

Section 1

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This Background Paper describes and assesses current concepts for directed-energy ballistic missile defense in space. Its purpose is to provide Members of Congress, their staffs, and the public with a readable introduction to the so-called "Star Wars" technologies that some suggest might form the basis of a future nationwide defense against Soviet nuclear ballistic missiles. Since these technologies are a relatively new focus for U.S. missile defense efforts, little information about them has been readily available outside the expert community.

Directed-energy or "beam" weapons comprise chemical lasers, excimer and free electron lasers, nuclear bomb-powered x-ray lasers, neutral and charged particle beams, kinetic energy weapons, and microwave weapons. In addition to describing these devices, this Background Paper assesses the prospects for fashioning from such weapons a robust and reliable wartime defense system resistant to Soviet countermeasures. The assessment distinguishes the prospects for perfect or near-perfect protection of U.S. cities and population from the prospects that technology will achieve a modest, less-than-perfect level of performance that will nonetheless be seen by some experts as having strategic value. Though the focus is technical, the Paper also discusses, but does not assess in detail, the strategic and arms control implications of a major U.S. move to develop and deploy ballistic missile defense (BMD).¹

This Background Paper grows indirectly out of President Reagan's celebrated television speech of March 23, 1983, in which he called for a "long-term research and development program to begin

to achieve our ultimate goal of eliminating the threat posed by strategic nuclear missiles."² Pursuant to the President's speech, the Department of Defense established a Defensive Technologies Study Team under James C. Fletcher (of the University of Pittsburgh) to prescribe a plan for the R&D program. A parallel effort, called the Future Security Strategy Study and headed by Fred S. Hoffman (of Research and Development Associates), addressed the implications for nuclear policy of renewed emphasis on BMD. This Paper covers the same technologies and issues as these Defense Department studies. The ABM Treaty reached at SALT I³ severely restricts the development, testing, and deployment of BMD systems. Though this Background Paper treats the strategic roles of missile defenses, including many of their arms control implications, it does not treat the vital international political implications of a major U.S. move to BMD.

Focused on directed-energy intercept of missiles in their boost phase, i.e., on "Star Wars" proper, this paper does not analyze midcourse and reentry BMD systems or non-BMD applications of directed-energy weapons.⁴ "Star Wars" efforts generally further concentrate on intercept of intercontinental ballistic missiles (ICBMs) rather than the related but somewhat different problems of intercept of submarine launched ballistic missiles (SLBMs) or intermediate-range ballistic missiles (IRBMs). This Paper is therefore not a substitute for a more complete treatment of the entire subject of BMD.⁵ Moreover, BMD itself is only part of the larger subject of strategic defense, comprising defense against bombers and cruise missiles, civil defense, passive defense of military targets, anti-submarine warfare (ASW), and preemptive counterforce attack in addition to BMD.

¹ BMD is the most common of four roughly equivalent acronyms referring to defense against nuclear ballistic missiles. Such defenses were formerly called anti-ballistic missile (ABM) systems, but this designation fell out of favor after the debate over and eventual demise of the Sentinel and Safeguard ABM systems in the late 1960's and early 1970's. BMD largely replaced ABM as the term of choice, but recently the more self-explanatory Defense Against Ballistic Missiles (DABM) has gained popularity. Within the Executive Branch, BMD efforts pursuant to President Reagan's so-called "Star Wars" speech are referred to as the Strategic Defense Initiative (SDI). Informally the term strategic defense comprehends other methods of limiting damage from nuclear attack besides BMD.

² The relevant portions of President Reagan's speech are reproduced in Appendix A.

³ The ABM Treaty and related documents are reproduced in Appendix B.

⁴ Appendix C describes briefly, but does not assess, other proposed military applications of directed-energy weapons.

⁵ For a more complete treatment, see *Ballistic Missile Defense*, ed. Ashton B. Carter and David N. Schwartz (Brookings, 1984).

It is unusual for the President to express himself on, and for the Congress and public consequently to concern themselves with, long-term research and development. "Star Wars" is thus a somewhat unusual subject for a technology assessment intended for a public policy audience. It is in the nature of this subject that unknown or unspecified factors outweigh what is known or can be presented in concrete detail. Many of the technologies discussed in this Paper, and most certainly all of the schemes for fashioning a defense system from these technologies, are today only paper concepts. In the debate over the Safeguard ABM system a decade ago, or over basing modes for the MX missile in recent years, one could analyze in detail the technical properties of well-defined systems in engineering development. So vague and tentative are today's concepts for "Star Wars" BMD that a comparable level of analysis is impossible. Fashions and "front runners" are likely to change. Nonetheless, one is faced with assessing the concepts receiving attention today within the Executive Branch and which underlie the President's Strategic Defense Initiative. Fortunately, judgments deduced from generic properties of these concepts, which are unlikely to change, are sometimes telling.

This Paper is based on full access to classified information and studies performed for the Executive Branch. But it turns out that a fully adequate picture of this subject can be presented in unclassified form. One reason is that the important features of the directed-energy BMD concepts are based on well-known physics, and many have in fact been discussed for 20 years. The second

reason is that at this early stage of conceptualization there is simply no point in (and little basis for) discussion at the detailed level where classified particulars make a difference. The properties of actual weapon systems in engineering development, by contrast, are normally and understandably classified.

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