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FEATURES

DEPARTMENTS

Flight Lines

LT COL JAMES W. SPENCER, EDITOR

FLIGHT LINES, VERSION 2.0

Countering Professional Relativism

AT SOME point in their careers, some of my contemporaries decided they would pursue professional development in their own way. Call it right to privacy or professional "choice," they determined to buy into the profession of arms on their own terms or keep private or masked their decision not to. Many of these professional relativists were eventually disappointed with their careers, disenchanted by their prospects for advancement, and disfranchised by the promotion process, unable to figure out why they were unhappy.

Their careers were progressing well enough. They managed to keep their supervisors happy with the work they were producing. There were the usual early promotions. They weren't slouches either. Younger airmen were Green Flagged—given disproportionately more flying opportunities to gain more experience quickly. Almost all Air Force professionals endured an early season of certifying themselves for their basic specialty. There was a lot to do and read back then. So when they signed up for the expected norm of completing professional military education (PME) by correspondence, they were already very busy and a bit overwhelmed early on with the additional work required. Perhaps their reaction to those first few textbooks affected their decision of whether or not to buy into professional development. If they were turned off, perhaps they were busy enough to justify their decision and early enough in their careers to rationalize that they would return to those realities later on. In that way, professional relativism crept into the careers of hundreds of officers who today may either discount the notion of focusing on any facet of continuing PME or assume self-sufficiency enough to reject assistance from others along the way.

We assert that some truths regarding career choices are made under the influence of this subtle career malaise. Professional relativism preaches that promotions come down to "definitely promote" anyway. We argue that the profession of arms involves more than this. Relativists would be the first to tell you that no one's rights have been violated. Everyone knows that any organizational mission says little, if anything, about guaranteeing professional success. Still, they continue to turn their professional lives on and off at different times during the day, week, or career.

Now, many midcareer officers may be emerging from the drawdown with some new career concerns. Some may sense a professional vacuum even though they've filled their squares going into their next promotion board. Perhaps professional development is no longer a matter that's relative anymore. Can you recover from a career shaped by professional relativism? We recommend that you consider three actions.

First, find a mentor—a senior officer you respect, whose career you wouldn't mind reflecting on your own. If you think you're too senior to have a mentor, bury that thought. Otherwise, the two of you could start back in our book review section or with a fine bibliographic essay such as Dr Mets's work in our Winter '95 edition. Call up our on-line book reviews on *Air Chronicles*. After reading reviews in a mutual area of interest, pick one or two books that both of you agree to read, and then compare your professional assessments of the authors' ideas. Why books? Because the great lessons learned from the Vietnam War come from people who are about to reach retirement age. Very soon, the written record will be all we have of the World War II experience. If you haven't prioritized time to pursue professional development, mentoring will take some. Books make your mentoring moments more valuable—for starters. And you'll discover that the rest of your time together goes much too fast.

Second, find a peer who will hold you accountable for your professional development.

Who passed out the notion that we should pursue professional development alone? Continuing professional education should be a shared experience. Write something we can publish in these pages, and find out how valuable your ideas really are. Let your peers tell you. You might be surprised.

Third, find someone to mentor, and share your lessons learned with that younger officer. When we discuss the profession of arms with others who are like-minded, we get away from relativistic notions. If we aren't about the business of mentoring others, we fail to promote a profession to which we've contributed our best days. Those days become lost "midst the hopes and dreams" of what we thought our careers could be. Ultimately, the service and its mission suffer.

Mentoring is much more than merely comparing notes on our service's history. It is about *making* history—the best kind. Uniting around the best ideas and professional lessons learned insures that the best minds will be at work turning the next series of problems besetting our service and country into challenges and opportunities.

For those of you who think I've violated my personal credo never to "talk down to the readership," I can truthfully tell you I don't know of anyone in the Air Force who practices professional relativism. They all left the service years ago—disenchanted and unable to discern why. If they're reading this now, I know we're both much happier. How about you?

What You Told Us

Our recent triennial readership survey told us a great deal about ourselves and about you. If you were one of the 1,157 officers who received our computer disk and returned it to the Survey Branch at the Air Force Personnel Center, you participated in an entirely new enterprise. We must admit to mixed feelings about the methodology. Although we did not resort to the ubiquitous digitek-coded answer sheet, we were concerned that encoding a prepared computer disk might sway some people from participating. Far from that, you responded extremely well. We thank you, and here's what you told us.

Over the last few years, more of you have become aware of the professional journal of the Air Force and have read at least one article in each edition. Although the vast majority (84%) believes that *Airpower Journal* is written at an appropriate level, 14 percent think the writing level is too lofty while 2 percent think the level is too low. Overall, 54 percent of you thought that *APJ* was meeting its goal to be an open forum for officers to discuss issues, while 36 percent thought that we were meeting that goal either very or extremely well.

We took the occasion to sample your thoughts about our new electronic medium—*Air Chronicles*. More of you thought you would read *Airpower Journal* after discovering it was on-line. We were encouraged by the fact that 72 percent of you said you would be more likely to discuss the articles and ideas you read on-line with your coworkers.

Your comments about our book review section were well taken, and we're working hard to "plus-up" that important professional reference. Look for more distinguished reviewers in future issues. Your voice regarding our single-issue themes has been heard. This year's special edition will be the last. More on that in Special '96. The good news is that our wider editorial focus allows us to run those research articles year-round, along with articles of interest to everyone.

Although we're not exactly publishing everything that everyone likes, our hope is that we're running more things that benefit more readers. Survey cards will soon appear in the back of every issue (if one's not back there now). Automated feedback has always been a feature on-line. We make our living by shaping the professional dialogue. If you're not part of that process, our job's a little tougher. Don't hesitate to let us know what you think. □

Ricochets and Replies

We encourage your comments via letters to the editor or comment cards. All correspondence should be addressed to the Editor, Airpower Journal, *401 Chennault Circle, Maxwell AFB AL 36112-6428. You can also send your comments by E-mail to Spencer=James%ARJ%CADRE@Chicago.AFWC.AF.MIL. We reserve the right to edit the material for overall length.*

STILL MORE ON WESTERMANN

Captain Westermann's thoughtful essay on contemporary civil-military relations (Summer 1995) needs correction on several points. He has misread some of my arguments and is misinformed about several aspects of American military history.

First, some factual errors. On the Newburgh conspiracy: the United States in 1783 was a confederacy, not a republic; the conspirators aimed not to overturn the confederation government but to force its strengthening; the leaders were in Congress (Robert and Gouverneur Morris and Alexander Hamilton), not in the Army—Gen Horatio Gates being only an unknowing tool. At the time, many people in the civil leadership supported the creation of the Society of the Cincinnati. James Wilkinson was a Jeffersonian, not a Federalist. The all-volunteer policy was installed by the conservative Nixon administration, and some of the earliest questioning of the draft came from conservatives—Barry Goldwater among them. Military leaders opposed the change until the very last moment (and some beyond that) when the civilians determined it—and Gen William Westmoreland loudly repudiated his support as chief of staff of the Army almost immediately upon retiring.

Second, some misreading of history. It is true that the American military has had, over time, a frequently factious relationship with its civilian superiors and that in the 1790s the tiny national Army was partisan. However, my argument is that this partisanship disappeared by the midnineteenth century and that nonpartisan subordination to civilian authority on the part of the officer corps as a whole—whatever particular friction existed at the top between service leaders and civilian officials—became the foundation for military professionalism. Both Samuel Huntington in his classic work of 40 years ago and William Skelton in a recent study endorse this interpretation. Westermann apparently does not understand that partisan politicization of the *professional* military is new, for he cites historical examples of citizen-soldiers' political activity and a single election (1868) that occurred during a period of the worst civil-military tension in our history. It seems to me utterly ridiculous to read the Truman-MacArthur conflict as an affirmation of the American practice of civilian control, especially in light of its repeated instances of defiance of presidential authority and declared national policy by the Army's most senior leader and a revered national hero, during a period of extraordinary military crisis. And to cite precedent for Lyndon Johnson's interference in operational matters in the Vietnam War, along with wide acceptance of civilian control by the military, in interpreting military thinking about how that war was waged is to ignore entirely the widely shared belief among the professional military leadership in the generation after the war that our worst mistake was too much civilian interference in the prosecution of the conflict.

Third, the misreadings of my article. I do not argue that the military rejects civilian control—only that certain behaviors and trends have weakened it, whether the military recognizes the facts or not, whether they contribute to this erosion willingly or unwittingly. That is why I wrote the article. I believe the American military to be loyal to the core, needing only to be alerted to these trends, facts, and problems in order once again to reassert the professionalism that contributes so substantially to maintaining civilian control. Concerning Gen Colin Powell, Captain Westermann misses the point entirely. The general was not "offering suggestions" or participating "in consonance with changing national strategy objectives" (Westermann's words), but

defining those objectives, formulating strategy and force structure, and then selling them within the government—in the absence of civilian direction and sometimes under or around significant civilian opposition. General Powell never sought "direct control" of policy—only its definition and creation by means of offering his own version and then managing its acceptance. I do not argue that the chairman's position has become a political one (nor should it!)—only that recent chairmen have partly mistaken their role, have become politicized to an alarming degree, and have acted or spoken in ways that circumscribe or undermine civilian authority, whether they know it or accept the fact or not. My concern about politicization is not that officers are conservative; I do not argue that the armed forces have become "dominated by supporters of a single political party." My contention is that a large majority of the officer corps of the services has abandoned its traditional personal political neutrality for a rather open partisan affiliation—and that it is overwhelmingly Republican. Statistical data would be helpful on this point, but an assistant secretary of defense for personnel told me recently that no such data exists and that it is likely impossible for the Defense Department legally to gather it. However, the anecdotal evidence is compelling.

The danger of this politicization to military professionalism and to the functioning of our government is twofold. On the personal level, officers who are politically involved in partisan ways (even if only intellectually) can find their loyalty to the political leadership—and their commitment to policy and to orders they oppose—weakened; movement of the government in directions they dislike can add pressure and emotional strain to what are already extremely stressful professional challenges and could conceivably harm the performance of their duty. On an institutional level, the military risks losing the trust of the American people if it comes widely to be viewed as just another self-interested bureaucracy or as a group loyal as much to a political party, ideology, or set of political leaders as to the Constitution and the nation as a whole. That trust is essential to American defense and to the functioning of the constitutional system, for it permits civilians to accept military recommendations as the disinterested advice of professionals concerned only with the welfare of the nation and allows them to pursue policies and make decisions without fear that the military is trying in some fashion to undermine civilian control for its own—or other—purposes. Once lost, that trust would take generations to restore.

Finally, I say explicitly in the article that the Republic is probably not in danger at the present time. My interpretation is that the trend in civilian control is alarming, and if defined as the relative weight of the military and civilians in determining national security policies and shaping American military activity, civilian control has been eroding. On that fundamental point, Captain Westermann and I seem to disagree.

Richard H. Kohn
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REGARDING OUR WINTER EDITION

EDITOR'S NOTE: Everything about our Winter edition—from the cover on—was designed to generate feedback regarding the larger professional journal of the Air Force. Many of you pointed out that we were possibly victims of growing pains. Among the errata: the Builder article is incorrectly attributed to his presentation at the "Air and Space Doctrine Conference" rather than "USAF Air and Space Doctrine Symposium." Dr Holley's article, likewise derived from his presentation at that symposium, included no reference to it at all. On page 22, we incorrectly attributed reference citation six to FM 1-5. Dr Mowbray's endnote cited it correctly. Many of you pointed out our production process error on page 70 at the bottom of the left column. Here, "dis-" should read "discussed in this. . . ." Although technical errors always disappoint us, we also received feedback like the following:

Congratulations on an outstanding issue. I have just read the entire *APJ* cover to cover (something I have never done before) in one sitting. The first four articles alone should generate enough heat to warm all of academic circle.

The piece on information warfare alone is worth the entire issue. Unfortunately, reading history is not considered "manly," so many airmen will miss the underlying message: information warfare is not new; neither is it a panacea or a medium in which battles are fought.

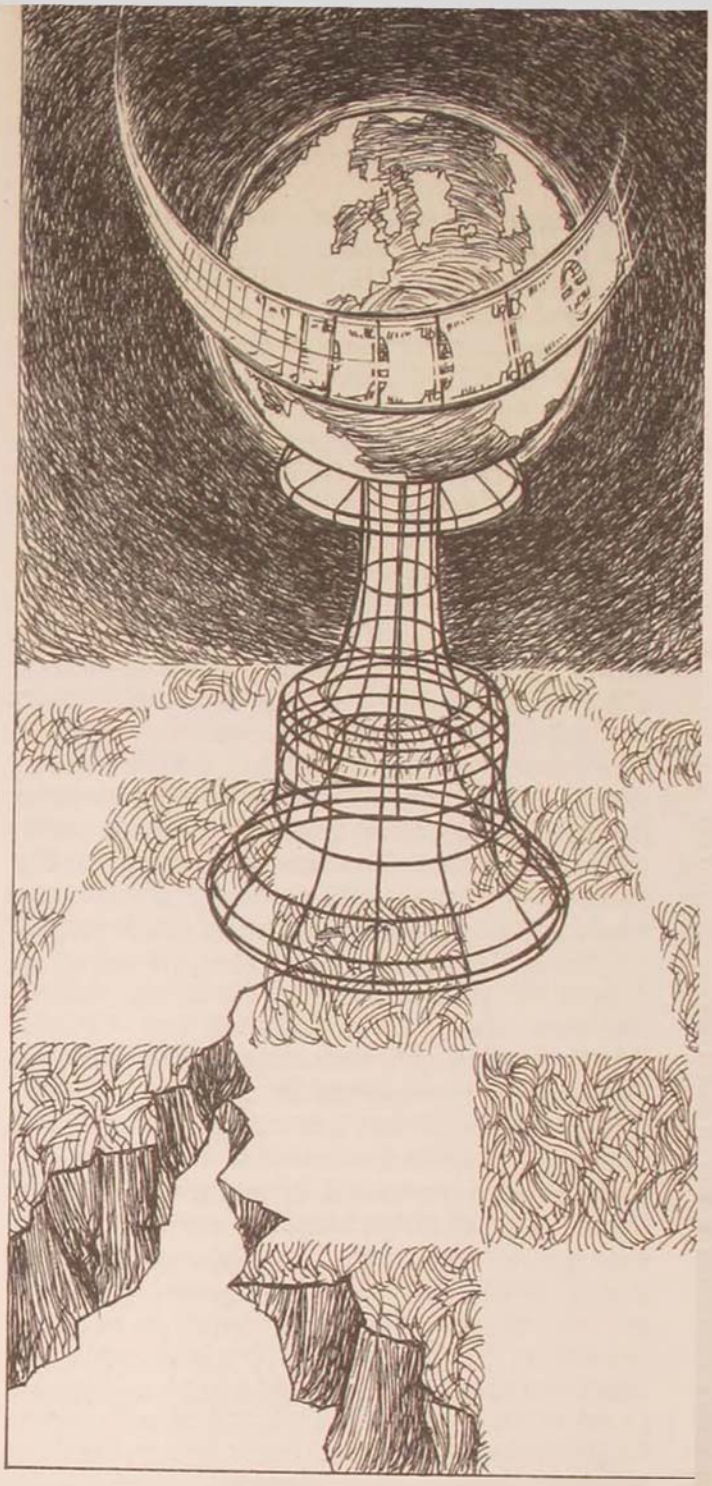
The Holley piece is invaluable. Once again he has educated another generation of airmen as to

continued on page 119

Telecommunications, Politics, Economics, and National Sovereignty

A New Game*

Dr George Bugliarello



TECHNOLOGY—the societal process for the production and operation of artifacts, both tangible and intangible—impacts virtually every other societal structure and process and is, in turn, influenced by them. From its inception at the early emergence of humans as a distinct species, technology was the instrument that extended our biological capabilities, eventually making possible increasingly large human aggregates. The emergence of a complex sociotechnological system, the *polis* (a Greek word for city-state), gave its name to the process we call politics.

The polis was a territorial entity, and politics to this day remains eminently a territorial phenomenon. In the words of the late Speaker of the House Thomas P. ("Tip") O'Neill, "all politics is local" as it is wedded to the people living in a given geographical region.[1] So is sovereignty itself—the phenomenon defining the sphere of power of an entity, whether it be a polis, a nation, or an empire, or whether it be politically democratic or not. Economics, as an emanation of the polis, also can be viewed as having a territorial substratum. In its broad acception of consideration of costs and returns, however, it becomes a nonterritorial abstraction.

Political power and economic power may operate over the same territory (as in the now rare case of isolated economies) but, more often, their domains do not coincide. The direct or indirect agent of the divergence is technology, the very process that created them and now makes possible global markets, which cross frontiers. When the domains of political and economic powers diverge,

*Presented at the Conference on Communications Technology and National Sovereignty in the Global Economy, 21–22 April 1995, Northwestern University. The conference was cosponsored by the Center for Urban Affairs and Policy Research and the Annenberg Washington Program.

inevitably some elements of political territorial sovereignty are lost, while purely economic communities almost inevitably tend to acquire political power that carries with it some elements of sovereignty. Today we are at a very critical moment when technology has greatly accelerated this divergence.

Given human nature, it was inevitable that technology, by its ability to dramatically extend our capabilities, would create an inexhaustible demand for ever greater and more powerful extensions—whatever their purpose—with enormous impacts on politics, economics, and other social processes.

In 1957 the first artificial satellites, circling way above any state's ability to capture or destroy them, forced states to officially concede limits to the extension of their sovereignty in the vertical dimension—a sovereignty that was held to be limitless until then.

In our consumer society, the ever-expanding appetite for goods and services made possible by technology has increased the demands on political and economic systems, and on technology itself, to provide sustenance, jobs, and an adequate standard of living. At the same time, it has created demands to remedy and conserve the very environment from which the consumer society draws its resources—hence the bidirectional nature of the interaction of technology and society. Technology offers tantalizing possibilities—not only economic but also political, military, environmental, and so on. In the process, wants are created that the economist and politicians endeavor to satisfy by guiding the allocation of resources and the direction of technology. Those demands can become so large, urgent, and often so irreconcilable as to raise doubts as to the future of the very society that technology made possible and to threaten its stability. Historically, major new technologies, while creating a new universe of opportunities, have almost always raised concerns about future directions of a society. This is very much the case today with telecommunications—or rather with the powerful synergy of telecommunications and information processing that, for the sake of brevity, I shall label "telecommunications."

To put the impact of telecommunications technology in perspective, we need to remind ourselves that our own country was agonizing some 200 years ago not only about how to achieve independence, but also whether the introduction of manufacturing, which was beginning to develop vigorously, would ensure independence and economic and social stability or subvert them. Manufacturing on a diffused scale, as had begun at that time also in England and in part of Europe, was of course traumatic to societies that had been what Walt W. Rostow calls pre-Newtonian.[2] In those societies, innovation had been sporadic in spite of the impact of the new geographical discoveries, which, however, did not penetrate and change fundamentally the agrarian economic life of the interior.

The danger of chaos is real.

Manufacturing created a corps of innovators and effective industrial enterprises, and it caused profound changes in the economy and in the life of towns and villages where the factories were located. The power of manufacturing became clearly evident in the America of the Civil War, in the subsequent construction of modern fleets that enabled the industrial nations to colonize so much of the world, and in the organization of modern land armies that gave sinews to the rapidly rising star of nationalism.

In effect, manufacturing and transportation became the foundation on which the modern nationalistic state could protect and attempt to extend its sovereignty. Even the maritime trade was carried out globally under national flags, protected by fleets of sovereign powers. However, the trade tended to generate in the great urban cities that were its terminals a cosmopolitan culture that clashed—as it also did in the American state legislatures of the post-Revolutionary War period—with more localist cultures from the interior regions.[3] This situation still characterizes, to a remarkable extent, some of the current conflicts in our political views.

If manufacturing was the foundation of the power of the modern nationalistic state, telecommunications, with the ability to cross frontiers and penetrate into the most distant regions of the world, have come to represent the quintessential challenge to territoriality and hence to national sovereignty. This is not a deliberate challenge but a challenge, as pointed out by Walter B. Wriston in pioneering essays,[4] that is intrinsic in the nature of the technology and in the economic and political processes that telecommunications make possible.

From Energy to Information and Complex Systems

The change in the leitmotiv of technology from energy to information, which characterizes so strongly the second half of this century, has been the result of the close interaction of information and telecommunications and of our ability to build and operate very complex systems such as telecommunications networks using satellites, fiber optics, or cellular telephones.

Of course, energy continues to be vital to our biological and economic activities, as well as to defense. The pertinent point here, however, is that energy or energy-driven networks (highways, railroads, airlines, shipping, etc.) are all tangible and require material resources (metal, cement, fuel, etc.) that are bound to increase in cost as demand increases. Virtually immaterial telecommunications, on the other hand, use very limited energy in the conveyance of information and tend to decrease in cost with increasing demand.

Because of its immateriality, the information conveyed by telecommunications is not consumed by use (but competitive advantage is lost if it is accessible to competitors). However, it can suffer from noise and can be degraded during its transmission. Thus, information needs to be maintained, and so do the programs that manipulate it and the data banks in which it may be stored. There is economic value in reducing the degradation of telecommunications (as evident from the publicity of competing telecommunications networks) and in maintaining systems that transmit the information.

Given the intrinsic immateriality of information, telecommunications systems are virtually not territorial, while systems for the production and use of energy are eminently territorial. For example, while the car user is confined to a system of roads, the time is approaching when every individual will be potentially addressable anywhere in the world with his or her identification data, bypassing territorial forms of control.

Finally, whereas energy flows are one-directional (say from A to B), information can flow in any conceivable direction—from B to A as well as from A to B, creating different values for A and B. That is, information is relative. If we use Claude E. Shannon's definition of information as the removal of uncertainty,[5] it is clear that different individuals may have different uncertainties, so that what is information for one individual may not be for another. Given also the importance—in business, war, diplomacy, the media—of the temporal element of information, that is, of obtaining information ahead of others, we can say that telecommunications enlarge the circle from which we can search and draw information instantaneously. Thus, value is created by telecommunications, and the massive growth of investments in the telecommunications-information sector vis-à-vis the energy sector stems in considerable measure from these factors.

Technology, Telecommunications, and Sovereignty

Sovereignty can be defined in many ways—as autonomy, independence, controlling influence, or, more appropriately in the context of this paper, as a political unit that has supreme authority on anything that happens within its boundaries. However, in the evolution of the modern democratic state, even that supreme authority has limits. There are inher-

ent freedoms of the citizens that not even the supreme authority of the state can abolish, and there are concessionary freedoms acquired by the citizens by concession by the state.[6] Sovereignty implies, therefore, a defining sphere within which it exerts its power. In the case of a nation, that sphere is defined by its borders—although it may extend beyond them (e.g., to the nation's ships).

The imperative for sovereignty is to defend the control within its sphere. Technology has both reinforced and weakened that control. Suffice it to think on the one hand of the powerful weapons that only a central authority with the power of taxation can afford and build and, on the other, of the impact of telecommunications from outside the borders on the former Soviet Union or on Cuba.

We can say, in general, that any technological system that enables people to reach on their own beyond the frontiers of a state, and to carry economic or political activities beyond such frontiers, has an impact on that state's sovereignty. Postal systems, books, trades, and international banking all have had (and have) that effect in various degrees. But with telecommunications and their synergy with information technology, the impacts on sovereignty have become dramatic and are still far from being understood in their nature and magnitude. All the underpinnings of sovereignty—not only political and economic power, but also the infrastructure that supports them and, more fundamentally, the outlook, values, and mores of citizens—are being transformed by that impact.

Territoriality and Metaterritoriality

A clear understanding of what is territorial—anchored, as it were, to the ground—and what is not is helpful in further clarifying the impact of telecommunications on politics, on economics, and on sovereignty. Obviously, any process, entity, or structure anchored to the ground is territorial, while virtually any activity of an intangible or abstract nature that can be conveyed as information or transformed into information can be regarded as metaterritorial.

These distinctions are exemplified by table 1. Thus, science as a method, as information, as a system of beliefs, is metaterritorial, like philosophy or literature, but the scientific laboratory is not. (However, through telecommunications, "virtual" scientific laboratories can be created, whereby it is only the interconnectedness of their components situated in

Table 1

Examples of Territorial versus Metaterritorial Entities or Activities

Territorial	*Metaterritorial*
Agriculture	Beliefs
Cities	Literature
Manufacturing plants	Information
Ground installation of networks (workstations, offices, etc.)	Science
Other elements of the physical infrastructure (water, power, railroads, highways, etc.)	Electronic transactions
Schools	Satellites (once launched)
Politics	
Armies	
Scientific laboratories	

different territorial jurisdictions that creates the laboratory—in this sense, a quasi-metaterritorial or potentially metanational entity.) Similarly, software or telephone conversations are metaterritorial; the devices that carry them are not, but their interconnectedness across territorial jurisdictions creates again a metaterritorial system—the "network." Politics, as a set of beliefs and ideas rather than as a practical activity, is also metaterritorial. However, it is so closely wedded to tangible entities—house, factory, infrastructure, military power, and so forth—as to properly represent, as per Tip O'Neill's epigram, the quintessence of territoriality.

The significance of the distinction in the table is at the core of the impact of telecommunications—the key instrument of metaterritoriality—on territorial processes, which, qua territorial, are the subjects of sovereignty. Specifically, in the context of sovereignty, metaterritoriality applies to a process or entity that cannot be stopped at a border, either materially (as in the case of microwaves or satellites), or for other reasons (such as the high speed and high volume of telecommunications that defy any practical control).

Of course, telecommunications technology did not start with radio. It started with the telegraph and later with telephones (if we neglect the much slower visual communications), but the traditional telephones and telegraph interconnected by wires have an element—the wire—that tangibly crosses national boundaries and thus, in principle, can be more easily controlled. On the other hand, microwaves are intangible, do not require wires, and are unstoppable except by electronic means of shielding. However, a modern fiber-optic connection, with its enormous bandwidth, is also hard to monitor, and a multiple-path combination of fiber-optic networks and microwaves is even more difficult.

Telecommunications penetrate national borders (and thus, potentially, sovereignty) in many virtually unstoppable ways: by economic, political, cultural, and diplomatic information (e.g., "the age of transparency" brought about by electronic media and by commercial observation satellites).[7] Electronic trading on the stock market and other exchanges; international telemedicine (which now assaults, for example, the concept of national licensure of physicians) ; international joint engineering endeavors; on-line services; and software—all these activities are breaking, in various measures, the walls of traditional territorial sovereignty and, as pointed out by Anne Branscomb in 1991, challenge the laws that govern the ownership and flow of information.[8] They will do so even more in the future, even if nations will constantly try to counteract these trends and to assert and defend their telecommunications sovereignty, for example, by regulating access to airwaves.

Interaction of Telecommunications with Politics and Economics

Telecommunications technology is still far from mature. However, it is progressing at such a fast and uncontrollable pace as to leave regulations, institutions, and national sovereignty far behind—trying to back and fill, to use the vernacular. Yet the process is far from autonomous. Politics and law influence it—just as much as it does them. It may be said, for instance, that the monopolistic license that American Telephone and Telegraph (AT&T) enjoyed until not too long ago made Bell Laboratories possible and hence the pioneering advances of American telephony. In turn, economics influences policy. We see this happening today in countries, foremost among them the US and Great Britain, which, under pressure of business interests, including those in telecommunications, have developed the most liberalized telecommunications policies. And, of course, policy influences economics, as is happening today in Sri Lanka, where every factory is obliged to have a fax line—a factor that has facilitated the production of garments and other merchandise for the world market. Politics and economics, however, are not the only processes affected by telecommunications and affecting them. Suffice it to

look at how telephone protocols have changed (an extreme case is shown in table 2), or at the ubiquitous use of cellular phones, or at how telecommunications have changed many other social mores.

Some of the principal characteristics of telecommunications (or, more properly, of the synergisms of telecommunications and information) and their economic and political implications are summarized in table 3. The complex challenge that telecommunications represent for national sovereignty stems from the cumulative impact of characteristics such as these.

Telecommunities

A new phenomenon in the impact of telecommunications on national sovereignty is the emergence of a set of incorporeal and potentially powerful communities of interest (they could be called "telecommunities") no longer wedded to geography or contained by national borders. Some key points help underscore the impacts of the telecommunities on traditional national sovereignty:

(1) The telecommunities constitute a new set of entities that, like nations or individual companies or operators, can participate in Ricardo comparative advantage trade-offs. Because of the large number of telecommunities (for example, well over 70,000 networks currently participate in the Internet), the trade-offs can give an enormous impulse to the economy and create a myriad of flexible and highly efficient markets. (To be precise, it is useful to differentiate between network and telecommunity. The network is the physical instrument that makes the telecommunity possible, while a telecommunity is defined by software protocols that may be carried over several networks and by the people who use them to communicate with each other.)

(2) Their power stems from their possession of information and their large number. However, given the ease with which competing communities can be formed, it cannot be a monopolistic power or a power dominated by a central authority.

(3) Their potential high economic power stems from their being focused on specific common interests, thus representing a specialized and self-selected market.

(4) Their potential political impact is exemplified by the very rudimentary telecommunity that helped bring to power Khomeini or, more recently, by the use of fax and E-mail by Mexican insurgents in Chiapas to sensitize public opinion abroad.

Table 2

Telephone Protocol
Austria, 1888

OPERATOR IN VIENNA TO OPERATOR IN BADEN:

"FRÄULEIN OPERATOR IN BADEN?

MIGHT I HAVE THE HONOR TO WISH YOU A GOOD MORNING?

IT IS MY PRIVILEGE TO ESTABLISH A CONNECTION ON BEHALF OF HIS EXCELLENCY, THE PRIVY COUNCILOR ALFONS BARON VON WIECK, WHO PRESENTS HIS COMPLIMENTS.

HIS EXCELLENCY WOULD BE GRATEFUL FOR THE PLEASURE OF CONVERSING WITH . . ."

Source: Frederic Morton, *A Nervous Splendor: Vienna 1888/1889* (New York: Penguin Books, 1980), 38–39.

Table 3

Some Key Characteristics and Capabilities of Telecommunications (Examples of Their Political and Economic Implications)

Characteristics and Capabilities	*Political Implications*	*Economic Implications*
Speed	Ahead of political decision-making process	Has great competitive value Weakens economic controls that rely on slower human intervention
Volume Capacity	Surfeit of information makes controls difficult	Large variety of simultaneous transactions possible
Territorial Independence (Microwaves, phones to a lesser extent)	Weakens territorial political power and the exclusivity of diplomacy and intelligence Makes international "telecommunities" possible	Can bypass traditional controls of currency, trade, etc.
"Capillarity"	Defies central control	Creates person-to-person and producer-to-person markets; weakens or transforms intermediate organizational structures Requires some new structures to discipline and filter traffic for users' convenience
Networking	End of single or simple issue politics	Economic value in the network *qua* network (self-selected community of users) Business opportunities in providing services to the network
Potentially limitless number of networks (User can participate in as many networks as desired)	Necessity to better understand and respond to the multiple interests of the electorate	Business opportunities in a network's nodal points
Information	Advantage in knowledge of information acquisition and manipulation Can defy political or central control Can defy taxation	Potential to use information as currency within the network (money-analogous instruments) Potential to create new network-currency relation business Competitive advantage of an information orientation and high ground
Energy insignificant (Movement of information requires very little energy)	Decreased political importance of energy sources	Economy tilted toward information-based, energy-saving activities
Interactivity (Implicit in networking and other characteristics above)	Demands better political dialogue: the territorial sovereignty must explain itself	Better market feedback; also potential for feed-forward New business and public service opportunities

Table 3 (cont'd)

Characteristics and Capabilities	*Political Implications*	*Economic Implications*
Transparency (In two senses) (1) Ease of eavesdropping (2) Observation satellites	Demand for public affairs to be conducted in the open (trials, diplomacy, etc.) Need to safeguard privacy of citizens and sensitive processes	Need for stronger intellectual property protection Advantages to the tele-information "hunter-gatherer"
Encryptionability (Can be coded and decoded; makes networks impenetrable)	Antidote to transparency An advantage for organizations	Essential for maintaining economic and business advantage of information
Vulnerability (Susceptible to disruptions)	Necessity to provide safeguards	Necessity to provide safeguards
Nationality and race (for voice) blind	Lessening of prejudice	Wider markets
Make possible high-value added applications	Pressures to allow and encourage commercial applications The question of fair competition The question of fair availability	Virtually limitless applications
Make possible distributed memories and data banks	Networks may possess better data banks than territorial power—including access to and use of international data banks intrinsic in a network	New business opportunities and competitive instruments
Make possible changes in: (1) population distribution (2) workplace imperatives (territoriality of workplace and physical presence) (3) transportation (4) energy consumption patterns	Changes the territorial bases of politics Creates new and different political demands	Changes in business (1) territorial imperatives (2) environmental impact (3) inventory and supply policies (e.g., just in time)
Make possible fundamental changes in delivery of other services: (1) health care (2) education (3) other	New political demands New transterritorial restructuring of services (including universities)	New business opportunities (e.g., telemedicine, private teledidactics, and home-focused services)
Make possible new criminal opportunities (tele-infocrime)	New legislation and other political safeguards New enforcement of justice approaches	Business must develop new safeguards New business opportunities
Make it possible to think of hyperintelligence (global social intelligence)	The ultimate challenge to traditional territorial sovereignty: new models of political systems to respond to new global imperatives	New tasks and responsibilities of business Growth of new, global business ethics

(5) They do not, however, possess military power, but it is possible to conceive of situations in which they could have some elements of it (e.g., territorial or military information).

(6) Their potential to define and issue their own information-based "currency," that is, their own units of exchange, can defy or make difficult political and fiscal control and thus weaken one of the key powers of sovereignty. Today's financial products—including new derivatives of all sorts—are but a pale image of what could happen when the potential power of the telecommunities is fully understood and unleashed.

But with telecommunications and their synergy with information technology, the impacts on sovereignty have become dramatic and are still far from being understood in their nature and magnitude.

(7) Although they exclude, intrinsically, the "information-disenfranchised" wherever they may be, if the disenfranchisement can be overcome by expanding access and participation, telecommunications could improve economic conditions faster than traditional aid approaches.

(8) They have, unfortunately, the potential of becoming fertile ground for new kinds of crime—an issue that may induce them to create their own "police" and further assert their own sovereignty.

(9) Because of their ability to potentially encompass members of many nations, and because several of their characteristics are virtually impossible to regulate by international treatises, they can be viewed not as international but as truly metanational communities. For sure, many telecommunities will be totally within national boundaries and thus will not press hard on the concept of sovereignty. But other communities, in growing numbers, will be truly metanational.

(10) They are governed by new imperatives. The cardinal ones are connectedness, access, speed, security, and the possession of information (to the point that a meaningful parameter of their power would be some quantified index of that information and its value).

(11) Because of their reach, and of the new imperatives that govern them, telecommunities will increasingly shake up and rearrange traditional economic and financial institutions and, in so doing, contribute significantly to the weakening or redefining of national sovereignty. While some traditional institutions such as banks have greatly benefited and acquired greater power from telecommunications, a host of new players is coming to the fore, such as telecommunications companies invading the domain of traditional financial institutions. These new players are intrinsically much more at ease with metanational operations and with the technology of which they are indeed often the source.

(12) With their rapidly forming and reforming, telecommunities offer the opportunity to create instruments to span several of them—again, instruments requiring speed, security, and so forth, as well as possessing some characteristics akin to international compacts, albeit by necessity much more flexible. It will be possible, for instance, to identify and assemble new telecommunities to almost instantaneously extract from them pertinent information (e.g., on their education, industry, trade, or capital availability) to create telebanks and other forms of telebusiness to serve them. A fierce competition of global dimensions can be expected in identifying these communities, finding value in them, nestling and combining them, working effectively with them, finding ways of coordinating within or across them on matters such as finance, industry, entrepreneurship, and so on.

(13) Telecommunities will also lead to the creation of new professions, new services, and new jobs in the coordination of components of a telecommunity, in the identification of telecommunities and of the competitive advantage they may offer, in new kinds of selling,

trading, and manufacturing, and in new ways of manipulating and using information.

(14) The telecommunities will require controls—new compacts, for example, about honesty in trade and/or about provisions for the have-nots. At the same time, those compacts cannot afford to neglect the fact that the members of the telecommunities are real and occupy a certain physical and geographical space. Thus, the compact needs to consider the geographical base of the telecommunities, the infrastructure of services that supports that base (telecommunications facilities, population, transportation, food, and health care services, schooling, and so forth) and therefore territorial politics and economics.

In brief, telecommunications and telecommunities confront national sovereignty with major challenges because of their unimpedible cross-boundary flows (of information), their integrating power (the power to create new metanational entities), and the challenges and opportunities they present to the political process, to economics, and indeed to the entire fabric of society. The national state has only a limited ability to control these intrinsic and at times potentially destabilizing powers of telecommunications and the telecommunities they make possible. We have seen, for instance, that international telecommunication networks have distributed ideas to secluded Islamic women, contributing to declines in fertility in Turkey, Indonesia, Kuwait, and Jordan.[9] We have also seen the frustration of political bodies, such as the US Senate, in attempting to address the problem of how to limit access to pornography on the Internet. In global financial markets, all it takes is a phone call to send large amounts of money across the border or back. This, of course, has contributed to the recent pesos crisis—the ability of short-term investors to remove instantaneously their investments from Mexico.

Further-on Telecommunities

The complexity of telecommunities can be extreme if we just consider a taxonomy based on their relation to national boundaries. Thus, there is an obvious distinction between telecommunities within a national boundary—for example, Internal Revenue Service (IRS) taxpayers or ex-servicemen, and telecommunities crossing such a boundary (e.g., chess players). A primarily national telecommunity may, however, encompass, without losing its national character, members beyond the border, such as taxpayers residing abroad.

Although today the largest number of people interconnected via telephones, modems, and telecommunications reside in the United States, there will be a rapid if not uniform global growth of telecommunications so that border-crossing telecommunities become much more dominant, both in numbers and complexity. It is worth reemphasizing that a telecommunity, particularly one crossing borders, does not coincide necessarily with a single telecommunication network. It may bring together members that utilize a variety of networks often based in many nations and that can be connected through a variety of alternate paths. This will make highly desirable those technologies that can find automatically the best paths (however specified, for example, in terms of speed, or cost, or quality of service) to interconnect the members of a telecommunity.

Can national or international authorities monitor and control the activities of a telecommunity? The answer is, only up to a point. Although telecommunications technology itself can help the monitoring and control process, there are at least two fundamental impediments.

The first stems from the cybernetic considerations that the intelligent regulation of a process requires a model of the same degree of complexity as the process itself. Thus, the complexity required by a model of tens of thousands and, potentially, even more numerous intersecting and interacting telecommunities is enormous, just as enormous in complexity as a model of a very simple brain. The second impediment is that a surfeit of controls can strangle the system.

Thus, effective control of the telecommunities is virtually impossible. Reliance must be placed on voluntary monitoring by the

telecommunities, and legal instruments need to be devised that are appropriate to this new situation. For instance, formal or informal covenants that may be created within the telecommunities would tend to bypass or defy traditional trading controls and safeguards, but ultimately the results of transactions within a telecommunity will need to "come to earth" at some end point— in other words, be reterritorialized using, for example, certificates recognizable by a territorial sovereignty (what can be called "end-point regulation").

The Issue of Global Stability

As many traditional aspects of sovereignty are being weakened by telecommunications and as the intense dynamics of the networks and the expansion of telecommunities revolutionize business and politics, there is a need to prevent the situation from becoming chaotic and uncontrollable rather than being one of enhanced opportunities. The danger of chaos is real. To counteract it will require focusing on a more flexible conception of sovereignty, one that preserves essential controls and continues to provide those elements of the territorial infrastructure that are indispensable to the civilized life and defense of the people, while still making possible the full range of opportunities offered by telecommunications. This is the essential duality that needs to be addressed because out of it will emerge the global civilization of the next century. (It is tempting to say, to imitate Voltaire's turn of phrase, that if sovereignty did not exist, it would be necessary to invent it. It is clear, however, that the invention must be one of a new conception of sovereignty.)

The instruments of the new sovereignty can include controls of the territorial elements of the networks (land stations, management offices, and devices), as well as the users of the networks—the persons, qua physical and hence, territorial entities. A new legal and fiscal vision and framework are needed to deal adequately with the new conception of sovereignty in the presence of powerful and ubiquitous metaterritorial entities. The imperative for that sovereignty is to be conscious of its limitations (but also opportunities) in a situation of enhanced international mobility made possible by telecommunications.

An example of that mobility is the rapidity with which financial transactions can be carried out across borders, a mobility that makes it imperative, for instance, for a state and the world community to find ways of bridging the gap between long-term investment needs and short-term money. There is truly a new highly mobile "world order" of finance in which money can move instantaneously across the globe. International "just in time" money is possible, and destabilizing flows in one direction need to be compensated by stabilizing flows in the opposite direction. At this moment, as in the Mexican example, the destabilizing flows can be immediate and beyond the power of national sovereignty, while the stabilizing flows by and large are made possible by national decisions (acting either directly or mediately through international organizations). Reaching these decisions can be very slow, but once reached, they can again be acted upon instantaneously through telecommunications.

However territorial sovereignty may be modified by the far-ranging impact of metaterritorial networks, one of its key responsibilities will be to evolve policies that enhance the state's attractiveness for the territorial elements of the telecommunications infrastructure. Another key responsibility will be to address the issues of ethics and morality in the new telecommunications environment. Basically, these involve both the impact of telecommunications on the traditional processes that take place under the aegis of a territorial sovereignty and the new ethical rules that should govern participation in telecommunities and the use of networks (e.g., new business ethics, new ethics of personal interactions in a network, and possible limits to self-expression). Congressional concern about network pornography is but one small example of how fundamental and urgent these issues are becoming.

Conclusions

With their digitalization, indissoluble connection to information processing, satellites, fiber optics, and so on, telecommunications will be an inexhaustible source of change for social mores, economics, and politics. Global telecommunications will make information ever more the key strategic ingredient for business and industry, causing an accelerated value migration to information-based business, making possible the creation of myriads of telecommunities, and bringing us closer to perfect markets. Politics, in turn, will have to resolve conflicts between micro- and macro-optimality—between regional interests and those of new global markets and communities of interest—and between the traditional domain of national sovereignty and the pressures of new realities, new ways of doing business, and new social demands that transcend national boundaries.

The impact of telecommunications on politics, economics, and national sovereignty is creating a new game. It is a game with a new playing field, new rules, new players, new rewards, new impacts on the players and all of society, new ways of cheating, new needs to control it and keep it honest, new potential conflicts, new potential inventions and opportunities, and new potential disasters. That game has engulfed us much before we were able to fathom it in its complexities and impacts and to prepare ourselves for it.

The societal imperative is to accept the reality of this new game and to draw intelligently on the tight interlocking of telecommunications, politics, and economics so as to find a productive balance between territorial sovereignty and processes on the one hand and the new metaterritoriality brought about by telecommunications. This demands the creation of new skills and new understandings, which need to include:

- A deeper understanding of the new economic and financial meaning of international telecommunities and of an information-based global economy.
- The development of a new meaning and practice of politics in an age of global telecommunications and of telecommunities.
- The creation of a new science and a new diplomacy of territorial-metaterritorial relations that must emerge from the recognition of the power and importance of telecommunities.
- The development of protocols for interactions in a web of telecommunities—particularly a web of global dimensions.
- The development of a clearer understanding of the impact of territorial-metaterritorial trade-offs on our private lives.
- The ecological implications and global sustainability of economies and political systems with telecommunications and information as their leitmotiv.
- The need to be alert to the possibility of the onset of chaos in the new and complex ensemble of telecommunities and in their relation to traditional territorial powers, as well as the need to understand how to avoid or control it—a political and economic imperative.

As a start, there needs to be the development of a a new and broad sociotechnological research agenda with the ultimate purpose of providing society with the tools to play the new game and thrive. □

Notes

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4. See Walter B. Wriston, "Technology and Sovereignty," *Foreign Affairs* 67 (Winter 1988-89); and *The Twilight of Sovereignty* (New York: Scribner's, 1992).

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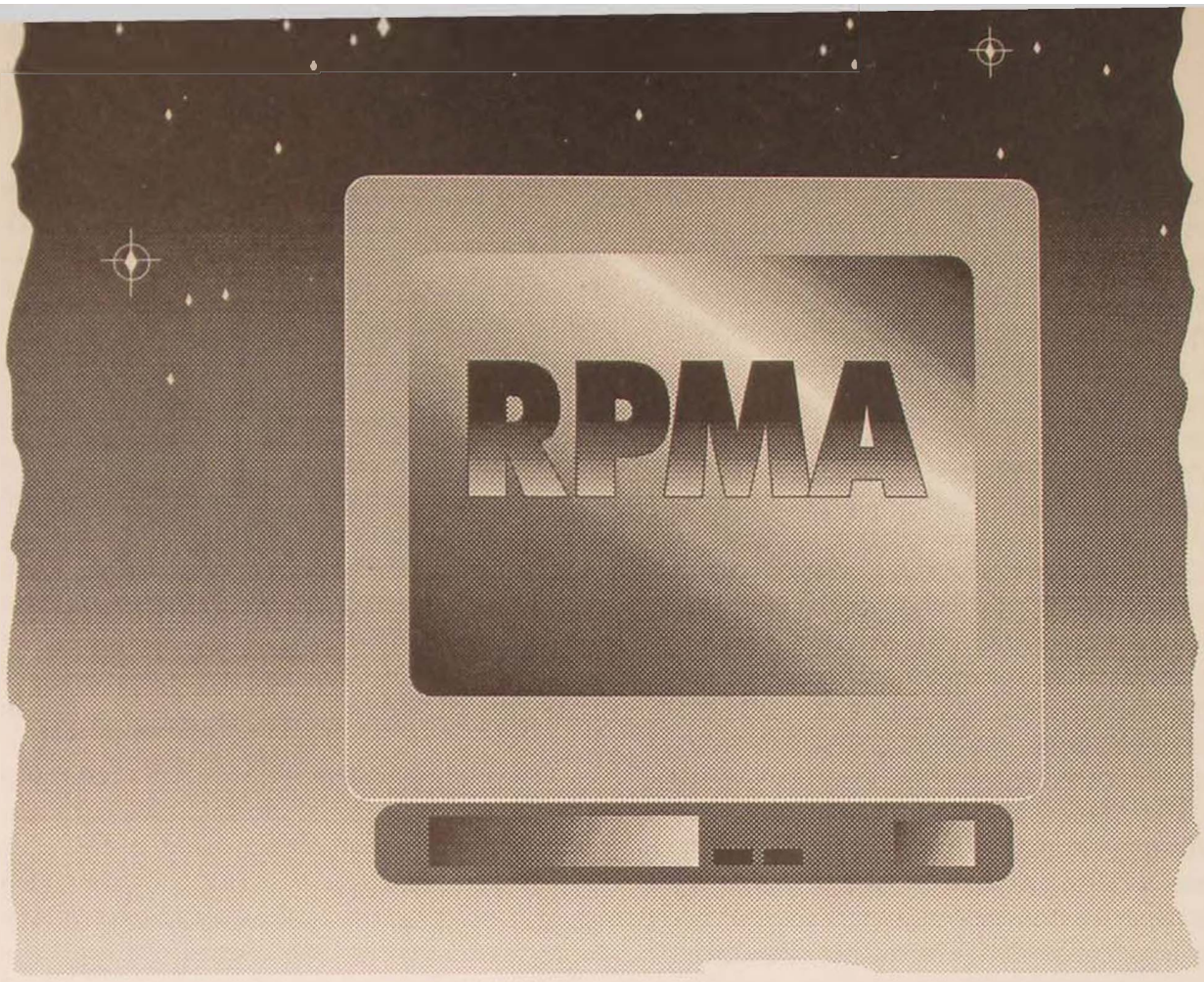

Generations, Waves, and Epochs

MODES OF WARFARE AND THE RPMA*

DR ROBERT J. BUNKER

THE PUBLICATION of the article written by Col Owen E. Jensen, USAF, entitled "Information Warfare: Principles of Third-Wave War" in the Winter 1994 issue of *Airpower Journal* represents a significant event. Tofflerian concepts, which have gained so much credence with the Army, are now beginning to openly influence Air Force dialogue on information-based future war. In that article, Colonel Jensen states that "the Tofflers provide probably the clearest and most accurate explanation of how this new type of warfare evolved."[1]

Before the Air Force openly embraces the Tofflerian trinity of agrarian, industrial, and informational war forms, some well-informed reflection should first take place. This reflection requires an understanding of the three dominant theories of future war currently debated in the military journals—fourth-generation warfare, third-wave war, and fourth-epoch war.[2] Specifically, these

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modes of warfare and perspectives on the revolution in political and military affairs (RPMA) need to be analyzed because these assumptions provide the foundations behind each theory's projections of future warfare.[3] Instances where the methodology behind such assumptions falls short should thus be a cause for concern because if a theory cannot accurately explain past modes of warfare and military revolutions, it will surely be unable to account for future ones.

Only after such analysis is undertaken can Air Force officers decide what attributes of the Tofflerian framework, and potentially those of the competing frameworks, should be utilized in the creation of post-Clausewitzian principles of future warfare.[4] This article provides an overview and synopsis of each competing theory, discusses its impact and shortcomings, and offers a limited conceptual comparison so that such informed decisions can begin to be independently made.

Fourth-Generation Warfare (1989)

This theory of warfare was developed by William S. Lind and four officers from the Army and the US Marine Corps (USMC).[5] Mr Lind, who has served as a legislative aide for two senators, is the director of a conservative think tank and is an authority on maneuver warfare. Fourth-generation warfare is primarily a tactical-level theory, which at times straddles the operational level, set in the modern era from about the Treaty of Westphalia in 1648 to the present (table 1). It was published concurrently in the October 1989 issue of *Marine Corps Gazette* and *Military Review.*

This theory is based on a qualitative dialectic stemming from the clash of thesis and antithesis and has not been satisfactorily developed. The introduction of either new technology or ideas is viewed as the basis for each succeeding generation of warfare. Military revolutions in this context are viewed as tactical, possibly operational, innovations in warfare that yield a decisive advantage to whoever adapts to them first. For this reason, the current military revolution would be considered comparable in scope to the one that took place back in the 1920s and 1930s.

In response to articles by this author and Lt Col Thomas X. Hammes, Lind and two Marine colleagues did a reappraisal of this theory in the December 1994 *Marine Corps Gazette* in which their theoretical perspectives went basically unchanged.[6] Ideas, not technology, would dominate future warfare. These authors only took the further step of voicing strong opinions concerning the potential fragmentation of American society due to the abandonment of Judeo-Christian culture.

First-Generation Warfare (Technology)

This form of warfare, which developed in about 1648, was based on the smoothbore

Table 1
Fourth-Generation Warfare

GENERATION	PERIOD	BASIS
First	1648 to present	Technology
Second	1815 to present	Technology
Third	1918 to present	Ideas
Fourth	Emerging	Technology
Fourth	Emerging	Ideas

musket and tactics centering on the line and column. This generation of warfare was linear and saw the fielding of small professional armies that relied upon rigid drill to maximize firepower. Interestingly, the French revolutionary armies with their low training levels and massive manpower levees were included in this generation. These armies represented the antithesis of the Prussian military system that had earlier dominated this mode of warfare.

Before the Air Force openly embraces the Tofflerian trinity . . . some well-informed reflection should first take place.

Second-Generation Warfare (Technology)

The second generation "was a response to the rifled musket, breechloaders, barbed wire, the machine gun and indirect fire."[7] Tactics remained essentially linear even though fire and movement now became common as troops dispersed laterally. Massed firepower replaced massed manpower as indirect fire began to dominate the battlefield. This generation saw the formal recognition and adoption of the operational art devised by the Prussians.

Third-Generation Warfare (Ideas)

Third-generation warfare was based on ideas rather than technology. German infiltration tactics devised in World War I were truly nonlinear, which resulted in maneuver instead of attrition being relied upon to destroy an opposing force. These concepts were then applied to the development of the tank and abstracted to the operational level to form the basis of World War II blitzkrieg campaigns, which were time-centered rather than place-centered.

Fourth-Generation Warfare (Technology)

Originally proposed in a 1989 article by Lind and others as one of the two alternative forms of future warfare which might develop, this warfare path was abandoned by these authors for their idea-based path once this theory became linked with Dr Martin van Creveld's 1991 book *The Transformation of War.* This is unfortunate because the potential offered by directed-energy weaponry, robotics, and media-based operations envisioned in the technology warfare path was generally accurate and has been addressed by both of the other theories embodied in this essay.

Fourth-Generation Warfare (Ideas)

The emerging fourth generation proposed by Lind and others is now envisioned to be firmly based on ideas, specifically non-Western ones. Terrorism, which bypasses traditional military forces and directly strikes at a nation's civilian populations, is viewed as a major component of this mode of warfare. The transnational or nonnational basis of terrorism makes it extremely difficult to attack. Ultimately, this form of warfare is nontrinitarian in character and, for that reason, is post-Clausewitzian.

Impact. While simultaneously published in both a Marine Corps and an Army journal, this theory has gone on to have a greater impact on the Marine Corps than the other services. This impact has apparently developed because of the Marine Corps's greater interest in low-intensity conflict, insurgency, and terrorism upon which the theory is focused (i.e., the other form of future war that is developing). Because fourth-generation theory focuses more on the subnational and non-Western threat to our government than on actually providing any suggestions on what should be done to counter it, its influence on the Marine Corps has remained limited. This theory has had no discernible influence on Air Force, Navy, or Army thinking.

Criticisms. Strong criticism of this theory first appeared in an Autumn 1993 *Parameters*

article written by Maj Kenneth McKenzie, USMC.[8] His well-crafted and persuasive arguments were directed at the theory's flawed methodological and historical underpinnings. Arguments against its relevancy, however, were less successful and were met by strong commentary delivered by van Creveld in the following issue.[9]

I directed criticisms against the methodological and historical attributes of this theory in a September 1994 *Marine Corps Gazette* article. Of specific concern was that the decoupling of technology and ideas results in an inaccurate mode of warfare modeling. Still, while it was suggested that the far larger and more encompassing fourth-epoch paradigm better explained the "military revolution" of our changing modern world, the theory of Lind and the others was acknowledged as visionary.

Criticism and support in a number of March 1995 *Marine Corps Gazette* articles have now focused on the five-year reappraisal of fourth-generation warfare.[10] That reappraisal has generated a controversial debate over the basic utility of this theory and where American society and the Marine Corps are now heading.

Third-Wave War (1993)

An early published reference to third-wave war can be dated to a 1991 *Los Angeles Times* article written by Alvin and Heidi Toffler.[11] It was not until the publication of their 1993 book, *War and Anti-War: Survival at the Dawn of the 21st Century,* that the third-wave war theory became widely known.[12] Alvin Toffler is one of the best-known futurists of the twentieth century. He has served as a Washington correspondent, as an associate editor of *Fortune,* as a visiting scholar, and as a consultant to major corporations. Along with his wife, Heidi, he has written numerous books and articles that have popularized their ideas.

War and Anti-War is a continuation of these earlier writings and the first attempt by these authors to analyze military matters. War is viewed as an extension of how wealth is made in a society. For this reason, it is subordinate to society's prevailing mode of production. Much like Marxist materialism without the accompanying normative baggage, this theory views humanity as developing three waves (e.g., "super-civilizations") over the course of its history (table 2).

Military revolutions in this theory are viewed as monumental events that mark the development of new war forms:

> A military revolution, in the fullest sense, occurs only when a new civilization arises to challenge the old, when an entire society transforms itself, forcing its armed services to change at every level simultaneously—from technology and culture to organization, tactics, training, doctrine, and logistics. When this happens, the relationship of the military to the economy and society is transformed, and the balance of power on earth is shattered.[13]

According to this perception, the military revolution we are now witnessing is viewed to be as significant as that of the French Revolution of the late eighteenth century.

Table 2
Tofflerian Waves

WAVE	WHEN DEVELOPED	MODE OF PRODUCTION
First	8,000 B.C.	Agricultural
Second	C. A.D. 1690	Industrial
Third	Current	Knowledge

Source: Robert J. Bunker, "The Tofflerian Paradox," *Military Review,* May–June 1995, 100.

First-Wave War (Agricultural)

This war form is based on poorly organized, poorly equipped, and poorly led armies that engage in seasonal fighting. Orders are verbal, pay is irregular and usually in-kind, and the nature of killing is face-to-face. First-wave civilizations engaged in this form of war range from classical Greece and feudal Europe to ancient China. The Roman legions at their peak were identified as an exception to this concept.

Second-Wave War (Industrial)

The second-wave war form is viewed as representative of industrial civilization. Mass armies using standardized weaponry produced on assembly lines engage in unlimited warfare based on attrition. Officers are now educated in military academies and orders are delivered in writing. The machine gun and mechanized forces have caused the development of entirely new tactics. War shifted from a struggle between rulers to one between peoples embodied by nation-states. This war form reached its apex of destructive potential with the development of huge nuclear arsenals stockpiled by the superpowers.

Third-Wave War (Knowledge)

This emerging war form is based on a new economy that is information-driven.[14] This is the most extensively written about war form envisioned by the Tofflers. Precision guided munitions, robots, nonlethal technology, directed-energy weaponry, and computer viruses are all viewed as attributes of third-wave war. Demassification, niche capabilities, and cyberwar are also discussed, and, as a result, have served to better inform military officers about advanced technology developments.

Along with the presentation of these intriguing and exotic technologies is a multitude of questions concerning their potential military impact and feasibility. The implications of such technologies on military ethics and societal ideals are, unfortunately, too often ignored. Still, the envisioned third-wave war form is post-Clausewitzian in nature and correct in many of its technical implications.

Impact. Third-wave war theory, with its futuristic and high-technology orientation, has had a significant impact on the thinking of senior Army officials, specifically Gen Gordon R. Sullivan, the former Army chief of staff. As a result, some of its ideas are directly tied to the creation of the "Information Age Army" envisioned in Training and Doctrine Command (TRADOC) Pamphlet 525-5, *Force XXI Operations*. Further, its waves of war have appeared in at least one official Army publication, and the Tofflers are constantly quoted by Army officers in military symposia. Its institutional influence on the Army may be transitory, however, now that General Sullivan has retired. Because the Marine Corps and Navy are now only beginning to enter the advanced technology aspect of the RPMA debate, this concept of war has had little measurable impact on either service. As mentioned in the introduction, third-wave war ideas are now finding their way into the Air Force debate, which is currently centered on the informational aspects of future war.

Criticisms. Criticism of Tofflerian theory is slowly mounting as its influence on the Army's senior leadership has now become apparent. While a number of its forward-looking aspects are viewed as significant contributions toward future war-fighting thought, its waves of war—as Col Richard Swain (USA, Retired), Dr Steven Metz, and I have shown—have no basis in historical reality.[15]

Dr Metz, a former professor at the Air War College, while expressing concerns over the popularity of third-wave war theory with the military, went on to quietly downplay the theory's significance in the Winter 1994–95 edition of *Parameters*. In a May–June 1995 *Military Review* essay, I launched a far more direct assault on its utility by specifically arguing that its envisioned war forms are severely flawed and, as a result, may be more of a burden than a benefit to the Army's RPMA debate.

The Tofflers are correct that a monumental transformation is embracing our society. Because they are first and foremost futurists, however, they have unfortunately had to rationalize this transformation by interpreting history so that it would conform to their abstract theory of super civilizations.

Fourth-Epoch War (1994)

This theory of war was developed in 1987 by Dr T. Lindsay Moore and this author in a research seminar on classical warfare at the Claremont Graduate School. We are actively teaching at the graduate level in the field of national security studies and rely primarily on historical analysis in our research endeavors. The concept of fourth-epoch war is based on a political science theory that examines the development of Western civilization over the last 2,500 years. Societal energy foundation change, which directly impacts polity forms and their economic and military systems, drives the assumptions behind this theory. The theory itself is concerned with the rise and fall of political communities, cyclical eras of mercenary dominance, and evolving modes of Western warfare. Because of the immense national security concerns this theory raises, it has purposefully been developed over the last nine years for applied use by US military and governmental policymakers.

While broad in scope, many components of fourth-epoch war have many components that are still unpublished. Documents pertaining to this theory have existed since 1989, with part of the theory being first put forth in a September 1994 *Marine Corps Gazette* article.[16] To date, only the land warfare attributes of this still-evolving theory have been published.

This theory divides Western civilization into four energy-based epochs (table 3). Each epoch is composed of one or more energy sequences, each of which expresses its own unique modes of warfare based on the experimental and institutionalized exploitation of a given form of energy (e.g., human, animal, machine, engine, postengine). Military

Table 3
Energy and War in Western Civilization

EPOCH	ENERGY	WARFARE
Classical	Experimental Human	Hellenic
Classical	Institutionalized Human	Roman
Medieval	External Threat	Raider
Medieval	Experimental Animal	Vassal
Medieval	Institutionalized Animal	Feudal
Modern	Experimental Machine	Dynastic
Modern	Institutionalized Machine	Absolutist
Modern	Experimental Engine	Corporate
Modern	Institutionalized Engine	Modern
Post-Modern	External Threat	Non-Western*
Post-Modern	Experimental Post-Engine	Advanced Technology

*Formerly Terrorist/Low-Intensity Conflict

Source: Robert J. Bunker, "The Transition to Fourth Epoch War," *Marine Corps Gazette*, September 1994, 22.

systems are viewed as a synthesis of technology and ideas that qualitatively differ between modes of warfare.

Military revolutions in this context are viewed as the attainment of a new energy threshold by Western civilization. *Intra*-epochal military revolutions (i.e., within an energy paradigm) are viewed as significantly less disruptive phenomena, while *inter*-epochal military revolutions (i.e., between energy paradigms) are viewed as massive civilization-changing events.

If a theory cannot accurately explain past modes of warfare and military revolutions, it will surely be unable to account for future ones.

Based on the historical trends isolated in this theory, the current RPMA represents an interepochal military revolution that will place the survival of the current dominant polity form, the nation-state, in considerable doubt and, as a result, will ultimately give rise to a postmodern form of political community. This military revolution, now only in its early stages, is viewed as being equal in magnitude to that of the European Renaissance.

First-Epoch War (Human Energy)

First-epoch war existed within the classical world and was based on the exploitation of human forms of energy. The two modes of warfare that developed were Hellenic warfare, which was based on the phalanx, and Roman warfare, which was based on the legion. The economy during this entire era was based on slave-holding, the city-state was the basis of the political community, and the dominant ideological paradigm was founded on virtue (i.e., the relationships and differences between masters and slaves).

Second-Epoch War (Animal Energy)

War in the second epoch took place within the Medieval world. This epoch contains three modes of warfare and is based on the exploitation of animal forms of energy. The raiders on the borders of Europe introduced mass cavalry-based warfare, which resulted in the fall of Rome and a period of barbarism in the West. The successor states to the Western half of this great empire responded by means of the development of indigenously based cavalry forces. Under the later feudal monarchies, these forces evolved into knights. The economy during this civilization epoch was based on fief-holding, the feudal state became the dominant polity form, and ideology rested on Divine Providence under the vestiges of the Church.

Third-Epoch War (Mechanical Energy)

The modern, or third, epoch of war exists in a mechanical-based energy paradigm. This paradigm contains two energy sequences of machine- and engine-based energy, respectively. The first energy sequence, based on machine energy, saw the rise of mercenary armies during the dynastic era and their eventual institutionalization during the Age of Absolutism. Mercantilism represented the dominant mode of production, while dynastic states represented the major political form. The second energy sequence, based on engine energy, witnessed the rise of corporate warfare ushered in by Napoleonic France in its early stage and the development of the German concept of blitzkrieg warfare in its later and more modern institutionalized stage. Capitalism replaced mercantilism as the basis of the economy, and the nation-state replaced the dynastic state as the focal point of political organization.

Fourth-Epoch War (Postmechanical Energy)

Fourth-epoch war represents the emerging warfare of the postmodern world. Two initial modes of warfare, based on postmechanical energy sources, are now developing. These

are non-Western and advanced technology warfare, respectively. Non-Western warfare is based on the blending of terrorism and low-intensity conflict (LIC) as a challenge to the West's dominance in modern warfare. This is a mode of warfare that is equivalent in many respects to idea-based, fourth-generation warfare.[17] Further, the increasing urbanization of the developing nations of the world is envisioned as negating much of the current dominance in modern war held by the West in its overseas operations. This dominance negation results because of the degradation of qualitative weapon superiority in the restrictive terrain of sprawling urban slums and the problem of distinguishing individual combatants from masses of innocent civilians.

Advanced technology warfare represents the rise of new military technologies such as precision guided weapons, information warfare, nonlethal weaponry, robotic war-fighting units, and directed-energy weaponry. Both Lind and the Tofflers recognize this rise of new technologies; however, only the Tofflers fully incorporate it into their projection of future war. While the Tofflers view the US Army in the Gulf War as having adapted Tofflerian doctrine to such advanced technology, I argue that it has been used in no more than a "strap-on" role and has not significantly altered AirLand Battle doctrine based on modern war-fighting principles.

Impact. The impact of fourth-epoch war theory has been limited, although it has contributed toward the redirection of the theoretical debate in the Marine Corps away from maneuver warfare and toward both the advanced technology and non-Western warfare aspects of the RPMA.[18] Directed toward the Army, this theory is now being used to help challenge the basic premises behind the operations-other-than-war (OOTW) concept, politico-military force implications of nonlethal technology, and fundamental concepts of battlespace.[19] No impact on the Air Force or the Navy has been noted other than an initial query from Naval Doctrine Command concerning the naval applications of this theory.

Criticisms. No in-depth criticisms have had time to develop in reaction to this theory. Past commentary has mentioned its failure to address developments in air warfare, the lack of emphasis on advanced information technology, the nonreflection of the reality of battle, and the overreliance on a single-factor (i.e., energy) explanation of historical change. As more components of this theory are published, stronger criticisms such as those voiced by Lt Gen Victor H. Krulak (USMC, Retired) will undoubtedly be directed towards the theory.[20]

. . . Third-wave war theory, however, may be critically flawed.

Conclusion

As I have stated, the Tofflers have promoted the most popularized theory of future war. Components of their third-wave war theory, however, may be critically flawed. For that reason, it should be compared to the other two theories highlighted in this essay before it is acknowledged as *the* authoritative work on this subject. To aid in this comparison, the modes of warfare qualitatively modeled in each framework have been placed side-by-side for analysis (table 4).

The subepochs contained within fourth-epoch war provide the most detailed modal delineations of Western history for the three theories presented in this essay. The reason for this is that this theory was first and foremost a model of historical trends and only in the last few years has it begun to be used to forecast future modes of warfare. Against the modes of warfare expressed in fourth-epoch theory, the waves of war envisioned by the Tofflers appear as what they are—superficial "MTV clips."[21]

The generations of modern war developed by Lind and his colleagues, on the other hand, hold up quite well to the subepochs of this theory. The reason for this is that their

Table 4
Subepochs, Waves, and Generations

SUBEPOCH (ENERGY SEQUENCE)	WAVE (MODE OF PRODUCTION)	GENERATION (TACTICAL BASIS)
Hellenic (Experimental Human)	First (Agricultural)	N/A
Roman (Institutionalized Human)	*Unexplained*	N/A
Raider (External Threat)	First (Agricultural)	N/A
Vassal (Experimental Animal)	First (Agricultural)	N/A
Feudal (Institutionalized Animal)	First (Agricultural)	N/A
Dynastic (Experimental Machine)	*Unexplained*	N/A
Absolutist (Institutionalized (Machine)	*Unexplained*	First (Technology)
Corporate (Experimental Engine)	Second (Industrial)	Second (Technology)
Modern (Institutionalized Engine)	*Unexplained*	Third (Ideas)
Non-Western* (External Threat)	*Unexplained*	Fourth (Ideas)
Advanced Technology (Experimental Post-Engine)	Third (Knowledge)	Fourth (Technology)

*Formerly Terrorist/Low-Intensity Conflict

generations approximate actual modes of warfare that have existed over the last few centuries.[22] Given the governmental and military backgrounds of the developers of fourth-generation warfare theory, their accuracy is not at all surprising.

A further comparison of these theories can be made regarding their perception of the current RPMA now taking place (table 5). The fourth generationalists originally viewed the current military revolution on a scale to that which took place back in the 1920s and 1930s with the development of armor, carrier aviation, and concepts of amphibious and strategic bombing operations.[23] Their theory cannot account for greater magnitudes of change because of its limited level of analysis. By linking it to the work of Dr Martin van Creveld, however, its authors now promote the perception that war will be waged outside of the nation-state framework and will possess nontrinitarian characteristics.

The Tofflers suggest that the current military revolution is equivalent in magnitude to that of the French Revolution. Besides change at the tactical and operational level, significant human civilization change is foreseen. Knowledge will become the new form of wealth, and, as a result, new economic, political, social, and military structures will develop. Because their abstract concepts have no basis in Western history, however, their "civilization waves" are flawed and therefore improperly articulate the historical process that is now taking place.[24]

Fourth-epoch war theory recognizes that both tactical and operational change along with economic, political, social, and military structure change will take place. This theory, however, views the current military revolution as equivalent to that of the European

Table 5
RPMA Equivalence

FOURTH GENERATION	THIRD WAVE	FOURTH EPOCH
Change Equivalent to 1920s and 1930s	Change Equivalent to French Revolution	Change Equivalent to European Renaissance
Tactical/Operational Change	Tactical/Operational Change	Tactical/Operational Change
N/A	Economic, Political, Social, Military Change	Economic, Political, Social, Military Change
N/A	N/A	Energy Foundation Change
		Altered Nature of Politico-Military Force
		Deinstitutionalization of Political Violence
		Rise of Military Entrepreneurs

Renaissance. Because of this perception, a shift in the energy foundation of Western civilization is foreseen along with an accompanying alteration in the nature of politico-military force and the deinstitutionalization of political violence (i.e., the loss of the nation-state's monopoly on war). As a result, a corresponding rise in military entrepreneurs (e.g., terrorists, guerrilla groups, local warlords, private armies, drug cartels, and multinational corporations) engaged in warfare will take place, bringing into question the political legitimacy, and hence survival, of the nation-state during the next century.[25]

Despite any flaws highlighted in these modal warfare and military revolution perceptual comparisons, the three dominant theories of future war highlighted in this article can each individually still provide a contribution to the emerging RPMA debate within the Air Force—although the contribution provided by the Tofflers will likely be far smaller than first envisioned. For these contributions to be fully understood, however, the primary documents relating to each theory should be explored so that its potential benefit toward the development of post-Clausewitzian Air Force operational concepts and principles can be assessed.

Further, it is imperative that there be serious reflection and debate on the historical magnitude of the current military revolution now taking place. Failure to recognize the true magnitude of the change taking place will result in inaccurate assumptions being made when formulating strategic and operational concepts. As a prime case in point, we must now ask ourselves if war is still "a struggle between nation-states or their coalitions over the preservation and extension of national sovereignty" or if it is now rapidly shifting to "a struggle between competing forms of social and political organization over which the eventual successor to the nation-state will be built." □

Notes

1. Col Owen E. Jensen, USAF, "Information Warfare: Principles of Third-Wave War," *Airpower Journal* 8, no. 4 (Winter 1994): 35–36.

2. Lesser-known theories include Russian "sixth-generation" warfare and the 10 military revolutions noted by Andrew F. Krepinevich. For more on these theories, see Mary C. Fitzgerald, "The Russian Military's Strategy for 'Sixth Generation' Warfare," *Orbis,* Summer 1994, 457–76; Andrew F. Krepinevich, "Cavalry to Computer: The Pattern of Military Revolutions," *The National Interest,* Fall 1994, 30–42.

3. I developed the RPMA concept because the earlier RMA debate ignored the massive political ramifications that the development of future warfare will have on our society and government. Military change as we are now witnessing does not take place in a political vacuum. To my surprise, Chuck de Caro, the theorist behind "SoftWar," had also mentioned in conversation at a December 1994 SO/LIC conference in Washington, D.C., the need for a new politico-military construct. My initial usage of the RPMA concept can be originally traced to my article "Rethinking OOTW" in the November–December 1995 issue of *Military Review.*

4. Colonel Jensen's initial step toward establishing principles of future war is laudable. This activity is being pursued in the other services, although at times not so openly, and hopefully will develop an interservice synergism as many of these concepts begin to be published. Unfortunately, the same process may also be beginning in the non-Western world. See Brig V. K. Nair, *War in the Gulf: Lessons for the Third World* (New Delhi: Lancer International, 1991).

5. The four were Col Keith M. Nightengale, USA; Capt John Schmitt, USMCR; Col Joseph W. Sutton, USA; and Lt Col Gary I. Wilson, USMCR.

6. Robert J. Bunker, "The Transition to Fourth Epoch War," *Marine Corps Gazette,* September 1994, 20–32; Lt Col Thomas X. Hammes, "The Evolution of War: The Fourth Generation," *Marine Corps Gazette,* September 1994, 35–44; William S. Lind, Maj John Schmitt, USMCR, and Col Gary I. Wilson, USMCR, "Fourth Generation Warfare: Another Look," *Marine Corps Gazette,* December 1994, 34–37.

7. "The Changing Face of War: Into the Fourth Generation," *Military Review,* October 1989, 3.

8. Kenneth F. McKenzie, Jr., "Elegant Irrelevance: Fourth Generation Warfare," *Parameters* 23, no. 3 (Autumn 1993): 51–60.

9. Martin van Creveld and Maj Kenneth F. McKenzie, Jr., "Fourth Generation Gap?" *Parameters,* Winter 1993–1994, 109. For further commentary, see Robert T. Foley and Maj Kenneth F. McKenzie, Jr., "Clausewitz and 'Fourth Generation Warfare,' " *Parameters,* Spring 1994, 116–18.

10. Maj Mark H. Bean, "Fourth Generation Warfare?" *Marine Corps Gazette,* March 1995, 53–54; Col Michael D. Wyly, USMC, Retired, "Fourth Generation Warfare: What Does It Mean to Every Marine?" *Marine Corps Gazette,* March 1995, 55–58; Lt Col Charles A. Krohn, USA, Retired, "Other Responses to 'Fourth Generation.' " *Marine Corps Gazette,* March 1995, 59.

11. Alvin and Heidi Toffler, "A New Theory of Warfare: The 'Third Wave' Arrives," *Los Angeles Times,* 5 and 6 March 1991, B7.

12. I must agree with Steve Metz's observation that the Tofflers have not developed a true theory of war like Martin van Creveld in *The Transformation of War* (New York: Free Press, 1991). At best, they have developed a "concept of war." Steven Metz, "A Wake for Clausewitz: Toward a Philosophy of 21st-Century Warfare," *Parameters* 24, no. 4 (Winter 1994–95): 126–32. Because of the confusion that may exist, however, I will call it a theory when comparing it to the other two theories addressed in this essay.

13. Alvin and Heidi Toffler, *War and Anti-War: Survival at the Dawn of the 21st Century* (New York: Little, Brown and Co., 1993), 32.

14. The visionary Peter F. Drucker, arguably the most well known and respected futurist of our century, has written over 20 books on management, economics, politics, and society. His 1993 book *Post-Capitalist Society* is a far more tempered, scholarly, and less sensationalized account of the information revolution that is now taking place.

15. Col Richard M. Swain, USA, review of *War and Anti-War: Survival at the Dawn of the 21st Century,* by Alvin and Heidi Toffler, *Military Review,* February 1994, 77–78; Metz, 126–32; Robert J. Bunker, "The Tofflerian Paradox," *Military Review,* May–June 1995, 99–102.

16. T. Lindsay Moore, "The Structure of War," unpublished paper, The Claremont Graduate School, Claremont, Calif., 1989, 1–33.

17. Current research is addressing the rise of deinstitutionalized soldiers and their interaction with advanced technology and the emergence of new war-making entities.

18. The impact of this theory on the theoretical debate in the Marine Corps was important only when combined with the four editorials on future warfare written by Col John E. Greenwood, USMC, Retired, the editor of the *Marine Corps Gazette,* and the articles in the *Marine Corps Gazette* by Col Thomas X. Hammes in the September 1994 issue and by William S. Lind, Maj John Schmitt, and Col Gary I. Wilson in the December 1994 issue. Research papers relating to this theory are now being forwarded to Marine Corps Combat Development Command (MCCDC) for evaluation.

19. See Bunker, "Rethinking OOTW"; Robert J. Bunker and T. Lindsay Moore, "Nonlethal Technology and Forth Epoch War: A New Paradigm of Politico-Military Force," Land Warfare Paper No. 23, Association of the United States Army, Institute of Land Warfare, Arlington, Va., February 1996; and Robert J. Bunker, "Advanced Battlespace and Cybermaneuver Concepts: Implications for Force XXI," *Parameters,* Autumn 1996 (forthcoming; originally prepared for TRADOC as National Security Studies Program [NSSP] Report 95-2, California State University, San Bernardino, California, July 1995).

20. Fred E. Perry et al., "The Future Revisited," *Marine Corps Gazette,* December 1994, 35–36.

21. Metz, 130–31.

22. Generations and the modern subepochs have many similarities. The major divergence is the fourth-generationalist school's nonacceptance of each mode of warfare as a synthesis of technology and ideas.

23. This is a perception also held by Andrew F. Krepinevich in his work.

24. Metz, 126–32; "The Tofflerian Paradox," *Military Review,* May–June 1995.

25. Mercenary dominance in Western warfare correlates during interepochal transitions such as the one we are now entering. These noninstitutionalized soldiers will represent one of the principal threats to our national security during the next century.

Revolutionizing Warfare through Interdiction

Lt Col Price T. Bingham, USAF, Retired

THE JOINT surveillance and target attack radar system (JSTARS) promises to revolutionize how US forces conduct conventional warfare. Before the development of JSTARS, US forces depended on close operations to defeat an enemy army. Because airpower's ability to destroy an enemy's mobile ground forces was severely limited, especially during darkness and bad weather, interdiction proved important to close operations—but in a supporting role—primarily by delaying and disrupting enemy maneuver and resupply.[1] Now, however, JSTARS and developments in precision guided munitions (PGM) will permit a commander to use interdiction to quickly destroy large numbers of an enemy army's vehicles, even during darkness and bad weather. Interdiction's vastly increased destructiveness against mobile forces will revolutionize the conduct of warfare by giving airpower a much more direct role in the defeat of an enemy army. Although close operations will still be necessary, friendly ground forces will most likely sustain significantly fewer casualties.

Examining the role of interdiction in past wars will help explain why JSTARS is the key to revolutionizing warfare through interdiction.

Interdiction: A Historical Perspective

By the time US forces began fighting in North Africa in World War II, military leaders such as Gen Dwight D. Eisenhower had come to recognize the importance of interdiction. Their perspective is reflected in US Army Field Manual (FM) 100-20, *Command and Employment of Air Power* (21 July 1943), which established interdiction as the second priority (after air superiority) of tactical (theater) airpower. The manual made close air support the third priority, explaining that "in the zone of contact, missions against hostile units are most difficult to control, are most expensive, and are, in general, least effective. Targets are small, well-dispersed, and difficult to locate. In addition, there is always a considerable chance of striking friendly forces."[2]

Remarks by Field Marshal Erwin Rommel, the enemy commander in North Africa who was on the receiving end of Allied airpower, appear to confirm the importance of interdiction. According to Rommel, "the first essential condition for an army to be able to stand the strain of battle is an adequate stock of weapons, petrol and ammunition."[3] Reflecting on why he lost the Battle of El Alamein, the German general wrote that if the enemy has air superiority, he can "strangle one's supplies, especially if they have to be carried across the sea."[4]

As Rommel discovered, Allied interdiction proved very effective in destroying supplies and reinforcements as they crossed bodies of water. Interdiction was able to destroy enemy forces at sea because of the environment's effect on the search for targets. Specifically, the water's relatively smooth surface not only facilitated visual searches, it also made radar an extremely effective means for finding ships—even during darkness and bad weather.

In contrast, interdiction's ability to destroy enemy forces on land was far more limited, in large part because of the immense difficulties airmen experienced in their search for those forces. Unlike the situation at sea, airmen could not use radar to find ground forces since the complexity of the land's surface created so much clutter that radars available in World War II, Korea, and Vietnam were completely ineffective for finding objects as small as trucks or tanks. Visual search was the *only* means airmen had for finding the enemy's mobile ground forces.

Visually searching for targets severely limited airpower's effectiveness. Since a visual search depended on good weather and—in most cases—daylight, airmen often were unable to make a search at all. Good weather and daylight permitting, many aircraft had to fly continuously over an area to improve their chances of finding targets. Even under ideal conditions, a number of these aircraft would find no suitable targets before running low on fuel. In this case, aircrews would either attack a prebriefed secondary target or return to base with their munitions. Adding to the problem of making a visual search was the danger from enemy air defenses. The low altitudes and airspeeds that helped in locating ground forces also increased the vulnerability to attack by enemy aircraft and surface-based air defenses.

Unfortunately for airmen, the same terrain that made radar ineffective for finding ground forces could also be exploited by those forces to make visual searching much more difficult. Soldiers could significantly increase airmen's problems by using concealment, camouflage, deception, and dispersal. Although these measures were effective, soldiers quickly realized that the best way to reduce their chances of being destroyed by airpower was to move only at night or during bad weather, when visual searches proved extremely difficult, if not impossible, for airmen.

Thanks to these countermeasures, effective interdiction against land forces has usually depended on synchronizing interdiction,

either by accident or by commander's design, with the actual or potential maneuver of powerful friendly ground forces. Synchronization created an unsolvable dilemma for enemy commanders. If they attempted to use rapid ground maneuver to defeat friendly ground forces, they usually moved their forces—often in lucrative concentrations—into the open during daylight and good weather, when interdiction's chances of success were greatest. In contrast, to reduce the chance of having their ground forces destroyed by air attack, enemy commanders had to move them only during darkness or bad weather. Such a limitation prevented commanders from maneuvering as fast as would otherwise have been possible. Since enemy commanders almost always chose to preserve their troops, interdiction's main contribution to success in most campaigns lay in delaying and disrupting enemy maneuver and resupply.

Allied operations during and after the invasion of France in 1944 illustrate the effectiveness of synchronization when friendly ground forces go on the offensive. German commanders, who depended on maneuvering their forces rapidly from one area to another to contain the invading Allies, faced the dilemma mentioned above. That is, Allied interdiction made any attempt to move during the day extremely dangerous. To avoid destruction, German commanders accepted delays by restricting their maneuver to nighttime. Exploiting the inability of the German army to maneuver quickly, the Allies massed their ground forces and, after very hard fighting, achieved a breakout that the Germans could not contain.

The Battle of the Bulge shows that interdiction could also create a dilemma when friendly ground forces assumed a defensive posture. Protected from Allied air interdiction by winter weather and long nights, the German offensive that began 16 December 1944 initially made significant progress against Allied ground forces. On 23 December, however, the weather cleared, allowing Allied fighter-bombers to fly thousands of interdiction sorties. Soon, according to the artillery commander of the Fifth Panzer Army, "attacks from the air by the opponent were so powerful that even single vehicles for the transport of personnel and motorcycles could only get through by going from cover to cover."[5] With interdiction severely handicapping the German army's maneuver and resupply, Allied armies had time to recover and soon were able to concentrate powerful forces that stopped the German offensive, although at a very high cost in friendly lives.

The Korean and Vietnam wars provide still more examples of the effectiveness of interdiction synchronized with ground maneuver. On three occasions in 1950, interdiction demonstrated that its threat of destruction was sufficient to cause enemy commanders to limit their maneuver and resupply to the hours of darkness or periods of bad weather: (1) during the initial North Korean invasion;[6] (2) before and during the breakout by United Nations (UN) ground forces from the Pusan Perimeter;[7] and (3) during the Chinese Communists' pursuit of withdrawing UN forces.[8] In Vietnam the same principle held true when the North Vietnamese army launched a powerful offensive in 1972, employing numerous trucks, tanks, and artillery pieces.[9]

World War II, Korea, and Vietnam all demonstrated that interdiction's main contribution to success was *not* the destruction of enemy forces but the delay and disruption of their maneuver and resupply. Even so, defeat of the enemy army still required that very large, powerful friendly ground forces engage the enemy in close operations, in which friendly forces often suffered many casualties.

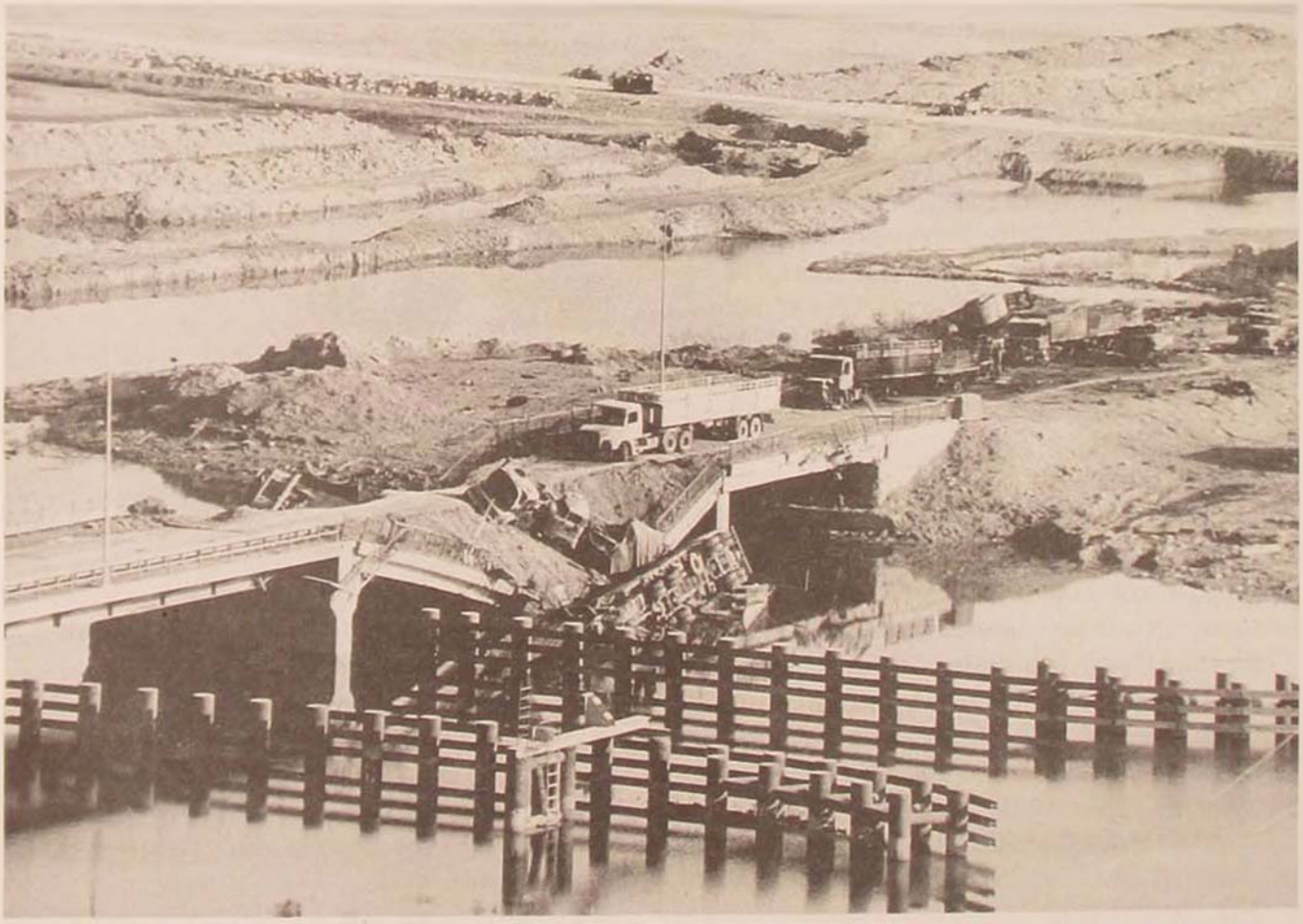
Operation Desert Storm: The Beginning of the Revolution

In 1991 came the first signs of a revolution in the conduct of warfare. These signs arose during the Gulf War, when the Iraqis

made the shocking discovery that coalition aircraft could find and destroy their vehicles, even if they moved only at night. In fact, interdiction caused so much destruction that it was a key factor in the coalition's ability to defeat the Iraqi army at a cost of far fewer friendly casualties than the number predicted by military experts. Of course, these experts had been thinking of interdiction only in terms of its ability to delay and disrupt enemy maneuver and resupply.

Part of the reason for interdiction's vastly improved ability to destroy vehicles has to do with developments in PGMs and night-vision technology, which allow airmen to inflict significant damage and do so with fewer weapons and sorties. However, since only a relatively small number of coalition aircraft were equipped with night-vision systems or could deliver PGMs (not to mention the fact that PGMs require good visibility), these developments alone are not sufficient to explain why interdiction was so much more effective at destroying ground forces.

Given the vast size of the theater and the relatively small number of aircraft performing interdiction at night, the prototype E-8A JSTARS aircraft was often the only reason that coalition airmen were able to find Iraqi vehicles. The unprecedented performance of JSTARS provided coalition commanders with near-perfect information in real time on all significant vehicular movement within its very large coverage area (assuming such movement was not screened by terrain or foliage). The ability of JSTARS to detect, locate, and accurately track the movement of vehicles, even during darkness and bad weather,



The destruction of Iraqi mechanized forces at Al Khafji and scenes like this along the Euphrates River appear to have convinced Iraqi army commanders of the futility of maneuvering in the face of the threat of interdiction.

ensured excellent situational awareness by allowing commanders to detect developing threats and exploit opportunities in time for airpower to respond with appropriate interdiction missions. Moreover, JSTARS provided target cueing and battle management, which dramatically multiplied interdiction's effectiveness at the same time it decreased the risk of losses by reducing aircraft exposure to enemy air defenses. In fact, contrary to previous experience with interdiction at night, aircraft ran out of weapons long before they ran low on fuel.[10]

Although interdiction controlled by JSTARS was responsible for destroying a significant portion of the Iraqi force, its most important effect on the campaign was psychological. As Iraqi soldiers discovered the adeptness of coalition airmen at finding and destroying their vehicles and heavy weapons—even in darkness—interdiction began to cause such fear that many Iraqi units disintegrated.[11] The Iraqi army's only major offensive operation—the battle at Al Khafji—clearly demonstrates interdiction's ability to cause military disintegration.

On the night of 29 January 1991, JSTARS detected elements of two Iraqi heavy divisions—the 5th Mechanized and 3d Armored—moving toward coalition positions at Al Khafji. Exploiting the unprecedented situational awareness of JSTARS, coalition leaders quickly concentrated airpower in the form of A-10s, AC-130s, AV-8Bs, F/A-18s, and armed helicopters against the advancing Iraqi forces. Maneuvering in the open, the enemy's ground forces were now far more vulnerable to air attacks than when they were dispersed and protected by revetments. Three days later, more than 1,000 sorties had caused immense damage to the two Iraqi divisions. As one Iraqi veteran noted, at Al Khafji his brigade had suffered more damage in 30 minutes than it had in eight years during the Iran-Iraq War.[12]

Al Khafji appears to have convinced many Iraqi army commanders of the futility of maneuvering in the face of the threat posed by coalition interdiction. Thus, the Iraqis were unwilling to mount an effective defense, let alone engage in offensive operations. For low-ranking Iraqi soldiers, the threat of interdiction—including nighttime "tank plinking" by F-15Es and F-111Fs—became so terrifying that they refused to drive their trucks and avoided tanks and other equipment believed to be targets.[13] The fear created by interdiction does much to explain why the Iraqis abandoned so many of their vehicles and weapons.[14] It also helps explain the brevity of the ground campaign and the fact that coalition ground forces sustained so few casualties.

JSTARS: The Key to an Interdiction Revolution

As the twenty-first century approaches, the powerful synergy created by JSTARS and weapons such as brilliant antitank (BAT) submunitions, which are able to destroy moving vehicles even during darkness and bad weather, will allow the US military to revolutionize its conduct of warfare. By exploiting the unprecedented operational- and tactical-level situational awareness provided by JSTARS, a US commander will be able to synchronize ground maneuver and interdiction so that interdiction becomes the primary instrument for destroying an enemy army.[15] In these circumstances, the commander would use information provided by JSTARS to maneuver ground forces to force the enemy army to move and therefore make it easy for JSTARS to detect and then direct air attacks against the enemy's vehicles. To ensure low casualties, a commander could also use JSTARS information to maneuver ground forces to reduce their exposure to the enemy's artillery and lower the risk of close operations with intact enemy units. After using interdiction to destroy the enemy's vehicles, a commander could then use JSTARS information to maneuver ground forces to finish off the enemy army and occupy key

objectives without fear of sustaining many casualties.

The unprecedented ability of interdiction under JSTARS battle management to destroy an enemy army's vehicles whenever they attempt to move is extremely important in revolutionizing how the US conducts warfare. Such destruction will quickly deny the enemy army commander the ability to maneuver, employ heavy weapons, and resupply forces. *In fact, this destruction would merely be a means to an end.* Moreover, depending on how skillfully a US commander uses the situational awareness from JSTARS to orchestrate the employment of precision weapons, in all likelihood only a small fraction of the enemy army's vehicles need be destroyed to achieve success. Further, the destruction of these vehicles probably would not kill many enemy soldiers. More importantly, targeting enemy military vehicles greatly reduces the risk to civilian lives and infrastructure.

As airpower continues to demonstrate its uncanny ability to find and destroy vehicles whenever they move,* no matter what measures the enemy takes, *the enemy's terror should continue to grow.

Fear explains how interdiction can achieve success without inflicting immense physical destruction and loss of life.[16] Enemy soldiers who survive sudden, violent interdiction attacks that can occur at any time become fearful of further attacks. As airpower continues to demonstrate its uncanny ability to find and destroy vehicles whenever they move, *no matter what measures the enemy takes*, the enemy's terror should continue to grow. Before long, this fear becomes so acute that enemy soldiers, even those who have not yet been attacked, become disoriented and unwilling to remain near their vehicles.[17]

As news of the destruction caused by interdiction spreads, the morale of an enemy army will likely become more fragile and easily shattered, especially when soldiers recognize that losing their mobility, firepower, and supplies guarantees defeat. Morale would then plummet as increasing numbers of soldiers witness attacks that prove interdiction's unprecedented ability to destroy their vehicles. Once enough enemy troops believe that continued resistance is useless, their units will disintegrate. At this point, a commander can easily use maneuver and close operations to complete the enemy army's defeat at a very low cost in terms of friendly casualties—as was the case during Desert Storm. Moreover, even before military disintegration occurs, interdiction is likely to achieve sufficient destruction to ensure that the enemy army poses little offensive threat.

The revolution in the conduct of warfare that JSTARS makes possible provides a truly immense opportunity for the US to help maintain international peace. The greatly increased (but very precisely focused) destructiveness of interdiction controlled by JSTARS should prove sufficient to deter most potential aggression. Adding to the strength of this deterrence, the comparatively low cost in terms of resources and lives (both friendly and enemy, military and civilian) of employing interdiction should make it much easier for US leaders to maintain strong domestic support for a policy of using force to prevent aggression. □

Notes

1. Interdiction is defined in Joint Pub 1-02, *Department of Defense Dictionary of Military and Associated Terms,* 1 December 1989, as "an action to divert, disrupt, delay or destroy the enemy's surface military potential before it can be used effectively against friendly forces" (187).

2. US Army Field Manual 100-20, *Command and Employment of Air Power,* 21 July 1943, 10–11.

3. B. H. Liddell Hart, ed., *The Rommel Papers* (New York: Harcourt, Brace, 1953), 328.

4. Ibid.

5. Wesley Frank Craven and James Lea Cate, eds., *The Army Air Forces in World War II,* vol. 3, *Europe: Argument to V-E Day, January 1944 to May 1945* (1951; reprint, Washington, D.C.: Office of Air Force History, 1983), 695.

6. Robert F. Futrell, *The United States Air Force in Korea, 1950–1953,* rev. ed. (Washington, D.C.: Office of Air Force History, 1983), 33, 85, 171–75.

7. Ibid., 162–75, 207–14.

8. Ibid., 242–46.

9. For an excellent treatment of airpower's role in the defeat of the Easter Offensive, see Dale Andrade, *Trial by Fire: The 1972 Easter Offensive, America's Last Vietnam Battle* (New York: Hippocrene Books, Inc., 1994). See also W. Scott Thompson and Donaldson D. Frizzell, eds., *The Lessons of Vietnam* (New York: Crane, Russak, 1977), 160.

10. Richard P. Hallion, *Storm over Iraq: Air Power and the Gulf War* (Washington, D.C.: Smithsonian Institution Press, 1992), 220. See also William L. Smallwood, *Strike Eagle: Flying the F-15E in the Gulf War* (Washington, D.C.: Brassey's, Inc., 1994), 177–83.

11. "Military disintegration is a condition of organizational paralysis characterized by the total and often sudden collapse of the willingness of the average soldier to resist or to attack the enemy. . . . Once organizational control over the fighting ceases, and combat becomes a matter of individual survival, disintegration has occurred." Stephen D. Wesbrook, "The Potential for Military Disintegration," in *Combat Effectiveness: Cohesion, Stress, and the Volunteer Military,* ed. Sam C. Sarkesian (Beverly Hills, Calif.: Sage Publications, 1980), 244.

12. Thomas A. Keaney and Eliot A. Cohen, *Gulf War Air Power Survey,* vol. 2, *Operations and Effects and Effectiveness* (Washington, D.C.: Government Printing Office, 1993), 239–40.

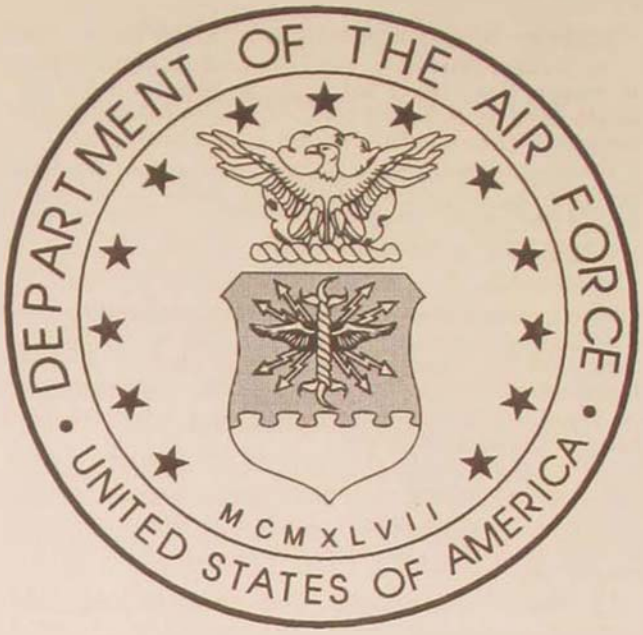
13. Thomas A. Keaney and Eliot A. Cohen, *Gulf War Air Power Survey: Summary Report* (Washington, D.C.: Government Printing Office, 1993), 97, 108.

14. Ibid., 109–10, 116–17.

15. "Synchronizing interdiction and maneuver (both land and sea) provides one of the most dynamic concepts available to the joint force. . . . JFCs [joint force commanders] may choose to employ interdiction as a principal means to achieve the intended objective. . . . Indeed, JFCs may employ a scheme of maneuver that enhances interdiction operations or vice versa." Joint Pub 3-0, *Doctrine for Joint Operations,* 9 September 1993, IV-19 and IV-21.

16. Many military analysts devote insufficient attention to the impact of fear, but as Carl von Clausewitz noted, "Without an accurate conception of danger we cannot understand war." *On War,* ed. and trans. Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1976), 114.

17. For an excellent treatment of this phenomenon, see Col Robert H. Scales, Jr., "Firepower: The Psychological Dimension," *Army,* July 1989, 43–50; and Ian Gooderson, "Allied Fighter-Bombers versus German Armour in North-West Europe, 1944–1945: Myths and Realities," *Journal of Strategic Studies,* June 1991, 210–31.



Commander's Intent

An Aerospace Tool for Command and Control?

LT COL MICHAEL STRAIGHT, USAF

Planning for employment of joint teams begins with articulating and understanding the objective, purpose of the operations, and commander's intent (the commander's vision of the end state to be achieved).

—Joint Pub 3-0, *Doctrine for Joint Operations*

THIS ARTICLE examines the mission-tasking concept of "commander's intent" from an Air Force perspective. What is it? Why do both the Army and Marine Corps consider it a vital combat leadership technique for all levels of command while the Air Force puts little official emphasis on it? Could greater use of commander's intent make a good Air Force command and control system even better?

History

No plan survives contact with the enemy.

—Field Marshal Helmuth von Moltke, 1800–1891

The commander's intent concept is a time-proven technique for operational leadership. Over 150 years ago, Carl von Clausewitz defined the fog, friction, and fear in combat that conspire against the rigid execution of a commander's best laid plans. One of Clausewitz's

students—Field Marshal von Moltke—adroitly accounted for these wartime realities in planning and executing the campaigns that ultimately united the modern German nation by 1871.[1] Von Moltke knew that he could not reliably anticipate the course of an operation beyond first contact with the enemy. To compensate, he employed decentralized decision making through "mission-oriented" orders (*Auftragstaktik*). This command technique directed *what* to do and *why* it must be done without specifying *how* to do it. Von Moltke's mission-oriented orders attempted to enlist "the total independent commitment of troops from the lowliest private up."[2] His goal was to unleash subordinate initiative in order to both accommodate the unexpected and capitalize on opportunity.[3] Improvement of this "mission tactics" technique during the First and Second World Wars helped produce Germany's consistent operational and tactical success against superior odds.

Key to von Moltke's mission-type tasking is the concept of "commander's intent." Instead of detailed instructions on how to execute, the commander must provide a concise written or verbal description of his vision of the operation's general form, purpose, and what he intends to achieve. This statement should offer subordinates "insight into the objectives at one [command] level, or possibly even two, above their own."[4] It should be a "subordinate's guidepost as he strives to deal with the unexpected" by ensuring the mission remains clear in the subordinate's mind.[5]

The German-style mission tactics and the concept of commander's intent have received significant US Army and Marine Corps attention since the early 1980s. Both services recognized commander's intent to be a critical command tool for operational-level success in maneuver-style warfare.[6] As a result, the Army and Marine Corps repeatedly emphasize the concept in basic doctrine and prescribe detailed technique for all levels of command. Additionally, since 1990, many joint publications have established the use of commander's intent as standard procedure for guiding interservice operations.

Used but Not Defined

This brings us to the motivation for this article: Though the US Air Force often employs the concept, the Air Force has not *doctrinally* embraced commander's intent as a command tool for servicewide use. This is true despite the fact that the Air Force often employs the concept (minus the label) at the tactical level in the premission briefings presented by flight leads. The Air Force even occasionally mentions the term itself in a few doctrinal publications in reference to the joint force air component commander's (JFACC) execution of the joint force commander's (JFC) intent. Joint command or staff positions often require Air Force personnel to be familiar with both the term and the technique. Similar familiarity is required of airmen who work closely with the Army in direct-support operations such as control of close air support (CAS). This fairly pervasive Air Force application of the concept at the tactical level, along with the consistent association with the term in joint operations, begs the question of whether the Air Force might not benefit from doctrinally defining an Air Force version of commander's intent and endorsing it as a tool for all levels of aerospace command and control. This article offers one answer to this question through the following sequence of discussions:

- Comparison of the Army and Marine Corps's rigorously defined and applied commander's intent technique with the Air Force's institutionally less definitive and much less frequent use.

- Comparison of institutional differences between land and air forces that have made commander's intent a less obvious (though no less useful) aerospace tool.

- Discussion of potential benefits possible with doctrinal Air Force employment of commander's intent at all command levels.

The Services' Use of Commander's Intent

The Army, Marine Corps, Air Force, and Navy command philosophies all provide common doctrinal justification for utilizing the commander's intent concept. The following discussions do not include the Navy, which, in most respects, parallels the Air Force's minimal doctrinal use of commander's intent as a leadership concept.

Tool of Decentralized Execution

The Army, Marine Corps, and Air Force all emphasize within their basic doctrine the importance of what the Air Force labels "centralized control and decentralized execution."[7] The actual labels vary, with Marines using "decentralized command" and the Army "decentralized decision authority."[8] However, the meanings are all compatible with their emphasis on centralized guidance and planning responsible for focusing and synchronizing all effort, complemented by decentralized decision making and subordinate initiative in the execution. Both the Army and the Marine Corps identify "commander's intent" as key to effectively decentralizing execution and decision making into workable spans of control. Both the Army and Marine Corps have rigorously standardized instruction on the definition and technique of commander's intent. In the following examples, note both the detail and servicewide standardization of "intent" as doctrine.

Commander's Intent—Army Style

The Army defines and emphasizes commander's intent within its basic doctrine for operations. The 1993 Army Field Manual (FM) 100-5, *Operations,* defines commander's intent as follows:

- It is a concise expression of the purpose of an operation.
- It describes the desired end state.[9]
- It must be understood two echelons below the issuing commander.
- It is the single unifying focus for all subordinate elements.
- Its utility is to focus subordinates on what has to be accomplished in order to achieve success, even when the plan . . . no longer applies, and to discipline their efforts toward that end.[10]

FM 100-5 also highlights the critical role that a clear and focused commander's intent plays in synchronization of all activities in time and space to collectively achieve operational objectives.[11] The Army repeatedly references and expands on commander's intent in eight additional doctrine manuals that supplement the basics in FM 100-5 (table 1).

Marine Corps "Mission Tactics"

The Marines likewise describe the importance of commander's intent in their basic doctrine manual, Fleet Marine Field Manual (FMFM) 1, *Warfighting.* Commander's intent complements the "mission tactics" of assigning a subordinate mission without specifying how the mission must be accomplished. It leaves "the manner of accomplishing the mission to the subordinate, thereby allowing him the freedom—and establishing the duty—to take whatever steps the subordinate deems necessary based on the situation. The senior prescribes the method of execution only to the degree that is essential for coordination." FMFM 1 stresses that the mission-type order must describe the desired result or *intent* of the action. This intent guidance is to provide "unity, or focus" to decentralized initiative. While a changing situation may make the original tasking obsolete, the intent should remain valid as a guide for action. The manual highlights how the subordinate's freedom in initiative encourages the high tempo of operations desired.[12]

The Marine Corps University—which standardizes Marine Corps doctrine and technique taught at all USMC schools from the

Table 1
Reference to Commander's Intent in Doctrinal Publications

Publication	Title	Number of References
	ARMY (9 out of 25 pubs)	
FM100-5	*Operations*	22
FM 100-7	*The Army in Theater Operations*	20
FM 1-100	*Principles for Army Aviation Combat Operations*	12
FM 100-10	*Combat Service Support*	5
FM 100-17	*Mobilization, Deployment, Redeployment*	4
FM 100-103	*Army Airspace Command & Control in Combat*	4
FM 44-1	*Air Defense Artillery Employment*	2
FM 90-2	*Battlefield Deception*	2
FM 101-5-1	*Operational Terms and Symbols*	1
	MARINE CORPS (10 out of 54 pubs)	
FMFM 2-7	*Fire Support in MAGTF Operations*	11
FMFM 6-18	*Fire Support Coordination*	11
FMFM 5-60	*Control of Aircraft and Missiles*	10
FMFM 7-32	*Raid Operations*	6
FMFM 1	*Warfighting*	5
FMFM 4	*Combat Service Support*	2
FMFM 3-22-1	*UAV Company Operation*	1
FMFM 5-40	*Offensive Air Support*	1
FMFM 1-7	*Supporting Arms in Amphibious Operations*	1
FMFM 3-1	*Command and Staff Action*	1
	JOINT PUBLICATIONS (14 out of 76 pubs)	
JP 3-0	*Doctrine for Joint Operations*	13
JP 5-00.2	*Joint Task Force Planning Guidance and Procedures*	7
JP 5-0T	*Planning Joint Operations*	4
JP 1	*Joint Warfare of the Armed Forces of the United States*	2
JP 3-05	*Joint Special Operations*	2
JP 3-15	*Doctrine for Barriers, Obstacles, and Mine Warfare*	2
JP 3-05.5	*Special Operations Targeting and Mission Planning*	2
JP 3-02.1T	*Landing Forces Operations*	1
JP 3-02.3	*Joint Special Operations Operational Procedures*	1
JP 3-06T	*Joint Riverine Operations*	1
JP 3-07.1	*JTTP for Foreign Internal Defense*	1
JP 2-0	*Joint Doctrine for Intelligence Support to Operations*	1
JP 5-03.1	*Joint Operation Planning and Execution System*	1
JP 3-10.1	*JTTP for Base Defense*	1
	AIR FORCE (4 out of 31 pubs)	
AFM 1-1, vol. 1	*Basic Aerospace Doctrine*	5
AFM 1-1, vol. 2	*Basic Aerospace Doctrine*	4
AFP 3-20	*Military Operations in Low Intensity Conflict*	3
JFACC 94	*USAF JFACC Primer*	1

Source: From approved joint publications and selected publications produced by J-7, Joint Staff, *Joint Electronic Library* 2, no. 1, 4 April 1994.

Basic School through the Marine Corps University—has standardized the following elements of the commander's intent that are to be included within operations orders:

- A statement of the end state of the battlefield as it relates to his force, the enemy force, and the terrain.
- The purpose of the operations.
- The enemy's actions and intentions.
- An identification of the enemy's vulnerability or center of gravity.[13]

The Marine Corps University offers the following additional guidance on commander's intent:

- Every marine must know the commander's intent two levels up.
- The shortage of time usually will result in the commander's intent statement being limited to the statement of the end state of the battlefield as it relates to friendly forces, the enemy forces, and the terrain.
- A technique used to describe the end state of the battlefield is to begin the statement with "Final result desired is. . . ."[14]

The Marine Corps defines and advocates commander's intent as a command technique in nine additional doctrine manuals (see table 1). The Army and Marine Corps both consider this concept to be a vital element of decentralized execution. As a result, both services procedurally require that commander's intent be included in operations orders issued by all levels of command.

Commander's Intent Helps Tie Together the Levels of War

Commanders at all levels should have a common understanding of the conditions that define success.

—Joint Pub 3-0, *Doctrine for Joint Operations*

Commander's intent is joint doctrine. The Joint Chiefs of Staff have embraced commander's intent as a vital tool for harmonizing the strategic-, operational-, and tactical-level actions of diverse military forces. The time-tested method helps unify the will and efforts of all services to collectively contribute to the ultimate operational or strategic goals. Fourteen joint service publications detail use of commander's intent for the operational-level commanders who are responsible for joint campaigns and major operations (see table 1). The JFC and his joint force air and land component commanders (JFACC and JFLCC) are operational-level commanders. Operational-level commanders design, coordinate, and support the joint campaigns and operations that cumulatively attain national policy at the strategic level of war. However, execution is largely in the hands of the many subordinate-level leaders, who create the tactical plans, choose the engagements, and earn the battle victories that collectively produce operational success. The operational-level leadership cannot plan and control most tactical-level details. Instead, decentralized execution relies on tactical leadership's initiative at the point where tactical-level commanders adapt the operational plan to the realities of combat. To guide his decisions, the tactical-level commander must know his boss's intent as well as the intent from an additional level above his boss. Commander's intent offers the cohesive focus from the top down that ensures tactical-level leaders have their boss's end-state goals in mind as they decide which battles and engagements to prosecute. The joint staff dictates the use of commander's intent to help tie the lowest tactical decisions to the highest strategic goals across service lines.

Air Force "Intent"

The sister services emphasize "intent" as a specific concept in their basic doctrine. In the Air Force Manual (AFM) 1-1, *Basic Aerospace Doctrine of the United States Air Force,* the Air Force mentions the intent of combatant and component commanders, implying its purpose and importance without clearly

developing it.[15] Unlike the two land services, the Air Force does not rigorously define commander's intent nor advocate it as a decentralized execution tool. The Air Force's unique organizational structure offers some explanation for the slower adoption of the concept as doctrine.

Land and Air Differences in Combat Command Structure

The command structure of land forces has encouraged evolutionary development of the commander's intent concept. Though the Air Force seems to have a similar command structure, the following discussion highlights how an air force's command structure in combat differs substantially from that of land forces.

Commander's Intent in the Army and Marine Corps

The land forces' fairly straight-forward command structure lends itself to the commander's intent concept. Figure 1 depicts the Army and Air Force components of a possible joint force for a major regional contingency. Note that the pyramiding of each Army command layer allows intent to propagate down through each succeeding level. The Marine Corps command organization is similar. Army commanders at each point in this chain—for example, the corps, division, brigade, battalion, company, and platoon—are responsible for choosing the subobjectives and targets they assign to their subordinate commanders in support of the superior's mission and intent. The line of administrative command is the same as the combat command and control (C^2) line through which each level of mission orders and target selection will pass. In other words, the Army and Marine Corps chains of command encompass both unit command and combat control.

Increasing emphasis on commander's intent has been a logical evolution within this system that has so many intervening levels of command stretching from the operational-level JFLCC to the thousands of platoon commanders at the lowest tactical level. Commander's intent has helped preserve the tempo of operations despite the span of control challenges created by the increasing size of armies over the centuries. The commander's intent concept is obviously applicable to the ground force command structure. In comparison, an air force's structure somewhat obscures the concept's utility.

Air Force "Mission Tactics"?

Air forces have a less traditional combat organization through which battlefield control often does not accompany unit command. Figure 1 displays the administrative unit command lines of a joint air component based on a numbered air force. This is not the line of combat command through which mission tasking and combat control pass. Instead, figure 2 depicts a common aerospace C^2 chain.

Unlike the two land services, the Air Force does not rigorously define commander's intent nor advocate it as a decentralized execution tool.

Airpower's potential for significant operational- or even strategic-level effect often depends more heavily than ground forces on the tenet of centralized control. This centralized control is the theater-level planning, coordination, and direction that focuses available aerospace power on those enemy vulnerabilities that will reap the greatest effect in pursuit of the JFC's operational design. This system significantly confuses the development of subordinate-level commander's intent.

How and Why It Is Different

At each level, ground units can generally focus on a limited geographic area within

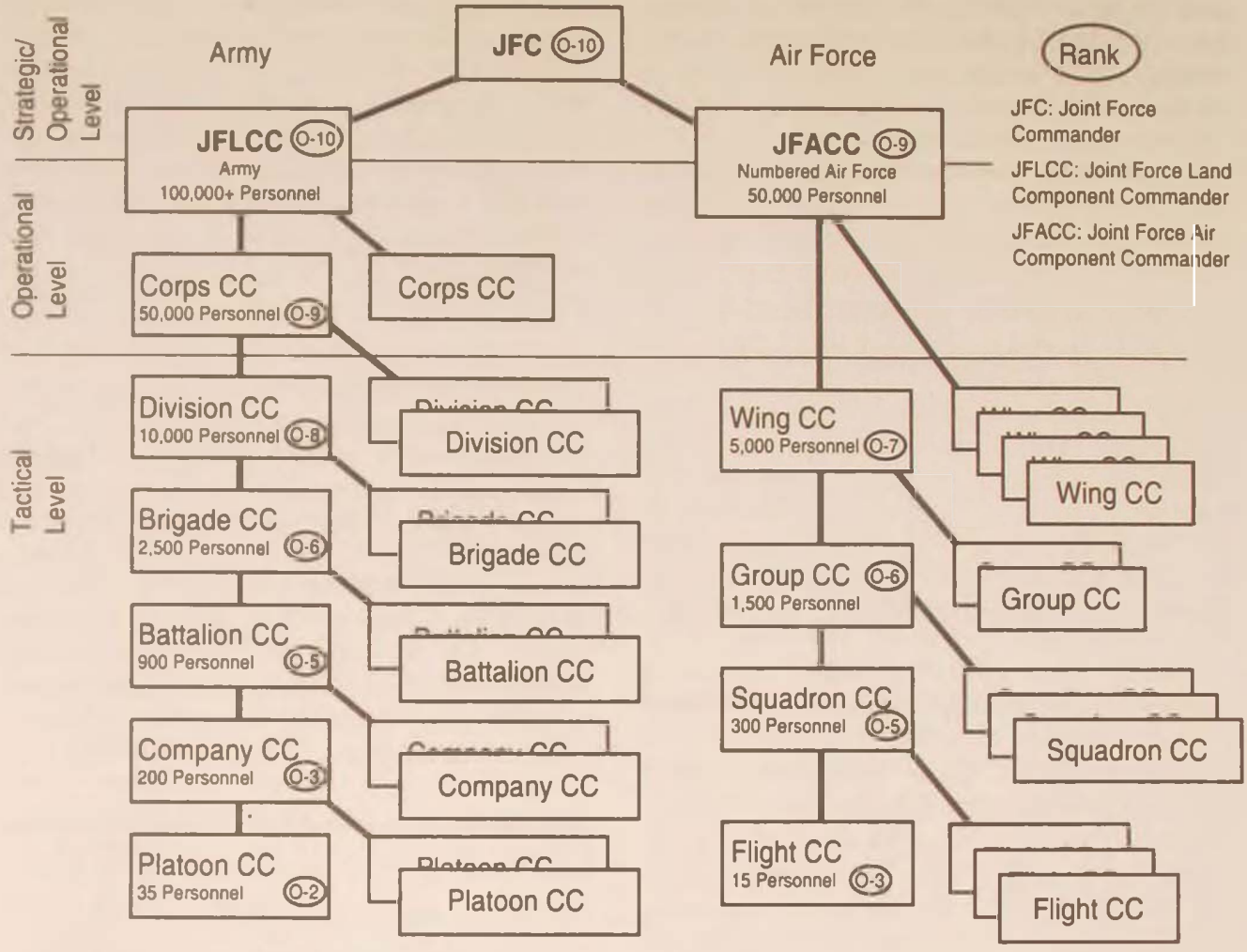


Figure 1. Chain of Unit Command

which the unit commander can subtask subordinate commanders. Ground unit commanders at each level select the missions and targets they assign to their subordinate commanders. In comparison, the Air Force does not assign individual unit responsibility for a particular region. Aerospace platforms best employ their range and speed advantages in combination with their geographic flexibility of massing anywhere in the theater as required by operational-level design. As a result, an aerospace unit, such as interdiction wings and squadrons, may receive tasking to simultaneously attack locations throughout the theater. Since all interdiction units in the theater can be used to hit a particular target, most of the target selection and mission assignment must issue from a centralized, operational-level control mechanism—not from the tactical-level unit commanders.

The JFACC owns this planning and execution mechanism. Joint Pub 3-56.1, *Command and Control for Joint Air Operations*, specifies that when a JFACC is designated, the JFACC's air operations center (AOC) produces the air tasking order (ATO). In the JFACC's name, this "staff" organization assigns the mission tasking for the lowest tactical units of two-ship fighter elements (or single night bombers) and even details the specific targets for most of the interdiction and strategic-attack sorties.[16] Decentralized execution lives in the ATO format. It provides mission-type orders to the units on targets or objectives, resources,

timing, boundaries, support, and so on without specifying how to accomplish the mission. The ATO leaves specific mission techniques to a unit's mission-planning cell or the mission commander leading the forces. Unlike their ground force counterparts, aerospace wing, group, and squadron commanders seldom have a direct hand in the AOC's mission and target tasking of their aircrews. This has been both a function of the commander's geographic separation from the AOC and the nonstop tempo of the ATO process.

Similar to the planning phase, battlefield control for decentralized aerospace execution diverges from the chain of unit command. When aircraft are airborne or on alert, the C^2 line passes from the JFACC through the AOC and the various levels of control agencies directly to the aircraft mission commanders and flight leads. Note that the line bypasses the unit commanders. Wing, group, and squadron commanders ensure resource availability and assign aircrews and aircraft to fill the air tasking order. Though outside the combat C^2 line, these unit commanders lead the critical unit esprit de corps, discipline, and tactics selection. To this extent, the combat command role of Air Force unit commanders is more characteristic of the land force fire support units such as artillery rather than maneuver units such as infantry or armor.

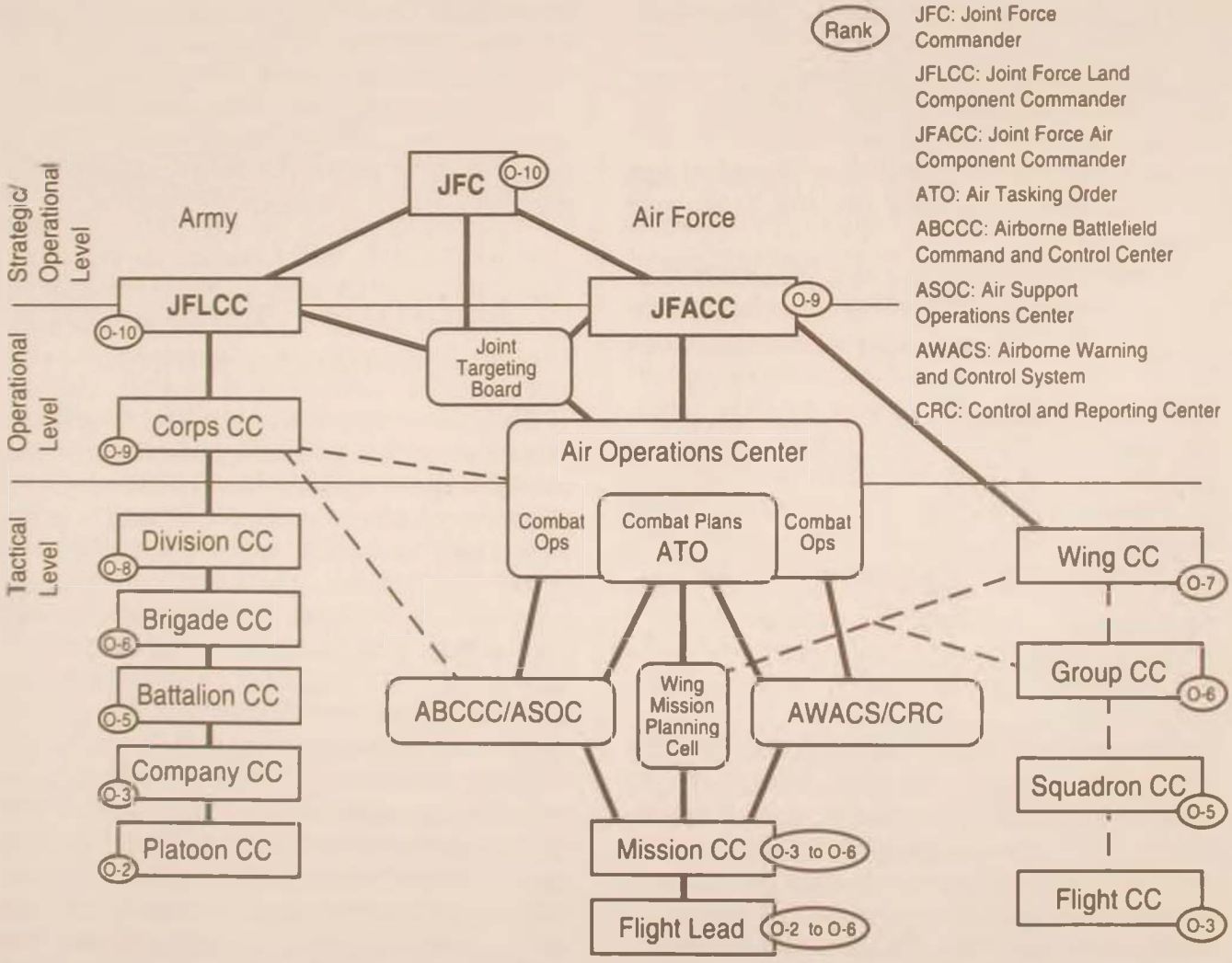


Figure 2. Line of Command for Selection of Shooter's Objectives and Targets (i.e., Who must develop and assign mission-type orders with commander's intent?)

Much of the Air Force's combat command falls on the air control system that links the airborne flight lead to the JFACC. These intervening control agencies, such as the air support operations center (ASOC) for close air support or the airborne warning and control system (AWACS) for offensive counterair (OCA) are not currently considered "commanders" in their own right. Instead, their authority is similar to that of the JFACC's staff, directing action in his name. Curiously though, these control agencies choose and assign subobjectives and targets in support of the JFACC's operational design much the same as the intermediate-level ground commanders. They own tactical control (TACON) of the aircraft under their direction and make the associated real-time calls on mission changes and tasking priorities. An example is an AWACS directing a flight of F-15Cs to target an inbound air threat. This begs the question—to be discussed later—of whether greater standardization and use of "intent" to and from these combat control agencies might not offer the benefits reaped by the Army and Marine Corps.

Figure 2 highlights air and ground differences in the span of control challenge. Note the ground and air structure difference in the number of "commanders" between the operational level and the lowest tactical level. Aerospace forces work with a much narrower span of control. This helps explain the lesser aerospace emphasis on a doctrinal concept meant to guard tempo, flexibility, and initiative in a challengingly large span of control.

The Missing "Why"

As discussed, the ATO abides by the mission-tactics concept by directing *what* to do without generally going too far into the *how*, other than key coordination issues. Yet, the ATO is often not clear on the *why*, or mission purpose, that would be part of a commander's intent statement. The JFC provides definitive commander's intent to the JFACC. Additionally, the JFACC provides his end-goal vision as intent to his higher-level AOC staffs who are selecting targets and allocating missions in the ATO. Formulation and issue of commander's intent below this level is much less consistent. Mission commanders and flight leads designing and leading the tasked sorties certainly attempt to offer their wingmen the equivalent of intent. However, their intent judgment is only tenuously founded on the intent from the two command levels above since the cryptic ATO tasking may be the only reference from which to infer the desired mission end state and purpose. Similarly, wing and squadron commanders attempt to provide general interpretations on risk management related to intent judgments. However, they have no commonly institutionalized reference from their superiors on which to base these judgments. A bottom line here is, though commander's intent is not part of Air Force doctrine, the technique is consistently used at the top operational level and the lowest tactical level. The Air Force could possibly profit from a more rigorously defined and pervasive use of commander's intent.

Aerospace Potential with Commander's Intent

The following points highlight how the Air Force has nothing to lose and much to gain from doctrinal definition and servicewide application of commander's intent as a procedure. First, our better commanders essentially already employ the concept without the label as part of the Air Force's advocated total-quality leadership technique—communicating to subordinates a vision of the desired end state and the purpose for achieving it. Second, emphasis on the development and dissemination of a standardized Air Force version of commander's intent in line with the variation used in the fighter community's flight briefings may offer potential for focusing combat efforts at operational tempos higher than the ATO's three-day cycle. Finally, commander's intent is already a joint procedure that the Air Force must understand and skillfully exercise for effective interservice operations.

Harnessing Initiative

Commander's intent is simply working with "that vision thing" so heavily emphasized in the Air Force's total quality management (TQM) instruction. TQM leadership stresses that dissemination of an organizational vision to our top-quality people is the first critical step in harnessing their initiative to achieve our goals. This is the essence of commander's intent. In recognizing TQM's potential contributions to daily operations, the Air Force must also seriously consider how it can incorporate the same "vision" concept into the main line of work—war. The Army and Marine Corps simply have a leg up on the Air Force in academically defining and procedurally prescribing battlefield "vision" in mission tasking.

ATO Flexibility

Procedural employment of commander's intent could increase Air Force operational tempo by helping to focus decentralized execution decisions. The AOC currently develops ATO tasking 24 to 48 hours out, with some targets chosen 72 hours or more in advance of attack. This long cycle would constrain tempo if execution adhered too rigidly to the ATO. Instead, ATO execution is flexibly adapted through decentralized decision making at all levels of the air control system. This decentralized execution enables the JFACC's air control system to exploit opportunity and operate inside the opponent's decision cycle. In the future, the information age and the digitization of the battlefield promise to dramatically increase availability of near-real-time targets such as Scud launchers, tank columns, or mobile headquarters. As a result, an even greater number of significant targeting decisions may migrate from the JFC/JFACC's targeting board or ATO shop to the mid-level air control agencies. As doctrine, commander's intent would offer a method of focusing the air control system's judgment in these decisions. Commander's intent would help ensure that these subordinates chose targets, engagements, and battles with the JFACC's operational vision in mind as opposed to simple random attrition.

The Air Force should consider requiring the development and dissemination of *intermediate-level* commander's intent. In Desert Storm, this was accomplished to some extent within the ATO, where, for example, target tasking included words on the purpose and importance of the target. With the AOC offering this mission purpose along with the desired end state (target destruction), flight leads were better armed to produce their own commander's intent for their flight members—offering guidance on priorities and levels of risk management. Each level of the Air Force C^2 system could benefit from similarly usable words from the immediately adjacent source of mission guidance.

The Air Force has nothing to lose and much to gain from doctrinal definition and servicewide application of commander's intent as a procedure.

The Air Force could possibly use the commander's intent technique to improve the "command" function of the C^2 agencies such as AWACS. These intermediate air control agencies tactically "command" the aircraft under their TACON similar to the land force division, brigade, or battalion commanders who receive tactical control of additional subordinate units. AWACS is responsible for the battle management command decisions that (1) require a bigger picture than what exists in the fighter flight leads' cockpits, and (2) are too time critical to defer to the AOC for resolution. The following is an example of how intermediate levels of intent could be produced and disseminated though AWACS. The AWACS mission commander would receive the JFACC's intent defining the operational vision of the *whole air operation* from two levels above. Based on this same guidance, the

By using the technique of commander's intent, the Air Force could improve the battle management function of such command and control agencies as AWACS.

AOC commander would provide his operational-tactical vision for the *day's air action* from one level higher. Next, either the AWACS mission crew commander or airborne command element (ACE) officer would translate the two preceding levels of guidance into his own tactical-level intent tailored to the AWACS crew for their *on-station time period.* Even the individual AWACS crew members/controllers would define intent to the extent that they could pass, time permitting, an abbreviated version to the aircraft they control within an *engagement.* (An example of providing intent to a flight of F-15Cs is "Rambo 1 flight, skip that target which is RTB [returning to base]. Instead, snap 300 degrees, 60 miles, for multiple low fast threats to the package. You are the only flight in position to engage.") A procedurally standardized location in the ATO could be the source of the JFACC's intent. The same is true for the AOC commander's intent for the day's operations, as well as combat plan's intent for specific missions. In addition, verbal updates of the words published in the ATO would be provided as required. For the AWACS's mission commander, and the levels below him, commander's intent would be a required element of mission planning and briefings.

Similar to this AWACS example, the Air Force could stress commander's intent in all C^2 agencies, such as the command and reporting center (CRC), the airborne battlefield command and control center (ABCCC), and the ASOC. By standardizing "intent" procedure at each level within the air control

system, the Air Force would improve the foundation on which these C^2 agencies based their battlefield decisions and resulting commands. Applied in this manner, commander's intent could help focus decentralized execution on the JFACC's centralized priorities even as the Air Force increasingly incorporates the information revolution to push execution tempo further beyond the ATO's targeting cycle.

The ASOC is an air control agency that is already steeped in the methodology of the commander's intent issued by the supported Army corps commander. This fact emphasizes the point that commander's intent expertise is often already required for joint operations.

A Jointness Requirement?

Joint command and staff emphasis on commander's intent suggests that some level of Air Force attention to the concept is appropriate. Commander's intent is the specified label for the doctrinally prescribed dissemination of a joint commander's vision of an operation. Joint publications specify that the JFC will employ commander's intent in his command relationship with the JFACC, requiring of the JFACC (who is likely to be an Air Force officer) experienced proficiency with the concept. Commander's intent is a common element of all Joint Strategic Capabilities Plan (JSCP)-tasked operations plans and concept plans produced by the regional commanders in chief (CINC)—with the assumption that all levels of subordinate command understand the concept. Air Force officers in Joint Staff billets consistently work for Army and Marine Corps commanders who expect their staffs to be fully proficient at producing recommended intent statements and interpreting intent to subordinate commands. Additionally, Air Force personnel execute many operations in direct support of sister services. Effective execution of these support operations, such as support of the Army with CAS or airlift, requires thorough understanding and application of the supported ground commander's intent. Currently, as noted before, Air Force commanders often communicate their vision for an operation to subordinates without a doctrinally rigorous "intent" label or procedure. However, joint operations involving Air Force officers would benefit from the airmen having the same familiarity with the jointly defined concept that the Army and Marine Corps officers possess. Table 1 demonstrates how pervasive the concept is throughout Army, Marine, and joint doctrine as compared to the minimal Air Force reference.

The professional training and command systems of the Army and Marine Corps provide their officers experience in interpreting senior commander intent at each level of rank and command, beginning with second lieutenants. Additionally, they become proficient at designing and disseminating their own "intent." Many Air Force leaders informally employ the concept at the lower tactical levels (for example, as pilots). However, the flight, squadron, group, and wing command assignments do not offer formal opportunity to build on the skill. Air Force officers might be even better prepared to command or otherwise contribute to joint operations if they possessed the same career-long proficiency in creating and disseminating commonly defined commander's intent that a senior Army or Marine Corps officer possesses. This jointness issue alone provides significant Air Force motivation to consider institutionalizing the concept at all levels of training and employment, thus ensuring that airmen grow up with the technique.

So What's My Point?

The wording of . . . orders I left to [the staff], with the exception of one paragraph, the shortest, which I invariably drafted myself—the intention. This gives, or should give, exactly what the commander intends to achieve. It is the dominating expression of his will by which, throughout the operation, every officer and soldier in the army will be guided. It should, therefore, be worded by the commander himself.

—Field Marshal Sir William J. Slim, commander in the Burma Theater, 1941–45

Commander's intent is a time-tested ground force tool for focusing decentralized decision making and initiative. The subordinate's knowledge of the intent from the two levels of command above has proven vital to focusing all theater energies and actions toward achieving operational-level goals. Commanders must arm subordinates with their intent in preparation for decisions that are to be made amidst the battle's fog, friction, and chaos that so often overcome the original planning. As a result, the Army, Marine Corps, and Joint Staff have extensively incorporated the concept into their doctrine. Airpower's unique combat command and control structure, which dissociates intermediate-level mission tasking from unit command, has restrained Air Force definition and prescription of the technique. Yet, there are no major C^2 constraints on institutionalizing commander's intent. Additionally, there is simple logic to doctrinally embrace a wartime command concept that mirrors current Air Force TQM philosophy. More rigorous use of the concept has theoretical potential for helping focus airpower's increasing combat tempo. Decentralized decision making, guided by commander's intent, can help keep decentralized execution focused on the JFACC's centralized priorities as the information revolution increases the number of decision-action cycles that occur inside the ATO's two-to-three-day limits. Finally, the increasing national emphasis on joint teamwork motivates multiservice standardization of this concept and the cultivation of an Air Force officer corps that is thoroughly proficient with the tool.

The Air Force should consider borrowing this command tool from joint doctrine and the standardized practices of the ground forces with whom the Air Force is teamed. The Air Force should consider doctrinally defining and embracing this tool in a manner appropriate to the unique organizational structure—institutionalizing commander's intent through common, servicewide instruction in all professional training from flight and tactics schools to war colleges and commanders' courses. □

Notes

1. Michael D. Krause, "Moltke and the Origins of Operational Art," *Military Review*, September 1990, 28–44.

2. Martin van Creveld, Steven L. Canby, Kenneth S. Brower, *Air Power and Maneuver Warfare* (Maxwell AFB, Ala.: Air University Press, 1994), 7, borrows from the World War II Wehrmacht's regulations.

3. Milan N. Vego, "Operational Art Lecture Notes," unpublished lecture note handout, US Naval War College, Newport, R.I., 1995, 11. Although commonly translated as "mission-type orders" or "mission tactics," a more accurate translation of *Auftragstaktik* may be "task-oriented orders."

4. Creveld, Canby, and Brower, 3–8.

5. Milan N. Vego, "Operational Leadership," addendum to Naval War College (NWC) 4001, *Operational Art: A Book of Readings*, 21 March 1995, 6.

6. John L. Romjue, *From Active Defense to AirLand Battle: The Development of Army Doctrine, 1973–1983* (Fort Monroe, Va.: US Army Training and Doctrine Command, June 1984), 58–59.

7. Air Force Manual (AFM) 1-1, *Basic Aerospace Doctrine of the United States Air Force*, March 1992, vol. 2, 130–31.

8. Fleet Marine Field Manual (FMFM) 1, *Warfighting* (Washington, D.C.: US Government Printing Office, March 1989), 65; and Field Manual (FM) 100-5, *Operations*, 1993, 2–6.

9. At the strategic and higher operational levels, *desired end state* is "the set of required conditions that achieve the strategic objectives." At these levels, it normally connotes diplomatic, economic, and informational conditions in addition to the desired or required military conditions. At the lower levels, it generally refers only to the *military* end state. Joint Chiefs of Staff, Joint Pub 3-0, *Doctrine for Joint Operations* (Washington, D.C.: US Government Printing Office, September 1993), III-2.

10. FM 100-5, 6-6.

11. Ibid., 2–9.

12. FMFM 1, 70–71.

13. *Center of Gravity*: The hub of all power and movement upon which everything depends. It is the characteristic, capability, or location from which enemy and friendly forces derive their freedom of action, physical strength, or will to fight. FM 100-5, 6–7.

14. Michael L. Ettore, "Commander's Intent Defined," *Marine Corps Gazette*, April 1993, 52–53.

15. AFM 1-1, vol.1, 3.

16. Joint Chiefs of Staff, Joint Pub 3-56.1, *Command and Control for Joint Air Operations* (Washington, D.C.: US Government Printing Office, 14 November 1994), vii–viii.

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"Where the Future Is Now"

TEN PROPOSITIONS Regarding Airpower

Col Phillip S. Meilinger, USAF*

ABOUT SIX years ago, when Air Force Manual (AFM) 1-1, *Basic Aerospace Doctrine of the United States Air Force,* was being rewritten, Lt Gen Michael Dugan, deputy chief of staff for plans and operations, proposed an unusual idea. Doctrine manuals were fine, but he wanted something brief and succinct—something that encapsulated the essence of airpower. His ultimate goal: to produce a list of principles or rules of airpower so succinct they would fit on a wallet-sized card that airmen could carry in a pocket. My first reaction was one of skepticism. As a historian, I had been taught to eschew simple solutions, formulas, models, and similar gimmicks that attempted to deal with complex problems. Yet, as one observer phrased it, "The consistency of the principles of war indicates that despite the doubts expressed by military theoreticians concerning their validity, they satisfy a deep need in military thinking."[1] Such a "need" encompasses the psychological search for guidelines when in chaos, the tendency to apply scientific concepts of cause and effect to daily activities, and the desire for an understandable system of beliefs to use as an educational tool for young officers.

The general's proposal faded, but, in truth, it never left my mind. The more I thought about it, the more appealing it seemed. Truly good writing, in my view, should be short, swift, and to the point. As Mark Twain said, "If I'd had more time I would have written less." Capturing the essence of what airmen believe about airpower and putting it into a concise and understandable—but not simplistic—format was a challenge.

I encountered a catalyst when I was preparing a course on the history of airpower theory. Reading the works of the top theorists—Giulio Douhet, Hugh Trenchard, Billy Mitchell, John Slessor, the officers at the Air Corps Tactical School (ACTS), Alexander de Seversky, John Warden, and others—brought many similarities to light. Even though liv-

continued on page 52

*This article is the product of many minds and ideas, but I would like especially to thank my faculty and student colleagues in the School of Advanced Airpower Studies, as well as the following people, who have been particularly helpful: Drs I. B. Holley, Jr., Don Levine, Dan Kuehl, Dave Mets, and Hal Winton; Col John Roe; Lt Cols Ernie Howard, Jason Barlow, and Tim Gann; Maj John Farquhar; and Group Capt Gary Waters (Royal Australian Air Force).

TWELVE PRINCIPLES Emerging From TEN PROPOSITIONS

COL RICHARD SZAFRANSKI, USAF

THE STRENGTHS of *10 Propositions Regarding Air Power** are that the volume is simple, slim, assertive, and challenging. These characteristics also contribute to a few of its weaknesses. Because it seems to aim at being a book of airmen's aphorisms, it is necessarily as insubstantial in the depth and strength of many of its arguments as it is slim in size. Its many assertions are not allotted the space to be buttressed by as many proofs. Consequently, elements of some propositions challenge logic, history, and some of the empirical data we have on the "power" of airpower. Some critics will opine that *10 Propositions* continues the tradition of promises, predictions, sweeping declarations, breathless exhortations, and grand but unwarranted syntheses found in the works of Giulio Douhet, William ("Billy") Mitchell, Alexander de Seversky, and—more recently—John Warden. Only Douhet provided a new airpower theory, scholars rightly observe. All true.

Yet, consider that the book was not written for scholars. Consider that the book, where it is faithful to its lofty ideal, is not analysis as much as it is pocket-size synthesis. What is new and good here is a superior idea, executed well: give airmen something simple and fairly solid to stimulate their thinking about air and space power. Without overlooking the arguable soft spots and hyperbole in *10 Propositions*, perhaps airmen can get even greater discernment by a transformational critique of the work. The goal of this critique is to take what's likelier than not true in *10 Propositions* and transform "proposition" into "principle." Twelve principles emerge (table 1).

The first principle is that **propositions are declarations that invite proof or disproof.** Propositions are neither principles nor rules nor verities. A proposition invites caution. It is merely an assertion—a proposal requiring proof in order to become more than a position or platform. Without proof, a proposition can be a falsehood—an untruth. The pre–World War II proposition that "the bomber will always get through," for example, was and is untrue. That proposition was associated

continued on page 73

*Col Phillip S. Meilinger, *10 Propositions Regarding Air Power* (Washington, D.C.: Air Force History and Museums Program, 1995). This is a small (3" x 5¼") paperback version of Colonel Meilinger's article on the same subject (facing page).

Ten Propositions
continued from page 50

ing in different times, different places, and different circumstances, these men had distilled certain principles, rules, precepts, and lessons that seemed timeless and overarching. Some of these had been demonstrated in war; others were mere predictions. After 75 years, however, I think there have been enough examples of airpower employment and misemployment to derive some propositions—*principles* would be too grand a term—from the theories. First, however, let me briefly describe some of airpower's unique characteristics—some strengths and some weaknesses—from which these propositions derive.

Even before the airplane was invented, writers sensed that the medium of the air possessed intrinsic qualities that could be exploited for war, and it is quite amazing how quickly after the Wright brothers first flew in 1903 that military men were positing the use of the airplane as a weapon. During the war between Italy and Turkey in Libya in 1911, airplanes were used for the first time in combat. Virtually all of the traditional air missions were employed: observation, air defense, air superiority, transport, ground attack, even bombing.[2] The world war that erupted a few years later saw all these air missions refined. By the end of the Great War, both air and surface officers were in general agreement about the unique strengths and weaknesses of airplanes.

Airpower's attributes include range (even the flimsy planes of 1918 could fly several hundred miles), speed (over 100 miles per hour [mph]), elevation (the ability to fly over hills, rivers, and forests that impede surface forces), lethality (concentrated firepower could be directed at specific points on and behind the battle area), and flexibility (a combination of other attributes that allowed airplanes to be used quickly, in many ways and places). The limitations of airpower were also apparent early on. Unlike surface forces, airplanes could not live in their medium and had to land in order to refuel and rearm. This restriction, in turn, meant aircraft were ephemeral: air strikes lasted but a few minutes and therefore lacked persistence. Although airplanes could indeed fly over obstacles, they were limited by bad weather and the night. In addition, as was true of surface forces, political restrictions could determine where, when, and for what purpose aircraft flew. Finally, aircraft could not occupy or hold ground. Even 75 years later, these attributes and limitations generally hold true, although some have clearly been nibbled away at the edges.

It is significant to point out here that, over the years, both air and surface proponents have cited these various characteristics—positive and negative—to justify their own views on how aircraft should be used in war. Airmen magnified the importance of the attributes but minimized the limitations. They wished to establish a separate service that would not be subordinate to surface commanders. Ground and sea advocates, however, noted the limitations inherent in airplanes but downplayed the positive aspects. They wished to maintain dominance of the new air arm. This political debate over whether airpower was revolutionary or evolutionary and, therefore, whether it should or should not be a separate service occupied decades of heated argument and caused needless animosity.

Today, all major countries have an air force as a separate service. More importantly, however, people are now aware that separateness does not equal singularity. Wars are fought in many ways, with many weapons. Seldom is one service used to wage a campaign or war, although one service may dominate such conflicts. The nature of the enemy and the war, the objectives to be achieved, and the price people are willing to pay determine what military instruments will be employed and in what proportion. My purpose in this article is to identify and discuss 10 propositions regarding airpower (see sidebar) in the hope that this endeavor will better inform those people who employ

military power and allow them to achieve objectives established by the country's leaders.

1. Whoever Controls the Air Generally Controls the Surface

If we lose the war in the air, we lose the war, and we lose it quickly.

—Field Marshal Bernard Montgomery

Some people refer to this concept as command of the air; others call it air superiority. But the point is clear: the first mission of an air force is to defeat or neutralize the enemy air force so that friendly operations on land, at sea, and in the air can proceed unhindered, while at the same time one's own vital centers and military forces remain safe from air attack. Virtually all airpower theorists subscribe to this proposition. Douhet, for example, stated simply that "to have command of the air is to have victory."[3] In a similar vein, John Warden wrote, "Since the German attack on Poland in 1939, no country has won a war in the face of enemy air superiority. . . . Conversely, no state has lost a war while it maintained air superiority."[4] Whether such a statement is true in unconventional warfare is debatable, but the armies of Germany, Japan, Egypt, and Iraq would certainly agree that conventional ground operations are difficult—if not impossible—when the enemy controls the air.

This emphasis on gaining air superiority often troubles ground commanders, who tend to equate proximity with security. Rather than have aircraft attack airfields or aircraft factories in the quest for air superiority, they prefer to have them close by and on call in the event enemy planes appear. This desire is understandable but misguided because it would be unwise to tether airpower to a static, defensive role. An aggressive doctrine has been very effective for the United States: American troops have not had to fight without air superiority since 1942; 1953 was the last time an American ground soldier was killed by air attack; and our Army has never had to fire a surface-to-air missile at enemy aircraft—because they have never been allowed to get that close.[5] In actuality, our Army's doctrine *assumes* friendly air superiority and sees its achievement as one of airpower's biggest contributions to land operations.

This need for air cover also extends to maritime operations. As early as the First World War, naval aviators such as John Towers saw the need for aircraft carriers to ensure air superiority over the fleet. For many years, surface admirals rejected this view, but Pearl Harbor and the sinking of the British capital ships *Prince of Wales* and *Repulse* by Japanese land-based aircraft in 1941 soon made it clear that ships required air cover to operate effectively. Aircraft carriers provided the mobile air bases for the planes that would help to ensure air superiority over the fleet, while at the same time increasing the ability to project power ashore.[6] The armadas that conquered the Central Pacific in World War II were based on air-

Ten Propositions Regarding Airpower

1. Whoever controls the air generally controls the surface.
2. Airpower is an inherently strategic force.
3. Airpower is primarily an offensive weapon.
4. In essence, airpower is targeting; targeting is intelligence; and intelligence is analyzing the effects of air operations.
5. Airpower produces physical and psychological shock by dominating the fourth dimension—time.
6. Airpower can simultaneously conduct parallel operations at all levels of war.
7. Precision air weapons have redefined the meaning of mass.
8. Airpower's unique characteristics require centralized control by airmen.
9. Technology and airpower are integrally and synergistically related.
10. Airpower includes not only military assets, but aerospace industry and commercial aviation.

craft carriers—not battleships—and the US Navy's force structure has reflected this emphasis ever since.

The clear implication in the writings of the air theorists is that gaining air superiority is so important that it might bring victory (i.e., air superiority could be an end in itself). But two problems attend this construct. First, air superiority is valuable only if the political will is available to exploit it. United Nations (UN) aircraft can easily dominate the skies over Bosnia, for example, but how can that air superiority be exploited? If intransigent opponents do not believe that air strikes against their industry or military forces will follow, then control of the air becomes meaningless. Second, achieving air superiority reintroduces the concept of the decisive counterforce battle. Just as an army that invades another country and deliberately bypasses the enemy army while marching on the interior risks the occupation of its own country or the severing of its supply lines, so too an air force that goes straight for the heart of a nation while ignoring the enemy air force courts catastrophe. Consequently, if the fate of nations hinges on the campaign for command of the air, then presumably a belligerent will focus his efforts and resources in that area. If that occurs, the air battle can be just as prolonged, deadly, and subject to the grinding effects of attrition as any land war. This happened in World War II. Airpower did not eliminate the trench carnage of that war; it just moved it to 20,000 feet. In reality, the attainment of air superiority has not yet brought a country to its knees. Therefore, the proposition remains that air superiority is a necessary but insufficient factor in victory. It is the essential first step.

2. Airpower Is an Inherently Strategic Force

Airpower has become predominant, both as a deterrent to war, and—in the eventuality of war—as the devastating force to destroy an enemy's potential and fatally undermine his will to wage war.

—Gen Omar Bradley

War and peace are decided, organized, planned, supplied, and commanded at the strategic level of war. Political and military leaders located in major cities direct the efforts of their industry, natural resources, and populations to raise and equip military forces. These "vital centers" of a country are generally located well behind the borders and are protected by armies and defensive fortifications. Thus, before the invention of the airplane, a nation at war generally hurled its armies against those of an enemy in order to break through to the more vulnerable interior. Some people still think this way, as exemplified by a noted military historian who recently wrote, "According to Clausewitz and common sense, an army in wartime succeeds by defeating the enemy army. Destroying the ability of the opponent's uniformed forces to function effectively eliminates what stands in the way of military victory."[7] Sometimes a country was fortunate and was able to annihilate its opponent's army, as Napoléon did at Austerlitz and in the battles of Jena and Auerstadt; such success could bring quick capitulation. But more often, battles were bloody and indecisive; wars were exercises in attrition or exhaustion. As wars became more total, armed forces larger, and societies more industrialized, the dream of decisiveness usually became an unattainable chimera. Armies became tactical implements that ground away at the enemy army, hoping that an accumulation of battlefield victories would position them for decisive, strategic operations.[8]

To some extent, navies are also condemned to fight at the tactical level of war. After one has gained command of the sea, a fleet can then bombard fortresses near shore, enforce a blockade, or conduct amphibious operations. In the first case, however, the results are limited by the range of the ships' guns; in the second, the enemy feels the results only indirectly and over time. Certainly, a blockade can deprive a belligerent of items needed to sustain the war effort; however, the blockaded party can substitute and redistribute its resources to compensate for

what has been denied. In short, indirect economic warfare takes much time; indeed, only rarely has a blockade brought a country to its knees.[9] In the last instance, amphibious operations are generally only a prelude to sustained land operations, but this action merely takes us back to the cycle of army versus army.

Airpower changed things by compressing the line between the strategic and tactical levels. Aircraft can routinely conduct operations that achieve strategic-level effects. To a great extent, airplanes obviate the need to confront terrain or the environment because of their ability to fly over armies, fleets, and geographic obstacles and strike directly at a country's key centers. This capability offers alternatives to both bloody and prolonged ground battles and deadly naval blockades. In truth, although early airpower theorists often spoke of the potential of this concept, it was largely a dream for many decades. Airpower did not remove the need for a land campaign in Europe during World War II, and although an invasion of Japan proper was unnecessary, the evidence was not clear-cut—it took four years and the combined operations of all the services to set the stage for the final and decisive air phase. Korea and Vietnam proved to many people that airpower was not an effective strategic weapon, although some would maintain that we never gave it a chance to prove itself.[10] Operation Desert Storm, on the other hand, came close to realizing the claims of the early theorists. Whether that event was the fulfillment of prophecy or an aberration remains to be seen.

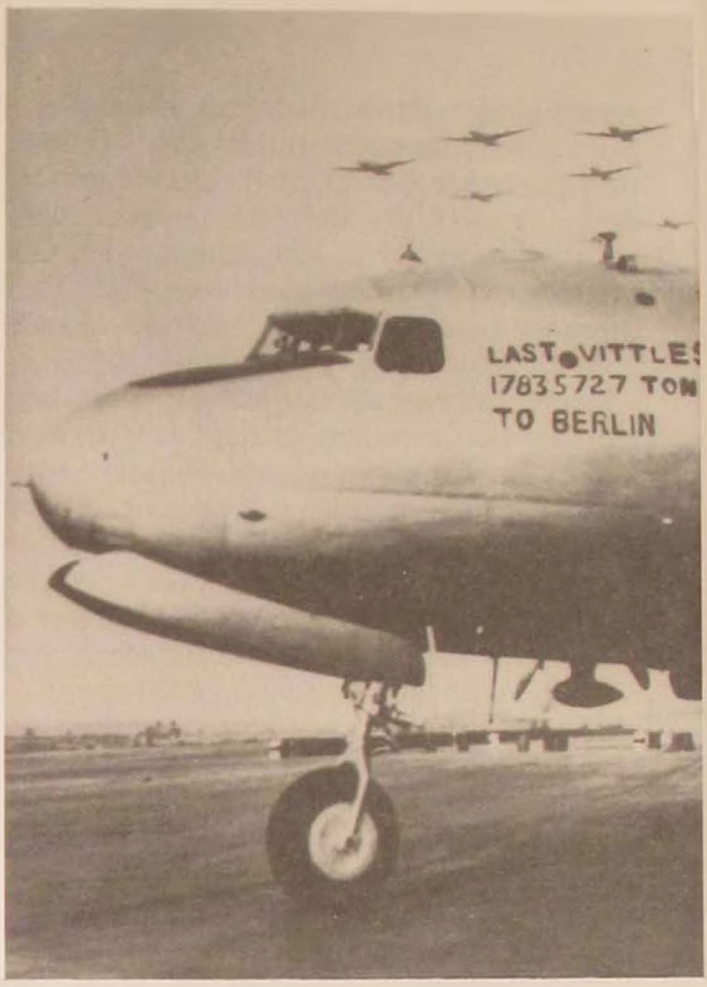
If the former, then Desert Storm confirms the premise that the goal of air commanders is to maximize their intrinsic advantage by operating at the strategic level of war while forcing the enemy to fight at the tactical level. Coalition airpower achieved this type of mismatch in the Gulf when, for example, it deprived Iraqi air defenses of centralized control, causing them to devolve into ineffectual tactical operations, devoid of strategic significance. Although one can also employ airpower at the operational and tactical levels, one should consider such instances closely to ensure that the effect intended is worth the candle. In essence, air war requires broad, strategic thinking. The air commander must view war in totality—not in a sequential or circumscribed fashion.

Finally, one must note that airpower has great strategic capabilities as a nonlethal force. In an interesting observation, John Warden noted that, basically, airpower delivers strategic information: some of it is "negative" (such as bombs) and some is "positive" (such as food). For example, the Berlin airlift of 1948–49 was perhaps the greatest Western victory of the cold war prior to the fall of the Berlin Wall itself. Yet, the airlift was a demonstration of airpower's peaceful application. After the Soviets shut off all land routes into West Berlin, airlifters supplied all the food, medicine, coal, and other essentials needed by the population over the next 10 months. The result of the airlift was enormous: the city remained free. This was a strategic victory of the first order, not in the least diminished because airpower achieved it without firing a shot. The evolving world calls for a greater reliance on airlift, both for force projection and humanitarian assistance. Advances in technology similarly emphasize the importance of space-based air assets such as communications and reconnaissance satellites that ensure nearly instantaneous command and control (C^2) of military forces, highly accurate location reporting, intelligence gathering, and treaty verification. Clearly, the importance of strategic airpower to our national security structure is growing—not decreasing.

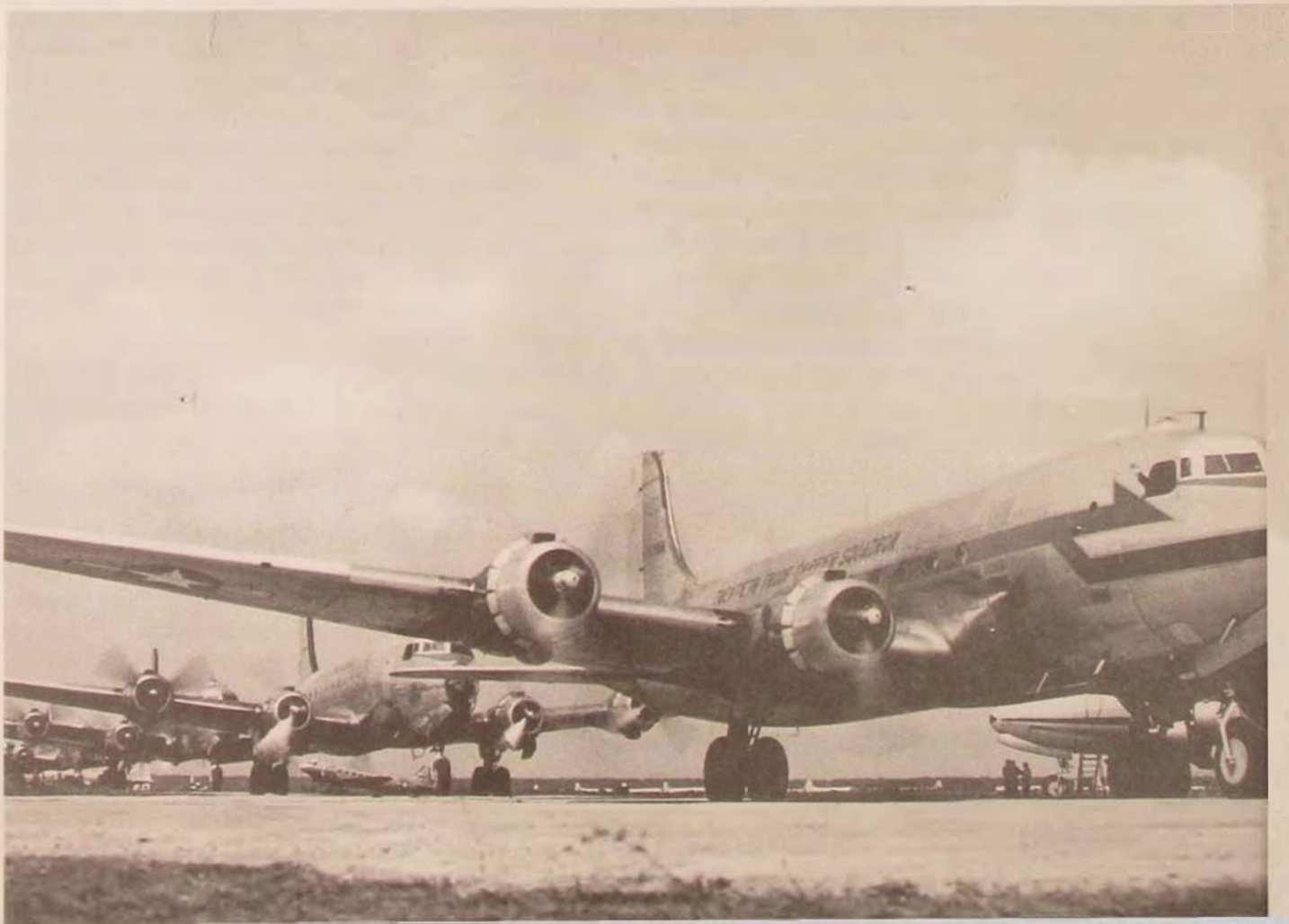
3. Airpower Is Primarily an Offensive Weapon

War, once declared, must be waged offensively, aggressively. The enemy must not be fended off, but smitten down.

—Adm Alfred Thayer Mahan



Airpower has great strategic capabilities as a nonlethal force. The Berlin airlift of 1948–49 was perhaps the greatest Western victory of the cold war prior to the fall of the Berlin Wall itself. C-54s flew thousands of tons of food, coal, and other supplies daily to western sectors of Berlin. The airlift was a demonstration of airpower's peaceful application.



Axiomatic to surface theorists is the idea that defense is the stronger form of war. That is, a country or army in a weak position will generally assume the defensive because it offers certain advantages. A defender can dig in, build fortifications, and operate on interior lines in friendly, familiar terrain. An attacker, therefore, has to assault this well-prepared enemy, usually by exposing himself to enemy fire. Moreover, the deeper one advances into enemy territory, the farther he is from his sources of supply. These innate strengths led Sun-Tzu to comment that "being invincible lies with defense; the vulnerability of the enemy comes with the attack."[11] The standard rule was that it took a three-to-one superiority at the point of attack to overcome a foe in prepared positions. As a result, one assaulted the enemy where he was not expecting it, thus ensuring superior numbers at the crucial point. One must understand, however, that the same theorists who believe the defense is the stronger form of war also admit that one seldom wins wars by remaining on the defensive; offensive action will eventually be essential. Thus, a defender must husband his resources in preparation for going over to the attack at a favorable opportunity.

Airpower does not fit this formulation. The immensity and tracklessness of the sky allow one to strike from any direction, whereas armies generally move over well-defined routes. Interception is the key issue here; certainly, radar will be watchful for an air attacker, but terrain masking, electronic measures, careful routing, and stealth technology make it extremely difficult to anticipate and prepare for an air assault. H. G. Wells commented in 1908 that there were no highways in the sky—all roads led everywhere.[12] He was, and still is, correct. Because there are no flanks or fronts in the sky, an air defender has little chance of building fortifications there or of channeling an enemy into a predictable path so his defenses can be more effective. Stopping an air attack completely is virtually impossible—some planes will get through. Even when Eighth Air Force bombers suffered "disastrous" losses in strikes against Schweinfurt in fall 1943, over 85 percent of the bombers penetrated enemy defenses and struck their targets. Surface forces, on the other hand, generally either break through or are repelled—an all-or-nothing proposition.

Moreover, in order to defend all his vital areas, an air defender must spread his squadrons widely, and each point protected must have sufficient strength to drive back an attacker.[13] Unlike the surface defender, the air defender has no implicit advantage—passive defense is impractical. Whereas the attacker can strike virtually anything, the defender is limited to striking the attacker—an inefficient situation. In addition, an effective defense requires a well-organized, responsive, and survivable C^2 network; the offense does not. Even if such a defensive system is in place, however, dispersion in an attempt to cover all of a country's vital areas may grant de facto local air superiority to an attacker. In short, in air warfare, the defender is stripped of his innate three-to-one superiority, and an air defender theoretically needs more forces than the attacker—the precise opposite of the situation on the ground.[14] This line of reasoning led Douhet and others to term the airplane the offensive weapon par excellence. If that notion is true, then interesting conclusions follow.

First, one reaps a reward by assuming the offensive. To wait in the air is to risk defeat; therefore, an overwhelming air strike offers great temptation. When such attacks are carried out, they can have devastating effects—as at Pearl Harbor or in the Arab-Israeli War of 1967 or Desert Storm. At the very least, the need for maintaining the initiative necessitates a sufficient air force in-being that is ready for immediate and decisive action upon the outbreak of hostilities. In air war, one cannot afford a mobilization that takes weeks or months—the conflict may be over before it can take effect.

Similarly, Sun-Tzu's dictum that a wise

commander defeats the enemy's strategy is inappropriate in air war because it assumes one will wait to see what that strategy is and then move to counteract it. Not only is this a risky business (one can easily guess wrong about the opponent's strategy and therefore counter the wrong move), but it once again surrenders the initiative to the enemy.[15] Finally, the concept of offensive airpower obviates the need for a tactical reserve. Land forces establish a reserve whose mission is to stand ready either to exploit success or reinforce a threatened point. Both of these scenarios imply a reactive and defensive posture. Air battles, on the other hand, occur and end so quickly that except in very limited circumstances, air commanders should avoid holding a reserve; instead, they should commit all available aircraft to combat operations.[16] In truth, this issue is ambivalent enough to warrant further study. Clearly, a reserve as meant in land operations is not applicable to air war. But could one argue that aircraft based in a different country hundreds of miles distant, yet only minutes away from the battle space, actually constitute a "tactical reserve"?[17]

In summary, the speed, range, and flexibility of airpower grant it ubiquity, which in turn imbues it with an offensive capability. Because one generally attains success in war while on the offensive, the adage "the best defense is a good offense" is almost always true in air war.

4. In Essence, Airpower Is Targeting; Targeting Is Intelligence; and Intelligence Is Analyzing the Effects of Air Operations

How can any man say what he should do himself if he is ignorant of what his adversary is about?

—Baron Antoine-Henri Jomini

Airpower—both lethal and nonlethal—can be directed against almost anything. The Gulf War showed that digging deeply and using tons of steel and concrete will not guarantee protection from precision penetration bombs. The hardened bunkers of the Iraqi air force were designed to withstand a nuclear attack, but they could not survive a perfectly placed high-explosive bomb. However, being able to strike anything does not mean that one should strike everything. Selecting objectives to strike or influence is the essence of air strategy. Virtually all air theorists recognized this point; unfortunately, they were frustratingly vague on the subject.

Douhet, for example, left it to the genius of the air commander to determine an enemy's "vital centers."[18] He did, however, single out popular will as being of first importance. He predicted that if the people were made to feel the harshness of war—through bombing urban areas with high explosives, gas, and incendiaries—they would rise up and demand that their government make peace. Other theorists had different candidates for priority targets. ACTS devised a doctrine concentrating on enemy industry. Their "industrial web" theory characterized a nation's structure as a network of connected and interdependent systems; as with a house of cards, if just the right piece were removed, the entire edifice would collapse and with it a country's capacity to wage war.[19] The Royal Air Force's (RAF) Jack Slessor emphasized the vulnerability of a country's transportation structure, advocating the interdiction of troops and supplies as the best method of achieving objectives.[20] John Warden stressed leadership. Since a country's leaders make decisions regarding peace and war, one should focus all air efforts on the will of those leaders to induce them to make peace.[21] The early writings (pre-1925) of Billy Mitchell saw the enemy army as the primary target of strategic airpower.[22] Thus, all the classic air theorists have had similar notions regarding centers of gravity, but they diverge on singling out the most important one. Indeed, a skeptic could argue that a history of air strategy is a history of the search for the single, perfect tar-

get.[23] Nonetheless, this basic framework for determining air strategy was a useful first step—but only a first step.

Airpower's ability to affect targets has always exceeded its ability to identify them. The Gulf War demonstrated that if one does not know that a target exists, airpower may be ineffective. For example, although coalition aircraft destroyed most of the known nuclear, biological, and chemical research facilities in Iraq, far more were unknown and not discovered until UN inspectors roamed the country after the war.[24] For airmen to claim that this was a failure of intelligence—not of airpower—is an evasion because the two are integrally intertwined and have always been so. Intelligence is essential to targeting; moreover, one requires intelligence specifically geared to air war. Military information-gathering agencies have existed for centuries, but their products were of a tactical nature: How many troops does the enemy possess? Where are they located? What is their route of march? What is the rate of fire of their latest weapons?

Although such tactical information was also necessary for airmen to fight the tactical air battle, strategic air warfare demanded more: What is the structure of an enemy's society and industry? Where are the steel mills and power plants? How do civilian and military leaders communicate with their subordinates? Where are the major rail yards? How far advanced is the chemical warfare program? Who are the key leaders in society, and what are their power bases? These types of questions, essential to an air planner, had seldom been asked before the advent of the airplane because they did not need to be.[25] Two analysts even argue that intelligence has become "a strategic resource that may prove as valuable and influential in the post-industrial era as capital and labor have been in the industrial age."[26] In this formulation, the key to all conflict is intelligence.

The third step, no less important than the first two, is analyzing the effects of air attacks. One aspect of this problem is termed bomb damage assessment (BDA), but it is only one aspect—with largely tactical implications. The simplest way of determining BDA is through postattack reconnaissance; however, the advent of precision munitions often renders this procedure inadequate. During the Gulf War, for example, coalition aircraft struck an Iraqi intelligence headquarters building. BDA reported that the sortie was 25 percent effective because one-quarter of the building was destroyed. Yet, the wing of the building hit by the bomb was precisely where the actual target was located. In reality, the sortie was totally effective. The BDA process used a measurement technique appropriate to a time when precision was unobtainable, so obliteration was necessary.[27] In short, BDA is as much an art as a science, and it is often difficult to determine the effects of a precision air strike.

The assessment problem at the strategic level is far more complex. Present standards used to measure the effectiveness of strategic air strikes are insufficient. In some instances, such as assessing damage to an electrical power network, the relationship between destruction and effectiveness is not linear. For example, during Desert Storm, Iraq shut down some of its power plants even though they had not been struck, apparently hoping that this action would shield them from attack. Because the coalition's intent was to turn off the power—not destroy it—the threat of attack was as effective as the attack itself. Thus, a small number of bombs produced an enormous power loss.[28] Unfortunately, although one can ascertain that a power plant is not generating electricity, judging how that fact will affect the performance of an air defense network (which may be the true goal of the attack) is a far more difficult task.

This assessment problem has haunted air planners for decades. Some people still have heated debates over the effectiveness of strategic bombing during World War II. Were the selected targets the correct ones? Was there a better way to have fought the air war? Surprisingly, this question has not

been answered by computer war games, which are unable to assess the strategic effects of air attack. Because of the visual impressiveness of these games, however, participants are mistakenly led to believe they are engaged in a scientific exercise. The challenge for airmen is to devise methods of analyzing the relationships between complex systems within a country, determining how best to disrupt them, and then measuring the cascading effect of a system's failure throughout an economy.[29]

We are a quantitative society with a need to count and measure things, especially our effectiveness. The military has a proclivity for body counts, tonnage figures, sortie rates, percentage of hits on target, and so forth. Such mechanisms are especially prevalent in air war because there is no clear-cut way of determining progress. Surface forces can trace lines on a map, but airmen must count sorties and analyze sometimes obscure and conflicting intelligence data. The real air assessment usually comes after the war. How do we break out of this American penchant for "Nintendo warfare"? Because airpower is a strategic force, we must better understand, measure, and predict its effectiveness at that level of war. For too long airmen have relied upon a "faith-based" targeting philosophy that emphasizes logic and common sense rather than empirical evidence.

5. Airpower Produces Physical and Psychological Shock by Dominating the Fourth Dimension—Time

How true it is that in all military operations time is everything.

—Duke of Wellington

When discussing the reasons for his success at Austerlitz, Napoléon noted that he, unlike his opponents, understood the value of a minute. He understood the importance of time. In truth, Napoléon was referring more to timing. Synchronizing the actions of multiple units so as to maximize their effect is vital—this is timing. Equally important, however, is thinking of time as duration. Commanders must consider how long it will take to move their units into position and then to actually employ them. More importantly, they must realize that when force is applied rapidly, it has both physical and psychological consequences that dissipate when it is employed gradually. Airpower is the most effective manager of time in modern war because of its ability to telescope events. It produces shock.

Although separating the physical and psychological components of shock is difficult, the two are decidedly different. Physical shock results when force collides with an object. It includes an element of overwhelming power; it is irresistible. Prior to this century, heavy cavalry generally produced shock, although at times heavily armed infantry deployed in column could also achieve this effect. Indeed, when handled properly, a charge of mounted troops produced enormous shock, sometimes sweeping away the enemy force, as at Arbela and Rossbach. Such was not always the case, however. Firepower could at times repel such a cavalry charge, as at Crécy and Waterloo. Nonetheless, shock effect on the battlefield is still important, although today it is generally provided by armored forces. Airpower can similarly produce physical shock because of the enormous amount of firepower it can deliver in a concentrated area. The impact of a B-52 loaded with 19 tons of high-explosive bombs is legendary, and even one F-15E can drop four tons of bombs on a spot with a footprint no greater than a good-sized house.

More importantly, airpower can produce psychological effects. At its most fundamental level, war is psychological. It may be that the best way to increase psychological shock is to increase physical shock, but one must be careful not to equate destruction with effectiveness. Rather, a commander should capitalize on airpower's speed and ubiq-

uity—its ability to increase dramatically the tempo of combat operations. One realizes the importance of these characteristics upon remembering that even the most energetic army is constrained by its speed of march. In studying thousands of campaigns over several centuries, one US Army researcher discovered that mechanized and armored forces stand still between 90 and 99 percent of the time. While heavily engaged with the enemy, they generally advance at the rate of approximately three miles per day—about the same as for infantry. There have been exceptions over the years, of course, but the study concludes that rates of ground advance have not appreciably changed over the past four centuries, despite the advent of the internal-combustion engine and the changes it has brought to the battlefield.[30]

Airpower increases speed of movement by orders of magnitude. Aircraft routinely travel several hundred miles into enemy territory at speeds in excess of 700 mph. Such mobility means that a commander can move so rapidly in so many different directions, regardless of surface obstacles, that a defender is at a severe disadvantage. This conquest of time by airpower provides surprise, which in turn affects the mind, causing confusion and disorientation. John Boyd's entire theory of the observe-orient-decide-act (OODA) loop is based on the premise that telescoping time—arriving at decisions or locations rapidly—is the decisive element in war because of the enormous psychological strain it places on an enemy.[31] In addition, speed and surprise can sometimes substitute for mass: if an enemy is unprepared physically or mentally for an attack, then force—rapidly and unexpectedly applied—can overwhelm him (e.g., France in 1940 and Russia in 1941). Moreover, surprise and speed can help reduce casualties because the attackers are less exposed to enemy fire. The fact that speed equaled survival is one reason jet aircraft quickly replaced piston-driven aircraft for most tactical air missions in the world's air forces.

Nuclear weapons offer the most compelling example of how airpower produces psychological shock. People have not really increased the destructive power of their weapons in centuries. The Romans destroyed Carthage totally, razing its buildings, killing its inhabitants, and sowing its soil with salt so nothing would grow. The destruction at Hiroshima and Nagasaki caused by blast pressure and radiation had similar results. The difference between these events is that several Roman legions needed over two decades to cause such destruction, while a single B-29 needed only two seconds. It was this instantaneous destruction—this conquest of time, not of matter—that so affected the will of the Japanese people and the world in general. Indeed, it still does.

This point leads to an important insight regarding the effectiveness of airpower in low-intensity conflicts. Because guerrilla war is protracted war, by its very nature it is ill suited for airpower, denying it the ability to achieve decision quickly.[32] Campaigns like Rolling Thunder during the Vietnam War indicate that airpower is particularly ineffective when denied the opportunity to telescope time. In these instances, the limitations of airpower are magnified. Indeed, when robbed of the dimension of time, the psychological impact of airpower may be virtually negative.

6. Airpower Can Simultaneously Conduct Parallel Operations at All Levels of War

Whereas to shift the weight of effort on the ground from one point to another takes time, the flexibility inherent in Air Forces permits them without change of base to be switched from one objective to another in the theater of operations.

—Field Marshal Bernard Montgomery

The size of an army is usually determined by the size of the enemy's army (or that of the coalition arrayed against him), because the goal of the commander is to win the coun-

terforce battle. Once that goal is achieved—quite possibly after a long time and much expense—the army can be used for such things as occupation and administrative duties. But that is not its main purpose; in any event, police or other paramilitary forces can effectively conduct such tasks. On the other hand, the size of an air force is not so dependent on the size of the enemy air force because fighting the air battle is only one of the many missions that airpower can conduct. More importantly, these other missions—such as strategic attack against centers of gravity, interdiction operations, or close air support (CAS) of ground troops in combat—are of potentially greater significance and can be conducted contemporaneously with the air superiority campaign.

Parallel operations occur when different campaigns, against different targets and at different levels of war, are conducted simultaneously. Unlike surface forces that must generally fight sequentially and win the tactical battle before they can move on to operational or strategic objectives, air forces can fight separate campaigns at different levels of war. While carrying out the strategic mission of striking a country's armaments industry, for example, airpower is able to conduct an operational-level campaign to disrupt an enemy's transportation and supply system. Meanwhile, an air force may also be attacking an opponent's fielded forces at the tactical level.

This is precisely what occurred in Desert Storm. While F-117s, F-15s, F-111s, and Tornados struck Iraqi nuclear research facilities, oil refineries, and airfields, F/A-18s, F-16s, and Jaguars bombed rail yards and bridges in southern Iraq to reduce the flow of troops and supplies to the Iraqi army. At the same time, A-10s, AV-8s, and helicopters flew thousands of sorties against Iraqi troops and equipment in Kuwait. In sum, although one never refers to a tactical and strategic army or navy, one does talk of tactical and strategic air forces. It is of great significance that one can do so—a fact that acknowledges airpower's flexibility.

Similarly, airpower can concurrently conduct different types of air campaigns at the same level of war, such as an air superiority campaign and a strategic bombing campaign. Indeed, it may even implement a third or fourth separate strategic campaign, as was the case during World War II when Allied airpower bombed German industry and contested the Luftwaffe for air superiority over Europe, while simultaneously winning the Battle of the Atlantic against German submarines and choking off the reinforcements to Rommel's troops in North Africa.

Finally, and perhaps most importantly, airpower's speed and range allow it to strike targets across the entire depth and breadth of an enemy country. Aircraft do not have to disengage from one battle in order to move to another—an extremely risky and complicated maneuver for land forces. Having disengaged, aircraft do not have to traverse muddy roads, cross swollen rivers, or redirect supply lines in order to fight somewhere else. The Israeli Air Force provided an excellent example of this ability in the Yom Kippur War of 1973. The Israelis constantly shifted airpower from the Sinai front to the Golan Heights front and from interdiction to CAS. They were able to make these shifts on a daily basis over a period of several weeks.

Such parallel operations can also have parallel effects, presenting an enemy with multiple crises that occur so quickly he cannot respond effectively to any of them. The most devastating demonstration of this phenomenon occurred during the first two days of the Gulf War, when hundreds of coalition aircraft hit, among other targets, the Iraqi air defense system, electric power plants, nuclear research facilities, military headquarters, telecommunications towers, command bunkers, intelligence agencies, and a presidential palace. These attacks occurred so quickly and so powerfully against several of Iraq's centers of gravity that to a great extent the country was immobilized and the war decided in those first

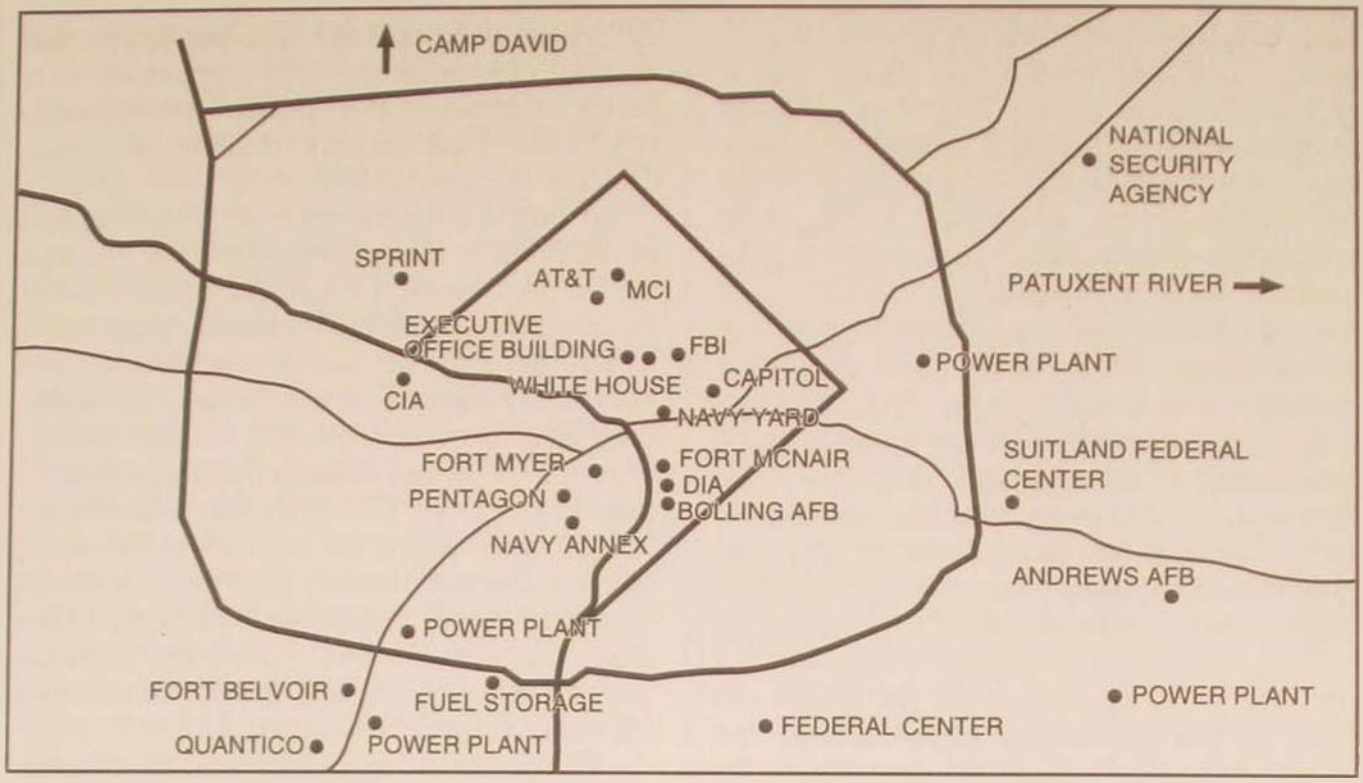


Figure 1. Hypothetical Parallel Attacks against Washington, D.C.

few hours. The Iraqi leadership found it extremely difficult to move troops and supplies, give orders, receive reports from the field, communicate with the people, operate radar sites, or plan and organize an effective defense—much less contemplate an offensive counterattack. Although some people questioned the worthiness of Iraq as an opponent, figure 1 demonstrates how similar parallel attacks would have looked against Washington, D.C. Could we have maintained our balance in the face of such an onslaught?

Bearing in mind the fact that the coalition simultaneously carried out air operations against Iraqi forces in Kuwait, one can appreciate the impact that parallel operations can have on an enemy. Such an effect represents the "brain warfare" envisioned by J. F. C. Fuller,[33] only at the strategic rather than the tactical or operational levels of war. Military commanders have long sought to paralyze an enemy rather than fight him—to sever his spinal column (the command structure) instead of grapple in hand-to-hand combat. Parallel air operations now offer this opportunity. Flexibility, a key attribute of airpower, is never more clearly illustrated than in the conduct of parallel operations.

7. Precision Air Weapons Have Redefined the Meaning of Mass

Of what use is decisive victory in battle if we bleed to death as a result of it?

—Sir Winston Churchill

Mass has long been considered one of the principles of war. In order to break through an enemy defense, one had to concentrate force and firepower at a particular point. As firearms became more lethal at greater ranges, beginning in the midnineteenth cen-

tury, defensive fortifications grew in importance. Defenses became so strong that it took increasingly greater firepower and mass to break through them.[34] Consequently, commanders were warned not to piecemeal or disperse their forces: attempting to be strong everywhere meant they would be strong nowhere. Mass dominated land warfare, and planners focused on how to improve means of transportation and communication to ensure that mass was available at the right place and time—before the enemy was aware of it. F. W. Lanchester's "N-squared law," which postulated that as quantitative superiority increased for one side, its loss rate correspondingly decreased by the square root, lent a modicum of scientific credence to this belief in mass.[35]

This principle also seemed to hold true for air war. Early operations of the Eighth Air Force in World War II resulted in high loss rates but had only a slight impact on the German war machine. The argument of Gen Ira Eaker, the Eighth's commander, was that his forces were not large enough. In order to ensure an effective strike yet at the same time provide defensive protection, bomber formations had to include at least 300 aircraft.[36] That figure proved low, however. German defenses were so formidable before the arrival of American escort planes that it took extremely large formations to ensure low casualty rates for the bombers—seemingly verifying Lanchester's "law" in practice.

Moreover, bombing accuracy was far less than expected, due partly to German defenses and deception and partly to abysmal weather. As a consequence, to destroy a target the size of a small house, one needed a force of 4,500 heavy bombers carrying a total of 9,000 tons of bombs.[37] Unfortunately, this process took time to neutralize a major system within a country. Taking down a single oil refinery required hundreds of bombers, but then the strike force would have to move to another target on the next mission. Because Allied aircraft had to hit hundreds of targets, each requiring a massive strike, the Germans were able to rebuild their facilities between attacks. In other words, the absence of precision forced airpower into a battle of attrition that relied on accumulative effects, essentially driving airpower down to the tactical level.

An outstanding example of this situation in World War II concerns Germany's Leuna oil refinery, an important facility protected by extremely powerful antiaircraft gun defenses as well as smoke-generating machines to hide the refinery from Allied bombardiers. As a consequence, only 2.2 percent of all bombs dropped on Leuna actually hit the refinery's production area. The Allies had to strike Leuna 22 times during the last year of the war to put it out of commission. As the US Strategic Bombing Survey concluded, dropping a few bombs accurately would have been far more effective than "string[ing] 500-lb. bombs over the whole target."[38] Exactly true!

The numbers regarding bomb accuracy changed over time. The Vietnam War saw the first extensive use of precision guided munitions (PGM) during the Linebacker campaigns of 1972; American aircraft were then able to demolish that proverbial "small house" with only 190 tons of bombs carried by 95 aircraft.[39] Desert Storm introduced an improvement in accuracy, combined with stealth technology, that allowed a remarkably low loss rate per sortie (less than .05 percent). Aircraft could thus safely hit more targets in a given time period (i.e., parallel operations were possible). Few people will forget the cockpit videos of laser-guided bombs flying down air vents and into bunker doorways. Only a small percentage of the total tonnage dropped was precision guided, and even these bombs sometimes missed their targets; nonetheless, when coalition aircraft used PGMs in suitable weather, our house now rated only one or two bombs and a single aircraft.[40] This combination of accuracy and stealth meant that aircraft could strike and neutralize targets quickly and safely.

The result of the trend towards "airshaft accuracy" in air war is a denigration in the importance of mass. PGMs provide den-

sity—mass per unit volume—which is a more efficient measurement of force. In short, targets are no longer massive, and neither are the aerial weapons used to neutralize them.[41]

One could argue that all targets are precision targets—even individual tanks, artillery pieces, or infantrymen. No logical reason exists for wasting bullets or bombs on empty air or dirt. Ideally, every shot fired should find its mark.[42] If this sort of accuracy and continued stealth protection are attainable on a routine basis, the political, economic, and logistics implications are great. One can threaten objectives—and attack them, if necessary—with little collateral damage or civilian casualties, at low cost and low risk since one needs so few aircraft. Accuracy and stealth also permit a vastly reduced supply tail: only a handful of cargo aircraft would have been necessary to supply all the PGMs needed each day during the Gulf War. But this fact may present air commanders with an unusual problem.

Because precision is possible, people will expect it. Air warfare has thus become highly politicized. Air commanders must be extremely careful to minimize civilian casualties and collateral damage. All bombs are becoming political bombs, and air commanders must be aware of this emerging constraint. For example, as a result of US strikes against Iraq during June 1993 in retaliation for an attempted assassination of former president George Bush, some European sources expressed concern because the cruise missiles used were "less than totally reliable." Eight Iraqi civilians were reportedly killed in the 30-missile strike, a number of casualties that some people considered excessive.[43] One can safely assume that the omnipresent eye of the Cable News Network camera will be an integral part of any future military operation. Hundreds of millions of people worldwide will judge the appropriateness of everything an air commander does.[44]

This reality must be factored into the decision process because in the future, airmen may have to wage war bloodlessly and delicately. The research in the area of nonlethal weapons is certainly a response to this trend. Although the ideal of bloodless war, sought by military leaders for centuries, has proven to be elusive, the quest continues.[45] Because of its intrinsically precise and discriminate nature (properties that are increasing), airpower may finally produce that coveted grail. At the same time, the evolving world situation indicates that America will become more involved in operations short of war, such as peacekeeping missions or humanitarian relief. The airdrop of food to Muslims in Bosnia is an example of this trend. These "food bomb" operations may become increasingly prevalent as our leaders turn to more peaceful applications of airpower to achieve political objectives.

8. Airpower's Unique Characteristics Require Centralized Control by Airmen

Air warfare cannot be separated into little packets; it knows no boundaries on land and sea other than those imposed by the radius of action of the aircraft; it is a unity and demands unity of command.

—Air Marshal Arthur Tedder

Gen Carl Spaatz once commented in exasperation that soldiers and sailors spoke solemnly about the years of experience that went into training a surface commander, thus making it impossible for outsiders to understand their arcane calling. Yet, they all felt capable of running an air force. That comment, echoed by American airmen for decades, was at the root of their calls for a separate air force.

Many early air theorists believed that airpower would never be able to grow and reach its true potential if it were dominated by surface officers. The use of airpower was so unlike traditional warfare that officers raised in the Army and Navy would have difficulty understanding it. (Obviously, the task

was not insurmountable; virtually all the early airmen began their careers as soldiers and sailors.) On a more practical level, the question of who controlled airpower became an administrative one. If the Air Force were subservient to the other services, then those services would determine such things as organization, doctrine, force structure, and manning. The American Army Air Service, for example, was commanded by nonaviators, divided up and attached to individual surface units, told what types of aircraft to procure and what missions to fly with those aircraft, and informed by nonflyers which airmen would be promoted and which would not. To say that airmen believed such a setup stifled their potential would be an understatement. For fundamental bureaucratic reasons, airmen wanted a separate service. At a higher level of abstraction, they also believed that airpower was most effective when commanded by an airman who understood its unique characteristics.

Surface warfare is largely a linear affair defined by terrain and figures on a map. Although the modern battle space has expanded dramatically, ground forces still have a primarily tactical focus and tend to be concerned primarily with an enemy or obstacles to their immediate front. Certainly, ground commanders worry about events beyond their immediate reach, but when operations move at an average of a few miles each day, such concerns are long term. New weapons have extended the range that armies can strike and have subsequently expanded their area of concern; nonetheless, this extension is slight, relative to airpower. An airplane can deliver several tons of ordnance in a few minutes at a distance of hundreds of miles, and this ability requires that one think in operational- and strategic-level terms.

Airmen must take a broader view of war because the weapons they command have effects at broader levels of war. Space-based assets, as well as airborne systems such as the airborne warning and control system (AWACS) and the joint surveillance and target attack radar system (JSTARS), help provide a theater-wide perspective. Moreover, Desert Storm was truly a global air war—the first of its kind—with personnel all over the world playing direct roles. For example, space operators in Cheyenne Mountain, Colorado, detected and tracked Iraqi Scud launches and then relayed that information to Patriot batteries in Saudi Arabia. Similarly, B-52s launched from air bases in Louisiana flew nonstop to bomb targets in Iraq. Finally, airlifters flew dozens of missions each day from the United States to the Middle East to deliver supplies and personnel.

Airmen fear that if surface commanders controlled airpower, they would divide it to support their own operations to the detriment of the overall theater campaign. However, in a typical campaign, operations ebb and flow; at times one sector is heavily engaged or maneuvering, while at other times it is static and quiescent—and this status is often determined by the enemy. As a result, if airpower is parceled out, it may be sitting idle in one location while flying continuously in another. Although this is also true of ground units, they generally have only a limited ability to assist their comrades on another part of the front. Airpower can quickly intervene over an entire theater, regardless of whether it is used for strategic or tactical purposes. To mete it out to different surface commanders would make virtually impossible the rapid and efficient shifting of airpower from one area in the theater to another to maximize its effectiveness.

To airmen, the necessity of centralized control has been amply demonstrated. Since World War I, one has witnessed an inexorable move towards greater centralized control of airpower as aircraft have achieved greater range and firepower. Initially, all air forces were controlled by tactical surface commanders; today, virtually all of the world's air forces are independent. Several examples illustrate this trend. In the North African campaign of 1942, the RAF was divided into packages and controlled by ground com-

manders. The results were disastrous and led to fundamental doctrinal changes.[46] On the other hand, the air campaigns of Gen George Kenney in the Southwest Pacific and those of Gen Hoyt Vandenberg in Europe demonstrated an extremely effective use of air assets at the theater level. Korea was another negative example, with Air Force and Navy air assets fighting separate wars with little coordination. Vietnam saw this situation repeated—although the Air Force itself violated the principle of centralized control of air assets. Due to struggles within the service, Seventh Air Force in South Vietnam fought the air war in-country, Thirteenth Air Force directed air operations in Thailand, and Strategic Air Command fought yet another campaign with its B-52 strikes.

In Desert Storm, things finally came together. Gen H. Norman Schwarzkopf selected Gen Charles Horner to be his joint force air component commander (JFACC). As JFACC, Horner controlled all fixed-wing assets in-theater, including those of other coalition countries. The synergies gained from diverse air forces working together as a team with one commander to focus their efforts played a major role in victory. During this combat test, the JFACC concept worked; for that reason, it will be the organizational option of choice in the future. This is especially important because future conflicts may not have the overwhelming air assets available that were present in Desert Storm. In such instances, tough decisions regarding prioritization will have to be made by people who understand airpower.

9. Technology and Airpower Are Integrally and Synergistically Related

Science is in the saddle. Science is the dictator, whether we like it or not. Science runs ahead of both politics and military affairs. Science evolves new conditions to which institutions must be adapted. Let us keep our science dry.

—Gen Carl M. Spaatz

Gen Carl Spaatz once commented in exasperation that soldiers and sailors spoke solemnly about the years of experience that went into training a surface commander, thus making it impossible for outsiders to understand their arcane calling. Yet, they all felt capable of running an air force. That comment, echoed by American airmen for decades, was at the root of their calls for a separate air force.

A recent US Army pamphlet states that people—not technology—have always been and will always be the dominant force in war: "War is a matter of heart and will first; weaponry and technology second."[47] The centrality of the infantryman and his rifle is a recurring theme in the Army's culture. Because this vision depreciates the importance of technology, most airmen do not subscribe to it.

Airpower is the result of technology. People have been able to fight with their hands or simple implements and sail on water using wind or muscle power for millennia, but flight required advanced technology. As a consequence of this immutable fact, airpower has enjoyed a synergistic relationship with technology not common to surface forces, and this is part of the airman's culture.[48] Airpower depends upon the most advanced developments in aerodynamics, electronics, metallurgy, and computer technology. When one considers the space aspects of airpower, this reliance on technology becomes even more obvious. One has only to look at how land warfare has advanced this century; the evolution of machine guns, tanks, and artillery has proceeded at a fairly steady pace. Certainly, that pace has been more rapid than in any other comparable time period, but it pales in comparison to the advance in airpower from Kitty Hawk to the space shuttle.

More importantly, the United States has achieved a formidable dominance in this area. We Americans have a tendency to adopt technological solutions to problems, evidenced in our approach to war.[49] Consequently, we have developed the most technologically advanced military in the world. With some exceptions, our equipment in all branches is unmatched. Indeed, in some areas, our dominance is so profound that few countries even choose to compete with us, and this superiority is especially true in airpower. Iraq simply refused the challenge; it seldom rose to contest coalition fighters, and after two weeks, its planes began fleeing to Iran to escape destruction. Similarly, only the former Soviet Union was able to approach us in the size of strategic airlift and in-flight refueling forces, and those capabilities have rapidly atrophied after the empire's dissolution.

The size and sophistication of American airpower relative to the rest of the world is, at present, staggering. A recent RAND study found that the US has more F-15s in its inventory than the rest of the world (excluding our allies and the former Soviet Union) has front-line combat aircraft combined. Considering that air forces require a level of technology and economic investment that only the richest or most advanced nations can afford, we can expect this favorable balance to continue.[50] Finally, no country can duplicate American space infrastructure, which has so revolutionized reconnaissance, surveillance, and communications functions. Today, only the United States can project power globally, and that is a fact of enormous significance.

Surprises always occur, but this technological edge is not likely to change significantly over the next few decades. Although the US defense budget is severely shrinking in the aftermath of the cold war, that of Russia has been slashed far more, totaling barely one-sixth that of the US.[51] Similarly, when one considers the aeronautical research and development (R&D) base, the United States has more than twice as many wind tunnels, jet and rocket-engine test facilities, space chambers, and ballistic ranges than the rest of the world combined; at the same time, it is able to maintain a qualitative edge. One must note, however, that this superiority is shrinking as countries in Europe and Asia are accelerating their own aerospace industries. We must guard against complacency.[52]

Some people argue that warfare is presently experiencing a military-technical revolution (MTR), and that this is the third such MTR in history. The first was the invention of gunpowder, and the second the explosion of the late nineteenth and early twentieth centuries, which resulted in the railroad, machine gun, aircraft, and submarine. John Warden goes farther, acknowledging the existence of the present MTR but arguing that it is actually the first such event.[53] He maintains that the current leap in technology is so profound that it makes prior changes appear as minor evolutionary steps. Regardless of whether this MTR is the first or third, airpower is the most affected asset because advancing technologies in

space, computers, electronics, low-observable weapons, and information systems will enhance those services that rely on technology to decide the issue of war.

10. Airpower Includes Not Only Military Assets, but Aerospace Industry and Commercial Aviation

With us air people, the future of our nation is indissolubly bound up in the development of airpower.

—Gen Billy Mitchell

A collection of airplanes does not equal airpower, a fact realized by almost all theorists. As early as 1921, Mitchell wrote about the importance of a strong civil aviation industry, the role of government in building that industry, and the importance of instilling an "airmindedness" in the people.[54] His later writings made these points even more emphatically. Similar sentiments were echoed by de Seversky and, most recently, by air leaders who spoke of the United States—the inventor of the airplane—as an "aerospace nation."[55] The vast size of the United States and the need to connect the east and west coasts—indeed, Alaska and Hawaii—demanded a rapid, reliable, and cost-effective method of transportation. The development of various airline companies—still the largest and most financially powerful in the world—was a direct result of American geography and the need it engendered.

Recognizing such economic and cultural imperatives, men like Mitchell and de Seversky stressed that airpower was far more than just airplanes. As discussed above, the technology required to develop first-rate military aircraft was so enormous, complex, and expensive, it was essential that government and business play active roles. In the early years, this involvement equated to government subsidy of airports, airway structures, location beacons, weather stations, and support for R&D. The investment required for this new industrial field was simply too great for businesses to handle on their own.

Many theorists also assumed that military and commercial aircraft would have similar characteristics and thus would enjoy a symbiotic design relationship. Douhet and de Seversky, for example, noted the feasibility of converting civilian airliners into military bombers or cargo aircraft.[56] More importantly, the skills needed to build, maintain, and pilot these aircraft were also similar. Theorists saw a close relationship developing in aviation that would produce a pool of trained personnel who passed back and forth between the military and civilian sectors—mechanics, pilots, navigators, air traffic controllers, and so forth. In essence, an interdependence existed between the two sectors that was not present in armies or even navies. The capability of an armored force, for example, did not rely on the automobile industry or the teamsters union to the same degree an air force was dependent on the aircraft industry and airline pilots associations.

More importantly, the quality of this aerospace complex is crucial. If transportation is indeed the essence of civilization, then aviation is the one industry in which America must remain dominant. The United States has often been in the forefront of emerging technologies—railroads, shipbuilding, automobiles, electronics, and computers—only to later retreat from the field, leaving it to competitors. We cannot afford to do that in the air and space. Although the current status is favorable, we must avoid negative trends.

Aerospace industry sales topped $140 billion in 1991. The world's airlines overwhelmingly fly American airframes. Although the European Airbus has been able to maintain a world market share of about 15–20 percent in the large commercial jet category, the remaining 80 percent belongs to Boeing and Douglas. Moreover, the new Boeing 777, has already garnered nearly 150 orders from airlines worldwide (coincidentally, 80 percent

of the market).[57] Internally, this dominance means the aerospace industry has a percentage value of the US gross national product behind only agriculture and automobiles. Consequently, aerospace has a trade surplus of over $30 billion in 1991, ahead of the traditional leader—agriculture—by a wide margin. At the same time, the number of air passengers continues to rise, as does the value and weight of air cargo. In addition, approximately 1 million people are employed in the American aerospace industry, making it the 10th largest in the country.[58] All this progress comes at a time when railroads are in decline and when our commercial shipbuilding industry has all but disappeared.

These figures translate into an extremely powerful and lucrative aerospace industry dominated by the United States. As already noted, the superiority of American military air and space assets is even more profound than in the commercial sector. No country in the world can rival us in the size, capability, diversity, and quality of our air and space forces.[59] Unfortunately, this dominance may be in danger as a result of massive downsizing after our victory in the cold war. One source states that the US is falling behind Europe and Japan in the race to maintain primacy in satellite communications. One must take pains to remember that American dominance in air and space is not automatic but must be constantly reasserted.[60]

Finally, the theorists urged that Americans think of themselves as an airpower nation in the way generations of Englishmen had considered themselves a maritime nation. They must see their destiny in the air and in the space. To a great degree, this perception may already be in place. It is perhaps not just the allure of special effects that has made movies like *Star Trek, Star Wars, The Right Stuff, Top Gun,* and others of that genre so popular in America.[61] In a very real sense, airpower is a state of mind.

These, then, are my 10 propositions regarding airpower. Most have an "ancient" pedigree: Douhet, Mitchell, Trenchard, and others from aviation's earliest years understood and articulated them. Others were mere prophecies and needed a trial in war to determine their veracity. In some cases, such as the proposition regarding the link between targeting and intelligence and the one dealing with centralized control, they had to be tried and tested in several wars before they were understood. Other propositions, such as the one regarding the importance of precision, are just beginning to show their significance and await future conflicts to prove their correctness beyond doubt.

Nonetheless, these propositions in their totality show airpower to be a revolutionary force that has transformed war in less than a century. The fundamental nature of war—how it is fought, where it is fought, and by whom it is fought—has been altered. An unfortunate characteristic of air theorists is that they long promised more than their chosen instrument could deliver. Theory outran technology, and airmen too often were in the untenable position of trying to schedule inventions to fulfill their predictions.[62] It appears that those days are now past. Airpower has passed through its childhood and adolescence, and the wars of the past decade—especially in the Persian Gulf—have shown it has now reached maturity. □

Notes

1. Svi Lanir, "The 'Principles of War' and Military Thinking," *Journal of Strategic Studies* 16 (March 1993): 1–17.

2. Renato D'Orlando, trans., *The Origin of Air Warfare,* 2d ed. (Rome: Historical Office of the Italian Air Force, 1961), passim.

3. Giulio Douhet, *The Command of the Air,* trans. Dino Ferrari (1942; reprint, Washington, D.C.: Office of Air Force History, 1983), 25.

4. Col John A. Warden III, *The Air Campaign: Planning for*

Combat (New York: Pergamon-Brassey's, 1989), 10. He later implies that this statement may not necessarily be true in low-intensity conflict.

5. This does not apply, of course, to the new threat of ballistic missiles. Iraqi Scuds were a major menace in the Gulf War, and this threat will no doubt continue to grow in the years ahead.

6. The classic work on the evolution of the aircraft carrier and naval air doctrine is Clark G. Reynolds's, *The Fast Carriers: Forging an Air Navy* (New York: McGraw-Hill, 1968).

7. Martin Blumenson, "A Deaf Ear to Clausewitz: Allied Operational Objectives in World War II," *Parameters* 23, no. 2 (Summer 1993): 16. Napoléon commented that European generals saw too many things, whereas he saw only one thing—the enemy army.

8. For a grimly pessimistic view regarding the inherently indecisive nature of land warfare, in any age, see Russell Weigley, *The Age of Battles: The Quest for Decisive Warfare from Breitenfeld to Waterloo* (Bloomington, Ind.: Indiana University Press, 1991).

9. Mancur Olson, Jr., in *The Economics of the Wartime Shortages: A History of British Food Supplies in the Napoleonic War and in World War I and World War II* (Durham, N.C.: Duke University Press, 1963), argues that Napoleonic and later German attempts in two world wars to starve Britain into submission were failures and never came close to success. On the other hand, naval embargoes can cause great hardship if imposed for a long period of time, as against Iraq since August 1990. Youssef M. Ibrahim, "Iraq Is Near Economic Ruin but Hussein Appears Secure," *New York Times,* 25 October 1994, 1.

10. For the airpower advocates, see Adm U. S. G. Sharp, *Strategy for Defeat: Vietnam in Retrospect* (San Rafael, Calif.: Presidio Press, 1978); and Gen William Momyer, *Airpower in Three Wars* (Washington, D.C.: Government Printing Office, 1978). For the opposing view, see Maj Mark Clodfelter, *The Limits of Air Power: The American Bombing of North Vietnam* (New York: Free Press, 1989).

11. Sun-Tzu, *The Art of War,* trans. Roger T. Ames (New York: Ballantine Books, 1993), 115.

12. H. G. Wells, *The War in the Air* (London: George Bell, 1908), 247–48.

13. A typical example used by early airmen was the London air defenses of 1918, which included over 600 aircraft to counter a German bomber force of approximately 40 planes. Squadron Ldr J. C. Slessor, "The Development of the Royal Air Force," *RUSI* (Royal United Services Institute for Defense Studies) *Journal* 76 (May 1931): 328.

14. This is an interesting instance of airpower's unique strength also being a weakness: aircraft generally "get through" because aircraft on the defensive lack "stopping power." Precisely because ground defenders can dig in and hold their position, they can repel an attack; aircraft cannot.

15. The Battle of Britain remains the major notable exception. Partial victories for the defense might include the retreat to night operations by Royal Air Force (RAF) Bomber Command to escape German defenses and the temporary lull in American bombing operations in fall 1943 after severe losses in daylight strikes.

16. The most notable exception to this principle occurred during the Battle of Britain, when the RAF withheld a large portion of its forces from the air battle. However, the RAF did not withhold for the traditional reasons of reserve employment or to exploit or plug, but to husband scarce resources of men and planes. Had the RAF been equal to the Luftwaffe in numbers and had it possessed a ready supply of reinforcements, it would have gained little by holding back its forces. For a contrary view on the desirability of an air reserve, see Warden, 115–27.

17. As one airman put it, one should consider an air reserve while the battle for air superiority is still raging; after achieving air superiority, the need for a reserve loses its rationale. Group Capt Gary Waters, Royal Australian Air Force (RAAF), to the author, letter, subject: Air Reserves, 26 July 1993.

18. Douhet, 50.

19. Maj Gen Don Wilson, "Origins of a Theory of Air Strategy," *Aerospace Historian* 18 (Spring 1971): 19–25.

20. One should not take Slessor out of context. *Air Power and Armies* was a collection of lectures he presented while an instructor at the British Army Staff College in the early 1930s. Given his audience, he was forced to address airpower in the context of a land campaign. Nonetheless, he reminded his readers that the primary role of airpower was to conduct strategic bombing operations against an enemy's centers of gravity. Wing Comdr John C. Slessor, *Air Power and Armies* (London: Oxford University Press, 1936), 3.

21. Col John A. Warden III, "Employing Air Power in the Twenty-first Century," in Richard H. Shultz, Jr., and Robert L. Pfaltzgraff, Jr., eds., *The Future of Air Power in the Aftermath of the Gulf War* (Maxwell AFB, Ala.: Air University Press, July 1992), 65.

22. Brig Gen William L. Mitchell, *Our Air Force: The Keystone of National Defense* (New York: Dutton, 1921), 15.

23. Interestingly, not only have most air theorists had a single, key target theory, but they have also been surprisingly prescriptive: their target is the key in all types of wars, in all types of situations, and against all types of opponents.

24. David Albright and Mark Hibbs, "Iraq's Bomb: Blueprints and Artifacts," *Bulletin of the Atomic Scientists,* January–February 1992, 30–40.

25. For an overview of the origins of this subject, see Robert F. Futrell, "U.S. Army Air Forces Intelligence in the Second World War," in Horst Boog, ed., *The Conduct of the Air War in the Second World War* (New York: Berg, 1992), 527–52.

26. John Arquilla and David Ronfeldt, "Cyberwar Is Coming!" *Comparative Strategy* 12 (April–June 1993): 143. In this interesting article, the authors argue that "netwar" and "cyberwar"—the attack on a country's information and communications systems—will be the dominant features of future wars.

27. I observed this example when I worked on the Air Staff in the Pentagon during the Gulf War. For an excellent critique of BDA in the Gulf War, see Lt Col Kevin W. Smith, *Cockpit Video: A Low-Cost BDA Source,* Research Report no. AU-ARI-93-1 (Maxwell AFB, Ala.: Air University Press, December 1993).

28. Gulf War Air Power Survey, *Effects and Effectiveness Report,* vol. 2 (Washington, D.C.: Government Printing Office, 1993), 303.

29. Lt Col Jason Barlow, a former student at the School of Advanced Airpower Studies, suggested this subject to me. His seminal master's thesis, *Strategic Paralysis: An Airpower Theory for the Present* (Maxwell AFB, Ala.: Air University Press, February 1994), first raised my consciousness to the symbiotic relationship between centers of gravity and the best ways of affecting that relationship.

30. Robert L. Helmhold, *Rates of Advance in Historical Land Operations* (Bethesda, Md.: US Army Concepts and Analysis Agency, June 1990), 1–9.

31. John Boyd has remained a somewhat legendary figure among a small coterie of American military officers. He has never published his theories but relies on lengthy briefings that include dozens, if not hundreds, of slides. For a good discussion, see Maj David S. Fadok, *John Boyd and John Warden: Air Power's Quest for Strategic Paralysis* (Maxwell AFB, Ala.: Air University Press, February 1995).

32. For an excellent discussion, see Col Dennis M. Drew, *Insurgency and Counterinsurgency: American Military Dilemmas and*

Doctrinal Proposals, CADRE Paper no. AU-ARI-CP-88-1 (Maxwell AFB, Ala.: Air University Press, March 1988), 39–40.

33. J. F. C. Fuller, *The Reformation of War* (New York: Dutton, 1923), 48–50.

34. At the Third Battle of Ypres (1917), the preliminary British artillery bombardment consisted of 4,283,550 shells, costing $110 million, weighing 107,000 tons, and requiring 35,666 truckloads to transport them from the railhead to the battlefield. Maj Gen J. F. C. Fuller, *Machine Warfare* (Washington, D.C.: *Infantry Journal* Press, 1943), 17.

35. F. W. Lanchester, *Aircraft in Warfare: The Dawn of the Fourth Arm* (London: Constable, 1916), 39–65.

36. James Parton, *"Air Force Spoken Here": General Ira Eaker and the Command of the Air* (New York: Adler & Adler, 1986), 290.

37. Gen Michael Dugan, "The Air War," *U.S. News & World Report,* 11 February 1991, 27.

38. US Strategic Bombing Survey, "Oil Division: Leuna," report no. 115, 1946, 51.

39. Dugan, 27.

40. Ibid.; and Richard P. Hallion, *Storm over Iraq: Air Power and the Gulf War* (Washington, D.C.: Smithsonian Institution Press, 1992), 303–7. The potential downside of this situation is that one terrorist with a satchel charge could not have eliminated 4,500 bombers, as is presently the danger with a single aircraft.

41. One should note that stealthy effects can also be generated by speed (e.g., a ballistic missile with 15-meter accuracy, such as the Soviet SS-21). Such missiles are, of course, limited by their expense and nonreusable nature.

42. An alternative view: the psychological effect of bombing is so devastating that even a miss can have a great impact. Take for example the story of the Iraqi troop commander who, when asked why he surrendered, replied that he did so because of the B-52 strikes. When someone pointed out that his division had never been attacked by B-52s, he responded that that was true, but he had seen a division that had been hit by B-52s. Hallion, 218.

43. Francis Tusa and Glenn W. Goodman, Jr., "Who Benefits from Baghdad Bashing?" *Armed Forces Journal International* 131, no. 1 (August 1993): 10. One should also note that countermeasures to at least some types of precision weapons may exist. Miniature jammers that reportedly can disrupt the signals of global positioning system (GPS) guidance systems have been developed and would be easy to mass-produce. John G. Ross, "A Pair of Achilles Heels," *Armed Forces Journal International,* November 1994, 21–23.

44. For an excellent discussion of this issue, see Lt Col Marc Felman, *The Military/Media Clash and the New Principle of War: Media Spin* (Maxwell AFB, Ala.: Air University Press, June 1993). In addition, the US Army's new doctrine manual emphasizes the importance of the media in shaping military operations. Field Manual (FM) 100-5, *Operations,* June 1993, 3–11.

45. Lt Col Alan W. Debban, "Disabling Systems: War-Fighting Option for the Future," *Airpower Journal* 7, no. 1 (Spring 1993): 44–50; Mary C. Fitzgerald, "The Russian Image of Future War," *Comparative Strategy* 13 (Summer 1994): 167–80. On the other hand, one study argues that the American public has more often called for stern action against an enemy when casualties mount. Thus, an enemy who tries to shed American blood in the hope it will break public will has generally provoked the opposite response. Benjamin C. Schwarz, "The Influence of Public Opinion Regarding Casualties on American Military Intervention: Implications for U.S. Regional Deterrence Strategies," draft, RAND, Santa Monica, Calif., 1993.

46. Vincent Orange, *Coningham* (London: Methuen, 1990), 132–37.

47. Gen Gordon R. Sullivan and Lt Col James M. Dubik, *Land Warfare in the 21st Century* (Carlisle Barracks, Pa.: Strategic Studies Institute, February 1993), 27.

48. To illustrate, when one visits an Air Force museum, the emphasis is on aircraft and weaponry displays; at an Army museum, the focus is on people, uniforms, and personal armament and equipment. For an excellent discussion of these cultural differences, see Carl H. Builder, *The Masks of War: American Military Styles in Strategy and Analysis* (Baltimore: Johns Hopkins University Press, 1989).

49. Russell Weigley, in *The American Way of War* (New York: Macmillan, 1973), advances this thesis most strongly.

50. Christopher J. Bowie et al., *Trends in the Global Balance of Airpower,* RAND Report MR-478/1-AF (Santa Monica, Calif.: RAND, 1995), 2, 49. This fact is especially compelling when one notes that the F-15 is 95-0 in air-to-air combat engagements.

51. In 1992 the US defense budget was $242.7 billion; Russia's total that year was $39.6 billion. Other major countries and their defense budgets (in billions of dollars) in 1992: China—$22.3, France—$21.8, United Kingdom—$20.7, Germany—$19.2, Japan—$16.9, Saudi Arabia—$14.5, Italy—$10.6, and Kuwait—$10.1. (All figures in 1985 dollars, using International Monetary Fund [IMF] exchange rates.) International Institute for Strategic Studies, *The Military Balance, 1993-1994* (London: Brassey's, 1993), 224.

52. "An Aerospace Challenge and the Path toward a New Horizon," Arnold Engineering Development Center paper and briefing, June 1993.

53. Col John A. Warden III, to Paul Wolfowitz, letter, subject: Comments on Study by Col Andy Krepinevich ("The Military-Technical Revolution" [Washington, D.C.: Office of the Secretary of Defense, August 1992]), ca. September 1992.

54. Mitchell, 143–58, 199–216.

55. Alexander P. de Seversky, *Victory through Air Power* (New York: Simon & Schuster, 1942), 329; and Donald B. Rice, *The Air Force and U.S. National Security: Global Reach—Global Power* (Washington, D.C.: Department of the Air Force, June 1990), 15.

56. Douhet, 124; and de Seversky, 296.

57. Harvey Elliot, "America Takes Over the Skies," *London Times,* 10 January 1994, 21.

58. All of these statistics come from James W. Chung, "Whither the U.S. Aerospace Industry?" *Breakthroughs,* Winter 1992–1993, 12–18.

59. The emerging dominance of airpower within American military strategy is covered in Col Dennis M. Drew, "We Are an Aerospace Nation," *Air Force,* November 1990, 32–36.

60. "Panel Says U.S. Losing Race for Next Generation Satellite Communications," *Aerospace Daily,* 30 July 1993, 168–69. For a good discussion, see Maj Steven Wright, *Aerospace Strategy for the Aerospace Nation* (Maxwell AFB, Ala.: Air University Press, August 1994).

61. For an excellent overview of the connection between aviation and American culture, see Robert Wohl, "Republic of the Air," *Wilson Quarterly* 17 (Spring 1993): 107–17.

62. Precisely the opposite may be said of military space operations, whose technology has far outpaced any coherent doctrine on how to employ space systems effectively.

Twelve Principles
continued from page 51

Table 1

Twelve Principles Emerging from *10 Propositions Regarding Air Power*

0.	A proposition is an assertion, not a proof or a truth.
1.	Control the heights or pay the price.
2.	Airpower can be a peculiarly "strategic" force.
3.	Strike the enemy to create opportunities.
4.	Airpower is about applying force to nodes, processes, webs, intersections, and unions.
5.	Enemies are bound to be resilient.
6.	Combined arms aim at convergent effects.
7.	Mass is concentrated force.
8.	The object of force application determines the form of force control.
9.	The informed application of superior technology can vitiate the enemy.
10.	Technology is unconfinable.
+1.	Effective integration can produce superior force.

with the combat deaths of tens of thousands of airmen. Thus, in the real world and in the world of logic, a proposition occupies roughly the same place as a political campaign promise in the universe of fact and truth.

It is honest to call a thing by its correct name. In the case of *10 Propositions Regarding Air Power,* one concludes that the word *proposition* is both accurate and descriptive. It is also a useful disclaimer, because what follows in some of *10 Propositions* cannot be proven or defended easily. While that logic obviously excuses those people who offer contrary propositions, it ill protects those who dare offer "principles." A principle, unlike a proposition, is an assertion of truth. Airmen—given both proposals and cold, hard facts—can make their own choices. This critique aims at distilling the propositions to their underlying, unarguable truths by modifying or refining what *10 Propositions* provides.

The first thing that requires refinement is the proposition that "generally" air control equates to surface control. Humans live on the earth. The land, even in the "Third Wave," is our home. Our terrestrial home remains the seat of purpose. Our government resides on the land. Our children are reared on the land. We cannot dwell on the sea, in air, or in space except at intervals. We can only transit these other media. We have always had and likely will always have ground combat because the ground is so dear to us. Armies are important because the land remains important. Naval forces and air forces ultimately serve to help control and defend the land. Land forces secure and protect both naval ports and air bases, the Achilles' heels of sea power and airpower. For US forces, land forces also provide air defense artillery. Control of portions of space, slices of air, and segments of sea are important primarily because these media abut the land that is our home. Yet, controlling these other media, in and of themselves, is not sufficient for controlling the land. We "generally" controlled the air in Europe, Japan, Korea, Vietnam, and Iraq. Yet, only the ground forces could wrest the kind of control that historically counted most. Control of the land "generally" or often requires seizing it from the opposing ground forces.

During World War II—and for a variety of reasons—German production increased as Allied bombing increased. During the Gulf War, the Iraqi government did not alter its war aims until ground forces came pouring toward Baghdad. Controlling the air did not evict Iraq from Kuwait, although it certainly helped set the stage for Iraq's hasty retreat as our fierce coalition soldiers and US marines pressed the attack. "Generally," we control the air over Iraq and Bosnia today. Generally, that control is not wholly relevant. A failure to understand the relevance of the land (or the sea) can lead to other muddled assertions and unnecessary squabbles with our land and naval partners. For example, to call the air control over parts of Iraq and parts of the former Yugoslavia an "air occupation" is to use imprecise language to pro-

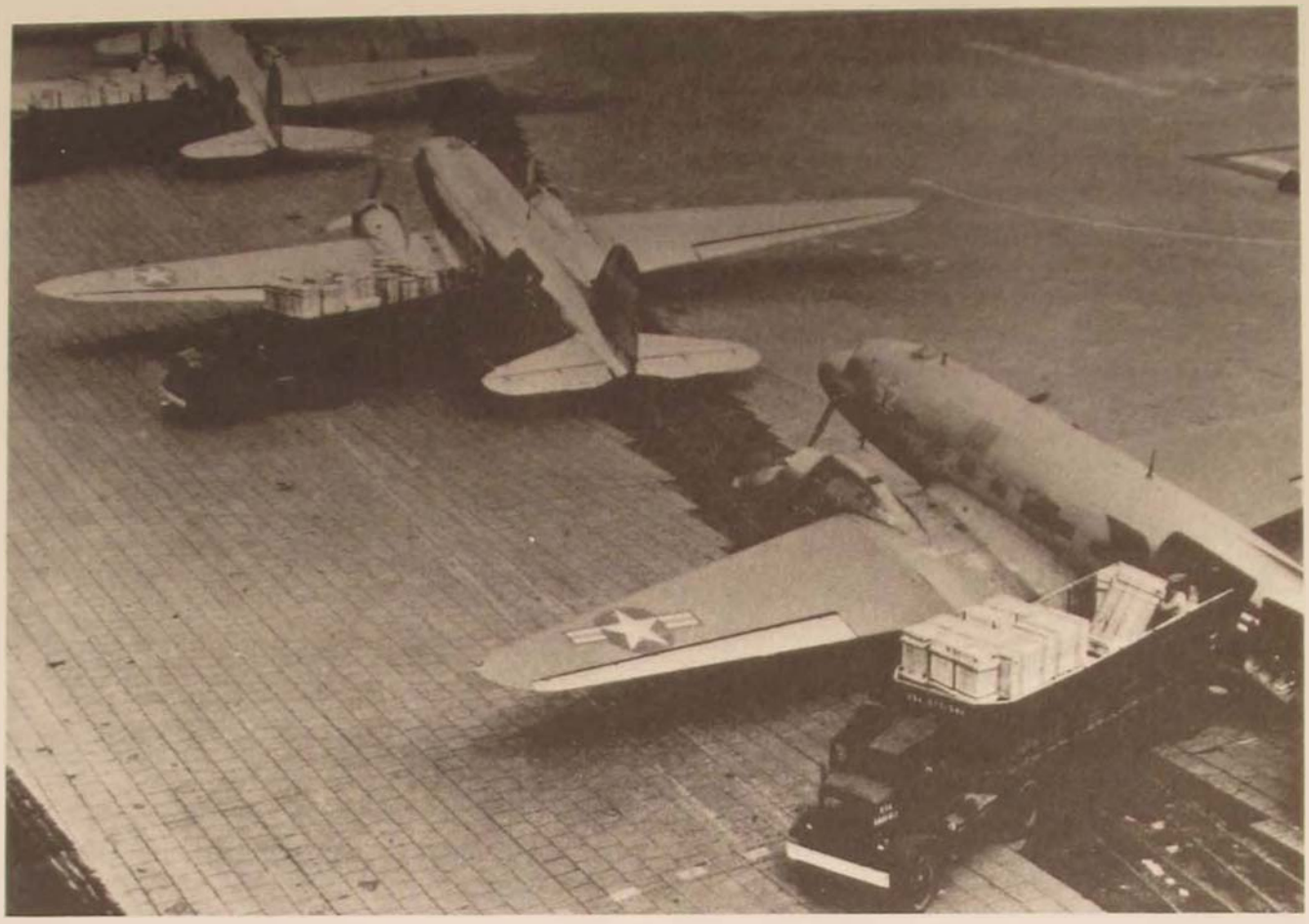
duce incredulity. It is to the author's great credit that he does not make such an assertion. But it is both correct and relevant to assert, as he does, that "in reality, the attainment of air superiority has not yet brought a country to its knees" (page 54, this edition). The author's quest for balance, here and throughout, manifests both reasonableness and praiseworthy scholarship.

Even so, airmen should understand and can assert that air and space power can swing the balance, because **failure to control the heights can impose extraordinarily dear penalties on people forced to operate on the land and the sea.** An adversary's air and space forces, if they control the right elevations of air and slices of space, can force us to pay a heavy price for operating beneath this umbrella of control. We might still meet our objectives, but doing so will assuredly cost us considerably more blood and treasure. The record on that is irrefutable. Air and space power are, as Gen Ronald R. Fogleman, Air Force chief of staff, frequently reminds us, "an economy-of-force force." Forces operating to control the air, space, and sea work in combination with those on the land to meet our objectives at an overall reduction in the real costs of warfare—*if* they are employed properly.

"Generally," we control the air over Iraq and Bosnia today. Generally, that control is not wholly relevant.

It is doubtful that anything is "inherently" strategic—aircraft, spacecraft, airpower, and space power included. Rather, everything seems to depend on purpose, objective, and use. **Air and space power can be a peculiarly "strategic" force,** but they do not constitute an inherently strategic force. To say that airpower is "inherently strategic" and that "aircraft can routinely conduct operations that achieve strategic level effects" (pages 54–55) may be to misunderstand "strategy" and to use this misunderstanding to make a set of overly ambitious assertions. There is nothing "routine" about strategic operations. The only support the historical record provides would force us to substitute "ground armies" for "aircraft," if accuracy and not exhortation were the goal. The history surrounding the Berlin airlift—described by the author as "a demonstration of air power's peaceful application" and a "strategic victory" that was "achieved without firing a shot" (page 55)—overlooks some of the facts. It fails to appreciate that the airlift continued because US resolve was punctuated by ground forces, naval forces, and nuclear forces that were at increased levels of attack readiness. The airlift was not explicitly violent, but the tacit violence waiting in the wings was awesome. Could it not have been the allied solidarity, the armies in Western Europe, the armadas of ships, the bombers moved to the periphery of the old Soviet Union, and the fighter escort in the air corridors—not just the C-47s—that helped enable the strategic victory? Thus, it was not the airlift itself that produced the strategic effects, but the whole employment of air, sea, and land power to underscore US and allied resolve. The airlift was only the more visible manifestation. The airlift truly was an operational success, but as a strategic success, it was not so much an Air Force feat as it was a United States and allied one.

To say that "basically, air power delivers strategic information" and to call bombs "negative" information and food "positive" information (page 55) is to employ a very private and idiosyncratic logic and lexicon. Later in the piece, the positive information—food—is portrayed using the negative example: "food bomb" (page 65). This kind of stuff is too coy or silly to encourage airmen to emulate it. Rather, those airmen who understand that air and space power, properly employed, can be peculiarly strategic in effect, take away the right lesson. Air can have peculiarly



During the Berlin airlift, C-47s flew thousands of tons of food, coal, and other supplies daily to the western sectors of Berlin. However, to call the airlift an example of airpower's peaceful application and a "strategic victory" that was "achieved without firing a shot" simply overlooks some of the facts. The airlift was not explicitly violent, but the tacit violence waiting in the wings was awesome. Could it not have been the vast armada of allied ships, fighter escorts, and bombers moved to the periphery of the old Soviet Union that helped enable the strategic victory?

strategic effects because it can range far and wide, deliver all kinds of helpful and hateful commodities, attack from unexpected axes, terrorize the enemy, flatten the enemy's statehouses, fracture the enemy's formations, badly hurt or destroy war-supporting industry, support the friendly invasion, or rapidly blunt the enemy one. Properly and precisely employed, the effects of air can be peculiarly strategic. That, I believe or hope, is what the author meant to say.

Does air produce *strategic paralysis?* The term sounds lofty and powerful, but the bald truth is that a state suffering from strategic paralysis is unable to terminate the war—actually or legally. It's paralyzed. Paralysis does not equate to defeat. Such a state's armed forces may remain tactically vital, requiring defeat in detail. After defeat in detail, the paralyzed state may require occupation. Are defeat in detail and support of occupation tasks too trivial for airpower? Of course not. Air and space power can be powerful even when only employed to achieve tactical effects.

Airpower may be an "offensive weapon" (page 55), but the proposition may overlook the more important truth: **it is by striking the enemy that military forces create opportunities.** There are a number of ways and combinations of ways to strike the enemy. Cruise missiles; ballistic missiles; and long-range, depressed-trajectory missiles or artillery

do not seem to be less effective as offensive weapons than airplanes. Organic, rotary-winged aircraft do not seem to be inferior to the faster ones for close support of the ground battle. Because some Army, Navy, and Marine Corps organic assets are available without quarrel or the tortuous timing and ritual of the air tasking order (ATO), they might even be superior in some circumstances. One suspects that commanders in the Army, Navy, and Marine Corps believe this to be the case. All of these (missiles, Army helicopters, Navy and Marine attack aircraft—even remotely piloted vehicles) are part of our nation's airpower arsenal. Airmen engaged in strike must not forget their unsung comrades-in-arms: support personnel, medical personnel, land-based missile forces, space forces, and transportation and logistics personnel. Striking the enemy with Air Force airpower creates opportunities, but everyone in the Air Force contributes to those strikes. Air strikes are only one way to create opportunity. Naval and ground commanders have others. Those who strike are but a team within a team.

Does airpower obviate the need for a tactical reserve on the ground, as the author suggests (page 58)? An economy-of-force force is not a magic force. One might offer that people who bear the consequences of bad propositions or tragic misjudgments ought to make their own risk assessments. Airmen may assert the "ubiquity" of airpower (page 58), but the ground forces pay the price if the claim is hyperbole. On the other hand, to say that air and space do in fact support or execute strike and that strike creates opportunities seems to be irrefutable without ignoring those who work to make strike possible—as well as the opportunities it creates.

To base the effectiveness of airpower on the adequacy of "intelligence" (page 58) illuminates airpower's greatest shortcoming. Airpower can blow a door off its hinges, but—unlike a simple soldier or marine—airpower cannot see what is behind the door. Airpower cannot attack what it cannot sense. Without knowledge, airpower cannot defer attacking that which it ought not attack. One cannot assess the effects of air attacks without understanding and predicting the relationship of targets to adversary capability. Today, as the author suggests, we airmen are unable either to assess or predict to perfection. All we know with certainty is that combat has cumulative effects and that at some point these take their toll on the enemy. To assert that "the real air assessment usually comes after the war" (page 60) is either to admit that we have scant idea just what it is we are contributing or to embrace the post hoc fallacy as a principal measure of effectiveness. Airpower, when integrated with ground power and naval power, can bring a fight to its culminating point. How much of that movement can be produced by air always defies easy assessment.

Airpower can blow a door off of its hinges, but—unlike a simple soldier or marine—airpower cannot see what is behind the door.

What we do know with certainty, however, is that **air and space power are about applying force to the enemy's nodes, processes, webs, intersections, and unions to impede the production, transportation, and control of enemy combat power.** When *10 Propositions,* published in February 1995, asserts in an earlier section that "the last American ground soldier killed by air attack was in 1953" (page 53), it forgets the friendly-fire episodes of Vietnam, of the Gulf War, and the tragedy that occurred on 14 April 1994. Friendly fire casualties are a risk when airpower attacks targets of opportunity or engages in close support. Attacks against cruise missiles, small ground formations, vehicles, and helicopters may be essential in some cases, but they do not hurt the enemy's nodes, processes, webs, intersec-

tions, and unions enough to impede significantly the production, transportation, and control of enemy combat power.

Thus, the *intelligence* that counts may be more the abstract noun than the concrete one. The intelligent questions to ask and answer are those that help identify the enemy's nodes, processes, webs, intersections, and unions that produce, transport, or control combat power. Smart enemies will attempt to hide and defend these. The author correctly notes the importance of thinking in terms of systems and assessing effects of attacks on key elements in an enemy's systems. The next step is to appreciate that it is combat power production, transportation, and control that count. The ground soldier in contact with the enemy harbors no doubt as to "what" produces enemy combat power in the form of incoming rounds. The airman, like the corps commander and the commander in chief (CINC), also must look to the sources of those rounds (factories, depots, caches), their transportation (road, rail, airfields), and their control (command centers, communications nodes, leadership) and aim at their destruction.

One of the reasons that airpower's individualized contribution to military success defies easy assessment is that **enemies are bound to be resilient**—*bound* meaning both that they are obligated to resist and also that we ought to count on it. Douhet's vision of destroying an enemy's will to resist by air attack remains a vision. We must expect enemies and their hostile will to be tough and durable. Bunkered or dispersed, disciplined troops can take tremendous poundings from bombs and artillery and still fight effectively. Anecdotal evidence from a few eager-to-please and compliant prisoners of war flies in the face of a much larger body of empirical data. Our Army and Marine Corps, for example, would not bolt and run if pounded by enemy air. Some would die, but the survivors would not run. Murderous enemy air attacks against our naval combatants in World War II did not cause the US Pacific fleet to disengage. Yet, enemy troops on the move over road or rail and columns of enemy combat power in transport are as lucrative targets for air as ship convoys are for submarines. The disruptive effects of applying airpower's striking power to the enemy's combat power production, transportation, or force-control nodes, processes, webs, intersections, and unions are well documented. Airpower, properly employed, can produce tremendous shock and disorientation, but these are merely opportunities to be exploited.

Speed and surprise do not, as the author suggests, "sometimes substitute for mass" (page 61). Rather, speed and surprise aim at massing or concentrating effects—both physical and psychological. To assert that there is such a thing as "the conquest of time" (page 61) by airpower is to posit some magical, superluminal power that airpower lacks. Squadrons of bombers and fighters can move more quickly than the ground corps or the carrier battle group. They can strike deep and hard, but they do not conquer time. The World War II bombing of Dresden and Hamburg, for example, produced tremendous shock and destruction in a very short period of time, but the dislocation was not enough to bring the ruling Nazis to their knees. Time is critical to opportunity, but air cannot thoughtfully be described as "dominating . . . time" (page 60). Perhaps air "exploits" time to concentrate its physical and psychological effects to erode the resilience of enemies more rapidly. Yet, even attacking 150 cities at once may not be enough to end the fight.

Airpower can conduct "parallel operations" (page 61), but so can naval forces and ground forces. Parallel operations against a diverse set of targets simultaneously and at multiple levels are nothing new. Capt (later Rear Adm) J. C. Wylie's notion of cumulative strategy and the targeting logic of the single integrated operational plan (SIOP) are three to four decades old. Parallel operations are not a new discovery. Gen U. S. Grant used them in the Civil War. To use air attacks

against Washington, D.C., to illustrate the effectiveness of parallel air operations and then ask, "Could we have maintained our balance in the face of such an onslaught?" (page 63) is somewhat off the mark. Might we not inquire, "Where was the US Navy in this case? Why did the Army's air defense artillery not mitigate these attacks? Where was the US air defense fighter force?" The author chose the example. Why he chose one that apparently or inadvertently trivializes our own Army, Navy, and Air Force is a puzzle. A proposition—a hypothesis—proved by a hypothetical case does not bolster the strength of the argument.

Is it just bad luck that too few airmen are CINCs, or is it because airpower always supports something larger than the application of airpower?

One flaw in the current notion of parallel war is the belief that the approach was invented by airmen during the Gulf War. Another flaw in the current notion of parallel operations is that—like the linear image from which the idea is drawn—parallel lines never converge. Parallel-warfare theorists seem to forget that it is the integration and convergence of effects that seem to culminate in success—not the parallel lines shooting off into space. When using examples drawn from the Gulf War in this section, *10 Propositions* fails to note the effect of the over 400,000 coalition troops at Iraq's borders. These were not so irrelevant as to deserve omission. Omitting them, like damning the defensive power of the US Navy, Army, and Air Force air defense force to irrelevance in the ill-chosen example of the hypothetical attack on Washington, is insensitve and may risk calling the validity of the proposition into serious doubt. This clearly could not have been the author's intention.

The principle at work seems to be simpler and more solidly grounded. **Combined arms aim at convergent effects**, and air and space power—being so wonderfully flexible—can be peculiarly strategic in effect. Air and space power, according to Maj Gen Chuck Link, bring speed, range, perspective, and freedom of maneuver or agility to the fight. These are the invaluable attributes that only air and space power can contribute. Because striking the enemy is the best way to create opportunity, these attributes serve the aim of force application. The objective of force application is to so harmonize the kinds of force applied, where the force is applied, and when it is applied that one increases the likelihood of a cascading collapse of the enemy's combat power. The more rapidly these effects converge, the better. Air can help the ground commander collapse it on the front, the naval commander collapse it inland of the beach, and the theater commander collapse it from the enemys capital outward. Air strikes can create opportunities, but notions of parallelism are less instructive than an awareness that convergent effects are the real goal.

Precision weapons have not redefined the meaning of mass—the author's assertion notwithstanding (page 63). Mass in scientific terms is one of the forms that energy takes. Mass in military terms is merely the concentration of effects. ***Mass* always has been the shorthand for the concentration of force.** The noun *force* is both abstract and concrete. Combat units—troops, weapon-delivery platforms, and weapons—possess energy and are production units. They produce lethality or force. Sometimes production capacity—the lethal or forceful effect—is dependent on the size of the production unit. Sometimes it is dependent on the velocity of the force applied. Sometimes size is unrelated to production capacity. Precision weapons, by concentrating force to hit what they aim at (which may or may not be what they should aim at) achieve the desired lethal effects with fewer engagements than nonprecision weapons. This is much the same awareness as realization that a

Green Beret, SEAL, Ranger, or marine may be a greater producer of lethality than a poorly trained, conscripted enemy infantryman. Precision weapons do not redefine mass. Rather, they accept in military science what is true in physics: things have intrinsic energy.

On the other hand, special forces, SEALs, Rangers, and marines cannot precisely airdrop food bombs. This notion of food bombs unfortunately may move small portions of *10 Propositions* from the category of arguable to the category of trivial. Nonetheless, the precision aerial delivery of food bombs—accepting for the moment that such things are germane—poses very important questions left unexplored by the author. Those questions are, Must an airman control the delivery of food bombs? Ought the delivery of food bombs be controlled by a greengrocer type of person? Or ought control of the delivery of food bombs be determined by the objective of "bombing" with food in the first place? It seems that the aim or function of an operation ought to determine its form (as Sun Tzu and Clausewitz urged)—not some a priori assertion of form apart from a consideration of function. While an airman may be uniquely qualified to tell how best to deliver food bombs, one cannot suppose that an airman knows any better than anyone else why it is food that needs delivery or where the food needs to go.

The important principle seems to be that **the object of force application ought to determine the form of force control.** There is nothing talismanic or magic about airpower. If joint professional military education for us and our allies is effective, any strategist of combined arms can advise where best to employ airpower to achieve its effects. Any targeteer can hunt for targets. But it may be unlikely that any airman is better than anyone else in assessing the relationship of targets to effects. Many are less qualified. Is it just bad luck that so few airmen are CINCs, or is it because airpower always supports something larger than the application of airpower? If unattended cockpits dominate at some time in the far future, for example, must "airmen" control them? While the national command authorities might very likely conclude that air and space power ought to be centrally controlled in some future fight, the form that control takes certainly will evolve. Must the air component commander and staff reside in-theater or even in one location? In the future, just as today, the object of force application ought to determine the form of force control.

It is indisputable that "technology and air power are integrally and synergistically related" (page 67). Yet, the principle airmen ought to appreciate is that **the informed application of superior technology can vitiate the enemy.** Having technology is not enough. It must be assimilated in the right things, in the right numbers. It must be applied with superior concepts of operations and codified in superior doctrine. Superior weapons—as I. B. Holley, Jr., rightly observed in *Ideas and Weapons* (1953)—"favor" victory, but they do not assure victory. Rather, the informed application of superior technology—informed by experience and the knowledge gained in realistic training, by sound doctrine, by innovative concepts of operations, and by the warrior spirit—can hurt the enemy badly. If airmen help create the superior technology and devise the superior concepts of operations for employing it, then perhaps airmen ought to control these applications. Likewise, unless airmen so understand our profession that they provide the operational pull and technology push, they mortgage our future.

The goal of *10 Propositions* is to give us airmen something simple and fairly solid to stimulate our thinking about air and space power. We already know that technology and airpower are integrally and synergistically related. What we must internalize is that it is not enough to have superior technology, which does not guarantee superior airpower—the Me-262 and V-2 being but two examples. We must have the vision to have the right superior technology and apply it in the right ways. Those things that promise to vitiate

the enemy are usually the right things, and hurting the enemy is usually the right way.

Likewise, one cannot fail to agree with the proposition that "air power includes not only military assets, but an aerospace industry and commercial aviation" (page 69). It was as true when Mitchell and de Seversky suggested it for airpower as it was when Julian Stafford Corbett, Alfred Thayer Mahan, Teddy Roosevelt, and Winston Churchill suggested it for sea power. The more provocative principle—and the one with more significant consequences for airmen and military airpower—is that **technology is unconfinable.** This means that in an era of global engagement and economic enlargement, in a future that promises continued real and virtual presence nearly everywhere, the US cannot count on technological monopolies. Powerful, significant, or even superior military technologies can no longer be confined and unavoidably will be deployed more widely in the future than ever before in the past. This includes the technologies necessary for information and counterinformation systems, transatmospheric vehicles, hypersonic systems, ballistic and cruise missiles, satellites, sensors, air surveillance, target acquisition, target engagement, and attack assessment. This means that some aspects of warfare could change rapidly and that unexpected asymmetries could develop. It means that in the near future close-in air bases may no longer be sanctuaries for short-range aircraft. It also means that the battle space may quickly become so lethal that some of the other air propositions are called into question. The principles, however, should endure. This particular principle warns us to keeping thinking and innovating.

This leads to a final principle—one disappointingly omitted from *10 Propositions*. It is that **effective integration can produce superior results.** We fight with combined arms. Jointness is not just something trendy since the Goldwater-Nichols-Hollings Department of Defense Reorganization Act. It's how we must fight. While one form of force may be better suited to a particular function than another, that fact in no way makes one superior and another inferior, one "dominant and decisive," and another subordinate or irrelevant. We must help the author of *10 Propositions Regarding Air Power* meet the objective of the laudable effort. That effort is aimed at increasing our "air-mindedness" without in any way diminishing our appreciation for combined-arms employment. This critique, remember, did not pull its principles out of the ether. Rather, it used and was dependent upon what the author of *10 Propositions Regarding Air Power* provided. The 10 propositions, as the Air Force historian tells us in the book's foreword, are "a group of provocative propositions." They are intended to provoke the discussion and debate that help begin the dialectic, which allows knowledge and wisdom to emerge. That dialectic regarding airpower must occur within each of the services and among them, both in the US and abroad. The aim is effective integration of all the instruments of power.

In summary and toward that end, don't just carry this book—as the Air Force historian suggests—in your flight suit or battle dress uniform (BDU) pocket. Read it carefully and then read it again. It's a good book and easy to read. When you can speak articulately to it, give it to soldiers, sailors, or marines and ask them to read it. When they've finished, ask them what they think. They're your customers. You're their supplier of air and space power. In that dialogue, real learning will continue. □

Winter 1995

IRA C. EAKER AWARD WINNER

Maj Kurtis D. Lohide, USAF

for his article

Desert Storm's Siren Song

Congratulations to Maj Kurtis D. Lohide on his selection as the Ira C. Eaker Award winner for the best eligible article from the Winter 1995 issue of the *Airpower Journal*. Major Lohide receives a $500 cash award for his contribution to the Air Force's professional dialogue. The award honors Gen Ira C. Eaker and is made possible through the support of the Arthur G. B. Metcalf Foundation of Winchester, Massachusetts.

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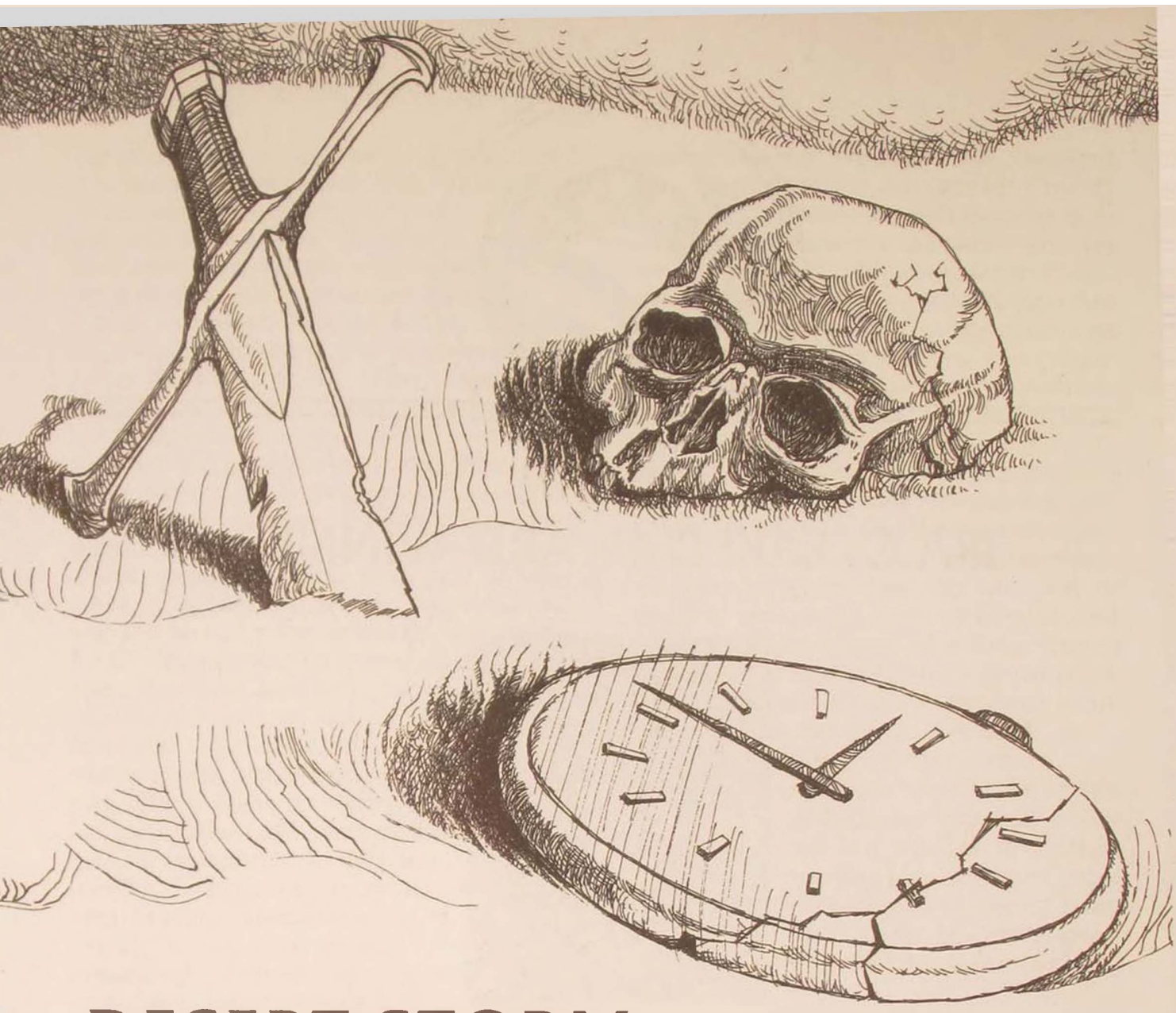


DESERT STORM

WAR, TIME, AND SUBSTITUTION REVISITED

Dr Herman L. Gilster

The military student does not seek to learn from history the minutiae of method and technique. In every age these are decisively influenced by the characteristics of weapons currently available and by means at hand for maneuvering, supplying and controlling combat forces. But research does bring to light those fundamental principles, and their combinations and applications, which, in the past have been productive of success. These principles know no limitation of time.

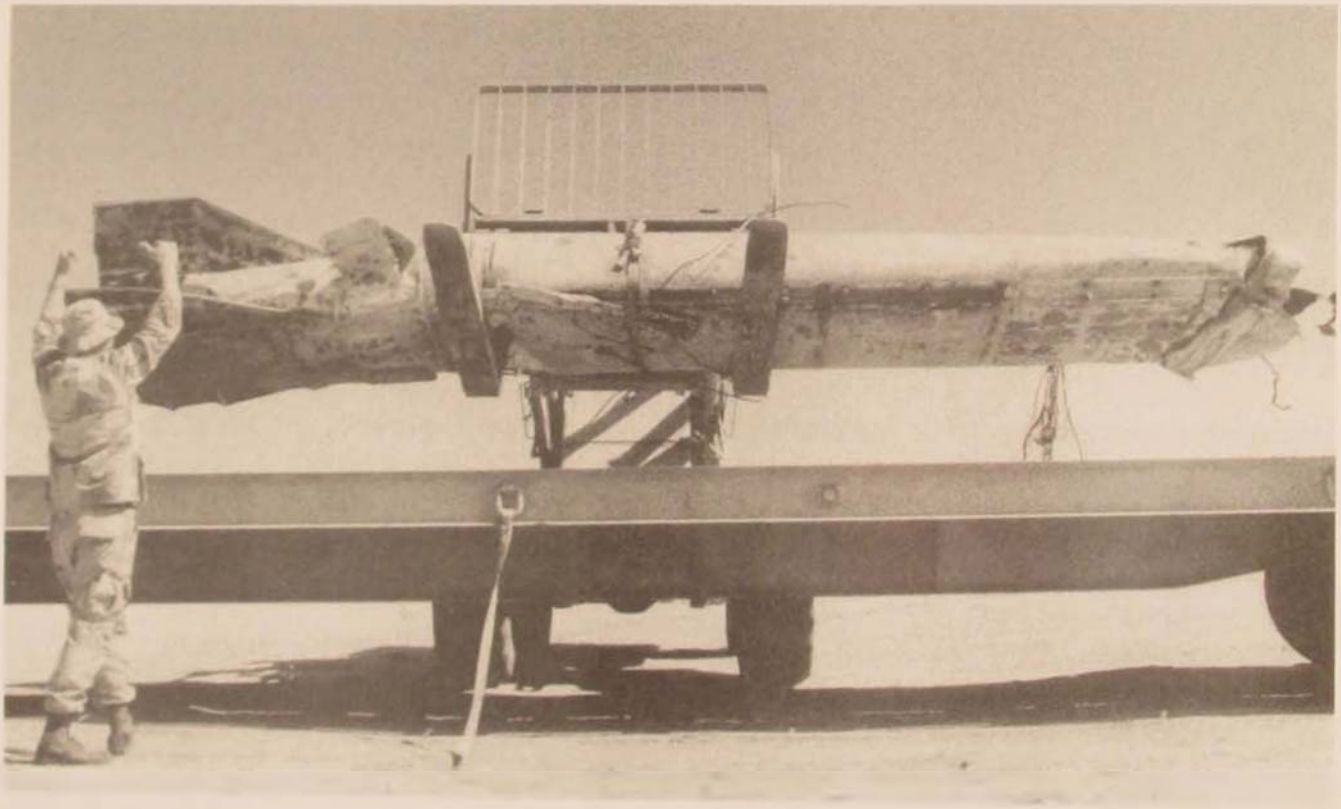
—Gen Douglas MacArthur

IN MY BOOK *The Air War in Southeast Asia: Case Studies of Selected Campaigns,* the final chapter, entitled "On War, Time, and the Principle of Substitution," is devoted to a discussion of the powerful roles that time and substitution play in the art of warfare.[1] Traditionally, nations under attack—given sufficient time—effect both product and factor substitution to a degree that in large measure attenuates the economic impact of military strikes against their industrial and logistics sectors. The chapter cites examples of this phenomenon from World War II, the Korean conflict, and the protracted war in Southeast Asia.

The above analysis calls for a return to the concept of blitzkrieg. The greatest successes of both air and ground forces in modern times came in short, intense combined-arms campaigns: the German blitzkriegs of World War II, the Normandy invasion, and the Six-Day War in the Mideast, to name a few. These successes suggest that military doctrine should be structured so that airpower is used in conjunction with other forces in fast and dramatic moves that give no opportunity for the principle of substitution to come into play.

It certainly appears that the experience in Operation Desert Storm was consistent with that hypothesis. Without a doubt, the coalition succeeded in rapidly crushing Iraq's military forces in Kuwait and southern Iraq, and airpower was a decisive factor in this success. The entire campaign lasted only 43 days and required only 100 hours of ground warfare to rout Iraqi forces completely. The campaign thus stands as an embodiment of the philosophy advocated in my chapter "On War, Time, and the Principle of Substitution."

Although coalition air forces performed brilliantly, it later became apparent that we



Significant deviations occurred in the planned execution of the air campaign. One began on the third day of the war, when Iraq launched Scud missiles at Israel. As a result of the political significance of these strikes, the coalition began intense operations to find, destroy, or suppress the mobile missile launchers. This effort continued throughout the war.

The Iraqi air force had essentially "hunkered down" to protect itself. The coalition undertook a major effort to find and destroy the sheltered aircraft so that the Iraqis could not use them later in a surprise "Tet-like" offensive. Here, steel blast doors from an aircraft shelter have been blown across the tarmac after a coalition air attack.

had not completely overcome the limitations of airpower revealed in past wars. The purpose of this article is to update our experience with substitution and outline which phenomena of past wars continued to play a moderating role during Desert Storm.

Since I viewed this war from afar—not firsthand, as in Southeast Asia—I had to rely on other sources for data and discussions about the effectiveness of airpower. A primary source was the *Gulf War Air Power Survey* (*GWAPS*), commissioned by the secretary of the Air Force and directed by Prof Eliot Cohen of Johns Hopkins University.[2] This five-volume study, produced by a team of civilian and military analysts, is probably the most comprehensive evaluation to date of airpower in the Gulf War. I gleaned additional detail from *Crusade: The Untold Story of the Persian Gulf War* by Rick Atkinson,[3] whose interviews with some 500 participants of the war provide additional insight into aerial effectiveness and the interaction between the military services and their commanders.

Course of the Air Campaign

Desert Storm began on 16 January 1991 after a buildup of coalition forces over the

preceding five months.[4] During the first two days, some of these forces executed the most thoroughly planned and complex air operations of the war. They struck virtually all target sets but directed their heaviest effort against air defenses, airfields, and command elements of the Iraqi regime. Air strikes also hit Iraq's electric power system and its nuclear, biological, and chemical (NBC) capability. Attacks against oil facilities, railroads, and bridges followed, as did an increasing number of strikes in the Kuwaiti theater of operations (KTO) to prepare the battlefield.

Two significant deviations occurred in the planned execution of the air campaign. The first began on the third day of the war, when Iraq launched Scud missiles at Israel. As a result of the political significance of the strikes against Israel, the coalition began intense operations to find, destroy, or suppress the mobile missile launchers. This effort continued throughout the war. The second redirection involved the destruction of Iraqi aircraft shelters in which the Iraqi air force had essentially "hunkered down" to protect itself. The strikes sought to destroy the sheltered aircraft so that the Iraqis could not use them later in a surprise "Tet-like" offensive.

From the second week on, the coalition directed an increasing concentration of sorties against the KTO. Strike operations in Kuwait aimed at sealing off the area from resupply, attacking traffic within the area, and attriting the Iraqi army. To effect this attrition, commanders lowered altitude restrictions for some aircraft to improve bombing accuracy, and aircraft employed laser guided bombs (LGB) against Iraqi armor and artillery in a procedure referred to as "tank plinking." As the ground offensive approached, the weight of effort shifted from the Republican Guard and theater reserve units to attacks on Iraqi frontline divisions.

During the short ground offensive, which began on 24 February, close air support (CAS) had sparse opportunity to operate. The lack of Iraqi resistance and the speed with which coalition forces advanced negated the need for much air support. Most destruction was caused by aircraft striking strategic reserves and retreating columns of the Iraqi army as it attempted to flee Kuwait along avenues such as the so-called highway of death. The war ended on 28 February with the Iraqi army driven completely out of Kuwait into a small corner of southeastern Iraq.

Strike Results

Air strikes during Desert Storm generally fall into three categories: those against the Iraqi army, those against targets that controlled the air and sea, and those against strategic targets (fig. 1).[5] Most strikes (approximately 70 percent) targeted the Iraqi army. Those against air and sea control targets made up about 15 percent of the total and consisted of attacks on airfields, air defense sites, and Iraqi naval and coastal facilities. Strategic targets, the primary subject of this review, comprised the remaining 15 percent. For purposes of the following discussion, I group these targets under four headings: key production, deployed ballistic missile forces, lines of communications (LOC), and command and control (C^2). This breakdown provides a more valid comparison with results attained against similar targets in past wars.

Key Production

Key production targets in Iraq included electric power facilities, oil facilities, and nuclear facilities. Strikes against electric power[6] facilities came early in the campaign, destroying or damaging an estimated 88 percent of Iraq's installed generation capacity. Lights went out in Baghdad, and available evidence indicates that electric power throughout central and southern Iraq was largely shut down during the initial days of the war.

During the Linebacker II campaign in December 1972—the closest historical analog to the strategic portion of the Desert Storm air campaign—US air strikes reduced North Viet-

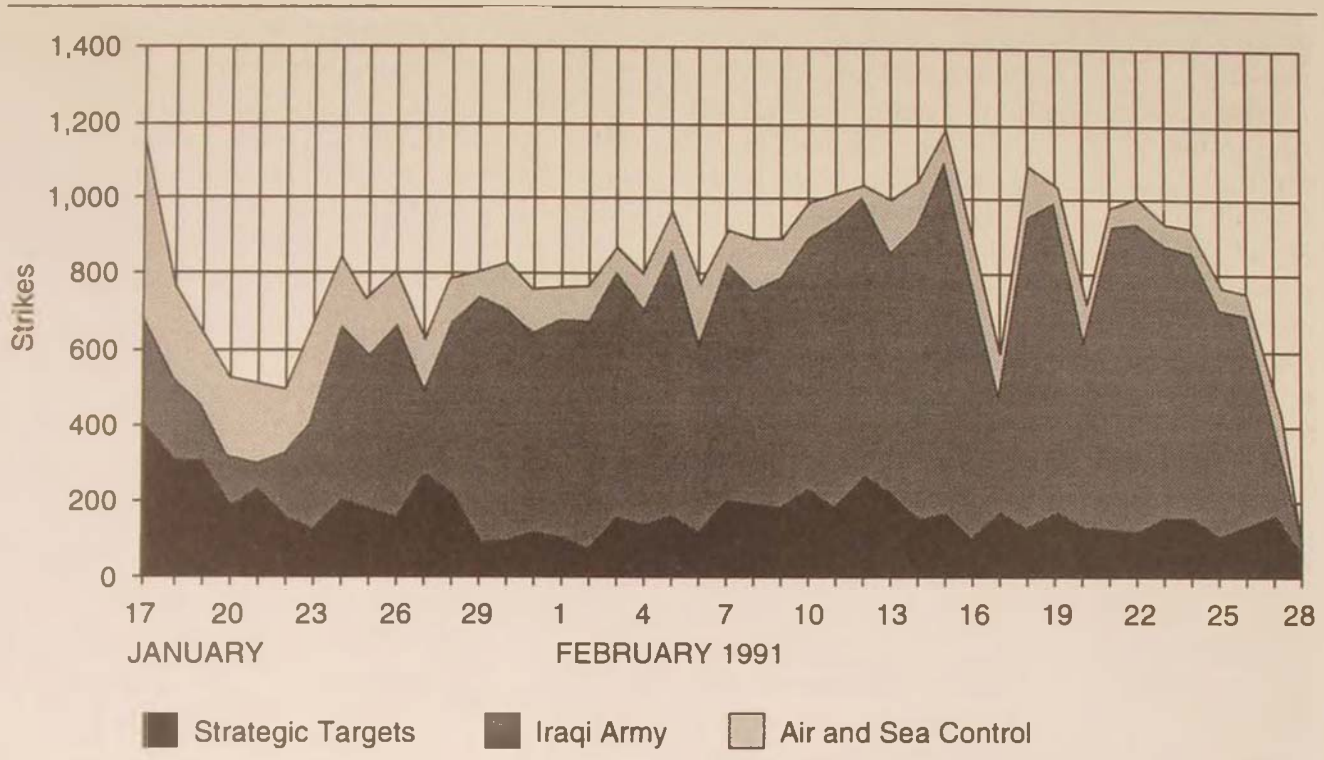


Figure 1. Coalition Air Strikes by Day against Iraqi Targets (from Eliot A. Cohen and Thomas Keaney, *Gulf War Air Power Survey: Summary Report* [Washington, D.C.: Government Printing Office, 1993], 13)

nam's electrical capacity by some 75 percent. The North Vietnamese, however, met essential requirements for electrical power by cutting back nonessential functions and relying on the system's inherent redundancy.[7] Obviously, a similar response occurred in Iraq, which possessed a relatively modern, redundant, and flexible power system and normally used less than 55 percent of its capacity. The decreased capacity caused by coalition air strikes probably forced the leadership and military onto backup power and resulted in major inconveniences; nevertheless, we could detect no evidence of disaffection toward the Iraqi leadership—one of the hoped-for objectives of the strikes against electric power.

The peak effort against oil facilities[8] came toward the middle of the campaign. The Central Intelligence Agency (CIA) concluded that more than 90 percent of Iraq's petroleum-refining capacity was rendered inoperative. The ironic aspect of all this is that Iraqi forces required very little petroleum. The Iraqi air force essentially sat out the war, and ground forces in Kuwait used Kuwaiti refining capabilities and oil stocks. Even after the coalition initiated air strikes against Kuwaiti facilities, sufficient stocks were available for weeks of combat. Although it appeared prudent to strike oil facilities to limit Iraq's ability to wage a protracted ground war, in actuality the attacks bore no significant military results—given the Iraqis' inability to mount a coherent or protracted defense on the ground. One might say that the impact of strikes against oil facilities was limited by the success of the air campaign against other target systems.

This situation is in sharp contrast to the one in which Germany found itself during the last year of World War II.[9] Fighting a two-front war severely strained the German economy, so the country had a critical need for oil. Consequently, the German oil industry

proved to be a lucrative target. Strikes against North Vietnam's oil-storage capacity, however, proved less lucrative. Although an estimated 70 percent of its oil capacity was destroyed during Operation Rolling Thunder (1965-68), North Vietnam's mode of operation required a minimum of oil. It could import whatever it needed from Communist allies.

An explicit military objective of Desert Storm was destruction of Iraq's nuclear capabilities.[10] After the Israeli strike on an Iraqi nuclear reactor in 1981, Iraq restructured its nuclear program to minimize its vulnerability. The Iraqis initiated redundant methods for producing fissionable material and made each method less vulnerable to air attack through concealment, dispersal, hardening, and deception. Consequently, strategic air attacks against nuclear facilities were far less effective than had been expected.

The *GWAPS* team concluded that Iraq's nuclear program was far more extensive and dispersed than coalition planners realized, that the Iraqis moved elements of the program away from coalition bombing after the conflict started, and that significant pieces of it either were not identified or not understood by the time of the cease-fire.[11] As a result, the United Nations (UN) inspection teams identified and destroyed more of the Iraqi nuclear program *after* the war than did the air campaign *during* the war. Likewise, the UN team uncovered some 150,000 dispersed chemical weapons that air strikes had not destroyed.

These results are reminiscent of our experience with Germany in World War II and North Vietnam during the war in Southeast Asia. German dispersal of ball-bearing, aircraft, and other production plants, for example, helped attenuate the impact of strategic bombing during World War II. Although primarily an agricultural country with little industry, North Vietnam also dispersed portions of its industrial sector. In addition, the North Vietnamese made extensive use of dispersal to protect limited stores of fuels, supplies, and equipment from air attack.[12] Iraq's successful use of dispersal indicates that this stratagem remains a viable counter to air attack—a factor with which airpower must continue to deal.

Deployed Missile Forces

If dispersal proved to be a nemesis to strategic air attack, mobility was even more so. This fact was particularly true of Iraq's Scud missile capability,[13] which was of great political significance because Iraqi Scud launches at Israel could have drawn that country into the war and split the coalition of Arab nations. Countering this threat required a major diversion of coalition air resources for Scud search and attack. By war's end, nearly every type of strike and reconnaissance aircraft used in the war had participated in the effort to bring the threat under control. This effort included conducting continuous airborne surveillance of Iraq, positioning strike aircraft over Scud launch areas for immediate targeting, attacking communication circuits thought to be transmitting Scud launch authorizations, and attacking suspected Scud hiding places. Although Scud launches decreased after the first week of the war, they rose again during the final weeks (fig. 2). Postwar searches indicated that coalition air strikes destroyed few, if any, mobile launchers and that 19 survived the war.

Mobile Scud crews were capable of moving from hiding sites, firing, and—within minutes—hiding again before aircraft could attack them. Moreover, the Iraqis reduced prelaunch electromagnetic emissions that might give away their locations prior to launch and seeded the launch areas with high-fidelity decoys and other vehicles. They displayed ingenuity in the use of decoys by placing mock missiles among barrels of diesel fuel to simulate secondary explosions when hit and by installing aluminum reflectors to emit confusing radar signatures and heat generators to baffle infrared detectors.[14] Consequently, confirming the destruction of any Iraqi mobile launchers during the war

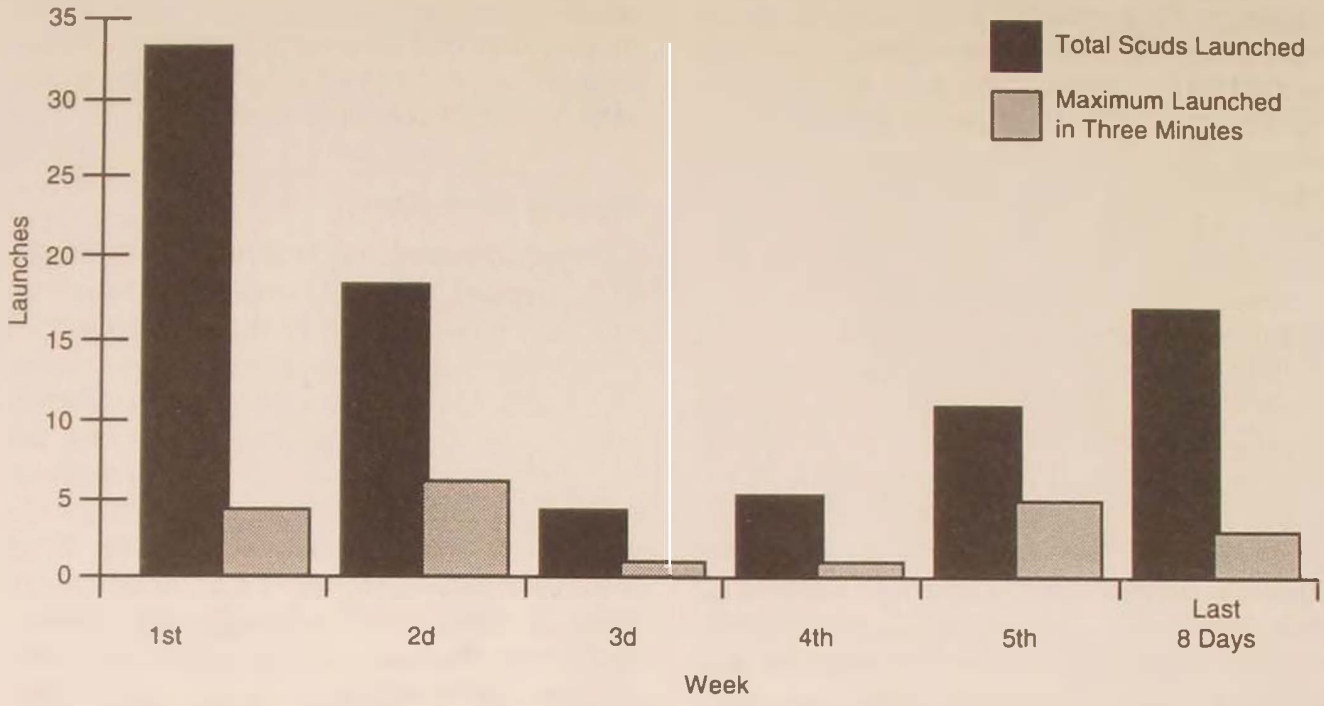


Figure 2. By-week Launch Totals and Maximum Salvo Size for Iraq: Scuds (from Eliot A. Cohen and Thomas Keaney, *Gulf War Air Power Survey: Summary Report* [Washington, D.C.: Government Printing Office, 1993], 88) .

proved impossible. Although aircrews reported destroying around 80 mobile launchers, most reports reflected destruction of decoys and objects that provided Scud-like infrared or radar signatures.

During Linebacker II, our forces experienced the same problems with surface-to-air (SAM) missile sites. The North Vietnamese were able to relocate their SAM sites rapidly—within four hours. Consequently, only two of 13 SAM sites attacked during the campaign were damaged.[15] Even in Desert Storm, despite our initial success against the Kari air defense system, the Iraqis found ways to regenerate portions of the system and fire radar-guided SAMs right to the end of the war. Likewise, Silkworm sites used in Iraq's coastal defense remained a threat to the end.[16]

Lines of Communications

Although Desert Storm planners included LOCs[17] in the strategic category, strikes against the enemy's road and railroad network traditionally have been considered part of the interdiction effort—and probably still should be. The objective of these strikes during Desert Storm was to isolate the KTO and disrupt Iraq's ability to resupply its forces. Because the LOCs frequently crossed rivers, bridges became key targets of air operations to isolate the theater.

The interaction between coalition and Iraqi forces in the air-interdiction sphere reads much like a script from Southeast Asia. To offset the destruction of their bridges, the Iraqis rerouted traffic to secondary routes, constructed temporary bridges, used amphibious ferry vehicles, and built earthen causeways. The Iraqi army possessed a variety of bridging equipment, including pontoon sections, ribbon bridges, and self-propelled ferries. Much of this equipment was prepositioned and concealed near key bridges that might be targets of air attack. The ingenuity of the

Iraqis in coping with coalition strikes against the LOC network was aptly described by Gen Charles Horner, the coalition air commander:

> Anybody that does a campaign against transportation systems had better beware! It looks deceivingly easy. It is a tough nut to crack. The Iraqis were very ingenious and industrious in repairing them or bypassing them. . . . I have never seen so many pontoon bridges. When the canals near Basra were bombed, they just filled them in with dirt and drove across the dirt.[18]

Another problem that has surfaced continually in past wars is that route capacity was considerably greater than that needed for resupply of combat forces. Whereas total route capacity stood at around 200,000 tons per day, Iraqi resupply required only 10 to 20 percent of this figure. To become less detectable by air, the Iraqis (as did the North Vietnamese) shifted from multivehicle convoys to single trucks, traveling largely at night. Moreover, sizable stocks of ammunition, petroleum, food, and water had been accumulated in the KTO—enough to support 35 to 40 days of combat—to hedge against any LOC vulnerability.

In spite of sufficient supply tonnages for combat operations, the Iraqis quickly gave way when the ground offensive began. Spot shortages of food and other supplies developed, and the Iraqis found it impossible to counter coalition thrusts. As with the Germans during Operation Strangle in Italy and the North Vietnamese during their invasion of South Vietnam in 1972, airpower severely limited the Iraqis' ability to position men and materiel in the right place at the right time.[19] Mobility denial rather than supply denial again had been the key to coalition success.

Iraqi Command and Control

With these strikes, the campaign planners hoped to disrupt the central nervous system of Saddam Hussein's regime.[20] They targeted the various government facilities used by Saddam and his associates to rule the country, maintain control over the people, and direct military operations. Some planners felt that these strikes would lead to the overthrow of Saddam's Baathist regime and the severance of communications between Baghdad and Iraqi military forces in the KTO—somewhat reminiscent of the hunt for Ben Franklin's "horseshoe nail" that would critically cripple Germany's war effort. In this case, the focus would be enemy leadership rather than production.

Looking first at the communications network, we find that the Iraqis possessed a modern, computerized, and highly redundant system. Completely severing a system this flexible and redundant would be extremely difficult—if not impossible. By the second week, it had become apparent that Iraq's national-level telecommunications system had not collapsed as a result of attacks on central switching facilities and microwave relays. Although we noted some disruption, the system turned out to be more redundant and more able to reconstruct itself than originally anticipated. The search to find the telecommunications "straw that would break the camel's back" continued to the end of the war—but to no avail.

During Linebacker II, we struck five of North Vietnam's telecommunications facilities, but they did not prove to be lucrative targets. The strikes had the effect only of producing a few brief periods of interrupted operations. The redundancy in the system, however, allowed the North Vietnamese to maintain all necessary operations. Poststrike analysis indicated that we achieved little of military value and that the psychological impact was questionable.[21]

The impact of Desert Storm strikes against command and leadership targets was also questionable. Although we noted considerable disruption, coalition forces did not succeed in toppling Saddam Hussein or completely severing his communications with the KTO during the 43-day war.[22] Saddam Hussein survived not only the war itself but, in its aftermath, re-

tained enough military power to quell Kurdish and Shiite uprisings in the north and south, respectively.[23] He was also able to continue radio broadcasts to his subjects throughout the war.

Through the ages, airpower apparently has been unable to affect political stability or a population's will to continue the fight.[24] As noted by the *GWAPS* team, Iraq's military forces proved to be the weak link—not its political regime. The Germans never overthrew Hitler after the massive area bombings of Germany's cities, nor did the North Vietnamese ever turn on Ho Chi Minh.[25] Even after the intensive Linebacker II bombings of Hanoi and Haiphong, nothing indicated that the North Vietnamese leadership had lost control of the situation.[26]

Allied Air Management

While on the subject of C^2, one should pay attention to the concept of a single manager for air, which was inaugurated to direct the coalition air war during Desert Storm. One of the primary campaign lessons from Linebacker II was the need for a single manager for air resources.[27] The separation of the strike effort by geographical areas, with Air Force strikes confined to one area of North Vietnam and US Navy strikes to the other, prevented the optimal integration of forces and ordnance in each of the areas. Moreover, the complexity of C2 for employment of B-52s was a major problem. Scheduling and support of B-52 strikes required constant coordination between major command elements, including Strategic Air Command, the overall commander of US forces (Military Assistance Command, Vietnam [COMUSMACV]), Headquarters Seventh Air Force in Vietnam, and the Navy's Task Force 77 in the Gulf of Tonkin. A single command authority in control of all air assets could have better insured proper allocation of air resources to various areas and could have made maximum use of aircraft and ordnance mixes.

During the fall of 1990, Gen Norman Schwarzkopf, commander in chief (CINC) for Desert Storm, designated General Horner of the Air Force as the joint force air component commander (JFACC) for all coalition air forces. Thus empowered, Horner could concentrate his air resources where he thought they could best support the CINC's overall war objectives. In spite of this authority, interservice rivalry at times constrained Horner's ability to function with supreme authority. From the beginning, the Army, Navy, and Marine Corps were concerned about someone else having control of their air assets.

The Navy resented the aircraft rules of engagement, which discriminated against Navy planes because they lacked the electronic means of distinguishing friend from foe at a distance; further, the Navy wanted control of its aircraft to defend the fleet.[28] Determined to avoid fratricide, the CINC supported Horner's more restrictive rules. Likewise, the Marine Corps thought that the very existence of its integrated air-ground team meant that the Corps should control its own aircraft.[29] In the end, the Navy and Marine Corps were allowed to reserve many sorties for their own use.

The Army accepted the notion of a single manager for air, but corps commanders worried about whether their needs would receive adequate attention from an Air Force that might wish to fight the war its own way. Disputes with the Army persisted until a greater weight of effort shifted from strategic targets in Iraq to battlefield preparation in Kuwait. Even so, disputes continued. During one such incident, the CINC ordered heavy bombing of Iraq's Republican Guard, while the corps commanders—unaware of the CINC's direction—called for strikes against Iraqi artillery in the frontline forces.[30]

In spite of such frictions, the concept of a single manager for air was an improvement over the diverse control exercised in previous wars. Moreover, as the *GWAPS* team stated, the superabundance of coalition aircraft, the absence of serious opposition in

the air or of effective attack against coalition air bases, and the ability of the coalition to choose the timing of the war's beginning all meant that neither the CINC nor the JFACC had to make harsh choices in unfavorable circumstances. They never had to strip the Marines of air support provided by Marine aircraft or endanger the fleet by leaving it with less than full air defenses, and they never had to remove air cover from soldiers in the face of an enemy attack.[31]

Conclusion

Regardless of the shortcomings discussed above, there is no doubt that the United States and its allies scored a brilliant victory in the Gulf. The war saw the full emergence of airpower as a preeminent factor in modern combat, a fact which led some advocates to declare that airpower had come of age—that technology had finally caught up with doctrine and that airpower alone could win future conflicts, à la Douhet.[32] Some people even considered airpower the linchpin of a new Pax Americana, just as land power had characterized Pax Romana and sea power had characterized Pax Britannica. Other airpower adherents, including the Air Force chief of staff and the JFACC for Desert Storm, recommended caution, citing the environment in which Desert Storm was fought.[33] First, the Gulf War took place in open-desert terrain well suited to the effective employment of airpower. Historically, battles fought in the desert tend to be decisive; armies cannot rely on topography, as did the North Vietnamese in Southeast Asia, to cover their actions. As Rick Atkinson observes, bones litter the world's deserts to prove the point. In Operation Compass in December 1940, the British completely annihilated 10 Italian divisions in North Africa, capturing 130,000 prisoners. At El Alamein, Rommel lost 55,000 men and 450 tanks in a fight that marked the beginning of the end of the Third Reich. "Just as the desert is incapable of compromise, battles fought therein result in total victory or total defeat."[34]

Second, although Desert Storm was touted as a high-technology war characterized by precision strikes by advanced aircraft and missiles, the data indicate that certain reservations are warranted. Some of the oldest aircraft in the Air Force inventory—including the B-52, F-111, A-10, and KC-135—were in greatest demand, and of the total number of weapons expended during the war, only about 8 percent were precision guided.[35] Even the more accurate delivery systems experienced their share of misses. For example, of the 167 LGBs dropped during the first five nights of combat by Air Force F-117s, 76 missed their targets because of pilot error, mechanical or electronic malfunctions, or poor weather.[36] Of 288 Tomahawk cruise missiles fired by the Navy, only about half struck their targets.[37] And the Army subsequently found that only 9 percent of its Patriot engagements resulted in confirmed Scud kills.[38]

Weather was a major factor in strike accuracy and the ability to use precision guided weapons. In the first three weeks of the war, approximately half of the attack sorties into Iraq had to be diverted to other targets or cancelled because of weather-related problems.[39] Although the weather was worse than forecast, it was better than aircraft might experience in other areas of operation. During Linebacker II, for instance, on only three afternoons of the 12-day campaign was cloud cover high enough to deliver LGBs.[40] The call for a better all-weather bombing capability remained largely unanswered in the Gulf War. Technology, at least at the time of Desert Storm, still had a way to go.

A final factor affecting the war was that the coalition command had greatly overestimated the size and capability of Iraqi forces. Although the command estimated 540,000 Iraqi troops in the KTO, the *GWAPS* team estimated only 336,000 in place at the start of the air campaign, with not more than 200,000 to 222,000 remaining when the

ground offensive began.[41] Against this force, the coalition had marshaled some 700,000 troops. The relative inferiority of the Iraqi forces became apparent even before the ground offensive—at the battle of Khafji, in which the Iraqis performed so ineptly.

Did Desert Storm marshal in a new era for military forces—a revolution in warfare?[42] I have my doubts. The conditions and environment under which coalition forces operated during Desert Storm were close to ideal. We may never again face an adversary under circumstances so congenial to airpower. We need only look back to the war in Southeast Asia to remember the limitations of airpower against a determined foe sheltered by mountains and thick foliage.

Even more important is the fact that many of the actions taken in the past to alleviate the impact of strategic bombardment remained effective during Desert Storm. Dispersal, deception, redundancy, and improvisation are the nemeses. These counters require costly, labor-intensive substitutions, but such costs are normally tolerable. The limits of strategic air attack encountered as far back as World War II manifested themselves again over Iraq in 1991. Substitution did not die with Desert Storm but remains an enduring facet of warfare.[43]

What in large part was nullified in Desert Storm was the mitigating effect of time. Allied forces used airpower in conjunction with other forces in fast and dramatic moves that gave little opportunity for the enemy to respond or for the principle of substitution to come fully into play. That was the success and the lasting legacy of Desert Storm. □

Notes

1. Herman L. Gilster, *The Air War in Southeast Asia: Case Studies of Selected Campaigns* (Maxwell AFB, Ala.: Air University Press, October 1993), 117–36.

2. Eliot A. Cohen, *Gulf War Air Power Survey,* 5 vols. (Washington, D.C.: Government Printing Office, 1993).

3. Rick Atkinson, *Crusade: The Untold Story of the Persian Gulf War* (New York: Houghton Mifflin Co., 1993).

4. Cohen, vol. 2, part 2, *Effects and Effectiveness,* 95–104. Most of the details in this and the following section on strike results were extracted from this volume. Some of the same information is also available in the more concise *Gulf War Air Power Survey: Summary Report* (Washington, D.C.: Government Printing Office, 1993), coauthored by Cohen and Thomas Keaney .

5. Cohen, vol. 2, part 2, 78–95.

6. Ibid., 290–308.

7. Gilster, 129–30.

8. Cohen, vol. 2, part 2, 309–12.

9. Gilster, 130–32.

10. Cohen, vol. 2, part 2, 312–30.

11. Ibid., 343.

12. Gilster, 124–25.

13. Cohen, vol. 2, part 2, 330–40.

14. Atkinson, 175.

15. Gilster, 90–92.

16. Cohen, vol. 2, part 2, 139, 229.

17. Ibid., 170–202.

18. Ibid., 186.

19. Gilster, 9–10, 27.

20. Cohen, vol. 2, part 2, 274–90.

21. Gilster, 84–86.

22. What remains unknown is whether the periods of disruption correlated with periods in which Saddam especially needed reliable, timely communications to maneuver his forces. Also, the fact that the Iraqis limited radio communications before the ground war does not necessarily mean that more secure communications links were always available. They may have chosen to limit radio communications rather than have their messages intercepted.

23. Ironically, the strikes against Iraqi C^2 may have encouraged the Kurdish and Shiite rebellions.

24. Literature provides ample evidence of the political impact of strategic warfare on a nation's population. Stephen A. Garrett, in a study of the British bombing of German cities, states that although the Strategic Bombing Survey tended to stress the power of the police state over its people to stymie their dissatisfaction, there also exists a "tendency of a population to rally around its leaders in times of crisis (especially wartime) and to commit one's resources and will to the nation at a time of maximum peril." *Ethics and Airpower in World War II: The British Bombing of German Cities* (New York: St. Martin's Press, 1993), 158.

Bruce D. Porter, in an analysis of the impact of warfare on the evolution of modern states over five centuries, concludes that "a kingdom at war may be a kingdom at peace. The exigencies of military conflict promote internal rallying: state and society unite in the common effort; economic and political cooperation increase; factionalism and partisanship are diminished; consonance reigns. A distinguished line of political philosophers from Bodin to Hegel have observed that war unites nations, checks domestic strife, and consolidates the power of the state. There are striking historical examples of this, when badly divided polities are suddenly united in war." Porter carries this assessment even further in stating that "mindful of the rallying effect of war, the leaders of divided states may be tempted to engage in divergence, promoting unity by resorting to foreign adventure—'to busy giddy minds with foreign quarrels' in the words of Shakespeare's Henry IV." *War and the Rise*

of the State: The Military Foundations of Modern Politics (New York: Free Press, 1994), 12.

25. One might argue, however, that the devastation rained on Germany and Japan during World War II resulted in the conversion of these nations from militarism to pacificism after the war.

26. Gilster, 114. For an evaluation of the earlier bombing effects of 1965–66, see Oleg Hoeffding, *Bombing North Vietnam: An Appraisal of Economic and Political Effects,* RAND Memorandum RM-5216-ISA (Santa Monica, Calif.: RAND, 1966).

27. Ibid., 113. To the credit of Desert Storm operatives, the major campaign lessons listed in the "Linebacker II USAF Bombing Survey" (ibid., 107–13) were incorporated into Desert Storm. The partial exception concerned the call for improved all-weather capability, which, of course, is more a function of technology than strike control.

28. Atkinson, 151–52.

29. Ibid., 219.

30. Ibid., 216–23, 338–40. See also Cohen and Keaney, 153–57.

31. Cohen and Keaney, 160.

32. Atkinson, 494; and Giulio Douhet, *The Command of the Air,* trans. Dino Ferrari (1942; new imprint, Washington, D.C.: Office of Air Force History, 1983). Douhet is often credited as the original advocate of strategic bombardment to win wars.

33. Public Broadcasting Service, "Can Bombing Win the War?" NOVA, WBGH Educational Foundation, 1993. Qualifying remarks by Gen Merrill A. McPeak and General Horner occur near the end of the one-hour telecast.

34. Atkinson, 250–51.

35. Cohen and Keaney, 226. It is interesting to note the important roles of older, less sophisticated equipment in past wars. After World War II, Gen Dwight D. Eisenhower identified the following as the five most important pieces of equipment that contributed to success in Africa and Europe: the "duck" amphibious vehicle, the bulldozer, the jeep, the two-and-one-half-ton truck, and the C-47 aircraft—none of which were designed for combat. *Crusade in Europe* (Garden City, N.Y.: Doubleday & Co., 1948), 163–64. During the war in Southeast Asia, the AC-130 gunship was by far the most effective weapons system over the Ho Chi Minh Trail in Laos. Gilster, 31–58.

36. Atkinson, 160.

37. Ibid., 224.

38. Ibid., 278.

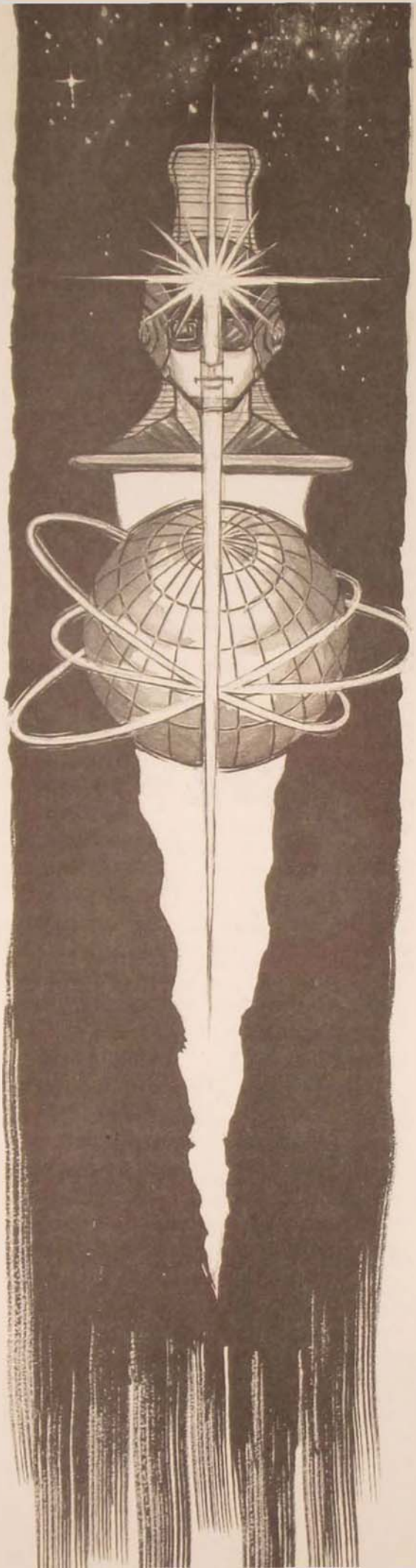
39. Cohen, vol. 2, part 2, 99–100.

40. Gilster, 101.

41. Cohen, vol. 2, part 2, 220.

42. Ibid., see chap. 7 for a comprehensive discussion on whether Desert Storm heralded a revolution in warfare.

43. Perhaps the only way to limit substitution and recovery is to target a nation's manpower base. Jack Hirshleifer of RAND conducted an in-depth investigation of historical disasters and recoveries. After evaluating the recovery of the South after the Civil War, Russia after World War I and the Communist Revolution, and Germany and Japan following World War II, Hirshleifer concluded that the "speed and success of recovery in the observed historical instances have been due in large part to the proportionally smaller destruction of population than of material resources." He also found that completely depopulated cities (e.g., Saint Pierre, Melos, Babylon, and Carthage) often failed to regain their former size and prosperity compared to cities destroyed physically but with large portions of their population intact; further, population was more likely to survive bombing and combat damage than was property. *Disaster and Recovery: A Historical Survey,* RAND Report RM-3079-PR (Santa Monica, Calif.: RAND, 1963), 121–22. Along this same line, over a century ago, economist John Stuart Mill noted that "the possibility of rapid repair of their disasters mainly depends on whether the country has been depopulated." *Principles of Political Economy* (London: Longmans, Green & Co., 1923), 75. A strategy that deliberately targets people, of course, would be unacceptable to a democracy such as the United States.



ANTIPODAL ZONES

Implications for the Future of Space Surveillance and Control

MAJ MARTIN E. B. FRANCE, USAF

MANKIND'S machines, his routes of travel and commerce, and the environment in which he has fought his wars were until relatively recent times confined to two dimensions that were restricted to the earth's surface—land and sea. During this long period, control of certain routes on land and sea have played critical roles in determining the wealth and power of nations. Napoléon said that the world could be his if only he had control of *La Manche* (the English Channel) for a day. The Fulda Gap, now a peaceful valley in central Germany, was once the focus of cold war land forces facing each other for over four decades. Critical choke points like the Suez and Panama Canals and the Straits of Gibraltar and Hormuz are so vital to world trade that the mere threat of closure incites talk of war. Enormous riches in the form of oil, raw materials, and finished goods pass through each daily. Russia's struggle for a warm-water port that would offer opportunities for trade, commercial development, and military power motivated the wars of Peter the Great as well as many of his successors, both imperial and communist.

Ideas about the supreme importance of the sea as a decisive factor in history as advocated by Alfred Thayer Mahan changed

suddenly in the twentieth century when man first challenged the third dimension. Aircraft could now overfly the bottleneck and relieve the blockade, as in the Berlin airlift, or fly over the "Hump" to China. Aerial observation revolutionized battlefield intelligence for the commander, and the long-range bomber added a new aspect to strategic warfare. Air occupation of hostile territory was conjectured and applied, albeit with arguable success. The sea and land routes remained valuable, but the new dimension of airpower redefined our ideas of time, borders, and military strength.

The next logical step, space, had an impact at least as important as that of the airplane. Near-instantaneous worldwide communication, real-time imaging and surveillance, and the spectre of an unstoppable nuclear exchange with less than an hour's warning changed the world. Satellites have an operational lifetime of years instead of the hours of an aircraft mission. Once launched, they are difficult to detect and even more difficult to intercept or neutralize. Control and access to important land, sea, and air routes and the infrastructure are still vital to power and wealth. Today no nation or organization is capable of competing on the world stage without access to space assets. It's the ultimate high ground, but space systems have their vulnerabilities also, one of which looks, at least at first glance, strikingly like an example of Mahan's proverbial narrow seas.[1]

The choke points of low-earth orbit, the antipodal zones, are of vital interest to the space user. A detailed understanding of what antipodal zones are, where they can be found, why they're important, and what we can do to exploit them is crucial to accomplishing aerospace control—a primary role of the US Air Force. This article provides that understanding as well as recommendations for both using antipodal zones to achieve aerospace control and mitigating our vulnerabilities to them.

Definition

The insertion of an artificial satellite into earth orbit requires a great deal of energy due to the earth's eastward rotation. This energy is needed to lift the satellite above the atmosphere and to accelerate it from its local, initial velocity on the launchpad to orbital velocities of greater than 7.5 kilometers (km) per second. Once this is done, the satellite will remain in orbit indefinitely, without any additional expenditure of energy, unless it comes into contact with the upper atmosphere.

Since the beginning of the space age, chemical rockets have launched every artificial satellite—manned and unmanned. While this is not the only way to space, it will almost certainly remain the method of choice for the foreseeable future. In terms of orbital analysis, a chemical rocket launch is very simple. Because of the short total engine burn time (10 minutes or less), the orbital insertion point is generally considered to be at the same longitude and latitude (but not altitude, obviously) as the launch site.

Once burnout occurs, if there are no other engine burns, the satellite will follow an elliptical path in a fixed plane that contains the insertion point and the earth's center and is parallel to the vehicle's position vector (fig. 1). Given the definition of the orbit shown in figure 1, one sees that regardless of the satellite's launch direction (i.e., the compass direction of its velocity vector at orbit insertion), all of the possible orbital planes contain a third critical point besides the earth's center and the launch point, defined here by the vector $-\underline{R}_i$.

Figure 2 displays this same feature, but in terms of orbital ground tracks on a flat projection map for satellites launched into a 1,000-kilometer altitude orbit from Cape Canaveral. This third point—called the antipodal point—is located exactly opposite on the globe from the launch/orbital insertion point. We define an antipodal zone (AZ), then, as an area on the earth's surface directly opposite from the orbital insertion

points possible at a specified launch complex. When one takes into account the rotation of the earth under the satellite during the period in which the satellite travels from insertion to antipodal point (approximately 11 degrees of longitude for low earth orbit—LEO), the adjusted antipodal zone (AAZ) for a launch site will be centered somewhere near 11 degrees west of the launch site's antipodal point. Any satellite launched into LEO (an altitude less than 1,000 km) from Cape Canaveral will pass over its AZ provided the spacecraft performs no other orbital maneuvers in its first half-orbit. Therefore, if one is looking for the ideal point from which to observe any satellite launched into LEO from a specific spaceport, they need look no farther than the antipodal zone!

Implications and Significance

In the nineteenth century, Alfred Thayer Mahan's treatise, *The Influence of Sea Power upon History 1660-1783*, discussed naval blockades that contained the maritime threat posed by an enemy fleet (e.g., the simultaneous British blockade of Toulon, Brest, the

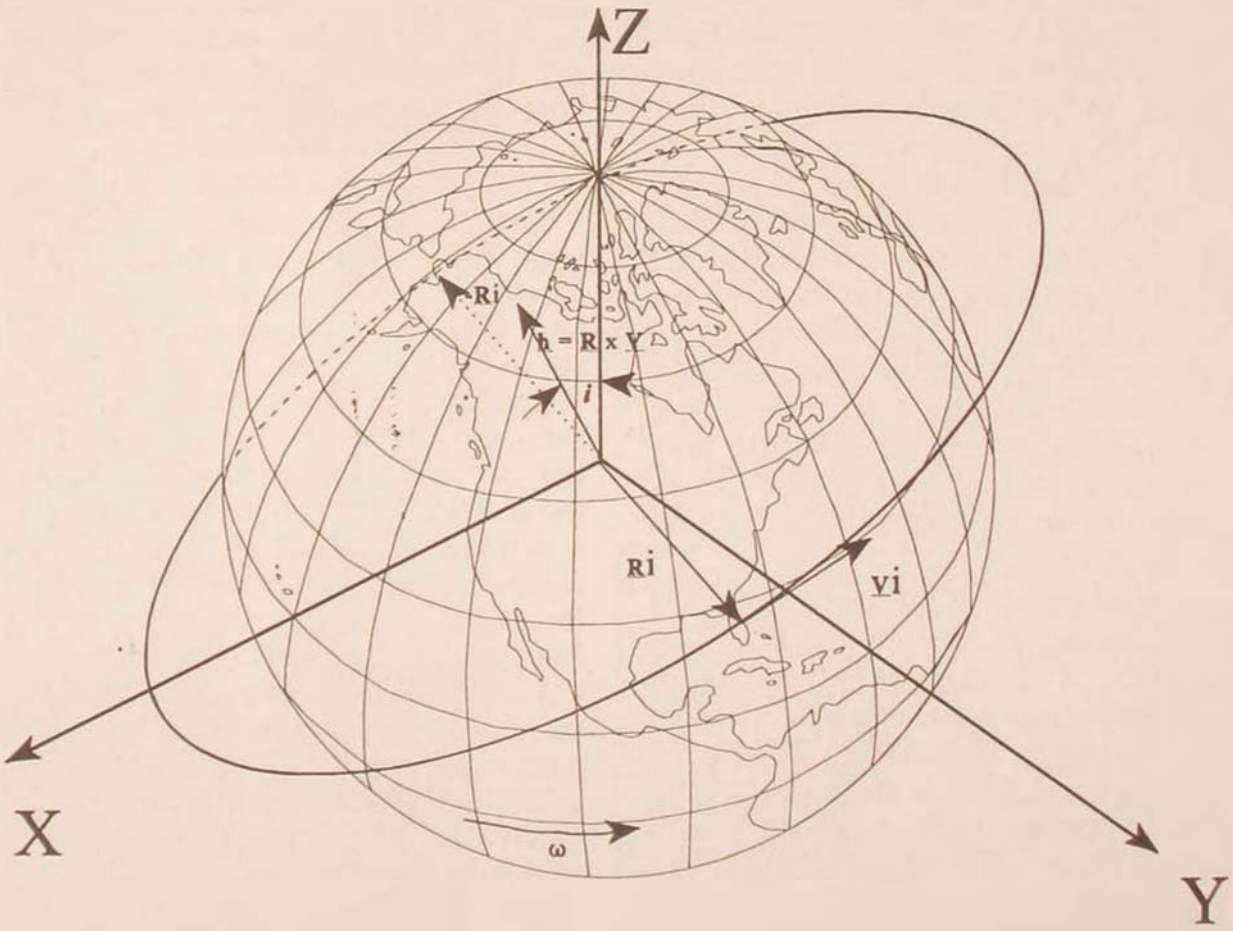


Figure 1. Orbital Geometry

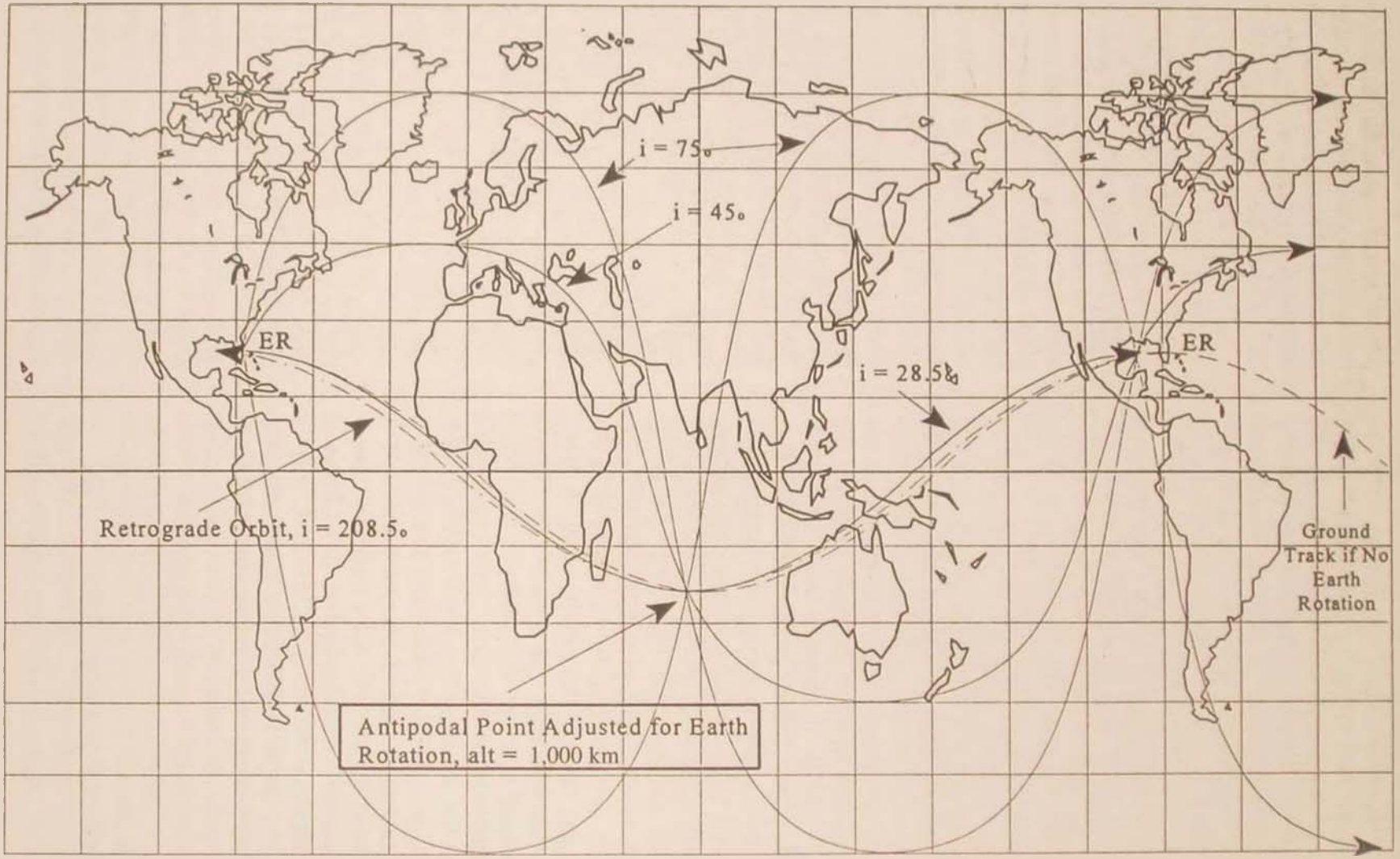


Figure 2. Orbital Track Illustration (Adjusted antipodal point for Cape Canaveral; altitude = 1,000 kilometers)

coast along the Bay of Biscay, and Cadiz)[2] and the control of key straits that could effectively deny necessary commercial trade to colonial nations of the era. Today space control is defined as operations that ensure freedom of action in space for friendly forces while limiting or denying the enemy freedom of action in the use of its space systems during conflict.[3] Is it possible, then, to blockade space? Can we effectively deny an enemy's access to space in the early stages of a conflict or at any time our adversary attempts to deploy additional space assets, such as surveillance, communications, or orbital antisatellite (ASAT) vehicles?

The complexes capable of supporting a satellite launch are very well known. Several are located in littoral regions and could be neutralized by air or naval strikes using conventional munitions. Launch complexes are not currently heavily fortified, nor are the launch vehicles themselves able to absorb much damage. Other, possibly more important, launch sites, however, are located well inland and would require either a spaceborne intercontinental ballistic missile (ICBM) attack or an air strike involving a very long and dangerous overflight of enemy territory. In the latter case, it might be preferable to intercept the launched satellite after its postboost stage but before it is fully operational or has in fact completed its first orbit. Antipodal zones hold the key to this type of operation.

Once the launch sites are located, the associated antipodal zones are also known. For low earth orbits, then, the satellite will pass almost directly the AZ about 45 minutes after launch. In the antipodal zone, friendly space control assets can be brought to bear against the target to either intercept and, presumably, destroy it or to examine and characterize it via remote sensors, be they electromagnetic (radar) or optical (telescopes). These assets could be either ship-based or airborne, since the antipodal zones mentioned are over open oceans.

In short, antipodal zones can be thought of as the modern-day space equivalent of passes or straits. Control of these points, comparable to the control of naval choke points found in Mahan's theory, could effectively deny space access to others. Allowing others to control our antipodal zones could be a fatal mistake.

Interception

The first required task prior to interception or detection at an AZ is launch detection. Current Air Force Space Command (AFSPACECOM) assets such as Defense Support Program (DSP) satellites would certainly be responsible here since this is part of their current mission. Once alerted, components of the US Space Command's (USSPACECOM) space surveillance network could relay preliminary orbital element data to interceptors (air or sea) at the AZ.[4] Radar data at the antipodal zone would then provide additional data to facilitate the terminal phase of interception. Such a mission seems to fit a ship-based system because of the size of radar needed to detect the incoming satellite soon enough to allow interception. However, without some prior warning from DSP or another system as to the direction of the incoming satellite, interception by a sea- or air-launched missile could be quite difficult because of the speed of the target.

A kinetic-energy intercept has its disadvantages. Most notably, the explosive disintegration of an orbiting satellite can add literally thousands of potentially lethal pieces of debris, each traveling over 7.5 km per second. These pieces of space junk can become widely dispersed due to changes in each chunk's orbital elements from those of the original satellite caused by the explosion and natural orbital perturbations (such as solar and lunar gravity, earth's oblateness, solar pressure, and so on) that act on any orbital body. The net result may be the poisoning of an entire orbital belt—something we do not currently have the means of cleaning—making it useless or very dangerous for

any assets, friendly or otherwise, that either traverse the belt or operate in it. This poisoning would be minimized for low orbits below 500 km because atmospheric drag would cause the reentry of most debris over time; above 500 km, however, the debris may stay in orbit for decades. AFSPACECOM currently tracks over 7,000 objects as small as 10 centimeters in LEO and one meter in geosynchronous earth orbit (GEO), although it has been estimated that there are 40,000 to 80,000 untrackable fragments in LEO down to one centimeter in diameter—nearly half of which are a result of nearly 100 satellite breakups since 1961.[5] Of course, any breakups caused by impacts with orbital debris would only serve to magnify the problem by producing even more high-speed space mines.

The use of a directed-energy weapon such as a laser would reduce necessary warning time even more because intercept occurs at the speed of light. In many cases, the chances of explosion and debris creation would also be reduced, but these benefits are tempered by the increased difficulty in assessing a target kill. Atmospheric conditions may also decrease the effectiveness of a laser, depending upon the wavelength chosen and the availability of adaptive optics necessary to compensate for atmospheric distortions of the beam.

What goes into LEOs and which of these satellites might be viable targets for antipodal-zone interception? Of primary military interest at low altitudes, high-resolution imaging satellites would probably be the first target of our proposed antipodal-zone interceptors. Signals and electronic intelligence (SIGINT, ELINT) satellites, responsible for eavesdropping on a potential adversary's radio traffic, might also be found at these altitudes.[6] The disabling of an enemy's space-based reconnaissance systems—engaged in both imaging and data collection—could effectively blind them during the critical early stages of an attack, especially in a situation in which friendly forces also have control of the airspace in the theater of operations, thus preventing aerial reconnaissance. In fact, the interception of newly launched platforms could even prevent an attack by making the enemy's chance of success too small to bear.

Fractional-orbit warheads—those that complete more than one-half but less than a full orbit prior to reentry and target strike—would also be vulnerable to antipodal-zone attack. The Soviet Union tested just such a system (a modified SS-9, Mod 3 Scarp)[7] in the 1960s. However, conventional ICBM and submarine-launched ballistic missile (SLBM) reentry vehicles, as well as intermediate-range ballistic missiles (IRBM) and theater ballistic missiles like the Scud, would not be vulnerable, since they reach their target in less than half an orbit (i.e., prior to passing over their launch site's antipodal point).

Problems with the Concept

Obviously, there exists a very important class of satellites that would seem to be vulnerable to early attack at antipodal choke points, but can this vulnerability be minimized or eliminated altogether by either a potential enemy or by American forces seeking to protect their space assets? Also, what types of satellites simply cannot be reached using this strategy due to their operational orbits? The latter question will be addressed first, continuing the discussion of satellite missions and their related orbits.

Three important classes of spacecraft are typically placed into orbits that do not lend themselves to antipodal-zone interception—commmunications, missile early-warning, and navigation satellites. Missile early-warning satellites, most current communications satellites, and many meteorological satellites are found in geosynchronous earth orbit. A satellite at GEO altitude (35,786 km) and zero inclination (i.e., the orbital plane lies in the earth's equatorial plane) rotates around the earth at precisely the same rate that the earth rotates about its axis. The result is a

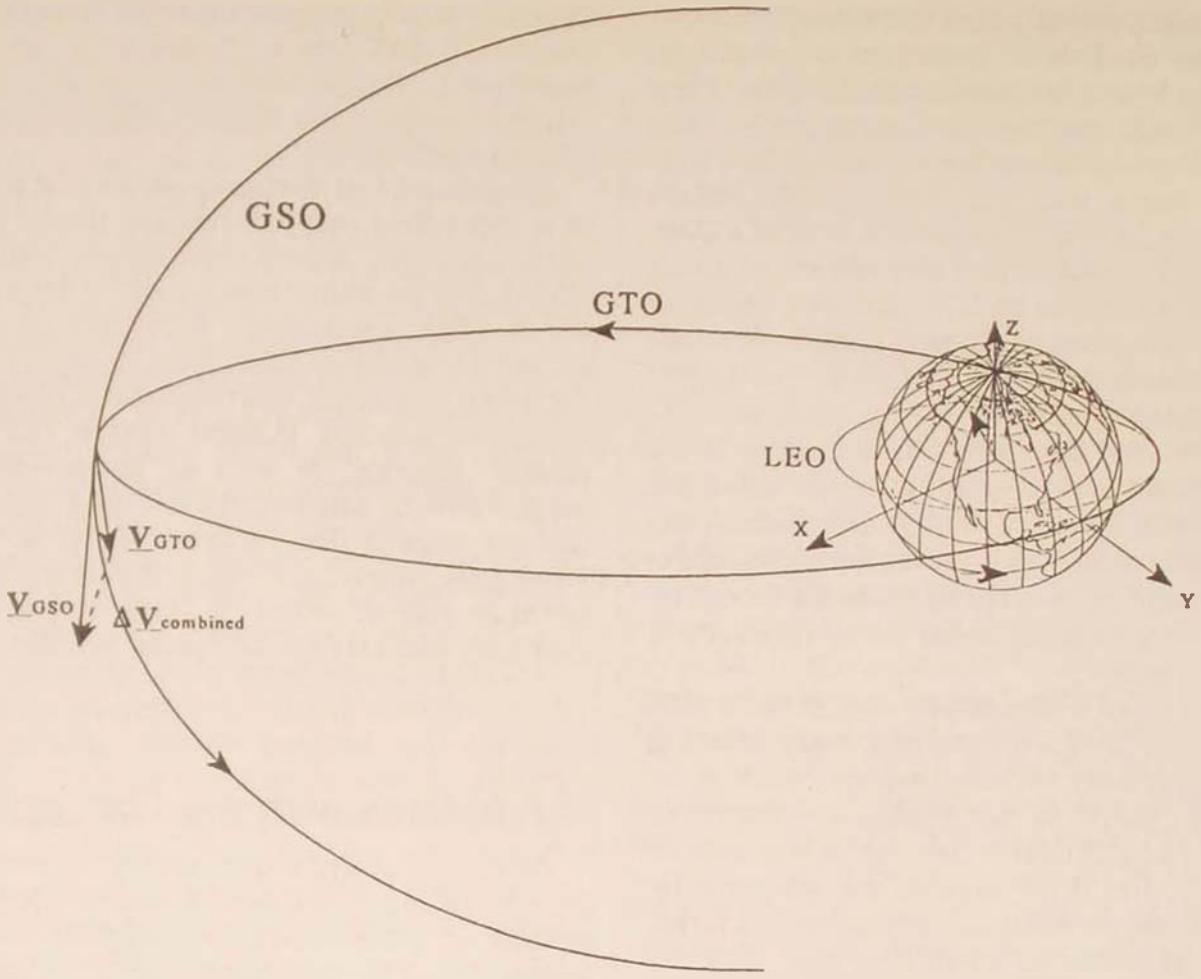


Figure 3. Combined Plane Change at Apogee of GTO

geostationary orbit (GSO), in which the satellite remains over the same spot on the equator, looking down over nearly half of the earth's surface. Three such satellites, appropriately spaced longitudinally, have worldwide coverage except for relatively small areas over the poles.

To put a satellite into GSO, the launch vehicle usually first inserts the spacecraft into LEO. As the satellite passes the equator, headed either northbound or southbound, an upper stage ignites, propelling the spacecraft into a geosynchronous transfer orbit (GTO). GTO is a highly elliptical orbit whose perigee (lowest altitude) is that of a typical circular LEO (e.g., 200 km) and whose apogee is at GEO altitude (35,786 km).

When the satellite reaches apogee, an integral upper stage or apogee kick-motor provides the necessary energy to circularize the orbit and change the inclination to zero degrees (fig. 3). This final maneuver is called a combined plane change, since the two thruster burns generally needed to circularize an elliptical orbit or to effect a plane change are combined into one. A GTO usually has the same inclination as the launch site's latitude—as is the case for a due-east launch that takes full advantage of the launch site's tangential velocity caused by earth's rotation. Like any satellite launched directly into orbit, one in GTO will pass over its antipodal point, since the thruster burn that moved it from LEO to GEO did not change the orientation of the orbital plane, only the size of the orbit. Unfortunately, be-

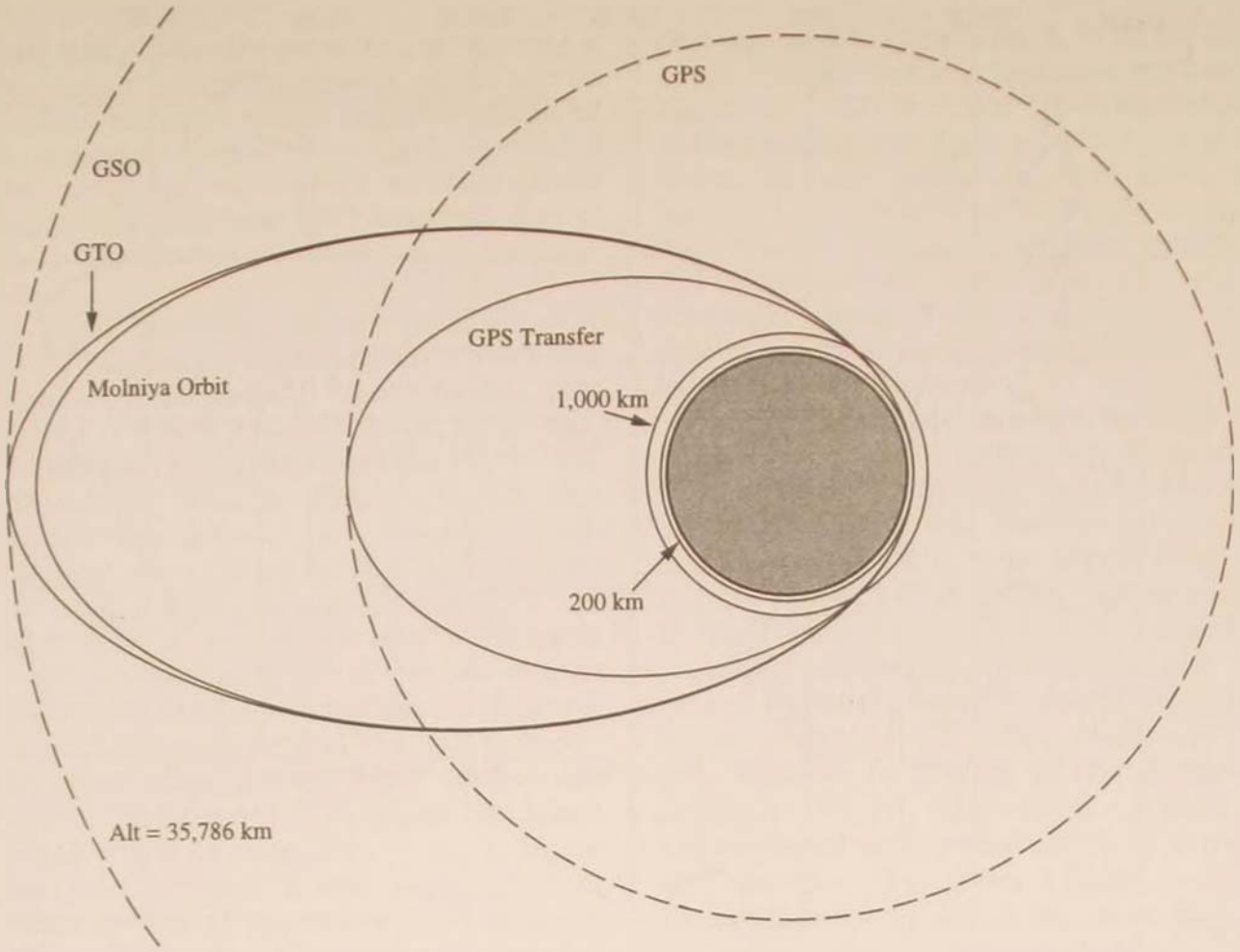


Figure 4. High-altitude Orbits (to scale)

cause of the size (semimajor axis) of the orbit, the elapsed time to where the satellite is directly over the launch site's antipodal point may be up to five hours. The earth may have rotated over 60 degrees in this time, much greater than the 11 to 13 degrees for LEO! Our intercepting platform, waiting at the LEO antipodal point will be nowhere near this point, and the rocket needed to intercept would be prohibitively large anyway, since the satellite's altitude would be much greater as well. If the optics problems due to beam propagation over such a large distance and through the atmosphere could be solved, however, laser interception might still be possible if we stationed our directed-energy weapon at an anticipated GTO antipodal point.

Other orbits above LEO that would cause similar problems for interception include those at semisynchronous (12-hour period) altitudes. Circular semisynchronous orbits are used by satellites in the GPS constellation, while Molniya orbits—inclined, highly eccentric, but still 12-hour orbits—are used by the Russians to provide communications support to high-latitude (polar) regions. In each of these cases, a prepositioned antipodal-zone LEO interceptor—particularly of the kinetic-energy kill variety—would be of little use. Figure 4 shows a comparison of the above orbits, while figure 5 shows the antipodal point for each orbit type (GPS, Molniya, and a first-chance GTO) projected onto the surface of the earth for a launch from the Russian complex at Tyuratam.

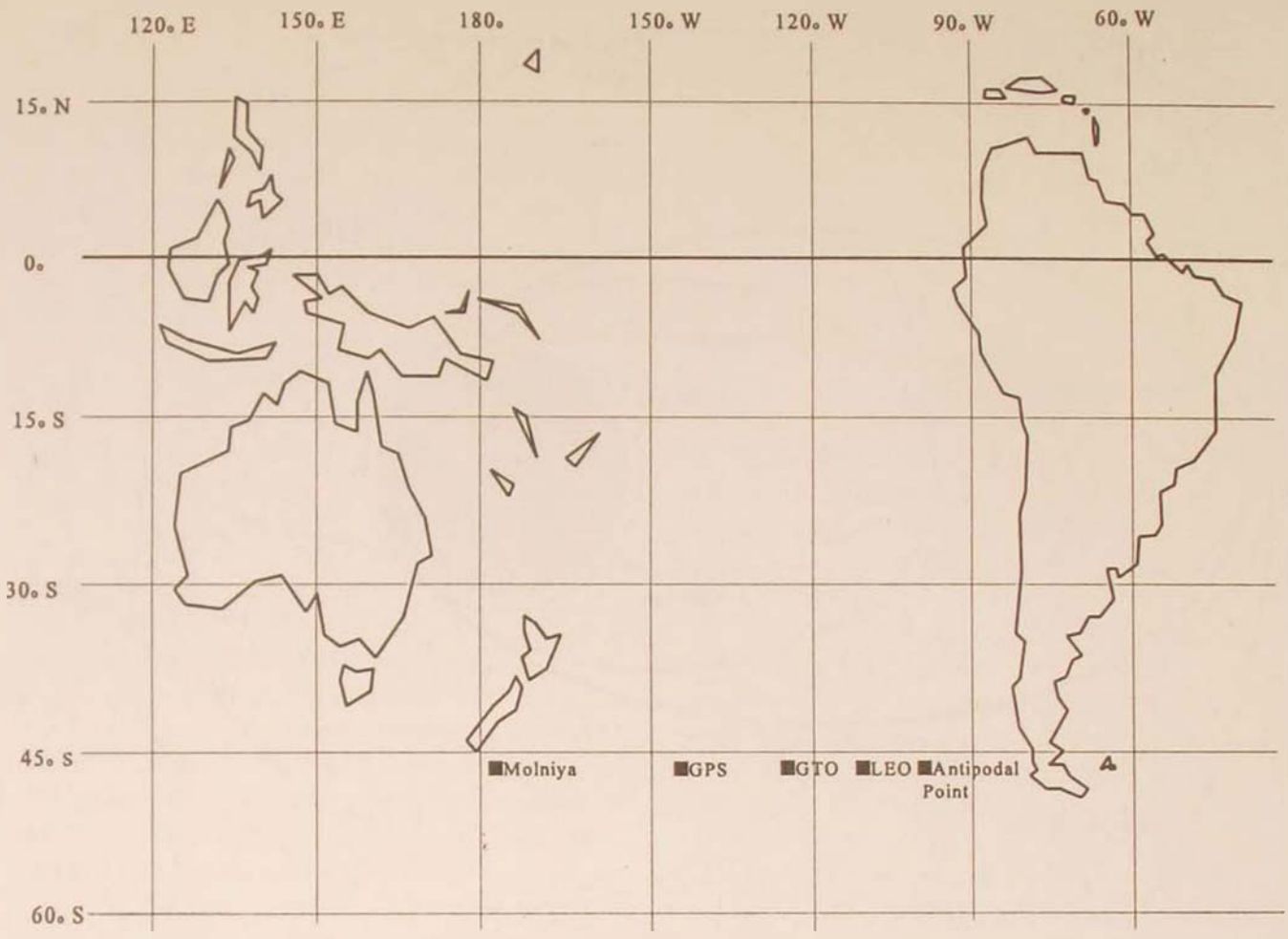


Figure 5. Illustrations of Adjusted Antipodal Points for Various Launches from Tyuratam

As another example, consider the case of a satellite launched directly east (minimum initial inclination) into GTO from the Xichang launch complex in China. If at the descending node a tangential thruster burn (i.e., in the same direction as the satellite's velocity vector, V) is accomplished resulting in a GTO, the satellite's ground track would pass no closer than 2,394 km from the launch antipodal point and approximately 1,000 km from the antipodal point adjusted for earth rotation (AAZ) at an altitude of 5,000 km. Because of this high altitude, however, line-of-sight contact would be possible from both points. Instead of the 44 minutes elapsed time from launch to antipodal (half-orbit) point typical of satellites in LEO, nearly 98 minutes will have passed.

A related weakness in the concept of antipodal interception is that posed by the orbital maneuvering capability possessed by many satellites besides those placed in GSO. The plane-change maneuver used to zero the inclination of a satellite in GSO can be accomplished by any satellite. If, for example, a plane change is effected during the first half of a satellite's orbit using onboard thrusters or a strap-on upper stage at the descending node of a satellite launched from the northern hemisphere, the satellite may not pass over its launch site's AAZ. Most LEO satellites, however, are launched directly into their operational orbits to minimize use of onboard fuel and to maximize either payload or service life. Any fuel expended to accomplish evasive orbital maneuvers reduces

fuel that otherwise would be used for on-orbit station keeping to counter orbital perturbations, maintain proper satellite attitude, or to power onboard systems. Still, because of the relatively low altitude involved, these maneuvers can take LEO satellites out of range (line-of-sight) for waiting AZ interceptors.

As an example, consider the case of a 1,000-kilogram reconnaissance satellite launched from Kourou, French Guiana, into a polar (i = 90°) circular orbit at an altitude of 200 km. As it passes over the North Pole, the satellite fires an attached upper-stage thruster directed in such a way as to maximize the orbital plane change while keeping the circular orbit altitude constant. If the objective is to change the orbit sufficiently so that the satellite is out of the line-of-sight of a surface detection/interception station at the AAZ, there are several strap-on commercial upper stages that can easily achieve this level of performance.[8] Although the added weight would be expensive, it would by no means be prohibitive and would be well within the launch capability of an Ariane 4 rocket. Obviously, if an enemy is aware that his launch site's AZ is controlled by opposing forces for a specific orbit altitude, he can take substantial and fairly simple steps to bypass this choke point, much like an aircraft taking an alternate route to the target. The additional costs are real (between $5,000 and $50,000 per kilogram, depending upon the system used)[9] but not insurmountable, especially in situations where national security is involved.

Probably the most serious threat to this new strategy of orbital strangulation comes from the development of mobile launchers. The United States currently has one operational mobile launcher, the air-launched Pegasus rocket produced by Orbital Sciences Corporation. First launched in April 1990 from off the Pacific Coast near Monterey, California, Pegasus is a winged, three-stage, unmanned vehicle carried aloft by the same USAF-owned, NASA-operated B-52 (#0008) that was used to launch the X-15 in the early 1960s. Orbital Sciences has since acquired a Lockheed L-1011 for later launches, but the point remains that such a system could be flown to any point on the globe for launch.[10] The benefit for evading an antipodal-zone interception is obvious: Intercepting forces would not know the launch antipodal point until after the launch, greatly reducing the chances of having early-intercept assets on hand.

Taurus is another system produced by Orbital Sciences Corporation. This standard vertical-launch, four-stage vehicle uses the same first stage as the Peacekeeper missile. The upper three stages are identical to the Pegasus rocket. What makes Taurus unique is its low-infrastructure launch capability. Originally contracted by the Defense Advanced Research Projects Agency (DARPA), Taurus is designed to place small satellites into LEO within 72 hours of command, following a five-day setup on a standard cement slab not unlike what could be found at any airport. The entire system is easily transportable to provide for wide deployment and surge launch capability.[11] Only very good intelligence gathering and mobile interceptors guarantee antipodal-point interception for a satellite placed into LEO by such a system.

Other future systems that could make antipodal-zone interception impractical are reusable launch vehicles (RLV) such as fully operational versions of the National Aeronautics and Space Administration (NASA) X-33 and X-34 RLV technology-demonstration programs. These systems may be self-ferrying and capable of operating at launch sites requiring little specialized support such as standard airport facilities or, in some cases, any flat piece of ground. Additionally, RLV systems are inherently more maneuverable than the standard direct-launch, expendable vehicles that have monopolized the launch industry since the days of Sputnik.

Whereas Pegasus is the only currently operational mobile launch system, there is little

doubt that other nations have the technology available. For example, in 1991 Space Commerce Corporation proposed using SLBMs of the former Soviet Union to launch small payloads into LEO from Delta-class submarines. The Vysota (SS-N-8 Sawfly), Volna (SS-N-18 Stingray) and Shetal (SS-N-23 Skiff) could all launch satellites into orbit with no more warning than an SLBM attack and, of course, very little time to position forces in the correct location to make antipodal-zone interception practical.[12]

The fact that mobile launch systems are not more common is probably due to the increased cost of development (in some cases) and the reduced payload over medium- and heavy-lift vehicles that currently operate from fixed, high-infrastructure sites. Also, no real threat of antipodal-zone interception has necessitated a hard look at the advantages of such a mobile system. However, if such a threat materializes, mobile systems will quickly become the norm, in much the same way that mobile ICBMs and IRBMs were considered quite seriously and in some cases fully developed during the cold war in response to the increased threat of counterforce targeting. Of course, SLBMs have always been mobile in this sense.

Alternatives

The question of which type of ASAT system would best serve the mission of space control is quite complex, and has already filled volumes—from studies to proposals, actual tests, and endless debate. The intention here is not to fully cover this subject but to suggest where antipodal-zone interception concepts might (or might not) fit into this debate.

Of course, an ASAT system would have some commonality with a ballistic missile defense (BMD) system and would in many cases be completely redundant. For example, a boost-phase (prior to orbital insertion) interception system would be equally as effective for negating a reconnaissance satellite launch as that of an ICBM. Space-based interceptors that could neutralize ICBM or SLBM reentry vehicles in the midcourse phase could also intercept satellites—particularly those in LEO. DSP satellites and other launch-detection assets mentioned earlier would provide launch warning for both system types. For these reasons, it would seem obvious that if the United States were to develop and deploy a boost or midcourse-interception BMD system, there would be little reason to develop an additional ASAT system based on antipodal-zone interception, although surface-based components of this type of system (directed-energy weapons, for example) could be deployed in critical AAZs during times of heightened tension.

A terminal-phase BMD system using kinetic interceptors might be employed in an AZ-interception scheme, assuming they had the altitude capability necessary for LEO intercept. However, deploying such a system for long periods of time in the open ocean would be expensive and difficult, especially since such a shipborne asset would be an attractive target to any enemies intent on preserving their space accessibility. A ship-based interceptor would presumably require the type of protection one would associate with a carrier battle group. Loiter time of an airborne intercept, or detection system at an antipodal point would be even more limited, and the distance of most AAZs from land would make ground-based, rapid-response, or alert aircraft ineffectual.

Still another argument against the necessity of placing interception assets in AAZs is the fact that any satellite launched into LEO will pass within line of sight and therefore presumably be within interception range, at least once per day, for any ground-based interception site located at a latitude less than or equal to the satellites inclination. In other words, we could intercept any satellite in LEO within 24 hours, using the same assets that an antipodal-zone system would use, from the safety and security of the con-

tinental United States (CONUS). The maximum wait time would be much less with additional assets based in several widely dispersed locations such as Hawaii and Diego Garcia. Considering the fact that the United States has already successfully tested an air-launched (from an F-15) ASAT against a target in LEO during the 1980s—though it was never operational—argues against the necessity of investing in an antipodal-zone interception system.

Conclusion

This paper has defined antipodal-zone interception of space assets in the context of modern space-control strategy without real regard to national policy or whether any ASAT system should be deployed. The point was not to argue if ASAT systems should be used, but simply to point out that certain operational and strategic objectives could be met through their employment, in times of crisis, if the necessary system infrastructure is present and the national command authorities decide to use them. Like any militarily significant technical advancement, the use of space assets to advance or secure national power in the context of the modern world will not be forgotten. In this grand strategy that aims primarily at access to or denial of vital information—command, control, communications, information, and reconnaissance systems—antipodal-zone interception of just-launched space assets constitutes an aspect of space control that both we, the United States, and our contemporaries in the space-faring world must recognize and exploit if possible and economically justifiable. The United States should continue to develop space launch systems that are relatively invulnerable to AZ interception, such as Pegasus, Taurus, RLV, and others, while maximizing launch flexibility and surge rates and minimizing necessary launch infrastructure and, therefore, cost. Designing for additional orbital-maneuvering capability in future high-value spacecraft would also minimize our vulnerability to AZ-based ASAT weapons systems. If adversaries develop AZ-interception capability, above and beyond any based on their own soil, US naval or air assets should be trained and employed to neutralize the threat, if necessary, in times of heightened tension or outright conflict.

Because of the many available counters to AZ interception, however, and the fact that cheaper and, in some cases, proven tactics already exist for ASAT operations, the United States should not pursue development or further study of an antipodal-zone interception system. It should not do this for reasons stated in the body of this paper—namely, that any interceptor technology developed for AZ use would almost certainly be just as effective, and in many cases no slower, if based within the borders of the United States, its possessions, or those of its allies. The price of a durable, persistent AZ-based system would almost certainly be much higher, however, because of the location of AZs of potential adversary nations. AZ basing would, again, be unnecessary and ineffectual if an enemy decided to employ evasive tactics or to develop mobile systems, as he most surely would if we had demonstrated control of the air and space above his launch site AAZs.

In conclusion, antipodal-zone interception is an interesting idea that deserved a complete evaluation. Awareness of any developments in ASAT technology in the future and being vigilant to threats they pose will continue to be important to the Air Force mission of space control. If used in conjunction with AZ control or basing, within a doctrine of generally minimizing the threat to our space assets, the relatively little leveraging such basing provides does not justify the expense to put them there. □

Notes

1. Aadu Karemaa, "What Would Mahan Say about Space Power," US Naval Institute *Proceedings*, April 1988, 48–49.

2. Alfred T. Mahan, *The Influence of Sea Power upon History 1660–1783* (Boston: Little, Brown and Company, 1890), 23–24.

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4. AU-18, *Space Handbook: A War Fighter's Guide to Space*, prepared by Maj Michael J. Muolo et al. (Maxwell AFB, Ala.: Air University Press, 1993), vol.1, 97.

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6. Joseph P. Loftus, Jr., Charles Teixiera, and Martin E. B. France, "Launch Systems," chap. 18 in Larson and Wertz, 617.

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8. Loftus, Teixiera, and France, 614.

9. Robert Wong, "Cost Modeling," chap. 20 in Larson and Wertz, 671.

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11. Ibid., 331–32.

12. Ibid., 261–62.

The ideal officer should be afraid of nothing, not even a new idea.
—Gen Sir Archibald Wavell

BASE ACCESS CONSTRAINTS AND CRISIS RESPONSE*

ADAM B. SIEGEL

AMID THE DEBATE over roles and missions in recent years, claims of land-based airpower's capacity to match the contributions of US Navy aircraft carriers have been a prominent theme. As part of that argument, some advocates of land-based aviation have argued that basing and other constraints have little relevance to the debate—that basing constraints have not prevented land-based airpower from contributing to US military operations. In a letter of 3 January 1995 to the Commission on Roles and Missions of the Armed Forces, Maj Gen Charles D. Link, USAF, special assistant to the chief of staff (USAF) for roles and missions, states,

> With regard to Admiral Boorda's concern about "unlimited access to foreign basing or that an enemy will not attack the airfields we intend to use" we are frankly perplexed. Since the establishment of the United States Air Force, we know of no significant operation in which land-based airpower has failed to contribute because of basing constraints.[1]

Although entirely truthful, General Link's comment masks a far more complicated history of US access to facilities and airspace. Although land-based airpower has contributed, in some manner, to every significant US military operation since World War II, basing constraints have often seriously limited the contribution of land-based airpower.

A wide range of basing and other constraints can limit—and have limited—the ability of US land-based aircraft to contribute to US military operations (table 1). These include (but are not limited to) four types of constraints:

*This article is abstracted from Adam B. Siegel, Miscellaneous Paper no. 178, *Basing and Other Constraints on Land-Based Aviation Contributions to U.S. Contingency Operations* (Alexandria, Va.: Center for Naval Analyses, March 1995). This article presents the author's views and not necessarily those of the Center for Naval Analyses, the Department of the Navy, or any part of the US government.

- *Overflight restrictions:* Countries—allied, neutral, and hostile—can refuse permission for US aircraft to overfly their airspace.
- *Base access problems:* Governments can deny the US access to basing facilities or can limit base use.
- *Limited base infrastructure:* Limitations on base infrastructure can hamper operations by limiting the number of deployable aircraft or by restricting throughput.
- *Political repercussions of unauthorized base usage:* When the US chooses not to seek permission or ignores the wishes of the host country, serious political repercussions can adversely affect US ability to respond to a different situation.

Table 1
Examples of Limitations on US Land-Based Air Operations during Contingency Operations

YEAR(S)	COUNTRY(IES)	RESTRICTION	DESCRIPTION
1958	Greece, Austria, Switzerland	Overflight denied	These three countries denied overflight rights for the transportation of US Army units from Germany to Turkey in support of Operation Blue Bat in Lebanon.
1958	Saudi Arabia	Base access denied; overflight denied	The Saudi government stated that the US could not use Saudi bases or airspace to support British operations in Jordan.
1964	Libya	Base access not sought	State Department vetoed Wheelus AFB, Libya, to support Congo operations.
1964	Spain	Transit rights denied; political repercussions	US airlift aircraft staged through Spain en route to the Congo without permission from the Spanish government. Spain refused to allow the aircraft to return via Spain.
1965-66	Vietnam	Physical limitations	South Vietnamese air bases could not support the required buildup of tactical aviation. Aircraft carriers deployed to fill the ground-support gap until air base construction caught up with requirements.
1973	Western Europe	Base access denied; overflight denied	With the exception of Portugal (Azores), all Western European countries denied the US permission to use their airfields or airspace in support of the airlift to Israel.
1975	Thailand	Restricted base use	During the *Mayaguez* rescue operation, the Thai government did not allow USAF strikes against the Cambodian mainland.
1979	Costa Rica	Base access denied	The Costa Rican government ejected a USAF unit that was forward deployed for a potential evacuation of Americans from Nicaragua.
1980-90	Persian Gulf	Base access denied	The US government had little success obtaining base access following the Shah's fall.
1986	Spain, France	Overflight denied	France and Spain did not grant overflight rights to UK-based F-111s participating in strikes against Libya.

Table 1 (continued)

YEAR(S)	COUNTRY(IES)	RESTRICTION	DESCRIPTION
1992-95	Italy	Restricted base use	The Italian government has placed restricted flight hours on bases from which aircraft support NATO and UN operations.
1994	Saudi Arabia	Base access delayed	The Saudi government delayed movement of USAF aircraft to respond to Iraqi movements.

Overflight Restrictions

For many, if not most, military operations involving land-based aircraft, the US will want these aircraft to fly through another country's (or countries') airspace. Most occasions involve the use of transport aircraft on essentially routine missions, and overflight rights are routinely granted.

Only rarely does the US have unimpeded and unquestioned overflight rights, and it either has had trouble acquiring or has been unable to secure approval for overflights in many contingency operations. In 1958, for example, Austria, Greece, and Switzerland refused to grant overflight to transport aircraft en route to Turkey in support of the US intervention in Lebanon. In 1973, NATO allies would not allow US aircraft to fly through their airspace en route to Israel. In April 1986, both France and Spain refused to allow F-111s overflight rights as part of the strikes against Libya. Before and during Operation Desert Storm, the Indian government restricted the overflight of transport aircraft.

Base Access Problems

Issues of national sovereignty can affect US military operations in many ways. Besides having to seek permission to fly through another country's airspace, the US must seek approval to use bases and airfields to support military operations. In many cases, such permission is a prenegotiated element of a base agreement. In others, such as typically occurs with airlift aircraft involved in humanitarian assistance operations, this process is essentially pro forma and rather rapidly accomplished. At other times, however, the host nation constrains or even refuses US use of facilities to support an ongoing US military operation (table 2). In some cases, the US will not even attempt to use or gain access to bases on the assumption that the host nation will deny their use.

The more interests that a host nation and the US have in common, the less likely a denial or constraint on US base access will occur. When US and host-nation interests diverge, however, US use of facilities may be constrained or even refused. For example, the US did not operate

Table 2
Selected Chronology of US Military Access Denials since 1947

YEAR(S)	COUNTRY	DESCRIPTION
1947-48	Australia	Australia denies the US postwar basing rights at Manus in the Admiralty Islands.
1960-61	Cuba	The US severs diplomatic relations with Cuba, partially due to the US military presence at Guantanamo Bay.
1962	Saudi Arabia	The Saudi government refuses to renew the US lease for bases at Dhahran airfield, ending the US presence there.
1963	Morocco	The Moroccan government shuts down three US bases.
1964	Spain	Following unauthorized use of Moron Air Base to support operations in the eastern Congo, Spain refuses to allow US aircraft or personnel to use Spanish bases for returning from Africa to Europe.
1966	France	France's withdrawal from NATO's united military structure forces the US to shut down all bases in France, including nine major air bases.
1969-70	Libya	Following his seizure of power, Col Muammar Qadhafi requires the US to leave Wheelus AFB.
1973	Western Europe	During the US resupply effort to Israel, Portugal was the only European country to allow the US to use its bases (on the Azores) for supporting the airlift effort.
1973-74	Thailand	Six US bases are shut down due to local opposition.
1975	Turkey	In response to US pressure on Turkey to moderate its role in Cyprus, Turkey requires the US to close all of its military installations on Turkish soil.
1975	Vietnam	Following the fall of South Vietnam, over 60 principal bases and installations constructed by the US during the course of the war are occupied by North Vietnamese forces.
1978	Ethiopia	The new Ethiopian regime forces the US to evacuate from its facilities.
1979	Iran	Following the fall of the Shah, the Islamic Republic effectively severs all previously negotiated prior-access agreements.
1988	Spain	Spain refuses to renew the lease on Torrejon Air Base outside Madrid, forcing the withdrawal of the 41st Tactical Air Wing.
1990	Liberia	The civil war in Liberia forces the evacuation of communication facilities and ends the use of Liberia as an emergency divert site for shuttle missions.
1990	Somalia	The disorder in Somalia leads to the removal of all supplies from the facilities at Berbera, Somalia, in December 1990.
1991	Philippines	Nationalist opposition in the Philippine Senate to US bases ends the almost century-long US military presence in the Philippines.

B-52s from the Philippines during the Vietnam War due to concerns over Filipino sensitivities,[2] and Thailand greatly restricted the use of bases in support of the *Mayaguez* rescue operation in 1975.[3]

Control over the access and use of bases provides host countries with a means of political leverage and a means to signal discontent over some aspect of US policy. The Italian government's displeasure over perceived slights with regard to its role in the former Republic of Yugoslavia led to a refusal to allow the deployment of USAF F-117 stealth fighters to Aviano, Italy.[4]

Sometimes the US finds it difficult if not impossible to gain access agreements to support military operations. From the fall of the Shah of Iran in 1978 until the Iraqi invasion of Kuwait in 1990, the US had only the most limited base access in the Persian Gulf region, even though US military activity was almost continuously high in this area.[5] Throughout this period, basing constraints limited land-based airpower's contribution to US military operations in the Persian Gulf region to airlift, aerial refueling, command and control, intelligence, and maritime surveillance patrols by US Navy aircraft.

Limited Base Infrastructure

In some cases, limitations on US military operations have little or nothing to do with political issues. Sometimes constraints are physical, creating limitations on the ability of forces to move into a region or limiting the ability to operate as desired. The following are examples of physical limitations hampering the ability of land-based airpower to contribute to an operation:

- In 1958, USAF combat and transport aircraft overwhelmed available bases in Turkey and the airport in Beirut as they moved in support of Operation Blue Bat in Lebanon. This situation delayed the movement of US Army forces from Europe and would have limited the ability of deployed combat aircraft to execute missions.[6]
- In 1960, airfield inadequacies constrained US airlift operations following a major earthquake in Chile. Constraints included airfields with inadequate (essentially no) ramp space and no capacity to support air activity in bad weather.[7]
- In 1965 and 1966, South Vietnam's air bases could not handle USAF and Marine Corps aviation required to support the buildup of ground forces. The commander in chief of Pacific Command ordered Navy aircraft carriers to "Dixie Station" off Vietnam to fill part of the gap in requirements. Construction of air bases eased this problem by mid-1966.[8]
- In 1992, an inadequate basing infrastructure hampered airlift movements to Mogadishu, Somalia, as part of Operation Restore Hope. Specifically, the support air base in Egypt had limited ramp space and could not support round-the-clock operations. In addition, the Mogadishu airport had minimal ramp space for unloading aircraft.

In these and other cases, Air Force (and other) personnel have diligently worked to overcome basing constraints on the full use of land-based airpower's capabilities to contribute to the overall operation. Inadequacies in base structure did not prevent land-based airpower from contributing but did make contributing more difficult.

Political Repercussions of Unauthorized Base Usage

The US has sometimes acted without seeking host-nation approval—an action that can lead to host-nation backlash, limiting future US activity. In 1964, for example, the US—without approval—moved a transport squadron through Spain to support operations in the eastern Congo. In response, the Spanish refused to allow the aircraft to return through Spanish airspace.[9] In 1980, the US—without seeking approval—used Omani facilities in the attempted rescue of US Embassy hostages in Teheran, Iran. The Omani government has restricted US use of Omani facilities since then.[10]

Summary and Conclusion

We have seen how limitations—imposed by US allies, neutral states, and physical realities—can affect the ability of land-based aviation to contribute to a US contingency operation. In many cases, the Air Force and other affected services have been able to overcome limitations and fully accomplish the mission. Such was the case when the Air Force adopted work-arounds after Austria, Greece, and Switzerland refused overflight rights for USAF aircraft en route to Lebanon during Operation Blue Bat in 1958. The pilots and planes had to fly longer distances, but the Air Force got the job done.

In other situations, however, basing (and other) constraints seriously limit the capabilities that land-based airpower can bring to bear. During the Arab-Israeli War of 1973, USAF fighter aircraft could not use European bases to provide escorts to airlift aircraft carrying supplies to Israel. Therefore, Navy aircraft (flying from aircraft carriers) provided protection to cargo planes throughout the Mediterranean. During the Earnest Will escort operations of 1987–88, America's Arab partners allowed only limited air operations from their countries and no fighter or bomber activity. Only Marine Corps and Navy aircraft flying from aircraft carriers could provide the necessary air coverage for the escort operations.

Without a doubt, land-based aviation, including the US Air Force, has contributed to every significant operation over the past 48 years—often in very important ways. However, these contributions should not mask the fact that basing (and other) constraints have seriously limited the ability of land-based aviation to assist many of these operations.

Alexandria, Virginia

Notes

1. Maj Gen Charles D. Link, USAF, AF/RO, to Mr Michael Leonard, executive director, Commission on Roles and Missions of the Armed Forces, letter, 3 January 1995. General Link goes on to say that "we would also disagree with the implication that airfields are somehow more vulnerable than carriers to attack." Although this issue is not the subject of this article and although history does not necessarily

foretell the future, it is interesting to note that since World War II, the US has not lost a single aircraft on an aircraft carrier due to enemy action. However, enemies have destroyed aircraft on land bases in such places as Korea, Vietnam, and Puerto Rico (due to terrorism).

2. Katharine Watkins Webb, "Are Overseas Bases Worth the Bucks? An Approach to Assessing Operational Value and an Application to the Philippines" (PhD diss., RAND Graduate Institute, 1988), 6.

3. David R. Mets, *Land-Based Air Power in Third World Crises* (Maxwell AFB, Ala.: Air University Press, July 1986), 56–57.

4. Daniel Williams, "Italy Seeks Bigger Role on Diplomatic Stage," *Washington Post*, 11 October 1995, 27.

5. Notable crises include the embassy hostages in Teheran, Iran; the Soviet invasion of Afghanistan and the subsequent war in that country; the Iraqi invasion of Iran; and the shipping war within the overall Iran–Iraq War. For further examples and brief discussions of military responses, see Adam B. Siegel, *The Use of Naval Forces in the Post-War Era: U.S. Navy and U.S. Marine Corps Crisis Response Activity, 1946–1990*, Research Memorandum no. 90-246 (Alexandria, Va.: Center for Naval Analyses, February 1991); and *45 Years of Global Reach and Power: The United States Air Force and National Security, 1947–1992* (Washington, D.C.: Department of the Air Force, 1992).

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7. Press release, Headquarters Military Air Transport Service (MATS), Scott AFB, Ill., 28 May 1960, in file "Press releases: MATS, USAF, Scott"; and CINCCARIB Quarry Heights C.Z. 26171B (May 1960) "Sit Rep 1 as of 261600Z May 60," in folder "AMIGOS Airlift (earthquake) May 1960," in Air Mobility Command archives, Scott AFB, Ill.

8. Edwin Bickford Hooper, *The United States Navy and the Vietnam Conflict*, vol. 2, *From Military Assistance to Combat, 1959–1965* by Edward J. Marolda and Oscar P. Fitzgerald (Washington, D.C.: Naval Historical Center, Department of the Navy, 1986), 515–16; C. Bernard Barfoot, *An Overview of CV TACAIR Operations in the Vietnam War*, Research Memorandum no. 94-152 (Alexandria, Va.: Center for Naval Analyses, October 1994), 6; J. F. Brennan et al., *Analysis of Tactical Aircraft Operations in Southeast Asia, 1965–1966*, Operations Evaluation Group Study no. 712 (Alexandria, Va.: Center for Naval Analyses, January 1968), 1:3, 2:10, 13; and René J. Francillon, *Tonkin Gulf Yacht Club: U.S. Carrier Operations off Vietnam* (Annapolis, Md.: Naval Institute Press, 1988), 42–43.

9. Maj Thomas P. Odom, *Dragon Operations: Hostage Rescues in the Congo, 1964–1965*, Leavenworth Papers no. 14 (Fort Leavenworth, Kans.: Combat Studies Institute, US Army Command and General Staff College, 1988), 75.

10. Paul B. Ryan, *The Iranian Rescue Mission: Why It Failed* (Annapolis, Md.: Naval Institute Press, 1985), 63; and Robert Harkavy, *Great Power Competition for Overseas Bases: The Geopolitics of Access Diplomacy* (New York: Pergamon Press, 1982), 218–19.

BASE ACCESS IN PERSPECTIVE

MAJ CHRIS DAEHNICK, USAF

IN HIS ARTICLE "Base Access Constraints and Crisis Response," Adam Siegel seems to be struggling to make a point. He acknowledges that land-based airpower has in fact contributed to every significant operation in the past 48 years. His contention that land-based airpower must deal with constraints is indisputable, and his illustration of constraints treads no new ground. However, his implicit assertion that carrier-based aviation has none of these constraints (or any constraints not facing land-based airpower) is flawed. Finally, he fails to make a case that basing constraints have "seriously limited" land-based airpower's contribution.

One thing should be clear up front: the Air Force is not arguing for the elimination of aircraft carriers. Without a doubt, a large-deck carrier battle group (CVBG) provides the US with a flexible capability unmatched by any other country. The issue raised during the roles-and-missions debate and by Maj Gen Charles D. Link in his letter is that land-based airpower has the ability to perform some functions traditionally assigned to CVBGs and that, as a consequence, the Department of Defense (DOD) should reexamine the number of large-deck aircraft carriers this country needs.

Criticisms of land-based airpower's ability to respond to crises tend to fall into the categories mentioned in Mr Siegel's article, but these arguments carry even less weight now than they might have in past years. In truth, all military forces operate under constraints and limitations—both physical and political. A proper evaluation of land-based airpower's contribution needs to address this issue honestly.

Perhaps the key debating points are overflight rights and base-access restrictions, which in turn increase transit time, decrease sortie rates, and complicate mission planning for land-based airpower. European refusal to allow overflight for the Operation El Dorado Canyon strikes against Libya is a timeworn example that proves little. Yes, the mission was more difficult as a result, but that's about all one can say. The F-111s did their job. Most of the other examples Mr Siegel mentions are even less relevant.

An example that Mr Siegel did not cite was the recent deployment of an air expeditionary force to Bahrain to cover a gap in CVBG deployments. A critic might argue that political constraints resulted in deployment of fewer aircraft than originally planned and that the capability deployed was less than that of a carrier air wing. Yet, the fact that the deployment has been an effective deterrent raises the question of whether a CVBG is always necessary for this mission. Perhaps, as Gen John Shalikashvili,

chairman of the Joint Chiefs of Staff, suggested to *Air Force Times*, some presence missions could be built around a much smaller naval component with forward-deployed land-based aircraft.[1]

But to focus only on military-employment issues is to miss the forest for the trees. In virtually every case, limitations imposed on US forces have resulted from a divergence of interests, a lack of vital interests at stake for one or more parties, or perhaps a failure on the part of the US to do necessary political and diplomatic homework. The more US interests are perceived to be at stake, the higher the price we will be willing to pay to intervene—whether in terms of cash, commitment, or political capital. The more the interests of a "host" nation are threatened, the more willing it will be to make concessions.[2] To see this, one need only look at the deployment of hundreds of US aircraft—not to mention hundreds of thousands of troops—to Saudi Arabia and other Arab states for Operation Desert Shield.

As a last resort, of course, forces might have to travel a long way from home bases over international waters to perform their mission. Unless the CVBG is already on station, it does this at around 30 knots—long-range aircraft at around 400.

Carrier advocates object that, once the CVBG arrives, it provides a sustainable presence and the ability to react more rapidly than long-range airpower. This is true, but the CVBG has costs and limitations as well. Operational experience indicates that one big-deck carrier can generate strike sorties for three to six days before standing down for one or two.[3] Consequently, sustained air operations with carrier aviation require more than one carrier. This comes at a cost of several thousand personnel and a long supply chain—all on ships that are vulnerable to attack.[4]

It seems particularly ironic that Mr Siegel uses "limited base infrastructure" as a constraint on the "full use of land-based airpower's capabilities"; after all, what air base could be more inherently limited than a ship? Given the need—and in relatively short order—land-based runways can be lengthened, necessary ramp space and facilities constructed, and all necessary supplies brought in.

Mr Siegel's final point—that political repercussions exist for unilateral US action—hardly bears discussing. This constraint exists for any use of military force (or other instrument of national power), and Siegel's examples have little more relevance to the debate on the merits of land versus sea basing than does the banning of US warships from New Zealand because of US refusal to declare whether or not nuclear weapons were on board.

Unquestionably, the US needs the ability to act unilaterally on occasion, but to an increasing extent, this is neither necessary nor desirable. As a consequence, the political and diplomatic groundwork necessary to respond successfully to a crisis will include negotiations over the use of foreign bases. If the US must respond globally, in a matter of hours,

long-range land-based aircraft with aerial refueling can deliver—cargo, troops, or bombs—regardless of basing or overflight constraints. If a large, high-tempo, and/or sustained effort is needed, it will almost certainly be in the interests of the US and whatever country it is supporting to negotiate basing and transit privileges. In such a case, the missions flown by land-based aircraft in-theater will rapidly outstrip what a CVBG can provide. At the same time, there exists an important transition area in which carrier aviation is essential. The real issue is determining how much force structure this justifies and whether the assumptions made in the past about land-based airpower's role are accurate. This is the case General Link made in his letter and the one Mr Siegel has not been able to challenge.

Headquarters USAF

Notes

1. Gen John M. Shalikashvili, "Readiness: It's a Balancing Act," *Air Force Times*, 2 January 1995.

2. In either case, two questions arise. If interests are insufficient to permit US action to the region or facilities, is the crisis worth US intervention? If political will in the US is insufficient to make some diplomatic commitment, can military action alone have any useful effect?

3. These figures are based on sortie generation during Operation Desert Storm and Operation Deliberate Force (Bosnia). See *Desert Storm Reconstruction Report*, vol. 2, *Strike Warfare*, Center for Naval Analyses Report CRM 91-178 (Alexandria, Va.: Center for Naval Analyses, October 1991), 1-10 through 1-12 and 9-20 through 9-21; and Allied Forces Southern Europe (AFSOUTH) daily activity reports, 30 August–15 September 1995, respectively. Although, as with all military forces, carrier aviation can surge to higher than normal sortie levels or for slightly longer periods, these experiences reflect current operational capabilities. Even at their best, carriers are unable to match the sustained sortie-generation capability of land-based air. (See *Strike Warfare*, 1-12.)

4. Mr Siegel points out that no aircraft have been lost on an aircraft carrier since World War II (an important qualification), but unsinkable ships have yet to be built, and the proliferation of sophisticated antiship missiles, mines, and submarines, coupled with a naval doctrine increasingly focused on littoral actions, suggests some caution. At the very least, it implies that the CVBG will continue to devote a large portion of its resources to self-defense.

AEROSPACE AND AIR AND SPACE

LT COL FRANK W. JENNINGS, USAF, RETIRED

IT APPEARS to me that the Air Force may have fallen into doctrinal confusion caused by the advances in science and technology during the past 50 years. As a result, it has adopted two distinctly different—and conflicting—views of its functions, missions, and the very medium in which it operates. When presented in public statements by Air Force leaders or in official, unclassified documents, these divergent expositions of the Air Force mission reflect a puzzling recital of Air Force capabilities.

For example, the current Air Force Manual (AFM) 1-1, *Basic Aerospace Doctrine of the United States Air Force,* vol. 1 (March 1992), states that "the advent of air power, and later aerospace power, did not change the essential nature of war, but air power did change the way war is conducted. Further, it created the requirement for development and cultivation of a new expertise, a competence in exploiting the three-dimensional aspects of aerospace forces" (page 5).

Three other statements from the first volume of AFM 1-1 are relevant here:

1. "The aerospace environment can be most fully exploited when considered as an indivisible whole. Although there are physical differences between the atmosphere and space, there is no absolute boundary between them. The same basic military activities can be performed in each, albeit with different platforms and methods" (page 5).
2. "Aerospace consists of the entire expanse above the earth's surface. Its lower limit is the earth's surface (land or water), and its upper limit reaches toward infinity" (page 5).
3. "Aerospace power grows out of the ability to use a platform operating in or passing through the aerospace medium for military purposes. Development of platforms that operate above both land and sea has significantly altered warfare by creating a third dimension for military operations" (page 5).

This indivisible interconnection between Air Force war-fighting operations—using electronic systems and a variety of vehicles in "the third dimension"—was amply demonstrated during Operation Desert Storm. About five years ago, it became evident that Air Force leaders had decided to discontinue use of the term *aerospace* in public statements referring to the fighting force's operational medium, seeming to prefer the concept of

a distinctly separated "air and space." No one has explained this discontinuance by the Air Force of terminology that is constantly used by the aerospace industry, as well as by other interests worldwide.

Last June, when I attended several briefings by Air Force space experts in Colorado Springs, I began hearing references to "space, the fourth medium of warfare." One chart showed "the four mediums" in this order: "air, land, sea, and space." In another chart, briefers presented a stylized operational medium labeled "air," which was cut off horizontally at a precise altitude, presumably not significantly related to operations beyond the line.

I believe that the Air Force should address what appears to me as a serious doctrinal dichotomy and should reconcile the apparent contradictions as soon as possible. If Air Force leaders do not have the service's missions, war-fighting functions, and doctrines clearly in mind, how can its rank-and-file members, the Congress, and the American public as a whole adequately appreciate the Air Force's distinctly unique and extraordinary capabilities?

San Antonio, Texas

Ricochets and Replies
continued from page 5

the value and relevance of why doctrine is so important.

I could go on, but I won't. I am going to reread the entire issue again and incorporate a lot of what has been written into my own thinking. Again, congratulations to the whole staff for a superb—and I do mean superb—issue.

Lt Col David G. Bradford, USAF
Maxwell AFB, Alabama

I think you have a very good product here; however, I wonder who has the time to read it.

Capt John C. Nutter, USAF
Sheppard AFB, Texas

REGARDING THE JFACC

Col Roberto Corsini's "The Balkan War: What Role for Airpower?" (Winter 1995) provided valuable background information on the history of the Balkan conflict. I particularly appreciate Colonel Corsini's thorough analysis of the challenges of linking military courses of action to political objectives in unconventional conflicts or military operations other than war (MOOTW). At issue is the ability of the Air Force to successfully operate asymmetrically against an adversary who relies on "first- or second-wave" warfare. Although his discussion represents a legitimate set of opinions about the use of airpower in Bosnia, it is somewhat dated.

Colonel Corsini is correct in stating that Bosnia is unique and requires us to exercise mental agility in setting up command arrangements and developing useful joint-force employment options. But we should be careful not to confuse the specific circumstances that create technical challenges or warrant political constraints with inherent limitations of airpower.

First, there is a requirement for a joint force air component commander (JFACC) in MOOTW. In every conflict—conventional or unconventional—all components bring distinct perspectives and unique competencies to the theater commander. This is critical. The JFACC brings the airman's perspective and advises the theater commander on the full range of airpower options available to accomplish theater objectives—both independent of and in concert with other component forces. In contrast, a land component commander (LCC) charged with surface operations generally offers a surface-oriented perspective. As regards airpower, the LCC is primarily concerned with responsive fire support—regardless of whether it's land, sea, or air based. Close air support would very likely be the LCC's highest priority.

Since airpower was not part of the equation when United Nations (UN) ground forces deployed for peacekeeping and humanitarian purposes, subsequent air support to the peacekeepers was essentially done on an ad hoc basis, using a cumbersome "dual-key" approach. The results, as indicated by Colonel Corsini, were marginal. Rather than add airpower to the existing situation on an ad hoc basis, an experienced JFACC can consider a theater-wide perspective for airpower and offer a wider range of employment options. Indeed, this was the case in August 1995, when the UN and the North Atlantic Treaty Organization (NATO) developed a coherent strategy that allowed the precise application of airpower to achieve limited objectives. The withdrawal and consolidation of lightly armed UN peacekeepers gave airpower the freedom to maneuver to attack the full range of targets carefully selected to reduce the Bosnian Serb military advantage, while minimizing collateral damage. Secretary of Defense William Perry noted that "Deliberate Force was the absolutely crucial step in bringing the warring parties to the negotiating table at Dayton."

Second, Colonel Corsini contends that Air Force doctrine does not sufficiently address MOOTW. He is correct. But it is worth noting that we recognized this deficiency long ago. Indeed, within Air Force Doctrine Document (AFDD) 1, *Air Force Basic Doctrine,* which will be released in the near future, we have already recognized the need to address the entire spectrum of warfare and will devote an entire section to airpower and space power in MOOTW. This is not to suggest that Air Force Manual (AFM) 1-1, *Basic Aerospace Doctrine of the United States Air Force,* failed to acknowledge our role in MOOTW; it was simply inadequate in today's environment. The air and space concepts of control, exploitation, enhancement, and support still apply, but the doctrine discussion needs to be expanded to include MOOTW. We recognize that our challenges today and in the future are more ambiguous and regionally focused. Although redressing our doctrine is important, equally significant is strong, experienced leadership from each of the

components. From our perspective, a JFACC is essential to maintain coherency in theater-ranging air operations in support of the theater commander's objectives. Gen Michael E. Ryan, as the JFACC, played a central role in planning and executing Operation Deliberate Force. Yet, his approach to targeting and employment was far different than Gen Charles Horner's in Operation Desert Storm. We gain situational flexibility through competent JFACCs and staffs who understand inherent airpower capabilities and can rigorously analyze a given situation to offer useful airpower contributions to solving a theater commander's problem.

Colonel Corsini's article offers insight as to the role of airpower in Bosnia. But he fails to appreciate the critical role a JFACC plays in any given conflict. I would suggest that the more ambiguous the conflict, the more essential a JFACC becomes. Although we remain committed to our primary tasking—the ability to conduct war fighting—we are making significant improvements in our ability to operate in MOOTW. We believe that MOOTW will increase in frequency, but this does not negate the requirement for the leadership and experience a senior Air Force commander can provide to the theater commander.

Col James E. Collins, USAF
Headquarters USAF

Net Assessment

The study of history lies at the foundation of all sound military conclusions and practice.

—Alfred Thayer Mahan

Heart of the Storm: The Genesis of the Air Campaign against Iraq by Col Richard T. Reynolds. Air University Press, 170 West Selfridge Street, Maxwell AFB, Alabama 36112-6610, January 1995, 147 pages.

Thunder and Lightning: Desert Storm and the Airpower Debates by Col Edward C. Mann III. Air University Press, 170 West Selfridge Street, Maxwell AFB, Alabama 36112-6610, April 1995, 220 pages.

By the summer of 1991, almost before all the returning American forces had departed the Arabian Peninsula, the Air Force began several efforts to analyze the role of airpower in the Gulf War and assess its effectiveness. The Office of Air Force History (AF/HO), quite naturally, undertook several such studies. Secretary of the Air Force Don Rice commissioned an even larger effort called the Gulf War Air Power Survey (GWAPS), patterned after the World War II-era United States Strategic Bombing Survey (USSBS). The GWAPS and AF/HO efforts focus on what happened, using events as the medium of analysis. Finally, at Air University (AU) a third, smaller effort was undertaken to focus specifically on the doctrinal origins and implications of the Operation Desert Storm air campaign. This was the genesis of two studies published by Air University Press—*Heart of the Storm* by Col Rich Reynolds and *Thunder and Lightning* by Col Ed Mann. Both officers, with the assistance of a third team member, Col Suzanne Budd Gehri, were members of the College of Aerospace Doctrine, Research, and Education (CADRE), which is AU's in-house think tank and research arm. Their effort concentrates more on the personalities involved (Reynolds's book) and the doctrinal basis and implications (Mann's book) of the air campaign. When taken in conjunction with the larger efforts of GWAPS and AF/HO, a relatively complete picture of the Desert Storm air campaign emerges. What Reynolds and Mann provide rounds out a trinitarian approach to airpower in the Gulf War—a portrayal of the complex interrelationships between airpower technology, doctrine, and the personalities employing them.

Heart of the Storm covers a very limited but momentous snapshot in time—it opens on Tuesday, 31 July 1990, and ends three weeks later at the close of Col John Warden's disheartening briefing to Lt Gen Chuck Horner in Saudi Arabia on 20 August 1990. Colonel Reynolds's mission is to explore the origins of the Desert Storm air campaign and the unlikely sequence of events through which a handful of airpower advocates in the Pentagon shaped the course of the entire Persian Gulf War. There is neither space nor need to tell here the story of how Colonel Warden and his team in Checkmate crafted and outlined the basics of an air campaign plan called Instant Thunder (in pointed and intentional opposition to Rolling Thunder)—that's what Reynolds has done. His tale is bluntly told and has clearly delineated personalities, some painted in a more flattering light than others. Among the former are Gen Mike Loh, the USAF vice-chief of staff; Gen Norman Schwarzkopf, the US Central Command (CENTCOM) commander who had the vision to see the possibilities in the Air Force's plan; and, of course, Colonel Warden, the intellectual force behind Instant Thunder. Among the latter are Gen Bob Russ, the commander of Tactical Air Command, and General Horner, the commander of CENTCOM's air component and the acting on-scene commander in Saudi Arabia during the bleak days of August 1990.

There is much good about this book—and some not so good. From a methodological standpoint, the book is almost entirely oral history, and basing a book solely on the memories of powerful participants is risky. In this case, it's also unnecessary because a great deal of documentary material critical to this story is available. Reynolds doesn't dig into the participants' motivations or the reasons they felt the way they did. Nor does he question the interviewees' statements. From the standpoint of pure history, in

fact, either of the other two efforts mentioned earlier—Diane Putney's for the Office of Air Force History and Sandy Cochran's for GWAPS—is far superior to Reynolds's. Stylistically, the book is raw and reads like a novel, which will hurt its credibility with many audiences (and help with others), yet it is a gripping story.

It's obvious that writing a conventional history is not what Reynolds intended; instead, he wanted to write something that the average pilot or operator would read. Reynolds clearly indicates that it was by no means certain that Instant Thunder would survive to become the nugget around which the eventual air campaign plan would coalesce. This, in fact, is one of its greatest strengths, for Instant Thunder could have gotten shunted aside at any of a number of steps on the way to Desert Storm. There was a great deal of opposition to it—from two camps. One was opposed for philosophical reasons to "Washington, D.C. interference"; the other was opposed for doctrinal reasons to an autonomous air campaign that paid little attention to cooperation with ground forces. Many opponents were in both camps simultaneously—a point that Reynolds makes clear, as is the side of the argument he falls on.

An intriguing question that neither Reynolds nor Mann tackles is whether the final air campaign was shaped primarily by technology or doctrine. Some people argue that platform capabilities made the views of Warden, Horner, the Marines, and so forth irrelevant. The plan came from stealth, range, and precision guided munitions (PGM), rather than doctrinal arguments, and would have eventually looked the same no matter who did the planning. Although this reviewer has examined this position and rejects the view of the technological determinists, it is a valid and useful issue to explore.

One persistent question is why AU chose to publish this book and publicly air so much of the Air Force's internal "dirty laundry." More than one general officer appears in less than flattering light in these pages. It's apparent that the motivation came from Gen Chuck Boyd, who had been director of plans and Warden's boss at the Air Staff the year before the crisis. If this book does nothing else, it makes crystal clear that the Air Force was suffering in 1990 from a terrible case of doctrinal and strategic schizophrenia regarding the proper role of airpower. General Boyd and his successor at Air University, Lt Gen Jay Kelley, saw this book as a means of educating the Air Force (and the rest of the defense community) about the need to look beyond airpower's role in the "near battle" to see how it can affect the strategic and political course of conflict. From the standpoint of intellectual honesty and the willingness to thrash through strongly held but widely divergent opinions—especially when held by several very senior and widely respected general officers—this book is to the Air Force's credit. It isn't smooth or glitzy, but it's a powerful story sure to generate powerful reactions—both positive and negative.

Colonel Mann's *Thunder and Lightning* is of another sort altogether: reasoned, logical, historical, intellectual—not the sort read by most Air Force officers but exactly the sort they should read. That's the problem, argues Mann: the generic Air Force officer would rather have a root canal than read about airpower doctrine, despite admonitions from well-meaning sorts such as the current chief of staff of the Air Force, Gen Ron Fogleman, who closes his foreword to *Thunder and Lightning* with the caution, "Not only must we know how to *do* aerospace power, we must also know how to *think* it" (pages x–xi, emphasis in original). Mann cites case after case showing how the Air Force (except for small pockets of people, not all of them fliers and some not even on active duty) has over the years disarmed itself intellectually, steadfastly refusing to "think" about the "whys" of airpower to concentrate instead on the "hows" of flying and fighting. Colonel Reynolds captures well the intense and often bitter philosophical arguments about airpower that racked the Air Force during August 1990—arguments that had their origins in an internal civil war described by Colonel Mann.

But Mann is not a doctrinaire zealot arguing for the primacy of a particular "type" of airpower or platform. Offering what amounts to a pragmatic and comprehensive view of airpower, he notes that the final Desert Storm air campaign was neither Instant Thunder nor a battlefieldcentric focus on Iraqi ground forces in the Kuwaiti Theater of Operations (KTO) but an amalgam of both—simultaneously a strategic air campaign and operational-level air-ground battle that complemented and cooperated with the ground scheme of maneuver by exploiting the fundamental attributes of airpower (speed, range, flexibility, and lethality). What's more, such an approach was a shining validation of existing airpower doctrine as found in the then-current (1984 edition) Air Force Manual (AFM) 1-1, *Basic Aerospace Doctrine of the United States Air Force.* When one examines the entire history of American airpower in search of its most successful examples, the answers span

the range of Air Force missions from strategic airlift (Berlin airlift, 1948) to interdiction (France, 1944) to close air support (Khe Sanh, 1968) to strategic bombing (Japan, 1945) to reconnaissance (Cuba, 1963) and so forth.

Mann makes a powerful argument that we should focus on airpower's comprehensiveness and that waging internecine warfare over missions or platforms weakens the entire Air Force. American airpower comes from the blending of all its constituent parts: the whole is far, far more powerful than the mere sum of those parts. To fully exploit and advance that power means that "many of us will have to undertake certain unmanly pursuits" (page 194)—taking on airpower in the intellectual arena and wrestling with unknown technologies, uncertain implications, and unforeseen political and social scenarios. To paraphrase an unnamed senior British officer from the turn of the century, "We are short of resources, so we shall have to begin to think."

Air University and its publishing arm, Air University Press, are to be commended for publishing these two volumes. Reynolds will probably make the reader bristle at times, and his focus on personalities will certainly generate an emotional response from people who identify with those personalities. Mann will make the reader think about airpower of the past, present, and future—how it has evolved, what its place is in our national military capability, and what its role will be in meeting American national security needs in the twenty-first century. His book may, in fact, be the year's best on airpower. *Heart of the Storm* and *Thunder and Lightning* belong on the shelf of anyone who thinks about airpower.

Dr Daniel T. Kuehl
Washington, D.C.

Courage and Air Warfare: The Allied Aircrew Experience in the Second World War by Col Mark K. Wells. Frank Cass & Co., Ltd., Newbury House, 900 Eastern Avenue, London, 1995, 240 pages, $40.00.

Undertaking a dissertation and then a book on the subject of aircrew courage in two air forces is itself an act of courage. The topic must ever be a subjective one shrouded in a whole host of imponderables. It is one also with a heavy burden of emotion arising from the deepest feelings of the survivors—and one with potential traps of national and service pride. Too, it is a topic difficult to approach without having walked in the shoes of those who are its subject. But in the end, Col Mark Wells gets it right, I think. Doing one's bit or the romance of aviation may have had major roles as motivators in the initial choice of entering flying training, and the fear of being thought cowardly might have had some power to cause some people to see combat through. But the major driver in combat seems to have been the small-unit loyalty, common in all successful services in all ages—the desire not to let one's buddies down.

One of the many strengths of *Courage and Air Warfare* is that it is superbly documented. Wells has done thorough research in the secondary literature and has used a host of primary sources—unpublished materials from such archives as the Historical Research Agency at Maxwell AFB, Alabama, and the Public Records Office in London as well as extensive interviews with many of the survivors. Yet, he is wise enough to know that (especially on a subject like this) a great deal did not make it into the documentary record—and he resists claiming too much.

It will come as no surprise to the reader that aircrew selection was more "scientifically" done in America than in Britain in World War II. That is to say, the US Army Air Forces used a wide variety of psychological and other tests to attempt to predict success. The Royal Air Force, on the other hand, depended upon criteria that highly valued a public school ("private" in American vocabularies) education and proper upbringing. In part, that decision arose from the circumstances, for Britain simply did not have the time and resources to do much more during the darkest hours of World War II. Too, it doubtless arose from differences in the cultures of the two nations—specifically, the traditional greater stratification of British society. Wells concludes that the American "system" was slightly more successful than the British one in predicting success in training, but that is not the same as success in combat.

Colonel Wells is wisely loath to identify one air force as more successful than the other when it comes to combat. First, he is right on the mark to cite the problem of measuring success. What are the criteria there? Survival? Target destruction? Persisting in the attack with mechanically imperfect aircraft? Bombing accuracy? Not landing damaged aircraft in Sweden or Switzerland? Winning the war? Being a contributing factor in winning the war? Even measuring the quantity of failures is a far-from-perfect exercise—many of them are partial failures, and many did not work their way into the written record.

As for command policies, the British approach was the sterner. It was more rigid and quicker to brand a person with the dread LMF (lack of moral fiber) label. The American policy was more flexible, possibly went a longer way toward attempting to rehabilitate wavering crewmen, and was slower to brand them with cowardice. Wells concludes that neither was demonstrably better than the other and that the problem never got bad enough in either air force to seriously impair mission accomplishment.

Courage and Air Warfare is well written and well researched. It is relevant to the labors of readers in many different career fields—but especially to those who would aspire to the command of flying units. Give it a very high place on your reading list.

Dr David R. Mets
Maxwell AFB, Alabama

The Hidden History of the Vietnam War by John Prados. Ivan R. Dee, Inc., 1332 North Halsted Street, Chicago, Illinois 60622-2637, 1995, 352 pages, $27.50.

Hidden History is about the lessons of the Vietnam War. By design, it does not provide a complete account of the war. Rather, John Prados uses short essays—28 in all—to address specific wartime microcosms. Topics include political and cultural issues, profiles of leaders, operations, and campaigns. The essays are unique, each one offering background material and then delving into the controversy, misconception, or hidden material that may have clouded the issue. Although some of the essays are new, many were previously published in *The VVA Veteran*—the monthly magazine of the Vietnam Veterans of America, Inc. The author revisited these essays and updated the information with new material and evidence, where available. Overall, I found the book to be well written and adequately sourced.

Prados is no stranger to the Vietnam conflict, having authored two books on Vietnam: *Valley of Decision* (about the battle of Khe Sanh; coauthor with Ray W. Stubbe) and *The Sky Would Fall* (about the diplomacy of Dien Bien Phu). *Hidden History* contains a rich diversity of topics. Of special interest to airmen is the essay on "Victory through Air Power," which singles out our airpower strategy for Vietnam. It does not, however, go to the heart of the problem (i.e., that the air objectives were simply not achievable due to the numerous constraints, restraints, force-structure limitations, weapon system limitations, and political factors that were placed upon our air operations).

Should you read this book? It depends on how much you know about the Vietnam War. If you have a good understanding and wish to delve into some of the more controversial issues, such as those identified in the essays, then I would say yes. In fact, I recommend the book for providing food for thought and discussion and for its great list of references. If you do not know much about the history of the war, then I believe that *Hidden History* could be confusing because it does not include a chronological account of the conflict. Readers should have sufficient background knowledge to fill in the gaps and place the essays in historical context.

Lt Col Chris Anderson, USAF
Maxwell AFB, Alabama

My American Journey by Gen Colin L. Powell with Joe Persico. Random House, 201 East Fiftieth Street, New York 10022, 1995, 643 pages, $25.95.

My American Journey is a compelling read. It traces the meteoric rise of Gen Colin Powell from the tenements of the South Bronx to the nation's highest military position—chairman of the Joint Chiefs of Staff. It's a wonderful success story about how one man rose to national prominence due to his virtues, values, and hero status among Americans. In a country whose heroes are usually overpaid professional athletes, it is refreshing to see this role model receive the accolades he so justly deserves.

With the help of Joe Persico, General Powell has produced a wide-ranging, resume-like biography that is both sweeping in scope and insightful in details. Readers will be thoroughly entertained by his story. The book is easy to read and comes across as a love letter to America. It is difficult to put down. Readers will cheer for Powell as he rockets to stardom and handles worldwide political and military leaders with class and style. He presents his story in a structured yet free-flowing chronological style, organized into four distinct parts: "The Early Years," "Soldiering," "The Washington Years," and "The Chairmanship."

As the general reflects on his pursuit of the American dream, he highlights his memoirs with particulars on his wife, family, close friends, and military and political mentors. He puts strong emphasis on his upbringing and his role-model parents—Luther and Maud Powell. His father

once told young Colin that if he simply worked hard and stayed out of trouble, America would reward him. Clearly, his father spoke the truth.

If his family provided the foundation for Powell's superb character and value system, then the Reserve Officer Training Corps (ROTC) program at the City College of New York was the catalyst and finishing school for his strong leadership and motivational skills. According to Powell, ROTC enabled him to discover the discipline, structure, camaraderie, and sense of belonging that he craved as a young man. After writing of his ROTC years, Powell entertainingly alternates his memoir entries between his professional military career and life with friends and family. On the personal side, he allows the reader to get up close and personal with him and gain insight into why he takes certain stands on various issues such as Vietnam and segregation. On the professional side, he vividly explains his climb to the top of the military spectrum by discussing each of his assignments—covering the bad experiences along with the good ones. He was a soldier's soldier in Germany, Vietnam, and Korea, but he solidified his future with superb political performances at the Pentagon and the White House. Mastery of political connections coupled with administrative brilliance propelled him up the ladder of success to become a White House Fellow, the youngest brigadier general in the Army, the first black national security advisor, and the youngest and first black chairman of the Joint Chiefs of Staff. Fearful of being labeled the political general, Powell goes to great lengths to dispel the notion that he ever sought any of these highly political assignments. He continually reiterates how he wanted to be with the troops rather than stuck in a Pentagon office.

One of the most important themes in his memoirs deals with success and race. The reader gets the message that he was determined never to let race stand in his way. Although he experienced segregation, he felt that the Army gave him a fair chance and that he got ahead because he felt challenge instead of discrimination. In spite of all the segregation he and his family experienced, he always remained totally committed to the nation, its values, and his superiors.

My American Journey answers the critics on such controversial issues as gays in the military, Operation Desert Storm, and Bosnia. Meeting the controversies head-on, Powell makes plausible arguments that leave little doubt about what actually happened. He clarifies murky events and counters other authors' recollections of controversial facts.

On balance, *My American Journey* is an exceptional book. It should be read and absorbed by anyone looking for a way to be better informed about leadership ability, integrity, and character. General Powell's incredible story establishes a standard for America's youth—both black and white.

Ronald S. Crooks
Maxwell AFB, Alabama

Mission Debrief

I Can Write Better than That!

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We need two typed, double-spaced draft copies of your work. We encourage you to supply graphics and photos to support your article, but don't let the lack of those keep you from writing! We are looking for articles from 2,500 to 5,000 words in length—about 15 to 25 pages. Please submit your manuscript via electronic file in either MS Word or WordPerfect format.

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The Editor

Our Contributors

Dr George Bugliarello (ScD, Massachusetts Institute of Technology) is an engineer and educator with a broad and distinguished background ranging from fluid mechanics to computer languages, biomedical engineering, and science policy. He is currently chairman of the Board of Infrastructure and the Constructed Environment of the National Research Council and serves on several other boards. He is a member of the National Academy of Engineering and is the US member of the Science for Stability Steering Group of the Scientific Affairs Division of NATO. He has received many honors in the field of science and technology, including the New York City Mayor's Award for Excellence in Science and Technology. He is chancellor of the Polytechnic University in New York, and was its president from 1973 to 1994. Dr Bugliarello has authored, edited, or contributed over 200 professional papers and numerous books.

Lt Col Price T. Bingham, USAF, Retired (USAFA; MA, University of Alabama), is manager of business development for Northrop Grumman Corporation. He was chief of the Current Doctrine Division, Airpower Research Institute, Center for Aerospace Doctrine, Research, and Education (CADRE), Maxwell AFB, Alabama, at the time of his retirement in August 1992. During his 30 years of military service, he flew fighters in the United States, Europe, and Southeast Asia. He served as a fighter and tanker duty controller in the Military Assistance Command, Vietnam (MACV)/United States Support Activities Group (USSAG) tactical air control center and as an air operations officer at Headquarters USAF. Colonel Bingham is a frequent contributor to *Airpower Journal* and has published in numerous other professional journals.

Col Phillip S. Meilinger (USAFA; MA, University of Colorado; PhD, University of Michigan) is dean of the School of Advanced Airpower Studies (SAAS) at Maxwell AFB, Alabama. Previously, he was professor of airpower history at SAAS. He has served tours as a C-130 pilot in both Europe and the Pacific, and as an air operations staff officer, Doctrine Division, Deputy Directorate for Warfighting Concepts Development, Headquarters US Air Force. He is the author of *Hoyt S. Vandenberg: The Life of a General* (Indiana University Press, 1989) and *American Airpower Biography: A Survey of the Field* (Air University Press, 1995), as well as many articles and book reviews dealing with airpower theory and history. Colonel Meilinger is a graduate of Squadron Officer School, Air Command and Staff College, and National Defense University.

Dr Robert J. Bunker (BA, BS, California State Polytechnic University, Pomona; MA, PhD, The Claremont Graduate School) is an adjunct professor, National Security Studies Program, California State University, San Bernardino. He is also a professor of special operations in military operations other than war (LIC/MOOTW) at American Military University. His research focus is on the influence of technology (energy) on warfare and political organization and on the national security implications of emerging forms of warfare. Dr Bunker has published in military journals such as the *Marine Corps Gazette* and *Military Review* and is serving as an assessor to the Air Force 2025 Study.

Lt Col Michael Straight (USAFA; MA, Naval War College) is chief, Aerospace Defense Branch, Headquarters NORAD. He has been an F-15C squadron commander and an instructor at both the US Air Force and US Navy fighter weapons schools. Colonel Straight has published articles in the *USAF Weapons Review*, the *Tactical Analysis Bulletin*, the *TOPGUN Journal*, and the *Airpower Journal*.

Col Richard Szafranski (BA, Florida State University; MA, Central Michigan University) is the first holder of the Chair for National Military Strategy at the Air War College, Maxwell AFB, Alabama. Colonel Szafranski's duties have included staff positions in the headquarters of Strategic Air Command, United States Space Command, North American Aerospace Defense Command, and Air Force Space Command. He has commanded B-52 units at the squadron and wing level, most recently as commander of the 7th Bomb Wing, Carswell AFB, Texas, from 1991 to 1993. He was also the base commander of Peterson AFB, Colorado. His writings on military strategy and operational art also have appeared in *Parameters*, US Naval Institute *Proceedings*, *Joint Forces Quarterly*, *Military Review*, and *Strategic Review*. Colonel Szafranski is a graduate of Air Command and Staff College and Air War College.

Dr Herman L. Gilster (USMA; MBA, University of Denver; MPA, PhD, Harvard) is a visiting professor at the USAF Academy. A retired Air Force colonel, Dr Gilster's assignments during his 26-year career included B-47 aircraft commander in Strategic Air Command; tenured associate professor and director of economics instruction at the USAF Academy; operations researcher at Headquarters Seventh Air Force in Vietnam, Headquarters Pacific Air Forces in Hawaii, and Headquarters USAF in Washington, D.C.; Federal Executive Fellow in the Defense Analysis Project at the Brookings Institution; and director of international economic affairs in the Office of the Secretary of Defense. After retirement from the Air Force, he worked with the Boeing Company for seven years, where he served as manager for economic forecasts and analysis. Dr Gilster has been a frequent contributor to the *Air University Review* and other professional journals.

Maj Martin E. B. France (USAFA; MS, Stanford University; PhD, Virginia Polytechnic Institute and State University) is assigned to the Plans Directorate, Headquarters Air Force Space Command, as the command lead for space operations mission area plans. Previous assignments include laser systems structural engineer at the Air Force Weapons Laboratory and teaching assignments as instructor, assistant professor, executive officer, and associate professor in the Department of Astronautics at the USAF Academy. As the USAF exchange engineer to France, Major France performed research at the Centre d'Etudes et de Recherches de Toulouse, Space Technology Department, Toulouse, France, where he specialized in modeling and simulation of charged particles in the operational orbit environment. He is a graduate of the Air Command and Staff College.

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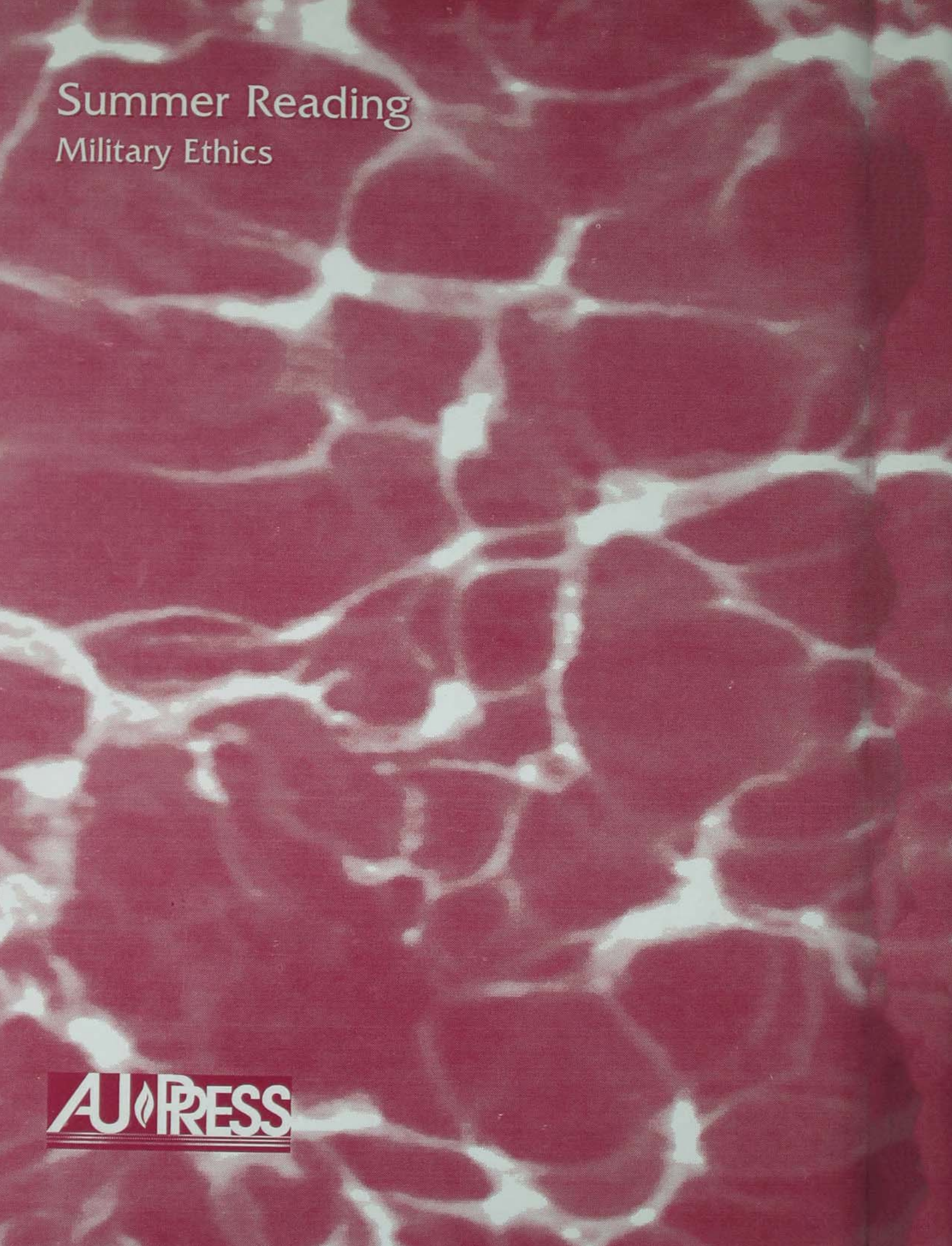

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