

SDI and the Prisoner's Dilemma

DAVID P. KIRBY

On 23 March 1983, President Reagan announced his intention to launch "an effort which holds the promise of changing the course of human history."¹ The effort he referred to is the US Strategic Defense Initiative (SDI), also referred to as Star Wars by some in the news media and those who generally oppose the program. SDI is a research program designed to examine the possibility of effective strategic defenses against ballistic missiles based on new technologies such as directed-energy weapons, super computers, and tracking/detection systems. In outlining the necessity for SDI, the President made the following points:

[My] predecessors in the Oval Office have appeared before [the American public] on other occasions to describe the threat posed by Soviet power and have proposed steps to address that threat. But since the advent of nuclear weapons, those steps have been increasingly directed toward deterrence of aggression through the promise of retaliation

What if free people could live secure in the knowledge that their security did not rest upon the threat of instant US retaliation to deter Soviet attack, that we could intercept and destroy strategic ballistic missiles before they reached our own soil or that of our allies?²

Response to the President's SDI proposal has run the full spectrum from unquestioned endorsement to outright rejection. Few subjects have stirred more or wider debate seven years into the Reagan presidency, and the

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attention is clearly deserved. The technical, political, and strategic implications are immense; and if SDI were to meet President Reagan's vision, the course of human history could indeed be changed as the nuclear superpowers could deal with each other based on mutual security, in lieu of the existing situation where fear of nuclear confrontation continues to cast an ominous shadow.

Technical experts, politicians, strategists, and academicians of all persuasions have written extensively about SDI. My intent in this essay is not to repeat the technical assessments, political arguments, or learned opinions. Rather, I intend to pose the Prisoner's Dilemma of game theory as a model of the extraordinarily complex strategic issues involved in SDI; address the nuclear weapons background leading to the Prisoner's Dilemma; assess the alternatives associated with deployment of SDI; and draw conclusions with regard to the prospects for the success of SDI.

What Is the Prisoner's Dilemma?

The Prisoner's Dilemma is a model used by game theoreticians and psychologists to assess certain situations where individuals or competitors have choices to make, the payoffs of which conform to a characteristic pattern. The following illustrates the theory of the model.

Two prisoners, held incommunicado, are charged with the same crime. They can be convicted only if either confesses. Designate by -1 the payoff associated with conviction on the basis of confessions by both prisoners and by +1 the payoff associated with acquittal. Further, if only one confesses, he is set free for having turned state's evidence and is given a reward to boot. Call his payoff under these circumstances +2. The prisoner who has held out is convicted on the strength of the other's testimony and is given a more severe sentence than if he had also confessed. Call his payoff -2. The game so defined is . . . represented by [the following matrix where C represents "Confess," D "Do not confess," the subscripts a and b the two prisoners, a's payoff the left number of each pair, and b's payoff the right number].

	D_b	C_b
D_a	1,1	-2,2
C_a	2,-2	-1,-1

Prisoner's Payoff Matrix

Of all the possible outcomes, with the prisoners consulting between themselves, both players would prefer outcome $D_a D_b$, with neither confessing and both being set free, over $C_a C_b$, with both confessing and both going to jail. Since the prisoners cannot consult, however, strategy C from a single prisoner's vantage will appear better than strategy D because at worst he will receive his just sentence and at best he will go free and receive a reward, whereas if he selects strategy D he might go to jail with an extended sentence. But this logic applies to both prisoners, so that when both choose strategy C both will inevitably go to jail. Result: the Prisoner's Dilemma.³

Today, nuclear weapons present what effectively amounts to a Prisoner's Dilemma for the superpowers, but instead of confessions and jail, the issues are nuclear arsenals and national survival. Following the model of the two prisoners, the most desirable option would be for both superpowers to eliminate their nuclear arsenals and adopt strategies which do not rely on such weapons. Both superpowers survive or at least neither will succumb to nuclear annihilation (very positive inducements), but neither can they use the threat of nuclear weapons as leverage in pursuing national interests (a negative inducement). Thus, this option has a medium payoff for both superpowers, for illustrative purposes say 1.

A second option would be for the United States to eliminate its nuclear weapons while the Soviet Union retains its nuclear arsenal. The Soviet Union would show strong preference for this option (payoff value of 2) relative to option one because it could use the threat of nuclear attack to coerce the United States without fear of retaliation. The United States, being subject to nuclear coercion or even a nuclear attack (a threat to national survival) with no capability to respond in kind, would strongly reject this option (payoff value of -2). The third option, leaving the United States with a nuclear arsenal and the Soviet Union without, would yield identical but reversed preferences and payoffs.

In the fourth option, both superpowers have nuclear arsenals. Assuming relative balance of weapons, neither is subject to nuclear blackmail (positive), but both are subject to the possibility of massive nuclear strikes which threaten national survival (very negative). Consequently, the payoff for both superpowers is negative although not as negative as when one or the other of the superpowers is subject to both nuclear coercion and nuclear attack without a means for nuclear retaliation. Relative to the other possibilities, this alternative would have a -1 value for

Colonel David P. Kirby, USAF, has a B.S. degree from the University of New Mexico and an M.S. from the USAF Institute of Technology. He is also a graduate of the Air War College and the Army War College. A communications officer by specialty, he is presently the commander of the 46th Communications Group at Barksdale AFB, Louisiana.

both the United States and the Soviet Union. The four options are tabulated below:

	USSR without nuclear arsenal	USSR with nuclear arsenal
US without nuclear arsenal	1, 1	-2, 2
US with nuclear arsenal	2, -2	-1, -1

Nuclear Arsenal Payoff Matrix

Of the four options, the most desirable (positive payoff for both superpowers) is the first, which would leave both superpowers without strategic nuclear weapons. Achieving this option, however, would require both superpowers to trust each other to eliminate their nuclear weapons (verification being judged inadequate). For the past 40 years, rather than pursue an option that was dependent on compliance by the other side, both the United States and the Soviet Union have followed a more independent course, that is, a course which calls for retention of a nuclear arsenal to ensure against attack. Possession of nuclear weapons is the dominant strategy because it has the better payoff whether the other side pursues a similar course (has nuclear weapons) or a different course (does not have nuclear weapons).

For the United States, and for that matter the Soviet Union, the great challenge is escaping the dilemma of the nuclear arsenals and moving to a military strategy which allows each of the superpowers to guard its own national interests without having to threaten to use nuclear weapons or to endure such threats from the other superpower. The question I now intend to examine is whether SDI offers an escape from the Prisoner's Dilemma of nuclear weapons and the strategy of deterrence based on mutual assured destruction.

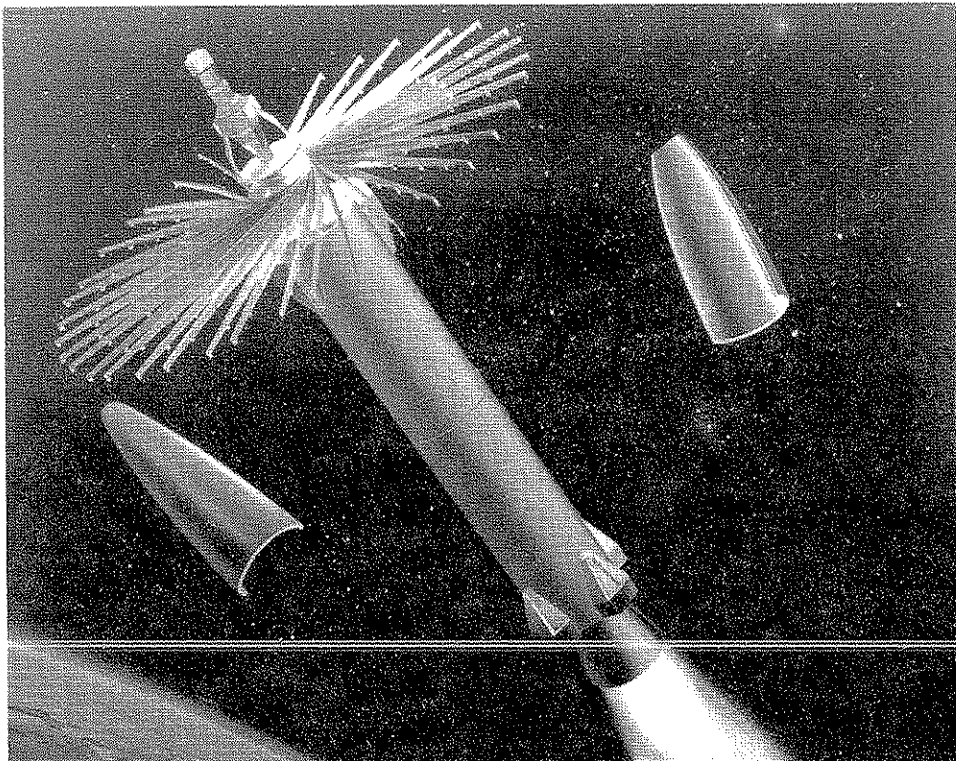
What Are the Implications for SDI?

Continuing with the basic Prisoner's Dilemma model, we find four options with respect to deployment of SDI. Since the Soviets do not call their system SDI, let us use the generic term "ballistic missile defense," or BMD, to cover both systems. The four options: neither has BMD; one has BMD while the other does not (two possibilities); and both have BMD. The first, in which neither the United States nor the Soviet Union deploys BMD, amounts in actuality to continuation of the situation existing today under the provisions of the 1972 ABM Treaty. Admittedly, the Soviet Union has

an operational ABM system around Moscow, but no one truly believes the system could counter a concerted attack. Obviously this option does nothing to change the precarious position of the two superpowers as they contemplate the destructive potential of the other side's nuclear ballistic missiles. The major implications are that the status quo, which the world has lived with for the past decade, is maintained and both superpowers avoid the expense of a BMD arms race.

But it is the status quo that President Reagan does not want to leave as a legacy for future generations. Who could fault him or any national leader for seeking an effective strategy of deterrence not based on the specter of mutual nuclear incineration. As former National Security Advisor Zbigniew Brzezinski observed, "A strategic posture that safeguards peace by the threat of annihilation, one that bases national defense on the threat of killing scores of millions of people, is ethically troubling, morally corrosive, and dehumanizing."⁴

The second possibility would have the United States with a deployed, comprehensive BMD system while the Soviet Union lacked one. This possibility, on the surface, might seem appealing to Americans—the United States would return to a preeminent position—but actually such a



“Pending . . . a change in the mutual distrust between the superpowers, both will pursue ballistic missile defense.” Here, an artist's depiction of US ground-launched, non-nuclear vehicle en route to intercept and destroy an incoming enemy warhead.

course (as well as the obverse course in which only the USSR is defended) could well prove to be the most dangerous of all the possibilities because it might tempt the superpower not building or owning BMD to launch a preemptive nuclear strike against the other superpower before the latter's BMD could be deployed.

While the United States might see the mix of an offensive and defensive posture as a means of preventing a disabling first strike against it, the opponent is likely to see that mix as a first-strike capability. The United States could launch a massive nuclear strike with the aim of destroying Soviet nuclear capability knowing that what Soviet ballistic missiles survived for use in a retaliatory strike could be countered by the deployed SDI system. US pronouncements that it would never undertake such an attack would have little influence. From a Soviet perspective, there is no incentive to entrust its security to the goodwill or gratuitous restraint of the United States. The Soviet Union learned a painful lesson in World War II when it sought security by signing a peace treaty with Hitler, only to be invaded later by hundreds of *Wehrmacht* divisions.

Even in the absence of a Soviet preemptive strike, however, the option that would have the United States with a BMD capability and none for the Soviet Union ignores the reality of Soviet military doctrine, defensive systems, and research and development over the past four decades. Soviet military doctrine has consistently stressed the importance of balance between offense and defense, even in the nuclear age. In his 1962 treatise on military strategy, Marshal V. D. Sokolovskii stated that "one of the cardinal problems for Soviet military strategy is the reliable defense of the rear from nuclear strikes."⁵

Soviet deployment of defensive systems proves Sokolovskii's words have been taken seriously. The Soviet Union has spent more than \$50 billion over the past 25 years to develop relocation sites (passive defense) for political leaders. The Soviets have the most extensive, most sophisticated air defense system in the world, and have an extensive civil defense program to protect a large segment of their population. Over the past decade, the Soviet Union has spent more on strategic defense than on strategic offense. While the United States has viewed deterrence as being based on mutual vulnerability, the Soviet Union has sought to reduce its vulnerability by development and deployment of defensive systems. In essence, the Soviets have been pursuing a strategy such that if deterrence should fail it would be in a superior position for engaging in nuclear war.⁶

The US-only option also ignores the long history of Soviet efforts to develop a BMD capability. The evidence indicates that the Soviet Union began developing ballistic missile defenses almost concurrently with their development of ballistic missiles. The Soviets have been conducting research in lasers, other directed-energy weapons, tracking systems, and subsidiary BMD technologies for nearly two decades. Some of this research has led to

the ongoing upgrade of the existing ABM system around Moscow.⁷ On 30 November of last year, in an interview with NBC correspondent Tom Brokaw, Soviet leader Mikhail Gorbachev admitted publicly for the first time that Soviet scientists were engaged in research on space-based strategic missile defenses.⁸ Given this history, it is highly unlikely that the Soviet Union would accept a situation that left it undefended while the United States planned or actually deployed a defensive capability such as contemplated under SDI. Soviet actions during and after the October 1986 Reykjavik summit between President Reagan and Premier Gorbachev give even stronger indications that the Soviet Union will not tolerate a BMD imbalance which yields a higher payoff for the United States. Furthermore, the third option—leaving the Soviet Union defended while the United States was not—would obviously be as untenable for the United States as option two would be for the Soviet Union.

If alternative one does little to resolve the current conundrum of nuclear arms, and alternatives two and three would be unacceptable to both the superpowers, how about the fourth option, one that leaves both superpowers with ballistic missile defense? On close inspection, even this alternative has serious shortcomings. First, the concept of a strategic defensive system that could protect military targets and population centers from all ballistic missiles is utopian. The Fletcher Panel, appointed by President Reagan to investigate the feasibility of ballistic missile defense, concluded that chances were slim for a defensive system able to protect the United States' population without constraints on Soviet forces. A study by the Congressional Office of Technology Assessment reached the same conclusion.⁹ This is not to say that a less-than-perfect BMD system is without value. Deterrence would be strengthened to the extent that a BMD system added uncertainty to the adversary's analysis of prospects for achieving his objectives in a nuclear strike. Still, the less-than-perfect BMD system would not make ballistic missiles impotent, nor would it free the United States from the fear of a ballistic missile attack.

A second serious concern for the United States would be the possible effect on the NATO alliance should the United States and Soviet Union deploy BMD systems. The NATO doctrine of flexible response, which assumes the ability to initiate limited nuclear attacks on the Warsaw Pact, loses credibility when the Soviet Union could counter the ballistic missile elements of such attacks. Mutual BMD thus conceivably leaves Europe open to the superior conventional forces of the Warsaw Pact. The British and French would see the deterrent value of their own nuclear forces degraded, for their territory would be vulnerable to nuclear weapons while the Soviet Union was defended.

For many European allies, going to strategic defensive systems will substantially undermine the arms control process.¹⁰ It shifts the arms race into new and expensive technological avenues, and it possibly reduces

incentives for offensive arms control. Allies also voice concern that a safely defended United States might dissociate itself from the defense of NATO. West German Defense Minister Manfred Woerner has warned that a "defended America could become a fortress America."¹¹ French Foreign Minister Claude Cheysson expressed the same theme in his assertion that an SDI-defended United States could "lead to an isolationist America unconcerned about European security."¹²

A third danger in mutual BMD is the possible emergence of instability as the superpowers work to perfect and deploy their systems. Even the most optimistic proponents of SDI acknowledge that deployment of an effective system would take a minimum of ten years. But a technological breakthrough by one side allowing it to achieve an early BMD capability would create the same circumstance as alternatives two and three. The side that perceived it was falling behind would likely take steps to strengthen its offensive capability as a hedge (or, as we have noted, it might take more drastic steps). It is thus conceivable that there would be two arms races, one offensive and one defensive. Given the distrust between the two superpowers, the propensity to hedge against the other side's technological breakthroughs, and the uncertainty regarding the full extent of the other's offensive and defensive capabilities, the transition to mutual BMD would be fraught with potential for instability and even peril. Consequently, alternative four yields a payoff that is less than optimum for both superpowers, but it is also more desirable than alternatives two and three, which leave one of the superpowers at a distinct disadvantage. In essence, the Prisoner's Dilemma continues.

How Do We Break Out of the Dilemma?

The debate on SDI and the desirability of deploying a BMD capability will undoubtedly continue for years. The issues are many and are extremely complex. They include unforeseeable repercussions on other elements of national military strategy, the question of affordability, impacts on alliance relationships, and perhaps even the possibility of dramatic change in the concept of world power. If SDI can meet the goals that President Reagan outlined in March 1983, resolution of these many issues would be less problematic. But until such time as the technologies of SDI emerge from the laboratories and are shown to be affordably feasible, much of the debate will be based on assumptions, conjectures, and ideological predispositions that have little to do with the intrinsic merits of BMD.

Notwithstanding these circumstances, the facts of the matter remain—in an atmosphere of mutual distrust each of the superpowers is driven to pursue a strategy that is putatively in its own best interest, and one that is independent of the actions taken by the other superpower. As long as the superpowers remain figuratively incommunicado with regard to their

strategic intentions and incapable of trust-based cooperation, they will remain locked in the Prisoner's Dilemma. Perhaps the greatest potential for BMD lies in making both superpowers and the world community aware that there is no single solution to the danger posed by nuclear weapons. While BMD might provide a partially effective counter to ballistic missiles, the superpowers and their allies would face different and formidable challenges in other nuclear delivery systems such as air- and sea-launched cruise missiles. The fact that BMD at best is only a limited solution might be the catalyst which causes the superpowers to reexamine the utility of nuclear weapons in general. The recent Reagan-Gorbachev summit agreement to undertake Strategic Arms Reduction Talks this year is a step in the right direction.

Pending a significant shift in thinking about the utility of nuclear weapons and a change in the mutual distrust between the superpowers, both superpowers will pursue ballistic missile defense. Just as the two prisoners end in jail despite their hypothetical ability to avoid it, both superpowers will pursue a dominant strategy—deployment of ballistic missile defense—knowing that such does not necessarily provide an escape from the dilemma of nuclear arsenals. One of the great challenges of the coming decades for both the United States and the Soviet Union will be to achieve mutual security based on strategic defense in such a way that reliance upon nuclear weapons is lessened and overall world security is increased.

NOTES

This article is an abridged adaptation of an essay titled "The Strategic Defense Initiative and the Prisoner's Dilemma" on file at the US Army War College and the Defense Technical Information Center.

1. Speech made by President Reagan 23 March 1983, and partially reproduced by Daniel O. Graham and Gregory A. Fossedal, *A Defense that Defends* (Greenwich, Conn.: Devin, 1984), p. 145. See also Sidney D. Drell et al., *The Reagan Strategic Defense Initiative* (Cambridge, Mass.: Ballinger, 1985), pp. 101-03.
2. Quoted in Graham and Fossedal, pp. 143-45.
3. Anatol Rapoport and Albert M. Chammah, *Prisoner's Dilemma* (Ann Arbor, Mich.: Univ. of Michigan Press, 1965), pp. 24-25. The notation has been adjusted for clarity.
4. Zbigniew Brzezinski et al., *Promise or Peril: The Strategic Defense Initiative* (Washington: Ethics & Public Policy Center, 1986), p. x.
5. Cited in Drell et al., p. 13.
6. Keith B. Payne, *Strategic Defense: Star Wars in Perspective* (Lanham, Md.: Univ. Press of America, 1986), pp. 46-50.
7. Caspar W. Weinberger, *Annual Report to the Congress, Fiscal Year 1987* (Washington: GPO, 1987), pp. 74-76. See also Payne, pp. 52-57.
8. Celestine Bohlen, "Gorbachev Sees Cuts Without SDI Ban," *The Washington Post*, 1 December 1987, p. A1.
9. See Alex Gliksman, in *Strategic Defense in the 21st Century*, ed. Hans Bunnendijk et al. (Washington: GPO, 1986), pp. 15-16.
10. Bunnendijk et al., pp. 85-101. See also Keith Dunn and William Staudenmaier, eds., *Alternative Military Strategies for the Future* (Boulder, Colo.: Westview Press, 1985), pp. 33-34, 37.
11. Payne, p. 194.
12. *Ibid.*, p. 201. See also Gary L. Guertner and Donald M. Snow, *The Last Frontier* (Lexington, Mass.: Lexington Books, 1986), p. 93.