The Missile Defense Systems of George W. Bush

Richard Dean Burns

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A Critical Assessment

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PRAEGER SECURITY INTERNATIONAL

AN IMPRINT OF ABC-CLIO, LLC
Santa Barbara, California • Denver, Colorado • Oxford, England

Library of Congress Cataloging-in-Publication Data

Burns, Richard Dean.
The missile defense systems of George W. Bush : a critical assessment / Richard Dean Burns.
p. cm.
Includes bibliographical references and index.
ISBN 978-0-313-38466-0 (hard copy : alk. paper) — ISBN 978-0-313-38467-7 (ebook) 1. Ballistic missile defenses—United States. 2. Ballistic missile defenses—United States—History. 3. Bush, George W. (George Walker), 1946– 4. United States—Politics and government—2001–2009. 5. United States—Military policy. 6. World politics—1989– I. Title.
UG743.B86 2010
358.1'740973090511—dc22 2010021795

ISBN: 978-0-313-38466-0
EISBN: 978-0-313-38467-7

14 13 12 11 10 1 2 3 4 5

This book is also available on the World Wide Web as an eBook.
Visit www.abc-clio.com for details.

Praeger
An Imprint of ABC-CLIO, LLC

ABC-CLIO, LLC
130 Cremona Drive, P.O. Box 1911
Santa Barbara, California 93116-1911

This book is printed on acid-free paper ♾

Manufactured in the United States of America

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Preface

President George W. Bush's controversial order to deploy a land-based ballistic missile defense in 2002, following the unilateral abrogation of the 1972 Antiballistic Missile [ABM] Treaty, did not end five decades of debate. Indeed, not only were old issues revisited but new ones arose, especially given the Bush administration's efforts to extend America's ballistic missile defense (BMD) network to Central and Eastern Europe. Nor did the Bush administration's efforts to use the new BMD system as a deterrent succeed in persuading the so-called rogue states of North Korea and Iran to halt their development of missiles or nuclear activities. This account, then, reviews the Bush BMD deployment after its first eight years and introduces the manner in which his successor, President Barak Obama, has sought to deal with the continuing issues. If this account's objectives are met, readers should have sufficient data to judge whether these issues have been adequately assessed by American leaders and, with the deployment of a missile defense system, whether the American public will actually be protected by the system.

For the preparation of the introductory chapters, I have revisited an earlier work, *The Quest for Missile Defense, 1944–2003* (2004), written in collaboration with Professor Lester H. Brune. The first three chapters provide a brief background regarding the research and development of various ballistic missile defense components as well as the pros and cons regarding the issue of actual deployment. A glossary is provided for easy reference to the acronyms used. A select bibliography is provided for those who wish to delve further into the issues. For those individuals uninitiated in the basic workings of ballistic missile and antiballistic missile systems, the chart following the Introduction may prove helpful.

Along the way, I have accumulated several debts. My wife, Glenda, encouraged me to stay with the challenge of preparing this study. My earlier coauthor, Lester H. Brune, provided a great deal of material for the initial study, some of which has found its way into this account. I especially wish to acknowledge the efforts of senior editor Steve Catalano at ABC-CLIO Praeger in steering this study through to completion.

Finally, I must acknowledge the vital assistance I have received from Philip Coyle; indeed, without his considerable efforts and material contributions it is unlikely that this book would have been completed. His reading of the manuscript and his willingness to share his extensive knowledge of the subject have helped me capture the technical features of the missile defense components. I owe Philip much for his encouragement, his kindness, and his perseverance.

Even so, I accept full responsibility for any errors that remain and all unattributed opinions offered in the text.

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Claremont, California

Abbreviations

ABL	Airborne Laser
ABM	Antiballistic Missile
ACDA	Arms Control and Disarmament Agency, U.S.
AEC	Atomic Energy Commission
ALI	Aegis Lightweight Exoatmospheric Projectile Intercept
ALTB	Airborne Laser Testbed
ARPA	Advanced Research Projects Agency
ATBM	Antitactical Ballistic Missile
BMD	Ballistic Missile Defense
BMDO	Ballistic Missile Defense Organization
BMDS	Ballistic Missile Defense System
BP	Brilliant Pebbles
CFE	Conventional Forces in Europe
CIA	Central Intelligence Agency
DAB	Defense Acquisition Board
DIA	Defense Intelligence Agency
DSB	Defense Science Board
EKV	Exoatmospheric Kill Vehicle (exoatmospheric = outside the atmosphere; endoatmospheric = inside the atmosphere)
ERIS	Exoatmospheric Reentry Interceptor Subsystem
FAR	Forward Acquisition Radar
FOAB	Father of All Bombs
GAO	General Accounting Office, U.S.
GAPA	Ground-to-Air Pilotless Aircraft
GMD	Ground-based Midcourse Defense (G. W. Bush)

GPALS	Global Protection Against Limited Strikes
GPS	Global Protection System
H-bomb	Hydrogen bomb
HEDI	High Endoatmospheric Defense Interceptors
HOE	Homing Overlay Experiment
ICBM	Intercontinental Ballistic Missile
INF	Intermediate-range Nuclear Forces
IRBM	Intermediate Range Ballistic Missile
JIAMDI	Joint Integrated Air and Missile Defense Organization
JLENS	Joint Land Attack Cruise Missile Defense Elevated Netter Sensor
LAR	Local Acquisition Radar
LPAR	Large Phased-Array Radar
MAD	Mutual Assured Destruction
MDA	Missile Defense Agency
MEADS	Medium Extended Air Defense System
MIRV	Multiple Independently Targeted Reentry Vehicle
MOAB	Mother of All Bombs; also Massive Ordnance Air Burst
NATO	North Atlantic Treaty Organization
NMD	National Missile Defense (ground-based-Clinton)
PAC-3	Patriot Advanced Capability-3
PATRIOT	Phased Array Tracking Intercept of Target
SAC	Strategic Air Command
SALT I	(1st) Strategic Arms Limitation Treaty (Talks)
SALT II	(2nd) Strategic Arms Limitation Treaty (Talks)
SAM	Surface-to-Air Missile (Soviet)
SBIRS-High	Space-Based Infrared System
SCC	Standing Consultative Commission
SDIO	Strategic Defense Initiative Organization
SLBM	Submarine-Launched Ballistic Missile
SM	Standard Missile
START	Strategic Arms Reductions Talks
START I	(1st) Strategic Arms Reduction Treaty
START II	(2nd) Strategic Arms Reduction Treaty
THAAD	Theater High-Altitude Area Defense
TMD	Theater Missile Defense
UHF	Ultra High Frequency
ZAR	Zeus Acquisition Radar

Introduction

The development of ballistic missiles by Nazi Germany launched the United States on a quest for the means to defeat this new weaponry. America's first Secretary of Defense James Forrestal supported this effort, because he believed that history has shown "that all new weapons always developed a countermeasure, beginning with what the Romans developed to counteract Hannibal's use of elephants." He did recognize, however, that technology could not always ensure success. Yet technical and operational capabilities of various ballistic missile defense (BMD) systems quickly garnered considerable attention from government officials, military officers, the scientific community, and a segment of the public. Gradually this attention spread to the broad political and strategic aspects of the BMD quest, along with the financial costs of its many projects.[1]

Those individuals subsequently advocating the deployment of BMD systems have based their demands on "threats" that changed frequently. During the Cold War, it was the threat of Soviet intercontinental ballistic missiles (ICBMs) and an occasional concern with mainland China's missiles. The BMDs were vital, according to these advocates, either to enhance and preserve the deterrence system, to serve as "bargaining chips" in negotiations, or to fend off accidental or unintended launches. In subsequent years, their attention focused on the so-called rogue nations, such as North Korea and Iran, who were thought to be developing nuclear weapons that could be attached to their missiles. Fear of these real and alleged activities persuaded neighboring countries such as Japan, South

Korea, India, and Israel to deploy various types of BMD systems. After the 9/11 attacks, Washington justified the use of BMDs as protection from terrorists.

President George W. Bush's decision to proceed with the deployment of an ABM defensive system in 2002 was the culmination of a series of increasingly partisan political controversies that reached back to the 1950s. During this half-century, three contentious debates witnessed increasingly insistent demands, which were equally aggressively criticized, to deploy the existing components. The first debates that spanned the presidencies of Eisenhower, Kennedy, Johnson, and Nixon arose in response to the army's deployment request in 1955 and to the Johnson-Nixon decisions to construct a rudimentary BMD system in the late 1960s. The controversy temporarily abated with the bilateral ABM Treaty of 1972. This initial debate was waged largely between the White House, the Pentagon, and Congress; only occasionally did it extend into the public arena. The second controversy, this time quite public, stemmed from President Ronald Reagan's startling request, in a speech on March 23, 1983, for the scientific community—that had created the nuclear-tipped ICBMs—to develop the means of shielding the American public from the consequences of their possible use. The Reagan administration's eagerness to develop and deploy a BMD system encountered several political and technical obstacles that eventually diminished enthusiasm for immediate deployment. His successor, President George H. W. Bush, reacted to the lack of technical progress by postponing deployment while the administration concentrated on the essential research and development needed to improve the various ABM components.

Reagan and his supporters' much publicized efforts, however, succeeded in making BMD deployment a partisan political issue. Indeed, they stitched it onto the ideological fabric of the Republican Party. The final contentious debate, stimulated by partisan politics and the July 1998 Rumsfeld Commission Report, found a Republican Congress demanding that the Clinton administration immediately deploy the existing ABM components. If President William Clinton ultimately rebuffed these partisan efforts, his successor George W. Bush moved with alacrity to abrogate the 1972 ABM Treaty and, subsequently, to order deployment of a controversial land-based BMD network in Alaska and California.

The American electorate has had considerable difficulty following the various arguments related to BMD systems. Pollsters discovered that the heated political exchanges over the deployment issue apparently served largely to confuse the electorate. A public opinion survey taken in late July 1998, for example, indicated that two-thirds of all Americans erroneously believed that a missile defense system *already existed* to protect them from a nuclear attack![2] The public's confusion over the status of missile defenses was undoubtedly due to a variety of reasons. Among the more obvious of these has been an overconfidence in America's technological

abilities, the public relations strategies of missile defense proponents and contractors, and the partisan political approach to the issue.

* * *

The contentious debates frequently centered on three basic issues: the financial expense, operational reliability, and impact on international strategic stability of ballistic missile defense systems. The fiscal cost of BMD efforts from 1945 to 2002 was substantial. Since the end of World War II, thousands of scientists and technologists had spent hundreds of thousands of hours seeking to develop effective antimissile components including specialized computers and their software, radar units, and interceptor missiles. Beyond extensive basic research, these specialists had developed experimental components and conducted tests of various ABM systems for more than 50 years at the cost of well over $120 billion. From 2002 to 2008, President George W. Bush's Missile Defense Agency (MDA) spent an additional $57 billion on development, deployment, and procurement of its antimissile systems. However, as Richard F. Kaufman and others pointed out in their concise study, *The Full Costs of Ballistic Missile Defense*:

> When a program requires many years of development, production, installation, and operation, the costs incurred at the beginning will be misleadingly low as to the ultimate cost of the system. As weapons systems have become more sophisticated and more complicated, this disparity between ultimate and immediate costs has grown. But few, if any, military or other systems match the long-run nature of the commitments involved in ballistic missile defense.

After thorough examination of the factors involved, these analysts concluded the long-run costs "could mount to the neighborhood of one trillion dollars." In a somewhat similar vein, the General Accounting Office (GAO) has pointed out "the cost to operate and support a weapon system traditionally accounts for over 70 percent of the total cost over the system's lifetime." Consequently, "the resources needed to operate and support BMDS could be significant over time." The GAO also noted in a March 2009 report that various MDA's ballistic missile defense systems have experienced cost overruns and vague accounting procedures. During the last few years, members of Congress, not surprisingly, have gradually began to ask more questions regarding the budgeting for the MDA's antimissile systems.[3]

Critics have persistently questioned the operational reliability of various ABM components and, especially, proposals for the deployment of these units as BMD systems. One measure of an antimissile's performance was its authorized tests, but confusion often surrounded the assessment of the test results. This skepticism stemmed from the Pentagon's early antimissile tests claims, which initially were widely touted

as successful but later found to be largely bogus. Media coverage of an antimissile test initially echoed the Pentagon's claims, but rarely clarified the specific nature of the actual test. Even an accurate, widely heralded "successful" test does not necessarily indicate that an antimissile system is operationally effective, because most of these tests have been heavily scripted. That is, the early tests were conducted with the target trajectory known in advance and at a lower altitude and slower speed than a hostile intercept would undoubtedly require, and some early test targets carried a transponder whose data were used to direct the interceptors toward the target area. Data defining the mock warhead were usually fed into the "kill" vehicles before their attempted intercept in order for them to locate the mock warhead among other objects, including decoys, in the area. When challenged, the Pentagon has readily admitted that its antimissile tests were scripted, but it defends these practices as necessary because of range limitations, safety considerations, and a lack of radar coverage across the entire test area. Also, missile defense officials point out that the first test for a new aircraft is to see if it will taxi properly; thus they insist scripted tests allow for the step-by-step determination of which individual pieces of equipment function properly and which require modification. Critics have continually challenged the Pentagon's evaluation of flight test results by pointing out that these activities, even if they accomplished their objectives, did not take place in a "real-world environment."[4]

Consequently, skeptics pointed out that the Bush administration undertook to deploy a system that the Pentagon could not certify as an operationally reliable BMD system capable of protecting the continental United States from an attack by a barrage of enemy intercontinental ballistic missiles or, perhaps, even a single missile. Indeed, it is difficult to assess the status of the U.S. missile defense systems, as a former assistant secretary of defense and director of weapon testing at the Pentagon, Philip Coyle, has emphasized, because "the current programs have no operational criteria for success." Consequently, he pointed out to the House Subcommittee on Strategic Forces in 2009, that it is very difficult to evaluate the system until one knows: "How good is the system supposed to be? Is 10% effectiveness good enough? What about 1%? Can the system handle realistic threats as documented in Intelligence Community threat assessments? How many interceptors should be required to defeat one target?"[5]

Then, too, there are serious considerations regarding actual "realistic operational conditions" that are rarely mentioned. Any adversary's use of several ICBMs to challenge America's ballistic missile defenses would involve nuclear warheads; the BMDs are not designed to intercept scores of bomblets loaded with biological weapons. In the case of such an ICBM attack, some enemy warheads could breach U.S. defense and reach their target, some enemy missiles may be equipped with warhead fuses that trigger the warhead just before defensive interceptors arrive, and some enemy warheads may explode when hit by an interceptor. Any nuclear

weapons that were triggered would produce mushroom clouds, blast, neutrons, x-rays, and fire storms, creating a disruptive nuclear environment. Such an environment could affect missile defense interceptors, satellites, and command and control installations, especially radars. Apart from the potentially chaotic nuclear environment, realistic operational conditions include the other dizzying aspects of warfighting and the fog of war that include such events as bad weather or the angle of the sun relative to infrared sensors. Although U.S. officials have frequently made exaggerated claims about the reliability and dependability of the nation's antimissile systems, they seldom consider the very real difficulties of trying to maintain BMD systems during a nuclear assault. As the director of Operational Test and Evaluation described it in the Survivability section of his January 2009 report to Congress, "Specific assets are unhardened to nuclear, biological, or chemical attack."[6]

* * *

The impact of BMD systems on the international strategic environment has often been a stated concern. As nuclear arsenals expanded in the 1960s, and the concept of deterrence grew, strategic theorists gradually linked the new idea with such descriptive words as "creditable," "effective," and "stable." These theorists also speculated about various ways in which the expanding nuclear arsenals might be employed. A "first strike" might occur when one nation thought it could unleash sufficient nuclear forces to overwhelm its foe and achieve a decisive victory. A closely related scenario, a "preemptive strike," called for launching a nuclear strike when a state anticipated its enemy was preparing to launch a first strike. A "retaliatory strike" or "second strike" would occur after a nation had absorbed a nuclear first strike and launched a retaliatory strike sufficient to ensure the destruction of the attacker. When each adversary possessed sufficient nuclear weaponry to conduct a second strike, theorists held, de facto deterrence became a reality. As Secretary of Defense Robert McNamara clarified this situation, "assured destruction" was less a particular policy or doctrine than it was *a strategic reality*. Many individuals pointed out that the U.S.'s vast nuclear arsenal and global delivery capabilities were more than adequate to deter a ballistic missile attack from any nuclear-armed state.

Advocates of BMD deployment have argued that terrorist groups were likely to seek missiles for use against American targets, but no nation was likely to allow terrorists to launch a ballistic missile from its territory because the host nation would risk instant retaliation and annihilation. Should foreign terrorists, according to several analysts, choose to use weapons of mass destruction, they would likely employ a ship or truck to carry them to their targets. After all, long-range ballistic missiles, which are complicated to load, aim, and launch, would likely be beyond the ability of covert terrorists. In this context, America's greatest threat, in one commentator's words, is not from rogue states, but from stateless rogues.

Those individuals who believed the mutual deterrence syndrome to be immoral hoped they could escape from it by building a missile defense system. According to James M. Lindsay and Michael E. O'Hanlon, "a national security policy that deliberately leaves the American people vulnerable to attack when technology makes it possible to protect them is immoral and unacceptable. Not only does it fly in the face of common sense to leave the nation undefended, but it could hamstring America's role in the world." Other proponents of establishing BMD systems argued that governments hostile to the United States possessing ballistic missiles might believe they could challenge America's worldwide interests and deter Washington, without a missile defense, from resisting the threat. Then, too, without an adequate missile defense, U.S. allies might question Washington's willingness to honor its security pledges and thus lessen U.S. global influence.

Additional questions have arisen regarding the possible destabilizing effect of ABM systems on the strategic environment. The Bush administration undertook to expand its BMD network into Central and Eastern Europe, ostensibly to detect and destroy any Iranian missiles aimed at European countries or the United States. This projection of American influence and power aroused the ire of the Russians and led to mounting tensions. Moscow viewed Washington's efforts to develop BMD sites in Poland and the Czech Republic as an infringement on its sphere of interest. Although the administration sought to ease tensions by insisting these new BMD sites did not threaten Russia's ICBMs or its security, this rationale was found unacceptable in Moscow. The White House sought to launch the construction of the European extension of its BMD system before the Bush administration ended despite the destabilizing effect such action might have on the relations between the two countries. "Such an approach," the Arms Control Association's executive director, Daryl G. Kimball, wrote, "is mistaken and reckless."[7]

The Obama administration inherited this ongoing dispute and the search to find a solution. In a speech on November 10, 2009, General Kevin Chilton, head of the U.S Strategic Command, pointed to the risks involved in creating an elaborate BMD program. As reported by Reuters and other news outlets, he explained that a U.S. missile defense system that is too robust could actually backfire and become destabilizing, prompting countries like China to expand their nuclear arsenal. Chilton explained, "We have to be cautious with missile defense. Missile defense can be destabilizing depending on how you array it." Certainly a BMD deployment might have a destabilizing impact on its relations with allies and adversaries. Would rival nations fear that the United States—believing it to be impervious to retaliation—might begin pressing them to conform to Washington's wishes or face serious consequences? Would missile defenses thus create a potential "first strike" situation? Would such activity impede strategic arms limitation efforts and launch a new strategic arms race? Is the next step to place weapons in space? Would U.S. missile

defenses renew the strategic nuclear arms race? Thus, BMD critics have contended that a nationwide missile defense could result in an adversary considering several options: launching a first strike, engaging in an arms race in outer space, or expanding their fleet of ballistic missiles and arsenal of weapons of mass destruction. In any of these, as well as other detrimental circumstances, Americans might find themselves with less, rather than more, security.[8]

* * *

The United States has not been alone in the pursuit of a missile defense system. The Soviet Union and, later, Russia have shown an interest in pursuing antimissile systems during the past five decades. "Soviet and Russian defence policy decisions," British analyst Jennifer Mathers has noted, "were shaped by a combination of domestic and international factors and by the agendas and priorities of individual political and military leaders as well as the constraints and opportunities of the environments in which they operated."[9] All in all, Moscow's decisions throughout were driven by fears and special interests, such as their powerful military industrial complex.

The Soviet Union expended considerable scientific talent, technological effort, and rubles, largely unsuccessfully, to develop an antimissile system for the protection of its major cities from ballistic missiles. During the Cold War, U.S. intelligence agencies attempting to follow these activities, often erroneously credited the Soviets with undeserved successes. American Cold War hawks then frequently used these claims to press various administrations to deploy one or another of the nation's fledgling missile defense systems. The recognized inadequacies of their early deployments around Leningrad and Moscow in the 1960s led Soviet leaders to join President Nixon in the bilateral 1972 ABM Treaty to limit the development and deployment of missile defense systems.

President George W. Bush's unilateral abrogation of the ABM Treaty in 2002, to pave the way for deployment of a nationwide missile defense system, forced Russian leaders to discuss reviving their pursuit of antimissile development. Moscow's limited resources, however, greatly hindered a serious BMD undertaking. Instead, the Russians opted to equip their existing ICBMs with various sophisticated decoy devices and to build more and more accurate ICBMs designed to overwhelm any American BMD system. Beijing officials revealed concern and irritation that their ICBMs might be the real reason for Washington's BMD deployment and began reassessing their missile arsenal. The Bush administration, however, insisted that the termination of the ABM Treaty and deployment of a land- and sea-based antimissile network were designed to counter any ICBMs from the so-called rogue nations—Iran and North Korea.

Although there has been an increase in the number of ballistic missiles around the world, there are legitimate questions as to whether national BMD systems are the only way to deal with the problem. Even if most

of the world's missiles are in the hands of governments that generally have friendly relations with the United States, perhaps more emphasis on controlling the proliferation of ballistic missiles might supplement BMD efforts. While missile nonproliferation and missile defense are directed against the same threats, according to former member of the U.S. Arms Control Agency Richard Speier, "in practice there are gaps and potential conflicts between nonproliferation and defense strategies." But, according to Speier, it should not be a situation of missile controls versus missile defenses. The Missile Technology Control Regime (MTCR) focuses on controlling, often restricting, transfer of ballistic missiles and, as such, has established a set of stringent rules governing their export. U.S. export of antimissile interceptors that approach and/or exceed the MTCR's 500 kilogram/300 kilometer line—such as the SM-3, the ground-based missile system (GBM), Israel's Arrow—invites the weakening of controls. If the MTCR's principle of restraint were damaged, and a large numbers of transfers were made, there is the danger that the basic rocket systems of these large interceptors might be used as the basis for offensive missiles. One solution that makes military and nonproliferation sense would be to have centralized control of these interceptors, especially among allies, rather than transferring ownership. "The key for missile defense policymakers," according to Speier, "is to avoid demonizing the MTCR and to look more broadly at export vulnerabilities and operational realities."[10]

* * *

The chapters that follow review the pros and cons raised by Americans regarding a decision to deploy an antimissile system. These chapters provide information regarding such a decision and address a wide range of considerations, not exclusive to the following:

1. Is the missile threat believable?
2. Is BMD the most effective way to deal with a potential foe?
3. Can raid attacks and countermeasures limit the effectiveness of a BMD system?
4. Are the benefits of a BMD worth the cost?
5. How reliable are the BMD systems?
6. Has their reliability been subjected to operational testing?
7. Can a BMD destabilize international strategic security?

If this account's objectives are met, readers should have sufficient data to judge whether these considerations have been adequately assessed by American leaders and, with the deployment of a missile defense system, whether the American public will actually be protected.

Certain themes, ideas, and data are central to grappling with this topic. Consequently, the reader may find some of these reiterated in the text because the author believes these concepts or data warrant repeating.

BALLISTIC MISSILE BASICS*

Ballistic missiles are classified by their maximum range, which is a function of the missile's engines (rockets) and the weight of the missile's warhead. To add more distance to a missile's range, rockets are stacked on top of each other in a configuration referred to as staging.

There are four general classifications of ballistic missiles:

- **Short-range** ballistic missiles, traveling less than 1,000 kilometers (approximately 620 miles)
- **Medium-range** ballistic missiles, traveling between 1,000–3,000 kilometers (approximately 620–1860 miles)
- **Intermediate-range** ballistic missiles, traveling between 3,000–5,500 kilometers (approximately 1,860–3,410 miles)
- **Intercontinenta**l ballistic missiles (ICBMs), traveling more than 5,500 kilometers

Short- and medium-range ballistic missiles are referred to as theater ballistic missiles, whereas ICBMs or long-range ballistic missiles are described as strategic ballistic missiles. The ABM Treaty prohibited the development of nationwide strategic defenses, but permitted development of theater missile defenses.

All Ballistic Missiles Have Three Stages of Flight:**

- The **boost phase** begins at launch and lasts until the rocket engines stop firing and pushing the missile away from Earth. Depending on the missile, this stage lasts between three and five minutes. During much of this time, the missile is traveling relatively slowly, although toward the end of this stage an ICBM can reach speeds of more than 24,000 kilometers per hour. The missile stays in one piece during this stage.
- The **midcourse phase** begins after the rockets finish firing and the missile is on a ballistic course toward its target. This is the longest stage of a missile's flight, lasting up to 20 minutes for ICBMs. During the early part of the midcourse stage, the missile is still ascending toward its apogee, while during the latter part it is descending toward Earth. It is during this stage that the missile's warhead(s), as well as any decoys, separate from the delivery vehicle.
- The **terminal phase** begins when the missile's warhead re-enters the Earth's atmosphere, and it continues until impact or detonation. This stage takes less than a minute for a strategic warhead, which can be traveling at speeds greater than 3,200 kilometers per hour.

*Reproduced with permission from *Arms Control Today* (July/August 2002): 31–34.

**Short- and medium-range ballistic missiles may not exit the atmosphere or have a warhead that separates from its booster.

CHAPTER 1

Missile Defense to ABM Diplomacy: From Eisenhower to Nixon

A new aerial threat arose late in World War II when, in September 1944, Germany launched V-1 and V-2 missiles at England and Allied forces in France. The V-1 was an unmanned, jet-propelled cruise missile, virtually a flying bomb; the V-2 was a liquid-fueled ballistic missile that propelled itself during the launch stage and then fell freely in its descent toward its target. Each German missile carried about one ton of high explosives, but since they could not be aimed with any precision, they were essentially weapons of terror. Beginning on September 8, 1944, for example, the first of 500 German V-2 missiles hit London resulting in, by the time strikes ended on March 27, 1945, more than 2,500 deaths. Meanwhile, the Germans had launched literally hundreds of these primitive missiles against France, Belgium, Holland, Luxembourg, and advancing Allied forces. Fortunately, the war ended before the Germans could deploy a planned two-stage ballistic missile that apparently was intended to target New York City. Although the Allies bombed the launch sites, when they could be located, there was no defense against V-2s once they were in flight. Had the "V" weapons been available earlier, according to General Dwight Eisenhower, the Allies' June 1944 Normandy invasion might have been impossible without an antimissile defensive system.[1]

Since it is an axiom of warfare that once a new weapon appears there is a rush to develop defensive countermeasures, it is not surprising that the Truman administration immediately initiated ballistic missile defense (BMD) research. Both the U.S. Army and its Air Corps promptly initiated separate programs aimed at developing antimissile systems to counter the threat of short- and medium-range ballistic missiles. The