignore how the distance between a base and the enemy affects the contribution to a campaign made by aircraft at that base (number of sorties flown, responsiveness, amount of munitions delivered, persistence in combat, and ability to exploit the maximum airspeed). Both tools must also have the sensitivity to assess the effect of this distance on the possibility of aircraft being lost due to landing accidents or fuel exhaustion. Finally, simulations and exercises must be able to evaluate how simultaneous runway closings at several bases—even if only for a few hours—affect the remaining bases in the

theater, especially their ability to generate and recover sorties and their vulnerability to enemy attack. □

Notes

1. Air Force Manual 100-5, *Operations*, 5 May 1986, 10. For further discussion of relational maneuvers and operational art, see Edward N. Luttwak, *Strategy: The Logic of War and Peace* (Cambridge, Mass.: Harvard University Press, 1987), 91–112.

2. Gen George C. Kenney, *Reports of the Pacific War* (New York: Duell, Sloan and Pearce, 1949), 216, 394, 416, 478.

3. Wesley F. Craven and James L. Cate, eds., *The Army Air Forces in World War II*, vol. 4, *The Pacific: Guadalcanal to Saipan, August 1942 to July 1944* (Chicago: University of Chicago Press, 1949), 26–29.

4. Gen Henry H. Arnold, *Global Mission* (New York: Harper & Brothers, Publishers, 1949), 337–38; Kenney, 377.

5. Arnold, 326.

6. Craven and Cate, vol. 2, *Europe: Torch to Pointblank, August 1942 to December 1943* (Chicago: University of Chicago Press, 1949), 116; see also 83, 89–91, 94, 100, 117–21.

7. Charles Messenger, *The Tunsian Campaign* (London: Ian Allan Ltd., 1982), 12–14; and Jack Coggins, *The Campaign for North Africa* (Garden City, N.Y.: Doubleday and Co., Inc., 1980), 102–4.

8. For a short but thorough account of how the interdiction of German lines of communication in the Mediterranean contributed to Allied victory, see Martin Van Creveld, *Supplying War: Logistics from Wallenstein to Patton* (New York: Cambridge University Press, 1977), 181–201.

9. Craven and Cate, vol. 2, 415–25.

10. Craven and Cate, vol. 3, *Europe: Argument to V-E Day, January 1944 to May 1945* (Chicago: University of Chicago Press, 1951), 69.

11. Col William B. Reed et al., eds., *Condensed Analysis of the Ninth Air Force in the European Theater of Operations* (Washington, D.C.: Headquarters Army Air Forces, 1946; new imprint, Office of Air Force History, 1984), 3.

12. Ibid., 20–25.

13. Reginald G. Nolte, *Thunder Monsters over Europe* (Manhattan, Kans.: Sunflower University Press, 1986), 27.

14. Dr Alan F. Wilt, "Coming of Age: XIX TAC's Roles During the 1944 Dash Across France," *Air University Review*, March–April 1985, 84.

15. The increasing distance between XIX Tactical Air Command's (TAC's) bases and advancing ground units created a problem with loiter time for fighter-bombers flying armored column cover. In order to maintain this cover until new bases could be built, the Ninth Air Force temporarily had to increase XIX TAC's force structure by giving it operational control over some IX TAC units. Reed, 30. See also Nolte, 40–48, for a detailed description of how the 405th's operations were adversely affected by the increasing distance between its base and the enemy.

16. Robert Frank Futrell, *The United States Air Force in Korea 1950–1953* (Washington, D.C.: Office of Air Force History, 1983), 65–68, 87, 94–95.

17. Ibid., 176–84, 694–95.

18. Maj Jeffrey L. Tyley, "Project Turnkey: Historical Perspectives and Future Applications," *Air Force Journal of Logistics*, Summer 1987, 4–5.

19. Reed, 3, 8, 10–11, 108–9.

20. Futrell, 176.

21. Tyley, 4–9. The Air Force still has relatively little ability to build air bases. There are only seven (four in the active force) 400-man, mobile, self-sufficient, heavy engineering units organized, trained, and equipped to build or upgrade air bases. Robert Paterson and Dana Lombardy, "Forward Airbases," *NATO's Sixteen Nations*, April 1987, 86.

22. Gen William W. Momyer, *Air Power in Three Wars* (Washington, D.C.: Government Printing Office, 1978), 141–50, 215–16, 236–42.

23. For a perspective on the nature of this threat, see Phillip A. Peterson and Maj John R. Clark, "Soviet Air and Antiair Operations," *Air University Review*, March–April 1985, 36–54.

24. Col V. Kirillov, "Conventional Wars and Ways of Waging Them," *Krasnaya zvezda*, 4 October 1986, 5. Published in "Soviet Press Selected Translations," *Current News*, no. 1599 (30 June 1987): 90.

25. Col V. Kirillov, "The Fighter-Bomber in Combat," *Aviatsiya i kosmonavtika*, no. 7 (1986): 29–35. Published in *Current News*, no. 1650 (29 October 1987): 145–47.

26. Maj Roger E. Bort, "Air Assault Brigades: New Element in the Soviet Desant Force Structure," *Military Review*, October 1983, 31–38.

27. Richard Simpkin, *Red Armour* (New York: Brassey's Defence Publishers, 1984), 161.

28. Gunter Lippert, "GSFG Spearhead of the Red Army," *International Defense Review*, May 1987, 561.

29. Bill Sweetman, "The New Soviet Fighters—How Good Are They?" *Interavia*, June 1987, 578–79.

30. *Jane's Defence Weekly*, 13 February 1988, 279.

31. Michael MccGwire, "Update: Soviet Military Objectives," *World Policy Journal*, Fall 1987, 723–31. He speculates that the Soviets may not believe a "major conflict with the United States in the Persian Gulf region would necessarily escalate to world war." This development could explain the addition of three TVDs, including one for the Indo-Arabian region.

32. Most modern fighters can accelerate on takeoff at about one gravity (g) (20 knots/second/second), yet—despite a lower weight and airspeed when landing—can usually decelerate at only about .25g (fighters cannot decelerate at .5g even when using thrust reversers). Dr John W. Fozard, "Tactical Jet V/STOL—Its Future in a CTOL World," SAE Technical Paper Series, no. 861637 (Long Beach, Calif.: Aerospace Technology Conference and Exposition, 13–16 October 1986), 51; also author's correspondence with Dr Fozard.

33. Jeffery P. Rhodes, "Landing on Less," *Air Force Magazine*, April 1987, 74–76.

34. Stopping on a wet runway takes 1.3 times the distance needed if it is dry. Icy runways increase the stopping distance to 3.2 times the dry distance. Ray Whitford, *Design for Air Combat* (London: Jane's Publishing Co., Ltd., 1987), 208.

35. Current aircraft have a touchdown longitudinal dispersal of plus or minus 500 feet. Robert R. Ropelewski, "Modified F-15 Will Investigate Advanced Control Concepts," *Aviation Week & Space Technology*, 11 February 1985, 51–53; and Bill Sweetman, "Short-field F-15," *Interavia*, July 1986, 791–92.

36. Whitford, 67.

37. One reason for this possibility is that—unlike most of our past experience—we would probably be operating from air bases that have been under attack. If our bases are attacked, it is likely that runways, arresting gear, navigation aids, and other equipment or facilities necessary for safe landings will be damaged or destroyed. At the same time, compared to the aircraft we had in World War II and the Korean War, our current aircraft are far more dependent on long, hard, smooth, clean runways to make a safe landing. This requirement means that relatively few suitable runways are likely to be available.

38. Modifying even the small T-45 Hawk to make it capable of carrier operation (catapult launch and unflared, arrested landing), increased its weight by 960 pounds, mostly due to the landing requirements. This amounted to over 10 percent of its

operating weight when empty. Dr John W. Fozard, "Harrier—Catalyst for Change in Naval Airpower," *Aerospace* 12, no. 5 (May 1984): 5–26.

39. Whitford, 207.

40. "USAF Tests Arresting Systems," *Aviation Week & Space Technology*, 2 January 1984, 45.

41. Testing of the British Tornado aircraft showed there could be aerodynamic interference between reverser efflux and aircraft control surfaces that could degrade the aircraft's lateral stability. Consequently, the aircraft would have difficulty staying on the runway. Whitford, 208–9.

42. Rhodes, 74–76. Of course, this reduction in speed will make wheel brakes more effective when the runway is dry.

43. Slowing a Harrier to a hover from 200 knots wingborne flight speed takes less than 30 seconds, only 3,000 feet of airspace, and less than 100 pounds of fuel. Repositioning in a hover over a distance of 1,500 feet in half a minute uses less than an additional 100 pounds of fuel. John W. Fozard, *Ski-Jump, A Great Leap for Tactical Airpower*, AIAA, First Atlantic Aeronautical Conference, March 1979, 5.

44. The AV-8B can safely use a landing surface with a California bearing ratio (CBR) of six, while an F-16 needs a surface with a CBR of almost fourteen. A baseball outfield has a CBR of nine, and a wet putting green is four. *AV-8B Rapid Deployment Overview* (St. Louis, Mo.: McDonnell Douglas Corporation, 1980), 24–25.

45. A number of changes have been made in the AV-8B: a new two-seat trainer, excellent cockpit visibility, a more effective reaction control system, engine improvements, and—most important—a stability augmentation and attitude-hold system that is operational throughout the hover envelope. Consequently, the pilot skills necessary to hover and land vertically have been greatly reduced compared to those required for the AV-8A. Brendan M. Greeley, Jr., "Improved VTOL Performance of TAV-8B Adds Realism to Attack Force Training," *Aviation Week & Space Technology*, 3 August 1987, 68–76.

46. An AV-8B can take off in less than 1,500 feet on a tropical day, carrying fuel and ordnance equal to 130 percent of its empty weight. In addition, only an aircraft with a vectored-thrust capability can make full use of a ski-jump launch that reduces takeoff rolls by up to 50 percent. Finally, contrary to popular misconceptions, a vertical takeoff requires little fuel—less than 100 pounds to reach weight-on-wings airspeed. Fozard, *Ski-Jump*, 11–13; "Tactical Jet V/STOL," 34; *AV-8B Harrier II: A Closer Look* (St. Louis, Mo.: McDonnell Douglas Corporation, n.d.), 2.

47. According to one Sea Harrier pilot who flew more than 60 day and night combat sorties during the Falklands War, he never got back to his ship with more than 500 pounds of fuel. Once, after shooting down a C-130, he had only 150 pounds of fuel when he landed. Alfred Price, *Harrier at War* (London: Ian Allan Ltd., 1984), 63.

48. Fozard, "Tactical Jet V/STOL," 47–48.

STRATEGIC CROSSROADS

The Road Not Taken?

Two roads diverged in a wood, and I—
I took the one less traveled by,
And that has made all the difference.

—Robert Frost
"The Road Not Taken"

Lt Col Donald G. Morrow, USAF

ROBERT Frost's "The Road Not Taken" creates a nostalgic awareness of turning points in our lives. This poignant contemplation of life's choices stands in stark contrast to the crucial decisions facing US policy planners looking forward to the twenty-first century.

Even as our leaders and the Soviets look past the signing of the Intermediate-range Nuclear Forces (INF) Treaty to the Strategic Arms Reduction Talks (START), America is again at a strategic crossroads where economic and national security issues intersect. Questions about the national debt are uppermost in many people's minds. At the same time, decisions regarding strategic defense—taken together with the confluence of other issues such as arms control, defense spending, and alliance concerns—will shape strategy for the United States and its allies for decades.

As we choose our road for security in the

next quarter century, key questions about our strategic forces must be answered. As we develop a strategic defense and conduct START negotiations with the Soviets, what road must we choose in regard to offensive weapons? Can we, like Frost, choose the road less traveled—rather than the familiar path of deterrence—and survive to contemplate the choice 25 years from now? Can we safely conclude that strategic missiles will soon be obsolete and, as a result, not build new ones? Or does the concept of a Triad of strategic forces—submarine-launched ballistic missiles (SLBMs), intercontinental ballistic missiles (ICBMs), and strategic bombers—remain valid? In answer to these questions, it is apparent that a defensive system that truly negates the threat of ballistic missiles is still far enough in the future to require a transition period from almost total offense to a balance of offense and defense. During this transition, prudence dictates that we maintain an offensive deterrent.

In a world of transition, with emerging strategic defensive systems and new arms agreements, we must complete our ICBM modernization program. This action is necessary for several reasons. First, the differences in ideology between communism and democracy will result in continuing conflict between the superpowers and their allies. To maintain peace, the United States must manage this conflict with a coordinated strategy that combines successful foreign policy and defense initiatives. The cornerstone of the US national security strategy in this environment will continue to be the policy of deterrence, a policy that will be sustained with both defensive and offensive forces. Second, since defensive forces will be phased in gradually, the United States must maintain a strategic offensive capability during this transition. The best force structure for this offensive capability is the Triad because it provides a unique combination of characteristics unattainable with smaller force structures. Finally, to maintain this Triad, the United States must modernize the ICBM force even as we are modernizing our submarines and bombers. We must take this step in spite of concerns over capability, survivability, cost, and other more emotional issues. This modernization is vital despite the smaller strategic force sizes that will likely result from the continuing START negotiations. Only by maintaining our ICBM force and the Triad can we maintain our security and world peace for the next quarter century.

Conflict and the Policy of Deterrence

The primary goal of our national security strategy in the next 25 years will continue to be the maintenance of peace and security for ourselves and our allies. As we analyze this goal, we must answer a central question: Do US policymakers envision a world with a decreased threat of conflict in the next quarter century? On the contrary, the president's *National Security Strategy of the United States* makes the following statement regarding US-Soviet relations:

> The fundamental fact is that the U.S.-Soviet relationship is essentially adversarial, and will remain so for the foreseeable future. But both sides agree that we have a responsibility to ensure that this relationship is peaceful.[1]

Some may argue that this view of superpower relations is militant, hawkish, and ultimately erroneous. General Secretary Gorbachev, however, says that

> the time we live in will go down in history as a time of intense class struggle in the world arena. There are sharp clashes between two lines, two diametrically opposed approaches to international relations.[2]

From these statements it is apparent that the ideologies of Marxist-Leninist communism and democracy are, and will remain, in conflict. To ensure that the conflict remains peaceful, we must continue the policy of deterrence.

Deterrence will continue to be the centerpiece of our security strategy and our alliance relationships. To sustain deterrence, we must maintain nuclear and conven-

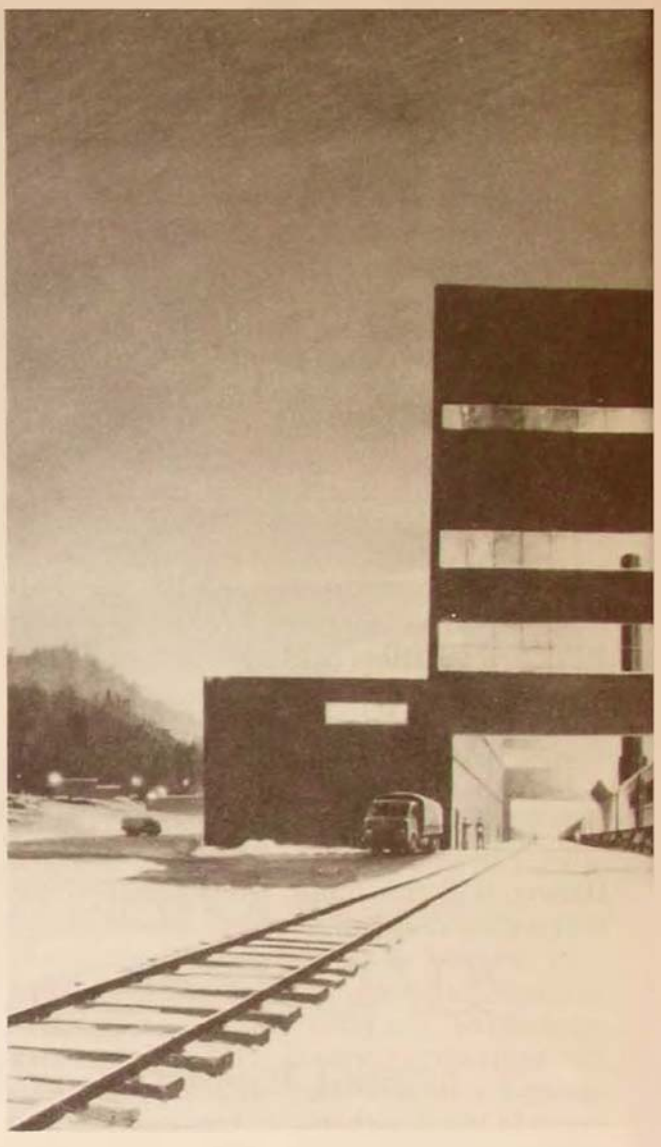
tional forces that leave no doubt about our ability and will to defend our vital interests. Even as we continue the arms control dialogue with the Soviets, we must be capable of taking actions to deter aggression as well. The old Roman axiom "Let him who desires peace, prepare for war" is as true in today's atmosphere of *glasnost* as it was in Rome and as it will be in the next quarter century. To keep the peace, we must develop and maintain both defenses and offenses.

Deterrence and Strategic Defense

A successful deterrence rests on the perceived ability to both absorb a blow and then to strike an opponent. Scholars of strategy in war conclude that there must be a balance between the defense and the offense. For example, Carl von Clausewitz in *On War* states that

> pure defense, however, would be completely contrary to the idea of war, since it would mean that only one side was waging it. . . . It follows that it should be used only so long as weakness compels, and be abandoned as soon as we are strong enough to pursue a positive object. . . . Thus, the natural course in war is to begin defensively and end by attacking.[3]

In analyzing Clausewitz's discussion of the defense, Lawrence Freedman notes that "to remain on the defensive throughout only makes it possible for an aggressor to renew his strength for another offensive."[4] Freedman summarizes by citing the familiar example of the Maginot Line, which was "constructed in the first half of the 1930s along the Franco-German border, stretching from Switzerland for 200 miles."[5] Two points about the Maginot Line are worth remembering: (1) it was a formidable defense system, but (2) it was not "leakproof" since it did not cover the Ardennes sector or the Belgian border. In fact, farsighted proponents of armored warfare in France urged that highly mobile armored forces be developed to cover any breakthroughs in the



line's defenses. The French High Command and Defense Ministry, however, never realized how armor could be employed as an independent striking force. Lacking a Guderian (the German general primarily responsible for the creation of panzer tactics), the French instead integrated their armor piecemeal with the infantry. The real failure of the Maginot Line was the failure to implement new offensive concepts along with the strong defense.[6] Freedman then points out the other major weakness: "The resources involved were so substantial that other requirements were left unmet, so that France became over-dependent upon the success of the Maginot Line."[7] It would be a grave error for the United States and its allies to repeat this mistake. Therefore, we

The Soviet Union has mobilized its ICBM forces to ensure their survivability. The road-mobile SS-25 (above) is currently in the field, and the rail-mobile SS-24 (left) could be deployed later this year.

must carefully analyze the concepts and capabilities of strategic defensive forces.

In this country, experts such as Lt Gen James Abrahamson, director of the Strategic Defense Initiative Organization (SDIO), and Richard Perle, former assistant secretary of defense for international affairs, indicate that research into defensive technologies is progressing well.[8] Indications such as these suggest that the United States will possibly develop and deploy a defensive system in the next quarter century. Given the Soviet effort (briefly discussed by Secretary Gorbachev during his 30 November 1987 NBC interview), it is realistic to assume that the Soviets, too, will deploy a more capable defensive system in the future. At the same time, proponents of a US strategic defense system realize that the technological development and deployment of such a system will be better served by an evolutionary process that minimizes risk. Caspar Weinberger, former secretary of defense, discussed a phased deployment plan as follows:

> Although a first phase would offer a defense against only some missiles, it would effectively defend against a limited ballistic missile attack initiated by design, as well as by accident. This protection alone justifies a first phase deployment.[9]

Secretary Weinberger has also said that "with adequate funding for the SDI program, we could confidently anticipate that phased deployment could begin as early as 1994 or 1995."[10] Unfortunately, proposed

funding reductions led Gordon Smith, SDIO deputy director, to say that the "development decision will have to slip out beyond 1992." In addition, some military contractors now say that they doubt the first phase of such a system could be deployed before the late 1990s.[11] Whether one concedes the accuracy of these dates or not, a phased deployment of SDI argues for a continuation of strategic offensive forces to ensure that the Soviets face continuing uncertainty in their ability to deliver a devastating first strike against the United States or its allies.

Deterrence and Strategic Offense

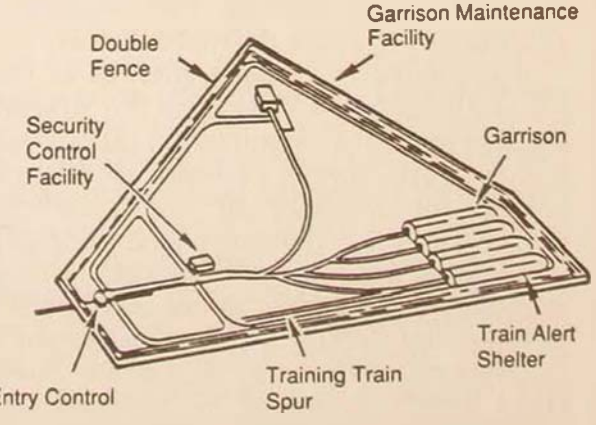
For almost 30 years the concept of deterrence has been linked to and supported by a strategic Triad of forces that effectively combines defensive and offensive capabilities. For this policy to work, each element of the Triad must have certain characteristics, including:

- Independence—the ability to act with little or no outside support once launched toward a target.
- Redundancy—the ability to maintain overall capability despite mechanical malfunction or technological surprise.
- Survivability—in the strongest sense, the ability of each leg of the Triad to preserve enough weapons after an attack to accomplish its assigned mission.
- Communication—the ability to receive launch instructions from the National Command Authority (that is, the president and the secretary of defense).
- Reliability—the ability of each element to launch and strike successfully the targets it has been assigned. In addition, each leg of the Triad has special characteristics that make the whole greater than the sum of the parts. These characteristics are listed in the accompanying table.

Using the combined characteristics of the Triad, we have preserved uncertainty in the Soviet planner's mind for almost 30 years. Secretary Weinberger writes, "Deterrence lies in the multiplication of uncertainty."[12] As we begin the delicate transition of introducing a strategic defense, we must multiply uncertainty by sustaining our ability to use offensive retaliation. We should convey our intentions in terms that the Soviet Union and the world understand—nuclear weapons. Although it sounds contradictory, the Reagan administration's concept of a "build down" in forces offers the only safe road for maintaining deterrence.

Yet, some might well ask, "Must we maintain a Triad in a world with emerging strategic defense and START?" Is the Triad sacrosanct? The answer to these questions is obviously no. We may choose not to maintain a Triad. Of course, either a dyad or a single strategic offensive system makes Soviet attack planning significantly easier. We can talk now about the relative invul-

Rail-mobile Peacekeeper missiles would be garrisoned on existing military bases during peacetime. If necessary, they could be readily deployed on the nation's rail system to enhance their survivability.



Garrison Concept Layout

Source: Boeing Co. briefing handed out at the 1987 AFA

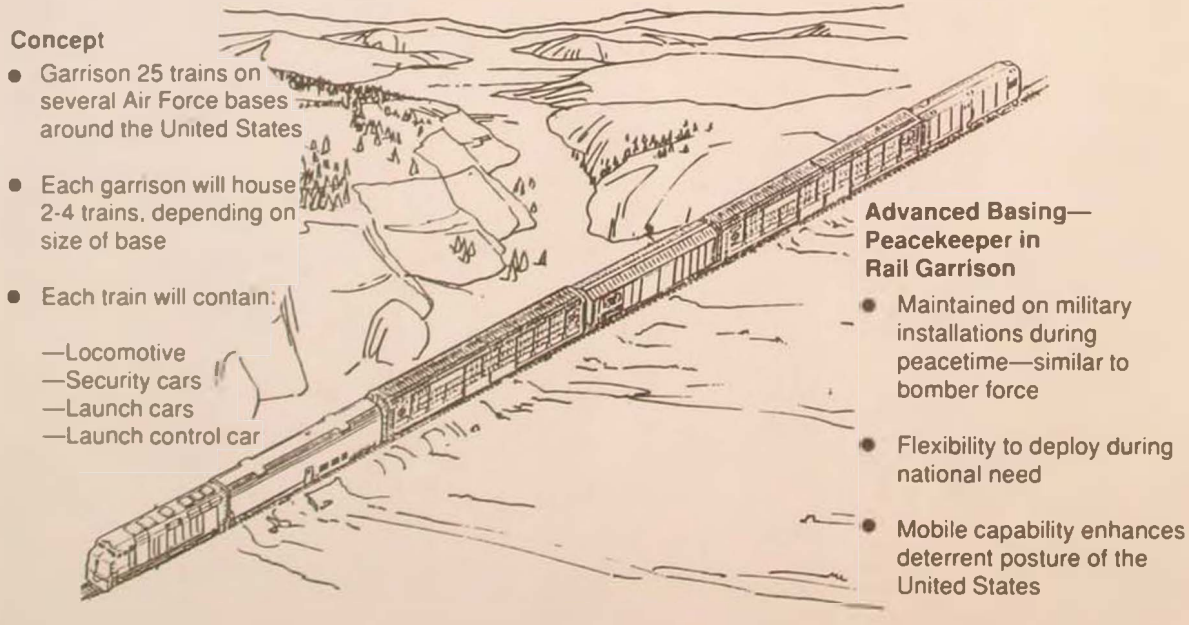
Triad System Characteristics

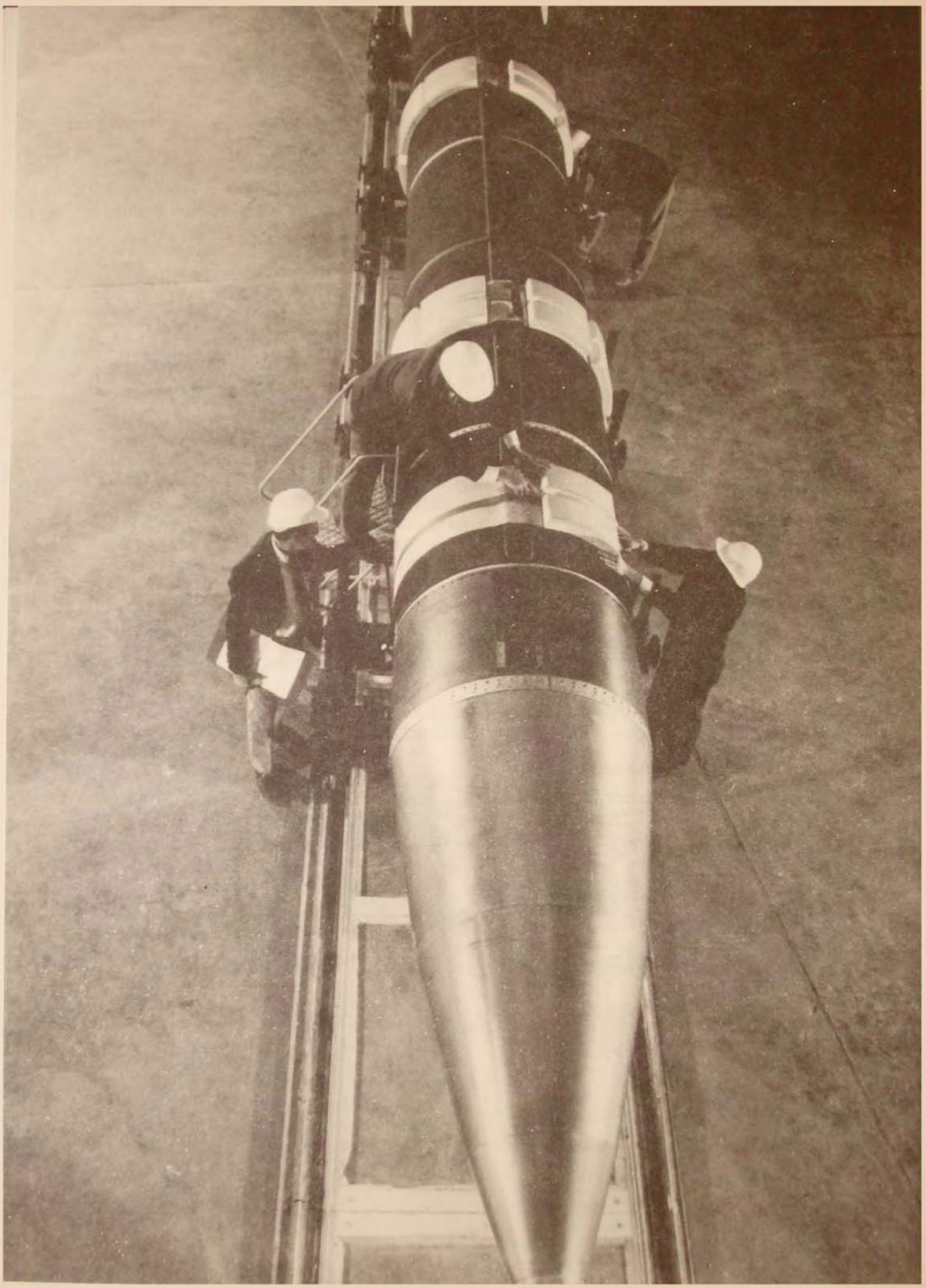
System	*Characteristic*
SLBM	Survivability and concealment when at sea
	With Trident II (D5) missile some hard target capability
	Independence from strategic and tactical warning when at sea
	Reliable command and control
Bomber	Versatility Can be launched on warning for survivability and recalled
	Can be retargeted
	Hard-target capability
	Reliable command and control
ICBM	Readiness, high daily alert rate
	Reliable command and control
	Prompt response
	Hard-target capability
	Relatively low operations support and costs

nerability of the SLBM force when at sea. If we leave this force as the only strategic missile carrier, however, the Soviets will have only one strategic problem to solve to counter US strategic missiles. Although antisubmarine warfare (ASW) poses many problems, we cannot afford to bet that they will not be solved in the next quarter century.

Current modernization of the submarine and bomber forces leaves little doubt about their continuing effectiveness as deterrents, but the indecision with regard to the ICBM leaves its continuing effectiveness in question. Nevertheless, deployment of the Peacekeeper Rail Garrison is being delayed, and the debate continues over the Small ICBM. As former Secretary of Defense Robert McNamara said, "No decision is a decision in itself. It is a decision to maintain the status quo which is almost always the wrong decision."[13] Given the unique characteristics of the ICBM and the overwhelming Soviet ICBM force, failure to modernize our ICBMs would be an error. In choosing a road for the next quarter century of national

The rail-mobile Peacekeeper concept calls for two missiles per train. It would use dispersal rather than hardening as its means of protection.





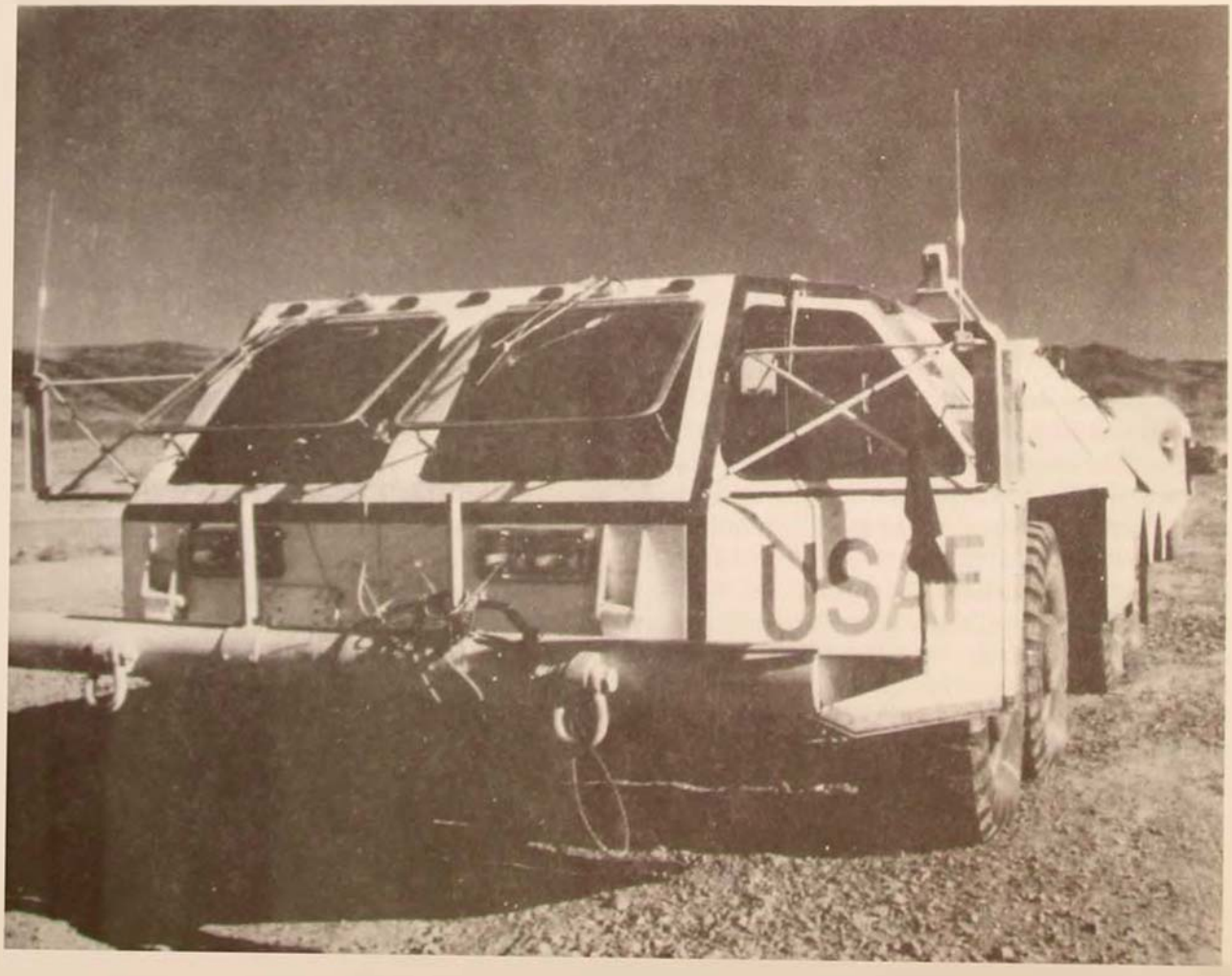
security, we must retain and modernize the ICBM. However, some issues regarding how to take this step toward continuing deterrence remain unresolved.

Deterrence and ICBM Modernization

The debate over the land-based ICBM is a study in the lack of political and military consensus concerning two essential characteristics: capability (the ability to destroy hard targets) and survivability (the ability to absorb a Soviet first strike and retain enough weapons to retaliate). The demand for continuing, or even increased, US ICBM capability to support deterrence comes from an assessment of the numbers and hardness of targets that the Soviets have produced in the past few years. For example, they have placed their SS-17, SS-18, and SS-19 ICBMs in the world's hardest operational silos. They are also placing their ABM in silos.[14] Unless the United States maintains a system that holds these targets at risk, we concede to the Soviets a guaranteed reserve of nuclear weapons. To maintain deterrence, we cannot accept this alternative. In fact, the land-based ICBM—especially the Peacekeeper—provides the capability to strike these targets. Of course, we are now deploying only 50 of the Peacekeeper missiles in Minuteman III silos because of continuing questions about the survivability of ICBMs in silos.

Survivability is the second and most troublesome part of the ongoing debate over ICBM modernization: the issues of basing modes and the obtrusiveness of the system are virtually irreconcilable. The concerns

The US concept of a road-mobile ICBM employs the single-warhead Small ICBM. Unlike the Soviet SS-25, the SICBM (left) and its hard mobile launcher (below) are still in the development stage.



about US ICBM survivability grew out of the truth of former Secretary of Defense Harold Brown's widely quoted dictum concerning the Soviet arms buildup: "When we build, they build . . . when we stop building, they build."[15] The disparity in ICBM development between the United States—which developed no new ICBMs between 1970 and 1980, and the Soviet Union, which developed the SS-17, SS-18, and SS-19 during the same period—is widely recognized and should be kept in mind in this discussion. This asymmetrical ICBM development led to discussions of a "window of vulnerability" for the US ICBM force in the early 1980s. It also led to a large number of proposed basing solutions, characterized by frustrated advocates as the "dirty thirty," according to Maj Gen John C. Toomay, USAF, Retired.[16]

For over 15 years discussions have continued about how to field the next generation ICBM (we are now basing the Peacekeeper in Minuteman silos). Antonia Handler Chayes, former assistant secretary of the Air Force, writes that survivability decisions were always postponed.[17] She also notes that the Scowcroft Commission Report led to "shifting the focus to the overall vulnerability of the whole nuclear force."[18] With regard to the Triad concept, this shift may be an appropriate focus in many respects. Gen Russell Dougherty, USAF, Retired—former commander in chief of the Strategic Air Command—states that the decision to deploy the Peacekeeper in Minuteman silos was not "nuclear necromancy" but a "sound deployment decision" since in this mode it cannot be attacked by Soviet submarine-launched ballistic missiles.[19] The Soviets would have to use their ICBMs to attack the Peacekeeper, an act that would provide enough warning for the US bomber force to escape and, together with the SLBM force at sea, to retaliate. In spite of the balance created by the Triad, enough questions concerning ICBM survivability remained to cause the Congress to halt Peacekeeper deployment in silos and direct that a more secure basing mode be found.[20]

Mobile ICBMs and Survivability

In an attempt to increase the land-based ICBMs' chances of surviving an attack, most basing schemes over the past 15 years have involved mobility on land, at sea, or in the air. This approach has not changed. For example, in testimony before the House Foreign Affairs Subcommittee in October 1987, Brent Scowcroft—former national security adviser and chairman of President Reagan's commission to study the ICBM—indicated that the United States should develop mobile ICBMs.[21] If we took this step, we would have to change the current US arms control proposal to ban all mobile systems. General Dougherty notes that this proposal "recognizes that the most destabilizing posture would be one in which the Soviets have a commanding inventory of mobile ICBMs, while the U.S. has none."[22] It follows that if we cannot agree on a plan for arms control that actually bans mobile systems, we should work to deploy our own mobile missiles. As a point of comparison, the Soviets have already developed and deployed a road-mobile system (the SS-25) and are expected to begin deploying a rail-mobile system (the SS-X-24) this year.[23] Although comparable US systems such as the Peacekeeper Rail Garrison and the Small ICBM and hard mobile launcher (SICBM/HML) are under development, actual deployment is not scheduled until the early 1990s. Both of these systems offer advantages that enhance survivability.

The Peacekeeper Rail Garrison is an advanced basing concept that uses the Peacekeeper missile in a rail-mobile system. Specifically, this basing system would include 25 trains with two missiles per train. Each train (when actually deployed) would carry self-contained launch hardware, communications, crews, and security teams. Ordinarily, the trains would be housed (garrisoned) at military bases—probably at those already equipped for missile operations and maintenance. Only in times of na-

tional need and at the direction of higher authority would the trains be dispersed into the nation's rail network.[24]

The mobile-deployment concept for the companion system, the SICBM/HML or Midgetman, uses a single warhead missile in an off-road-capable launcher. The hard mobile launcher would consist of a diesel tractor and a launcher trailer aerodynamically designed to provide protection from the shock wave created by a nuclear blast. The off-road capability of this system would allow it to be deployed throughout a wide range of government lands. In accordance with the initial basing concept, however, it would be located at Minuteman sites and would be dispersed upon warning of attack or in times of national need.[25]

Mobile ICBMs and the Issue of Obtrusiveness

The fact that mobile ICBMs are only now being developed is not an indication that such concepts are invalid. Antonia Chayes warns that basing modes were "studied and cast off with the rapidity of a debutante's wardrobe" during the Carter administration.[26] The issue of survivability will not go away, however, and since the "coming out" of a full SDI is still some time in the future, we need to reexamine these cast-off ideas with a view toward upgrading our ICBM force. In this review, certain issues will continue to act as guidelines and, in some cases, as constraints.

Any ICBM basing mode will have to be the result of a compromise between obtrusiveness and survivability. The American public will not likely settle for any system that relies on continuous dispersal in the countryside and not on government reservations as its primary means of survival during peacetime. General Dougherty notes that this concern is the primary reason the rail-mobile Minuteman concept was abandoned in the 1950s. He says, "The idea of a train roaming the U.S. countryside loaded with strategic missiles in peacetime creates many perceptions, almost all of which are bad."[27] The alternatives are garrisoning or basing in shelters or silos. Critics note that mobile ICBMs in garrisons are dependent on warning for survival. It should be pointed out, however, that the missiles in these garrisons will be on alert and ready for launch within minutes. Garrisoning will be less obtrusive. On the other hand, questions remain about the advisability of making the ICBM force dependent on a deployment decision by the national leadership, not in order to use it, but to gain stability in anticipation of an international crisis. It may be argued, however, that advances in SDI research will include significant improvements in attack warning and assessment systems. In addition, the capacity to construct a limited defense may add protection to, among other things, the missile garrisons, making the need to disperse less critical. Nevertheless, the strongest basing mode—without regard to cost—for a mobile ICBM force in the near term would include hardened shelters or silos to provide protection. Obtrusiveness of a hardened system could still be reduced if the missiles were carried on rail- or road-mobile launchers that did not require large, dedicated land areas. Arms control requirements could be met by a combination of on-site verification procedures and Soviet satellite surveillance.

Mobile ICBMs and Cost

Although mobile systems will increase the survivability of the ICBM force, they will also increase the cost—an issue that any new ICBM will have to face. It is readily apparent that the defense budget will be decreased next year and that significant growth is unlikely in the next few years. In a discussion of cost, however, it is important to keep in mind that strategic forces account for only about 12 to 13 percent of the defense budget.[28] In addition, the ICBM force has historically been the least expen-

sive element of the Triad in overall cost. ICBM modernization is not cheap; however, it costs less than other DOD weapon systems. Naturally, mobility will increase the cost of the system. The cost to buy and operate 500 warheads for 15 years is about $12 billion for 50 rail-garrison-mounted Peacekeeper missiles. The same number of warheads will cost about $46 billion for the SICBM.[29]

Proponents of the SICBM argue that such a missile increases stability because it has only one warhead and that the Soviets will have difficulty targeting a large number of mobile weapons. The net result is an increase in survivability, which decreases chances of a preemptive attack. Opponents of the system note that the cost is high and that if we garrison-base the SICBM, survivability remains dependent on tactical warning. Neither of these arguments takes into account the possibility of a phase-one SDI, which could provide a degree of protection through defense of the missile garrisons.

If active defense of missile garrisons is a possibility, the best buy for the money is the more capable system—the Peacekeeper. Those who argue that buying the Peacekeeper would be injurious to diplomacy should consider that the Soviets have already developed and will soon deploy the SS-24, which is a rail-mobile system carrying 10 warheads. Those who say that the Peacekeeper could be destroyed through barrage tactics should consider this possibility: that the issue of obtrusiveness will likely drive the basing mode for the SICBM to a similarly constrained day-to-day operation equally susceptible to a barrage attack. The answer lies not in mobility alone but in a careful combination of defensive and offensive capabilities that are technologically feasible in the near future.

Mobile ICBMs and Other Issues

In addition to the issues of capability, survivability, and cost, any effort to modernize the ICBM force will also have to deal with emotional arguments against such a step. For example, some will argue against building more warheads because both the United States and the Soviet Union have enough to destroy the world several times over. Such an argument is emotionally appealing since no one could argue that we should build weapons in an effort to destroy the world. It is, at the same time, a gross oversimplification of the issue of deterrence because it fails to recognize that nuclear weapons can also be used for coercion.

The paradox of deterrence in the nuclear age is that we must build nuclear weapons so we will not have to use them and will not have to succumb to nuclear blackmail. As Michael Novak writes in *Moral Clarity in the Nuclear Age*, "Since nuclear weapons have a political as well as an explosive use, deterrence of both uses demands a sufficiency of threat. The only known path to this sufficiency is a corresponding threat of destruction to a potential aggressor's industrial base or else of its warmaking capacity."[30] The number, size, and yield of US and Soviet weapons is only part of the issue; however, the central issue is how to deter nuclear war.

Many of the same critics who say the United States has enough warheads to destroy the world would advocate banning the nuclear arsenal in the hope that the Soviets would follow suit. The Soviets did not follow suit in the early 1970s nor have they slackened their pace today. When the United States stopped deploying ICBMs with the Minuteman III in 1970, the Soviets developed five new classes of ICBMs, and they have since upgraded these missiles eight times.[31] Although meaningful arms control agreements and the eventual development of a strategic defense are worthwhile opportunities, we cannot lessen our vigilance as we work to realize them. Instead, we must pay the next installment on our strategic forces—particularly our ICBM force—in order to maintain deterrence for the next generation.

A second emotional argument against

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modernizing the ICBM force is that the Soviet people have an affinity for the American people and would never start a nuclear war. Accordingly, there is no need to continue costly maintenance of ICBM forces. The problem with this argument is that it ascribes to the Soviet people a degree of control in government equal to what we in democratic societies enjoy. Is this assumption tenable? Andrei Sakharov writes in *Foreign Affairs* that citizens

> have the right to control their national leaders' decision-making in matters on which the fate of the world depends. But we don't even know how, or by whom, the decision to invade Afghanistan was made! People in our country do not have even a fraction of the information about events in the world and in their own country which the citizens of the West have at their disposal. The opportunity to criticize the policy of one's national leaders in matters of war and peace as you do freely is, in our country, entirely absent.[32]

Clearly, even in an era of *glasnost*, responsibility for making decisions will not shift to the Soviet people. The key, therefore, is to convince the Soviet leadership rather than the Soviet people since the people are not the ones who initiate war. In the nuclear age, it is vital that the United States and its allies try to prevent war by continuing to orchestrate a skillful combination of diplomacy and strength. In maintaining our security, we must walk a line between the hopeless "naivete" of peace through concession, which led to war in 1938, and the equally wrong "excessive cynicism" that brooks no compromise and is likely to lead to war as well.[33] This task is not easy since decisions in one arena often contradict or influence decisions in another. For example, the arms control discussions between President Reagan and Secretary Gorbachev will certainly affect the decisions we make regarding both strategic offensive and defensive forces.

Effects of a START Agreement

Efforts to modernize US land-based missiles must be completed within any guidelines arising from a START agreement. Based on discussions conducted during the Washington summit of December 1987 and subsequent negotiation, the guidelines will likely call for an overall reduction in ballistic missile warheads to 4,900 on each side.[34] On the surface, this significant reduction in numbers would seem to argue against building new ICBMs. This argument is specious, however, since it fails to consider several unchanged facts. First, even after the reduction, the Soviets are left with a very substantial force of land-based ICBMs in hardened silos, while the US force is largely composed of aging systems. The Minuteman II was deployed in 1966 and the Minuteman III in 1970. By the time we can build a phase-one SDI that is effective against missiles (optimistically by the late 1990s), the largest part of the US ICBM force will be at least 30 years old, unless we take steps to replace these systems. The proposed sublimit agreement, in fact, leaves a continuing requirement for a smaller but more effective and survivable ICBM force. Certainly we could put all of our missiles in the Trident submarine fleet. Placing all our strategic eggs in one basket, however, is not safe. If the Soviets are able to solve the ASW problem (difficult though it is), our strategic missile deterrent is useless. Our bombers must then deal with the world's largest air defense system in order to strike Soviet targets. To deny that the Soviets could find a way to solve the ASW problem amounts, on the one hand, to believing in SDI technology while, on the other hand, arguing that ASW technology will not advance. In choosing a road for deterrence over the next quarter century, we cannot count on this mixed appraisal of the future. The strongest and most complete deterrent lies in developing and fielding an improved ICBM force to complement the other parts of the Triad. The best choice, then, is to deploy at least 50 additional Peacekeeper missiles in the rail-garrison mode. This option would provide survivability through mobility and add another 50 highly capable missiles. The de-

ployment should be accompanied by an early decision to build a phase-one defense that will further complicate Soviet attack problems.

Conclusions

Even in an age of increasing diplomacy and dialogue between our country and the Soviet Union, we cannot totally discount the possibility of conflict. Nor can we afford to leave ourselves open to nuclear blackmail through inaction in maintaining the credibility of our deterrent forces. In this light, it is imperative that we maintain deterrence through a skillfully applied combination of diplomatic and defense measures. The fact that diplomacy and arms control are currently at the fore should not cause us to neglect defense. While diplomacy and arms control offer a hope for effective arms reductions, they do not assure peace. As Sen Sam Nunn has said,

> First, even under the best arms control regime we can now envision, stability will require both continued strategic force modernization and effective investments in research on defensive systems. Second, we should continue development of both the Midgetman and the Rail-Mobile MX ICBM systems until a rational choice can be made based on survivability, stability and cost effectiveness.[35]

In an imperfect world where human intent cannot always be correctly judged and where the simplicity of nuclear weapons virtually guarantees their existence for the next century, peace must be maintained by strength. In terms of strategic forces, this strength is best maintained by the Triad.

The reasons for maintaining the ICBM component of the Triad are compelling. First, the ICBM provides the necessary threat of retaliation against Soviet hard targets. Second, the age of our Minuteman ICBM force dictates that in the near future we take steps to modernize. Failure to modernize our land-based missile force will leave the Soviets free to study the problems of antisubmarine warfare with increased intensity and explore ways to thwart US strategic defense efforts. The cost of modernizing the ICBM part of the Triad is not small. However, decisionmakers should bear in mind that the ICBM force is the least expensive of our strategic forces in overall cost. In addition, the offensive nuclear deterrent must be maintained at all costs since the possibility of nuclear coercion by an enemy due to weakness in our forces is unacceptable. Maintenance of the ICBM force—and, therefore, the Triad—is the most cost-effective guarantor of continued US and allied security strategy.

Faced with two roads, Robert Frost chose the one "less traveled by," and that choice "made all the difference." In choosing our road to national security for the next quarter century, we cannot do the same. Instead, we must continue along the familiar path of deterrence with the strategic Triad of forces. This choice is necessary even as we begin to develop a strategic defense and continue to negotiate reductions in nuclear forces. We must maintain a modern ICBM force in order to ensure security for ourselves, our allies, and ultimately the world. □

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net assessment

Victory Denied: The Rise of Airpower and the Defeat of Germany 1920–45 by Dudley Saward. New York 10016: Franklin Watts, 1987, 376 pages, $18.95.

Dudley Saward, already an accomplished military historian, has in this volume broadened his examination of air power in the twentieth century. Although his penchant for detail and biography remains, he has here attempted a comprehensive look at the relationship between the air weapon and the political goals and constraints of its parent societies.

However, as commendable and ambitious as this goal may be, the purpose of this study is not readily apparent in Saward's book. He gives no statement of what it is that he intends to accomplish aside from his brief subtitle of "The Rise of Air Power and the Defeat of Germany, 1920–1945." This omission may make one wonder about the purpose of the long passages on the rise of Hitler and the nuances of German interwar politics, even if intertwined with the development of the Luftwaffe. In fact, there are many published accounts of air power through World War II and indeed many that deal with the combination of the technical and political instruments of statecraft. Yet *Victory Denied* does serve a purpose (if unstated) of demonstrating how one nation did (to varying degrees at different times) adopt a new technology, even a new theory of war itself, to its particular geostrategic and political condition.

This approach, however, has also resulted in a certain national parochialism which, although perhaps understandable, does not lead to a sense of objectivity in the book. How many times shall we read of "gallant crews" in Spitfires who combat the faceless minions of Hitler? Likewise, no matter how much of a supporter of national defense a reader may be, the case can still be overstated (by constant repetition) of Britain's unpreparedness in the interwar period. Yet, in this regard Saward's treatment of the issue is in fact useful with its particular emphasis on air power both as a major instrument of the German threat and as a means of countering that threat.

The advent of the effect of the critical nature of technology on the relationship between warfare and politics is a twentieth-century phenomenon, perhaps being seen initially before and during World War I. Saward indirectly narrows this topic down to air power and provides an account of how the United Kingdom did what no nation in the Great War could do—adapt political behavior to new, emerging technological realities. These relationships, and not the general question of unpreparedness, perhaps constitute the main lesson to be learned from a study of air power and the defeat of Germany. In this respect, Saward's contribution is quite useful and, one may speculate, applicable to an analysis of the present strategic environment.

Perhaps what began the British concern with German air power was the "realization that Germany now had a powerful and growing air force which could bridge the Channel and bring the war home to the civilian population as never before." This post-World War I "sputnik" forced Britain into a reevaluation of its traditional noncontinental role. Saward is accurate in his political and technological description of this development, but he minimizes the theoretical concerns in the new type of warfare.

Thus, by focusing on the question of rearmament, he ignores the great debate among air power theorists in the interwar period. In this debate, those who supported "strategic bombardment" were ranged against those who supported a development of tactical aviation to be used either in cooperation with the army or in the role of air superiority. Modern science, of course, had its impact on this controversy, but unless we adopt a "technology-driven model," we must see air power doctrine as being greatly influenced by alternative theories as to its optional employment.

Thus, Saward's claim that the buildup initiated by the chief of the Air Staff, Sir Edward Ellington, was the "vital factor in Britain's initial survival in World War II and thus in the final victory of the Western Allies in Europe" is at best a partial truth. All military buildups are not equal: Ellington's foresight was in transforming Royal Air Force (RAF) doctrine from an emphasis on "defense by offense" or strategic bombing to a more balanced combination of offensive and de-

fensive forces. While the need for this transformation may seem to be obvious to us today, it took some courage in the 1930s to admit that the use of air power was not unique in the history of warfare. The RAF was in the midst of a 20-year battle for its own independent existence, and the prevailing mood was that the single theory model of the use of air power would best guarantee its equality, if not predominance, in national military establishments. The doctrine of the US Army Air Corps would demonstrate this view well.

In terms of Ellington's demand for a modern four-engine heavy bomber, Saward accurately and importantly interprets the need for a congruence of doctrine and equipment—a lesson as applicable today as it was in the 1930s. But in terms of the major shift from a Douhetan air doctrine to a more Clausewitzian view of a balance between offense and defense (e.g., the Inskip decision of December 1937), Saward seems to miss the point. Perhaps this mind-set is what prompted him to make the remarkable declaration, in relation to the bomber campaign, that if "Churchill, Portal, and Harris had been heeded in earlier, pre-war days, then the Allies might well have prevailed by the end of 1943."

But this attitude may be understandable given his personal expertise and the role he played in the events he recounts. His activities not only in the Blind Approach Technical and Development Unit and as commander of the then new RDF (radar) Department, but also his technical and command responsibilities, including planning bomber raids, all contribute to an authenticity of the book that makes it a unique resource. This expertise also allowed him to make the doctrinal point (which he does repeatedly—perhaps the sign of a still surviving 40-year-old frustration) that a doctrine of offensive night bombardment makes little sense if the equipment to carry it out neither exists nor is planned for development. The issue of the creation of a heavy bomber has already been mentioned; the remaining problem of aids to navigation and bombing accuracy is what dominates his analysis. "Concentration" is a time-tested principle of war, and Saward clearly saw the need to accomplish this both in terms of bombs concentrated on specific aim points and in terms of bombers across the target in the minimum amount of time.

This account of the realization of the need for and the subsequent development and initial employment of Gee, GH, Oboe, H_2S, and airborne radar weaves a fascinating tale, not only of technology but also of policy development and the interaction of leadership personalities at the highest level. The human and technical drama that Saward here recounts is the heart of his book. In this respect, *Victory Denied* will remain a valuable contribution to the history of the development of air power during the first half of the twentieth century.

Maj Douglas L. Erwin, USAF
USAF Academy, Colorado

The Night Tokyo Burned: The Incendiary Campaign Against Japan, March–August 1945 by Hoito Edoin. New York 10010: St. Martin's Press, 1987, 248 pages, $16.95.

This account of the air raids against Japanese cities in the spring of 1945 emphasizes the March attacks by American B-29s on Tokyo, Nagoya, Osaka, and Kobe. The author relies heavily on interviews with the survivors and places great reliance on their seemingly accurate recollections of more than 40 years ago. Typical of the victims is a "pretty Tokyo housewife" who "came from a well-to-do family of very well-bred people," and in the aftermath of the 10 March devastation "this elegant, wealthy, cultured young woman took the shoes of a corpse and put them on without a whimper." Interspersed in the narrative are accounts of the impact of the bombing upon the rhythm of life in Japanese cities, the response of the military and civil defense officials, and particularly the loss of credibility of the Japanese government as the despair and suffering of their urban population contrasted sharply with the optimistic official accounts of the bombings.

The author's sympathy with the emperor is evident as he recounts the ruler's extremely rare ventures outside the palace grounds to view the devastation. According to him, when the emperor "set his mind to something, he would have his way." Hirohito's strong will, however, did not then extend to intervening successfully to end the war, an event that was six months, Hiroshima, Nagasaki, and thousands of casualties in the future.

The culprit in the narrative is Maj Gen Curtis LeMay, and the pejorative phrases are endless. The bombs that destroyed much of these cities become "LeMay's." LeMay "wanted desperately to continue the tempo of the fire-bomb raids" and "seemed bent on burning every city in Japan if he could" while "trying desperately to make

his mark." The author states that "if higher authority would just let him [LeMay] alone, he would indeed burn up Japan" and that the March 10 raid by this "remorseless" officer was "all that an arsonist could have asked for." He concludes that "all that General LeMay wanted was a handful of cigars, the thousand B-29s that General Arnold had promised him by summer, and a license to burn all the cities in Japan." Edoin contends that most of the destruction was to houses, schools, and hospitals.

Along with a lack of balance, the volume has other shortcomings. The sources cited in the bibliography occupy but 26 lines, including only three volumes in English. It is obvious, however, that other sources were used. For example, *The Army Air Forces in World War II: Combat Chronology, 1941–1945* states on page 505 that in a November 1944 raid against Tokyo "a ftr rams the bmr, shearing off the elevator and right horizontal stabilizer, becoming the first XXI BC VHB lost to Japanese action." Edoin writes on page 15 that a fighter did manage to "ram a bomber, shearing off the right horizontal stabilizer . . . the first XXI Bomber Command plane to be lost to enemy action."

Important sources in English, such as the many accounts and personal papers of the major American participants, are ignored. No contemporary Japanese sources readily available in English, such as the Kido diary, seemed worthy of the author's attention. He also ignores recent scholarship, such as Ronald Shaffer's *Wings of Judgment: American Bombing in World War II*, that assesses the moral attitude of the American leadership toward civilian targeting (including LeMay for whom there are 21 references in the index). Errors in assignments, ranks, and other facts are far too numerous. Quotations are voluminous, but in many cases there is no indication of their source.

There are strengths to the volume, including the ability of the author to re-create in a very clear and readable fashion the terrible ordeal that many of the survivors endured. The heroism as well as the stoicism of the Japanese victims is graphically described by the author and strengthens the desire of most human beings to prevent a recurrence of this tragedy.

Civilian casualties have become unavoidable and increasingly frequent as a result of modern warfare, and the immense potential of today's weapons threatens even greater destruction. The cause of peace may not be enhanced by treatises such as this one, which presents a facile, unbalanced coverage of the motivation for, as well as the damage done by, aerial bombing. Attacks against population centers were not the invention of the US Army Air Forces, and there is convincing evidence that the configuration and demography of Japanese cities made it impossible to distinguish between houses occupied by Japanese civilians producing war materiel in cottage-type industries and adjacent ones occupied by civilians engaged in less belligerent activities.

People have used and will continue to use those weapons in their arsenal that will ensure national survival, and the United States—weighing the staggering costs of invasion of the Japanese homeland—was no exception. Possibly one significant lesson to be learned from this volume is wasted on this author. It is that citizens, then and now, must hold their leadership responsible for their actions and appreciate that irresponsible activities of governments make its citizens hostage for retaliation. Edoin may wish to pretend that the "rape of Nanking" (which produced more noncombatant casualties than the bombing of Tokyo), the Bataan "death march," and Pearl Harbor never occurred, but they were acts of the Japanese government, and one of the results was the horrible attacks on Japanese cities so graphically described in this volume.

Maj Gen John W. Huston, USAF, Retired
United States Naval Academy, Maryland

Guardians: Strategic Reconnaissance Satellites by Curtis Peebles. Novato, California 94947: Presidio Press, 1987, 418 pages, $28.95.

The devastating consequences of Hitler's invasion of the Soviet Union in June 1941 and the Japanese sneak attack on Pearl Harbor remain as an indelible imprint in the collective memories of today's military strategists. As a result, the United States and the Soviet Union have invested heavily in perfecting the "eyes and ears" of reconnaissance satellites that move silently through space to guard against surprise attacks of the future. Tracing the evolution of these satellites and the role they have played in the total defense picture since World War II is the theme of Curtis Peebles's book.

This work, more descriptive than analytical, is an excellent introduction for the reader unfamiliar with the development of military satellites. It is not intended to be a definitive history, as the

author readily admits. Instead, it serves as an extremely useful reference describing the successes and failures of boosting satellites into orbit, the process of getting them to operate properly, their role in collecting and interpreting intelligence data, and the need for advanced technology to improve performance.

In the first two chapters, the author weaves an interesting account of how US procedures for collecting military intelligence changed dramatically within only a few years. After World War II, US reliance on spies, high-altitude balloons, and advanced aircraft had obvious drawbacks. Spies were captured. Balloons were lost. Penetration of Soviet territory by our aircraft was a risky political gamble that eventually led to disaster with the downing of U-2 pilot Francis Gary Powers in 1960. Although there were frequent disappointments, the system did manage to collect invaluable information on the size of the Soviet bomber force (not as large as US experts had estimated) and the locations of Soviet surface-to-air missile and radar sites, nuclear test facilities and storage areas, and submarine yards.

A new era in space reconnaissance began with the launch of the first Soviet satellite in 1957. Aided by the invention of the transistor (in 1948) and the microcircuit (in 1960), US scientists argued that lightweight satellites could find out about the most closely guarded secrets of the enemy.

The road taken in developing the required technology base was a rocky one. Peebles leads the reader through a discussion of five generations of US satellites, beginning with Discoverer—the workhorse of the early program—and ending with today's advanced photoreconnaissance spacecraft.

The author draws almost exclusively on the open literature—*Aviation Week & Space Technology* is frequently cited—because of classification restrictions on primary documents. He states that US technical setbacks centered on booster failures, getting the satellite in the proper orbit, problems with the sophisticated high-resolution cameras/optics, and transmitting data back to earth. Even into the 1970s, failures were common. But the successes demonstrated the value of investing in expensive reconnaissance satellites. For example, in 1961 Discoverer 29 sent back to earth the first photos of the Soviet Plesetsk ICBM site in the northwest Soviet Union. Only four missiles were identified, relieving the fear that a significant "missile gap" existed. As bigger boosters emerged, they carried not only improved cameras but also sophisticated electronics gear to monitor radio signals and radar to locate key military facilities and even ships on the ocean.

For every US system he considers, the author also addresses its Soviet counterpart. There are chapters on Soviet reconnaissance satellites, electronic intelligence (ELINT), the Salyut manned space station, and ocean and early warning satellites.

This book is well written. Peebles has a knack for distilling complicated technical data into understandable language for the layman. He even includes a useful tutorial on "Orbital Mechanics Made Easy." Especially appealing is the large number of superb photos strategically positioned to complement the text. A 50-page appendix listing US and Soviet military satellites from 1959 through 1985 is a quick and handy reference.

What is most disappointing is the book's conclusion. It focuses on "social factors"—not previously discussed—and avoids addressing the development and contributions of reconnaissance satellites. After 344 pages of solid coverage, I was looking for a more meaningful summary. The conclusion also missed a good opportunity to make an assessment of how US and Soviet satellites stack up against one another.

Overall, this book is important to anyone trying to gain a better understanding of where satellites fit into the often confusing military formula. It probes a timely topic that few people have written on but that more people need to know about. I commend Peebles for mixing history with technology and recommend that *Guardians* be read by officers of all services.

Dr Robert W. Duffner
Kirtland AFB, New Mexico

Ricochets

continued from page 3

tell the unhappy pilots, "Like it or leave!" The problem exists! Solve it! Don't deny it!

Jerome G. Peppers, Jr., USAF, Retired
Fairborn, Ohio

"Amen!" and a big one to your editorial. It really hit the mark.

Gen Charles L. Donnelly, Jr., USAF, Retired
Arlington, Virginia

Reference your editorial on "Blinders, Too, Are Made of Leather," I fully concur that one needs a broad base of experience to be a successful middle and senior leader. However, one thing that you failed to ask those "point-of-the-spear" types is who they want to plan and orchestrate the war? If it were me, I would want a flight commander, a weapons school grad, or an ops-officer-caliber troop doing the planning, conducting exercises, staffing problem areas, etc. Going over the hill knowing that a perennial Blue Four or "warm body" was responsible for all the myriad of details for a combat scenario would not give me a warm fuzzy.

I hear too many "WA-WAs" from the younger pilots concerning the possibility of a staff tour. Seems to me they need to take a look at one of the things they complain about most—the big picture.

Lt Col Claude T. Sullivan, USAF
England AFB, Louisiana

THE PATH TO SDI

I agree with Lt Col Gene Myers's assessment in the Summer 1988 issue of the *Airpower Journal* ("The Strategic Defense Initiative in the Military Context") that condemns an unbalanced approach to the funding of military programs. However, I fundamentally disagree with his focus—the potential for SDI funding to threaten other programs. In fact, right now, quite the reverse is true.

It is time to stop complaining about vague, idealistic dreams of making nuclear weapons obsolete and realize that any defense is only as strong as its weakest link. It is difficult to unambiguously verify what in space is armed and what is not; and as it becomes progressively more practicable to deploy space weapons, the chances for strategic surprise grow. Weapons in space can be stationed within a hundred miles of anywhere in the world, either denying access to space or uncomfortably threatening timely, offensive action. And the advent of the Soviet Energia rocket has created a Soviet capability to put a great deal of equipment into space very quickly.

The military art is built around the idea of choosing the path of least resistance. If the United States continues down the path of placing all of its weapons on (or just beneath) the surface and none in space, it is obvious what theater of war any superpower adversary would choose for confrontation.

Maj Thomas C. Blow II, USAF
Maxwell AFB, Alabama

POW DOCTRINE

I am writing to react to an article published in the Spring 1988 *Airpower Journal* entitled "Doctrinal Deficiencies in Prisoner of War Command," by Col John R. Brancato. During my career, I have had the pleasure of working both in the "resistance training" arena and in the world of joint doctrine development. The article crossed both of these lines and was misdirected in both respects. Parts of this article might have meant something had it been written in the mid-1950s shortly after the Korean conflict; however, as published in 1988, it needs help. The following reaction is offered out of respect for and on behalf of all the men and women in the field who conduct resistance training for our American warfighters.

The author would lead us to believe there is a giant void regarding guidance and training on "survival in captivity." He states that this "conflict spectrum has been largely ignored—perhaps forgotten—in the US armed forces." That's as shallow as saying the United States is ignoring advanced air combat tactics in the tactical air forces. The author didn't do his homework. The author also says there are "gaps in US doctrine on the all-important matter of POW command." Then he goes on and on regarding command, the senior ranking officer, and leadership in captivity. He quotes from and references the *Code of*

Conduct and various publications, directives, and manuals to support his "beliefs." The author appears to be another guy who requires definitive written guidance on everything. He needs to understand that in the heat of a battle—or the stressful environment of the POW camp—flexibility, sound judgment, and the will to survive are more important than a checklist of dos and don'ts.

Colonel Brancato is well read on the Southeast Asia experience. That's good. Reviewing the past is sound in some respects. The historical perspective of warfighting is important. The way we fought in the past and the way we will fight in the future are founded in history and linked to technological advances, national interests, and societal changes. The way we understand history guides many of the decisions made in developing warfighting doctrine. So there is some merit to the author's discussion of what happened in Southeast Asia.

The training and education presently being provided on survival in captivity have come a long way since Southeast Asia. Remember that smart warfighters, strategists, and leaders go to school on the historical perspective. We took massive steps in this regard after the Korean conflict. The author would be amazed at the quality, substance, and effects of current efforts in providing our future warfighters with the knowledge and tools they need to meet the challenges of surviving in captivity. Throughout the services, this training is absolutely outstanding. Students attending these training programs experience education far beyond what could ever be provided by the written word. The young men and women providing this training are some of the most dedicated, motivated, and talented professionals in the military. They work hard to provide a training experience that helps answer the questions the author says are "left unanswered." These super troops are filling a void—not working in one!

Doctrine, *command*, and *leadership* are really not some of our most well-defined terms. Just look at the varying definitions for these terms. There are still those who think that "doctrine" is a panacea. Warfighting doctrine is not dogma—the end to all ends. It is not the problem-solving "answer book." Military doctrine simply provides guidelines to enhance, facilitate, or standardize warfighting. Like a playbook, doctrine should provide a basic framework. It tells you what plays are available and which ones might work and when, but it doesn't tell you exactly how to hold the ball and cut upfield.

"Leadership" and "judgment" are not qualities the military has ever been nor will ever be able to teach. It is easy to say that the senior ranking officer will be in "command" in the POW environment, but if he doesn't possess the qualities of leadership and judgment, no doctrine will make him capable of commanding. As we know, leaders rise to the top in the toughest situations, and the POW environment is one of the toughest. "Good" commanders (leaders) don't need or want a doctrinal checklist to meet every contingency—that's why they are leaders.

The author also seems to be confused about establishing a joint chain of command. He and anyone else confused about this issue must have slept through this lecture during their precommissioning program. The chain of command, be it multiservice or single service, is fairly well defined. I'll grant that in the POW environment defining the chain might take some coordination and cooperation, but there is really no mystique involved. By the way, this issue is covered in the services' resistance training programs.

The troops who run the resistance training programs in the services could tell a lot of stories about the men and women who rise to the top as leaders in the training exercise scenarios at their schools. They would probably relate the same thing we witness everyday in our peacetime military: rank has nothing to do with leadership or judgment. So, regardless of the doctrine written or the training provided, leaders will be leaders when the time comes, and I guarantee that the followers will be followers. Remember, the leaders we venerate from past conflicts—from sea, land, or air campaigns, or from the POW camps—did not achieve a position of prominence because they had some doctrinal masterpiece to follow. They rose to the top because they possessed requisite leadership qualities.

This "point on the conflict spectrum" is not as largely ignored or forgotten as the author would lead you to believe. It is an important issue that each service works "hard." Let's not discredit the selfless efforts, professionalism, dedication, and expertise of some super troops in the resistance training business. They do a wonderful job of helping our future warfighters find answers to the tough questions they might be confronted with in the POW environment. Don't forget that some of the questions are just as hard to define as the answers are to provide.

Maj Terry Austin, USAF
Headquarters USAF

COLONEL BRANCATO RESPONDS

In an unofficial survey conducted at the Air War College in 1987, the entire class of resident Air Force active-duty-list officers—150 out of 239 students, including 80 officers who possessed aeronautical ratings—were asked a simple question: How is seniority determined in a prisoner of war (POW) camp? The respondents were given five possible answers: (a) grade and date of rank at the time of capture, exclusively; (b) grade and date of rank at the time of capture, but honoring reliable reports of later promotions brought in by new prisoners; (c) either method "a" or method "b," as decided by majority vote of the POWs themselves; (d) there presently is no guidance on this; and (e) not sure.

There were 142 responses. Incredibly, they were almost equally distributed across each of the five possibilities!

I recall thinking at the time about what Herbert Hoover said in 1935, and I must confess that I thought about this again after reading Major Austin's letter: "A good many things go around in the dark besides Santa Claus!"

I surely *hope* I would be amazed about what's going on, as Major Austin has promised. However, in his zealous defense of the super young men and women who make up the "resistance-training" community, he has misperceived my target and misread my theme in several respects:

First, my article has no criticism of how survival school instructors and other survival school staff perform their work.

Second, my article has nothing to do with good leadership or the exercise of sound judgment in a POW environment. It has everything to do with giving POWs a firmer *technical structure* on which they can exercise good leadership and sound judgment. As long as the *Code of Conduct* vests command in the senior POW, I would think by anybody's standards that POWs are entitled to have—and to know before capture—the answers to certain fundamental issues that are raised by the *Code*. The most compelling of these are the ones presented in the article: Who is eligible to command? How is seniority determined? What happens if the senior eligible prisoner declines command or is physically, mentally, or morally unfit to command? How far does the command extend?

Third, it is true that no astute warrior believes that military doctrine is a panacea for effective problem solving under wartime conditions. But neither is military doctrine nonessential or optional. Colonel-General Shtemenko was fond of saying that his forefathers defeated their enemies "without ever suspecting that such a thing as military doctrine existed." However, I suspect that his forefathers had some doctrine and knew it well; they just did not know what to call it, and they had no means of reading about it. Those who are principally concerned about sound judgment should heed the words of General LeMay on the first page of AFM 1–1, *Basic Aerospace Doctrine of the United States Air Force*: "Doctrine is fundamental to sound judgment." Every worthy member of every worthy profession knows that about his profession!

Fourth, while I appreciate and agree with Major Austin's lecture on the value of military history, I am not sure that he and all the current POW "gurus" have read the right history lessons. Names such as Risner, Denton, Stockdale, and Dramesi appear on the author pages of some very provocative books—each of which, among other things, makes an impassioned plea, explicitly or implicitly, for attention to one or more of the above issues. Chapters in other books present the views of people with names such as Flynn and Guy. The latest offering—a powerful 1988 book by civilian prisoner Ernie Brace, who was interned with these wonderful but unfortunate heroes—presents more of the same. Parts of the 1976 *Report of the Defense Review Committee for the Code of Conduct* do likewise. And yet, where's the beef? None has been widely forthcoming. (The responses at the Air War College from people who usually are acutely aware of what's going on—people who would not be amazed—appear to prove that.) Why?

Fifth, survival-school staff, developers of joint doctrine, and "front-line" warriors do not have a monopoly on critical thinking about POW issues. Except for health-care providers and chaplains, we all are combatants and, therefore, potential POWs. We all should be concerned.

Misdirected? Shallow? Unprepared? Another "guy" who requires written guidance on everything? Confused? Your readers can decide for themselves. They should also be able to make a rational and dispassionate evaluation of the situation, without all the defensiveness.

Col John R. Brancato, USAF
Hill AFB, Utah

Editorial
continued from page 2

One of the centerpieces of our efforts in Vietnam was an operation called Rolling Thunder, the sustained bombing of North Vietnam by US Air Force and Navy warplanes. Ignoring the various halts and cessations that punctuated Rolling Thunder from early March 1965 through the end of October 1968, it was the longest sustained bombing campaign ever conducted by the United States. But was Rolling Thunder effective?

This is not an easy question to answer. Still, there are certain facts about Rolling Thunder that readily substantiate the view that political ends and military means are, in practice, inseparable. Take the matter of Rolling Thunder's objective. Any assessment of the campaign's effectiveness would presumably need to weigh the means applied and results achieved against the aim (or aims) sought. But the fact of this matter is that the political goal of Rolling Thunder changed over time and, in the end, became an issue of bitter controversy between senior civilian policymakers involved in the campaign and their military counterparts. As the Pentagon Papers reveal, when Rolling Thunder shifted from tit-for-tat reprisals to a sustained bombing campaign in mid-March 1965, its stated goal was to apply sufficient pressure to "persuade [the] North Vietnamese regime that [the] costs of continuing their aggression [were] becoming unacceptably high."[1] At this stage, targeting was "completely dominated by political and psychological considerations," and there was "a real expectation" among decisionmakers in Washington and Saigon that the means being applied would inflict "such pain or threat of pain" on North Vietnam that its leaders "would be compelled to order a stand-down of Viet Cong violence" and to accept American terms for a negotiated settlement.[2] It was only after these early hopes were dashed by Hanoi's intransigence and, from a US viewpoint, irrationality that Rolling Thunder's focus shifted to more military-oriented objectives such as interdicting the flow of men and supplies into South Vietnam. Yet despite the unmistakable evidence of this shift to more modest objectives insofar as Secretary of Defense Robert S. McNamara was concerned, more than two years later, in testimony before the US Senate, the senior military field commander for Rolling Thunder, Adm U. S. Grant Sharp, persisted in the belief that the campaign's overall goal was "to speed the day when Hanoi will conclude, on the basis of the situation in North and South Vietnam, that its aggression in the south is both unsuccessful and exceedingly costly—to the point that it is not rational to continue."[3]

At the core of this evident confusion over Rolling Thunder's objectives is the question of matching ends with means in war. Admiral Sharp, like many US airmen, believed that if only the political leaders would have relaxed the various constraints on the bombing, Hanoi could have been forced to abandon its quest to conquer South Vietnam. But with the failure of the mid-1966 petroleum, oil, and lubricants (POL) campaign, Secretary McNamara had ceased to believe that any bombing campaign short of one aimed at the physical extermination of North Vietnam's population could break Hanoi's will to persist.[4]

In addition to this disagreement over ends versus means, which was never satisfactorily resolved, there is reason to believe that the most senior military leaders never voiced their broader concerns that, overall, the military means being applied were unlikely to achieve American objectives in Vietnam. As Gen Harold K. Johnson, who was Army chief of staff during the years 1964–68, noted afterwards, "Not once during the war did the JCS advise the commander-in-chief or the secretary of defense that the strategy being pursued most probably would fail and that the United States would be unable to achieve its objectives."[5]

Thus, narrowing the focus of the *Airpower Journal* to the effective application of air power in isolation from the broader is-

sues of military strategy and national policy seems ill-advised, if not thoroughly dangerous. In a very real sense, the US military tried to separate political ends from military means during the Vietnam War, and the result was, arguably, disastrous. It was not by accident that Carl von Clausewitz insisted over a century and a half ago that in war "means can never be considered in isolation from their purpose." The path suggested by the editor not only ignores Clausewitz but invites us to repeat the fundamental mistake of Rolling Thunder rather than learning from it.

This is not to say that we object to focusing on the operational level of war. Indeed, a thorough discussion and debate of the role of air power at this level of war is certainly warranted, if not long overdue. To begin with, no edition of AFM 1–1 (except a proposed revision that was quashed within the Air Staff in 1986) has ever acknowledged that there is anything except strategy and tactics. Moreover, the difficulties the Army has encountered in achieving a consensus as to what this level of warfare entails suggests that the Air Force has a great deal of catching up to do. Since first embracing operational art in 1982, "the Army has been involved in a debate both internally and externally on what constitutes the proper number of levels of war."[6] Finally, the 1986 Defense Reorganization Act mandates greater emphasis on joint operations in which the operational level of war is the centerpiece.

What troubles us, then, is the prospect of focusing on operational art to the exclusion of the strategic and policy matters that provide the setting for the operational level of war. The importance of this setting is underscored by the definition of operational art contained in the quashed version of AFM 1–1: the "operational level of war" is the planning and execution of campaigns and operations "within a theater of war *in support of overall national strategic goals.*" (Emphasis added.)

In addition to his unwise decision to narrow the scope of the *Journal* by separating ends and means in war, the editor seems to have made a faulty assumption or two about the *Journal*'s readers and their professional needs. Supposedly, one reason for replacing *Air University Review* (the *Journal*'s predecessor) was that it ranged too broadly over the full scope of professional topics and therefore could not gain and hold a significant readership among officers. Yet, the *Airpower Journal* seems to be founded on the idea that officers will read this journal for information on operational art and then turn to the likes of *Foreign Affairs*, *International Security*, and *Strategic Review* for insights into other aspects of their profession like doctrine, strategy, and national policy.

And what about Air Force officers who wish to *publish* their ideas about the political and strategic ends that air power should serve? Are they going to find journals like *Foreign Affairs* and *International Security* receptive to articles on air power doctrine or the role of air power in low-intensity conflict? Is an editor of one of these journals likely to help a young captain who has a good idea but whose writing is a little rough?

We do not mean to be too hard on the *Journal*'s editor. After all, what he has done is perfectly consistent with Air Force thinking. With the exception of the Air Corps Tactical School and a few notable individuals since then, our basic interest has been and continues to be "kicking tires and lighting fires" and "sortie generation." Air Force officers are not comfortable with thinking in broader terms about air power and how it relates to national policy and strategy. Remember, it was our own Gen David C. Jones who said that the US military system has "never sired a Clausewitz. In our system, Clausewitz would probably make full colonel, retire at 20 years and go to work for a think tank."[7]

In sum, our view is that the editor's decision to narrow the focus of the *Airpower Journal* is both wrong and dangerous. It will tend to strengthen old, bad habits in the Air Force officer corps by encouraging us to believe that we can reasonably and safely "leave aside questions of whether or not

military power should be applied." Such a belief blinds us to the possibility that there may be political goals that air power cannot serve. In short, our hypothetical air chief of the future may have to tell the president, "Air power cannot support the political objectives you have in mind."

Col Thomas A. Fabyanic, USAF, Retired
Lt Col Donald R. Baucom, USAF

Notes

1. Department of Defense, *United States-Vietnam Relations, 1945–1967 (Washington, D.C.: Government Printing Office, 1971), book 4, pt. IV.C.3, 72.*
2. Ibid., 43 and 74.
3. *Senate, Air War Against North Vietnam: Hearings Before the Preparedness Investigating Subcommittee of the Committee on Armed Forces,* 90th Cong., 1st sess., pt. 1, 9–10 August 1967, 5.
4. Ibid., pt. 4, 25 August 1967, 275, 277, 279–80.
5. Bruce Palmer, Jr., *The Twenty-Five Year War: America's Military Role in Vietnam* (Lexington: University Press of Kentucky, 1984), 46.
6. Lt Col Clayton R. Newell, "The Levels of War," *Army*, June 1988, 26. Newell is director of joint operations concepts in the Department of Military Strategy, Planning, and Operations of the Army War College.
7. "Retiring Chief Speaks Out on Military Council," *New York Times*, 25 February 1982, 14B.

Refrain

The Airpower Journal does not argue with the authors' contention that an appreciation of policy's preeminence in warfare is an absolute requirement for senior military leadership. Nor do we advocate that the means of war be separated from its ends.

But these points are not the issue. The issue is the proper level and focus for the Airpower Journal. The argument advanced by the authors of "Mayday" implies the Journal's focus should be on senior officers' concerns with the appropriateness and methods of translating political objectives into reality through military action. On occasion, the Airpower Journal has published articles approaching those desired by the authors of "Mayday." (See "Use and Misuse of Conventional Tactical Air Power," Summer 1987; or "Counterrevolution in Namibia," Winter 1987–1988.) However, the Airpower Journal's target audience is company and junior field grade officers, and we believe our emphasis should be on their concerns with effectively orchestrating military action to achieve the objectives set by the strategists and higher-level campaign architects. This intermediate stage of development would seem to be necessary to ultimate useful service in the politico-strategic realm.

The issue seems worthy of comment by our readers. Over? KWG

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Notices of upcoming conferences, seminars, and other professional notices of a noncommercial nature should be sent to Editor, Airpower Journal, Walker Hall, Maxwell AFB AL 36112-5532. We reserve the right to edit material for length and content.

USAF Academy Military History Symposium

The Department of History at the United States Air Force Academy has announced that its Thirteenth Military History Symposium will be held 12-14 October 1988. The topic is the role of intelligence in military operations. The department has sponsored a symposium series since 1967, and all symposium proceedings but the first have been published through the Office of Air Force History by the Government Printing Office. For further information, please write to Capt Mark Clodfelter, HQ USAFA/DFH, USAF Academy CO 80840-5701. Telephone inquiries may be made at (303) 472-3230 or AUTOVON 259-3230.

Air Force Intelligence Conference

Air Force Intelligence is sponsoring a conference on "The Soviet Union—Towards the Twenty-First Century: Political-Military Affairs in the Gorbachev Era." The conference will be held 19–22 October 1988 in Arlington, Virginia. Individuals interested in presenting papers or participating in one of the panels should contact the Conference on Soviet Affairs, AFIS/INIS, The Pentagon, Washington DC 20330-5110, or call (202) 695-7266.

Command and Control Workshop

The Joint Services Working Group on Command and Control Decision Aiding will hold its Sixth Annual Workshop on Command and Control Decision Aiding on 21–23 February 1989 at the Naval Ocean Systems Center, San Diego, California. For conference information, write NOSC, Code 444, Attn: Mr Eddington, 271 Catalina Blvd, San Diego CA 92152, or call (619) 553-4146.

VMI/American Military Institute Military Education Conference

The Virginia Military Institute's Department of History and Politics will host the annual meeting of the American Military Institute on 14–15 April 1989 in Lexington, Virginia. The conference theme is "Military Education and Thought." Papers that treat the establishment of formal military education, the creation of academies and service schools, or the formulation and institutionalization of military doctrine through military education are invited. Papers may focus on any nation or period of history. Please send proposals to AMI Conference Coordinator, Department of History and Politics, VMI, Lexington VA 24450. The deadline for submissions is 31 October 1988.

Old Dominion Soviet Military Doctrine Conference

Old Dominion University is sponsoring a conference on "Soviet Military Doctrine in an Era of Change" to be held at Old Dominion University on 25–27 May 1989. For more information, contact Philip S. Gillette, Graduate Program in International Studies, Old Dominion University, Norfolk VA 23529-0088, or call (804) 440-4643.

USAF Historical Research Center Grants

The USAF Historical Research Center has announced that it will make available several grants for FY 1989 for the study of the history of air power, to be conducted at the Historical Research Center, Maxwell AFB, Alabama. Applicants must have a graduate degree in history or related fields and a background in aeronautics, astronautics, or military-related subjects. A broad range of military subjects may be researched with an emphasis on performing research using primary resource material of the USAF Historical Research Center. For applications and further information, write to Director, USAF Historical Research Center, Maxwell AFB AL 36112-6678. Application deadline is 31 December 1988.

contributors

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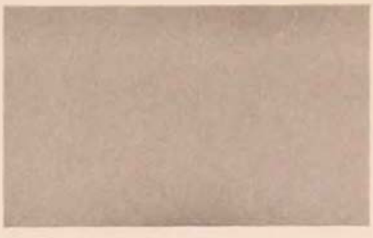

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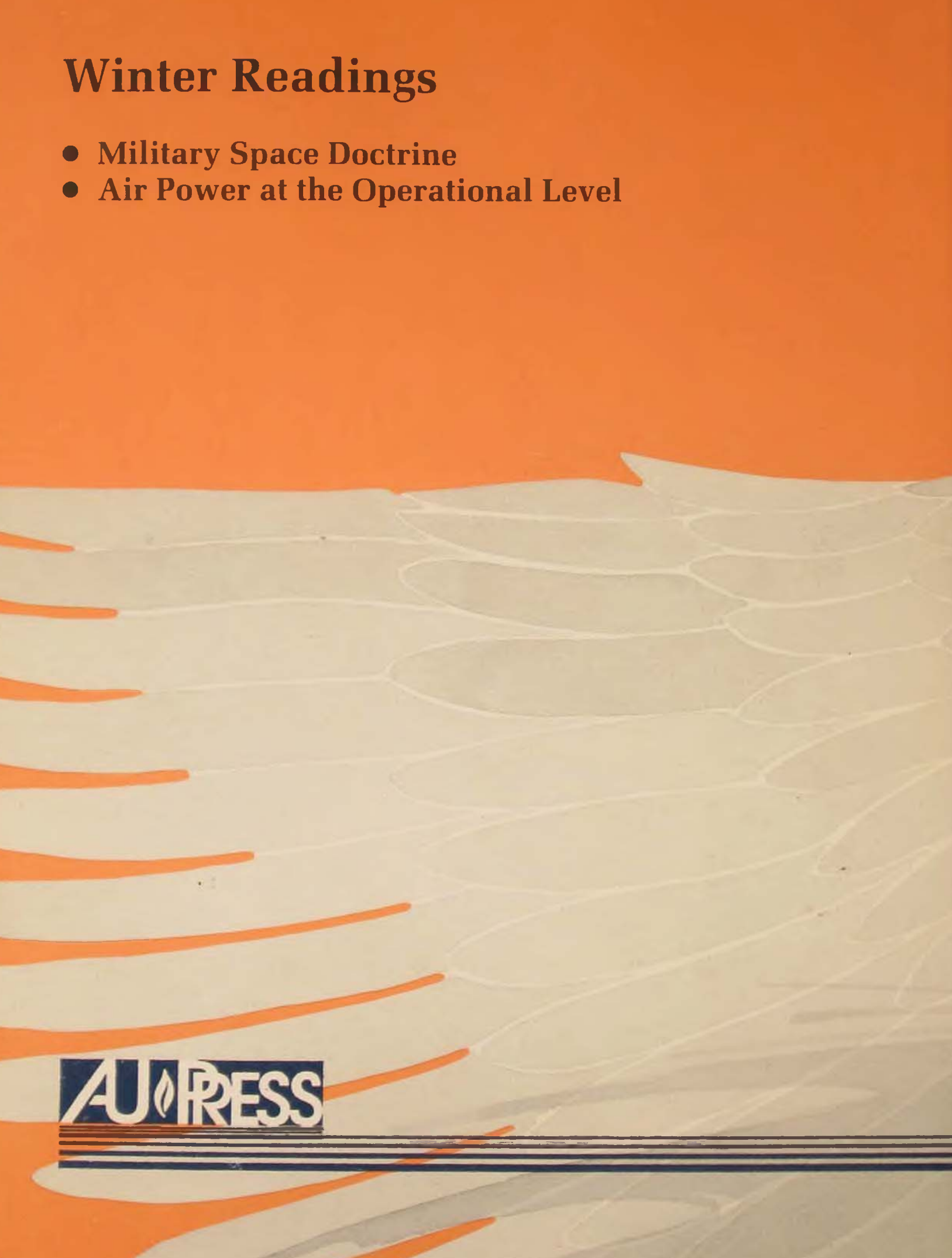
Winter Readings

- Military Space Doctrine
- Air Power at the Operational Level



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