Aerospace Strategy for the Aerospace Nation

STEPHEN E. WRIGHT, Maj, USAF
School of Advanced Airpower Studies

THESIS PRESENTED TO THE FACULTY OF
THE SCHOOL OF ADVANCED AIRPOWER STUDIES,
MAXWELL AIR FORCE BASE, ALABAMA, FOR COMPLETION OF
GRADUATION REQUIREMENTS, ACADEMIC YEAR 1992–93.

Air University Press
Maxwell Air Force Base, Alabama

August 1994

Disclaimer

This publication was produced in the Department of Defense school environment in the interest of academic freedom and the advancement of national defense-related concepts. The views expressed in this publication are those of the author and do not reflect the official policy or position of the Department of Defense or the United States government.

This publication has been reviewed by security and policy and review authorities and is cleared for public release.

Contents

Illustrations

Abstract

This study analyzes the need for a national aerospace strategy that encompasses the two aspects of aerospace power: the aerospace industry and military aerospace. The author assesses the aerospace industry as to its importance to the United States. The conclusion is that this industry provides the kind of high-technology, high-wage jobs necessary to improve the nation's standard of living in the future. Next, the writer evaluates current military strategies against a set of political imperatives and the reliance each strategy has upon aerospace power. The results of this process show that each military service is very reliant upon aerospace power for the success of its strategy. By coupling these two building blocks with the serious problems that exist in the aerospace industry and in military aerospace, the author shows the need for the United States to develop a national aerospace strategy. The final section of the study proposes the goals and objectives of such a strategy and proposes the formation of a National Aerospace Council to fully develop and implement a national aerospace strategy.

About the Author

Maj Stephen E. Wright was commissioned through the Reserve Officer Training Corps, Texas A&M University in 1977. Graduating from undergraduate pilot training in 1978, he went on to fly B-52s as a copilot and aircraft commander. Following an Air Staff training assignment, he returned to B-52s. He was subsequently selected to transition into the B-1B and served as a Combat Crew Training Squadron instructor pilot and an instructor pilot at one of the B-1s new main operating bases. Major Wright is a senior pilot with over 3,500 flying hours. He has a BS degree in floriculture from Texas A&M University, an MA degree in industry and technology from East Texas State University, and an MA degree in national security and strategic studies from the US Naval War College. In July 1993, Major Wright was assigned to Eighth Air Force as an air campaign planner.

Chapter 1

Introduction

> America is an aerospace Nation. Our aerospace technology and industry is a national treasure and a competitive edge, militarily and commercially. Assured access to air and space are as important to the Nation's economic well-being and security as access to the sea has always been. . . . Now, more than ever, we have the opportunity to mature the abilities of our air and space forces and make them even more useful tools for meeting our national security objectives.
>
> *Global Reach—Global Power*

I agree. The purpose of this paper is to examine why former secretary Donald B. Rice is correct in his statement and to expand his focus of "air and space forces" to include the aerospace industry.[1] Together, the aerospace industry and its military counterpart combine to form US aerospace power. That capability requires a national aerospace strategy to exploit its potential in providing for the future economic and national security well-being of the United States. What factors then make a national aerospace strategy important for America's future?

To state that the world is changing its geopolitical course seems a bit of British understatement these days. Several world events occurred in 1991 that indicate global relations underwent watershed changes on a scale not seen since the post–World War II years. The defeat of Saddam Hussein in Desert Storm infused Americans with confidence in their military forces. Never before had aerospace power so decisively dominated a conflict. The transformation of the Soviet Union ushered in a new political environment that alters the cold war paradigm of international relations. The changing geopolitical environment alone provides impetus for reconsidering US national security strategy; however, the need to review that strategy becomes essential in light of the economic imperatives facing the United States. Since the late 1980s, the US economy grew at a meager rate (one to three percent a year) while at the same time the national debt more than tripled. With yearly budget deficits exceeding $3–400 billion per year, domestic issues became the focal point for the 1992 presidential race that resulted in President Bill Clinton's election.

The newly elected Clinton administration quickly spotlighted the aerospace industry. The reductions in defense spending initiated by the Bush administration coupled with a poorly performing world economy resulted in a crisis situation in the aerospace industry. United States's airlines lost over $10 billion from 1990 to 1992 and layoffs in both the airlines and aerospace manufacturing were numbering in the thousands. In office just over a month,

President Clinton traveled to Washington state to assure Boeing employees (some 28,000 of whom face layoffs in the near future) that he was concerned about the future of the vital aerospace industry.[2]

Today, both military and commercial aerospace struggle toward an uncertain future. What that future entails depends upon decisions made today. The United States must determine if and how it will remain the preeminent aerospace nation in the future or falter and assume some lesser position. To begin this odyssey, one needs to ask some basic questions.

Is the US the preeminent aerospace nation? American aircraft manufacturers control over 80 percent of the world-wide large commercial jet market. Further, with the political and economic downturn in the former Soviet Union, no nation provides the range of space services that the US does. Desert Storm demonstrated America's military aerospace dominance—there are no competitors in the world—today.

But, is the US an aerospace nation? Navalists argue that the US is a maritime nation. Their argument usually hinges on water and weight. First, water covers 70 percent of the globe and second, most of the cargo, by weight, is transported by ship. True; however, 100 percent of the globe is covered by air and by value for amount shipped, aerospace looms far ahead.[3] For example, less than one-third of one percent of goods (by weight) imported or exported to/from the US do so by air. However, this tiny fraction of a percent in weight accounts for over 32 percent by value of those goods—a percentage value that doubled from 1970 to 1990. As a manufacturing industry, maritime concerns generate only one-eighth the product value of the aerospace industry. Perhaps we would be better served to say the US is an aerospace nation with significant maritime interests.

If indeed the US is an aerospace nation, how do its component parts, economic and military aerospace, relate to the future well-being of the United States, what problems exist that indicate America needs an aerospace strategy, and what ideas form the basis for such a strategy? These questions presage the rest of this paper. The next chapter describes the importance of the aerospace industry to the US economy. Chapter 3 looks at the reasons that war remains a concern for national security considerations and discusses the political imperatives that will govern the application of military force in the future. Chapter 4 reviews the espoused strategies of the military services and examines them in light of the political imperatives and their reliance upon aerospace power for successful execution. Chapter 5 considers the problems facing the economic and military elements of aerospace power and offers ideas as to the nature of a national aerospace strategy.

Notes

1. Secretary of the Air Force Donald B. Rice, *Global Reach—Global Power*, white paper (Washington, D.C.: Department of the Air Force, November 1992), 15.

2. Jim Impoco and David Hage, “White House Workout,” *U.S. News & World Report*, 8 March 1993, 28.

3. Trend information presented here extracted from the US Bureau of the Census, *Statistical Abstract of the United States: 1992*, 111th edition (Washington, D.C.: Government Printing Office[GPO]), 1992.

Chapter 2

The Economics of Aerospace

From the earliest theorists of air power to current day aerospace strategists, economists, and politicians, all have recognized the important relationship between the aerospace industry, the economy, and the government's aerospace forces. Giulio Douhet linked all three aspects in his seminal work, *The Command of the Air*.[1] In addition to forecasting a future for military aviation, he devoted considerable effort to explaining "aerial navigation" as a new form of transportation.[2] Gen ("Billy") Mitchell clearly understood the potential of air power when he stated,

> Those interested in the future of the country, not only from a national defense standpoint but from a civil, commercial and economic one as well, should study this matter carefully, because air power has not only come to stay but is, and will be, a dominating factor in the world's development.[3]

Another early air power strategist, Alexander de Seversky, foresaw the necessity to couple the development of both commercial and military aerospace. He stated that "their development must be scientifically meshed into the military-aeronautical structure" of the United States.[4] Then Secretary of the Air Force, Donald B. Rice, noted the "great potential [for aerospace forces] to draw on advanced technologies" and the increasing importance of technology to national defense.[5] President Clinton and Ross Perot both acknowledge the importance of the aerospace industry to the well-being and competitiveness of the overall US economy. Finally, noted economists like Robert Reich, Laura Tyson, and Lester Thurow point to aerospace as one of the key industries for the future.[6]

The linkage between commercial and military aerospace, the two components of aerospace power, differs fundamentally than those for land and sea power. No one connects tanks and the automobile industry by intimating that if the US stopped building tanks it could no longer build automobiles. Likewise, this linkage is missing from the relationship between naval forces and the merchant marine. The US has the premier navy in the world; yet, its merchant marine ranks far from the top and, other than naval construction, commercial shipbuilding received only one order for a vessel larger than 1,000 gross tons in fiscal year 1991.[7] In contrast, Japan is the world's leading shipbuilder and has the largest merchant marine but a very limited navy.

Aerospace enjoys a unique position in the relationship between its industry and military components, the US government, and the economy. The relationship is synergistic in its effect within each of these elements. Three questions

help us understand this unique relationship. First, what impact does the aerospace industry have on the US economy? Second, what links the aerospace industry and government aerospace components? Third, what explains the ties between these elements?

The Aerospace Industry and the US Economy

After World War II the aerospace industry experienced a growth streak that propelled it to the number one ranking export industry in the US in 1991—exceeding even agriculture.[8] Over this time frame, the aerospace industry grew into an industrial sector of great importance to the overall US economy.

One key indicator of the industry's growth is sales. In 1948, the industry had sales of almost $1.5 billion; by 1991 this figure exceeded $134 billion.[9] Table 1 details this growth in sales that shows almost a 100-fold increase since 1948.

Table 1

Aerospace Industry Sales
(millions of current dollars)

Year	Total Sales	DOD[a]	NASA & Other Govt Agencies[b]	Other Customers[c]	Related Products
1948	1,493	1,182		117	134
1955	12,411	10,508		786	1,117
1965	20,867	11,396	4,490	2,816	2,165
1975	28,373	13,127	2,727	7,727	4,792
1985	96,571	53,178	6,262	21,036	16,095
1990	134,375	60,502	11,097	40,379	22,396

[a] Includes foreign military sales
[b] NASA formed in 1958
[c] Primarily nonmilitary aircraft sales

Source: Aerospace Industries Association of America, Inc., *Facts and Figures.*

Over the last 30 years, aerospace accounted for 2.5 to 3.5 percent of US gross national product (GNP) and averaged nearly 4 percent of all manufacturing industries.[10]

Jobs are another measure of aerospace's impact on the economy. In 1990, aerospace provided 1.295 million jobs, about the same number of jobs as the automobile industry. Moreover, aerospace furnishes the kind of high-technology, high-skill, high-value jobs that economist Robert Reich argues are critical to an improving standard of living.[11] During the post–World War II period, production workers in aerospace enjoyed on average a 10 percent advantage in hourly wages over the average worker in durable goods manufacture.[12]

Employment of scientists and engineers yields another indication of aerospace's economic power. Since the 1950s, one of every four scientists and engineers worked in aerospace. The fact that aerospace scientists and engineers received from 7.5 to 9.0 percent more pay than their contemporaries in other fields serves as another indicator of the importance of these workers to the national economy.[13]

Another key sign of aerospace's influence on the economy results from its position as the nation's top net exporter and its number six position in industry in terms of value of shipments in 1991.[14] The nearly $30 billion (net balance) in exports in 1991 surpassed even agriculture and accounted for nearly $1 in every $10 of US exports.[15] Table 2 contrasts aerospace exports and imports with three other major product groups. Aerospace leads the nation in export balance.

Table 2

Trade Balance of Selected Commodities (billions of dollars)

Commodity	Exports	Imports	Balance
Aerospace	39,083	11,801	27,282
Agriculture	40,003	22,099	17,904
Chemicals	36,485	20,752	15,733
Motor Vehicles	25,480	79,003	(53,523)

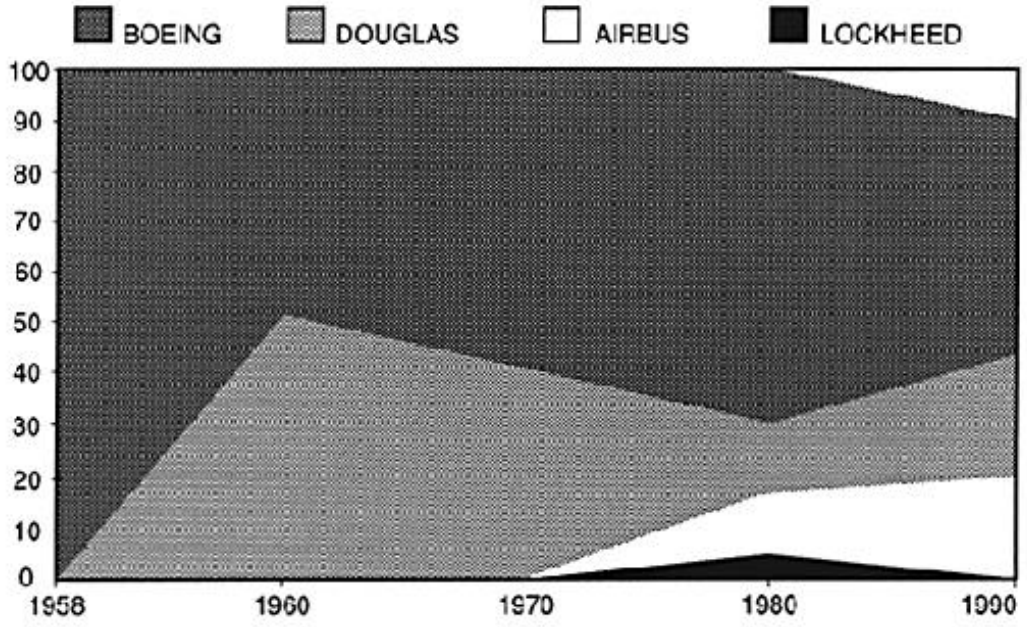
Source: AIA, *Facts and Figures 91–92* and *The Statistical Abstract of the United United States*.

A final indicator of the importance of the aerospace industry comes from its preeminent position in the world market for large jet aircraft. Figure 1 graphically portrays this trend.[16] Even today, the US maintains a market share in excess of 80 percent of the world market despite Lockheed's withdrawal from the large jet manufacturer competition.

These indicators show the aerospace industry to be a crucial part of the overall health of the US economy. The president, economists, and of course the military all see aerospace as one of the key useful technologies for the future well-being of America. In the final decade of the twentieth century, aerospace can look forward to a projected total world air traffic growth of 5.4 percent.[17] Clearly, aerospace represents a crucial industrial field that is important to the future competitiveness of America's economy.

Linking the Aerospace Industry and Government Aerospace

A synergistic relationship exists between the aerospace industry and government aerospace. Laura D'Andrea Tyson describes this effect stating, "The



Source: James W. Chung, "Whither the U.S. Aerospace Industry's" in *Breakthroughs*, Winter 1992–1993.

Figure 1. World Market Share of Large Jet Airplane Deliveries

synergies between the military's emphasis on performance and flexibility and the commercial sector's emphasis on cost and reliability have been central to aircraft technology and innovation."[18] She goes on to note that "a competitive commercial aircraft industry thus contributes to a nation's military prowess."[19] The relationship Tyson describes is obviously driven by technology, and many examples abound to illustrate this connection.

A key area linking two entities is engine technology. Engineers first designed jet engines for military aircraft in World War II, and their efforts continued in the postwar era. Boeing used its J-57 engine in its proposal for the B-52 and later coupled this same engine to the United States's first successful commercial jet aircraft, the Boeing 707.[20] The competition to develop jumbo jet technology to haul over-sized military cargo resulted in the engine designs to power aircraft as large as the Lockheed C-5. Boeing put this technology to use on its Boeing 747. The 747 went on to become the greatest post–World War II success story in commercial aviation history.

Several other innovations mark this association between industry and government. Designers still use the swept-wing design of the B-47; the Boeing 707 being the first commercial jet aircraft to incorporate this innovation. Airbus incorporated fly-by-wire technology, originally pioneered in the F-16 fighter aircraft, into its A320 aircraft—the first commercial jet so equipped. Supersonic flight not only resulted in aircraft design introductions but also drove improvements in metallurgy and fuels. The composite materials found in the military's newest stealth aircraft have increasingly found their way

into commercial aircraft. Composite structures not only add strength, but reduce weight resulting in more fuel-efficient aircraft.

The technology spin works in the other direction as well. The commercial sector improves and innovates many new systems that find their way into military use. The airline industry improved onboard radar capabilities originally developed by the military and produced specialized weather radar equipment. Many military aircraft, especially transport aircraft, incorporate this technology. The commercial industry enhanced the capabilities of cathode ray tube technology creating "glass cockpits" that enhance the presentation and type of information presented to pilots. Newer military aircraft, like the F/A-18 and F-117, incorporated this technology into their cockpits, increasing the performance of their flight crews. Although the highest risk technology still flows from government-to-industry, significant transfer occurs in both directions.

The pathway between the aerospace industry and government aerospace runs in both directions. Clearly a dedicated link exists between these two aspects of aerospace power. Thus far we have seen how important the aerospace industry is to the US economy and the linkage that exists between it and the government side of the equation. The next section seeks to explain why this relationship exists.

Explaining the Linkage

The focal point in an explanation of the linkage between government and industrial aerospace is risk. In the United States the government served to reduce the risk accrued to aircraft manufacturers by underwriting their production costs via indirect and direct means. The primary indirect methods were research and development (R&D) funding and military aircraft purchases. Direct risk reduction resulted in the federal funding of the US space program; however, space accrued much higher political risks as a result of that arrangement.

After World War II the federal government continued to underwrite a large portion of aviation research and development. In the 1950s and 1960s, aerospace R&D exceeded 30 percent of all federally funded R&D dollars and approached almost 40 percent in the 1960s.[21] From the mid-1970s until the start of the Reagan military buildup, 50 percent of all federal R&D dollars went to aerospace and from 1984–1989 this percentage increased to over 60 percent.[22] Table 3 provides the details of the R&D dollars. The preponderance of aerospace R&D funding comes from the National Aeronautics and Space Administration (NASA) and the Department of Defense (DOD). From the early 1970s to the mid-1980s, NASA and DOD furnished approximately 97 percent of federal aerospace R&D funds.[23] Laura Tyson refers to this national R&D effort as the "visible hand of government."[24]

Table 3

US Government Research and Development Expenditures
(millions of current dollars)

Year	All Industries	Aerospace Industry		
	Total	Total	Federal Funds	Company Funds
1950	1,143	*	1,080	*
1960	10,509	3,558	3,180	378
1970	18,062	5,245	4,032	1,213
1980	44,505	9,198	6,628	2,570
1990**	104,344	25,357	19,217	6,140

* Breakout of data not avilable
**Last year data available

Source: *Facts and Figures*.

Table 3 shows that three of every four aerospace research dollars comes from federal sources. If one breaks out aerospace funds from the rest of industry, one finds a federal-to-industry funding ratio of one-to-three, a virtual reversal from that of the aerospace industry.[25]

Not only is the cost of R&D high in the aerospace industry; failure can be disastrous to the individual company. Of the $4–6 billion to produce a new aircraft product line, development expenses represent two-thirds of fixed costs.[26] These represent high entry barriers for any business, let alone one as volatile and risky as commercial aircraft manufacture. Tyson quotes the Office of Technology Assessment as estimating that, in 1991 dollars, it cost $3 million in 1936 to develop the McDonnell Douglas DC-3. Today, Boeing expects to pay over $10 billion to develop its Boeing 777.[27]

These facts serve to highlight the high cost of R&D in the aerospace industry and the risk that must accompany an investment of that magnitude. In effect, the risk of failure represents an all-or-nothing gamble that forces the builder to "bet the company" with each major aircraft venture.[28] Boeing sank every resource it had to launch the 747 program, nearly bankrupting the company. Lockheed's failure with the L1011 aircraft forced it out of the commercial aircraft manufacturing business altogether. The list is long for those companies that, like Republic, Wright, and Curtis, great names in aviation, are no longer corporate entities.

The government takes direct action to support the aircraft industry by its purchase of military planes. Several companies like Lockheed, General Dynamics, and Northrop make their living primarily through government contracts. Many other firms rely upon the government for varying but significant portions of their revenues. At times government support took the form of loan guarantees like the $250-million loan guarantee to Lockheed in the 1970s.

A special risk results from government involvement in aerospace—political risk. Nowhere is this risk manifested so clearly as in the US space industry.[29] Through NASA, the government controls the price and schedule of the US space launch business. Further, NASA exerts additional oversight as the

certification authority for flight payloads. By funding most of the US space program the government virtually eliminates risk to space manufacturers. Risk enters in when political decisions result in severe handicaps for the industry. For example, prior to the *Challenger* accident, the US made the decision to forego all other launch vehicles and rely solely on the space shuttle (this decision was made in an attempt to make the shuttle program more cost-effective). After the *Challenger* accident, the US failed to launch another satellite for some two years because it had no alternative launch capability. The resulting gap in American launch capabilities allowed European competitors (primarily France) to enter the space business as effective challengers.

The historical data shows us that the federal government effectively reduced operating risk for the aerospace industry by funding R&D and purchasing military aircraft. In essence, this funding amounted to a subsidy of the industry and served to mitigate the risk involved in the development of high-technology, high-cost aircraft. This government support through R&D dollars underpinned the industry throughout its development and fostered the cross flow of technology from the commercial industry and the government (especially military) sector of aerospace. The government further supported its aerospace industry by purchasing large numbers of aircraft and funding the space program. With drastic cuts in defense procurement, industry risk will increase (chapter 5 covers this in detail).

In the next chapter, we examine the potential for war in the future. We also look at some imperatives that will govern the application of military force should it be necessary.

Notes

1. Giulio Douhet, *The Command of the Air,* trans. Dino Ferrari (New York: Coward–McCann, 1942, reprint, Office of Air Force History, 1983).

2. Ibid. Douhet provides extensive analysis of the future of aerial transportation from pages 77–92. In this text he details his views on the relationship between economics, industry, and national security within the context of aviation.

3. William Mitchell, *Winged Defense* (New York: Dover Publications, Inc., 1988), 119.

4. Alexander de Seversky, *Victory Through Air Power* (New York: Simon and Schuster, 1942), 295.

5. Secretary of the Air Force Donald B. Rice, *Global Reach—Global Power,* white paper (Washington, D.C.: Department of the Air Force, November 1992), 1.

6. Robert B. Reich, *The Work of Nations* (New York: Vintage Books, 1992); Laura Tyson, *Who's Bashing Whom? Trade Conflict in High-Technology Industries* (Washington D.C.: Institute for International Economics, 1992); and Lester Thurow, *Head to Head, The Coming Economic Battle Among Japan, Europe, and America* (New York: William Morrow and Co., Inc., 1992).

7. US Department of Transportation, *MARAD '91,* Maritime Administration 1991 Annual Report (Washington, D.C.: Maritime Administration, 1992), D, 2.

8. James W. Chung, "Whither the U.S. Aerospace Industry?" in *Breakthroughs,* Winter 1992–1993, 12.

9. Aerospace Industries Associaton of America, Inc., *Aerospace Facts and Figures 92–93* (Washington, D.C.: Aerospace Industries of America, Inc.), 13. Hereafter referred to as *Facts and Figures*. *Facts and Figures 79–80,* 13; and *Facts and Figures 1960,* 10.

10. *Facts and Figures 92–93*, 48; *Facts and Figures 85–86*, 18; and *Facts and Figures 79–80*, 16.

11. Reich, 3.

12. *Facts and Figures 92–93*, 147; *Facts and Figures 79–80*, 131; and US Bureau of the Census, *Statistical Abstract of the United States: 1992*, 111th edition (Washington, D.C.: GPO, 1992), 410. Hereafter referred to as *Statistical Abstract of the United States: 19xx*. *Statistical Abstract of the United States: 199l*, 413; *Statistical Abstract of the United States: 1975*, 366; and *Statistical Abstract of the United States: 1965*, 237.

13. *Facts and Figures 92–93*, 153; and *Facts and Figures 79–80*, 132.

14. Chung, 12.

15. Ibid.; and Jim Impoco and David Hage, "White House Workout," *U.S. News & World Report*, 8 March 1993, 28.

16. Chung, 15.

17. Ibid., 16.

18. Tyson, 157.

19. Ibid., 160.

20. Robert J. Serling, *Legend and Legacy, The Story of Boeing and Its People* (New York: St Martin's Press, 1992, 107.

21. *Facts and Figures 92–93*, 105; and *Facts and Figures 79–80*, 101.

22. *Facts and Figures 92–93*, 105.

23. Ibid., 108.

24. Tyson, 157.

25. *Facts and Figures 92–93*, 105.

26. Tyson, 162–63.

27. Ibid., 163, Table 5.3; and "Making Elephants Fly," *The Economist*, 23 January 1993, 77.

28. Tyson, 168.

29. John L. McLucas, *Space Commerce* (Cambridge, Mass.: Harvard University Press, 1991), 203–4.

Chapter 3

War and Political Imperatives

The second element of aerospace power is the military one. Prior to looking at how military aerospace capabilities influence the military strategies of the services, one must consider two questions. First, will war or conflict be a factor in the future conduct of nations? Second, if war and conflict persist in the future, what political imperatives might control a US response to a crisis? Understanding these two issues will prepare the reader to assess the role of aerospace power in the military strategies discussed in the next chapter.

A Future of Armed Conflict

The nature of the international security environment is changing. In the former Soviet Union, Boris Yeltsin's supporters appear fewer in number, and he operates in a growing climate of unrest. Can Yeltsin hold onto the democratic reforms or will Russia return to communism? If the Russians do revert to communism, will it be with the same global ambitions seen during the cold war? How will the nations of the world deal with the violence in Bosnia-Herzegovina? What can these same nations do about growing ethnic unrest in the southern regions of the former Soviet Union? These questions, and the many more that could be asked, serve to highlight the uncertainty the United States and the rest of the world face in building toward the future. There are, however, two questions that must be addressed before examining the military service strategies devised to meet the challenges of the future. First, will there be armed conflict in the future, and if so, why? Second, what political imperatives may drive the US response to potential conflicts?

The global unrest discussed above indicates that the occurrence of armed conflict is one of the few certainties the world faces in the future. Since the end of the cold war and Desert Storm, the United States, as part of ongoing United Nations efforts, sent over 20,000 troops into Somalia to feed people and restore law and order. The US continues to fly military aircraft in the Middle East to enforce the no-fly zone over Iraq. American forces are conducting operations to impel UN economic sanctions on Iraq and Serbia. Just recently, the US committed forces to implement the no-fly zone over Bosnia-Herzegovina. At the same time, the US finds itself losing its "War on Drugs" and concerned about the "economic war" of the twenty-first century.[1] What then are the potential centers of conflict for the future?

To predict the future, sometimes a look to the past is beneficial. People/countries have fought wars for a variety of reasons. Historically, nations most commonly have gone to war for economic reasons. Agrarian societies sought the acquisition of more and better land. As trade became a more dominant feature of society, the issue became trade routes, resources, and colonies. Today, some argue that economic warfare involving the use of armed forces is a thing of the past. Is it? Friedman and Lebard in their book, *The Coming War with Japan*, provide compelling arguments that a war between the United States and Japan is not just possible but "inevitable."[2] Their key tenet states that an immutable tension exists between Japan, needing to obtain resources and expand into markets for its products, and the United States, needing to protect its own economy from the ravages of trade deficits and declining economic power. According to Friedman and Lebard, the dynamics of each country, as it seeks to optimize its economic position, will propel the two countries toward conflict. The conflict described by Friedman and Lebard portends a shooting war of global proportions. Is this theory too far-fetched? One might ask: What happens if a country attempts to extort US financial markets by manipulating currencies or debt financing? In the summer of 1992, changes in German currency exchange rates greatly affected economies around the world (negatively for the most part). What would the US response be if that kind of manipulation were purposefully directed at its economy in order to compel economic crisis? Would not the United States construe such action as an invasion of sovereignty and a possible threat to the "economic" survival of the nation? It appears plausible that a whole new world of economic coercion is possible in the global electronic marketplace of the future.

Ideological concerns represent a second rationale for conducting war. Several variations of this category exist. First, religious differences served as justification for bitter wars, the Crusades being an excellent example of this kind of war. A second variation, an offshoot of religion (and often enmeshed in religious differences), is ethnic friction. Cultural differences between people often result in conflict. In the Middle East, the Persian Iranians and the Arabs of Iraq fought one of the bitterest wars in history in the 1980s. In this case, the power of cultural differences exceeded the ties of religion. Iraqi Shiites fought with Iraqi Sunnis against their Shia brethren in Iran. Certainly the breakup of Yugoslavia illustrates both the religious and the cultural tensions that can produce war. A final source of ideological contention between countries results from differences in governmental processes. The cold war pitted communism and its totalitarian rule against the West's democracy. With the waning of communism, some strategists predict that this kind of conflict will subside. They pin their hopes on the tenuous assumption that democracies do not go to war against each other. Unfortunately, there are many "democratic" totalitarian governments in the world. In 1990, the US invaded Panama to capture "elected" president Manuel Noriega and bring him to the US to face drug-related charges. Richard Betts and Samuel Huntington argue convincingly that by the end of this century the world will face

an increase in totalitarian regimes with potential instabilities resulting from expected power transition problems.[3] Thus, an assortment of ideological reasons may result in conflict for the United States.

A final category of rationales for war results from those leaders who seek some form of self-aggrandizement. These leaders seek to create their own personal legacy at the expense of their own people and the people of affected countries. Saddam Hussein provides a recent example of this kind of leader. Although no one knows his reasons for attacking Kuwait, a plausible hypothesis states that he sought to set himself up as the leader of the Arab world, much as Gamal Nasser attempted to do some 30 years before. Napoléon fits this mold, especially in the final years of his military career when the opposing coalition (British, Germans, Russians, and Austrians) sued for peace on generous terms, but he held out seeking one last great victory. The world political scene has rarely lacked some new Napoléon, Hitler, or Hussein.

While conflict still appears inevitable, not every disagreement will escalate to war; however, armed conflict seems more certain today now that the overwhelming fear of nuclear armageddon has abated with the decline in tensions between the United States and the former Soviet Union. What political imperatives, then, will direct the responses, specifically the use of armed force, in crisis situations?

Political Imperatives for Future Conflicts

Karl von Clausewitz wrote that war was an extension of political intercourse; thus, it comes as no surprise that political imperatives (others may consider them to be restraints) govern the conduct of conflict. Whether conflict resolution involves an economic, diplomatic, or military solution, political imperatives will preside over the issue(s) in dispute. Nine dictums will govern the application of the military instrument in crisis situations in the future.[4] The first imperative results from the change in East-West relations. The monolithic threat of communism, reflected in the nuclear arsenals of the United States and Soviet Union, has lessened greatly with the breakup of the former Soviet Union and subsequent dissolution of the Warsaw Pact. The bipolarity indicative of the old international security paradigm has been altered to one reflecting greater multipolarity.

The second imperative is an extension of the first. In the future, the US will focus on regional crises. The relaxation of tensions between East and West manifested itself in an explosion of third world ethnic violence. The southern border countries of Russia, the former Yugoslavia, and many African countries are experiencing great unrest and threaten international security. Burgeoning populations in Asia and Africa are increasing migratory pressures and increasing social tensions for improvements in the quality of life. The great disparity between the concentrations of wealth in the Northern Hemisphere versus the Southern Hemisphere exacerbate the cultural ten-

sions that already exist. In the former Soviet Union, drastic changes must occur, otherwise the stabilizing effects of the nuclear standoff between the US and the Soviet Union will be lost in a wave of regional upheaval. Thus, as the US National Security and National Military Strategies state, the focus of future wars will be regionally based.

The third imperative flows from the two previous dictums. The global community will face more threats, although of lesser world-wide impact, in the future. As described above, the potential sources of conflict multiplied after the superpowers lifted the lid on East-West tension.

The next area of political direction is based upon the assumption that the United States desires to continue in its role as the leading power within the international community. With the many threats that exist in the world today and the interconnected relationships within the business community, the US appears to have little choice but to remain engaged in the political process of nation-states.

The fifth imperative involves another assumption. It assumes that the desire to remain an economic power will serve to direct US policy. Americans will see this dictum reflected in further reductions of the defense budget, increased emphasis on job creation and training, and so forth. Economic concerns will indeed be a compelling force in political decision making.

The remaining four political imperatives deal exclusively with how the US will employ force in the future. The sixth imperative assumes the United States will strive to wage short, decisive wars, and avoid the long, costly wars of attrition such as Vietnam. This dictum directly reflects the overarching concern for the economic welfare of the nation.

Another imperative that falls out from the concern for the economy is the employment pattern of US forces. In the past the United States forward deployed much of its active duty forces. The US Army had hundreds of thousands of troops in Europe, and the Air Force had hundreds of fighter aircraft and crews. The Navy has maintained a yeoman's schedule of fleet deployments in the Atlantic, Pacific, and Indian oceans as well as in the Mediterranean Sea and the Arabian Gulf area. Now, however, the US will continue to withdraw troops from overseas locations and reduce its naval commitments consistent with decreasing defense budgets and naval force structure. Clearly, America finds itself in a position that requires the use of forces that can project power from the United States to whatever geographical destination is required by circumstance. The United States simply will not be able to afford large, forward-deployed forces in the future.

The eighth political dictum issues from the previous imperative. Because fewer troops will be forward deployed, a capability to respond from the United States must be present to allow America to meet its treaty commitments with its allies. Historically, responses to the smaller, regional type crises envisioned for the future required a rapid response capability. Examples abound illustrating this demand, such as the Berlin Airlift in the late 1940s, the Suez crisis in the 1950s, and on up to Grenada, Panama, and the Desert Shield portion of Gulf War II. These crises, and hundreds of other emergencies and

disasters, demanded the rapid response of US forces to distant places to achieve the desired political outcomes of US policy.

The final imperative involves casualties and collateral damage. In the future, unless the war is one of survival for the US, wars must minimize both casualties (US and the adversary) and collateral damage to the enemy's noncombatant structures. Lt Gen ("Buster") Glosson, one of the key architects of Desert Storm's air campaign, recalled in an interview that President Bush stated "in no uncertain terms" that Coalition forces needed to minimize the loss of life and damage to any of Iraq's cultural symbols or nonwar supporting facilities.[5] The requirements to minimize casualties and collateral damage will increase as a result of Desert Storm because of the accuracy exhibited by precision guided munitions and the precise bombing demonstrated by high-technology weapon systems like modern aircraft and cruise missiles. In tomorrow's conflict environment, the exigency for accuracy will be more demanding, requiring even more capable weapon platforms and munitions.

These imperatives underpin the military responses possible in future crises. Assuredly, as time goes by, some of these dictums will change. Certainly the president in office and the makeup of the Congress at the time of a given crisis will greatly influence which of these imperatives receives greater emphasis in a given situation. For the military services these imperatives serve to limit the strategies each service can employ and/or contribute to the kit bag of options for US political leaders.

Notes

1. Cable News Network reported on 15 April 1993 that a recent study showed that children, especially those in the eighth grade, are increasing their use of drugs, including a rising rate of LSD usage as the "new" drug of choice.

2. George Friedman and Meredith Lebard, *The Coming War with Japan* (New York: St Martin's Press, 1991), first paperback edition, 1992, xiv.

3. Richard K. Betts and Samuel P. Huntington, "Dead Dictators and Rioting Mobs," *International Security*, Winter 1985–1986, 112–46.

4. Pieces of the imperatives that follow in the text are to be found in many articles. The key articles used to develop this section include: *Global Reach—Global Power*; US Department of the Army, FM 100-5, "Operations," final draft (Washington, D.C.: Headquarters Department of the Army, January 1993); H. T. Hayden and G. I. Wilson, "Defining the Corps' 'Strategic Concept'," *Marine Corps Gazette*, May 1992, 44–46; Carl E. Mundy, Jr., "Expeditionary Forces: A Defining Concept for the Future," *Sea Power*, April 1992, 43–44, 48, 50, and 52; . . . *From the Sea - Preparing the Naval Service for the 21st Century* (Washington, D.C.: US Department of the Navy, September 1992); Stan Weeks, "Crafting a New Maritime Strategy," Naval Institute *Proceedings*, January 1992, 30–37; and Thomas C. Linn, "Naval Forces in the Post–Cold War Era," *Strategic Review*, Fall 1992, 18–23.

5. Edward O'Connell, "A Look into Air Campaign Planning" (unpublished research paper, US Defense Intelligence College, Washington, D.C., 1992), 17.

Chapter 4

Of Aerospace and Military Strategies

Each of the military services has sought to develop strategies that operate within the political imperatives discussed in chapter 3. This chapter seeks to relate each strategy to the political imperatives discussed in the previous chapter and to show how dependent each strategy is upon aerospace power.

Naval Expeditionary Forces
. . . From the Sea

On 28 September 1992, Secretary of the Navy Sean O'Keefe, Chief of Naval Operations Adm Frank B. Kelso II, and Commandant of the Marine Corps Gen Carl E. Mundy, Jr., signed a white paper delineating the Navy-Marine Corps strategy of the future. They titled the strategy, *. . . From the Sea*.

This new construct refocuses the Navy away from a blue-water perspective towards regional, littoral operations. The Navy-Marine Corps team seeks, through forward deployment and presence, to provide on-call power projection and crisis response to littoral conflict.

In devising this strategy, the naval services assumed they had control of the seas; therefore, they could now concentrate on littoral warfare.[1] The concept calls for the "team" to seize and defend ports, naval bases, and/or control coastal air bases to allow entry of US air and army forces as required.[2] Upon successful penetration, naval forces then turn the mission over to heavier Air Force and Army units. This reliance on Air Force and Army firepower coupled with planned reductions in Naval and Marine Corps capabilities indicates that the strategy envisions the "team" operating at the lower end of the low-intensity conflict spectrum.[3] Thus, *. . . From the Sea* is a limited focus strategy tightly linking the Navy and the Marine Corps in the projection of power upon littoral areas.

The new construct identifies four key operational capabilities necessary for success. First, the team recognized that command, control, and surveillance capabilities are essential to joint and combined operations.[4] The secretary of the Navy (SecNav) directed the Naval War College's Wargaming Center to evaluate the new strategy with respect to the Navy's Program Objective Memorandum (POM), the Navy's programmatic budget.[5] The Navy discovered that the entire architecture of C^4I^2 (command, control, communication, computers, information, and intelligence) required increased attention. The

wargame identified key problem areas such as positive identification systems, real-time battlefield damage assessment, and multispectral surveillance. Further, the Navy found that it needed improved intelligence dissemination capabilities. These shortcomings reflect the increasing emphasis on the exploitation of space for the successful employment of naval strategy.[6]

The team identified battle space dominance as the second key operational capability. Naval forces consider this area the heart of naval warfare. The two components of the battle space are landward and seaward. Naval forces seek to, within the littoral area, control the sea (on and below the sea), the air, and operations on the land. Space control receives emphasis, too. As the strategy states, "We must use the full range of US, coalition, and space-based assets to achieve dominance in space as well."[7]

Achieving battle space dominance makes possible the third key capability, power projection. The naval forces team expects to use its mobility, flexibility (tailorable forces), and technology to mass its strength against enemy weakness(es). Embedded in this aspect of the construct is the fourth capability, force sustainment. The . . . *From the Sea* strategy touts the Navy's ability to sustain deployed operations and its ability to remain on station for long periods of time.

The new naval forces expeditionary strategy does reflect most of the political imperatives discussed above. The strategy shifts its focus from a Soviet, blue-water threat to a regional, littoral one.[8] The complete refocus of the team to littoral warfare indicates implicitly that the naval services see the increase in lesser threats and that the US will desire to maintain a leadership role in those areas. The new strategy recognizes the economic and threat imperatives resulting in downsizing its force structure as it seeks to make its operational capabilities work in a more flexible manner. In the future, the team will increasingly operate surface action and amphibious readiness groups independent of carrier battle groups (CVBG). As stated in . . . *From the Sea*, the Navy Department "must structure a fundamentally different naval force to respond to strategic demands and these new forces must be sufficiently flexible and powerful enough to satisfy enduring national security requirements."[9] The new strategy recognizes the imperative for minimizing casualties as evidenced by its listing this goal as one of the seven key results in the SecNav Strategy-POM wargame.[10]

At odds with the political imperatives is the strategy's reliance on forward deployment/presence to enhance response time to a crisis. As long as the Navy-Marine Corps can maintain forward basing in Japan, the Mediterranean, and the Indian Ocean (the Marines still have a significant amount of prepositioned equipment afloat there) the naval team can achieve power projection measured in days versus weeks. The move to lighten Marine forces will ease deployment and sustainment problems for the Corps but, at the same time, reinforce a limited role at the lower end of low-intensity conflict. Thus, they will be used in short conflicts or as early on forces awaiting the arrival of heavier air and army units. Overall, within its stated focus, the . . .

From the Sea strategy confirms and operates within the stated political imperatives.

The results from the Navy's Strategy-POM wargame illustrate the areas the Navy-Marine team must focus on to "flesh out" their new strategy. The study also offers us a tool to show the dependence of this new strategy on aerospace power. Bockman and Hayes list seven major results from the game; six directly relate to aerospace power (the seventh emphasizes the importance of minimizing casualties in any future conflict).[11]

The first key result area recognizes the increasing importance of C^4I^2 systems. Bockman and Hayes list requirements for command data links, position location gear, and super and extremely high-frequency communications. In the surveillance area, they note the need to exploit multispectral capabilities. All of these areas require extensive use of aerospace power. The global positioning system, used so successfully in Desert Storm, can provide immediate help to navigation capabilities. Improved capabilities in satellite systems like the Defense Satellite Communications System and LANDSAT will enhance capabilities in global command, control, and communications (information handling) and multispectral imaging. Improving the links between operators and national intelligence satellites will facilitate the flow of intelligence information to the users most in need of their data.

The need for defensive capabilities against theater ballistic missiles (TBM) was the second key result area. This aerospace threat requires the ability to detect, target, and kill not only the missile but also the launcher. Aerospace assets like J-STARS and strategic surveillance satellites will complement the Navy's effort to develop antiballistic missile defenses on its Aegis cruisers and provide the Navy with the initial tools to face this threat.

Third, the increased integration of precision guided munitions (PGM) for naval aircraft will provide the strike capability for attacking TBM launchers and other high-value, hard-to-get-at targets. Bockman and Hayes note the Navy seeks penetrating weapons in greater numbers than ever before.[12] Obviously the Navy desires to increase the flexibility of its aircraft firepower.

To aid weapons delivery, the Navy-Marine team seeks to procure multimission, low-observable aircraft. This fourth key area coupled with the fifth area, the acquisition of unmanned aerial vehicles (UAV) illustrates the Navy's reliance on aerospace power to provide the penetration force of the naval forces team.

Finally, the Strategy-POM game reinforced the need to resolve the Marines' need for medium vertical lift; a problem exacerbated by the political haggling over the V-22. Once again, aerospace is at the forefront of naval power projection strategy.

Thus, reflected in this major evaluation of its new strategy, US naval forces recognized the absolute necessity of aerospace power for their ability to prosecute their strategy today and in the future. As the Germans learned in the Battle of Britain and the Navy learned at Pearl Harbor and during the war in the Pacific during World War II, control of the air must be achieved before surface operations can be successfully conducted against an aerospace-capable

adversary. The Navy and the Marine Corps clearly realize the need for space operations to enhance communications, navigation, and surveillance. Implicit in . . . *From the Sea* is the requirement for aerospace control and dominance. No one can imagine exposing amphibious or carrier forces to an environment where US or allied air control is lacking. The linkage of CVBGs to amphibious readiness groups to form the new naval expeditionary force team reflects the concern for gaining and maintaining air control in littoral warfare.

Army Operations

The Army's new doctrine, *Army Operations*, seeks to project strategically agile forces while providing the bulk of US forward presence on five continents.[13] Gen Gordon R. Sullivan, Army chief of staff, notes several forces of change in the international environment: democracy, ethnic strife, ideological and religious tenets inimical to free markets and democracy, economic crises in many countries, proliferation of military technology, and threats from drug traffickers.[14] He goes on to note that these forces drive the Army toward a strategic power projection footing. Further, Sullivan sees two constants that result in the need for a capable Army. First, enduring American global interests of democratic and economic processes require access to critical resources and free economic and political interaction.[15] Second, there is the argument that 50 years of American world leadership cannot be abandoned. The Army operations manual, FM 100-5, *Operations*, states the Army's role is to apply "force to fight and win quickly, with minimum casualties," and, as General Sullivan states, "With the Army, America signals that national interests are at stake."[16] To meet the challenges that General Sullivan poses in his world view, the Army developed a strategy geared to mobility and versatility. Based on a mobility study, the Army has set requirements to move one light and two heavy divisions from the US to a conflict theater 7,500 miles away in 30 days. Further, the Army plans to transport the remainder of the corps and two more divisions to the theater within an additional 45 days. To accomplish this task, the Army wants to fund a $13-billion buy of 39 ships including medium roll-on, roll-off ships. To fight the war envisioned by Army strategists, the service developed a strategy to maximize the maneuverability of Army forces as seen during Desert Storm.

The Army's new strategy focuses on power projection as its central element.[17] To accomplish its mission, the Army plans to function within an eight-phase construct of force-projection operations. The phases may occur sequentially or run simultaneously depending on specific circumstances. The eight phases are predeployment activity, mobilization, deployment, entry, decisive operations, restoration, redeployment, and demobilization. The first three phases entail activities leading up to the embarkation of troops. These activities include training, requirements formulation, the assembling of troops and materiel, and deployment execution.

The entry phase may be opposed or unopposed. The Army wants a forced entry ability capable of success under any conditions. “Speed is especially important” as the Army wants to seize the initiative.[18] The entry phase sets the stage for decisive operations by creating the environment within its area of influence to mass forces to destroy the enemy.

In the decisive operations phase, the Army brings it all together counting on speed, maneuver, shock action, and violent aggressive tactics to overwhelm the enemy with as little loss of US lives as possible. The strategists plan to attack only at critical time(s) and emphasize offensive operations, using the defensive only as required. Key to accomplishing this phase is the use of massed fires to support maneuvering troops and massed combat service support to sustain operations. The supported land commander will require not only close air support, but interdiction fires short of, and beyond, the fire support coordination line.

The Army seeks to dominate the enemy through battlefield preparation and shaping. Preparation actions include: establishing the detection area, using available detection sensors to define the battlefield, determining the location of high-value targets, and protecting the main battle force and logistics support elements. Army commanders seek to shape the battlefield in order to gain and maintain the initiative. To accomplish this task, they rely upon the heavy use of air assets and long-range fires to disrupt the enemy. By integrating tactical air support, battlefield air interdiction, and conventional weapons (and nuclear and chemical ones if required), the Army plans to mount a massive fire support effort to throw the enemy force off balance and keep them there. The planners also note the need to deliver logistics support to maintain the high tempo of operations.

The final three phases of restoration, redeployment, and demobilization occur after “the cessation of armed conflict.”[19] In these phases, the Army plans to assist in the restoration of civil order including civil affairs activities and the clearing of military hazards (mines, ammunition, etc.). Prior to redeployment, the Army remains prepared to resume hostilities should the peace fail. Demobilization completes the transfer of Army units to a peacetime posture.

To employ this strategy in a war-winning manner, the Army adopted five key tenets that help establish conditions for victory.[20] Those tenets are initiative, agility, depth, synchronization, and versatility. To gain a greater understanding of the Army's strategy, we will briefly review each tenet.

In its first tenet, initiative, the Army imputes an offensive spirit in the conduct of all operations.[21] Using offensive strike, the Army seeks to never let the enemy recover from the shock of attack. If placed on the defensive, the Army seeks to quickly turn the tables on the attacker and reestablish offensive operations. For operations other than war (OOTW), Army forces seek to control the environment instead of allowing it to control operations.

The second tenet is agility.[22] Agility, the prerequisite for seizing and holding the initiative, is done by reacting faster than the enemy. The Army views agility as much a mental as a physical quality. The strategy plans to use greater quickness to rapidly concentrate strength versus enemy vulnerabilities.

Depth, the extension of operations in time, space, resources, and purpose serves as the third tenet.[23] The Army envisions a three-dimensional maneuver battlefield extending up to 300 kilometers or even beyond. This extension represents a vast projection in the depth of the battlefield from even the 150 kilometer moves in Desert Storm. For OOTW, the Army wants to extend area activities as above to affect and shape the environment to achieve the desired political resolution.

The fourth tenet, synchronization, seeks to achieve "the focus of resources and activities in time and space to mass at the decisive point."[24] The Army views synchronization as "both a process and a result." Synchronization incorporates activities like intelligence, logistics, and fires with maneuver to achieve synchronized operations. In short, the Army wants to get the "maximum use of every resource where and when it will make the greatest contribution to success."

With versatility, the final tenet, the Army wants its units to have the capability "to meet diverse mission requirements."[25] Thus, Army forces could inherently adapt to different missions or tasks, even tasks that may not have been on the unit's original mission-essential task list.

How, then, does the new strategy, *Army Operations*, reflect the new political imperatives, and how does it rely on aerospace power? General Sullivan provides us a clear insight into the development of this strategy. His view of global changes and the need to meet future challenges are reflected in the emphasis on deployability and maneuver. In his acknowledgement of the constants requiring a highly capable Army, General Sullivan recognized the need to have forces capable of projecting US power to ensure that democratic and economic imperatives are met. Further, the deployability of the new Army appreciates the need to respond rapidly to regional crises. The focus of the Army's new operations manual, FM 100-5, to apply "decisive force to fight and win quickly, with minimum casualties" clearly recognizes the imperatives for short, minimum casualty wars. Thus, *Army Operations* clearly supports the new political imperatives facing the US in the future.

The key new element in the Army's new construct helps us understand just how reliant the strategy is upon aerospace power. Crucial to Army actions in the future is the replacing of close battle with deeper maneuvers employing joint operations, fighting at the maximum range of weapons. In short, the Army seeks to push out the engagement line to avoid casualties. To do this, the Army must employ aerospace power.

In entry- and decisive-operations phases of the new strategy, the Army needs the sophisticated "eyes and ears" of aerospace assets to conduct the intelligence preparation of the battlefield. Currently the Army uses Guardrail aircraft to conduct electronic and signal surveillance of the battle area. They also employ Mohawk aircraft to do close-in targeting of enemy forces out to some 50–70 kilometers. (J-STARS will provide the Army with the capability to do this mission virtually throughout the theater, as was evidenced in its performance in Desert Storm.) The Air Force aids this process by providing air and space systems to conduct intelligence gathering operations through-

out a theater of operations, facilitating Army desires to function out to 300 kilometers. Conducting deeper operations, the Army will rely more heavily upon satellite communications systems as its units move beyond line-of-sight communications ranges. The Army discovered in Desert Storm that the Global Positioning Satellites (GPS) provide exceptionally accurate navigation data. This capability will expedite targeting, resupply, and battlefield management capabilities for ground forces.

As we saw earlier, the conduct of decisive operations required significant amounts of aerospace power for interdiction and close air support (CAS). Of course, Army helicopters are a fundamental part of aerospace power on the battlefield. Recall that Army air assault brigades sealed off the roads out of Kuwait towards Iraq during Desert Storm. Improving helicopter technology is one of the four critical technology areas for the future Army, according to General Sullivan.[26] Furthermore, aerospace power provides the rapid airlift capability that allows the Army the logistics flexibility to mass for decisive operations. While Army attack helicopters will be involved increasingly with CAS, Army doctrine still views the principal function of its aviation brigades as a flexible maneuver force.[27]

Finally, to support Army deployment to and from the theater, aerospace power—through strategic and tactical airlift (to include helicopters)—provides the Army the ability to deliver high-value replacement equipment or parts (even repair units) exactly when and where needed. No other mechanism provides this combination of flexibility and response time.

Like the Navy and the Marine Corps, the Army of the future has set its sights on a strategy that demands the unique capabilities that aerospace power brings to the combat environment. Aerospace power inherently embodies each of the five key tenets for successful Army operations. Aerial power always seeks the initiative, uses its own agility and flexibility to deliver ordnance or beans throughout the combat theater, and offers the capability to choreograph the deep fires necessary to minimize casualties in future conflicts. Thus, throughout its new strategy, the Army weaves aerospace power into its operations to provide it with the decisive edge for war winning.

Global Reach—Global Power

The Air Force calls its strategy *Global Reach—Global Power*. As did the other services, the Air Force took notice of the end of the cold war and refocused its attention to a regional one. The Air Force adopted a strategy designed to provide “the quickest, longest range, leading edge force available to the President in a crisis.”[28] The Air Force envisions itself as becoming the force of first choice and serving as the primary instrument of national military power.[29]

The Air Force foresees conflict based upon a regional threat. Complicating this focus are two factors. First, the declining force structure requires the Air

Force to operate with fewer assets. Second, the proliferation of sophisticated weapons and technologies creates a dangerous threat environment for operations.[30] The heart of *Global Reach—Global Power* is encapsulated in the following quote from the 1992 White Paper:

> The demands of our new military strategy play to the inherent strengths of air and space power. In an age of uncertainty, with the location and direction of future challenges almost impossible to predict, space forces allow us to monitor activities around the world and to know the battlefield even before our forces arrive. With smaller forces overall and fewer deployed overseas, airpower's ability to respond globally—within hours, with precision and effect—is an invaluable capability that is America's alone.[31]

Gen Merrill A. McPeak, Air Force Chief of Staff, stated the mission of the Air Force in a speech at Maxwell Air Force Base, Alabama.[32] He said that "the job of the forces we bring to the fight is to defend the United States through control and exploitation of air and space." Five key objectives and five key tenets support this mission.[33] First, the objectives begin with the goal of sustaining deterrence, relying primarily upon nuclear forces. Next, the Air Force seeks to provide versatile combat capability through its ability to conduct and sustain theater power projection operations. Third, the Air Force wants to conduct rapid global mobility via its airlift and air-refueling tanker aircraft. In fact, with the new regional focus, the Air Force envisions greater demands for both of these capabilities, especially for operations other than war.[34] Fourth, and perhaps most important, the Air Force wants to control the high ground of space and command, control, communications, and intelligence (C^3I). It seeks to do this by attaining and maintaining space dominance. In its last objective, the Air Force desires to enhance US influence abroad by strengthening US security partners through deployments, exercises, and education and training programs.

To achieve these objectives, the Air Force relies on what it considered to be the "inherent" tenets of characteristics of aerospace power. These five tenets are composed of speed, range, flexibility, precision, and lethality.[35] As might be expected, the Air Force considers Desert Storm the validation of these tenets. The combination of stealth aircraft, crew training, precision guided munitions (PGM), air refueling (an "indispensable force multiplier"),[36] and the introduction of space into combat operations affirm these characteristics. For nearly 40 days, the world watched aerospace power dismantle Iraqi war-making capability with amazing deftness and finesse. General McPeak stated that the Air Force has become the "maneuver force par excellence."[37]

For the Air Force, space represents an area of increasing importance. The Air Force contributes 80 percent of the Department of Defense space budget and provides, as mentioned previously, some 98 percent of space manpower.[38] In *Global Reach—Global Power* the Air Force states that "space forces' superiority of speed and position over surface and air forces points to *control* of space as a prerequisite for victory. Space superiority has joined air superiority as a sine qua non of global reach and power."[39] Most importantly, control and exploitation of space provides the capability to achieve a level of battlefield

situational awareness never before possible. Some of the fog of war has cleared from the battleground. As the strategy states, in the future the "control of the high ground will increasingly make space forces part of the versatile combat forces—decreasing the time required to respond to aggression and allowing us to strike anywhere with overwhelming but discriminate power."[40] Within the new Air Force strategy, *Global Reach—Global Power*, we find evidence of each of the future political imperatives. Up front in this strategy, the Air Force acknowledges the end of the cold war and the need to downsize its forces while changing to a regional focus. The extended quote presented above clearly reflects the imperatives of a new, regional focus with fewer forces (reflecting the economic imperatives at work in American politics). Another clear indicator of the Air Force's response to changing circumstances is its shift in viewpoint on strategic and tactical weapon systems. In the post–Desert Storm environment, the Air Force views its weapons platforms in terms of mission accomplishment, not by an arbitrary label. So we see fighters, previously labeled as tactical weapons, doing strategic bombing and B-52s conducting strikes against troop concentrations.[41] In fact, the Air Force no longer refers to its units as fighter or bomber wings; it simply calls them wings (e.g., the 1st Wing, formerly the 1st Tactical Fighter Wing).

Global Reach—Global Power concentrates on the ability to project power from the continental US (or a few forward bases) to any point on the globe. Clearly the Air Force recognizes the political emphasis on improving US economic competitiveness by decreasing defense costs. The Air Force's strategy supports that effort by seeking to provide forces that can do the job without the expense of forward basing and deployment. In time of crisis, however, the Air Force plans to take advantage of its airlift and air refueling capabilities to quickly project power when and where it is needed.

The Air Force is restructuring itself to provide forces that can "punch hard and terminate quickly."[42] A prime example of these efforts is the formation of composite wings providing ready force packages capable of delivering the hard punch. Key elements of the strategy serve to support US imperatives of short wars with minimal casualties. Former Air Force secretary Donald B. Rice targeted these aspects in one of his first writings on the new strategy.[43] He pointed out that the Air Force sought the ability to strike quickly with lethality and survivability. He credits stealth technology with providing this combined capability. The discriminate nature of precision guided munitions provides the capacity to limit collateral damage.

Thus, we see that the Air Force's new strategy, *Global Reach—Global Power*, clearly supports the new political imperatives driving national security policy. Naturally, the Air Force relies upon aerospace power in order to support national security objectives. But, as stealth and PGMs helped redefine the capabilities of aerospace power, space will redefine those capabilities in the future.

Space, then, will be the high frontier of military aerospace power, and the Air Force plans to "operationalize" space forces to benefit all war fighters.[44] Gen Charles A. Horner, US Space Command commander, notes the stunning

successes of Desert Storm in areas like navigation, weather, surveillance, missile warning, and communications.[45] He plans to improve upon these capabilities. The Air Force leads the efforts to develop next-generation missile warning systems like the Follow-on Early Warning System (FEWS). The GPS system not only provides superb navigational data but may help solve the friendly fire problem seen in Desert Storm. A major program, Talon Sword, seeks to take data from national reconnaissance assets and transmit that information directly to aircraft cockpit displays.

Space represents the future of the Air Force and, increasingly, aerospace power will be projected through space systems. Although the cost of operating from space is high, the force leverage gained is immense. Indeed, the Air Force is committed to providing the United States with the forces to control and exploit air and space.

Serious problems, however, face the aerospace nation. The next chapter examines the major problems confronting US aerospace power and offers the beginnings of a national aerospace strategy.

Notes

1. . . . *From the Sea - Preparing the Naval Service for the 21st Century* (Washington, D.C.: US Department of the Navy, September 1992), 1–2. Hereafter referred to as . . . *From the Sea.*
2. Ibid., 4.
3. "Remarks of Gen Carl E. Mundy, Jr., before Congress," *Marine Corps Gazette*, April 1992, 36. General Mundy stated that the Marines were cutting 50 percent of their tanks and 30 percent of their towed artillery to achieve a lighter, more agile force. This initiative results in a marked decrease in firepower. Furthur, the Navy has re-retired its battleships thereby reducing the capabilities of naval gunfire.
4. . . . *From the Sea*, 7.
5. Larry J. Bockman and Brad C. Hayes, "Breathing Life into the Naval Service's New Direction," *Marine Corps Gazette,* February 1993, 48.
6. . . . *From the Sea*, 7.
7. Ibid., 8.
8. Ibid., l–2.
9. Ibid., 2.
10. Bockman and Hayes, 49.
11. Ibid.
12. Ibid.
13. Gordon R. Sullivan, "'Vital, Capable and Engaged'," *Army*, October 1992, 24 and 28.
14. Ibid., 24.
15. Ibid.
16. Sullivan, 28; and FM 100-5, "Operations," final draft (Washington, D.C.: Headquarters Department of the Army, January 1993), 2-3. Hereafter referred to as FM 100-5.
17. The information for this chapter was taken primarily from chap. 3, FM 100-5.
18. FM 100-5, 3-10.
19. Ibid., 3-11.
20. Ibid., 2-11.
21. Ibid., 2-11 to 2-12.
22. Ibid., 2-12 to 2-13.
23. Ibid., 2-13 to 2-14.
24. Ibid., 2-14 to 2-15.

25. Ibid., 2-16.
26. Sullivan, 28.
27. Lt Col Mark P. Gay, USA, Joint Warfighting instructor, Air War College, Maxwell Air Force Base, Ala., interview with author, 29 April 1993.
28. Secretary of the Air Force Donald B. Rice, *Global Reach—Global Power*, white paper (Washington, D.C.: Department of the Air Force, November 1992), 4.
29. Ibid., 2–3.
30. Ibid., 2.
31. Ibid.
32. Merrill A. McPeak, "Does the Air Force Have a Mission?" lecture, Maxwell Air Force Base, Ala., 19 June 1992, 5.
33. *Global Reach—Global Power*, 1 and 3; and McPeak, 4.
34. *Global Reach—Global Power*, 7–8.
35. *Global Reach—Global Power*, 1; and McPeak, 4.
36. *Global Reach—Global Power*, 7.
37. McPeak, 6.
38. *Global Reach—Global Power*, 8.
39. Ibid., 8. Emphasis is in the original text.
40. Ibid.
41. Ibid., 3–4.
42. Donald B. Rice, "Punch Hard and Terminate Quickly," *Air Force Times*, 26 March 1990, 23.
43. Ibid.
44. James W. Canaan, "Space Support for the Shooting Wars, *Air Force Magazine*, April 1993, 34.
45. Ibid., 31.

Chapter 5

A National Strategy for the Aerospace Nation

In the previous three chapters, we examined economic and military aspects of aerospace. These two components combine to produce aerospace power. In the US aerospace industry, we saw a business that provides a significant portion of the nation's high-value, high-technology manufacturing base. Militarily, we noted the tremendous importance of aerospace to the future strategies of each of the military services. If, as this thesis argues, aerospace power is crucial to the economic well-being and national security of the United States, then one would expect the US to have a national strategy for aerospace power. No such strategy exists. Furthermore, current efforts aim only at either the economic or military components—no strategy exists to integrate these elements into a cohesive policy of national aerospace power.

Two questions, then, remain to be answered. First, what problems exist indicating the need for such a strategy? Second, what is entailed in a national aerospace strategy; what are its objectives and recommended processes?

Trouble in the Aerospace Nation

In chapter 2 we discussed the importance of the aerospace industry to the US economy. However, serious problems abound for both the economic and military components of aerospace power. First we will examine aerospace industry concerns, then, the military ones. To discuss the industry problems, I limited the discussion to the aircraft manufacturing and airline subsets of the aerospace industry. Most of the problems facing these two concerns affect other aspects of the aerospace business. Together they account for over 50 percent of total aerospace sales. Aircraft production supplies 80 percent of the world's large commercial jet aircraft. Thus, these two segments of the aerospace industry provide a good way to review the problems plaguing this vital industry.

In industry, the trouble starts with the bottom line. From 1990 to 1992, the world's airlines lost $10.8 billion; US carriers accounted for 73 percent of that total or some $7.85 billion.[1] Employment statistics further highlight the industry's woes. The aerospace business lost 87,000 jobs in 1991; production workers declined in number by more than 7 percent.[2] Boeing alone cut 10,000 employees in 1992 and plans to slash another 28,000 from its payroll by 1994.[3] Since mid-1990, Douglas Aircraft Company reduced its work force from

approximately 43,000 to only 19,000. They expect to cut another 4,000 jobs this year.[4] Worker reductions affect management, too. United Airlines recently announced it was trimming 20 percent of its senior officers in the face of continuing losses.[5] Further, United wants some $300 million in wage concessions from its employees in an effort to improve its financial picture (United alone lost almost $1.3 billion in 1991–92). Another factor is the declining market trend in military and commercial aircraft sales. Between a 1981 high point and 1991, military aircraft delivered by industry fell by 30 percent.[6] Commercial aircraft sales turned downward in 1991. Both Boeing and Douglas scaled back production some 40 percent to meet the reduced demand.[7] Already this year aircraft manufacturers suffered $15 billion in cancelled orders.[8]

But these are just the symptoms; what are the roots of the problems? At the heart of industry's problems is the issue of competitiveness. The key to competitiveness in the aerospace industry is risk management. The American aerospace industry historically used government military contracts and R&D funding (see Table 3 in chapter 2) to reduce its production costs thereby reducing product risk. Table 4 illustrates the dramatic increase in development costs that federal contracts and R&D funding helped to offset.

Table 4

Changing Aircraft Production Costs

Aircraft Type	Year Entered Service	Development Costs (1991, $ millions)
McDonnell Douglas DC-3	1936	3
McDonnell Douglas DC-6	1947	90
McDonnell Douglas DC-8	1959	600
Boeing 747	1970	3,300
Boeing 777		10,000[a]

[a]Estimated

Source: Laura Tyson, *Who's Bashing Whom?* and "Making Elephants Fly," *The Economist,* 23 January 1993, 77 (Washington, D.C.: Institute for International Economics, 1992).

These traditional risk management supports are diminishing in the face of budget deficit pressures. As discussed earlier, military aircraft sales are in decline. Also, the Clinton administration proposes to realign the ratio of nondefense to defense R&D funding from the current 40:60 ratio to a 50:50 ratio.[9] How critical is federal research and development funding? Recall from chapter 2 that federal funding comprises three of every four dollars expended on aerospace R&D (all other manufacturing industries receive only 1.4 in 10 dollars from federal R&D).[10] How will the US aerospace firms compete with foreign consortiums like Airbus, which has the financial backing of three powerful governments? What happens to the Far East market if Japan targets the aircraft building industry through the financial backing of its Ministry of International Trade and Industry? Eiju Toyoda, chief executive officer

of Toyota Motor Corporation, told visiting Boeing executives that Toyota was "in the transportation business. It's our destiny to be in the airplane business."[11] The challenge to American leadership in aerospace is very real.

The US government exacerbates the competitiveness issue with inconsistent policies. For example, the Clinton administration's proposed energy tax will add approximately $1 billion in tax burden to the airline industry. Further, the cuts in federal R&D funds to aerospace described above can only worsen the very industry the president is committed to support. Additionally, the onset of Stage II noise restrictions may create a greater demand for quieter aircraft but will increase airline debt burden as companies are forced to buy new aircraft. Clearly, the industry requires a national strategy to integrate these facets of market and government policy.

Civilian and Department of Defense policy makers suffer from their own strategic dysfunctions. As we saw in chapter 4, each service has its own aerospace force dependencies; however, no DOD-level integration office exists to coordinate military aerospace power. In fact, as analysts for *The Economist* point out, the DOD remains the only western military establishment with separate service-acquisition systems.[12]

A more dramatic indication of military dysfunction is evident in the DOD response to Sen Sam Nunn's (D-Ga.) questioning of the efficacy of the military's having four air forces (meaning the four services).[13] The DOD response came in Gen Colin Powell's report on roles and missions.[14] The report argues that "the other services have aviation arms essential to their specific roles and functions but which also work jointly to project America's air power."[15] The debate argues that as it makes no sense to assign all radios or trucks to one service, so too it would not make sense to assign all aircraft to one service. Is this an aerospace rationale? Would we need aerospace forces to operate differently in the services' strategies if there were only one air service? Would we not be better served to describe *what* we want US forces (land, sea, and aerospace) to do and develop an integrated strategy to achieve some desired end state? For example, if the nation wants a highly mobile amphibious assault capability, it needs Marines with air power. If the nation wants sea control and power projection capabilities with minimal reliance on other nation support, it needs a Navy with air power in the form of carrier air wings. If the US wants an Army with the capability to do sustained, heavy combat with low casualties, it will need aerospace power. If the nation wants to exploit air and space forces as it did in Desert Storm, it will need many air and space capabilities. As we found in chapter 4, the future service strategies depend on aerospace power. The political imperatives driving those strategies devolve upon aerospace capabilities. If the Defense Department is to answer Senator Nunn, it must answer within the context of a military aerospace strategy.

The ties linking the aerospace with its military counterpart were forged through two world wars, a cold war, Korea, Vietnam, and other lesser conflicts. Add to this crucible of the past the economic challenges of the future and one sees the desideratum of aerospace power. To achieve a position of predominance in aerospace, the US requires a national aerospace strategy.

Whither the Aerospace Nation?

If this paper serves no other purpose, it must serve as a wake-up call, a call to action for the aerospace nation.[16] United States policy makers must view aerospace power as a national treasure. If economists like Robert Reich, Michael Porter, and Lester Thurow, are correct, the aerospace industry will be critical to America's future economic prosperity. Each argues that the future belongs to those nations with trained, skilled workers who add unique, high value to products. Each agrees that aerospace is one of those industries. Militarily we cannot operate without control of aerospace—all military strategies rely upon it. Aerospace dominance provides the capability for US forces to win within the political imperatives of the future, especially with reference to casualties. Aerospace power, both its economic and military elements, is under great pressure to succeed in the future. To do so requires a national aerospace strategy.

What, then, should be the goal of an aerospace strategy? The economic vision needs to be one that aspires to world leadership in aerospace technology. The military vision is clear—provide aerospace control and exploitation capabilities on demand, regardless of whether land, sea, or aerospace forces represent the predominant medium in any given circumstance. Together these two ideals combine to form the goals of the US aerospace strategy.

What are the broad objectives that work to achieve the goals stated above? To paraphrase Laura Tyson, "Ultimately, the fate of the nation's (aerospace strategy) depends not on trade battles fought abroad but on the choices we make at home: in macroeconomic policy, education policy, technology policy, industrial policy, (and national defense policy)."[17] We will use Ms Tyson's framework to offer broad objectives and ideas for formulating a national aerospace strategy.

On a macroeconomic level, the national strategy should contribute to the economic well-being of the United States. Aerospace should help the US improve its standard of living providing a better life for its people. Further, improved economic well-being ensures the US the capacity to support military capabilities to secure national security interests.[18]

The leading objective of US macroeconomic policy is to make the aerospace industry profitable and competitive in the world marketplace. Several policy options work to attain this goal. A key option task is to level the playing field of aerospace competition. As we saw earlier, federal RDT&E funding and military aircraft purchases supported (subsidized) US commercial aerospace in an indirect manner. The European Community used direct subsidies (direct government financial support) to help Airbus break through the start-up barriers in the aircraft manufacturing field. Now other countries (like Japan) seem poised to take off. Bilateral/multilateral agreements need to account for these extra-market forces. The 1992 United States-European Community bilateral agreement on trade in civil aircraft provides a starting point. This agreement stipulates a set percentage (33 percent) for direct government

funding of aircraft development. The agreement also states that "indirect (i.e., military) supports should neither confer unfair advantage . . . nor lead to distortions in international trade in such aircraft."[19] Trade agreement discussions with aspiring entrants to the aerospace industry (like Japan) would have to provide provisions for new players to overcome the high entry barriers to the aviation business.

Another key to macroeconomic policy is the question of foreign investment in US aerospace. The US needs to develop consistent policies to accommodate foreign investment. In his book, *The Work of Nations,* Robert Reich lays out the argument that *where* investment dollars come from is irrelevant.[20] What matters is having the production and skilled workers in the United States. That way, if the foreign investors pull out, the US still has the people and process. Naturally, one would have to consider security issues; however, the high cost of aerospace development is driving industry firms to seek joint ventures, consortium, and ad hoc arrangements to generate the skills and/or funds to produce new products. As Reich and others argue, globalization of the aerospace industry is a trend that is here to stay.

US tax structures provide another issue of concern for macroeconomic policy as it applies to aerospace. Obviously, in an industry that carries as much debt as aerospace, tax structure is very important. The aerospace strategy must produce a consistent tax plan that encourages civil research and development investment. At the same time, this new tax structure must recognize that commercial success from R&D expenditures is an inherently low-return proposition. Further, the strategy needs to avoid/resolve situations like the proposed energy tax that work at cross-purposes to other industry promoting efforts. Few industries can absorb a $1 billion tax mistake.

Education policy requirements are often overlooked in policy proposals. The aerospace industry needs highly skilled engineers, designers, and craftsmen to compete in the future. Likewise, the military requires highly qualified engineers, technicians, and flyers. The objective of US education policy must seek to provide education and training to equip its workers with the skills to compete for and obtain the high-technology, high-wage jobs that result in an increased standard of living. This policy must not limit itself to college education but must be extended to include vocational training so that a supply of educated and trained technicians is available to the industry. Reich argues for "positive economic nationalism" focused on improving job skills through national education programs.[21] He argues that the educational (and financial) elites must accept the social responsibility to raise the educational and training standards of America's workers. Whatever mechanism the strategy adopts will impact not only aerospace but the nation as a whole.

The aerospace strategy should commit the United States to a technology policy seeking dominance in the aerospace field, commercial and military. As we noted earlier, President Clinton directed US policy toward this objective by stating that certain technologies are more important than others for the US to compete in the future global economy. Aerospace is one of those "designated" technologies. Technology transfer between the commercial and mili-

tary sectors lies at the heart of technology policy.[22] Currently, the US is structured to deal only with the transfer of military technology to the commercial sector; the Defense Advanced Research Projects Agency (DARPA) leads this effort. This policy needs to be broadened to include transfers from the commercial sector to the military. Recall that in chapter 2 we discussed this important relationship.

A concern exists, however, that the new DARPA focus degrades its primary job of developing new defense-related technologies.[23] Reports indicate DARPA suffers from undermanning and high personnel turnover, begging the question of whether or not DARPA is the best choice for this job. Several analysts recommend creation of a National Advanced Research Projects Agency (NARPA) to facilitate the transfer of defense and other technologies into the commercial sector freeing DARPA to continue to concentrate on its own projects. Separating the two agencies would minimize security concerns and allow NARPA to adopt a more visible role in sponsoring the commercial transfer of technology from DARPA. The two agencies could be linked by agreement or by formal structure to achieve the cross flow to make dual-use technology run both directions.

A fundamental industrial policy consideration concerns the legal framework within which industry and military aerospace operate. The industry needs a centralized methodology to guide industry and military programs. This methodology would help the administration and Congress develop and enact legal structures that provide a streamlined, consistent way for aerospace industries to move into and out of joint ventures, ad hoc partnerships, and so forth. Further, the legal construct should address investment, ownership, technology transfers, and government funding guidelines (this list is by no means all-inclusive). The development of these guidelines will require international agreement. International law and transparency regimes must be pursued to provide oversight capabilities. Militarily, these guidelines should serve a similar streamlining purpose to aid foreign military sales and foreign aid involving aerospace issues. Certainly, these legal concerns cut across most of the policy ideas offered in this paper.

The defense policy objective should seek to provide an integrated aerospace plan for congruous force application and programmatic support (development, acquisition, maintenance) of military aerospace. Instead of having four aviation and space programs, the Department of Defense needs to view its aerospace power as a single entity. As we have seen, aerospace power has a central role in each of the services' strategies. Further, the high cost of obtaining aerospace capabilities and continuing reductions in DOD budgets requires the adoption of methods to eliminate needless redundancies without giving up needed capabilities. Programmatically, the Defense Department should consider combining its service acquisition systems, at least for aerospace.

The United States is not without an example in developing a broad construct under which to craft a national aerospace strategy. The president's National Space Council provided the space community the kind of oversight direction envisioned for an aerospace strategy.[24] The council, chaired by the vice presi-

dent, sought to integrate all US space efforts for government, industry, and space customers (military and civilian). The aerospace strategy requires a similar high-level process. That process must encompass both elements of aerospace power, industry and military, and include the governmental agents included on the space council. Thus, the space council construct provides an excellent methodology from which to initiate a national aerospace strategy.

The scope and effort required to develop and implement a national aerospace strategy will necessitate the realignment of many government organizations. A National Aerospace Council could provide the oversight/integration leadership to manage the many changes implicit in the development of a national aerospace strategy. The time to start this process is now. Aerospace power is too critical to the economic and national security well-being of the United States to be left to the chance direction of market forces and budgetary pressures.

Closing Remarks

The transition and development of the US into an aerospace nation underwent many starts and stops in both its economic and military elements. What this paper showed was the absolutely essential contribution aerospace power makes to the security and well-being, economically and militarily, of the United States. There can be no doubt that America is an aerospace nation. However, many problems cloud US aerospace power necessitating a national strategy that encompasses both elements of its power.

The aerospace industry provides the jobs, skills, and products that serve to increase the US standard of living. It serves as a visible symbol of the technological expertise and economic power of America. Militarily, the US faces uncertainty about potential threats; however, as long as it can control and exploit aerospace at will, its future is secure from hostile intent.

Americans can be justifiably proud of what aerospace power has accomplished for the United States: the first man on the moon, worldwide dominance in aircraft and space manufacturing, and military aerospace forces capable of providing decisive results in combat. Now, the US must go forward with a national aerospace strategy that secures the leadership role of the aerospace nation for the twenty-first century.

Notes

1. Danna K. Henderson, “1993: Hesitant Optimism, Hopes for Joint Efforts,” *Air Transport World*, January 1993, 24.

2. Aerospace Industries Association of America, Inc., *Aerospace Facts and Figures 92–93* (Washington, D.C.: Aerospace Industries of America, Inc.), 138. *Facts and Figures* included employment data up to 1991; 1992 numbers were not available.

3. Henderson, 24.

4. Bruce A. Smith, “Commercial Strategy Developed for Douglas,” *Aviation Week & Space Technology*, 22 February 1993, 26.

5. James T. McKenna, "United Cuts 20% of Senior Officers," *Aviation Week & Space Technology*, 22 February 1993, 37.

6. *Facts and Figures 92–93*, 40.

7. Michael A. Dornheim, "Cuts, Layoffs Affirm Transport Boom's End," *Aviation Week & Space Technology*, 1 February 1993, 22.

8. Henderson, 25.

9. Jim Impoco and David Hage, "White House Workout," *U.S. News & World Report*, 8 March 1993, 28.

10. *Facts and Figures 92–93*, 105.

11. Dori Jones Yang and Andrea Rothman, "Reinventing Boeing Radical Changes Amid Crisis," *Business Week*, 1 March 1993, 61.

12. "Slimming the General," *The Economist*, 16 January 1993, 64.

13. Rick Maze, *Air Force Times*, 13 July 1992, 3. Senator Nunn asked his question in a speech delivered to the Senate on 2 July 1992.

14. Colin L. Powell, *Chairman of the Joint Chiefs of Staff Report on Roles, Missions, and Functions of the Armed Forces of the United States (*Washington, D.C.: US Government Printing Office, 1993), xv.

15. Ibid.

16. James W. Chung, "Whither the U.S. Aerospace Industry?" in *Breakthroughs*, Winter 1992–1993, 12.

17. Laura Tyson, *Who's Bashing Whom? Trade Conflict in High-Technology Industries* (Washington, D.C.: Institute for International Economics, 1992), 296.

18. Paul Kennedy lays out this argument in his books *The Rise and Fall of the Great Powers* and *The Rise and Fall of British Naval Mastery*.

19. Tyson, 208.

20. Robert Reich, *The Work of Nations* (New York: Vintage Books, 1992), chap. 22.

21. Ibid., chaps. 23–25.

22. My reference here to technology transfer is somewhat different from the normal connotation. Normally one associates technology transfer as that occurring between states. Indeed I recognize that construct; however, I believe that issue needs to be discussed as part of industrial policy.

23. William B. Scott, "Caution Urges on DARPA Changes," *Aviation Week & Space Technology*, 1 February 1993, 28.

24. The charter of the National Space Council reads: "The National Space Council is responsible for advising the president on national space policy and strategy, and coordinating the implementation of the president's policies. It was authorized by an act of Congress in 1988 and was established as an agency of the government by President Bush on April 20, 1989." The council was chaired by the vice president and included the secretaries of State, Treasury, Defense, Transportation, Commerce, and Energy and the director of the Office of Management and Budget, the assistant to the president for National Security Affairs, the assistant to the president for science and technology, the chief of staff to the president, the director of Central Intelligence, and the administrator to the National Aeronautics and Space Administration.

Bibliography

Industries Association of America. *Aerospace Facts and Figures*. Washington, D.C.: Aerospace Industries of America, 1992.

"*Air Cargo World's* 1992 Listing of Airports." *Air Cargo World*. October 1992, 34–68.

Air Force Center for Studies and Analyses. *Methodology for Analyzing Global Reach—Global Power*. Washington, D.C., October 1990.

"Airlines: Financial." *Air Transport World*. October 1992, 70–73.

"Airlines: Traffic." *Air Transport World*. October 1992, 74–78.

Air Transport Association of America. *Air Transport Facts and Figures*. Washington, D.C.: Air Transport Association of America, 1991/92.

"Aspin's FY94 Budget Lacks Bite." *Armed Forces Journal International*. May 1993, 17–18, 21–22.

Baer, George W. "U.S. Naval Strategy 1890–1945." *Naval War College Review*. Winter 1991, 6–33.

Barreto, Dawn. "Airports Took Off in New Directions with Cargo's Arrival." *Air Cargo World*. October 1992, 20–22.

_____. "Taming the Turbulent North Atlantic." *Air Cargo World*. July 1992, 32–39.

Baucom, Donald R. "Technological War: Reality and the American Myth." *Air University Review*. September–October 1981, 56–66.

Bhagwati, Jagdish. *The World Trading System at Risk*. Princeton, N.J.: Princeton University Press, 1991.

Bird, Julie. "About 350 U.S. Airmen Remain as Somalia Mission Winds Down." *Air Force Times*. 19 April 1993, 22.

Betts, Richard K. and Huntington, Samuel P. "Dead Dictators and Rioting Mobs." *International Security*. Winter 1985/86, 112–146.

Bingham, Price T. "The Air Force's New Doctrine." *Military Review*. November 1992, 12–19.

_____. "Air Interdiction and the Need for Doctrinal Change." *Strategic Review*. Fall 1992, 24–33.

Blake, Dan. "Airline Ills Affecting Aerospace Industry." *The Montgomery (AL) Advertiser*. 27 February 1993.

Bockman, Larry J., and Brad C. Hayes, "Breathing Life Into the Naval Service's New Direction." *Marine Corps Gazette*. February 1993, 47–49.

Boneu, Z. *The Interaction Between Technology and Tactics—Can the Process be Improved?* Potomac, Md.: C&L Associates. August 5, 1988.

Borowski, Harry R. "Leadership to Match our Technology." *Air University Review*. May–June 1984, 30–34.

_____., ed. *The Harmon Memorial Lectures in Military History, 1959–1987*. Washington, D.C.: Government Printing Office, 1988.

Brown, Harold. "Technology, Military Equipment, and National Security." *Parameters*. March 1983, 15–27.

Brune, Lester H. "Foreign Policy and the Air Power Dispute, 1919–1932." *The Historian: A Journal of History*. Vol. 23. August 1961, 449–464.

Burns, Robert. "Clinton Plans High-Tech Economic Bridge." *Montgomery (AL) Advertiser*. May 11, 1993.

Bush, Vannevar. *Modern Arms and Free Men*. New York: Simon and Schuster, 1947.

Cahn, Robert. "Dr. Theodore von Karman Gemutlicher Genius of Aeronautics." *Air Force Magazine*. October 1957, 41–48.

Canan, James W. "A Watershed in Space." *Air Force Magazine*. August 1991, 32–37.

_____. "Space Support for the Shooting Wars." *Air Force Magazine*. April 1993, 30–34.

_____. "The Instrument of Airpower." *Air Force Magazine*. April 1993, 12–13, 15.

Cannon, Michael W. "Just Meeting a Requirement?" *Military Review*. August 1992, 63–69.

Cate, James L. "Development of Air Doctrine 1917–41." *Air University Review Quarterly*. Winter 1947, 11–22.

Cheney, Dick. *Annual Report to the President and the Congress*. Washington, D.C.: Government Printing Office, January 1993.

_____. *Defense Strategy for the 1990s: The Regional Defense Strategy*. Washington, D.C.: US Department of Defense, 1993.

Chung, James A. "Whither the U.S. Aerospace Industry?" *Breakthroughs*. Winter 1992/93, 12–18.

Clay, Lucius D., Jr. "Shaping the Air Force Contribution to National Strategy." *Air University Review*. March–April 1970, 3–9.

Clayton, Anthony. *The British Empire as a Superpower, 1919–1939*. Athens, Ga.: The University of Georgia Press, 1986.

Cogar, William B., ed. *New Interpretations in Naval History, Selected Papers from the Eighth History Symposium*. Annapolis, Md.: Naval Institute Press, 1989.

Collins, John M. *Grand Strategy Principles and Practices*. Annapolis, Md.: Naval Institute Press, 1973.

_____. *U.S. and Allied Options Early in the Persian Gulf Crisis*. Washington, D.C.: Congressional Research Services, 1990.

Congressional Research Service. *World-wide Space Activities*. Prepared for the Sub-committee on Space Science and Applications of the Committee on Science and Technology, US House of Representatives, 97th Congress. Washington, D.C.: Government Printing Office, 1977.

Conver, Stephen K. "Defense Industrial Base: Shaping the Downsizing." *Armed Forces Journal International*. March 1993, 48–52.

Corn, Joseph J. *The Winged Gospel: America's Romance with Aviation*. New York: Oxford University Press, 1983.

Correll, John T. "One Air Force." *Air Force Magazine*. April 1993, 2.

Crutsinger, Martin. "U. S. Trade Deficit Improves Dramatically as Exports Rise." *The Montgomery (AL) Advertiser*. December 18, 1992.

"DASA and Fokker Conclude Buyout Pact." *Aviation Week & Space Technology*. February 22, 1993, 27.

Davis, Bob, and Bruce Ingersoll. "Aiding Aviation Firms, As Clinton Vows to Do, Will Be Very Tricky." *The Wall Street Journal*. March 8, 1993.

Dentzer, Susan. "Clinton's High-Tech High-Wire Act." *U.S. News & World Report*. March 29, 1993, 44.

de Seversky, Alexander P. "Air Power in the Modern World." *The New York Times*. December 27, 1942.

_____. *Victory Through Airpower*. New York: Simon and Schuster, 1942.

Diehl, Alan E. "Create a U.S. Aerospace Service." *Aviation Week & Space Technol-ogy*. 25 January1993, 71.

Dornheim, Michael A. "Cuts, Layoffs Affirm Transport Boom's End." *Aviation Week & Space Technology*. February 1, 1943, 22–24.

Douhet, Giulio. *The Command of the Air* (translated by Dino Ferrari). Reprint ed. Washington, D. C.: Office of Air Force History, 1983.

Drew, Dennis M. "Desert Storm as a Symbol: Implications of the Air War in the Desert." *Airpower Journal* 6, no. 3, Fall 1992, 4–13.

_____. "The Airpower Imperative: Hard Truths for an Uncertain World." *Strategic Review*. Spring 1991, 24–31.

Dugan, Michael J. “Operational Experience and Future Applications of Air Power.” *The RUSI Journal*. August 1992, 35–38.

Earle, Edward M. “The Influence of Air Power Upon History.” *The Yale Review*. June 1946, 577–593.

_____, ed. *Makers of Modern Strategy*. 2d ed. Princeton, N.J.: Princeton University Press, 1973.

Emme, Eugene M., ed. *The Impact of Air Power*. Princeton, N.J.: Van Nostrand, 1975.

_____. “The NASA Space Program.” Lecture. Air War College, Maxwell Air Force Base, Ala., February 1, 1963.

_____. “The Relationship of Air Power to National Policy.” Lecture. Air War College, Maxwell Air Force Base, Ala.: September 11, 1958.

_____. “Technical Change and Western Military Thought.” *Military Affairs*. Vol. 24, 6–19.

Fawcett, John M. “Which Way to the FEBA?” *Airpower Journal*. Fall 1992, 14–24.

Federal Maritime Commission. *30th Annual Report Fiscal Year 1991*. Washington, D.C.: Federal Maritime Commission, 1992.

Fiedler, David M. “AirLand Operations, The Army’s Answer to a Changing World.” *National Guard*. February 1992, 26–29.

Flint, Perry. “Partners Preferred.” *Air Transport World*. February 1993, 59, 60, and 62.

Freeman, Waldo D., Randall J. Hess, and Manual Faria. “The Challenges of Combined Operation.” *Military Review*. November 1992, 2–11.

Friedman, George, and Meredith Lebard. *The Coming War with Japan*. New York: St Martin’s Press, 1991.

Friedman, Norman. “The Future Shape of the U.S. Navy.” *Annals of the American Academy of Political and Social Science*. September 1991, 106–119.

Fulghum, David A. “ALCMs Given Nonlethal Role.” *Aviation Week & Space Technology*. February 22, 1993, 22–23.

“Full Naval Review.” *Aviation Week & Space Technology*. February 27, 1989, 9.

Futrell, Robert F. *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force 1907–1960*. Vol. 1. Maxwell Air Force Base, Ala.: Air University Press, 1989.

_____. *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force 1961–1984*. Vol. 2. Maxwell Air Force Base, Ala.: Air University Press, 1989.

Gilpin, Robert. *War and Change in World Politics*. Cambridge: Cambridge University Press, 1981.

Glossen, Buster C. "Aerospace Power in Modern Warfare: After the Storm." Unpublished paper, Washington, D.C.: US Air Force, December 1992.

_____. "Military Capabilities for the New Covenant The Aerospace Contribution." Unpublished paper, Washington, D.C.: US Air Force, December 1992.

Goodman, Glenn W., Jr. "Powell's Roles and Missions Report Retains Services' Major Redundancies." *Armed Forces Journal International*. March 1993, 10.

Graydon Michael. "Roles and Changing Priorities." *The RUSI Journal*. August 1992, 28–34.

Greeley, Brendan M., Jr. "Carrier Air Wings Trained for Coordinated Strikes." *Aviation Week & Space Technology*. 27 February 1989, 46–47.

Green, Brian. "Down Another $126.9 Billion." *Air Force Magazine*. April 1993, 9.

Guinn, Gilbert S. "A Different Frontier: Aviation, the Army Air Forces, and the Evolution of the Sunshine Belt." *Aerospace Historian*. Spring, March 1982, 34–45.

Gunzinger, Mark A. *Power Projection: Making the Tough Choices*. Maxwell Air Force Base, Ala.: Air University Press, June 1992.

Hampton, Ephraim M. "Air Power, Global Force in a Global Struggle." *Air University Quarterly Review*. Spring 1955, 68–77.

Hayden, H.T., and G. I. Wilson. "Defining the Corps' 'Strategic Concept'." *Marine Corps Gazette*. May 1992, 44–46.

Healy, John P. "Air Power and Foreign Policy." *Air University Quarterly Review*. Fall 1948, 15–26.

Henderson, Danna K. "1993: Hesitant Optimism, Hopes for Joint Efforts." *Air Transport World*. January 1993, 22–26, 30, 32–34, 36–38, 41.

Hittle, James D. "Roles and Missions Fight is Endless." *Marine Corps Gazette*. December 1992, 21–22.

Howard, Michael. "The Forgotten Dimensions of Strategy." *Foreign Affairs*. Summer 1979, 975–986.

Hughes, David. "Videoconferencing May Cut Air Travel." *Aviation Week & Space Technology*. 8 February1993, 31,33.

Hurley, Alfred F., and Robert C. Ehrhart., eds. *Air Power and Warfare*. Washington, D.C.: Government Printing Office, 1979.

Impoco, Jim, and David Hage. "White House Workout." *U.S. News & World Report*. 8 March 1993, 28–30.

Interview with Lt Col Mark P. Gay, USA, Joint Warfighting Instructor, Air War College, Maxwell Air Force Base, Ala.: April 29, 1993.

Jackson, Brendan. "Air Power." *The RUSI Journal*. August 1992, 27.

Jacquemin, Alexis. *The New Industrial Organization: Market Forces and Strategic Behavior* (Translated by Fatemah Mehta). Cambridge, Mass.: MIT Press, 1987.

Jones, John F., Jr. "Giulio Douhet Vindicated Desert Storm 1991." *Naval War College Review*. Autumn 1992, 97–101.

Jones, Neville. *The Beginnings of Strategic Air Power, A History of the British Bomber Force 1923–39*. London: Frank Cass & Co., 1987.

Kaufman, Robert G. "A Paradigm for a Post–Postwar Order." *Naval War College Review*. Winter 1991, 83–97.

Kaufmann, William W., and John D. Steinbruner. *Decisions for Defense: Prospects for a New World Order*. Washington, D.C.: Brookings Institute, 1991.

Kelso, Frank B., II. "Looking Ahead—Where We Go From Here." *Sea Power*. April 1992, 31–39.

Kendall, Frank. "Exploiting the Military Technical Revolution: A Concept for Joint Warfare." *Strategic Review*. Spring 1992, 23–30.

Kennedy, Paul M. *The Rise and Fall of British Naval Mastery*. Malabar, Fla.: Robert E. Krueger Publishing Company, 1982.

_____. *The Rise and Fall of the Great Powers: Economic Change and Military Conflict from 1500 to 2000*. New York: Random House, 1887.

Kutyna, Donald J. "The State of Space." Prepared statement of General Kutyna, USAF, commander in chief, US Space Command, to the Senate Armed Services Committee, April 23, 1991. In *Defense Times*. 6, no. 14, 1–8.

Lancaster, John. "Military Reshaping Plan Is Short of Clinton Goals." *The Washington Post*. 13 February 1993, A4.

Layton, P. B. *The Strategic Application of Air Power in the New World Order*. Air Power Studies Center Paper no. 9. Fairbairn Base, Australia: Royal Australian Air Force, January 1993.

Lee, Joseph, W. "Boost U.S. Lab's Role in Technology Transfer." *Aviation Week & Space Technology*. 7 December 1992, 59.

Lenorovitz, Jeffrey M. "USAIR Opposes Delays in BA Investment Plan." *Aviation Week & Space Technology*. 15 February 1993, 32.

Linn, Thomas C. "Naval Forces in the Post–Cold War Era." *Strategic Review*. Fall 1992, 18–23.

Loh, John M. "Advocating Mission Needs in Tomorrow's World." *Airpower Journal*. Spring 1992, 4–13.

Lopez, Virginia C., and David H. Vadas. *The U.S. Aerospace Industry in the 1990s A Global Perspective*. Washington, D.C.: Aerospace Industries Association of America, 1991.

Luttwack, Edward N. *Strategy: The Logic of War and Peace*. Cambridge, Mass.: Harvard University Press, 1987.

Mahan, Alfred T. *Retrospect and Prospect: Studies in International Relations, Naval and Political, 1902*. London: Sampson Low, Marston and Company, 1902.

_____. *The Influence of Sea Power upon History 1660–1783*. New York: Dover Publications, 1987.

_____. *The Problem of Asia and the Effect upon International Policies*. Boston: Little, Brown & Co., 1905.

Mahnken, Thomas G. "Planning U.S. Forces for the Twenty-First Century." *Strategic Review*. Fall 1992, 9–17.

"Making Elephants Fly." *The Economist*. January 23, 1993, 77–78.

"Marine Training Prepares Crews for Combined Operation." *Aviation Week & Space Technology*. 27 February 1989, 48–49.

"Maritime Priorities Shifting." *The Officer*. January 1993, 10–13.

Markusen, Ann, and Joel Yudken. "Building a New Economic Order." *Technology Review*. April 1992, 23–28, and 30.

_____. "The Birthing of Aerospace." *Technology Review*. April 1992, 29.

Mattson, Roy M. *Projecting American Air Power: Should We Buy Bombers, Carriers, or Fighters?* Maxwell Air Force Base, Ala.: Air University, June 1992.

Maze, Rick. "Aspin Warns of Dangers Ahead for U.S. Military." *Air Force Times*. 25 January 1993, 10.

_____. "Nunn Urges Overhauling of Military Roles, Missions." *Air Force Times*. 13 July 1992, 3.

McCarthy, James P. "New Directions in U.S. Military Strategy." *Parameters*. Spring 1992, 2–10.

McKenna, James T. "United Cuts 20% of Senior Officers." *Aviation Week & Space Technology*. February 22, 1993, 20–22.

McLucas, John L. *Space Commerce*. Cambridge, Mass.: Harvard University Press, 1991.

McNeill, William H. *The Pursuit of Power: Technology, Armed Force, and Society*. Chicago: University of Chicago, 1982.

McPeak, Merrill A. "Does the Air Force Have a Mission." Lecture. Maxwell Air Force Base, Ala.: 19 June 1992.

Mehuron, Tamar A. “Starting Points for the New Defense Budget.” *Air Force Magazine*. April 1993, 10–11.

Meilinger, Phillip S. “The Problem with Our Air Power Doctrine.” *Airpower Journal*. Spring 1992, 24–31.

Mitchell, William. *Winged Defense*. New York: Dover Publications, 1988.

Moore, R. Scott. “The Army Plans Its Future.” *Marine Corps Gazette*. January 1992, 48–49.

Morocco, John D. “Defense Cuts Made in Policy Void.” *Aviation Week & Space Technology*. 15 February 1993, 20–21.

_____. “JCS to Backtrack Decisions in Roles, Missions Study.” *Aviation Week & Space Technology*. January 18, 1993, 58–59.

_____. “Pentagon Faces $88-Billion Cut.” *Aviation Week & Space Technology*. February 22, 1993, 22–23.

_____. “Somalia to Impact Debate on Reshaping U.S. Forces.” *Aviation Week & Space Technology*. 14/21 December 1992, 23–24.

_____. “Shifting Economic, Political Tides Force Reevaluation of Navy’s Strategic Role.” *Aviation Week & Space Technology*. 27 February 1289, 38–39 and 44–45.

Mundy, Carl E., Jr. “Expeditionary Forces: A Defining Concept for the Future.” *Sea Power*. April 1992, 43–44, 48, 50, and 52.

_____. “Marines Continue to be America’s ‘Force-in-Readiness’.” *The Officer*. August 1992, 40–42.

_____. “Naval Expeditionary Forces and Power Projection: Into the 21st Century.” *Marine Corps Gazette*. January 1992, 14–17.

_____. “Naval Expeditionary Forces: Stepping Lightly.” *Marine Corps Gazette*. February 1993, 14–15.

_____. “Redefining the Marine Corps’ Strategic Concept.” US Naval Institute *Proceedings*. May 1992, 66–70.

National Space Council. *National Space Council Report to the President*. Washington, D.C.: May 1992.

“Now for the Really Big One.” *The Economist*. January 9, 1993, 57–58.

Nunn, Sam. “Roles, Missions Under Scrutiny.” *The Officer*. February 1993, 20–24.

Ochmanek, David, and John Bordeaux. *Comparing Airpower Assets for Power Projection* (RAND Draft Report DRR-166-AF). Santa Monica, Calif.: RAND Corporation, January 1993.

O’Connell, Edward. “A Look Into Air Campaign Planning.” Unpublished research paper, US Defense Intelligence College, Washington, D.C., 1992.

O'Connell, Robert L. *Sacred Vessels, the Cult of the Battleship and the Rise of the U.S. Navy*. Boulder, Colo.: Westview Press, 1991.

Ott, James. "USAIR/BA Alliance Poses Global Issues." *Aviation Week & Space Technology*. 8 February 1993, 28–29.

_____. "U.S. Airlines Await Clinton Directions." *Aviation Week & Space Technology*. 25 January 1993, 34–35.

Paret, Peter, ed. *Makers of Modern Strategy from Machiavelli to the Nuclear Age*. Princeton, N.J.: Princeton University Press, 1986.

Perin, David A. *A Comparison of Long-Range Bombers and Naval Forces*. Alexandria, Va.: Center for Naval Analyses, December 1991.

Perry, William. "Fallow's Fallacies." *International Security*. Spring 1982, 174–182.

Porter, Michael E., ed. *Competition in Global Industries*. Boston: Harvard Business School Press, 1986.

Powell, Colin L. *Chairman of the Joint Chiefs of Staff Report on Roles, Missions, and Functions of the Armed Forces of the United States*. Washington, D.C.: US Government Printing Office, 1993.

_____. "Information-Age Warriors." *Byte*. July 1992, 370.

_____. "U.S. Forces: Challenges Ahead." *Foreign Affairs*. Winter 1992/93, 32–45.

Racz, Gregory N. "Airline Strength Is Held 'Critical' for Economy." *The Wall Street Journal*. May 25, 1993.

Reich, Robert B. *The Work of Nations*. New York: Vintage Books, 1992.

Reinhardt, George C. "Air Power Needs Its Mahan." US Naval Institute *Proceedings*, April 1952, 362–367.

"Reinventing Boeing: Radical Changes Amid Crisis." *Business Week*. March 1, 1993, 60–62 and 67.

"Remarks of Gen Carl E. Mundy, Jr., before Congress. "*Marine Corps Gazette*. April 1992, 34–37.

Rice, Donald B. "AF's Future Strategy: 'Punch Hard and Terminate Quickly'." *Air Force Times*. 26 March 1990, 23.

_____. "Airpower in the New Security Environment." Lecture, Washington Strategy Seminar, US Congress, Washington, D.C., May 7, 1991.

_____. "The Air Force in Transition." Lecture, Air Force Association National Convention, Washington, D.C., September 15, 1992.

Roucek, Joseph S. "Geopolitics and Air Power." *Air University Quarterly Review*. Spring 1955, 52–63.

Scott, William B. “Caution Urged On DARPA Changes.” *Aviation Week & Space Technology*. 1 February 1993, 28.

“Selective Realism.” *The Economist*. January 9, 1993, 59.

Serling, Robert J. *Legend and Legacy, The Story of Boeing and It's People*. New York: St Martin's Press, 1992.

Shifrin, Carole A. “USAir/BA Pact Faces New Fight.” *Aviation Week & Space Technology*. February 1, 1993, 29.

Siegel, Adam B. *U.S. Navy Crisis Response Activity, 1946–1989: Preliminary Report*. Alexandria, Va.: Center for Naval Analyses, November 1989.

“Slimming the General.” *The Economist*. January 16, 1993, 63–64.

Smith, Bruce A. “Commercial Strategy Developed for Douglas.” *Aviation Week & Space Technology*. 22 February 1993, 25–27.

“Spacecraft Played Vital Role in Gulf War Victory.” *Aviation Week & Space Technology*. April 22, 1991, 91.

Stanton,Shelby l. *Anatomy of a Division The First Cav in Vietnam*. New York: Warner Books, 1987.

Sullivan, Gordon R. “Doctrine A Guide to the Future.” *Military Review*. February 1992, 3–9.

_____. “'Vital, Capable and Engaged'.” *Army*. October 1992, 24–26, 28, 30, 32, and 34.

Sweetman, Bill. “Why Not Just Satellites?” *International Defense Review*. February 1993, 107.

Thurow, Lester. *Head to Head, The Coming Economic Battle Among Japan, Europe, and America*. New York: William Morrow and Company, 1992.

_____. “New Rules for Playing the Game.” *Phi Kappa Phi Journal*. Fall 1992, 10–13.

Toguchi, Robert M., and James Hogue. “The Battle of Convergence in Four Dimensions.” *Military Review*. October 1992, 11–20.

Toti, William J. “Sea-Air-Land Battle Doctrine.” *Proceedings*. September 1992, 70–74.

Trenchard, Hugh M. *Airpower: Three Papers*. London: Directorate of Staff Duties, Air Ministry, December 1943.

“Trends.” *Air Transport World*. October 1992, 1.

_____. *Air Transport World*. January 1993, 1.

Tyson, Laura D'Andrea. *Who's Bashing Whom? Trade Conflict in High-Technology Industries*. Washington, D.C.: Institute for International Economics, 1992.

US Air Force. Air Force Manual 1-1, *Basic Aerospace Doctrine of the United States Air Force*. Vol. 1. Washington, D.C.: Government Printing Office, 1992.

_____. Air Force Manual 1-1, *Basic Aerospace Doctrine of the United States Air Force*. Vol. 2. Washington, D.C.: Government Printing Office, 1992.

_____. *Global Reach—Global Power*. White Paper. Washington, D.C.: US Air Force, November 1992.

_____. *Reaching Globally, Reaching Powerfully: The United States Air Force in the Gulf War*. Washington, D.C.: Department of the Air Force, September 1991.

_____. *The Air Force and U.S. National Security: Global Reach—Global Power*. Washington, D.C.: Department of the Air Force, June 1990.

_____. *The Evolving Air Force Contribution to National Security: Global Reach—Global Power*. White Paper. Washington, D.C.: Department of the Air Force, November 1992.

_____. *The United States Air Force and U.S. National Security: A Historical Perspective 1947–1990*. Washington, D.C.: Secretary of the Air Force, 1991.

US Air Force Headquarters, Strategy Division. *Aerospace Power in Modern Warfare*. Briefing. Washington, D.C.: US Air Force Headquarters, Strategy Division, 1992.

US Atlantic Command and Air Combat Command. *Joint Force Air Component Commander (JFACC) Concept of Operations for the U.S. Atlantic Command and Air Combat Command*. Norfolk, Va., and Langley Air Force Base, Va.: US Atlantic Command and Air Combat Command, September 18, 1992.

US Atlantic Command and US Pacific Command. *Joint Force Air mponent Commander (JFACC) Concept of Operations*. Norfolk, Va., and Honolulu, Hawaii: US Atlantic Command and US Pacific Command, January 15, 1993.

US Bureau of the Census. *Statistical Abstract of the United States: 1992* (111th edition). Washington, D.C.: Government Printing Office, 1992.

US Department of the Army. FM 100-5: *Operations*. Final Draft. Washington, D.C.: Headquarters, Department of the Army. January 1993.

US Department of the Navy. ...*From the Sea - Preparing the Naval Service for the 21st Century*. Washington, D.C.: US Department of the Navy, September 1992.

_____. *Conduct of the Persian Gulf Conflict An Interim Report to Congress*. Washington, D.C.: Department of Defense, 1991.

_____. *Retaining Competitive Advantage*. Briefing slides and notes. Washington, D.C.: US Department of the Navy, n.d.

_____. *The United States Navy in "Desert Shield" "Desert Storm"*. Washington, D.C.: Department of the Navy, 1991.

US Department of Transportation. *MARAD '91* (Maritime Administration Report 1991 Annual Report). Washington, D.C.: Maritime Administration, 1992.

US General Accounting Office. *1993 Air Force Budget—Potential Reductions to Research, Development, Test, and Evaluation Programs*. GAO/NSIAD-92-319BR. Washington, D.C.: US General Accounting Office, September 1992.

US Space Command. *United States Space Command Operations Desert Shield and Desert Storm Assessment*. Peterson Air Force Base, Colo.: January 1992.

van Crevald, Martin. *Technology and War, From 2000 B.C. to the Present*. New York: Free Press, 1989.

Velocci, Anthony L., Jr. "French Firms In 'Crisis'; U.S. Policies Assailed." *Aviation Week & Space Technology*. 15 February 1993, 40–45.

_____ "TWA Set to File New Business Plan." *Aviation Week & Space Technology*. 15 February 1993, 28.

Warden, John A., III. "Exploiting Air Power into the Twenty-first Century." Draft paper for Air Command and Staff College, Air University. January 3, 1993.

Weeks, Stan. "Crafting a New Maritime Strategy." US Naval Institute *Proceedings*. January 1992, 30–37.

The White House. *National Security Strategy of the United States*. Washington, D.C.: Government Printing Office, 1993.

Winton, Harold R. "Reflections on the Air Force's New Manual." *Military Review*. November 1992, 20–31.

Woolsey, James P., Anthony Vandyk, Arthur Reed, and Danna K. Henderson. "CEOs: Cooperate and Profit." *Air Transport World*. January 1993, 43–45, 48 and 49.

Wylie, J. C. *Military Strategy: A General Theory of Power Control*. Annapolis, Md.: Naval Institute Press, 1989 (reprint).

Yang, Dori Jones, and Andrea Rothman. "Reinventing Boeing Radical Changes Amid Crisis." *Business Week*. March 1, 1993, 60–62 and 67.