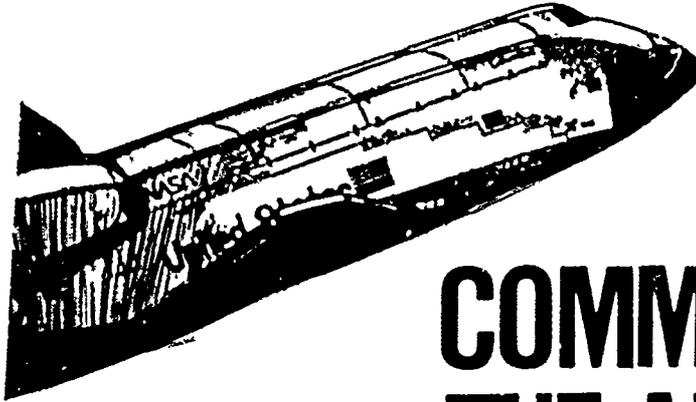


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Convergence of Theory and Technology in Shaping an Aerospace Force in 2025

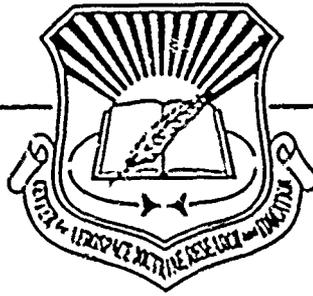
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COMMAND OF THE AEROSPACE:
CONVERGENCE OF THEORY AND TECHNOLOGY IN SHAPING
AN AEROSPACE FORCE FOR 2025

by

ARTHUR L. BENNETT, JR., Maj, USAF
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Air University Press
Maxwell Air Force Base, Alabama 36112-5532

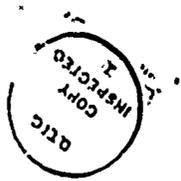
August 1986

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

Gen H. H. "Hap" Arnold (1945)

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FOREWORD

"The reach should ever exceed the grasp." This line from Browning reminds us that the reach of the mind should always soar beyond the grasp of what is ready at hand. The reach of potential technology opens views to the mind which application of technology can bring within the grasp--till new reaches of the mind point to new endeavors. The reach should guide the progress. This is the theme running through this fine study by Major Bennett.

He begins--quite properly--at the beginning. What does the country need? What can technology offer toward meeting those goals and needs? There are two constants (or near constants) in the equation, and one dynamic variable. One of the near constants, the national goals, is discernible in the Constitution, which has been nearly stable for two centuries. Major Bennett finds the most pertinent national goals in terms of safety for our population, protection of our individual and institutional freedoms, and support of an international environment in which trade and domestic prosperity may flourish. The second near constant for the next 40 years is the current international environment in which those goals are threatened and there is no international agency to constrain aggression. Soviet expansionism is a pervasive threat and is likely to continue so for the next few decades, at least; and terrorism is a growing threat. The Soviet threat is unique in our history. For the first time our people are in great danger at home.

Since it is our people who determine the course of our national policy, it is they who need defense. And since terrorism is unpredictable in source, protection is needed from that threat also.

But the problems do not end there. Our friends and trading partners are threatened also. If we lose them, our safety and freedom are in jeopardy, and domestic prosperity, as a reflection of loss of trade, will suffer also. These national needs require not only defense but the capability to take offensive action if necessary to counter foreign threats. And this offensive action requires the will and courage of our people--who, again, stand in need of defense. National goals, defensive needs, offensive requirements, and technological potential form a continuing circuit.

Major Bennett concludes that national military posture must embrace both offensive and defensive capability. It is here that the dynamic variable--burgeoning technology--becomes the controlling factor. What capabilities, now just beyond our grasp, can technology develop to bring the reach of today within the grasp of tomorrow?

Major Bennett surveys the spectrum of useful technological development and projected capability, and does so with competence and objectivity. He uses an interesting formula. He "looks backward to see forward"--and vice versa.

He reviews the technological progress of the last 40 years, surveys the current achievements, and looks forward to the possibilities of technological achievement in the next 40 years, to the year 2025. Hindsight gives a parameter to foresight, lest projection rise in an unconstrained escalation that ends in fantasy. He looks at the requirements of aerospace power under three "worlds," which outline conditions in 2025 if we follow three avenues of technological development. Major Bennett concludes that "aerospace" is the arena of the most important military technological development of the next 40 years, and development in this field can have profound effects upon the safety and progress of America.

Success in the Strategic Defense Initiative is probably the most fundamental first step, in my opinion. I believe Major Bennett agrees. Without defenses to support the will of our people and the survival of our population and our institutions, we will have little opportunity to successfully employ any military options in conflict with the Soviet Union. He concludes that success in this endeavor will reduce reliance upon nuclear weapons. This change will give civilization a new lease on life and will transfer reliance for strategic force to nonnuclear devices, some of which will probably be space-based. Some of those devices that he describes are only barely observable now on the horizon.

The study contemplates a considerable population in space stations by 2025. In the time interval prescribed--40 years--it seems to me that space habitation is likely to be very sparse. But this is a speculation heavily weighted in technological progress. It seems to me that this is a speculation in which the reach is likely to exceed the grasp for quite a long time. But who will decry the reach--or deny the ultimate grasp?

And the study forecasts a period when aerospace forces reach ultimate flexibility so that the same force can be used either for offense or defense. I suspect that this condition must be qualified. Defensive forces may be used for offensive purposes and vice versa, but it is likely that aerospace forces must be optimized for one or the other.

If there is a criticism of this study, I would list it as Major Bennett's reluctance to push his arguments to their limits. As the author correctly states, war is an

expression of politics. There must be a political objective to be attained. That political objective is the forcing of the enemy nation to conform to our will. But how is this end result to be brought about? The inference is that "command of the aerospace" will produce it. However "command of aerospace," like "command of the air" in decades past, is simply an intermediate step that may or may not be necessary to victory. The source of enemy policy and resistance is on the ground. It is there that the objective is to be found. It is there that pressure must be applied. "Command of Aerospace" can lead to victory, but is it necessary to achieve "command" in order to apply decisive pressure on the source of enemy policy?

Command of the air or aerospace is a relative term. It is unlikely that it can be absolute. If one has a superb aerospace defensive system and a good aerospace offensive system, does it necessarily follow that one must defeat the enemy aerospace system before decisive pressure can be brought to bear upon the enemy political system? Is an aerospace counterforce war always a mandatory prelude to victory? Much will depend upon the relative impermeability of the aerospace defense systems, and upon the relative vulnerability of the rival political systems. And if access to enemy targets can be achieved, what systems of targets will bring capitulation? Aerospace war is not necessarily counteraerospace force war. What must be accomplished within the enemy nation? How can it be achieved through aerospace power?

This is, in my opinion, a truly valuable study. It can have a saving influence upon the development of Air Force aerospace power in the pursuit of American goals in the next four decades.

The reach of the mind describes the goals to be sought, the technology that must be exploited, and the process that should be undertaken to bring to reality the capabilities to be brought within the grasp--till the reach of the mind describes still other visions.

I endorse this study in highest terms.


HAYWOOD S. HANSELL, JR.
Major General, USAF, Retired

ABOUT THE AUTHOR

Maj Arthur L. Bennett, Jr., enlisted in the Air Force in 1965 and served as a Strategic Air Command (SAC) airborne electronics radar technician until acceptance into the Airmen's Education and Commissioning Program in December 1970. After graduating from Texas A&M University with a BS in aerospace engineering in December 1972, he entered Officer Training School (OTS) in January 1973. A distinguished OTS graduate, he was commissioned in March 1973. He then entered undergraduate pilot training at Williams AFB, Arizona, and graduated in June 1974. Desiring a career in bombers, he chose an assignment to a B-52 squadron at Dyess AFB, Texas. During his brief time in B-52s, he was selected well ahead of his peers for early upgrade to aircraft commander and was selected routinely to participate in higher headquarters missions involving new training concepts and equipment. His career in bombers was superceded by a directed duty assignment to the Air Force Institute of Technology (AFIT), Wright-Patterson AFB, Ohio, in August 1979.

As a graduate of the Strategic and Tactical Sciences Program at AFIT, Major Bennett received an MS in operations research in March 1981. He was then assigned to Headquarters Strategic Air Command, Offutt AFB, Nebraska, in June 1981 as a future concepts staff officer in the Future Concepts Directorate, Deputy Chief of Staff, Operations Plans. In this position, he was responsible for evaluating and formulating proposed changes to force structure, employment concepts, doctrine, strategy, and policy from national to MAJCOM level and was deeply involved in a wide range of space-related topics from doctrine to employment, offensive and defensive weapons, force structures, and programmed and conceptual capabilities. In June 1985 he was selected as a SAC command-sponsored visiting research fellow at the Airpower Research Institute, Maxwell AFB, Alabama, to complete research begun at the headquarters on the future of aerospace power. He completed this study while at Maxwell. His professional military education includes Squadron Officer School, Air Command and Staff College, and National Security Management.

PREFACE

What if free people could live secure in the knowledge that their security did not rest upon the threat of instant US [nuclear] retaliation to deter a Soviet attack, that we could intercept and destroy strategic [nuclear] ballistic missiles before they reached our own soil or that of our allies?

President Reagan's 23 March 1983 speech

Indeed, what if? For the past six years, I have had the opportunity to explore this question from many different perspectives. Beginning in 1980, I first explored this question from the perspective of an analyst when Capt (now Lt Col) Marv Matthews and I developed a detailed mathematical model designed to analyze the effectiveness of a hypothetical constellation of space-based lasers. Throughout this research, Marv's incisive logic helped to codify my appreciation for the complexities of the orbital mechanics, rules of engagement, and battle management associated with a constellation of space-based directed-energy platforms.

After completing this research in 1981, I spent the next four years at Headquarters Strategic Air Command (SAC) as a future concepts staff officer where I had the opportunity to become thoroughly familiar with advanced weapons systems research and system operational concepts and their potential impact on policy, strategy, and guidance. In this capacity, I had a unique opportunity to participate in the research and study efforts aimed at understanding the broader issues regarding potential space weapons applications. In these efforts, the ballistic missile defense application identified in President Reagan's speech was but one important element of the overall implications associated with future aerospace weaponry. In addition, I had the opportunity to author or co-author (primarily with Maj Rod Liesveld) numerous works for SAC regarding potential space weaponry applications from an operational perspective. Rod's grasp of the implications as well as the potential applications of space weaponry applications as well as the potential applications of space weaponry directly contributed to my own appreciation of these issues.

After working on advanced aircraft, missile, and space operations issues from 1980 to 1984, I was selected by SAC to participate in the Air Force Innovation Task Force (AFITF). Without a doubt, the AFITF experience helped form my convictions regarding the future of aerospace power and

compelled me to undertake this work. As a participant in the AFITF, I was exposed to four alternative futures focused on the year 2025 that were developed for the AFITF by The Futures Group in Glastonbury, Connecticut. These four futures or worlds were developed through a systematic process to provide the greatest stress to Air Force planning while maintaining a high degree of credibility. After being introduced to these worlds, the participants were expected to "wake up" in each of these worlds and postulate how the Air Force would perform across the conflict spectrum.

It was during this process that I was able to freely express my thoughts regarding the far-reaching implications of President Reagan's question and to benefit from my interaction with the other participants. Special acknowledgment must be given to the five officers who worked tirelessly to shape my vision for the future of the Air Force into a concept of operations suitable for use by the AFITF. Of particular note were Lt Col Jim Ridenour and Maj Gene Gulick, who were a constant source of encouragement, critical assessment, and operational insight throughout the development of the innovation titled "Space: A Concept of Operations for 2025." As it became apparent that our innovation would survive the AFITF selection process, we were able to enlist the help of three additional participants (Lt Col Zel Cantrell, Maj Barry McFarland, and Capt Wayne Sommars) whose different technical expertise and operational backgrounds were instrumental in ensuring that a wide range of perspectives were represented. It has been particularly gratifying to monitor the progress of our contribution to the AFITF since 1984. The establishment of the Aerospace Forum, which will undoubtedly increase the awareness within the Air Force regarding the need for the Air Force to grow into an aerospace force, is the most notable result of our contribution.

Although many of the thoughts expressed in the work that follows were originally conceived prior to and during my participation in the AFITF, the need to continue the development of these ideas was the "itch" that compelled me to apply for and accept my present task. I firmly believe that aerospace power will eventually surpass all other military instruments of power. I also believe that the vision included in this work answers President Reagan's question in a manner consistent with the fundamental values and institutions of the United States. The unknown in my mind is not if this aerospace vision will be implemented, but rather how it will be implemented.

I wish to thank Gen Bennie L. Davis, USAF, Retired, former commander in chief of SAC, for affording me the opportunity to capture on paper my thoughts regarding the future of aerospace power by selecting me to participate in

the visiting research fellow program. I must also thank Lt Gen Harley Hughes and Maj Gen Jack Farris, former and current deputy chiefs of staff, respectively, Operations Plans, Headquarters SAC, for the faith they placed in me in allowing me to explore the future of aerospace power while serving on their staff. My thanks also to Col Gordon C. Kearle, Skip Nowlin, William E. Cassady, and Henry E. Shinol of the SAC staff and Lt Cols Rob Welch, Jim Burke, Les Nelson and Jeff Watson for their personal support and encouragement and professional insights.

Special thanks are due to Dr Stanley Spangler, CADRE senior visiting research fellow from Tufts University, Fletcher School of Law and Diplomacy, who as my academic advisor was an endless source of encouragement, wisdom, and constructive counsel; to Maj Gene Myers, who as my military advisor was the grist against which my often abrasive thoughts were honed and challenged; and to my editor, Mr Hugh Richardson, for his courage in accepting the challenge of converting my rambling writings into proper English. Special thanks also to Lt Col Bernie Claxton for the acuity of his historical insights and special grasp of the doctrinal impact of space operations, and to Maj Fred Chapman for his incisive operational insights. To Dorothy McCluskie and her staff, thanks for another job well done.

And finally to Cheryl, Shawn, Lee, and Robert who endured the "creative process" associated with producing this work with a calm that can only be attributed to grace.



ARTHUR L. BENNETT, JR., Maj, USAF
Research Fellow
Airpower Research Institute

CHAPTER 1

LOOKING BACK TO SEE AHEAD

At the forefront of the winds of change in war today is America's increasing access to and dependence on space, which challenges the Air Force to determine how it should prepare for the impact of space operations on Air Force roles and missions. As the service that has claimed for itself the expanse above the earth's surface where space is but the outer reaches of the aerospace operational medium, the Air Force is still struggling with the intricate and inextricable link between doctrine and organization. We still speak of "strategic" and "tactical" forces when we talk of air, aerospace, or space power and refuse to codify the concept of defense as a fundamental principle of war. The Air Force possesses tremendous military capability; however, such capability without a clear plan or "vision" can be self-defeating or, even worse, can fail at a critical moment and allow the defeat of our nation. The purpose of this work is to develop an aerospace vision that lays the foundation for aerospace operations in the twenty-first century.

The Two Perspectives

An aerospace vision may be defined as a long-range plan that provides both an operational and a technological perspective between aerospace operations of today and aerospace operations in the twenty-first century. The operational perspective is merely a military viewpoint on the nature and object of war and how this viewpoint should relate to future aerospace warfare. This work's operational perspective will be developed by looking back in history for those "correct theories, founded upon right principles, sustained by actual events of wars" that "form a true school of instruction"¹ suitable for formulating a military viewpoint regarding future aerospace warfare. Professor I. B. Holley, however, cautions:

History is a seductive mistress. A superficial reading can lead us to answers which are plausible but unsound, so-called "lessons" of doubtful validity. History will serve us best when it is used to suggest questions which induce a profounder knowledge of the issues at stake.²

In a similar manner, the technological perspective is a military viewpoint based on looking ahead in time for those technological trends, factors, and themes that should

have the greatest influence on future aerospace warfare. However, the future can be as difficult to read or interpret as the past. In 1938 President Franklin D. Roosevelt asked for an assessment of what to expect over the next ten years regarding technological trends. The scientific experts charged with this task missed radar, computers, and atomic energy. Therefore, it is left to the reader to assess whether this two-phased approach (looking back to see ahead and looking ahead to see back) does, in fact, (1) answer the fundamental question of how the Air Force should fight, (2) focus our attention on future operations, (3) develop an "integrated" look at our roles and missions, (4) create opportunities rather than simply react to events, and (5) respond to policy issues in a consistent manner. Clearly, if the aerospace vision developed in this work does not satisfy these objectives, it will be of little use to current and future leaders of the Air Force.

It is precisely because this work is intended for use by current and future leaders of the Air Force that the term "aerospace" will be used. Aerospace forces include those systems that can: (1) operate only in the atmosphere, (2) operate only in space, and (3) operate in the atmosphere and in space. As mentioned earlier, at the forefront of the winds of change in war today is the impact of space operations on Air Force roles and missions. This is not to say that the other services have no role in space because of the above definition of aerospace forces. In fact, the opposite is true. The Army and Navy are developing their own concepts of how to integrate aerospace forces into land and naval operations. Just as the Navy in its maritime strategy integrates assigned subsurface, surface, and aerospace forces into an overall concept for wartime employment of naval forces, the Air Force must develop a carefully considered aerospace strategy that integrates assigned aerospace forces into an overall concept for wartime employment of its aerospace forces. Therefore, the term "aerospace" will be used throughout this work except in those specific instances where air or space are uniquely appropriate.

Having discussed in general terms the scope and purpose of this work, the remainder of this chapter will be devoted to establishing the "operational perspective" for aerospace operations of the future. It should be stated at the outset that the foundation for the operational perspective is deeply rooted in the writings of Giulio Douhet, a distinguished gentleman who, in the author's opinion, eclipses all others who have attempted to develop a vision of the roles and missions of aerospace power. Although we may disagree with his vision, we can agree that he has had an enduring influence on aerospace operations in the twentieth century. Many of his critics, however, are quick

to point out that his influence has not always been in the best interest of aerospace operations. They are essentially correct. Where Douhet scoffed at history because he perceived a radical change in the nature of warfare, we will court this "seductive mistress" in an attempt to search out those "correct theories, founded on right principles and sustained by actual events of war." The format for this search will be the following series of questions: What is war? What is victory? What is the object of war? How has war been waged in the past? The first three questions will be addressed as part of the prologue to the operational perspective. We will answer the final question as part of the discussion on the heritage of aerospace power. When answered, these questions should yield a "profounder knowledge of the issues at stake" and serve as the operational perspective for future aerospace operations.

Prologue to the Operational Perspective

A model of an aerospace vision for today and into the twenty-first century is revealed in the writings of Giulio Douhet: "Victory smiles upon those who anticipate the changes in the character of war, not upon those who wait to adapt themselves after the changes occur."³ Today, however, in this period of rapid technology growth and transition, we must appreciate Bernard Brodie's caution that "we have a situation for the first time in history where the opening event by which a great nation enters a war--an event which must reflect the preparations it has made or failed to make beforehand--can decide irretrievably whether or not it will continue to exist."⁴ In fact, if one accepts the hypothesis of the nuclear winter concept, not only is the existence of the belligerent nations⁵ at risk, but also the existence of mankind as we know it.⁵ Therefore, in anticipating the changes in the character of war, we must carefully consider the definitions of war and "victory" as well as the preparations we make or fail to make if the aerospace vision is to have enduring value.

This leads us to our first question, What is war? The answer that seems most appropriate for the United States can be found in the writings of Carl von Clausewitz: "War is merely the continuation of [national] policy by other means."⁶ It involves an act of force designed to overcome the hostile will of an enemy and by its nature makes the assumption that the other instruments for supporting our national policy have proved inadequate.

Our overall national policy is derived from our Constitution and is based on our desire and determination to preserve our security and our basic freedoms, fundamental values, and institutions. The strategy employed to carry

out this policy is designed to capitalize on the enduring strengths of the United States--its political and psychosocial values, diversified economy, values, advanced technology, and the ingenuity of its people. Security, however, is a paramount consideration. Self-preservation is the strongest of man's instincts and the same thing applies to nations. Thus, the security of the United States is intricately related to the security of its allies and friends in the community of nations. In the final analysis, therefore, our national policy seeks to preserve not only the security of the United States but also that of its allies and friends. To this end, the United States must have a military strategy that supports our national policy and provides for the furtherance of national policy by other means--war.

As for the question, What is victory? we must also address the related question, What is the object of war? It is through the careful consideration of these related questions that the true nature of future aerospace operations can be understood. In their simplest form, the answers to these questions are straightforward. If war is the furtherance of national policy through an act of force designed to overcome the hostile will of an enemy, then the object of war is to overcome the hostile will or, in other words, to impose the will of one nation upon another nation. It follows that victory is achieved when the object of war has been attained.

Although these definitions still appear to be valid in nonnuclear warfare, we must expand on them if they are to be relevant in nuclear warfare, where presently neither side can defend against an attack by the other. At present, the capacity to win an all-out nuclear war requires a decisive and completely secure superiority in offensive nuclear weapons that virtually eliminates any possibility of retaliation (i.e., perfect offense). If only a few hundred of the thousands of nuclear warheads are launched in retaliation, then the nation initiating the attack would be far worse off than if it had not initiated the attack. Aside from the millions of people in both nations who would perish, it is doubtful that the fundamental values and institutions of either nation could survive. Those responsible for formulating national policy in the nation initiating the attack would be hard-pressed to justify such an act of force if it would result in the destruction of their own nation.

Thus, the United States' military strategy seeks to deter war while maintaining a secure environment within which the United States and its allies and friends can pursue legitimate interests. This strategy has evolved over the past 40 years and reflects the viewpoint that in an all-

out nuclear war between the United States and the Soviet Union there would be no winners. It also reflects the reality that in most cases (i.e., lower levels of conflict) it is apparently acceptable for these nations to further their national policy through an act of force designed to overcome the hostile will of an enemy, providing they do not directly threaten the survival of the other. Thus, we have the anomalous situation where these two nations, whose nuclear arsenals are capable of reducing the hostile will of other nations to ashes, must depend on their nonnuclear arsenals as the most acceptable means to overcome the hostile will of an enemy and to avoid their own destruction.

It is this inconsistency that presently turns the objective of war into something quite different from what it should be according to theory. Rather than something final and decisive, it becomes something incoherent and incomplete. Should we formulate our objectives based on the least likely form of war, an all-out nuclear conflict with the Soviet Union in which our national survival is at risk and victory is meaningless? Or should we formulate our objectives on the much more likely limited types of war in which our national survival is not at risk and some form of victory is an achievable reality? The former is by far the more dangerous form of war and thus it has been the general point of reference in our national policy. Although more limited forms of war have not been totally ignored, fears of Soviet involvement have greatly complicated the task of setting and achieving clear objectives that satisfy to some degree the requirements of our national strategy. One unfortunate result has been that lesser nations simply engage in wars of attrition designed to eventually overcome our will to continue.

The result of this inconsistency is that we find ourselves with a double-edged nuclear and nonnuclear sword that could be used to strike a decisive blow but one reduced to the lightest rapier--sometimes even a harmless foil good only for thrusts, feints, and parries. The reason for this inconsistency can, in part, be traced to one missing link in our military instrument of national policy--our inability to defend against a nuclear attack. Without this link, our political leaders appear to be burdened with the virtually impossible task of formulating a coherent national policy regarding war and the objectives of war in view of the utterly intolerable punishment that is presently inevitable in a nuclear exchange. An aerospace defense offers our political leaders the hope that if the threat of retaliation fails to deter a nuclear attack, they at least stand a chance of preserving our fundamental values and institutions. In this context, the author's definition of

victory is one in which we are able to overcome the hostile will of the enemy while maintaining our own fundamental values and institutions.

With these thoughts in mind, we will now lay the foundation for the operational perspective. To do this, let us again return to Clausewitz:

If war is a part of policy, policy will determine its character. As policy becomes more ambitious and vigorous, so will war, and this may reach the point where war attains its absolute form. If we look at war in this light, we do not need to lose sight of this absolute: on⁷ the contrary, we must constantly bear it in mind.

By arming the United States with both a double-edged sword and an effective shield, we provide a more effective means for our national policy to determine the character of war and, thus, avoid the absolute form of war (mutual assured destruction). As we shall see when we discuss the heritage of aerospace power, a fundamental premise of a viable operational perspective for future aerospace operations is that it must have both an effective offense and defense if it is to be an effective instrument of national policy.

The Heritage of Aerospace Power

Unlike naval power and land power, aerospace power does not have a repository of the collective wisdom from historians and military students that spans many centuries. We have not yet been blessed with an Alfred Thayer Mahan or a Carl von Clausewitz who could combine the military, historical, and scholarly expertise necessary to produce a definitive work on the influence of aerospace power upon history. We are not without our mentors, as we shall see, but the list is relatively short. This is understandable considering that the history of aerospace power, if we discount lighter than air balloons, is less than a century old. Even so, aerospace power has had a profound influence on the art and science of war. It has been the collector through which the energies of revolutionary technologies and visionaries have pulsed. Therefore, it is not surprising that the history of aerospace power is largely, though by no means solely, a narrative of friction between visions and technology.

Our search for a beginning of this narrative need go no further than the writings of Giulio Douhet. Although many of the ideas he presented may not have been his own, he was the first to integrate them into a coherent vision for the use of aerospace power. It is to his credit that his

principles of offensive warfare were accepted as "correct theories, founded upon right principles" and "sustained by actual events of war" as evidenced in the successful bombing campaigns of World War II. Unfortunately, the defensive elements of his vision were flawed.

It is not the intent, however, to denigrate his vision, but rather to attempt to identify those elements of his vision that offer insight for future aerospace operations. With this objective in mind, the following discussion of Douhet's major work titled Command of the Air, is intended to acquaint the reader with the technological and operational perspectives of Douhet's vision.

With regard to his technological perspective, Douhet believed that airplanes fundamentally changed the character of war. This perspective was based on his experience in World War I, when he was convinced that "nothing man can do on the surface of the earth can interfere with a plane in flight."⁸ While he accepted the premise that pursuit planes could be effective if in position to engage attacking planes, he maintained that only those escorting the attack force were of any consequence.⁹ Thus, he concluded that "all the influences which have conditioned and characterized warfare from the beginning are powerless to affect aerial action."¹⁰

Without a doubt, his operational perspective was shaped by this technological perspective. Based on his conviction that there was no effective defense against aerial actions, he concluded that it was now possible to invade the enemy's territory without first breaking through his defensive lines--that is, it was possible to strike directly at the enemy's homeland. Thus, it is not surprising that he developed the operational perspective that "there is only one attitude to adopt in aerial warfare--namely, an intense and violent offensive, even at the risk of enduring the same thing from the enemy."¹¹

Armed with these technological and operational perspectives, Douhet combined them into a vision that advocated an independent air force "composed of bombing units and combat units, the first to direct offensive action against surface targets, the second to protect the bomber against possible enemy opposition."¹² His guiding principle for bombing actions was simple: "The objective must be destroyed completely in one attack, making further attack on the same target unnecessary."¹³ His guiding principle for combat or pursuit planes was equally simple: they were to clear the sky of enemy interference so the bombers could accomplish their mission. Thus, his vision of an independent air force was not meant to be a force capable of carrying out any military action whatsoever, but an air

force fit to strive for command of the air, which he defined as "that state of affairs in which we find ourselves able to fly in the face of an enemy who is unable to do likewise."¹⁴

Without a doubt, Douhet was committed to the concept of an independent air force made up of bombers and fighters capable of winning the struggle for the command of the air. For he believed that whoever possesses it is capable of "protecting all his own land and sea territory from enemy aerial offensives and at the same time of subjecting the enemy's territory to his own offensives."¹⁵ In fact, he believed that "the defenses on land and sea will no longer serve to protect the country behind them; nor can victory on land or sea protect the people from enemy aerial attacks unless that victory insures the destruction, by actual occupation of the enemy's territory, of all that gives life to his aerial forces."¹⁶

It should be abundantly clear from this brief synopsis of Douhet's vision why the heritage of aerospace power is so deeply rooted in his writings. However, the friction between his vision and technology is clearly reflected in aerospace power as it exists today. In fairness to Douhet, he was aware of the friction brought about by his disdain for the defensive aerospace technologies of his day:

I will give up all my theories if someone will prove to me that, by means of a determined organized aerial defense, practically possible to bring into existence, we could reduce the force of eventual aerochemical offensives against our country to a point where they would be unimportant and not dangerous to its safety. If, thanks to aerial defense, we had to fear from the enemy aerial offensives only unimportant and not dangerous damage, I would be the first to uphold such a defense even if¹⁷ it required all our national aerial resources.

It is unfortunate that the technology of the day did not allow anyone to meet his challenge. Although it is doubtful he would have given up all his theories regarding offensive aerospace operations, it is certain he would have expanded his vision significantly to include defensive aerospace operations. We would have gained immeasurably in our understanding of aerospace power had we received the benefit of his incisive and logical mind. Nevertheless, it is on this point that he deserves our criticism as well as our understanding. Although he clearly understood the value of defensive aerospace power, he could not overcome what he perceived to be an insurmountable technological problem--that is, achieving the capability to reduce an aerospace offensive to a point where it would be relatively

unimportant. In fact, his indictment of aerospace defense was so persuasive that it has withstood the test of time as evidenced by the fact that those who followed him were unable to build an operational perspective to overcome the friction caused by this technological problem.

Particularly noteworthy in this regard was a group of officers stationed at the US Army Air Corps Tactical School at Maxwell Field, Alabama, in the mid-1930s. In his book titled The Air Plan that Defeated Hitler, Maj Gen Haywood S. Hansell, Jr., gives an excellent accounting of their efforts to build the operational perspective that served us so well during World War II. The following perhaps illustrates their greatest contribution as pointed out by General Hansell:

They struggled against, and broke, the chain of mental inertia which binds all established organisms--and military organisms in particular--to continuation of existing patterns. This inertia is a normal human characteristic and its peculiar strength in military matters stems largely from the fact that military organizations have few opportunities to test the validity of proposed changes--war is terribly expensive as a laboratory--and it also stems from the disastrous effects of miscalculation. Hence, there has been a natural tendency among military men to perpetuate the concepts, tactics, and equipment that have proved reasonably satisfactory in the past, and to concentrate on improvement in the technical characteristics of existing weapons.¹⁸

Although the Air Corps Tactical School group was successful against the mental inertia of the War Department General Staff in the mid-1930s, it is uncertain whether we will be as successful against the mental inertia of the Air Force in the mid-1980s.

The reason for this uncertainty stems from the fact that within the Air Force today there are two groups with different perspectives on the Air Force role in aerospace operations. The first group is virtually convinced that the mental inertia of the Air Force is insurmountable. They contend that space has opened a new field of action and that the Air Force is incapable of adapting to the changing character of war brought about by this new field of action. For this reason, they advocate a separate service or Space Force. The second group also contends that space has opened a new field of action; however, they remain convinced that the Air Force is capable of evolving to accommodate this new field of action. For this reason, they advocate a gradual evolution of the Air Force into a true Aerospace Force.

With these thoughts in mind, the efforts of the Air Corps Tactical School's faculty members and students in the 1930s take on new meaning. They too were faced with the issue of whether to advocate a separate service or a gradual evolution of the Army. They chose the latter even though they surely recognized that if their efforts were successful the need for an independent air force would be self-evident. However, there is a distinct difference between what they were attempting to do and what must be done today. They were proposing a revolutionary new aerospace mission that had previously not existed in the Army--attacking the heart of a hostile nation without first having to wage an exhausting war at that nation's frontiers. In contrast, today we are concerned with the evolution of the aerospace defense mission that has existed in the Air Force since its creation.

Nevertheless, the method they chose to overcome the mental inertia of the Army seems particularly appropriate as we seek to evolve the Air Force perspective regarding aerospace warfare. Borrowing again from General Hansell:

It is not too difficult for ardent airmen to break away from traditional restraints and stake out new claims. But to be persuasive in their arguments and claims is quite a different matter. Such persuasive arguments must be dispassionate and well reasoned. It requires detachment from standard military cliches, and calm assessment of the nation's real military needs.¹⁹

The Air Corps Tactical School met this challenge by developing a series of lectures that tackled such fundamental questions as, What is war? What is the object of war? How has it been waged in the past? Has modern civilization increased the vulnerability of nations? Has technology provided a new method of waging war?

Since we have already answered two of these questions, we can now turn to the third--How has war been waged in the past? The answer developed by the visionaries at the Air Corps Tactical School provides an excellent starting point for our discussion.

In the past, governments that resorted to war directed their armies against the hostile nation in order to seize the vital areas upon which national life depended. The defender interposed his own army--or made a similar attack intended to seize the vital areas of the aggressor, and was in turn faced by an enemy army. In both cases, the enemy army must be defeated:

Therefore, we find throughout the pages of military writings statements that the objective of a nation at war is the destruction on the field of battle of the enemy's main forces. Such a conclusion is a confusion of the means with the end. The destruction of the military forces of the enemy is not now and never has been the objective of war; it has been merely a means to an end--merely the removal of an obstacle which²⁰ lay in the path of overcoming the will to resist.

After introducing the concept that the destruction of the enemy's military forces is merely a means to an end, they proceeded to offer an alternative means using offensive aerospace power against the other instruments of national policy. They reasoned that nations would be more susceptible to defeat through attacks designed to disrupt or destroy the enemy's political, economic, psychosocial, and technological fabric. Armed with this insight, they were able to conclude that "air power has given the world a means whereby the heart of a nation can be attacked at once without first having to wage an exhaustive war at that nation's frontiers."²¹

However, unlike our earlier answers to the questions raised by the Air Corp Tactical School, we will now begin to diverge from the offense-dominated perspective of aerospace power that has persisted since the time of Douhet. For the value of defense was clearly demonstrated in World War II during the Battle of Britain as well as the bombing raids against the German homeland. In the next chapter, where we "look ahead to see back," we will discuss in detail the technological trends, factors, and themes to be expected over the next 40 years. What will be abundantly clear is that the advanced technologies being explored today portend an end to the technological problems associated with a viable aerospace defense.

This same question regarding the actual capabilities of technology existed during the times of Douhet and those who followed him. We have previously justified their disdain for aerospace defense because they perceived it to be an insurmountable technological problem. Perhaps it would be more accurate to view their efforts from a different perspective. These early aerospace pioneers were clearly trying to establish aerospace power as an essential element of the military instrument of national power. "Whether air power can, by and of itself, accomplish the whole object of war is certainly an academic question; but that the air phase of a future war between major powers will be the decisive phase seems to be accepted as more and more plausible as each year passes."²² But to do this, they had

to break away from traditional restraints and stake out claims that could only be achieved through aerospace power. However, since the time of Napoleon the predominant theme of military doctrine has been the inviolate primacy of the offensive. To have highlighted the fact that an effective aerospace defense could render the aerospace offense relatively impotent would have challenged the conventional wisdom regarding the offensive and undermined the claim that only aerospace power could strike at the heart of an enemy nation without first having to wage an exhausting war at that nation's frontiers.

When viewed from this perspective, the offense-dominated nature of their efforts is certainly understandable. It is virtually impossible to envision war today that does not depend on offensive aerospace power. In fact, the military strategy behind our current national policy is based in large measure on the capability of our offensive aerospace forces to strike at the heart of an enemy nation without first having to wage an exhausting war at that nation's frontiers. This is not to say that the early aerospace leaders' emphasis on the offensive was always in the best interest of aerospace power, as illustrated by the heavy attrition of our unescorted bombers during World War II. However, such illustrations do not negate the value of their contribution--rather, they simply point up the fact that defensive aerospace power is also important. Thus, having completed what they considered at the time the most important part of their work, Douhet and those who followed him have left for us the task of developing an aerospace vision that recognizes the contribution of an aerospace defense.

Let us now return to the question, How has war been waged in the past? It is certainly true that the destruction of the military forces of the enemy is merely a means to an end--the removal of an obstacle preventing us from overcoming the will to resist. That is not to say that it is an unimportant obstacle. For even Clausewitz believed that "of all the possible aims in war, the destruction of the enemy's armed forces always appears as the highest."²³ The reason for this belief is that prior to the advent of offensive aerospace power it was necessary to destroy the enemy's armed forces before the heart of the enemy nation could be attacked. The advent of effective defensive aerospace power means (just as it did during the air campaigns of World War II) that once again the attacking nation will have to contend with the enemy's defenses before the heart of the enemy nation can be attacked.

In the author's opinion, the advanced technologies being explored today that portend an end to the technological problems associated with a viable aerospace

defense against nuclear attack also portend a change in the character of war as envisioned today. However, this change is not in the direction of some new and radically different form of war; on the contrary, it is in the direction of the past, a return to concepts and approaches of earlier years. Because of this, we can once again draw on the collective wisdom of the past.

War has always depended on the interaction between the offense and the defense. If we are to build a viable operational perspective for war in the future, it is imperative that we understand the nature of this interaction. To begin our search for understanding, let us first view this interaction from the perspective of Sun Tzu: "Invincibility lies in the defense; the possibility of victory in the attack."²⁴ The strength of this perspective is that skillful warriors of the past "first made themselves invincible and awaited the enemy's moment of vulnerability."²⁵ For they understood that "invincibility depends on one's self; the enemy's vulnerability on him."²⁶ "Therefore the skillful commander takes up a position in which he cannot be defeated and misses no opportunity to master his enemy."²⁷

Thus, we see the fundamental essence of the interaction between the offense and the defense that has been reaffirmed by such military scholars as Mahan and Clausewitz and sustained throughout the history of warfare by the actual events of war. In the words of Mahan, "The offense undertakes certain risks and disadvantages in order to reach and destroy the enemy; the defense, so long as it remains such, refuses the risks of advance, holds on to a careful, well-ordered position, and avails itself of the exposure to which the assailant submits himself."²⁸ However, it is in the writings of Clausewitz that Sun Tzu's perspective is discussed in sufficient detail to serve as the foundation of an operational perspective that fully integrates the offensive and defensive elements of aerospace power. To this end, the following excerpts from Clausewitz's work titled On War are presented here to acquaint the reader as quickly and comprehensively as possible with his thoughts regarding the defensive form of war.

What is the concept of defense? The parrying of a blow. What is its characteristic feature? Awaiting the blow. It is this feature that turns any action into a defensive one; it is the only test by which defense can be distinguished from attack in war. Pure defense, however, would be completely contrary to the idea of war, since it would mean that only one side was waging it. Therefore, defense in war can only be relative, and the characteristic feature of waiting should

be applied only to the basic concept, not to all of its components. . . . Thus, a defensive campaign can be fought with offensive battles, and in a defensive battle, we can employ our divisions offensively. Even in a defensive position awaiting the enemy assault, our bullets take the offensive. So the defensive form of war is not a simple shield, but a shield made up of well-directed blows.

What is the object of defense? Preservation. It is easier to hold ground than take it. It follows that defense is easier than attack, assuming both sides have equal means. Just what is it that makes preservation and protection so much easier? It is the fact that time which is allowed to pass unused accumulates to the credit of the defender. He reaps where he did not sow. Any omission of attack--whether from bad judgment, fear, or indolence--accrues to the defenders' benefit.

But defense has a passive purpose: preservation; and attack a positive one: conquest. The latter increases one's own capacity to wage war; the former does not. So in order to state the relationship precisely, we must say that the defensive form of warfare is intrinsically stronger than the offensive.

If defense is the stronger form of war, yet has a negative object, it follows that it should be used only so long as weakness compels, and be abandoned as soon as we are strong enough to pursue a positive object. . . . thus, the natural course in war is to begin defensively and end by attacking. . . . In other words, a war in which victories were used only defensively without the intention of counterattacking would be as absurd as a battle in which the principle of absolute defense--passivity, that is--were to dictate every action.

Even when the only point of the war is to maintain the status quo, the fact remains that merely parrying a blow goes against the essential nature of war, which certainly does not consist merely in enduring. Once the defender has gained an important advantage, defense as such has done its work. While he is enjoying this advantage, he must strike back, or he will court destruction. . . . Wherever a victory achieved by the defensive form is not turned to military

account, where, so to speak, it is allowed to wither away unused, a serious mistake has been made.

In the author's opinion, the above collection of thoughts from the writings of Clausewitz are the missing elements of Douhet's vision that when integrated form a viable operational perspective for future aerospace operations. In adhering to the defensive form of war, the Air Force would place a preponderance of its aerospace forces in a reactive posture, persistently waiting for enemy initiatives. However, unlike today's aerospace forces, these aerospace forces should be perceived as "forward deployed" and "usable" at all levels of conflict. That is, they are "forward deployed" in the sense that they can take immediate and decisive actions against an enemy from great distances in the same amount of time as land or sea forces that are physically deployed along the enemy's frontiers. They are "usable" in the sense that the specific effects or influences these actions produce do not involve the use of chemical, nuclear, or biological weapons. Therefore, an enemy posturing for an attack would know that his forces are "in front of our lines and within range." Time that is allowed to pass unused would accumulate to the benefit of the United States, either through opportunities to use the other instruments of national policy or through continuous refinement of how, when, or where our counterattack should begin. Thus, even in its defensive position of awaiting the enemy's attack, the United States would seek to control the conditions of the attack contemplated by the enemy.

Given an attack by an enemy, it would be consistent with the defensive position of the United States to initially employ these forward-deployed and usable aerospace forces defensively so long as weakness compels (i.e., our preservation is at risk). However, the United States would constantly seek to turn these aerospace forces from the defensive to the counterattack--that is, to exploit any omission in the attack or any favorable conditions created by the defensive. Thus, consistent with the defensive form of war, these aerospace forces are not a simple shield, but a shield made up of well-directed blows.

Therefore, in future Air Force aerospace operations that dare to return victory as an operative concept of war, our aerospace forces must be capable of fending off an enemy initiative in one instant and in the next, or even simultaneously, seizing the initiative through integrated counterattacks directed against the enemy and enemy-controlled area or assets. To this end, the Air Force concept for the wartime employment of its aerospace forces should not be constrained to being only offensive or defensive dominated. Rather, it should be able to assume an

offensive emphasis, defensive emphasis, or a balanced offensive-defensive emphasis as the conditions of war dictate.

Unfortunately, to implement such an aerospace strategy, the Air Force must overcome its own mental inertia regarding the value of the defensive form of war. Although they would probably deny it, many of the leaders in the Air Force today are products of their experiences in which offensive dominance has reigned supreme as the only natural form of war. Although they may know as a matter of practical experience that it is sometimes necessary to assume a defensive posture, they seem reluctant to codify defense as a basic principle of aerospace warfare. In fact, the basic aerospace doctrine of the Air Force addresses defense in terms of the security it provides friendly military operations from enemy activities.³⁰ Thus, Clausewitz's conception of the defense being the stronger form of war is likely to be met with skepticism from most of the leadership of the Air Force today.

Equally unfortunate, though, is the fact that those Air Force leaders who do impute a special virtue to defense believe that the United States must forego its offense-dominated strategy and move toward a defense-dominated strategy. Clearly, they are being spurred on by the advanced technologies being explored today that portend an end to the technological problems associated with a viable aerospace defense. However, in their zeal to break away from what they perceive as traditional restraints and to stake out new claims for aerospace defense, they seem determined to develop an aerospace vision in which the offensive element of their vision is as flawed as the defensive element of Douhet's vision.

As mentioned earlier, there are those who contend that space has opened a new field of action that is only suited for aerospace defense. They reason correctly that to open this new field of action to aerospace offense would probably make Soviet leaders more determined to counter the US efforts with an all-out quantitative and qualitative arms buildup. The reason for this is that while the President's Strategic Defense Initiative (SDI) is clearly aimed at aerospace defense, the Soviets choose to view it differently: "The fundamentally new detection, guidance and destruction technologies that are being developed in the USA are usable both for defense and attack, regardless of what the US Administration is telling people in the United States and its NATO allies about the purposes of the presidential strategic program."³¹ However, what the US advocates who equate space only with aerospace defense seem determined to overlook is the corollary to this statement; that is, the fundamentally new technologies that are being developed in

the Soviet Union are also usable both for defense and attack, regardless of what the Soviet leadership is telling the American or the Soviet people. With this in mind, it does not seem prudent to consider space suitable for aerospace defense only if the most likely Soviet response could include aerospace systems that are usable for both defense and attack. To do so would not be in the United States' best interest since it would yield the advantage in this new field of action to the Soviet Union.

The Operational Perspective

Thus, we finally arrive at the point where it remains but to state the operational perspective that we have developed for future Air Force aerospace operations that dares to include a balanced offense and defense as an operative concept of victory in war. War is a furtherance of national policy by other means. The object of war is to overcome the hostile will or, in other words, to impose the will of one nation upon another nation. Victory is achieved when we are able to overcome the hostile will of the enemy while maintaining our own fundamental values and institutions. As stated earlier, to achieve victory, our aerospace forces must be capable of fending off an enemy initiative in one instant and in the next, or even simultaneously, seizing the initiative through integrated counterattacks directed against the enemy and enemy-controlled area or assets. Therefore, the Air Force concept for the wartime employment of its aerospace forces should not be constrained to being only offensive or defensive dominated; rather, it should be able to assume an offensive emphasis, defensive emphasis, or a balanced offensive-defensive emphasis as the conditions of war dictate. However, this concept includes the premise that the defensive form of war is the stronger form of war or, in other words, it is in the best interest of the United States to be able to parry an attacking nation's initial blow and then strike while the iron is hot (1) to prevent a second onslaught and (2) to overcome the hostile will of the enemy. The defensive form of war is not a simple shield, but a shield made up of well-directed blows designed to overcome the hostile will of an attacking nation by preserving our fundamental values and institutions and imposing our will on the attacking nation through effective counterattacks.

Thus far we have focused our attention on looking back to see ahead. Without a doubt, we owe a great debt to those who have preceded us. Unfortunately, in looking back at the heritage of aerospace power we have been relatively brief. What should be clear, though, is that we should not view the new field of action of space from a radically new perspective. It is merely a medium through which we employ

a means to an end. Therefore, the operational perspective we have developed by looking back in history for those correct theories, founded upon right principles, and sustained by actual events of wars is intended to be valid even if the United States does not deploy weapons in space. However, for reasons that will soon be made clear, it is the opinion of the author that the changing character of war will include such weapons.

Having developed an operational perspective for future aerospace operations in general terms, we can now turn our attention to developing an aerospace vision that fully recognizes the contribution of offensive and defensive aerospace power. To do this, though, we must first develop a technological perspective that looks to the future for those technological trends, factors, and themes that should have the greatest influence of future conflict. Consistent with the format we have used thus far, we will continue to use the questions developed by the Air Corps Tactical School to structure our discussion of the future--will technology provide a new method of waging war and will modern civilization increase the vulnerability of nations? For it is only after we have answered these fundamental questions that we can develop a usable aerospace vision for the Air Force on how it should prepare for the impact of space operations on Air Force roles and missions.

NOTES

CHAPTER 1

1. Brig Gen J. D. Hittle, Jomini and His Summary of The Art of War (Harrisburg, Pa.: Military Service Publishing Co., 1947), 160.

2. I. B. Holley, Jr., "Looking Backward to See Ahead in Space." Second Annual Military Space Symposium, Air Force Academy, 12 October 1982. As evidenced by the title of this chapter, Professor Holley's remarks had a profound impact on the opinion of the author, who participated in the symposium, regarding the importance of doctrine.

3. Giulio Douhet, The Command of the Air, ed. Richard Kohn and Joseph Harahan (Washington, D.C.: Office of Air Force History, 1983), 30.

4. Bernard Brodie, Strategy in the Missile Age (Princeton, N.J.: Princeton University Press, 1965), 7.

5. Col Dennis M. Drew, Nuclear Winter and National Security: Implications for Future Policy (Maxwell AFB, Ala.: Air University Press, 1984), 3-6. The nuclear winter concept asserts that the accumulative effect of nuclear war on the environment would decimate a nation as a viable society and could destroy mankind.

6. Carl von Clausewitz, On War, ed. and trans. Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1976), 87.

7. Ibid., 606.

8. Douhet, The Command of the Air, 9.

9. Ibid., 34.

10. Ibid., 9.

11. Ibid., 110.

12. Ibid., 34.

13. Ibid., 20.

14. Ibid., 95.

15. Ibid., 95-96.

16. Ibid., 10.

17. Ibid., 239.
18. Maj Gen Haywood S. Hansell, Jr., The Air Plan That Defeated Hitler (Atlanta, Ga.: Higgins-McArthur/Longino & Porter, Inc., 1972), 30-31.
19. Ibid., 31.
20. Ibid., 33.
21. Ibid., 34.
22. Ibid.
23. Clausewitz, On War, 99.
24. Samuel B. Griffith, Sun Tzu--The Art of War (New York: Oxford University Press, 1971), 85.
25. Ibid., 85.
26. Ibid.
27. Ibid., 87.
28. Capt A. T. Mahan, The Influence of Sea Power Upon History, 1660-1783 (New York: Hill and Wang, 1957), 5.
29. Carl von Clausewitz, On War, ed., Michael Howard and Peter Paret, Book Six (Princeton, N. J.: Princeton University Press, 1976), 357, 358, and 370. The author recognized that much of this information appeared on the surface to be dated. However, the concept of the defensive form of war seems to be ideally suited to the needs of the United States. For this reason, complete excerpts from Clausewitz have been included in an attempt to provide the reader with the underlying rationale for the defensive form of war.
30. AFM 1-1, Basic Aerospace Doctrine of the United States Air Force, 16 March 1984, 2-6.
31. Translated from the Russian, "Star Wars" Delusions and Dangers (Progress Publishers, 1985), 27.

CHAPTER 2

LOOKING AHEAD TO SEE BACK

As previously stated, the history of changes in aerospace power is primarily a narrative of friction between visions and technologies. Unfortunately, advocates for these two methods of introducing change into aerospace power often polarize into a "binary" thought process. That is, the operational requirements of the vision must guide technology, or the changes in technology must guide the vision. A fundamental premise of this work is that it should not be an either-or process; rather, it should be a single process where the two methods for introducing change are merely the end points. It is for this reason that the definition of an aerospace vision includes both an operational perspective and a technological perspective. Having just defined the operational perspective for future aerospace operations, we will now turn our attention to the technological perspective.

The time span for this technological perspective is from 1986 to 2025. The reasons for choosing this time span are (1) to allow for evolutionary, revolutionary, and possibly even radical aerospace weaponry to be addressed, and (2) to look beyond the impending defensive transition.¹ During the course of our discussion, we will also address the demographics, economics, energy and natural resources, and other technologies of 2025. In this way, we will attempt to avoid the criticism of so many visions in the past that did not allow for such related changes in the character of war sufficient to endure the test of time.

Based on this discussion of what we can expect in 2025, we will then answer the fourth and fifth questions we introduced in the previous chapter, Will technology provide a new method of waging war? Will twenty-first century civilization see an increase in the vulnerability of nations? In answering these questions, we will discover that information-related technologies will introduce new methods of waging war and greatly increase the vulnerability of the United States. However, these same information-related technologies will lead us to some fundamental insights regarding future aerospace operations.

We will conclude our discussion on looking ahead to see back by developing three end-game scenarios or worlds intended to illustrate how the United States might exploit space during the next 40 years. The intent of this exercise of viewing the future as history is to define the US-USSR relationship in terms that directly relate to the integration of space operations into Air Force roles and

missions. However, in doing this, the three worlds take on added significance since they represent three technological perspectives. Thus, in choosing a world, we in fact choose a technological perspective for future aerospace operations. Having presented the outline for the remainder of this chapter, let us return to our first topic of discussion.

Aerospace Weaponry of 2025

The discussion of aerospace weapon systems that follows is not intended to be inclusive, only suggestive of the many kinds of aerospace weapon systems that will be available in 2025. However, the discussion is intended to include those aerospace weapon systems that will have the greatest effect on future aerospace operations. Thus, we will address both the availability and use of these weapons. Deliberately excluded from our discussion will be aerospace weapon systems and platforms that are standard issue today and those that are likely to be available in 2025 (e.g., bombers, fighters/interceptors).

Our primary source for this information will be the work of the Alternative Futures Panel of the Air Force Innovation Task Force, which separated these weapon systems into three groups--evolutionary, revolutionary, and radical weapons. Evolutionary weapons are those that are fairly direct descendants of current weapons or current research and development (R&D) work. They evolve from familiar technologies and are employed in familiar combat situations. In the second group are revolutionary weapons. Many of the technologies required to make these systems operational are still in the area of basic research today; however, the research path toward development is generally understood. When deployed, these systems will be employed in familiar combat situations. In the final group are radical weapons or innovations that require little or no further R&D effort but whose application may change radically the nature of war. While other radical weapons can be conceived in broad conceptual terms (e.g., weather control, force fields, etc.), they will not be discussed since the basic research and R&D path to their development is not clear. However, their omission should be of little consequence since the intent of this work is to produce an aerospace vision for future aerospace operations that is not easily made obsolete by unanticipated advances in technology.

Evolutionary Weapons

Real-time multispectral satellite sensors (RTMSSs) will be increasingly available and integrated in all military operations. These space-based platforms will include both

active and passive sensors (e.g., synthetic aperture radar, infrared, electro-optical, and others).³ By 2025 we can expect RTMSS capabilities to range from high-resolution, small-area/volume sensors to two-dimensional, large-area sensors and three-dimensional, large-volume sensors. If these sensor capabilities are coupled to computers that (1) have pattern recognition capabilities, (2) draw inferences in several fields, (3) accurately simulate expert judgments of intelligence analysts, (4) exploit parallel processing and other advanced computer architectures, and (5) have extremely high speeds and storage, then near-real-time, large-scale surveillance and assessment could be the norm in 2025. The RTMSS capability could vary from whole earth surface and subsurface coverage to coverage of the entire volume from subsurface to at least geosynchronous orbit. In any case, the RTMSS will be vital to future aerospace operations.

Stealth platforms will be employed in all military operations as one of the primary means of overcoming the RTMSSs in 2025. This weaponry technology will include active and passive concepts for denying the enemy information regarding the location and/or purpose of the stealth platform (e.g., energy-absorbent materials and coatings,⁴ antidetection emitters, structural designs, and others). Thus, the ability to achieve surprise or mass in view of the RTMSS capabilities previously discussed will depend directly on the successful integration of stealth platforms in military operations and will be an essential element of future aerospace operations.

Precision guided munitions (PGMs) will be one of the most commonly used aerospace weapons in future aerospace operations. The PGM family of weapons includes unmanned weapons (e.g., cruise missiles, short-range attack missiles, intercept/interdiction missiles, remotely piloted vehicles, maneuvering reentry vehicles, etc.) delivered or controlled by manned aerospace systems in order to engage land, sea, and aerospace targets.⁵ By 2025 we can expect PGM capabilities to range from remotely piloted weapons to highly sophisticated, autonomous concepts involving explosive nonnuclear, kinetic impact, and directed-energy kill mechanisms accurately delivered over short to intercontinental distances. When combined with stealth technology, PGMs will be widely used by all nations requiring survivable, highly accurate, low collateral damage aerospace weapons for aerospace operations.

Battlefield robots will be widely used in land, sea, and aerospace operations. By 2025 the development of advanced artificial intelligence and pattern-recognition capabilities in robots should increase,⁶ their independence and adaptability to near-human levels. Therefore, we can

anticipate widespread use of armed battlefield robots in space and other hazardous environments for routine tasks such as cable laying, minesweeping, satellite replacement/retrieval, and transport operations.

Hypersonic aerospace vehicles (HAVs) will dominate most terrestrial aerospace operations. The family of manned HAVs will be capable of conducting worldwide aerospace operations at speeds in excess of Mach 10. By 2025 the development of advanced alloys, ductile ceramics, and reinforced polymer composites with greatly improved performance and reliability, coupled with advanced hypersonic propulsion technologies, will provide HAVs capable of rapid, worldwide, or even low-earth orbit (LEO) access. When combined with the stealth technology and PGMs previously discussed, HAVs will be widely used for prompt aerospace operations.

Revolutionary Weapons

Aerospace battlefield control (ABC) assets will be a vital element of all future aerospace operations. The ABC system is the family of assets that allows the aerospace commander to survey, assess, command, and control aerospace operations. By 2025 the ABC system will fully integrate surveillance, reconnaissance, warning, C³I, weather, and electronic combat assets to provide a coherent pattern for employing forces. The development of computers that speak and understand natural language, use syllogisms rather than numerical computations, and have the other advanced capabilities previously discussed will allow man-in-the-loop, positive control of all aerospace operations. Through the ABC system, the aerospace commander should be able to survey, assess, command, generate assets, and control all offensive and defensive engagements with the enemy in near-real-time.

Multitiered defense (MTD) technology will be widely available by 2025. The MTD system is a family of aerospace (atmospheric, transatmospheric, and possibly space) weaponry deployed to provide multiple tiers of defensive forces. Advances in high-power, directed-energy weaponry (e.g., laser and particle beam) and third-generation nuclear weaponry (e.g., x-ray and enhanced radiation), coupled with the weaponry technology previously discussed, should virtually guarantee the deployment of some form of MTD. The types of MTD systems deployed by the United States and the USSR may vary from point/area defense systems that defend against atmospheric threats to point/area defense systems that defend against atmospheric and space threats. However, the effectiveness of these MTD systems against ballistic missiles will be one of the key issues to be resolved regarding their inevitable

deployments. Viewed from a military perspective, a MTD system with space-based elements should hold an advantage over those without them since boost-phase intercept of ballistic missiles is greatly enhanced if space-based weapons are part of the MTD.

Multitiered offense (MTO) technology will be available by 2025. The MTO system is a family of aerospace (atmospheric, transatmospheric, and possibly space) weaponry deployed to provide multiple tiers of offensive forces. The availability of technology to produce advanced aerospace vehicles and space battle stations, coupled with the weaponry technology previously discussed, should virtually guarantee the availability and deployment of some form of MTO. As the effectiveness of MTD systems increase, the need for alternative means to hold at risk what an enemy values most--that is, his tools of power and control--will be one of the key issues to be resolved regarding this inevitable MTO deployment. Thus, the types of MTO systems deployed by the United States and the USSR in 2025 may vary from essentially modernized versions of today's nuclear and nonnuclear MTO systems to predominantly nonnuclear MTO systems based on advanced aerospace weaponry technology. Viewed from a military perspective, an MTO system with space-based elements should hold an advantage over one without these elements since near-real-time space and global force projection should be greatly enhanced if space-based weapons are part of the MTO system.

Radical Weapons

Data/information manipulation (DIM) have the potential to change the character of war by 2025 since most nations will have essentially completed their transition to an information-based world society of nations. In a world totally dependent on the daily transmission and reception of data/information concerning political, economic, military, and psychosocial affairs, the ability to manipulate this data/information will open up an unlimited number of opportunities for influencing or controlling the conditions and outcome of war. To this end, all advances in computers, sensors, automation, and communication should be viewed as DIM weaponry technology that can be exploited for military purposes. Therefore, in the opinion of the author, it is imperative that the capability to ensure our free access to accurate data/information and to deny an enemy's access to accurate data/information be fully integrated into future aerospace operations.

Genetically engineered biological weapons (GEBWs) based on current biological research may radically change the nature of war by 2025. The following examples are

intended to be representative of potential GEBWs that could be derived from current biological research: biological weapons designed to destroy enemy crop production; human diseases triggered by race, diet, climate, or other catalysts that are designed to eliminate specific elements of world population; biologically modified insects designed to carry diseases or destroy an enemy's natural resources; and viruses that induce genetic weaknesses such as reduced life span where only the enemy has a designated antidote for the genetic weakness. In the author's opinion, these GEBWs should be relatively cheap and easy to produce for all international actors and could be "great levelers" in the sense that they will be weapons available to all. As such, GEBWs will be a necessary element of future aerospace operations.

This concludes what is intended to be suggestive of the many kinds of aerospace weapon systems that will be available by 2025. This discussion is not meant to be predictive of what will be; rather, it is intended to provide a technology framework regarding aerospace weaponry suitable for developing an enduring technology perspective for future aerospace operations. Without a doubt, other aerospace weaponry not discussed in this work will be developed and deployed. However, it is the intent of this work to develop an aerospace vision that can adapt to such weaponry without significantly compromising its contribution to deterrence. With this in mind, we will now discuss trends and factors in other areas that might directly or indirectly affect our ability to develop an enduring technological perspective.

Other Trends and Factors

In looking ahead to see back, we must consider more than just the aerospace weaponry of 2025. Equally important is an appreciation of other trends and factors that will affect future aerospace operations. Hence, we will discuss some of the more important trends and factors that should hold true in each of the three worlds (i.e., scenarios) we will present later. The specific areas we will discuss are demographics, economics, energy and natural resources, and technology. Although the source of information for this discussion is again derived from the Air Force Innovation Task Force,¹⁰ the author has integrated his own opinions regarding space-related trends and factors in keeping with the stated purpose of this work.

Demographics

By 2025 we can expect substantially larger populations in South Asia, Latin America, and Africa. In fact, the world's population of 4.4 billion in 1980 is projected to nearly double by 2025. The distribution of the world's population will be substantially more urbanized in 2025 with at least 58 percent living in urban areas compared to the 41.1 percent in 1980.¹¹ However, for reasons that will soon be made clear, we can also anticipate a significant population (i.e., thousands) of permanent and semipermanent space dwellers.

Economics

The world economy should nearly quadruple in total gross domestic product, from \$12 trillion in 1986 to at least \$45 trillion by 2025. In addition, the volume of world trade is expected to expand at least eightfold, from \$1.4 trillion to more than \$11 trillion.¹² While most industrial production will continue to relocate to developing nations, we can expect a significant industrial production capability in space by 2025. Much of this industrial production in space will likely be highly autonomous, requiring little if any involvement by man. However, we can also expect that much of the industrial production in space will be sufficiently complicated to require the permanent or semipermanent presence of man.

Energy and Natural Resources

Without a doubt, demand/supply will remain an important focus of international economics and politics in 2025. Regarding demand, we can expect major advances in energy efficiency. Although industrialized nations will remain the major consumers, we can expect a less intense demand for energy due to service/high-tech industries. Regarding supply, fossil fuels will still dominate, but conventional sources of oil and natural gas will become increasingly scarce. Thus, by 2025 we can expect a growing dependence on space-based sources of energy and resources (e.g., space-based solar power generation and mining operations). Although many of these operations will be highly autonomous, we can again anticipate a significant requirement for permanent and semipermanent space dwellers in support of more complicated power generation and deep-space mining operations.

Technology

By 2025 high technology will likely be available to all but the poorest nations, with many nations having both terrestrial and space-based advanced R&D and production centers. From these centers we can expect new alloys/synthetics with high performance and reliability as well as the ability to design and tailor these materials for specific applications. Regarding biochemistry, we can also expect improved agricultural productivity, new food sources, a longer and healthier life span, and improved cognition and retention. Regarding computers, automation, and communication, we can expect dramatic increases in sensing, storing, transmitting, and processing to be coupled with a natural language input/output capability. However, some of these advances will likely depend on products that can only be made in the space-based R&D and production centers and require highly trained professionals to man and operate. Thus, once again, we can expect a significant number of permanent or semipermanent space dwellers (e.g., R&D and production of large crystals or pharmaceuticals in space).

This completes what is intended to be a suitable background for answering the questions, Will technology provide a new method of waging war? Will modern civilization increase the vulnerability of nations? In the preceding discussions, we have deliberately attempted to look 40 years into the future and postulate what we might expect. In keeping with the purpose of this work, we have attempted to focus our vision on key issues, trends, and factors associated with space operations that will affect future aerospace operations. In the section that follows, we will continue with this premise by answering the fourth and fifth questions and discussing some fundamental insights regarding future aerospace operations.

Fundamental Questions and Insights

Will technology provide a new method of waging war? Since technology has always provided new methods of waging war, the simple answer to this question is yes. However, the reason for this answer may be surprising to some, for it is not based on advanced technology weapons as much as it is based on the world's transition to an information-based society of nations. In order to justify this assertion, we will analyze how the three information-related weaponry technologies previously discussed will affect the basic pattern of employment of future aerospace operations.

The pattern of employment for warfare in general and aerospace warfare in particular is a closed cycle comprised of the following sequential elements: survey, assess,

command, generate assets, control, engage/attack, evaluate results, and continue the cycle until objectives are achieved.¹³ The speed with which we as a nation can complete this cycle directly affects our ability to conduct aerospace warfare. This is also true for our enemies. Thus, aerospace warfare in its simplest form is the continuous interaction between two opposing cycles, with each nation striving to get inside the cycle of the other. That is, we strive to survey and assess the enemy's actions fast enough to respond appropriately, or we strive to quickly survey, assess, and attack the enemy's weakness before he can respond.

With these opposing cycles in mind, we will now overlay the information-related weaponry technology of 2025. The first we will consider is the real-time multispectral satellite sensors (RTMSSs). Because of the increased likelihood of terrorist organizations having access to weapons of mass destruction (a.g., chemical, nuclear, and biological), it is not unreasonable to assume that we would attempt to monitor these organizations in real time. When coupled with similar requirements to monitor the USSR as well as other nations, we can expect the quantity and quality of RTMSSs and other information-gathering assets to be greatly increased by 2025. Thus, during daily peacetime operation this multispectral sensor system will routinely collect real-time information on a wide variety of human affairs on earth and in space. When we think of this system being coupled with computers that can continuously correlate, fuse, and retain this information for months or even years, we can begin to appreciate the tremendous impact RTMSSs and other information-gathering assets will have on future aerospace operations.

For example, through the RTMSSs and other information-gathering assets (terrestrial and space-based) it is conceivable that by 2025 we will be capable of monitoring in real-time the daily activities of a terrorist organization or even specific members of this organization for prolonged periods of time. Armed with such information, we will have the opportunity to preempt such activities or at least to initiate actions that make it more difficult for terrorists to carry out their objectives. Clearly, this is an optimistic assessment regarding the future capabilities of RTMSSs and other information-gathering assets. Nonetheless, this is the direction in which such technology is leading us.¹⁴

The next information-related technology we will consider is data/information manipulation (DIM). The importance of this technology cannot be overemphasized. As previously stated, in a world that depends on the transmission and reception of data/information on political,

economic, military, and psychosocial affairs, the ability to manipulate this data/information creates an unlimited number of opportunities to influence or control the international environment. By way of illustration, let us return to our terrorist example. Assuming they are aware of our attempts to monitor their activities, they have an opportunity to use DIM technology to subtly or radically alter the data/information we are collecting in such a way that we would be unaware of their true activities. This could result in a potentially embarrassing or tragic situation in which we either "preempted" a nonexistent terrorist activity or failed to preempt a horrendous terrorist act.

However, let us consider another example that goes to the heart of the assertion that information-related technology will provide a new method of waging war. Given that through DIM technology the potential exists to alter subtly or radically the data/information base of an entire enemy nation, there will be a radically new method of waging war in the future. Such a war would be an essentially nonviolent conflict, possibly lasting many decades, where only one side (the attacker) would be aware that a war was in progress. In such a war, the only indication the nation under attack might have that something was amiss would be unexplained failures in political, economic, or psychosocial initiatives or even aerospace operations.

Thus, we come to the third and perhaps most important information-related technology we will consider. For it is through the aerospace battle control (ABC) system that future aerospace commanders will survey, assess, command, generate assets, and control all offensive and defensive engagements with our enemies. However, in view of the RTMSS and DIM technologies just discussed, the ABC should be able to complete the above cycle quick enough to exploit an enemy's weakness and ensure our access to accurate, real-time data/information while denying such access to the enemy. For this reason, the ABC will become our first line of defense against long-term, essentially nonviolent wars involving data/information manipulation.

Unfortunately, for exactly the same reasons just discussed, the USSR as well as other nations will also develop and deploy these information-related technologies by 2025. This brings us back to our discussion of the continuous interaction between two opposing cycles, with each nation striving to get inside the cycle of the other. In the author's opinion, it will be this interaction that will ultimately determine the aerospace weaponry of 2025. The reason for this assertion is simple. There are essentially no constraints on information-related technology; thus, the information explosion we are presently

experiencing will almost certainly continue until costs or the laws of physics dictate otherwise. Although current and planned aerospace weaponry may be inherently flexible, it is doubtful that by the end of this century the ability to engage an enemy offensively or defensively (requiring hours or even days) will be compatible with the real-time or even near-real-time capabilities of the information-related technologies previously discussed.

Thus, we find that both the United States and the USSR will soon be confronted with the mismatch between their near-real-time (measured in seconds) ability to survey, assess, command, and control and their relatively slow (measured in hours or days) ability to offensively or defensively engage an enemy. Faced with such an incoherent pattern of employment, it seems reasonable for us to assume that both will aggressively pursue aerospace weaponry technology capable of restoring coherence--thus, our assertion that information-related technologies will provide new methods of waging war and ultimately dictate the aerospace weaponry of 2025.

Having established the linkage between information-related technologies and aerospace weaponry, we can now discuss the specific aerospace weaponry appropriate for such a coherent pattern of employment. In our previous discussions, we consistently used examples involving terrorist organizations to illustrate the new methods of waging war. In these examples, we introduced the possibility that the tools of terrorism in 2025 may include DIM, GEBW, chemical, nuclear, and biological weapons. The reason for this was to establish the premise that the likelihood of confrontation at the lower end of the spectrum of conflict will continue to be as high as it is today. However, unlike today, when the threat to our national security is relatively low compared to nuclear conflict, by 2025 the threat to our national security will be high compared to nuclear conflict if the tools of terrorism include DIM, GEBW, chemical, nuclear, and biological weapons.

When we consider the possibility that many developing nations will also possess these weapons, it seems doubtful that deterrence based on nuclear weapons will inhibit the actions of these developing nations or terrorist organizations in 2025 any more than it does today. The reason for this is simple. In the face of world opinion today as well as in 2025, it seems inconceivable that the president would authorize the use of nuclear weapons against a small developing nation or a terrorist group. Unfortunately, it is conceivable today and in 2025 that an unstable developing nation or terrorist organization would resort to nuclear weapons regardless of world opinion.

Faced with the growing severity of the threat at the lower end of the conflict spectrum, we can expect the United States to aggressively develop and deploy aerospace weaponry that is appropriate and therefore "usable" in the fish bowl of world opinion. Thus, we can expect the United States to deploy the nonnuclear aerospace weaponry previously discussed as a deterrent against the threat at the lower end of the conflict spectrum.

The above discussion equally applies to the USSR. As the United States and the USSR move into the twenty-first century, both will be faced with the problem of maintaining a large nuclear arsenal (with little deterrent value except against each other) while expanding their nonnuclear arsenals to deter the growing threat at the lower end of the conflict spectrum. Although nuclear weapons should continue to be more cost effective based on their high, single-shot probability of kill against single or even multiple targets, we can expect highly accurate, relatively cheap nonnuclear weapons to begin to close this cost-effectiveness gap. However, if effectiveness is the dominant criterion, by 2025 it should be possible to strike the full range of military targets on earth and in space using the nonnuclear aerospace weaponry previously discussed. Thus, "the enormous arsenals of strategic nuclear weapons now possessed by the two superpowers could no longer be justified for such military purposes as counterforce or countermilitary campaigns or flexible or limited responses. They would finally become what many have always contended them to be: destroyers of societies and national symbols of political power."¹⁵

With this in mind, the United States and the USSR would probably experience increasing international pressure to reduce their nuclear arsenals as the rationale for these weapons diminished.¹⁶ This is not to say that the United States and the USSR will be devoid of nuclear weapons. It is to say that nuclear weapons and possibly the new GEBWs will be relegated to the same position as today's chemical weapons. The United States and the USSR will maintain a significant capability to conduct chemical, biological, or nuclear warfare, but they will no longer rely on these weapons as the foundation of deterrence.

Thus, in the author's opinion, the trend over the next 40 years will be for the United States and the USSR to reduce their reliance on nuclear offensive weapons and to increase their reliance on offensive and defensive nonnuclear systems, signaling a return to a more "conventional" method of waging war. However, caution is clearly warranted as this transition to predominantly nonnuclear systems will involve greater costs, threaten the current symbols of national power, and incur the dangers associated with a potentially unstable transition process.¹⁷

Armed with these answers and insights regarding the methods of waging war in 2025, we can now answer our fifth and final question.

Will twenty-first century civilization see an increase in the vulnerability of nations? Unfortunately, the answer to this question is also yes. Again, the reason for this answer can be traced to our transition to an information-based society of nations. The widespread availability and use of information-related technology will allow nations as well as terrorist organizations to accumulate over time vast amounts of specific information regarding strengths and weaknesses of "open" societies. Even in "closed" societies, the daily monitoring through the information-related technologies previously discussed will over time reveal to their potential enemies a reasonably accurate assessment of their strengths and weaknesses, including what the leadership in these "closed" societies value most. Even if the world were only armed with DIM technology, it seems axiomatic that this modern information-based civilization will increase the vulnerability of nations.

Once again, an example involving a terrorist organization will be used to support our assertion regarding the increased vulnerability of nations. Given that the terrorist organization possessed an accurate assessment of the strengths and weaknesses of the target nation(s), the opportunities to exploit this information would be virtually unlimited. The terrorists' operational plans could range from sequential operations involving a series of seemingly unrelated acts for the purpose of achieving a long-term objective to simultaneous global operations intended to achieve an immediate objective. Clearly, we have attributed capabilities to this terrorist organization that require a tremendous degree of sophistication. However, it is not inconceivable that by 2025 a relatively small group of terrorists could be expert enough in DIM technology applications to orchestrate such sophisticated operational plans. Although obviously contrived, this example should at least illustrate a particular vulnerability associated with civilization's transition to an information-based society of nations.

To more fully appreciate this increased vulnerability, however, let us now turn our attention to the US-USSR relationship. Here we are not dealing with a small group of terrorists but with the vast resources of two superpowers. Today, these two nations already possess sophisticated information-related systems on earth and in space. Considering the point made earlier regarding cost and the laws of physics being the only constraints, we can state with virtual certainty that by 2025 at least the superpowers

will possess the RTMSS, DIM, and ABC capabilities previously described. In other words, both the United States and the USSR will have a greatly improved capability regarding how, when, and where to exploit each other's strengths and weaknesses as well as those of other nations. Without a doubt, the vulnerability of all nations will be increased as a result of this awareness.

With this increased vulnerability in mind, we can now discuss the increasingly dominant role of space systems on future aerospace operations. Even today we find that space systems enable the president to be directly involved in military operations. Since he is the commander-in-chief and is ultimately responsible for the security of the United States, it is not surprising that he has assumed a greater role in crisis situations involving hostages, acts of terrorism, rescue operations, and even military operations in other nations.

However,³ along with the increased capabilities of space-based C³I, the president must also contend with mass media information systems. Thus, he must constantly deal with the reality that the appropriateness of his decisions and US military operations will be immediately reported to the world community of nations. With the deployment of the RTMSS, DIM, and ABC systems previously described, we can expect future presidents to continue this trend since the pattern of employment for effective military operations conducted under the scrutiny of near-real-time world opinion will likely require the president's direct involvement. It seems inevitable that by 2025 crisis situations will essentially be viewed as confrontations between the president and the leader of the belligerent nation or organization. In fact, we have already observed several presidents dealing directly with an "on scene" commander during crisis situations. For this reason, we can expect future presidents to actively support command and force structures that enhance the pattern of employment for appropriate military operations.

As the predominantly space-based RTMSS, DIM, and ABC systems become fully operational, the United States will become increasingly dependent on the routine access to integrated/fused intelligence over the entire surface of the earth either discretely (against a terrorist organization) or as a continuum (simultaneously over the entire surface of the earth). By 2025 it is possible that after years of availability of such near-real-time intelligence, the civilian and military leadership will no longer view terrestrial conflict from a "theater" perspective. In the same way that US ambassadors to other nations no longer operate autonomously (as they did before the advent of secure real-time worldwide communications), unified

commanders will increasingly be viewed as field commanders operating on specific instructions from the president and his advisors. Thus, the concept of unified commanders responsible for "geographic" areas will likely be abolished or modified and replaced with a global perspective of terrestrial conflict more compatible with the near-real-time involvement of the president.

However, presidential control will not be the only reason for adopting this "global" perspective. As previously mentioned, we can expect presidents to actively support command and force structures that enhance the pattern of employment for appropriate military operations. Thus, it seems reasonable to expect future presidents will support the increasingly dominant role of space systems that are ideally suited to the "global perspective." Although few would argue with this assertion in the context of the militarization of space (i.e., use of space for military C I and other information-related purposes), the weaponization of space (i.e., offensive/defensive weapons employed in and from space) is quite another matter. However, from our previous discussions, it should be clear that there should be a plethora of space-based aerospace weaponry technology available by 2025. In the opinion of the author, it is precisely because of the increased vulnerability of nations associated with the information-related technologies previously discussed that the development and deployment of space-based aerospace weaponry is virtually inevitable. As stated by Colin Gray, "Space weaponization follows space militarization as surely as trade follows the flag or offense stimulates defense. It is as absurd to propose that space be maintained as a 'zone of peace,' or some such formula, as that maritime weaponry be banned--and for the same reason."¹⁸

From the discussion above, it should be abundantly clear that space systems should play an increasingly dominant role in military operations. However, although the militarization of space is expected to continue at a tremendous pace, the inevitable weaponization of space is subject to wide variations depending on the dynamics of the US-USSR relationship during the next 40 years. With this in mind, we will now attempt to illustrate how the United States might exploit space during this time period.

The Future as History

Thus far in looking ahead to see back, we have attempted to present background information suitable for developing an enduring technological perspective for future aerospace operations. In what follows, we will present the future as history by describing three possible worlds in

2025 based on this background information in order to investigate the extent of worldwide "superpower" involvement 40 years from now. For the purpose of this work, the term "superpower" refers to the United States and the Soviet Union. This is not to say that other nations will not achieve superpower status during the next 40 years; rather, it is to say that the relationship between the United States and the USSR will still be the primary element in determining the scope and purpose of future Air Force aerospace operations.

To understand the importance of this relationship to future aerospace operations, we will rely on an end-game approach. The term "end-game" in this instance refers to the process of looking at the year 2025 and postulating the overall scenario that might influence or even dictate the roles and missions of Air Force aerospace forces. Clearly, such an approach is open to criticism since there are virtually an infinite number of end-game scenarios possible by the year 2025. However, in the opinion of the author, we must be willing to risk such criticism in order to gain a more comprehensive view of the future US-USSR relationship and to develop a technological perspective today that is in the best interest of the United States.

To this end, the three scenarios or worlds we will discuss are intended to present, as a set, the range of possibilities most meaningful to the issues surrounding the US-USSR relationship during the next 40 years. However, because of the basic purpose of this paper, we will attempt to define this relationship in terms that directly relate to the integration of space operations into Air Force roles and missions. That is, we will present three worlds to illustrate how the United States might weaponize space during the next 40 years. There are, of course, dangers associated with attempting to integrate many variables around a single variable; but in the author's opinion, this approach will be helpful in formulating technological perspectives suitable for future aerospace operations.

While the information presented in these three worlds is again derived from the work of the Alternative Futures Panel of the Air Force Innovation Task Force,¹⁹ the author has assumed in each of the worlds that the current arms control negotiations will be at least marginally successful regarding reductions in offensive nuclear weapons. This common assumption is simply an attempt to define the US-USSR relationship in terms that directly relate to the integration of space operations into Air Force roles and missions. Should the arms control negotiations results fail regarding reductions in offensive nuclear weapons, the technological perspectives associated with the three worlds that follow should still represent a plausible range of

possibilities for future aerospace operations since each world assumes different results from these negotiations as they relate to the exploitation of space. With this in mind, the three worlds are not forecasts of what will be; they are descriptions of three possible future worlds intended for use as technological perspectives suitable for future aerospace operations.

World I (Isolationist United States)

The first end-game scenario or world we will discuss is a possible world where the United States elects to pursue a defense-dominated strategy based on near-term arms control negotiations that limit the military exploitation of space to C³I systems and weapons that are intrinsically defensive in nature. In the intervening years the United States has increasingly moved toward isolationism and by 2025 has basically withdrawn from the role of a dominant superpower. As such, there is only sporadic and limited support for US involvement in world affairs due to past failures, disillusionment with European NATO allies, and development of the capability (or at least the "perceived" capability) to defend the homeland independently. In contrast, the Soviets are optimistic about what they view as a decline in US power but are increasingly concerned with the rise of neighboring powers. The Soviets surpass all in military power, but face significant political, economic, and technological competition. International politics revolves around the objectives of maximizing or restricting Soviet power, depending on one's point of view.

Regarding political/social attitudes, the United States is concerned with only domestic political, economic, and social freedoms and seeks strong measures to curtail legal and illegal immigration. A strong elite emerges with preferred access to education, economic advancement, and authority over the general population. The United States has little interest in sharing military or economic power since it maintains a significant capability for continental defense and has developed a relatively self-sufficient economy. However, economic and political freedoms in the United States and other industrialized nations are gradually restricted as these nations attempt to counteract the growing power of Soviets. At the same time, the Soviet Union's repression of political and economic freedoms continues to increase in its dealings with its satellites and other nations within its sphere of influence. In short, the Soviet Union tends to increasingly dominate the world scene as the United States withdraws.

Consistent with this isolationist policy, the United States maintains limited control of sea and space lanes with

limited force-projection and forward deployment in selected areas around the world (e.g., Southeast Asia, Central America, and the Horn of Africa). Although the United States continues to emphasize nonnuclear forces, its primary emphasis is on continental defense against the USSR as well as emerging nuclear powers. The United States, the Soviet Union, and other industrialized nations dominate space, but many nations have at least a limited antisatellite (ASAT) capability. However, US weapons in space are essentially limited to defensive aerospace systems since the focus is on homeland defense. Although many nations can operate in space, air, land, and water and have moderate force-projection capabilities, only the USSR can project significant force globally or in space within hours. Military instruments are used by all actors fairly regularly, especially in conjunction with other national policy tools, and on a wide range of issues.

In the opinion of the author, the preceding end-game scenario of World I represents a plausible evolution of events and trends that would follow if the United States elects to pursue a defense-dominated strategy. In such a world, the United States would exploit space for C³I and other information-related purposes but would only place weapons in space that were intrinsically defensive in nature. In the next end-game scenario or world, we will attempt to describe a plausible evolution of events and trends that might follow if the United States elects to continue its current offense-dominated strategy based on successful negotiations with the Soviet Union that only marginally reduce their nuclear arsenals and preclude any weapons in space.

World II (Multipolar Competition)

In this world of 2025, both the United States and the USSR are faced with a diminishing role in world affairs. By entrenching nuclear weapons as the coinage of international power, developing nations and nonstate actors will be encouraged to acquire nuclear weapons as international symbols of political power. As a result, other nations with nuclear arsenals (e.g., Great Britain, France, and China) will continue to expand their nuclear arsenals in an attempt to maintain their relative position in international affairs.²⁰ Thus, between 1986 and 2025, developing multiple independent power centers (parts of shifting alliances) are likely to emerge. This will create a situation in which, even though the United States and the USSR maintain arsenals with thousands of nuclear weapons, the hundreds of nuclear weapons controlled by these independent power centers can threaten the United States or the USSR with mutual assured destruction. In the opinion of the author, this will allow

nations with only moderate nuclear arsenals to essentially "catch up" with the United States and the USSR in nuclear superpower status.

In this highly competitive world, there is limited support for US foreign involvement due to past failures in dealing with growing anarchy in the international system and to the perception that the USSR's diminished superpower status has resulted in a reduced threat. Soviet involvement is limited due to economic difficulties, foreign failures, and the anarchic character of the international system. Eastern Europe has considerable political and economic independence. In addition, strong natural resource alliances/cartels cause periodic interruption in energy and critical minerals supplies. These alliances/cartels cause a significant global redistribution of wealth that leads to economic recession, chaos, and conflict in the world economy. The United States and the USSR are economically troubled. The major thrust in global politics is to maximize or to constrain alliances and cartels, depending on one's viewpoint and national objectives.

Regarding political/social attitudes, the United States no longer pressures other nations about human rights since internal policies now emphasize political and economic equity for minorities only in ways compatible with economic realities. Strong measures are taken in the United States to curtail immigration. Elsewhere consumerism and political/economic freedoms grow in previously Soviet-dominated societies as a means of enhancing their technological and economic strength and thus their ability to effectively compete in world markets. The Soviet government suppresses domestic ethnic and dissident movements but allows slow growth in economic freedoms and consumerism as a means of minimizing public dissatisfaction and bolstering the domestic economy.

The gradual worldwide collapse of the international economic system enhances centralized decision making and control as governments take away many political and economic freedoms after considerable unrest and turmoil as their economies stagnate and decline. Economic power and competition are determined by shifting resource and technological alliances and cartels rather than dominant long-term economic powers. With the collapse of global economic institutions, a large number of intracartel, regional, and alliance institutions develop into economically powerful actors, many with the capacity and inclination toward severe violence internationally.

In this multipolar, highly competitive world, we find wide distribution of highly lethal nuclear and nonnuclear weapons. It is doubtful that nuclear deterrence will act as

an inhibitor on unstable, developing nations or nonstate actors that possess nuclear weapons. Thus, it is highly probable that during the intervening years, a major conflict stemming from third party nuclear conflict could occur in the Persian Gulf or Middle East region and involve the superpowers. By 2025 the result would most likely be a worldwide antinuclear sentiment coupled with an overriding concern for defense against a variety of threats and major deployments along all borders. Superpowers, other industrial powers, and nonstate economic actors would have limited force-projection capabilities and would face significant resistance from local powers. Most actors should have access to space, primarily for C³I and other information-related purposes. However, in this highly competitive world, military instruments would be commonly employed foreign policy tools by all actors across any issue.

Although weapons are clearly not the sole determiner of world events, in the opinion of the author, World II is representative of the US-USSR relationship in 2025 if they attempt to maintain their offense-dominant, nuclear superpower status and preclude weapons in space. In our final world we will attempt to present a plausible flow of events if the United States and the USSR move away from deterrence based on nuclear weapons and do not preclude the weaponization of space.

World III (US Leadership)

In this final end-game scenario we will discuss a possible world where the United States has successfully assumed the role of the leading superpower. As such, World III represents the author's opinion of a plausible evolution of events and trends that are consistent with a decision by the United States to pursue a balanced, essentially nonnuclear, offense-defense strategy. In this world, the United States would exploit space for C³I and other information-related purposes, but it would also place nonnuclear offensive and defensive weapons in space. This assumes the near-term precursory event of successful arms control agreements between the United States and the USSR to reduce offensive nuclear forces and to explore possibilities of sharing SDI technologies.

Within the constraints of such an arms control agreement, both the United States and the USSR would initially seek to achieve dominance in world affairs. However, various world dynamics such as terrorism, economic and environmental problems, and domestic difficulties in both the United States and the USSR increase the range of "common interests" between the two and actually promote a

significant form of "cooperation" in global affairs. This would result in continued but shifting support for combined high-level US-USSR multilevel involvement worldwide (i.e., economic, military, political, and nongovernment).

US political, economic, and technical power would surpass all others except in specific areas where the United States would face strong competition from the USSR, a continental European union led by France and West Germany, and a Japanese/Chinese-led alliance of several East Asian and Southeast Asian states. To meet this challenge, the United States supports increased economic interdependence and international institutions to deal with inherent tensions and demands (successes and failures). In addition, the United States places strong emphasis on rights to attain popular domestic and foreign support but not in ways likely to fracture relations with governments/alliances it views as critical to US interests.

Regarding political/social attitudes, there are global popular pressures for individual freedoms and human rights akin to those in the United States, whose socioeconomic system begins to be viewed by other societies as the one to emulate. The prevailing popular and governmental sentiment among other nations is to enhance their competitive position, especially vis-a-vis the United States; therefore, public sentiment in the Soviet Union and wealthier industrialized nations calls for increased commercial and military use of space. Immigration into the United States remains high, with periods of large influx as the doors are largely open to the underprivileged around the world, who continue to view the United States as the land of opportunity. Although terrorism on earth and possibly in space is supported by many in autocratic states and by nonstate actors, global public sentiment is strongly against terrorism as a legitimate policy tool.

For a variety of reasons (such as the conviction that the Soviet homeland can now be protected, economic difficulties coupled with foreign failures, and growing cooperation with the United States), there is a consensus among the Soviet leadership to concentrate on domestic issues. In addition, the Soviets adopt a balanced, essentially non-nuclear offense-defense military posture based on an effective strategic defense (possibly even sharing certain space-based systems with the United States) and a reduced motivation to challenge the United States. Competitive cooperation between the United States and the USSR allows both to reduce military expenditures and to emphasize economic growth and foreign trade. Both nations actively seek to avoid the reemergence of a noncooperative relationship. Freedom in Soviet satellites continually grows, with periodic but declining USSR intervention as it

withdraws from its goal of world domination. Consumerism and political, economic, and social freedoms grow in the USSR and in other previously Soviet-dominated societies as a means of enhancing technological and economic strength and thus the ability of these societies to compete in world markets. The USSR, in particular, is becoming highly competitive in these markets.

US military power surpasses all others but can be challenged by the USSR and large coalitions because of the moderately wide distribution of highly lethal, nonnuclear weapons. However, although many nations have a moderate force-projection capability in space, air, land, and water, only the United States and the USSR can unilaterally project significant force globally or in space within hours. Enduring moderate levels of global violence by terrorist organizations and developing nations lead to a restructuring of the concept of the acceptable use of force since nonnuclear military instruments are considered to be legitimate foreign policy tools and are regularly employed on earth and in space.

This concludes our brief excursion in viewing the future as history. The intent of this exercise was to define the US-USSR relationship in terms that directly relate to the integration of space operations into Air Force roles and missions. For this reason, each of the worlds began with the common assumption that current arms control negotiations will be successful regarding reductions in offensive nuclear weapons. Thus, the differences in the worlds reflect the author's opinion of a plausible flow of events and trends that might follow based on possible results of these arms control negotiations regarding the exploitation of space.

By way of review, in World I the United States exploits space for C³I and other information-related purposes but also places intrinsically defensive weapons in space. World II is intended to be an extension of today; that is, the United States exploits space only for C³I and other information-related purposes. Finally, in World III the United States exploits space as in World II but also places nonnuclear offensive and defensive weapons in space. It is hoped that should the arms control negotiations results vary significantly from those presented here, the technological perspectives associated with these three worlds will still represent the plausible range of possibilities for future aerospace operations.

The Technological Perspective

The specific aerospace weaponry technology we develop and deploy must contribute to a coherent pattern for employing US aerospace forces that is consistent with the national policy of the United States. Simply stated, this is the technological perspective between today's aerospace operations and effective aerospace operations in the future. On inspection, we see that the definition of the technological perspective for future aerospace operations contains three related elements (i.e., aerospace weaponry technology, coherent pattern of employment, and US national policy). Unfortunately, this brings us back to the "binary" thought process we discussed in the opening paragraph of this chapter. Will the aerospace weaponry technology we have discussed guide the technological perspective for future aerospace operations? Or will our national policy guide the technological perspective? In formulating a technological perspective for future aerospace operations, we must therefore integrate the same operational and technological end-points we had previously associated with an aerospace vision.

With this in mind, we can appreciate the true value of the three worlds in which we attempted to integrate aerospace weaponry technology and national policy through a pattern of employment that was consistent with these end-points. For in each world we find a technological perspective suitable for future aerospace operations. We therefore arrive at the point where we must choose the technological perspective most suitable for future aerospace operations.

Before we make this choice, let us review some key points from our previous discussions. First, in looking ahead we find that information-related technologies will introduce new methods of waging war and will greatly increase the vulnerability of the United States. Second, both the United States and the USSR will enter the twenty-first century with a near-real-time capability to survey, assess, command, and control aerospace forces. Third, space systems will play a dominant role in all future military operations. Fourth, the concept of unified commanders responsible for "geographic" areas will likely be abolished and replaced with a military command structure compatible with a global perspective of terrestrial conflict. Fifth, we can expect a significant number of men and women in space to be involved in a variety of military and nonmilitary activities. Armed with these key points, we can now choose the technological perspective most suitable for future aerospace operations.

In the opinion of the author, Worlds I and II illustrate the deleterious flow of events where the United States either transitions to a defense-dominant strategy or continues its current offense-dominant nuclear strategy, respectively. Neither appear to be in the long-term best interest of the United States. Therefore, only World III contains a technological perspective for future aerospace operations that is in the long-term best interest of the United States.

Upon reaching this point, the reader might conclude that the accuracy of the author's vision with respect to the future is not 20/10, 20/20, or even 20/100. In fact, the reader may declare the author legally blind with respect to the key issues, trends, and factors affecting future aerospace operations. For these readers, it is the author's hope that the remainder of this work will at least contribute to their own work in this regard. Hopefully, those readers who choose to continue on after this point will regard the preceding discussions as sufficiently plausible to accept World III as the technological perspective most suitable for future aerospace operations.

In choosing World III, we have committed the United States to a national policy that supports a balanced offense-defense force structure capable of near-real-time aerospace operations. Inherent in this commitment is the necessity to develop and deploy nonnuclear, space-based elements of the MTO and MTD previously discussed. In the author's opinion, these deployments are the keystone to World III, where nuclear weapons are no longer the foundation of deterrence. In looking ahead to see back, we find that the desired technological perspective includes a balanced offense-defense aerospace force structure capable of near-real-time aerospace operations. In chapter 1, we found that the desired strategy for future aerospace operations called for a balanced offense-defense emphasis depending on the conditions of the war. Thus, we find a convergence between the operational perspective and the technological perspective for future aerospace operations. In the next chapter we will integrate the operational perspective and the technological perspective into an aerospace vision suitable for future aerospace operations.

NOTES

CHAPTER 2

1. Statement of Ambassador Paul H. Nitze, 26 February 1985, in Senate, Commitments, Consensus, and US Foreign Policy: Hearings Before the Committee on Foreign Relations, 99th Cong., 1st Sess., 1985, 367-89. In his statement, Ambassador Nitze outlined a three-phase approach that links the Strategic Defense Initiative to long-range arms control proposals. The stated objective is to transition to a defense-dominant strategy circa 2015.

2. Harold S. Becker, executive vice president, Futures Group, "Alternative Futures for the Air Force Innovation Task Force" (presented to the Air Force Innovation Task Force (AFITF) participants in Washington, D.C., June 1984), 169-197. The AFITF was chartered by the chief of staff of the Air Force to generate innovations in technology, operational concepts, and organizational structure aimed at improving the Air Force's ability to meet future national security requirements. To this end, the Alternative Futures Panel identified numerous alternative futures within which the Air Force might operate in 2025. As a participant in the Air Force Innovation Task Force for six weeks in 1984, the author used these alternative futures extensively and was intimately familiar with their contents. In conducting research on advanced aerospace weaponry concepts, the author found it readily apparent that many of the potential evolutionary, revolutionary, and radical aerospace weaponry concepts listed by the Alternative Futures Panel were still appropriate. With this in mind, the list of potential aerospace weaponry concepts presented in this work has as its source the work of the Alternative Futures Group. However, the descriptions, applications, and insights regarding these potential aerospace weaponry concepts reflect the opinions and research of the author and do not represent an official position of the Air Force or the AFITF.

3. Secretary of Defense Caspar W. Weinberger, Annual Report to the Congress, Fiscal Year 1987 (Washington, D.C.: US Government Printing Office, 1986), 258. While the capabilities and applications attributed to the RTMSS of 2025 are ambitious, current R&D in sensors and signal processing technologies are clearly moving in this direction.

4. Armed Forces Journal, September 1980, 30.

5. Carl H. Builder, Strategic Conflict Without Nuclear Weapons (Santa Monica, Calif.: The Rand Corporation, 1983), 24.

6. Weinberger, Annual Report to the Congress, Fiscal Year 1987, 260.

7. Ibid.

8. Ibid., 287.

9. Ibid., 35. If the United States is to achieve a credible nonnuclear deterrent, then the enemy must confront a credible nonnuclear threat that aggression will trigger counterattacks that result in losses exceeding any possible gains by the aggressor. Thus, in the opinion of the author, some form of the nonnuclear MTO described here is inevitable.

10. Becker, "Alternative Futures for the Air Force Innovation Task Force," 51-149. The information provided by the Alternative Futures Group was very detailed and well documented in these areas. However, in keeping with the purpose of this work, the author has only presented key facts deemed to be appropriate in developing the technological perspectives that follow. Thus, these discussions reflect the opinions and research of the author and do not represent an official position of the Air Force or the AFITF.

11. Ibid., 59. The Alternative Futures Group used official United Nations data in deriving these demographic projections.

12. Ibid., 77.

13. AFM 1-1, Basic Aerospace Doctrine of the Air Force, 16 March 1984, 2-19.

14. Weinberger, Annual Report to the Congress, Fiscal Year 1987, 260.

15. Builder, Strategic Conflict Without Nuclear Weapons, 47.

16. Ibid., 47.

17. Ibid., 48.

18. "SDI Necessary for National Security," Defense Science 2003 +, February-March 1985, 15.

19. Becker, "Alternative Futures for the Air Force Innovation Task Force," 25-49. Because of the precursor assumptions regarding arms control negotiations results, the worlds presented in this work are significantly different from those developed by the Alternative Futures Group. Thus, the worlds reflect the opinions and research of the author and do not represent an official position of the Air Force or the AFITF.

20. Builder, Strategic Conflict Without Nuclear Weapons, 47.

CHAPTER 3

A VISION FOR THE AIR FORCE: COMMAND OF THE AEROSPACE

In our previous discussions we have developed an operational perspective and a technological perspective intended to be suitable for the research, development, acquisition, deployment, and employment of future aerospace forces. However, even though the operational and technological perspectives include aerospace systems and employment concepts that currently do not exist, these two perspectives are for the most part applicable today. This is an important point. Since the purpose of this work is to develop an aerospace vision that lays the foundation for future aerospace operations, the vision must provide a clear path between aerospace operations of today and those of the future, when these advanced aerospace systems and employment concepts are fully integrated into Air Force roles and missions.

With this purpose in mind, we will now fuse these operational and technological perspectives into an aerospace vision for the Air Force of 2025--command of the aerospace. The outline we will use for presenting the aerospace vision consists of (1) national security objectives and policies, (2) threats to US interests, (3) national and military strategies, (4) combat missions, and (5) a concept of operations. This outline was chosen so that the logic of the aerospace vision would be clear.¹ That is, the need for aerospace forces arises from US security interests and commitments. These interests are threatened by adversaries in ways that create contingencies that aerospace forces must be able to meet. National and military strategies about the manner and method of US responses are translated into aerospace missions as well as requirements for specific aerospace forces that, when employed through the Air Force concept of operations, are designed to provide the necessary capabilities.

With this general framework in mind, we will now present the national security objectives and policies for 2025 that the author feels are consistent with the previously discussed operational and technological perspectives. Clearly, the concepts of deterrence based on nonnuclear weapons and a balanced offensive-defensive aerospace force structure will dominate the discussion.²

National Security Objectives and Policies

The national security objectives of the United States in 2025 should remain essentially unchanged from those established in the late 1940s, except where necessary to include new US interests in space.³ The primary national security objective will remain the preservation of the security of the United States with its fundamental institutions and values intact. As a secondary objective, the United States will also seek to preserve the security of its allies and friends, recognizing the importance of the increased interdependence among nations. In addition, the United States will preserve the integrity of its alliances and where possible promote freedom of choice and self-determination for aligned and nonaligned nation-states. The overall long-term objective of the United States will be to promote the political, economic, psychosocial, and technological advances by all nations that facilitate the evolution of a more secure and peaceful environment on earth and in space. To this end, we will protect US and allied citizens and access to lines of communication and critical resources while limiting expansion of those regimes that threaten our vital interests.

In general, then, the national security policy of the United States in 2025 will entail the pursuit of the national security objectives above. With regard to military power, the declaratory national security policy of 2025 will be expanded not only to renounce "first-strike" military actions involving nuclear, chemical, or biological weapons, but also to renounce the "first use" of these weapons. Although the United States obviously will not renounce military actions using nonnuclear weapons to counter aggression by terrorists, hostile nonstate actors or nations, the national policy of the United States supports the defensive form of war described in chapter 1. Thus, the United States seeks to implement its national policy primarily through the political, economic, psychosocial, and technological instruments of national power.

Threats to US Interests

Although the Soviet Union will continue to be the major threat to the United States and its interests, Soviet-backed efforts will be mainly covert because of the growing cooperation between the United States and the USSR. Consistent with the World III "global" perspective, the United States views the current "regional" portion⁴ of conflict spectrum as a subset of global conflict in 2025.

Terrorism

The United States and the USSR will be key targets of both state and nonstate actors. Terrorism includes overt terrorist activities involving physical violence (possibly with low-yield nuclear weapons) and hostage taking. It also includes covert terrorist acts such as poisoning crops and water supplies and disrupting or manipulating military, government, and financial data bases.

Insurgency/Guerrilla Warfare

Based on growing cooperation with the United States, the USSR will engage only in covert efforts to change the balance of power away from the United States and gain influence in nations possessing critical natural resources. Insurgency will likely continue as the primary method used to displace one governmental regime with another. The key targets of insurgency/guerrilla warfare will be governments that have severe internal socioeconomic problems.

Civil Wars/Revolutions/CounterCoups

Consistent with the World III technological perspective, conditions should generally be improving; however, there will still be many "genuine" conflicts of this nature that occur without US or USSR instigation. Regarding Soviet involvement, we can again expect the Soviets to back only covert disruption of political and economic stability in areas where they perceive an opportunity to improve their alliances, their access to critical natural resources, or their economic assets. Conflicts of this nature will likely be carefully analyzed by the United States before open military hostilities occur so that other nonmilitary instruments of national power can be applied in support of US political objectives.

Conflicts Between Governments/Global Conflict

By 2025 both the United States and the USSR will rely on nonnuclear forces as the foundation of deterrence. For this reason as well as the growing cooperation between the United States and the USSR, the likelihood of global nuclear, chemical, and biological warfare should be relatively low. However, the US-USSR relationship will be highly competitive in the political, economic, psychosocial, and technological arenas. In addition, nonnuclear military instruments will be considered to be legitimate foreign policy tools and will be regularly employed on earth and in space by the United States and the USSR to combat violence

by terrorist organizations and developing nations. Thus, the likelihood of global nonnuclear warfare that could lead to nuclear warfare may be increased if the United States and the USSR are unable to control escalation in the lower levels of conflict.

Therefore, by 2025 the United States will no longer view bilateral or multinational disputes over terrestrial borders, "territories" in space, or political/ideological/religious beliefs affecting natural resources and economic/market access from a "theater" or "regional" perspective. Consistent with the "global" perspective of World III, the United States (through the aerospace battlefield control system and other intelligence-gathering resources) will attempt to determine before open hostilities the cause(s) of the problem, the key members of the opposing factions, and the most effective and appropriate response(s) based on its global commitments. Thus, the specific political and military objectives established to guide US involvement on earth or in space during bilateral or multinational disputes will be subsets of a larger set of political and military objectives involving all military forces.

Global Data/Information Manipulation and Psychological Operations

By 2025 these related threats will be viewed as subsets of global conflict. As such, the United States can expect covert attempts by all actors to subvert, disrupt, or compromise government and military data bases and to manipulate C I systems essential to the United States and its allies. In addition, the United States can expect many actors to attempt to influence the attitudes of the United States and its allies. From the US perspective, global DIM and psychological operations (PSYOP) will be absolutely essential across the spectrum of conflict in order to achieve US objectives by means other than armed conflict and/or to enhance US military operations.

Strategies

In 2025 the national and military strategies of the United States must combine the ends toward which the United States is striving (national security objectives) and the means (national security policies and military posture and forces) by which it is seeking to get there. Clearly, this is also true of the strategies of the United States today. Thus, the discussion that follows merely reflects the evolution of today's strategies consistent with the

operational perspective of chapter 1 and the World III technological perspective of chapter 2.

National

By 2025 the current strategy of containment designed to counter the spread of Soviet communism⁶ should evolve into a strategy of competitive cooperation that is based on the strength of US ideology as opposed to the strength of Soviet ideology. The competitive cooperation strategy of the United States consists of two elements: (1) an open ideological, political, and economic competition with the USSR based on our fundamental differences and (2) mutual cooperation in certain areas based on a common interest on the part of both nations in protecting themselves, as well as their friends and allies, from weapons of mass destruction. The enabling catalyst or glue for this strategy will be the information-related technologies previously discussed. By effectively fusing the United States' political, economic, military, psychosocial, and technological instruments of national power into a coherent pattern of employment consistent with its national security objectives, the United States will view US-USSR relations from a position of increased confidence, strength, and realism. With its new confidence and strength, the United States will begin to be viewed as the socioeconomic system to emulate, and Communist nation-states will be faced with the problem of countering a US ideological firestorm. Based on a greater international discernment and realism, the United States and the USSR will come to accept the differences between the two ideologies and seek areas of mutual cooperation that reduce the threat of a major US-USSR confrontation.

Military

Consistent with the national strategy of competitive cooperation and the declaratory national security policy that supports a defensive form of war, US military strategy will be dominated by neither offense nor defense. Rather, it will be a flexible strategy able to assume an offensive emphasis, a defensive emphasis, or a balanced but shifting offensive-defensive emphasis as the situation dictates to support the national command authority (NCA). Simply stated, the US military strategy will be a strategy of waiting for enemy aggression. Thus, it is imperative that the readiness, sustainability, and force dispositions of US military forces be capable of fending off an enemy initiative in one instant and in the next, or even simultaneously, be capable of seizing the initiative through integrated counterattacks directed against the enemy and enemy-controlled areas or assets on earth and in space.

The ends or military objectives of the US military strategy will remain the same as today's military strategy-- to deter attacks against the United States and its allies; to prevent an enemy from coercing the United States, its allies, and friends; and to provide the NCA with the flexibility to respond appropriately to aggression. However, the means or military forces capable of achieving these military objectives will be significantly different if they are to be consistent with the national security objectives, policies, and strategies of World III that call for a decreased reliance on offensive nuclear weapons and an increased reliance on offensive and defensive nonnuclear weapons.

From the US perspective, an effective US defense strategy of deterrence based on nonnuclear weapons must meet five tests. First, our nonnuclear forces must be able to counter a preemptive nuclear, chemical, or biological attack with sufficient strength and effectiveness to threaten the aggressor with losses that outweigh gains. Second, our nonnuclear potential must be perceived as effective across the spectrum of conflict. Third, our response to any attack must be credible enough that the potential aggressor believes we could and would carry it out. Fourth, the action to be deterred must be sufficiently clear to our adversaries so that the potential aggressor knows what is prohibited. And fifth, the risk of failure through accident, unauthorized use, or miscalculation must be minimized.

With these tests in mind, the US defense strategy of deterrence provided primarily by the nonnuclear MTO and MTD systems discussed in the previous chapter must effectively and totally integrate all land, sea, and aerospace forces. For if deterrence fails, the MTO and MTD systems, in conjunction with our land and sea forces, must be employed so as to control the level, intensity, and termination of terrestrial/space conflict on terms favorable to the United States and its allies. However, as we shall soon see, although land and sea forces will be vital, aerospace forces in general and space-based forces in particular should play the dominant role in most US military operations.

Combat Missions

For the United States as well as its enemies, the coherent pattern of employment for aerospace forces is a closed cycle comprised of the following sequential elements: survey, assess, command, generate defensive/offensive as ets, control, engage/attack, evaluate results, and continue the cycle until military objectives are achieved. Thus, aerospace warfare in its simplest form can be viewed

as the continuous interaction between two or more opposing cycles where each nation strives to employ aerospace power as an indivisible entity based on military objectives, threats, and opportunities. Although military objectives, threats, and opportunities constantly change during aerospace warfare, the fundamental effects and influences desired are constant. Therefore, in the author's opinion, the missions of aerospace forces in 2025 should be based on the specific effects and influences they produce as part of a coherent pattern of employment for aerospace forces and not by specific objectives, threats, organizations, weapon systems, or regions of the earth's surface or of the aerospace.

In the opinion of the author, the survey, assess, command, and control elements are not missions since they do not directly produce effects or influences. They are merely part of the process by which the aerospace missions that produce specific effects and influences are integrated into a coherent pattern of employment to achieve our national objectives. With this in mind, the ability to generate defensive/offensive assets, engage/attack, and continue the cycle until military objectives are achieved will form the basis for the fundamental missions of US aerospace forces in 2025. Therefore, there are only three aerospace missions contained in the pattern of employment-- aerospace offense, aerospace defense, and aerospace transport. By 2025 these missions will be conducted within or across both the atmosphere and space and will be directed against enemy assets in space or those launched from space against targets in the aerospace or on the earth's surface. Aerospace commanders may execute these interdependent missions unilaterally, with other services, or with other nations.

Aerospace Offense

Aerospace offense (AO) is the broad combat mission area involving offensive actions to produce specific effects or influences that are undertaken on US initiative and directed against an enemy or enemy-controlled area or assets at a time and place of US choosing. The objective is to seek out and neutralize or destroy an enemy's war-fighting or war-sustaining capabilities or will to fight. AO forces project the will and capability of the United States at all levels of conflict through the systematic application of force, electromagnetic energy, data manipulation, or PSYOP to a selected series of vital targets. Targets may consist of, but are not limited to, the enemy's key military, political, economic, psychosocial, and technological power bases. AO includes counteroffensive actions in and from the aerospace (1) to seek out and neutralize or destroy enemy land, sea,

and aerospace forces and their supporting infrastructures; (2) to neutralize, destroy, or temporarily degrade enemy land, sea, and aerospace defensive systems; (3) to interdict an enemy's military potential before it can be brought to bear effectively against friendly forces; (4) to support land, sea, and aerospace operations by attacking in and from the aerospace those hostile targets in close proximity to friendly forces; and (5) to control land, sea, and aerospace lines of communication.

Aerospace Defense

Aerospace defense (AD) is the broad combat mission area involving defensive actions to produce specific effects and influences that are undertaken in response to enemy initiatives and that are directed against the attacking enemy forces. The objective is to seek out and to destroy or neutralize enemy forces attacking the war-fighting or war-sustaining capability or the will to fight of the United States or its friends and allies. Thus, AD forces protect the will and capability of the United States at all levels of conflict by destroying or neutralizing the enemy's systematic application of force, electromagnetic energy, data manipulation, or PSYOP against the military, political, economic, psychosocial, and technological power bases of the United States and its allies. AD includes, but is not limited to, defensive actions in and from the aerospace that protect (1) the populations on earth and in space; (2) the land, sea, and aerospace forces and supporting infrastructures; and (3) the land, sea, and aerospace lines of communication of the United States and its allies.

Aerospace Transport

Aerospace transport (AT) is the broad combat mission area involving the specific effects or influences produced by deployment, insertion, extraction, and sustaining of friendly forces. The objectives are to deploy, insert, extract, and sustain military forces through the movement, rescue, recovery, and transference of personnel, equipment, and supplies. Thus, AT provides the means for continuing the aerospace pattern of employment at all levels of conflict until AO and AD objectives are achieved. During war, AT allows aerospace commanders to sustain aerospace forces and their essential combat support in critical areas. In peacetime, AT enhances national objectives by providing military assistance, supporting civilian relief programs, assisting civilian rescue activities, and demonstrating national resolve while reinforcing combat capabilities in specific areas.

Concept of Operations for 2025

In order to set the stage for the concept of operations that follows, we must first present a structural model of the Air Force in 2025. To this end, the structural model illustrated in figure 1 is intended to define the force structure of the Air Force and operational environment in which the Air Force will conduct aerospace operations in 2025. Consistent with the three missions of the Air Force in 2025, the Air Force should have operational command and resource management of the aerospace weaponry discussed in chapter 2. In addition, this force structure should include advanced stealth versions of the aerospace weapon systems that are standard issue today (bombers, fighters/interceptors, transports, and intercontinental ballistic missiles). The primary aerospace environment in which the Air Force will conduct its missions is from the surface of the Earth out to the orbit of the Moon. Consistent with the operating characteristics of the aerospace weaponry of 2025, the primary aerospace environment has two basic regions (atmospheric and cislunar), defined by concentric spheres extending out from the surface of the Earth to the Moon. The secondary aerospace environment in which the Air Force will conduct its missions is the region of space beyond the orbit of the Moon that includes translunar and interplanetary space.

In 2025 command of the aerospace will be a necessity. Command of the aerospace is defined as a state of affairs in which the United States is able to use the aerospace to achieve military objectives. Command of the aerospace does not mean supremacy in the aerospace or a preponderance of aerospace means but the state of affairs where US aerospace forces are able to achieve military objectives against a determined enemy who is unable to do the same. Therefore, in posturing its aerospace forces to command the aerospace, the Air Force should adhere to a bidirectional concept of defense-in-depth as illustrated in figure 2. That is, in deploying its MTO, MTD, AT, and ABC systems, the Air Force should provide defense-in-depth for both terrestrial conflict and space conflict.

With regard to terrestrial conflict, the first line of defense would be the earth-based and space-based aerospace forces capable of sustained aerospace operations against the terrestrial and low-earth-orbit (LEO) areas and assets controlled by the enemy. The second line of defense would be space-based aerospace forces capable of sustained aerospace operations against terrestrial, LEO, high-earth-orbit (HEO), and geosynchronous orbit (GEO) areas and assets controlled by the enemy. The third line of defense would be space-based aerospace forces capable of sustained aerospace operations against terrestrial and cislunar areas and assets

EMPLOY AEROSPACE POWER AS AN INDIVISIBLE ENTITY BASED ON OBJECTIVES, THREATS, AND OPPORTUNITIES

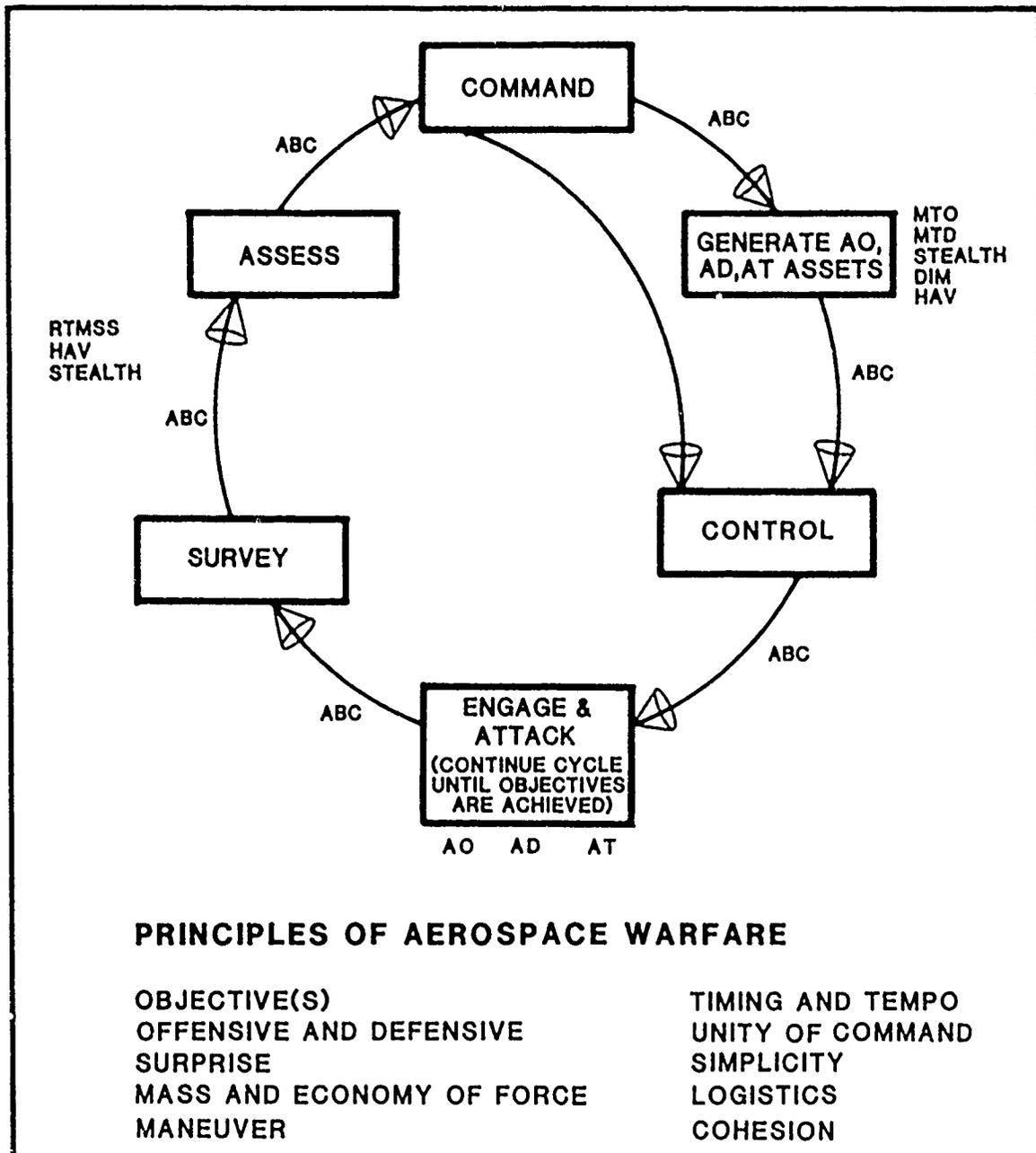


Figure 1. Structural Model for Aerospace Warfare

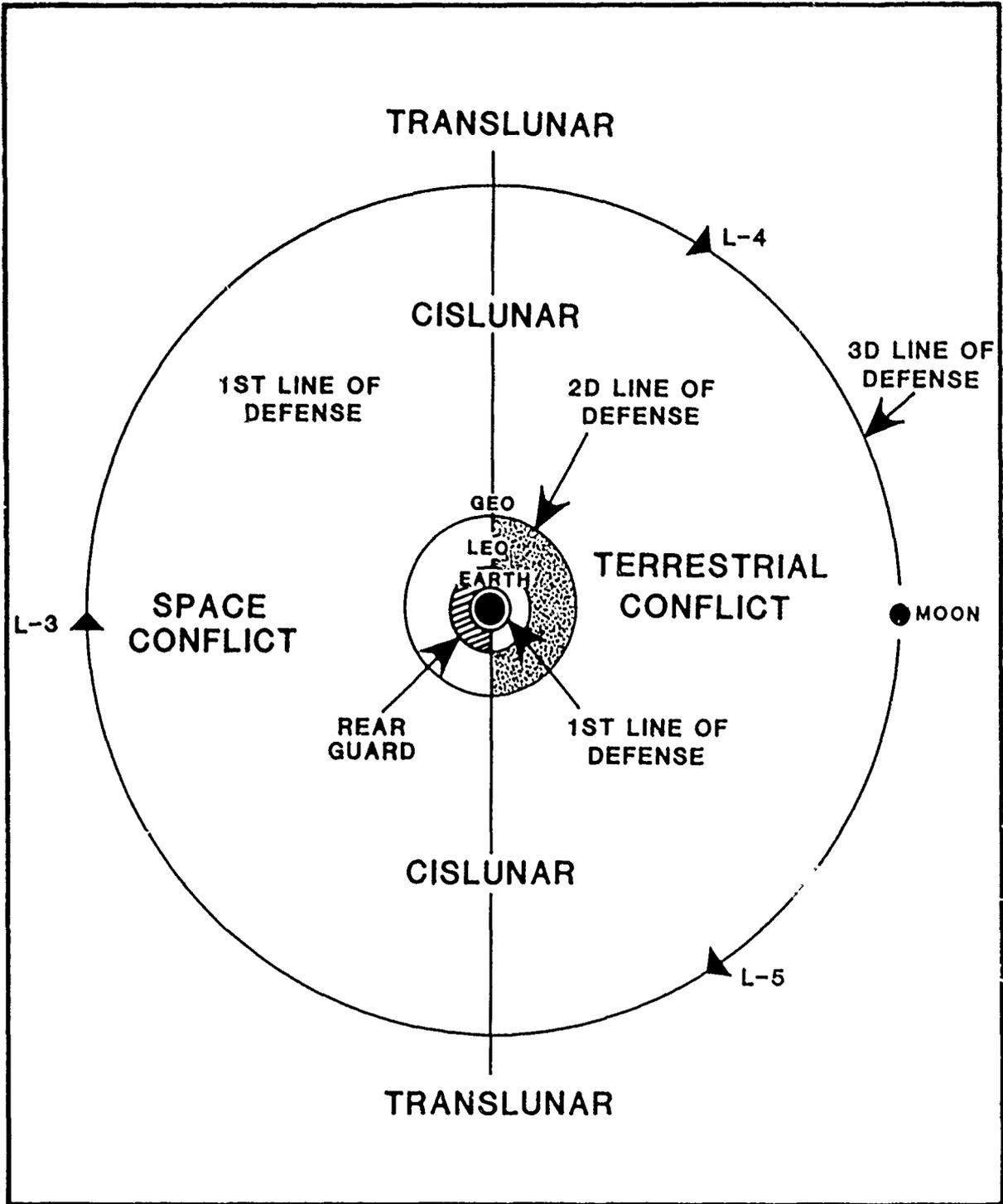


Figure 2. Bidirectional Defense-in-Depth

controlled by the enemy. Simply stated, with regard to terrestrial conflict viewed from an aerospace perspective, we would have forward deployed earth-based and LEO aerospace forces, second echelon HEO and GEO aerospace forces, and third echelon cislunar (e.g., lunar- and Lagrangian-based) aerospace forces.

With regard to space conflict, the defense-in-depth concept is reversed. That is, the lunar, Lagrangian, GEO, and HEO aerospace forces are considered to be forward deployed, and the earth-based and LEO aerospace forces are the second echelon or rear guard. The reason for this reversed defense-in-depth perspective is to protect and project US will and capability against enemy aggression in and from space.

This concludes our outline of the force structure and operational environment that the Air Force will use to conduct aerospace operations in 2025. In the discussion that follows, we will attempt to fuse the national security objectives and policies, threats, strategies, aerospace missions, force structure, and operational environment into a coherent concept of operations. However, it should be noted that the typical method for developing a concept of operations is to adopt a bureaucratic approach that aligns the concept of operations around "functional staff" aggregations (e.g., strategic offensive, strategic defensive, counter air, space operations, etc.). In the opinion of the author, it is virtually impossible to set goals or articulate transcendent priorities for aerospace forces of 2025 when the specific effects or influences to be achieved are divided among these overlapping and often competing functions (i.e., operations). With this in mind, the concept of operations that follows will be organized around the following principles of war:¹⁰ objective, the offensive and the defensive, surprise, mass and economy of force, maneuver, timing and tempo, unity of command, simplicity, logistics, and cohesion. These principles will ultimately guide the coherent pattern of employment of aerospace forces that seeks to employ aerospace power as an indivisible entity based on objectives, threats, and opportunities.

Objective

The most basic principle of success in any military operation is a clear and concise statement of a realistic objective. However, war is the furtherance of national policy by other means, and the object of war is to overcome the hostile will of the enemy or to impose our will on an enemy. Therefore, the intimate bond that ties war to politics must not be ignored. War is a means to achieving a

political objective and must never be considered apart from the political end. With this linkage between political and military objectives established, military objectives in 2025 will vary from the overall military objective of deterrence to the desired effect or influence of a specific engagement or confrontation. However, because of the nature and scope of specific effects or influences that aerospace forces can produce, the range of options available to the NCA as well as aerospace commanders for achieving military objectives will be greatly increased over those available today. To illustrate the increased options provided by aerospace forces, we will discuss the following key military objectives: deterrence, defense of vital interests on earth and in space, protection of space and sea lines of communications (LOCs), and power projection.¹¹

Deterrence. In 2025 the core of our defense strategy, as it has been for most of the postwar period, will be to prevent war by persuading potential adversaries that the costs of attacking us will exceed any gain they can hope to achieve.¹² To this end, the predominantly nonnuclear force structure of aerospace forces integrated into the coherent pattern of employment associated with this concept of operations would be available to the NCA. Consistent with the military strategy previously discussed, the range of options for responding to enemy aggression could now include defensive response options. Thus, our options would vary from a defensive response followed by threats of retaliation to a defensive response combined with a counterattack directed against both the enemy's homeland and his forces in the field.

However, the addition of defensive response options that complicate the enemy's attack could also provide the NCA with new ways to produce specific effects or influences that deter war. For example, consistent with our national strategy of competitive cooperation, the United States and the USSR could agree to jointly operate a portion of a space-based MTD system specifically designed to destroy ballistic missiles during boost phase. By way of illustration, if five or more ballistic missiles were simultaneously launched from a single or from multiple location(s), the joint system would automatically turn on and prepare to destroy the ballistic missiles. To prevent the impending engagement, both the United States and the USSR would have to veto the engagement within a small time window (seconds). If either nation failed to meet the time window, the engagement would continue; however, additional time windows would provide options for terminating engagements already in progress. Thus, the system would provide protection for both the United States and the USSR from a ballistic missile attack regardless of the source or intended target of the simultaneous launches. However,

since the system only turns on if five missiles are launched simultaneously, both nations would retain their options to threaten retaliation at levels below the agreed-upon threshold or to use aerospace weaponry other than ballistic missiles.

With or without such a competitive cooperation agreement, the United States could complement a MTD boost phase ballistic missile engagement with precise, nonnuclear MTO (e.g., PGM and directed-energy) counterattacks against uncommitted ballistic missiles in the enemy's homeland, further complicating an enemy's attack. However, because of the accuracy and low collateral damage associated with these weapons, the MTO will also provide additional options at lower levels of conflict. For example, the space-based elements of the nonnuclear MTO capable of engaging an aggressor's forces within minutes would likely be perceived as both "forward deployed" and "usable." Therefore, consistent with the declared military strategy that advocates the defensive form of war, the MTO could respond to enemy aggression on earth or in space with an immediate counterattack designed to produce a specific effect or influence that is appropriate for the situation. In addition, stealth platforms (e.g., bombers, fighters, and transports) would increase the options available to respond to highly sensitive crisis situations requiring unobserved access (e.g., terrorist activities involving hostages).

Defense of Vital Interests. Unlike today's situation where the credibility and prudence of relying on nuclear threats to respond to nonnuclear attacks is questionable,¹³ the predominantly nonnuclear aerospace force structure of 2025 will allow the United States to appropriately respond to nonnuclear attacks against the vital interests of the United States and its friends and allies both on earth and in space. In fact, because the predominantly nonnuclear MTO and MTD systems will likely be perceived as an effective and "usable" shield that is also capable of well-directed blows against such attacks, it seems more likely to assume that the United States in cooperation with its friends and allies, can effectively discourage most overt attacks against their vital interests on earth and in space. Unfortunately, because of the sophistication and, possibly, protracted nature of DIM and PSYOP activities, it is less certain that covert attacks against vital interests can be effectively deterred. However, the ability of the United States to respond to covert attacks will be increased by the ability of the aerospace force structure (e.g., primarily through DIM, RTMSS, and ABC assets) to detect and counter such attacks.

Protection of Space and Sea Lines of Communication.

With regard to sea lines of communication, by 2025 the Air Force should play a dominant role in protecting surface sea lines of communication. The capability of ABC assets to continually monitor the location of virtually all surface vessels, coupled with the "forward deployed" and "usable" nonnuclear aerospace weaponry previously discussed, should provide immediate options for protecting friendly surface vessels under attack as well as for initiating a counterattack against the aggressor. In fact, it seems reasonable to assume that because of the increasing vulnerability of naval surface vessels to aerospace weaponry, both the United States and the USSR will decrease their reliance on a "blue water surface navy" and will increase their reliance on aerospace weaponry and a subsurface navy by 2025. Clearly, this assertion flies in the face of a maritime strategy that sees naval surface vessels continuing as the primary means of protecting sea lines of communication. However, in keeping with the current efforts to identify and implement competitive strategies for deterrence,¹⁴ this assertion regarding naval forces is consistent with the strategy and aerospace force structure advocated in this work.

With regard to space lines of communication, the versatility provided by the unique capabilities of both manned and unmanned aerospace forces on earth and in space will provide the United States with a variety of viable options for producing effects and influences that deter attacks against space lines of communication. However, because of the vastness and characteristics of space, many of the space lines of communication will be extremely fragile. For example, as previously stated, by 2025 we can expect space lines of communication associated with a significant population of permanent and semipermanent space dwellers involved in the commercial exploitation of space. Consistent with the bidirectional concept of defense-in-depth regarding space conflict, the forward deployed aerospace assets will be faced with the dilemma that it may take hours or even days to effectively respond to overt enemy attacks against space lines of communication if directed-energy options are ineffective. In addition, covert attacks on earth or in space could interrupt space lines of communication for extended periods of time. With this fragility in mind, aerospace forces could provide some means of protection by routinely "patrolling" the space lines of communication in order to deter enemy attacks through an armed presence.

Power Projection. Again, consistent with the strategy of the United States advocating a defensive form of war, the aerospace force structure would provide the option of shielding the United States and its friends and allies while

the appropriate power-projection option was selected. The United States could then initiate a counterattack designed to produce specific effects or influences tailored to the provocation. Because of the tremendous power-projection capability inherent in the MTO, the United States will undoubtedly face criticism whenever the MTO is used for power projection. However, it is precisely because the United States has the capability and will to project power through the MTO that the United States can deter power projection by an enemy.

This concludes our discussion of the ways in which the concept of operations for future aerospace forces relates to key military objectives. It should be clear from this discussion that by relying on nonnuclear aerospace forces, the Air Force can satisfy the principle of the objective in furthering national policy across the spectrum of conflict.

The Offensive and the Defensive

Simply stated, the principle of the offensive is to initiate, attack, or counterattack, and the principle of the defensive is to respond or react. Unfortunately, these two principles are often viewed separately with an inviolate primacy attributed to one or the other.¹⁵ In the opinion of the author, this approach is counterproductive. It is the interaction between these two principles that dominates the art and science of war and not the individual principles. With the primacy of this interaction in mind, it is not surprising that both the operational perspective and technological perspective converged on the need for a balanced offensive-defensive perspective regarding future aerospace warfare.

Therefore, a balanced offensive-defensive perspective has been the central theme throughout the presentation of this 2025 aerospace vision. This was necessary to ensure that the individual elements of the syllogism (i.e., national security objectives and policies, threat, national and military strategies, missions, and concept of operations) are internally and externally consistent. For if the vision is to be useful in furthering national policy by other means, it must be a logical extension of each of these elements.

With this in mind, it should be abundantly clear that the principle of the offensive and the principle of the defensive are integral parts of this concept of operations since it includes both MTO and MTD aerospace forces. However, consistent with the coherent pattern of employment previously discussed, these aerospace forces are not employed independently. The fundamental premise of this

concept of operations is that the aerospace commander seeks to employ these forces as an indivisible entity based on objectives, threats, and opportunities.

As the direct link between the political objective and the military means to achieve that objective, the aerospace commander must understand the political imperatives that shape and define the specific effects and influences his forces are to produce. Armed with this understanding, the aerospace commander balances the desired effects and influences against the various threats and opportunities and initiates offensive, defensive, or a combination of offensive and defensive actions, as appropriate. Clearly, this process is a dynamic process since during the course of the conflict the objectives, threats, and opportunities will inevitably change. Herein lies the true strength of the balanced offensive-defensive force structure associated with this concept of operations because a preponderance of the MTO and MTD systems are capable of performing both offensive and defensive actions. Thus, the aerospace commander is able to shift the weight, phasing, and timing of offensive and defensive aerospace actions to produce the desired effects and influences as they change during the course of the conflict.

Surprise

The principle of surprise is to engage the enemy at a time, place, and¹⁶ manner for which the enemy is unable to react effectively. To this end, stealth platforms, DIM weaponry, and space-based directed-energy weapons are but a few examples of the aerospace forces available to achieve surprise through security, deception, audacity, originality, and timely execution. However, the combined capabilities of the aerospace force structure associated with this concept of operations offers the greatest potential for achieving surprise. By shifting the weight, phasing, and timing of offensive and defensive actions, the aerospace commander can unexpectedly reverse the military situation through defensive actions that generate opportunities to counterattack or change the direction and nature of the actions in a manner that disrupts the cohesion and fighting effectiveness of the enemy forces.

Mass and Economy of Force

Success in achieving military objectives requires effective implementation of the principles of mass and economy of force. The principle of mass is to concentrate aerospace power at the right time and place to overwhelm the enemy defenses or to defeat the enemy attack and secure the

objective. The principle of economy of force is to concentrate aerospace power with appropriate mass at the critical time and place without wasting resources on secondary objectives or without failing to take maximum advantage of available force where needed most.¹⁷ In the author's opinion, the concept of operations for the aerospace force structure previously described is ideally suited to the application of these principles. Through the ABC system, the aerospace commander is able to be constantly aware of the critical times and places of hostile attack, thus allowing him to shift the weight, phasing, and timing of both offensive and defensive aerospace actions to concentrate decisive aerospace power where it is needed most to overcome the enemy defenses or to thwart the enemy attack.

Another example relates to the principle of economy of force. The preponderance of the MTO and MTD force structures are made up of highly accurate nonnuclear weaponry capable of effective firepower over vast distances (e.g., HAVs and stealth bombers/fighters with PGMs, space-based PGMs, directed-energy systems, etc.). With these weapons linked through the ABC, the aerospace commander should be able to prioritize objectives and to apply appropriate mass at the critical time and place in order to achieve decisive results as quickly as possible. Therefore, the aerospace commander can secure multiple objectives either sequentially or simultaneously. Through the bidirectional concept of defense-in-depth, US aerospace power can simultaneously protect space and sea lines of communication while engaged in power projection on earth and in space. Through the ABC, the aerospace commander can adjust the weight, phasing, and timing of aerospace actions between these competing objectives as they are secured or as they become secondary, thereby avoiding expending excessive resources that could dissipate the strength of aerospace forces and render them incapable of achieving other key objectives.

Maneuver

War is a complex interaction of moves and countermoves. Maneuver is the movement of friendly forces or firepower in relation to enemy forces or firepower.¹⁸ The principle of maneuver is an integral part of the concept of operations for future aerospace forces. With regard to atmospheric systems, the speed, range, and flexibility of bombers, fighters, and transports when combined with stealth technology will greatly enhance their ability to maneuver effectively. With regard to transatmospheric systems (e.g., HAVs and advanced aerospace vehicles), their speed, range, and flexibility (their ability to make unpredictable changes

in orbital inclination or dip into the atmosphere to change course), combined with the range and maneuver of PGMs, will enhance their ability to maneuver effectively.

However, with regard to space-based systems, effective maneuver not only involves the movement of forces but also the movement of firepower. The maneuver of the individual space-based forces illustrated in figure 1 will be limited due to gravity considerations, vastness, and lack of adequate propulsion techniques.¹⁹ However, when we overlay a similar force structure of the Soviet Union as well as other nations, the inherent maneuver of these forces will affect the terms of every engagement. For example, the forces at a particular circularized orbital altitude and inclination will have relative motion (i.e., constant maneuver) with respect to forces on earth or at other orbital altitudes and inclinations. In addition, forces in elliptical orbits will have a wide range of relative motion (depending on velocity at apogee vice perigee) with respect to forces on earth or at other orbital altitudes and inclinations. Therefore, when we juxtapose friendly forces with enemy forces, we see that from the perspective of the aerospace commander these opposing forces are in a constant state of maneuver with respect to each other. Through the ABC, the aerospace commander can exploit this constant state of predictable maneuver by engaging the enemy's weaknesses while avoiding engagements with forces of superior strength. The aerospace commander can also initiate small orbital changes in individual forces (possibly stealth platforms) or even constellations of forces that over time will dictate the terms of engagement. Without a doubt, this predictable maneuver associated with space-based forces will be a key consideration in the application of the other principles of war.

As stated earlier, effective maneuver of space-based forces also involves the maneuver of firepower since the space-based directed-energy portions of the MIO and MTD systems can redirect (maneuver) their firepower over vast distances in a matter of minutes. For example, a portion of these MTO/MTD forces engaged with enemy forces in space could be directed by the aerospace commander to "maneuver" their firepower to engage enemy forces on earth as soon as the MTO/MTD forces are in effective firepower range. However, maneuver of firepower is not without risk since it could lead to loss of cohesion and control.

Timing and Tempo

Timing and tempo is the principle of executing military operations at a point in time and at a rate that optimizes the effectiveness of friendly forces and that inhibits or denies the effectiveness of enemy forces.²⁰ With regard to the concept of operations for aerospace forces, it is through the application of this principle that the aerospace commander seeks command of the aerospace. As described in the principle of maneuver, the space-based forces of the United States will be juxtaposed with similar forces of the USSR as well as other nations. Because of this dynamic balance of opposing forces where both the United States and the USSR occupy the same aerospace, the concept of aerospace superiority, or gaining control of the aerospace environment, must be expanded to include not only the use of the medium but also the objectives achieved through the medium. The reasons for this are (1) that the enemy's nonnuclear aerospace weapons will have the freedom of action and capability to attack the United States and its people, vital interests, and lines of communication without first overcoming the US forces in the field (i.e., direct attacks against the US homeland) and (2) that the enemy's forces can simultaneously attack US aerospace forces in the field (i.e., attempt to control the use of the aerospace medium).

Therefore, consistent with the military strategy advocated in this work, the first priority of aerospace power is to thwart such attacks (deny the enemy's objectives) and in the next instant or even simultaneously be able to initiate counterattacks (achieve US objectives). With this first priority in mind, the aerospace commander views control of the aerospace as a means towards the end of achieving that state of affairs in which US aerospace forces are able to achieve military objectives in the face of a determined enemy who is unable to do the same. This, as previously defined, is command of the aerospace. To achieve this state of affairs, the aerospace commander applies the principle of timing and tempo through a mix of offensive and defensive, surprise, mass and economy of force, and maneuver to exploit emerging and fleeting opportunities.

Unity of Command

Unity of command is the principle of vesting appropriate authority and responsibility in a single commander to effect unity of effort in carrying out an assigned task.²¹ This concept of operations for aerospace forces is predicated on the principle of unity of command. To take full advantage of the pervasive presence, versatility, and firepower of this predominantly nonnuclear aerospace force structure, a single aerospace commander must

be given authority and responsibility for the weight, phasing, and timing of all aerospace actions. The effective leadership of a single aerospace commander produces the coherent pattern of employment necessary to employ aerospace power as an indivisible entity based on objectives, threats, and opportunities. Through the ABC, this single aerospace commander uses the principle of timing and tempo to orchestrate the overall aerospace effort to achieve command of the aerospace.

Simplicity

To achieve a unity of effort toward a common goal, guidance must be quick, clear, and concise. It must have simplicity.²² The principle of simplicity is prevalent throughout this concept of operations for aerospace forces. Although the force structure is extremely complex, diverse collection of advanced technology systems, the concept of operations is designed to fuse this force structure into a simplified but coherent pattern of employment that employs aerospace power as an indivisible entity based on objectives, threats, and opportunities. The applications of the principle of simplicity inherent in this concept of operations will promote understanding, reduce confusion, and permit timely and appropriate accomplishment of objectives in the intense and uncertain arena of aerospace warfare.

Logistics

Logistics is the principle of sustaining both man and machine in combat by obtaining, moving, and maintaining war-fighting potential. Success in warfare depends on getting sufficient men and machines in the right position at the right time.²³ The concept of operations for aerospace forces incorporates the principle of logistics in all elements of the aerospace force structure. Through the aerospace transport forces, the aerospace commander maintains a high state of readiness in peacetime by sustaining aerospace forces at levels of provision adequate for war (e.g., on-orbit spares, wartime reserves, etc.). Logistical supply centers located in space (possibly at the stable Lagrangian points) should provide support for the space-based aerospace systems at lower levels of conflict. In addition, many aerospace forces will be highly autonomous with self-repair capability as a means to reduce the resupply frequency or permit faster repair. During all levels of conflict, the AT forces (e.g., HAVs, advanced aerospace vehicles, atmospheric stealth transports, etc.) are intended to provide a simple, secure, and flexible means of deploying, inserting, extracting, and sustaining friendly aerospace forces.

Cohesion

Cohesion is the principle of establishing and maintaining the war-fighting spirit and capability of a force to win.²⁴ The principle of cohesion is the underlying strength of this concept of operations for aerospace forces. As discussed in the previous chapter, by 2025 we can expect the president to become increasingly involved in aerospace operations since world opinion will view crisis situations as confrontations between the president and the leader of the belligerent nation or organization. Thus, the aerospace commander must instill in his people a unity of purpose through confidence in each other and in their equipment, leadership, and training that supports the president as the leader of the free world. To this end, the unity of purpose associated with this concept of operations is that the people involved with aerospace operations are the "protectors of peace with freedom." Consistent with the defensive form of war, US aerospace forces maintain a posture of waiting, secure in their strength and purpose that if called on, they will prevail.

This concludes what is intended to be an objective and well-reasoned description of an aerospace vision for 2025. Although most of this vision is merely an extension of current thoughts regarding the evolution of aerospace power, without a doubt there are elements of this vision that are controversial. In our final chapter we will review these issues and conclude with a discussion on the challenges facing current and future Air Force leaders.

NOTES

CHAPTER 3

1. Secretary of Defense Caspar W. Weinberger, Annual Report to the Congress, Fiscal Year 1987 (Washington, D.C.: US Government Printing Office, 1986), 31.

2. As a participant in the Air Force Innovation Task Force for six weeks in 1984, the author in collaboration with Lt Col Jim Ridenour and Maj Gene Gulick was successful in gaining support for submitting an innovation titled "Space: A Concept of Operations for 2025." Many of the thoughts in this chapter came as a result of discussions with these collaborators and were included in the concept of operations submitted to the Air Force. Their contributions and assistance were invaluable in helping the author overcome his own mental inertia.

3. Weinberger, Annual Report to the Congress, Fiscal Year 1987, 27.

4. Much of this 2025 threat assessment is based on the author's research in collaboration with Lt Cols Jim Ridenour and Zell Cantrell, Maj Gene Gulick and Barry McFarland, and Capt Wayne Sommars as part of the Air Force Innovation Task Force in 1984. In conducting research for this work, the author concluded that, with the exception of global conflict and global DIM and PSYOP, the threat compiled in 1984 was still appropriate for aerospace operations in 2025.

5. Weinberger, Annual Report to the Congress, Fiscal Year 1987, 33.

6. Ibid., 28.

7. The Organization of the Joint Chiefs of Staff, Military Posture FY 1986, Washington, D.C., 1.

8. Weinberger, Annual Report to the Congress, Fiscal Year 1987, 33. While these tests were written in the context of today's forces, as modified they should be equally valid in 2025.

9. G. Harry Stine, Confrontation in Space (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1981), 60. This book contains an excellent discussion on the military value of the Moon and the five Earth-Moon Lagrangian points. The aerospace forces deployed on the Moon or at the L-4, L-5 and possible L-3 positions would be an Air Force equivalent of present-day Navy carrier task forces; that is, their presence would be a powerful deterrent to enemy attacks

against US vital interests or space lines of communication in cislunar or translunar space.

10. AFM 1-1, Basic Aerospace Doctrine of the Air Force, 16 March 1984, 2-5 through 2-9. At the Space Doctrine Conference held at Space Command in November 1985, much was said regarding the lack of applicability of the principles of war to space operations. The author disagrees with this premise and has chosen to present the concept of operations for aerospace forces through the current principles of war as a way of illustrating their continued applicability for aerospace operations of 2025. With the exception of expanding the principle of security to become the principle of defensive coequal with the principle of offensive and removing the offensive emphasis in the other principles, the current principles of war required little modification to accommodate space operations.

11. Weinberger, Annual Report to the Congress, Fiscal Year 1987, 34. In the author's opinion, these key military missions or objectives will continue to be valid in 2025. However, the modifications to these objectives were necessary to accommodate a global vice regional perspective and space operations.

12. Ibid., 32.

13. Ibid., 34.

14. Ibid., 40.

15. AFM 1-1, 2-5. The changes and additions to the defensive are consistent with both the operational and technological perspectives previously discussed.

16. Ibid., 2-6.

17. Ibid., 2-7.

18. Ibid.

19. Maj Richard C. Goodwin, Military Space Doctrine for the Twenty-first Century (Maxwell AFB, Ala.: Air University Press, 1985), 29.

20. AFM 1-1, 2-8.

21. Ibid.

22. Ibid.

23. Ibid., 2-9.

24. Ibid.

CHAPTER 4

CONCLUSION

In the previous chapters, we developed an operational perspective for future aerospace operations that codified the interaction between a balanced offense and defense as the fundamental premise of aerospace power. In addition, we developed a technological perspective that seeks to provide a balanced, predominantly nonnuclear offensive and defensive force structure consistent with a coherent pattern of employment. We then combined these converging perspectives into an aerospace vision for future aerospace operations. Having satisfied the purpose of this work, in this final chapter we will review the key implications associated with the implementation of this aerospace vision and conclude with the challenges facing current and future Air Force leaders.

Given the scope of the aerospace vision advocated in this book, this is perhaps a more modest goal than anticipated. However, the decisions associated with the possible implementation of this vision will involve hard choices between costly alternatives as current and future leaders of the Air Force attempt to accommodate political, military, economic, psychosocial, and technological realities. Therefore, except to point out during the following discussions that the Air Force already has three specified commands with the offensive, defensive, and transport combat missions identified in this vision, the author will avoid the temptation to recommend specific changes regarding divestiture, reorganization, and resources. Such specific recommendations would tend to be confrontational at best and would detract from the fundamental purpose of this book--to develop an aerospace vision that lays the foundation for aerospace operations in the twenty-first century.

This is not to say that the vision is devoid of controversial issues. Clearly, any work of this nature (i.e., a future-oriented study) is likely to be controversial and subject to criticism since the future is extraordinarily difficult to predict. An infinite number of possible scenarios for the twenty-first century can be plausibly predicted, and a reasonably good case could probably be made for all of them. Therefore, in no sense does the author claim infallibility for this vision of the Air Force future. If this vision only serves to stimulate an awareness of the key issues involved and the critical necessity of addressing them in terms of the future, then the purpose of this work will have been admirably served.

With this in mind, there are six key points or outcomes associated with the implementation of the aerospace vision described in this work. They are (1) a balanced offensive-defensive emphasis vice offensive or defensive emphasis, (2) command of the aerospace vice aerospace superiority, (3) a global vice theater perspective, (4) an aerospace vice maritime strategy, (5) a nonnuclear vice nuclear deterrence strategy, and (6) a national strategy of competitive cooperation vice containment. Collectively, these outcomes represent the author's vision for the future of the Air Force that is in the best interest of the United States. In the discussions that follow, each of these outcomes will be addressed individually since they represent some of the key areas that current and future leaders of the Air Force must be aware of in shaping an aerospace force of 2025.

Balanced Offensive-Defensive Emphasis

The most important theme throughout this work has been the advantages inherent in a balanced offensive-defensive emphasis, both from an operational perspective and a technological perspective. With the imminent availability of defensive weaponry capable of thwarting the ballistic missile portion of the nuclear offensive,¹ there are those who seek a permanent ascendancy of the defensive over the offensive. Unfortunately, they overlook the obvious, as so eloquently expressed by Colin Gray: "Indeed, if there is no basic change in the terms of East-West political relations, it is sensible--taking the long view--to say that a mature defensive transition will be an offensive transition waiting to happen."² Of course, the potential defensive transition inherent in the Strategic Defense Initiative should be proof enough that the corollary--the current offensive emphasis is a defensive transition waiting to happen--is also true.

Thus, while aerospace power may experience periods of time where the principle of the offensive or defensive dominates, these periods should be recognized as relatively fleeting in the context of the long-term balance of power. Therefore, even in periods when it has a relative advantage in offensive or defensive aerospace power, the United States should resist sweeping offensive or defensive transitions in its objectives and strategies that usually only offer relatively brief periods (30 or 40 years) of unstable security. When viewed in the context of the long-term balance of power, a fundamental premise of aerospace power is that it should constantly seek to restore a balanced offensive-defensive emphasis where the preponderance of its forces are capable of both offensive and defensive actions.

In general, the implications of accepting this premise should have a restoring or stabilizing influence on

aerospace power. For example, with regard to the organization and resources of the Air Force, acceptance and implementation of this fundamental premise should signal an increase in the role of the Air Force specified commands and a return to the intent of the National Security Act of 1947, which established that the Air Force "shall be organized, trained, and equipped to perform prompt and sustained offensive and defensive air [aerospace] operations."⁵ It should also signal a departure from the seemingly endless missions and specialized tasks that have reduced the Air Force to a collection of internally competing functional staff aggregations. Unfortunately, it should also raise the specter of divestitures and realignments regarding roles and missions and force structure. Since the Air Force bases its total obligational authority (TOA) requests on these roles and missions, current and future Air Force leaders would have to evolve alternative criteria for determining their TOA requirements.

Command of the Aerospace

Throughout this work we have consistently advocated the fundamental premise of command of the aerospace vice aerospace superiority. As previously stated, in aerospace operations of today as well as those of the future, the United States faces a determined enemy capable of simultaneously (1) striking directly at our homeland or vital interests without first engaging US forces in the field and (2) attacking our forces in the field in order to control the use of the aerospace medium. Once again, the corollary is true--today and in 2025, an enemy faces a United States capable of simultaneously (1) striking directly at his homeland or vital interests without first engaging enemy forces in the field and (2) attacking his forces in the field in order to control the use of the aerospace medium.

Thus, we see that the conflict that has plagued aerospace power since Douhet will still be with us in 2025. For those forces striking directly at the homeland or vital interests, aerospace superiority means achieving that state of affairs that will permit successful penetration of the threat environment in order to achieve the objective. For those forces engaging enemy forces in the field, aerospace superiority is the continuous attempt to gain and maintain the capability to use the aerospace to perform our combat missions and to deny the enemy the use of the aerospace. As in our discussion of the principle of the offensive and the defensive, neither of these perspectives should be viewed as the inviolate "first priority" of aerospace power. It is the simultaneous interaction between these two perspectives that is the true strength of aerospace power. Thus, command

of the aerospace assumes that efforts to control the use of the aerospace medium will occur simultaneously with efforts to strike directly at the enemy's homeland or vital interests. With this in mind, command of the aerospace incorporates control of the use of the aerospace medium as a means toward the end of achieving that state of affairs in which US aerospace forces are able to achieve military objectives in the face of a determined enemy who is unable to do the same.

If the reader's concept of aerospace superiority includes these two simultaneous requirements (control of the medium and control of the military objectives achieved through the medium), then the difference between command of the aerospace and aerospace superiority is a moot point. However, if the reader's concept of aerospace superiority is that it is the first priority of aerospace power to gain and maintain the capability to use the enemy's aerospace to perform our combat missions and to deny the enemy the use of our aerospace, then there is a vast difference between command of the aerospace and aerospace superiority. If the first priority of aerospace power is to control the use of the aerospace medium with only a passing interest in the military objectives achieved through the medium, we may win the battle for control of the medium but lose the war.

Global Perspective Regarding Aerospace Operations

Clearly, the trend with regard to aerospace operations is toward a "global" perspective as opposed to today's "theater" perspective. As the predominantly space-based RTMSS, DIM, and ABC systems become fully operational, the Air Force should have routine access to integrated/fused intelligence over the entire surface of the earth either discretely (against a terrorist organization) or as a continuum (simultaneously over the entire surface of the earth). Armed with this information as well as the aerospace weaponry previously discussed, the Air Force views bilateral or multinational disputes as subsets of its global commitments. Although there may still be a "regional" specialist (i.e., unified commander), decisions regarding the employment of aerospace forces will be in support of a larger set of global political and military objectives involving all aerospace forces.

An Aerospace Strategy

Inherent in the aerospace vision described in this work is the potential for aerospace power to assume the dominant role in all military operations. The near-real-time to prompt presence of the aerospace weaponry discussed in this

work portends an end to the dominance of seapower (i.e., blue water surface navy) in influencing world history. As the future unfolds, the need for a maritime strategy featuring aircraft carriers as the key "players" may succumb to an aerospace strategy with the coherent pattern of employment associated with the MTO and MTD systems as its central element. Although the influence of seapower on history has clearly been a dominant factor, the influence of aerospace power on the future could be equally dominant.

Nonnuclear Deterrence

Another central theme throughout this work has been the fundamental premise that the United States could provide effective deterrence across the conflict spectrum with nonnuclear aerospace weapons. In accepting this premise, the Air Force would merely be aligning itself with the long-range goals of the United States. As stated by Secretary of Defense Caspar Weinberger:

Our goal, therefore, is to achieve a credible conventional deterrent. This is the first line of defense in a secure spectrum of deterrence that encompasses conventional, intermediate nuclear, and strategic nuclear systems. The closer we come to a credible conventional deterrent, the closer we are toward achieving President Reagan's more secure and safer world.

Thus, it appears that the future of aerospace power depends on the Air Force's ability to decrease its reliance on nuclear offensive weapons and to increase its reliance on nonnuclear offensive and defensive systems in a manner that provides an effective nonnuclear deterrent. The aerospace vision described in this work is possibly the key to achieving this goal.

Competitive Cooperation

Consistent with the five previous factors or outcomes we have associated with the aerospace vision described in this work is the real possibility for what may be the most important aspect of the US-USSR relationship of 2025--a growing spirit of competitive cooperation between the United States and the USSR. The fundamental premise of this competitive cooperation strategy is that the United States and the USSR accept the differences between their ideologies and seek areas of mutual cooperation that reduce the threat of a major US-USSR confrontation. As stated earlier, an enabling catalyst for a strategy of competitive cooperation with the USSR should be the information-related technologies

previously discussed. By effectively fusing the United States' political, economic, military, psychosocial, and technological instruments of national power, the United States will view US-USSR relations from a position of increased confidence, strength, and realism. The true value of this strategy is that it would seek to capitalize on the enduring strengths of the United States--its political and psychosocial values, diversified economy, advanced technology, and the ingenuity of its people--while attempting to reduce the Soviet's reliance on nuclear weapons (or other weapons of mass destruction) as their primary coinage of international power.

With this in mind, aerospace power will likely be a key player in such a strategy. For example, aerospace power is likely to be involved in thwarting Soviet-backed covert operations designed to undermine the influence of the United States. In addition, the United States may even be involved with the USSR in jointly operating aerospace systems that mutually benefit both the United States and the USSR. Thus, inherent in the aerospace vision described in this work is the increasing role of aerospace power as a primary military instrument of national power.

The Challenge to the Air Force

This concludes our discussion of the key implications or outcomes associated with the author's vision for the future of the Air Force. And now we will end as we began by noting once more that at the forefront of the winds of change in war today is America's increasing access to and dependence on space, which challenges the Air Force to determine how it should prepare for the impact of space operations on Air Force roles and missions. With this challenge in mind, the author has presented a vision for the future of the Air Force that (1) rejects the need for a separate service for space operations, (2) answers the fundamental question of how the Air Force should fight, (3) focuses our attention on future operations, (4) creates opportunities rather than simply reacts to events, and (5) responds to problems of policy in a consistent rather than a haphazard manner.

Thus, it remains but to state the challenge that faces current and future leaders of the Air Force. Today, the Air Force stands at the crossroads of time. Looking back in time, what the Air Force stands for is codified in its doctrine, organization, equipment, and people. Looking forward in time, it is the author's opinion that the Air Force should contribute to a future of opportunity and hope based on an aerospace vision that arouses people's energies to meet the challenge of securing our nation's future. To

this end, the author has sought a convergence of theory and technology in shaping an aerospace force for 2025 that is best suited to ensure peace with freedom for the United States. Clearly, the challenges facing current and future leaders of the Air Force in implementing this vision will be tremendous--but so is the reward of securing our nation's future.

NOTES

CHAPTER 4

1. Secretary of Defense Caspar W. Weinberger, Annual Report to the Congress, Fiscal Year 1987 (Washington, D.C.: US Government Printing Office, 1986), 287.

2. "SDI Necessary for National Security," Defense Science 2003 +, February-March 1985, 14.

3. AFM 1-1, Basic Aerospace Doctrine of the Air Force, 16 March 1984, 3-1.

4. Weinberger, Annual Report to the Congress, Fiscal Year 1987, 35.