CURRENT NEWS
SPECIAL EDITION

18 June 1986 No. 1452

THE WASHINGTON QUARTERLY

Volume 9, No. 1 Pgs. 139-154, 155-167

Winter 1986

THE CENTER FOR STRATEGIC AND INTERNATIONAL STUDIES
GEORGETOWN UNIVERSITY

SDI: At Odds Over Essentials

Technology has to be related to strategy at some point in its development. Amidst all the smoke and noise about the Strategic Defense Initiative, an explicit discussion of the strategic rationale for the technological choices being made is rare. The theology of SDI has been presented, and the technological varieties have been endlessly debated, but strategists have apparently chosen to wait for a stage when they have a better focus on what is being debated.

In a discussion of the "strategy of SDI," two issues come to the fore: the maintenance of peace-stability in crisis management, and the reestablishment of peace-stability in the process of the exchange of nuclear weapons. Robert Hunter and Keith Payne—although disagreeing about the bottom-line utility of SDI—focus on these issues to help *Quarterly* readers understand the real stakes in SDI.

Denise Brown, Editor

Harry Zubkoff, Chief, News Clipping & Analysis Service (SAF/AA), 695-2884

The Deterrence Requirement for Defense

Keith B. Payne

THE THEORY OF strategic nuclear deterrence that has dominated U.S. strategic thinking for two decades has been challenged by the Reagan administration's manifest interest in ballistic missile defense (BMD). The Strategic Defense Initiative (SDI) was inaugurated by President Reagan's March 23rd, 1983 "Star Wars" speech wherein the president expressed his desire to see the end of the condition of mutual vulnerability.[1] Following the president's speech the Department of Defense established the Strategic Defense Initiative Organization to pursue a comprehensive research and development program to demonstrate key technologies for defense against ballistic missiles. This program, it is hoped, will provide the basis for an informed decision during the early 1990s regarding full scale engineering development of BMD systems.

The theory of deterrence threatened by the SDI is predicated on a basic assumption that the condition of mutual vulnerability to nuclear retaliation is stabilizing and probably inescapable. That theory warns against BMD and offensive counterforce capabilities that might threaten the stabilizing condition of mutual vulnerability—that might appear to deny the Soviet Union its nuclear threat. According to this view of stability there is an incompatibility between the pursuit of a defensive capability and the pursuit of deterrence—indeed threatening the Soviet Union's deterrent is said to threaten stability.[2]

Although U.S. deterrence policy has evolved considerably over the past two decades,[3] the overall focus has remained the same: to pose a retaliatory nuclear threat to the Soviet Union sufficient to deter attack against the United States, its allies, and vital interests. Considerations of strategic targeting and employment flexibility have become more sophisticated, but the approach to stability has remained constant—deter the Soviet Union with nuclear punishment, and accept the Soviet capability to threaten the United States with nuclear fire. If this acceptance of U.S. vulnerability seems unbelievable, note the following statement by Secretary of Defense Harold Brown appearing in the Department of Defense *Annual Report to Congress for Fiscal Year 1980*:

> In the interests of stability, we avoid the capability of eliminating the other side's deterrent, insofar as we might be able to do so. In short, we must be quite willing—as we have been for some time—to accept the principle of mutual deterrence and design our defense posture in light of that principle.[4]

Keith B. Payne is vice president and director of national security studies at the National Institute for Public Policy.

Keith B. Payne

Deterrence theory based upon the mutuality of nuclear vulnerability has had a profound effect on U.S. strategic thought. For example, as a result of this type of thinking a parity of vulnerability has come to be seen as the condition of strategic stability, and measuring the relative level of post-exchange damage is considered a primary means of measuring stability—if that damage is roughly equal, stability is assumed to be secure. This parity measure is used extensively within the defense analytic community to examine the implications of defense for stability.

This stability measure suggests that a mutual and high level of vulnerability is stable. If such mutual vulnerability does represent an acceptable stability for the United States then there is little deterrence need for comprehensive strategic defenses—by this criteria stability probably can be achieved without comprehensive defenses. Ironically, this stability measure is prevalent even within that part of the defense analytic community highly sympathetic to the SDI and the president's hope of bringing the condition of mutual vulnerability to an end—even though it suggests ample rationale from a deterrence perspective for skipping the SDI in favor of a high level of stable mutual vulnerability.

The president has emphasized that the SDI is intended first to serve deterrence.[5] Yet a prevalent analytic model of stability employed by those examining the potential role of strategic defense suggests from the beginning that deterrence stability does not require comprehensive defenses. This undoubtedly reflects more the acceptance of an inappropriate concept of stability than it does a conscious effort to undercut the SDI. However, it should be recognized that this type of parity-stability analysis is inappropriate for the United States and ought not be used.

Deterrence stability from the American perspective cannot be based on a condition of U.S. vulnerability, whether that vulnerability is shared by the Soviet Union or not. Comparing post-exchange damage, if it is at mutually high levels, is irrelevant to an understanding of U.S. needs for stability. That stability measure, employed with such frequency and quantitative precision, is wrong in conception. It is wrong in conception because it does not take into account the spectrum of deterrence responsibilities for which the United States has accepted responsibility.

U.S. responsibilities include the deterrence of nuclear and conventional attack on U.S. allies. The United States has long sought to fulfill this deterrence function by holding out the threat of nuclear first use[6]—the theory being that the threat of strategic nuclear escalation will deter Soviet conventional aggression. However, U.S. vulnerability to Soviet nuclear fire is incompatible with its extended deterrence commitment to escalate to the use of strategic nuclear weapons. How could a U.S. president rationally escalate a conflict, in Europe for example, into a strategic nuclear conflict that could well result in 160 million U.S. casualties? Such escalation could only increase the risk to the U.S. homeland—not reduce that risk. To base a deterrence threat on an act that clearly would be irrational and self-destructive is to have a manifestly incredible deterrent.

The dilemma for the United States is clear. It has continued to accept extended deterrence responsibilities based on a strategic nuclear first use threat, yet that threat cannot be credible when the United States is com-

pletely vulnerable to Soviet nuclear retaliation. Yet that condition of mutual vulnerability, until very recently, was formally endorsed by the U.S. approach to deterrence; and our tools for analyzing stability still reflect this absurdity.

There has been a clear schizophrenia in U.S. strategic thought and policy—it has accepted deterrence responsibilities that are incompatible with wholesale vulnerability and yet endorsed mutual vulnerability as stabilizing. Henry Kissinger is one of the few U.S. statesmen to have noted this critical dilemma publicly:

> If my analysis is correct we must face the fact that it is absurd to base the strategy of the west on the credibility of the threat of mutual suicide . . . and therefore I would say—that I might not say in office—that our European allies should not keep asking us to multiply strategic assurances that we cannot possibly mean, or if we do mean, we should not want to execute, because if we execute, we risk the destruction of civilization. Our strategic dilemma is not solved by verbal reassurances, it requires redesigning our forces and doctrine.[7]

As a result of pretending that this key dilemma does not exist, and that mutual vulnerability is an acceptable basis for stability, the type of parity analysis described above—flawed in conception—is considered useful. A measure of equivalence or parity in post-exchange destruction might be a useful means of quantifying stability in the rarefield air of abstraction wherein one uses "country A" and "country B" as theoretical constructs and assumes "all other things are equal." The point is that country A and Country B do not exist, the United States and Soviet Union do, and "all other things" are not equal. It is the United States which has a far flung alliance structure. It is the United States whose allies and other vital interests abut the greatest conventional landpower on earth, a landpower that controls the heartland of Eurasia. It is the United States which must as a consequence hold out the threat of strategic nuclear escalation to deter conventional and nuclear attack on its distant allies and vital interests. The Soviet Union needed only to counter the West's first use threat to destabilize the strategic deterrence relationship by which the United States provides security to its allies. The Soviet Union achieved that counter through its strategic buildup of the 1960s and 1970s—a buildup that made the U.S. threat of strategic nuclear escalation suicidal, and hence incredible. Yet the defense analytic community has become so accustomed to the notion that parity of vulnerability equals stability that use of this type of quantitative analysis persists—despite the fact that it is inappropriate from the U.S. perspective because it does not consider the wide spectrum of U.S. deterrence responsibilities. Indeed, if the full range of U.S. deterrence responsibilities is considered—and thus the U.S. need for a credible strategic nuclear escalation threat is included—an effort to quantify stability must reflect the fact that stability from the U.S. perspective mandates a damage limitation capability regardless of the Soviet level of vulnerability. Given U.S. deterrence responsibilities, a high level of mutual vulnerability cannot logically meet U.S. requirements for stability.

Of cause, the exact threshold of U.S. defensive capabilities necessary to render the U.S. extended deterrent credible cannot be determined precisely or apart from a crisis details of

the scenario.[8] But the fact is clear that a defensive requirement already exists to provide a credible (or, as Herman Kahn would note a "not incredible") U.S. deterrent across the spectrum of responsibility. If one grants that credibility of threat is a key to the functioning of deterrence,[9] then there is no alternative but to recognize that the U.S. extended deterrent commitment mandates a U.S. capability for strategic defense. A high parity level of expected destruction (i.e., mutual vulnerability) is not an acceptable condition for stability given U.S. extended deterrent responsibilities. As the prominent British strategic analyst Michael Howard has observed:

> Peoples who are not prepared to make the effort necessary for operational defense are even less likely to support a decision to initiate a nuclear exchange for which they will themselves suffer almost inconceivable destruction . . .[10]

There is an important distinction between observing that effective damage-limitation may be beyond reach and therefore we may have to try to maintain stability without it; and positing that defense is not critical for the credibility of the U.S. deterrent which supports stability. These statements are not the same, yet the general acceptance of the first has been translated in the minds of many into an uncritical acceptance of the second. However, to acknowledge that effective defense will be very difficult is a far cry from any suggestion that defense is unimportant for stability and need not be pursued for the sake of stability.

It occasionally is suggested that peace in Europe during the recent period of wholesale U.S. vulnerability proves that defense is not important to the functioning of the extended deterrent. However, that is not the case. First, it is impossible to prove why there has not been a war in Europe—it may or may not have anything to do with the effectiveness of an incredible extended deterrent threat. Second, the more likely case is that deterrence simply has not undergone a serious test since the Cuban Missile Crisis of 1962—when the United States probably did have a significant damage-limitation capability. The recent period of peace coinciding with vulnerability may well demonstrate only that we have been lucky.

The Defensive Contribution to Deterrence—During and After the Transition

When assessing the deterrence requirements for defense it is clear that the existing U.S. extended deterrence commitments mandate an effective, comprehensive defensive capability. However, a comprehensive defense for U.S. cities, such as would enhance the credibility of the U.S. commitment, could take several decades to achieve, if ever.

A concern is that the Soviet Union could defend its highest values before the United States could achieve a significant damage-limitation capability for its own highest values, i.e., cities and people. This concern stems from the fact that the Soviet Union is acquiring a capability for rapid BMD deployment while the United States is not[11] and because Soviet highest values, as identified by the bipartisan Scowcroft Commission, tend to be more difficult to threaten and easier to defend than cities. Soviet highest values are said to consist of " . . . hardened ones such as military command bunkers and facilities, missile silos, nuclear weapons and other storage . . . which the Soviet leaders have given

every indication by their actions they value most, and which constitute their tools of control and power."[12] It is clear that these Soviet highest values are becoming increasingly difficult to threaten even in the absence of additional Soviet BMD capabilities. Complementing existing Soviet active and passive defenses for their highest values with layers of BMD would likely remove any possibility that the United States could hold them at risk for deterrence purposes.

The question is, during the early stages of a defensive transition, how might U.S. defenses contribute to deterrence? It is clear that mature, multilayered defenses would support the credibility of extended deterrence; how might limited U.S. transitional defenses contribute to deterrence and help overcome a potentially destabilizing initial Soviet defense advantage?

An essential element in the answser to that question may be found in the likely Soviet fear of prolonged war.[13] Soviet strategic doctrine focuses upon the need for preemptive surprise to annihilate the opponent's will and military capability. Although the Soviet Union prepares for prolonged conflict, it obviously would much prefer a quick and decisive victory. Soviet leaders know full well the possible political implications of a long indecisive war—their own revolution was born under such conditions.

Even limited U.S. transitional defenses could help ensure that the Soviet Union could not anticipate a quick, decisive victory under any conditions—transitional defenses would help ensure that war, even nuclear war almost certainly would be prolonged. Anticipation of a prolonged unwinnable conflict should provide a powerful deterrent against the Soviet Union—even if Soviet defenses further reduce the U.S. capability to threaten Soviet highest values. The Soviet Union would not face the prospect of an immediate strike on its highest values, but it would be forced to weigh the costs and risks of engaging in conflict with a United States that could, with increasing reliability, sustain its military capability and potential. Such a prospect should provide effective deterrence leverage. Defenses for NATO (ATBM) that would enhance NATO's capability to stop an attack in Europe (by protecting tac air, nuclear and chemical weapons, C^2 facilities, etc.) would contribute significantly to this deterrent structure.

The precise nature of strategic deterrence is inherently unknown and unknowable through any scientific method. Consequently, there is no basis for claiming with certainty that extended deterrence is more effectively based upon the current incredible prospect of U.S. strategic nuclear escalation, or the prospect of a prolonged conflict in which the Soviet Union could have no confidence of winning, and could ultimately fear losing. Yet the fact that a prolonged war would be a certainty during and following a defense transition could provide the basis for establishing deterrence upon a threat other than mutual vulnerability to catastrophic retaliation.

Strategic defense, even transitional defenses of limited effectiveness, would have a significant impact upon the capability of the United States to prolong conflict. Limited defenses may be particularly useful for enhancing the survivability and endurance of U.S. strategic forces and C^3 facilities, as is required by considerations of prolonged war.

In principle the capability to engage in a prolonged conflict has become a requirement for the United States. In the *Annual Department of Defense Posture Statement for Fiscal Year 1983*, Sec-

retary of Defense Weinberger noted the particular need for C^3 endurance as a requirement of preparing for a prolonged war. As Secretary Weinberger observed: "Strategic C^3 systems must be capable of supporting an initial retaliatory response by our forces during or after an enemy attack. They must also be able to operate reliably over an extended period after an attack, should that prove necessary."[14]

The development of the official U.S. approach to nuclear deterrence and strategy has resulted in an increasingly severe requirement for C^3 endurance and flexibility. Since the early 1960s U.S. nuclear strategy has evolved from a relatively straightforward formulation of massive retaliation to the reportedly more recent emphasis upon the capability to engage in a prolonged war and prevail.[15] Reflecting this trend, the Defense Guidance for Fiscal Years 1984–1988 reportedly set forth the requirement that U.S. strategic force and C^3 be capable of endurance for prolonged war operations:

> U.S. strategic nuclear forces and their command and communication links should be capable of supporting controlled nuclear counterattacks over a protracted period while maintaining a reserve of nuclear forces sufficient for trans- and post-attack protection and coercion.[16]

This sensible requirement, stemming from a relatively recent concern for the possibility of prolonged war, provides a potentially significant (indeed, possibly essential) role for near- and mid-term strategic defenses.

The C^3 capabilities required by prolonged war considerations include: early warning; enduring warning; initial and enduring capability to transmit retaliation decisions to U.S. forces; damage assessment data; two way communications with strategic forces-forces status reporting; real-time imagery and other intelligence collection tasks.[17] Most of these requirements heretofore have not been part of the U.S. strategic posture requirements. General Stansberry, as Commander of the Air Force Electronics Systems Division noted that:

> In previous years the concept for C^3 was that it only had to be able to get off a launch of U.S. strategic weapons in response to a first strike before damage was unacceptable. The idea that there was no way to win a nuclear war exchange sort of invalidated the need for anything survivable. There is a shift now in nuclear weapons planning, and a proper element in nuclear deterrence is that we be able to keep on fighting.[18]

U.S. nuclear forces and their employment policies have evolved in support primarily of a relatively short-war strategy, and yet for a decade doctrinal development has increasingly come to emphasize the need for survivability, endurance, and flexibility. The SDI may provide a means of redressing the asymmetry in U.S. policy and strategic force posture.

There are numerous potential and possibly unique roles for transitional defenses to enhance the survivability and endurance of U.S. C^3. A few examples will illustrate the range of possible overlap between initial phases of BMD deployment and the C^3 requirements of a prolonged war capability.

Mid-course defenses employing preferential and selective defense tactics could facilitate useful BMD coverage for critical airborne C^3I systems. For example, defense of NEACP, PACCs, TACAMO aircraft, and Airborne Launch Control Systems, could

help facilitate the initial survivability of those critical systems. Even a few minutes of additional escape time provided by BMD might make a significant difference for airborne assets dependent upon rapid escape. The rationale for the planned Site Defense of the U.S. National Command Authority (NCA) during the early 1970s was not that Site Defense could preserve the NCA itself for long, but that it could provide additional minutes of survival, minutes that could be extremely critical for escape.[19]

Assuming that NEACP (E-4B) can escape, the selective defense of alternative landing strips could provide a safe rendezvous site for NEACP aircraft and the Crown Helicopter (CHELO). Otherwise, it might require relatively few Soviet weapons to destroy potential NEACP and CHELO rendezvous sites. Because of its potentially very large defensive footprint, selective mid-course defense would deny the Soviet Union any certainty concerning the site to be defended during the initial exchange.

Perhaps more important, preferential defense of selected airfields could provide alternative, intact runways for NEACP landing and refurbishment. Once airborne, E-4B aircraft may be limited to approximately 72 hours of continuous airborne operations before landing and refurbishment are necessary.[20] Following this immediate post-attack period, the availability of intact runways, support equipment (i.e., fuel, spare parts, food, etc.) and personnel (ground and air crews) could permit continued NEACP operations during extended trans- and post-attack periods. Even possible future NEACP aircraft with extended loiter capabilities would require such intact facilities in the context of a prolonged war. EC-130 TACAMO (Take Charge and Move Out) aircraft (and future Boeing E-6A aircraft) reportedly intended to relay EAMs to SLBM submarines might similarly benefit from preferential defense of airfields, thereby facilitating communications with SSBNs during an extended post-attack period.

A capability for reconnaissance and intelligence-gathering during a prolonged conflict will, as mentioned above, be necessary. Assuming that the effectiveness of many U.S. reconnaissance satellites will be degraded during a prolonged war, strategic aircraft are likely to become increasingly important for post-attack imagery and intelligence-gathering. Thus, the protection of a set of airfields in order to support reconstitution of critical aircraft over an extended period could be a key to critical intelligence-gathering during a prolonged period. Similarly, the possibility of future airborne early warning assets (possibly carrying LWIR telescopes) might achieve some necessary endurance for prolonged war through such selective defense.

Of course, to provide continued protection for a set of CONUS-based airfields would require endurance for some U.S. BMD components, and the denial of Soviet post-attack intelligence-gathering capabilities that might permit concentration of nuclear fire on surviving airfields during the post-attack period. Providing continuous defense for a limited subset of several hundred potential dispersal airfields would be simplified if the Soviet Union could be denied accurate information concerning which airfields had been defended during the initial exchanges. U.S. ASAT capabilities of various types would be important in this regard.

Near-term BMD might also play an important role for fixed, ground-based assets. For example, the Emergency Rocket Communication System

(ERCS) is reported to be a component of the Minimum Essential Emergency Communications Network (MEECN) that could transmit an EAM to bombers, ICBM LCC's, and TACAMO aircraft.[21] Yet, ERCS appears to be as vulnerable to early destruction as is the silo-housed booster which would carry it. Consequently, ERCS might require a prompt launch in order to survive. Such a condition is incongruous with the survivability, endurance, and flexibility mandated by the evolution of strategic doctrine. Preferential and selective defense of an expanded number of ERCS could provide an important measure of survivability and possibly endurance.

Similarly, preferential defense might function as a time-buyer to enhance the survival of other important ground-based assets that are time-critical. Dispersed, deceptively-deployed, and/or mobile ground-based assets might achieve a useful level of endurance for prolonged war operation; active defense could complement such measures. As a time-buyer, defense of early warning radars such as PARCS, satellite ground terminals, and command centers such as Cheyenne Mountain, Fort Ritchie, and SAC HQ might facilitate the collection and utilization of the type of accurate attack information that would be useful for determining appropriate flexible response options and/or ICBM launch-under-attack options.

Additionally, post-attack reconstitution of U.S. satellite assets could be extremely critical for U.S. prolonged war capabilities. Preferential defense of dispersed and (possibly) deceptively-deployed boosters for satellite reconstitution could help provide the United States with enduring and extremely valuable surveillance capabilities. Defense of any future satellite ground-mobile terminals could also be important for an enduring reconnaissance and surveillance capability.

Similarly, defense of any future ground-mobile command and control centers could help provide a level of endurance for those facilities that could be difficult via mobility alone. In these cases of preferential defense for ground-mobile assets, the defense would attempt to intercept any warheads on trajectories posing a threat to ground-mobile assets located in safe areas designated for defensive coverage. A combination of midcourse and terminal interceptors might provide a significantly-improved endurance capability for such critical assets as any SAC Headquarters Emergency Relocation Team.[22]

The current vulnerability of many critical C^3I systems to immediate destruction, and the likely, relatively-rapid degradation of even the more survivable of C^3I assets, indicates that the United States is unlikely to be capable of effectively waging a prolonged nuclear conflict lasting weeks or months. There are, of course, C^3I improvement programs (MILSTAR, TACAMO upgrade, ELF, E-4B, etc.) that will enhance the trans- and immediate post-attack survivability of critical C^3I systems. However, prolonged war requirements appear to necessitate a significant level of post-attack endurance that could be extremely difficult to attain. Selective and preferential defense employing limited BMD systems could enhance the endurance of assets that are hardened, mobile and/or dispersed, such as ERCS, command center aircraft, and ground-mobile terminals. Defense might also provide a short but useful amount of additional time for important, but vulnerable, fixed targets such as command centers and early warning radars.

This brief review of the potential

for strategic defense to contribute to C^3I endurance suggests that even the limited BMD likely to be available during a defensive transition could be helpful, perhaps extremely helpful. The contribution of strategic defense would depend upon many factors, including the survivability and endurance of the defense itself. Also important would be the capability to employ selective and preferential defense tactics in the mid-course so as to exploit the large defensive footprint of mid-course interceptors. If these conditions pertain, strategic defense could be important to the posing of a prolonged war deterrent threat during the transition period.

Strategic Defense and Force Endurance

The same type of strategic defense capabilities that could facilitate enhanced C^3I and NCA survivability and endurance could also enhance strategic force survivability and endurance. Selective and preferential defense could be particularly helpful for land-based systems and their logistical support.

For example, logistic support that can sustain weapons systems will contribute to (or may be necessary for) the endurance of forces for prolonged war. Yet, for economy and efficiency reasons, the logistics support for major Air Force strategic systems (for example) reportedly have been centralized into a handful of major supply and repair depots,[23] (i.e., those ALCs in Ogden, Oklahoma City, Sacramento, San Antonio, Warner-Robins, Georgia, and Newark Air Force Station, Ohio).

Obviously the capability to support an enduring capability for follow-on strikes will require personnel, spare parts, repair equipment, etc. The highly-centralized U.S. logistics base may pose severe problems for the maintenance of enduring U.S. strategic force capabilities. A combination of dispersal (possibly including some element of deception), modest hardening, and selective and preferential defense could enhance the endurance of the U.S. logistic support base.

The role of strategic bombers is likely to become much more important in the context of a prolonged war if survival and endurance can be achieved. The unique capability of bombers to be reused, to adapt to changing conditions, to seek and destroy targets of opportunity, and to perform multiple tasks (such as reconnaissance) makes surviving bombers extremely valuable in prolonged war scenarios. Strategic defense may contribute significantly to an enduring bomber capability in much the same way it might contribute to the endurance of airborne C^3I systems. (Several additional critical non-strategic Air Force missions will be essential to the U.S. prolonged war capability, and initial strategic defenses could also facilitate the capability to perform those missions.)[24]

For example, even a small number of surviving bombers, if available for repeated sorties, could threaten Soviet reconstitution and recovery, particularly if Soviet air defenses had been significantly degraded in the initial exchange(s). An enduring capability to pose such a threat would be critical for supporting post-attack negotiations for war termination on terms acceptable to the United States. Strategic defense could be helpful or perhaps essential to providing that enduring bomber capability.

Enduring survival for strategic bombers in a prolonged war will depend upon the post-attack availability of bases and support facilities. Bombers would have to be capable of sur-

viving the initial strikes, performing assigned missions and landing safely, reloading and refurbishing, and then be available for additional missions. Yet, SAC airbases and civil runways of potential strategic utility may well be attacked during initial exchanges. There are several hundred runways in the United States of sufficient size to handle lightly-loaded B-52s.[25] These runways would likely constitute a high priority for Soviet target planning, and would require a small investment in warheads. In the absence of strategic defense, it would appear unlikely that the necessary refurbishment would be available, (e.g., landing locations, fuel, spare parts, crews, munitions, flight materials, etc.)

To achieve an enduring bomber capability, the United States must deny the Soviet Union an ability to destroy in initial or subsequent strikes, all of those runways and support assets necessary to maintain bombers and tankers. Selective and preferential defense could be an essential element in maintaining a network of surviving airfields throughout the period of a prolonged war. As was the case in reference to maintaining facilities for enduring airborne C^3I systems, preferentially defending a select set of airbases and support facilities for an extended period could depend upon a U.S. capability to deny to the Soviet Union the ability to retarget its surviving forces against defended points in order to saturate the associated defenses. However, even in the case where the Soviet Union could retarget previously-defended points, it could not be certain which points would be defended preferentially against follow-on strikes.

This is not the place to address key questions in this regard, concerning the number and type of defensive interceptors available post-attack, and how effectively the United States could deny the Soviet Union useful overhead surveillance. Indeed, such concerns, while critical, cannot be considered usefully in the absence of a more detailed examination of specific defensive systems and scenarios. The purpose here is to note generally that an enduring bomber capability would be extremely important in a prolonged war; that support facilities and requirements (including logistic support) appear to be highly vulnerable to initial and follow-on strikes; and that even a limited defense, employing selective and preferential defenses, could help alleviate those vulnerability problems for the logistics and refurbishing-support necessary for continued air operations.

Silo defense has been the focus of most Army BMD research for almost two decades.[26] Defense of hardened ICBM launchers provided the major presumed potential mission for BMD until the president's March 23rd speech shifted the focus toward a comprehensive defense mission. Hardened launch points, whether arranged in multiple protective shelters, arrays of closely-spaced silos, or the current Minuteman silo-basing, appear to lend themselves to protection by limited defenses.[27] This is a function of the relatively small keep-out zone necessary for hardened point targets, the value of even porous defenses for ICBM silos, and the fact that a relatively short time-period of defense effectiveness would be useful for ICBMs. Preferential and even simple subtractive defense of silos and LCCs could facilitate ICBM survivability. Endurance for silos-LCCs might also be facilitated if the Soviet Union could be denied the post-attack intelligence helpful for re-targeting.

Interestingly, the sharpest criticism in the political arena against ICBM

modernization has been the continuing concern for the survivability of fixed land-based silos.[28] As a result, the deployment of limited defenses for ICBM silos has received high-level and bipartisan endorsement—even from some who were architects of the 1972 ABM Treaty. Henry Kissinger recently endorsed some measure of defense for ICBMs:

> . . . the existence of some defense means that the attacker must plan on saturating it. This massively complicates the attacker's calculations. Anything that magnifies doubt inspires hesitation and adds to deterrence.
>
> The case grows stronger if one considers the defense of Intercontinental Ballistic Missile (ICBM) launchers. A defense of the civilian population would have to be nearly 100 percent effective, while a defense that protected even 50 percent of land-based missiles and air bases would add hugely to deterrence.[29]

Zbigniew Brzezinski recently made much the same point, stating that

> The fact is that strategic defense has become feasible not in the sense that it can safeguard society but because it can increasingly complicate the planning and execution of an effective first strike. In other words, strategic defense can somewhat negate the offensive advantages of increasingly sophisticated strike systems, restoring the element of deterrence simply by creating again greater uncertainty as to the consequences of a first strike.[30]

Complementing passive ICBM defenses (e.g., mobility, hardening, and/or deep-underground basing) with BMD could perhaps provide the basis for an enduring hard-target capable ICBM force. For example, as was discussed regarding mobile ground terminals for satellite relay, the United States might use selective and preferential defense to provide defended zones for mobile-launcher sanctuary. Such a defense could significantly increase the Soviet requirements in any barrage-attack planning against a mobile SICBM.

Limited defenses might also contribute to maintenance of a U.S. SLBM reserve. The survivability of FBM submarines renders them a logical instrument to support post-attack coercion of the opponent, and to support negotiations for war termination. Obviously, the United States would wish to keep these reserve strategic assets safely at sea for the duration of a prolonged war—which could last longer than the nominal FBM submarine patrol period. The survival of on-patrol FBM submarines would be extremely important for the functioning of any post-attack deterrence.

Strategic defense might provide some enhanced survivability for submarine tenders and key essential replenishment assets, (e.g., crews, spare parts, consumables, calibration equipment, etc.).[31] FBM submarines might exploit pre-designated defended dispersal sites for such replenishment; again the preservation of location uncertainty (PLU) for rendezvous sites would be helpful. Airborne BMD sensors and interceptors could be important in this regard both for defending sites distant from CONUS and for enhancing the prospects for BMD survivability.

For the same reason that the United States would want to have an enduring SLBM capability, it would be advantageous for the United States to deny that capability to the Soviet Union. Strategic defense might facilitate an enduring capability to target Soviet FBM submarine reserves and thereby

reduce the Soviet capability for post-attack coercion of the United States. Active defense could help provide endurance for ASW aircraft, satellite reconstitution facilities in support of continued ocean surveillance, and communication links to SSN attack submarines. Even a modest surviving ASW capability could constrain Soviet SSBN movement and operations in a useful way. Denying Soviet FBM submarines easy post-attack access to U.S. coasts, for example, could be important in efforts to maintain surviving U.S. aircraft.

There exist a host of military mission requirements for prolonged war.[32] These missions are not necessarily strategic in the SALT-inspired sense of what constitutes a strategic weapon (i.e., ICBMs, SLBMs, modern cruise missiles, and heavy bombers). Nevertheless, they would be important or essential to a U.S. prolonged war capability, and strategic defense could enhance the U.S. capability to perform some of those missions.

For example, maintaining national integrity against possible internal pressures for post-attack political devolution and discord and possible foreign incursion would be absolutely essential for meaningful U.S. prolonged war capabilities. These threats could include domestic rebellion or anarchy, Soviet SPETSNAZ operations, and Cuban or other potential local threats. To counter these threats would require a manifest U.S. military presence and capability. It could necessitate enduring infantry units, (including some highly mobile forces), helicopters, APCs, light armor, light aircraft, active defense of airports, and some surveillance assets. Mobility and the capacity for quick response could be essential for the rapid re-establishment of post-attack governmental authority. In addition, the capability for a rapid show of force could be a key to maintaining national sovereignty over U.S. territory.

Preservation of a post-attack airlift capability would facilitate rapid responses to domestic or foreign challenges to U.S. integrity. As a result, a network of transport bases and dispersal airfields capable of accommodating transport and surveillance aircraft would be vital, as would the survival of some minimum number of transport aircraft (e.g., C-130s, C-141s, C-5s, the Civil Reserve Air Fleet, etc.). Tactical squadrons with attack aircraft and aircraft equipped for sea-control and maritime surveillance (possibly B-52s) could help deny low-risk land or sea approaches to CONUS.

If the SDI matures and defenses become increasingly effective, strategic defense would provide a key to maintaining the survivability and endurance of necessary transport, attack, and surveillance aircraft, a minimum network of air bases and dispersal fields, and critical Army units at designated and defended dispersal areas. Obviously, this type of post-attack military capability would require a relatively-high level of defense effectiveness—as would some of the corresponding defensive missions, such as providing coverage for dispersed U.S. logistical support facilities. For these types of missions, several layers of preferential defenses, if complemented by some dispersal and hardening, could help provide the post-attack military power necessary to ensure continued national political authority.

The same network of surviving facilities could help preserve a U.S. capability to deny the Soviet Union free post-attack access to CONUS airspace. A small number of surviving Soviet heavy bombers could seriously retard U.S. recovery and reconstitu-

tion efforts. Unfortunately, it is likely that most U.S. fixed radars of the Joint Surveillance System would be destroyed relatively early in initial exchanges. Consequently, the United States could be reliant upon airborne systems for surveillance of CONUS airspace and direction of fighter aircraft. A network of defended airbases and dispersal fields could help ensure the endurance of the modest number of AWACS necessary to cover most approaches to the United States. Selective and preferential defense of a designated subset of longer runways necessary for AWACS operation would facilitate continuous AWACS coverage throughout a prolonged war.

It has been suggested that C^3I and strategic force endurance for prolonged war (measured in weeks or months) is impossible, because of the gross devastation of nuclear attack, and because the critical U.S. assets are likely to be targeted heavily.[33] The addition of active defenses to other passive measures may provide the necessary survivability for U.S. strategic assets to support a prolonged war capability. This may be possible during the early to mid periods of the transition towards what the administration has referred to as the ultimate objective of the SDI—a comprehensive defense that can render strategic nuclear weapons obsolete. This prolonged war capability should help provide the basis for a stable transition, even if an initial Soviet BMD breakout further degrades the U.S. capability to wield a comprehensive threat against those Soviet assets identified as being of highest value.

Summary and Conclusion

Strategic defense is, in theory, necessary for stability across the spectrum of U.S. deterrence responsibilities. At the time the United States accepted extended deterrence responsibilities its prospective capabilities for damage-limitation probably were quite good. However, vulnerability to nuclear fire was imposed on the United States by the Soviet strategic buildup. This vulnerability became part and parcel of the U.S.-Soviet deterrence relationship; and what had earlier been understood—that defense was essential for the deterrence functions required of the United States—was forgotten. Rather than acknowledging that a damage-limiting capability is necessary but beyond reach, perhaps temporarily, the U.S. defense community simply revised its theory of strategic adequacy and declared that a mutuality of vulnerability had somehow become compatible with stability. Consequently the use of parity of vulnerability as an index for stability became an accepted means of assessing strategic force needs. Ironically this misguided index continues to be used by those searching to establish quantitative guidelines for defensive requirements—despite the fact that it excludes a basic defensive requirement from the outset. In this case a cliche provides apt commentary, skewed assumptions will produce skewed results. A deterrence requirement for defense that is compatible with the long-term defense objective of SDI is to reestablish the necessary basis for a credible U.S. extended deterrent commitment.

There is legitimate concern that during the transition to the long-term defense objective the Soviet Union will achieve an immediate (if temporal) and destabilizing defensive advantage based upon its apparent BMD breakout capability, and its presumably easier-to-defend highest values. There are questions then of identifying how the United States might min-

imize potential instabilities, and determining whether defenses would play a significant role in addressing the problem. An important element in the answer to that question is that deterrence in the future may be predicated less on a threat to Soviet highest values, which as currently defined in U.S. policy are possibly beyond prompt risk anyway, and more on the threat that any prospective war would be prolonged at least, and unwinnable in Soviet terms. ATBM for Europe, and strategic defense for North America could contribute significantly to the U.S. capability for prolonged war. This should not be seen as a suggestion that the objective of the SDI is to make the world safe for fighting prolonged nuclear wars. Rather, it is to suggest there may well exist an important near and mid-term defense mission that could support deterrence by helping to stabilize a defense transition; and that mission is to ensure that the Soviet Union must anticipate that nuclear war with the West would be a long and extremely doubtful affair. Indeed, given the increasing difficulty of threatening Soviet highest values, with or without more Soviet defenses, the United States will have to reconsider the basis of its deterrent threat in any event.

Strategic defense cannot provide a panacea for Western security concerns—regardless of its ultimate level of effectiveness. However, a first step in understanding the relationship between stability and defense is to recognize that a comprehensive defense capability is necessary for the credibility of the U.S. extended deterrent commitment. In addition, defenses may provide near- and mid-term capabilities extremely important to the preservation of the U.S. deterrent, and thus the maintenance of stability.

Notes

1. The text is reported in, "A Decision which Offers a New Hope for our Children," *Washington Post*, March 24, 1983, p. A12.
2. For a relatively early presentation of the view that there is an incompatibility between deterrence and defense see Glen Snyder, *Deterrence and Defense: Toward a Theory of National Security* (Princeton, NJ: Princeton University Press, 1961), especially chapters one and two; see also Jerome Kahan, *Security in the Nuclear Age: Developing U.S. Strategic Arms Policy* (Washington, DC: Brookings Institution, 1975), pp. 272–273, 282; and Jeremy Stone, *Containing the Arms Race: Some Specific Proposals* (Cambridge, MIT Press, 1966), pp. 21–22.
3. For an examination of the evolution of U.S. strategic nuclear policy see, Lawrence Freedman, *The Evolution of Nuclear Strategy* (New York: St. Martin's Press, 1982).
4. Harold Brown, *Department of Defense Annual Report, FY 1980* (Washington, DC: USGPO, January 25, 1979), p. 61.
5. See for example, *The President's Strategic Defense Initiative* (Washington, DC: USGPO, January 1985).
6. For a recent authoritative presentation of this fact see the statements by Gen. Bernard Rogers in, "How NATO's Top Officer Views the Alliance," *U.S. News and World Report* (October 1, 1984), p. 38.
7. See Henry Kissinger, "The Future of NATO," in *NATO the Next Thirty Years*, Kenneth Myers, ed. (Boulder, CO: Westview Press, 1978), p. 8.

   Very early in the nuclear age Bernard Brodie recognized this need for a damage-limitation capability to support extended deterrence duties: "The moment we think of deterrence in somewhat bolder terms—that is, as something to be practiced concerning territories beyond our shores—the issue of whether or not we have provided reasonable protection for our population may become all important." "The Anatomy of Deterrence," *World Politics*, Vol. 11, No. 2 (January 1959), pp. 187–188.
8. Herman Kahn estimated that holding casualties down to approximately 10 percent of the population would provide the United States with a "not incredible" extended de-

terrent. See, *On Thermonuclear War* (Princeton, NJ: Princeton University Press, 1961), p. 141–144.

9. The importance of credibility has been debated. For the view that credibility is not essential for extended deterrence see, Thomas Schelling, *Arms and Influence* (New Haven, CT: Yale University Press, 1966), pp. 97–98, 104, 107.

10. "The Forgotten Dimensions of Strategy," *Foreign Affairs*, Vol. 57, No. 5 (Summer 1979), p. 983.

11. For the most recent available review of the Soviet BMD "breakout" potential see, *Soviet Strategic Defense Programs* (Washington, DC: USGPO, October 1985).

12. President's Commission on Strategic Forces, *Report of the President's Commission on Strategic Forces* (April 6, 1983), p. 6.

13. For an excellent examination of Soviet views and concerns regarding prolonged war see Rebecca Strode, *The Integration of Political and Military Objectives In Soviet Strategic Arms Control Policy*, Forthcoming Ph.D. Dissertation, Harvard University, 1985, chapter entitled "Changes In Soviet Strategy Since SALT I."

14. Caspar Weinberger, *Department of Defense Annual Report to the Congress Fiscal Year 1983* (Washington, DC: USGPO, February 8, 1982), p. III–66.

15. See, for example, U.S. Senate, Committee on Foreign Relations, *U.S. Strategic Doctrine, Hearings*, 97th Cong., 2nd sess. (Washington, DC: USGPO, Dec. 14, 1982). See also, Jeffrey Richelson, "PD-59, NSDD-13 and the Reagan Strategic Modernization Program," *The Journal of Strategic Studies*, Vol. 6, No. 2 (June 1983), pp. 125–146; and Richard Halloran, "Pentagon Draws Up First Strategy for Fighting a Long Nuclear War," *The New York Times*, May 30, 1982, pp. A1, 12.

16. As presented in Michael Getler, "Administration's Nuclear War Policy Stance Still Murky," *The Washington Post*, November 10, 1982, p. 1.

17. See Richelson, PD-59, NSDD-13 and the "Reagan Strategic Modernization Program," p. 133–134.

18. Quoted in Robert Scheer, "Pentagon Plan Aims at Victory in Nuclear War," *Los Angeles Times*, August 15, 1982, p. 1.

19. See the discussion in, Congressional Research Service, *The Anti-Ballistic Missile Defense of Washington: A Continuing Issue*, UC-500-USC, 74-35-F (Washington, D.C.: USGPO, Feb. 7, 1973), pp. 36–39.

20. See the discussion in Christopher Branch, *Fighting A Long Nuclear War*, National Security Affairs Monograph Series 84-5 (Washington, D.C.: National Defense University Press, 1984), pp. 32, 49.

21. See the discussion in, Desmond Ball, *Can Nuclear War Be Controlled?*, Adelphi Papers, No. 169 (London: IISS, 1981), pp. 40–41.

22. As discussed in Charles Zraket, "Strategic Command, Control, Communications, and Intelligence," *Science* (June 27, 1984), pp. 1306–1311.

23. See Branch, *Fighting A Long Nuclear War*, pp. 21–22, 43–44

24. For a very useful treatment of Air Force missions critical for prolonged war considerations, see Felix Godwin, *Post-Attack Missions of Surviving Military Forces* (Huntsville, AL: Teledyne Brown Engineering, October 1984).

25. Branch, *Fighting A Long Nuclear War*, p. 23.

26. See Pat Friel, "U.S. Ballistic Missile Defense Technology: A Technical Overview," *Comparative Strategy*, Vol. 4, No. 4 (1984), pp. 319–347.

27. See Ibid.; and Williams Davis, "Ballistic Missile Defense Will Work," *National Defense*, Vol. 66, No. 373 (December 1981), pp. 16–23.

28. See for example, Daniel Moynihan's much-acclaimed *Loyalties* (New York: Harcourt Brace Jovanovich, 1984), pp. 17–30.

29. See Henry Kissinger, "Should We Try to Defend Against Russia's Missiles" *Washington Post*, September 23, 1984, p. C-8.

30. See, "From Arms Control to Controlled Security" *Wall Street Journal*, (July 10, 1984), p. 36.

31. See Godwin, *Post-Attack Missions of Surviving Military Forces*, pp. 60–62.

32. For an excellent survey of many prolonged war requirements see, Ibid.; and its companion piece, (with Connie Wooldridge,) *U.S. Military Installations: A Description of Major Installations in the U.S. Excluding*

ICBM & C³I Facilities (Huntsville, AL: Teledyne Brown Engineering, 1984).

33. See Zraket, "Strategic Command, Control, Communications, and Intelligence," p. 1310.

SDI: Return to Basics

Robert E. Hunter

Herman Kahn: "If we deploy a full-scale anti-ballistic missile system, we can save 50 million lives."

Bernard Brodie: "Herman, in order to save 50 million lives, you've got to have a war."

THIS EXCHANGE, WHICH reputedly took place at an Oxford University conference during the 1960s, went to the heart of the debate then raging over whether the United States should develop and deploy an anti-ballistic missile (ABM) system to try protecting the people of the United States against Soviet missile attack. Since then, technology has moved on and so has the rationale for trying to defend the United States against nuclear weapons. The Strategic Defense Initiative (SDI) proposed by President Ronald Reagan on March 23, 1983, is, even in modified form, far more ambitious than anything heretofore contemplated. Yet the central question remains the same: Will building defenses against missile attack increase or decrease the risks of nuclear war?

As debate about SDI has developed during the past two and a half years and has become more intensely political, in both domestic and foreign terms, it is worth trying to create a basic benchmark of strategic analysis against which to measure particular proposals. Indeed, strategic theory provides the critical test—whether Reagan's original idea or some variant of it should be pursued, or whether SDI should simply be foresworn.

Robert E. Hunter is director of European Studies at CSIS and contributing editor of *The Washington Quarterly*.

The Sociology of Debate

First, however, it is important to understand the particular quality of the debate that is now underway and whose outcome could have truly revolutionary consequences. In fact, the strategic community in the United States has seen little like it for at least a generation. Reagan's proposal and its many variations have intensely polarized the attentive community. Experts and political figures alike are choosing sides. Oftentimes, it seems as though the strength and quality of arguments are less important than the number of prominent names that can be arrayed on either side of the issue, like a pagan ritual of piling rocks on a cairn to see which will emerge the larger.

The explanation for this political phenomenon lies only partly in the quality of the ideas being advanced for or against some sort of protection against attack by nuclear weapons. We have seen debates of similar complexity on more than one occasion in the past. Nor is there some imminent decision—comparable to whether Congress should approve funding to deploy a new strategic missile or pass judgment on a major arms control treaty—to explain the debate's intensity. The irony of the current controversy about strategic defense is that,

as Gertrude Stein said of Oakland, California, "there is no there, there." Indeed, expert opinion holds that it will be several years even before any basic decisions could be taken to move forward with serious deployments of strategic defense, as opposed to demonstrations either to validate individual technical concepts, to drum up political support for the program, or to breach existing treaty limits.

The sociology of the debate relates directly to the terms in which Reagan first couched his SDI proposal and then repeated it after the 1984 election, when it finally caught fire with both proponents and opponents. As originally conceived, the Strategic Defense Initiative is not designed just to provide a limited degree of protection for missile silos or even for U.S. cities. At the rhetorical extreme, it is to make nuclear weapons "impotent and obsolete." But that hyperbole does not have to be believed—and its adherents are few—for attention to be riveted on the core suggestion that today's prevailing U.S. nuclear doctrine of Mutual Assured Destruction (MAD) could itself be made obsolete.[1] According to the proposition advanced by Reagan and others, instead of holding Soviet cities hostage, the United States would rely increasingly on defense to inhibit attack. With similar technological capabilities, the Soviet Union could achieve a parallel result. Both sides could then reduce their offensive nuclear weapons. In fact, the Reagan administration has suggested that the United States and the Soviet Union could reduce their offensive nuclear forces in expectation that both sides will deploy strategic defenses—the so-called transitional phase.

The emotional intensity of debate about this proposal to change the basic U.S. strategic doctrine stems in part from the resistance of nuclear strategists, arms controllers, and political leaders who have lived by a particular canon for so many years. But that can only be a partial explanation. Rather, the skeptics and opponents are also concerned lest a doctrine that has worked for so long be jettisoned for something that would require a level of technological sophistication that has never before been achieved and that must be implemented, or phased in, with an orderliness on both the American and Soviet sides that has never before been attempted.

More important, the appeal of a full-blown strategic defense to one side of the debate, plus resistance on the part of the other, stems from the extent to which Reagan has tried, consciously or not, to steal the thunder of long-time opponents of the nuclear arms race. In effect, many of these opponents—including major elements of the nuclear freeze movement and the U.S. Catholic bishops—have characterized the doctrine of MAD as both insane and immoral. By their lights, it is insane because to implement it would mean global suicide; it is immoral because it premises the security of each side on the threat to kill tens of millions of people on the other side.

The promise or the vexation of the Strategic Defense Initiative, as originally set forth by Reagan and still contained in many variants, is that it accepts these condemnations of MAD and provides a direct answer, however radical. Its very elegance can be seen in five simple phrases that capture its essence. SDI is defense, not offense, relying on protection against attack rather than the threat of mass annihilation. It will be non-nuclear. It will be deployed in space and not on American soil. It can lead to the elimination (reduction) of offensive nuclear weapons, thus ending the tyranny of MAD and, as a bonus,

restoring the United States' broad ocean barriers to attack. And it will be produced through the ingenuity and skill of U.S. high technology. In each instance, SDI appeals to something innate in the American character and historical experience. This includes the frustrated desire evident since Hiroshima to be relieved of the burdens imposed when the awful knowledge of the atom was unlocked, henceforth to threaten mankind's survival. SDI is thus the answer to Prometheus Revisited.

Except for concerns about SDI's potential price tag, strategic defense as conceived by Reagan is thus likely to gain considerable public support in the United States, even as it attracts committed enemies. Yet it is hard to believe that a debate of today's intensity can be sustained for the number of years required to prove the viability of the various concepts that must be investigated even before first deployments can begin. At the same time, the opponents of SDI have no hope of prevailing in Congress with efforts to prevent serious research into strategic defense, although the pace of that effort will surely be debated and appropriations adjusted accordingly. The Reagan administration may have overstated its case that the Soviets are ahead of us in strategic defense, but Moscow is clearly engaged in extensive research. Simple prudence thus demands that the United States do likewise. Indeed, an absolute ban on research could not be verified, and there may be things to be discovered that will confound even the opponents of SDI. In fact, if a perfect defense against nuclear attack from all quarters were possible, we would be foolish if not crazy to neglect it, and no government could sustain opposition to it. In short, some research into strategic defense will continue. Even if Reagan himself suddenly decided totally to abandon his own proposal, he would not and could not be permitted to stop all research.[2]

For this complex of reasons, it is not surprising that debate about strategic defense has become so fashionable in the United States, even without considering the reaction of the Soviet Union and the Western allies, especially those in Europe. To be sure, for a time in 1985 it did appear that the intensity of debate over SDI might begin to wane. This would happen if it turned out that Reagan has merely been a superlative poker player, attempting to sell the ABM Treaty of 1972 to Moscow for a second time in exchange for Soviet arms control concessions in some area of major interest to the United States, such as deep cuts in its large land-based missiles targeted on U.S. missile silos. Indeed, throughout the runup period to the U.S.-Soviet summit in Geneva, the Soviet Union was unusually creative in making arms control offers with at least cosmetic appeal. The United States' West European allies were the primary market, and the Reagan administration was being pressed hard to compete in this political arena by signaling terms and conditions under which it would accept significant limits on SDI. These would begin with reaffirmation of language in the ABM Treaty that permits only research and, in any literal reading of the treaty, rules out development, testing, and deployment.[3] Of course, this political debate begged the question whether Reagan was prepared to compromise on what is not a proposal to build some new military hardware but a basic revision of strategic doctrine.

Alternatively, the SDI debate could be resolved, or at least much of the intensity leached from it, if the program were reshaped into a form much

more limited than contained either in Reagan's initial proposal or later variants. This more limited form of strategic defense would be an effort designed, on our side, simply to protect U.S. missile silos. Indeed, this form of strategic defense could be deployed relatively quickly, through so-called terminal defenses rather than through weaponry based in space. Under this scheme, defense of the U.S. population, in general, could either be traded away or consigned to a never-never land sufficiently remote in time and concept to keep SDI from being the continuing source of political tensions, at home and abroad, that it now threatens to be.

Of course, if SDI were denatured of its current implications for the continued viability of Mutual Assured Destruction, it would lose much of its psychological appeal, but at the same time it would also lose much of its putative danger. It is even conceivable that, assuming the Soviet Union fails in its U.S.-beating campaign on SDI, the two superpowers might one day agree to permit limited defensive systems on both sides to fit the strategic perspective of each. The United States might elect to defend missile silos, and the Soviet Union either to defend silos against Trident II and MX missiles or to build a limited shield against city-busting missiles from small third-country nuclear arsenals. Of course, these proposals would have to be subjected to the scrutiny of strategic analysis. An idea is not necessarily good just because both superpowers agree on it, nor, in the current political debate over SDI, does an idea become good just because the Soviets oppose it!

Reagan, however, anticipated such a half-loaf approach to SDI, by arguing that defenses designed specifically to protect missile silos would undercut his proposal. The good, in this case, would be the enemy of the best. Indeed, in his own terms Reagan is correct. Defending missile silos as an end in itself implies that there would be a need to retain significant numbers of land-based offensive nuclear weapons even after the Soviet Union, presumably, developed missile defenses of its own. Under circumstances in which that would be necessary, today's basic nuclear equation—ultimate reliance upon Mutual Assured Destruction—would persist.

To be sure, it may turn out that Reagan's rejection of silo defenses as subverting the essence of SDI has been simply a poker player's way of raising the stakes to get a better deal from the Soviet Union in terms, say, of limits on large land-based missiles. More likely, it reflects Reagan's appreciation of the inherent popular appeal of a system that might, indeed, grapple in a fundamental fashion with the dilemmas posed by the nuclear genie.

Yet these observations do not leave us faced with the need to live with the imponderables of strategic defense until such time as either the United States trades it away to the Soviet Union for something valuable or SDI research resolves debate about key technological issues. The argument that we should wait and see what happens with the technology before judging the strategic merits of SDI has been often repeated. But it does more to reflect exhaustion in the debate over SDI than to portray the limitations of knowledge. Indeed, it is possible to discuss now the circumstances, both strategic and political, that would obtain under different conditions of strategic defense and nuclear offense. How these conditions might be arrived at sometime in the next few decades is essentially immaterial. We do not, in fact, have first to

determine whether or not exotic technologies will work in order to understand their strategic and political impact. Instead, we can posit future conditions and draw valid conclusions from them today.

Nor is this a new method of strategic analysis. In the mid-1950s, for example, it was possible to understand in advance the strategic changes that would take place if the United States shifted reliance in its nuclear arsenal from vulnerable bombers and above-ground ICBMs to missile-carrrying submarines and silo-based missiles. The United States did not have first to begin producing and deploying the new weapons systems for strategists to understand the consequences with a high degree of accuracy. In that case, they projected the onset of second-strike deterrence, which was the father of Mutual Assured Destruction as well as, not coincidentally, the period in East-West politics called detente.

Taking a step back from the details and the intensity of current debate, it is worth examining some basic strategic propositions. This could enable us to determine, in advance, the value and the possible dangers of strategic defense, whether in the form conjectured by President Reagan or some other possibility. Indeed, one of the major ironies of the SDI debate is that each interlocutor seems to have a *sui generis* idea of just what the term strategic defense means. Also, strategic analysis of SDI is important for yet another reason. Now that some basic questions have been raised about the viability of the doctrine of MAD, it is not clear that nuclear debate can ever be the same again. The implications of that development must be faced whether or not the United States ever deploys some strategic defense.

The Core Arguments

As analysis of SDI continues, no doubt a wide variety of issues will have to be discussed and decided. This has also been true of every other key debate about the United States' strategic arsenal, doctrine, and arms control. Each element of strategic defense will have to be examined and understood on its own merits, as well as in terms of its impact on other questions. For example, some senior administration officials have said that SDI should not move into production until and unless certain conditions are met. These conditions include a favorable economic balance between the costs of one side's new defenses and the costs of the other side's offsetting offenses.[4] But as argued above, one central question is of supreme importance: Would SDI, in whatever form, make nuclear war more likely or less likely?

Of course, it is not self-evident that this is the litmus test of SDI. Indeed, this question has a chance of dominating debate on the theory of defenses against missile attack only because another basic issue has, at least for now, been settled: whether U.S. strategic policy should emphasize preventing a nuclear war, or either winning or halting such a war if it should begin. With the end of the latest round of discussion about limited nuclear war, prevention has won out, at least temporarily. This fact implies that conflicts among different U.S. objectives in the areas of nuclear programs, doctrines, or arms control should in general be resolved in favor of war prevention. The narrowness of congressional votes on the MX missile, for example, has reflected in part a widespread concern about a strategic equation regarding the prevention of nuclear war. The argument is that we should not deploy so many MX missiles in vulnerable

silos that either the United States would acquire a significant ability to attack Soviet missile silos or that the MX missiles themselves would provide overly-tempting, high-value targets to Soviet stategic planners and political leaders.[5]

The underlying debate about the role of strategic defenses in making nuclear war either more or less likely resolves, in essence, to analysis of a single proposition in deterrence theory. This is that a nation is more likely to be deterred from nuclear attack if it is uncertain of the results. This principle of uncertainty is central to prevailing strategic doctrine. In the case of the superpowers, it implies that neither will nationally embark upon a nuclear attack on the other if it is uncertain that it can achieve a disarming first strike. That concept means the ability to cripple the opponent's nuclear forces to the point that they cannot retaliate and cause damage unacceptable to the original attacker.[6]

However, analysis of the relationship between strategic defense and the uncertainty principle is clouded by a confusion that is often made, even by some professional strategists, between the defense of missile silos and the defense of cities. Indeed, this confusion lies at the heart of the SDI debate. Yet the distinction is not trivial. Indeed, it will continue to be central to arguments about strategic defense.

Protecting missile silos—that, is, ensuring the survival of land-based missiles—is an idea with a long pedigree. It is also one that permits a broad range of choices. If there continues to be general agreement that the United States needs to retain its triad of nuclear retaliatory forces (bombers, missiles in silos, and missiles in submarines), then the issue becomes simply which means is best to protect the land-based missile leg of the triad against an enemy first strike capable of crippling that leg.[7]

Ideas canvassed over the years have included the use of deceptive basing for land-based missiles (e.g., Jimmy Carter's race track), special nuclear effects (Ronald Reagan's dense pack), mobility (Midgetman), superhardening of silos, and missile defenses. The last named may or may not be the best alternative for protecting land-based missile silos; that debate goes beyond the scope of this article. But the basic goal can be simply stated: the United States needs to deprive the Soviet Union of the certainty that it could destroy all, or perhaps even a large fraction, of the U.S. land-based missile force. Indeed, a defense or other protection of silos might only have to be as low as, say, 20 percent or 30 percent effective to deny the Soviet Union its objective—for example, the preemption of a major retaliatory attack by land-based missiles sufficiently accurate to be targeted on Soviet silos or other high-value military targets. The principle of uncertainty would be validated—namely, the less certain the Soviets would be that they could launch a disarming first strike, the less likely they would be to attack at all. Further, the so-called window of vulnerability would also be closed, since the Soviets would know that they could not completely cripple even one leg of the U.S. strategic triad. The U.S. president would know that, following a Soviet first strike, he would not be faced with the choice of attacking mostly Soviet cities or doing nothing. He would thus be more confident in a crisis.[8]

Defending Cities

This relatively straightforward argument about the application of the uncertainty principle to the survival of

land-based missiles is unremarkable. Yet it is often stretched in debate over SDI to cover attacks against cities and to support a more ambitious form of defense that also includes city defense. This is, in effect, the difference between a traditional form of anti-missile defense and SDI. The distinction here is of technological and economic as well as strategic interest. Building silo defenses may prove to be the preferred means of protecting the land-based missile leg of the triad. But doing so does not require any of the complex of efforts that make SDI unique. For example, it does not require the interception of enemy ICBMs in their boost phase or in mid-flight—i.e., those things that make SDI new and different. Defending enough missile silos to be strategically significant (perhaps 20–30 percent) is a simple proposition compared to the city-defending objectives of SDI, whether under Reagan's original idea or later variants. Indeed, a meaningful level of silo protection can be achieved through so-called terminal defenses, as nuclear reentry vehicles enter the atmosphere. And it could be done using technology more or less off the shelf.

This point helps to explain the anxiety that some proponents of a fully-blown SDI exhibit with regard to terminal defenses of missile silos, even terminal defenses clearly viewed as a transitional device to bring some SDI-related technology into production rapidly. Such a diluting of the concept of city protection would tend to undercut the rationale for the more ambitious technological feats, with their promise of perhaps one day obviating the need for MAD. There would thus be no relatively automatic transition to a full-scale defense of the entire nation. Terminal defense of missile silos could become the be-all and end-all of the strategic defense program.

But can the uncertainty principle be applied to the defense of populations? No question is more important to the future of SDI, in either strategic or political terms. It is, indeed, the question on which a nation-protecting SDI, as opposed to terminal defense of missile silos, deserves to stand or fall. This issue has risen in importance because many proponents of SDI have either abandoned or never embraced the idea that there could be perfect defense of cities. The defense that would be technologically possible would be relatively modest. Indeed, it would be most unlikely that Mutual Assured Destruction could be done away with.

Nevertheless, according to this school of thought, SDI is important for reasons that go beyond Reagan's logic or political insight. This school agrees with him that Mutual Assured Destruction has become less credible the longer it has been in being. This is especially so with regard to U.S. nuclear guarantees to Western Europe. In time, the moral, political, and psychological bases for MAD will crumble. But, unlike the Reagan argument for total protection of the United States, this school of thought holds that the risks of nuclear war will go down in proportion to the greater uncertainty a potential attacker has that he can successfully destroy the enemy's cities as well as his missile silos. Thus even an imperfect SDI, far short of Reagan's hyperbole about making offensive weapons "impotent and obsolete," would be of great value.

Stretching the uncertainty principle to cover city as well as silo defense is not as simple as it sounds, however. Indeed, current strategic doctrine is based on the premise that this will not

happen. Indeed, deterrence of nuclear attack is assumed to increase in credibility when an attacker becomes less certain that he can prevent retaliation—for example, because the attacked nation can protect its retaliatory weapons, perhaps with silo defenses. By contrast, the essence of Mutual Assured Destruction is that each side is not uncertain about being able to retaliate, under any and all circumstances, and to cause unacceptable damage to the enemy. Both superpowers have spent enormous time, energy, and money reinsuring against the possibility that they could be uncertain about being able to retaliate. In fact, it is conceivable that each side could deter the other from taking a wide variety of actions, perhaps running the gamut as understood in today's doctrines, with only 100 or so nuclear weapons of the right kind and deployed in the right ways. Yet both the United States and the Soviet Union have been sufficiently anxious about this proposition that they have built several thousand more weapons, even discounting those potentially designed for other purposes by one or both countries.[9]

Sorting out the benefits and risks of applying the uncertainty principle to the defense of cities requires analysis of what might happen in a major crisis between the United States and the Soviet Union when both have city defenses and not just silo defenses. This is the distinction between traditional ABMs and SDI: a space-based SDI system that is 20 percent effective in defending silos would have roughly the same effectiveness in defending cities.[10] For purposes of analysis, three preliminary points need to be made. First, both sides would have to have strategic defenses that are roughly equal. If only one side had them or there were major disparities, the nuclear equation would, almost by definition, become unstable. Second, the crisis must be one that could, in today's terms, risk escalation to nuclear war. Indeed, if such crises are presumed to be impossible because of inherent caution in both Washington and Moscow, then it hardly matters whether or not there is strategic defense on even some part of today's stategic offensive forces.[11] Third, the analysis that follows holds true whether strategic defense of cities were only modestly effective or were highly effective—99-plus percent. The issue is not the degree of protection; it is the effect of a significant degree of uncertainty that either superpower could deliver a devastating blow with its ballistic missiles against the other's cities.

At the very least, strategic defense on both sides would further truncate the amount of time available to national leaders to make decisions in the heat of crisis. In fact, with strategic defenses designed to begin intercepting missiles soon after they have left their silos or submarines, human intervention would probably be impossible. Delegation of authority to computers would be mandatory. To be sure, the automaticity implicit in this delegation, long avoided by both superpowers, would not involve offensive nuclear weapons, but in a crisis political leaders might not clearly recognize a firebreak between the beginning of space-based attacks against missiles, satellites, and strategic defenses and the use of nuclear weapons.

More important in terms of behavior in a crisis, the existence of strategic defenses would add yet more layers of consideration for political leaders on both sides. Not only would they have to try to understand one another's motives and intentions, but they would not have today's relative luxury of

knowing that, come what may, they could ride out a nuclear attack and decide much later whether to begin retaliating with nuclear weapons and causing unacceptable damage.

In addition, leaders on each side would have to make abstruse calculations, under pressures of times, ideological bias, lack of adequate intelligence, and the "fog of war," about the relative capacities of its offensive and defensive weapons, compared with those of the enemy. Each would also have to attempt mirror-thinking to understand the enemy's own calculations. Under such circumstances, events like discovering that the leadership of the other superpower has left its capital could have a highly unsettling effect. One has only to recall the deep concern of many U.S. political leaders over Soviet civil defense efforts, which promise only a marginal defense against the ability of the United States to cause unacceptable damage.[12]

This, then, is the crux of the matter. Would leaders faced with this added uncertainty and complexity opt for safety and refrain from any use of nuclear weapons? Or would they instead be induced to seek what advantages could arise from calculations of relative system capabilities, while also weighing gravely the potential losses from failing to act? It is too facile to assert simply that leaders on both sides, certain that they could neither disarm the enemy nor be disarmed, would never use nuclear weapons. If that would be true in the world of strategic defenses, then it is also not possible for the superpowers to go to nuclear war today, because there is no doubt that each side has the ability, come what may, to devastate the other. Arguments about the vulnerability of missile silos are indeed at the margin. As in the case of the window of vulnerability, they deal with the psychology of a crisis or the mechanics of warfighting, not with the realities of deterring the outbreak of a nuclear war.

Thus two basic conclusions can be drawn about strategic defenses designed to protect population centers. First, any increase in deterrence afforded by SDI—that is, any decrease in the chances of nuclear war—would come from the protection of retaliatory forces, not from efforts to protect cities. To be sure, with strategic defenses that involved devices designed to intercept ballistic missiles even before these missiles' targets would be known, silo defense would be the automatic byproduct of a system designed to defend cities. But such space-based defenses of the whole country do not have to be constructed in order to get the benefits of just protecting missile silos through terminal defenses. It is like making a net sufficient to catch minnows when bass are the object. Second, the additional uncertainties that would face U.S. and Soviet leaders in a crisis because of city defenses would not increase deterrence of nuclear war beyond that afforded by protecting missile silos. Those added uncertainties might actually make nuclear war more likely, although this proposition is harder to prove. Thus, at best, the world would be no better off than it is today, after a colossal effort to build weapons systems of unprecedented magnitude and cost.

This second conclusion is reinforced by a technical factor that is rarely given enough attention in debate on the Strategic Defense Initiative. This discussion about the difficulties potentially posed by added uncertainties in a U.S.-Soviet nuclear crises applies even to defenses against ballistic missile attacks that are 100 percent effective. Yet for both the United States

and the Soviet Union, defending against such attacks is only part of the problem. It must also be clearly recognized and understood that a superpower determined to deliver nuclear weapons against enemy cities will, without a doubt, find the means to do so for as far into the future as it is possible to speculate.

As currently formulated, the Strategic Defense Initiative by itself says nothing about nuclear munitions deliverd by bombers, cruise missiles, or depressed-trajectory ballistic missiles—the last-named launched, for example, from submarines near the U.S. coastline. To be sure, technological solutions could be developed to deal with these threats, but at a price. Yet even if the economics of offense did not continually overwhelm the economics of defense, as is most likely, it is unrealistic to expect that there could also be perfect defenses against unconventional means of delivering nuclear weapons. And this delivery, after all, would take place in anger and with determination. These unconventional means range up to and include surreptitious emplacement of weapons in preselected and secure locations in a small but sufficient number of enemy cities well in advance of any crisis. This possibility is not at all fanciful. Modern nuclear weapons can indeed be made that small. And discussion of total megatonnage in the superpowers' nuclear arsenals often leads us to forget just how little nuclear explosive power is required to devastate entire cities.

Indeed, so long as superpower conflict continues, both the United States and the Soviet Union will find some means of delivering large numbers of nuclear weapons against the other, however effective SDI proves to be. In short, whether we like it or not and with or without the most ambitious strategic defense, Mutual Assured Destruction is here to stay, even if "assured" has to be written with a lowercase "a." MAD is not in fact a doctrine at all. Rather, it is a fact of life.

The Unstated Assumption

There is nothing special or unique about the foregoing arguments: that it is unrealistic to expect that uncertainties added during a nuclear crisis by efforts to defend cities against ballistic missiles will reduce the risks of nuclear war. All these arguments derive from basic strategic theory; all were thoroughly explored during the ABM debate of the 1960s.

The continued propagation of arguments for a full-blown strategic defense system in fact depends upon an unstated assumption. It is that, when confronted with strategic defenses, both the United States and the Soviet Union will begin to resolve their political differences and develop genuine trust in one another. Such trust would be required, for example, to permit a phasing-in of defenses on both sides at such a pace and through such means so that at no point would either superpower make any miscalculations that would lead to strategic instability. Mutual trust would be required for both sides to decide to limit their offensive weapons instead of seeking all means possible to confound the other's defenses. Not surprisingly, both sides are now committed to seek those means. And mutual trust would be required even if both sides developed only partial defenses (e.g., to defend missile silos) with the risk that these defenses could be upgraded to try defending populations. This problem of upgrading was a hallmark of debate on anti-ballistic missiles in the 1960s; nothing has happened to resolve it. Even if the two superpowers could de-

velop the political means of making the transition to a military relationship that is dominated by strategic defenses, they would need basic trust in one another lest one or both be threatened by nuclear weapons delivered by unconventional means.

In sum, the case for city-protecting strategic defenses rests, finally, on the prior accomplishment of a basic change in the U.S.-Soviet political relationship. Ironically, supporters of SDI are thus required to accept premises about the possibilities in U.S.-Soviet relations that many of them explicitly reject. Indeed, these possibilities, akin to seeing U.S. relations with the Soviet Union become like those with the other nuclear powers, are accepted by few Americans, for good reason.

This point leads to a third basic conclusion about trying to defend cities with SDI. As in the case of the window of vulnerability, the most profound impact of city defenses could be felt in circumstances in which nuclear war was not even contemplated. Simple uncertainty about the consequences of nuclear conflict, in terms of the reliability of penetration for retaliatory forces, could be enough to confound the best efforts to relax tensions between the superpowers. Rather than presaging a new age of security, SDI could be the harbinger of an open-ended age of renewed anxiety.

In the final analysis, therefore, the question of strategic defenses returns to a basic home truth. Salvation in the nuclear arms race between the United States and the Soviet Union, if salvation there be, lies not in yet another technical fix, but rather in the politics of the relationship. Indeed, if that relationship could be developed to the point where a full-blown Strategic Defense Initiative could be safely implemented, then it would not be needed at all, with all of its attendant costs and potential risks. Fulfilling the political conditions needed for SDI to be stabilizing and not destabilizing is today beyond reach if not beyond imagination. But if it were not, it would permit other courses of action that are clearly more desirable.

With such a final sentence upon SDI, it is remarkable that the United States is prepared to risk so much, not least in arms control and in relations with its West European allies, for a goal that is itself not the objective desired. Instead, in the best of circumsances SDI is only an unnecessary and potentially dangerous impediment to stability and reduced tensions in the nuclear age.

Notes

1. Mutual Assured Destruction holds that neither the United States nor the Soviet Union will attack the other provided that each knows that the consequences would be a retaliatory strike that would cause "unacceptable damage" in return. Unacceptable damage is a loss, calculated in the attacker's value system, that is greater than any gain to be derived from the original attack. MAD requires that sufficient nuclear retaliatory forces on both sides can survive and retaliate, come what may; it also implies that each side has the will, *in extremis*, to launch a retaliatory nuclear attack.

2. Even if a grand Soviet-U.S. bargain were to prove possible in which the United States traded away SDI, some research into strategic defense would have to continue.

3. Article V of the ABM Treaty states, in part: "1. Each Party undertakes not to develop, test, or deploy ABM systems or components which are sea-based, air-based, space-based, or mobile land-based." Agreed Statement D, however, states in part that ". . . the Parties agree that in the event ABM systems based on other physical principles . . . are created in the future, specific limitation on such systems and their components would be subject to discussion in accordance with Article XIII (etc.). . . ." In late 1985, this latter statement was cited by

Reagan administration officials as potentially justifying all-out work on SDI. That position has been subject to considerable challenge.

Some strategists see irony in possible U.S. efforts to convince the Soviet Union that we did truly wish to abandon the SDI. Such efforts might be stymied by the lack of verifiable means to assure the Soviet Union that U.S. declared intentions to move to SDI deployments were indeed dead. This point is implicit in statements made by some senior administration officials that the deployment of everything in SDI, save antisatellite weapons, is already banned by either the ABM Treaty or the Outer Space Treaty of 1967. Other officials have sought to define this ban away.

4. Paul Nitze, senior arms control advisor, ". . . also said the new systems must be 'cost-effective at the margin,' that is, they must be cheap enough to add additional defensive capability so that the other side has no incentive to add additional offensive capability to overcome the defense.'" *The New York Times*, February 21, 1985.

5. To be sure, this view has to recognize that the Soviet Union has already developed, in theory, the ability to attack and destroy U.S. land-based missile forces. The key arguments against the United States following suit are that there is no point in both sides taking a risky step strategically and that the Soviet Union might be more likely to behave irrationally out of paranoia. When the United States deploys its Trident II (D-5) missiles, coupled with Geosynchronous Position (GSP) satellites, it will increase its ability to target Soviet land-based missiles. This development must be factored into Soviet calculations about both offensive and defensive weapons.

6. In strategic theory, the uncertainty principle holds that a potential attacker must not be permitted to calculate that a retaliatory response will be less, in terms of the attackers calculus of value, than what it expects to gain through its initial attack.

7. Further confusion in strategic debate is often introduced in the use of the term "first strike." In itself, that means simply the first attack in a nuclear war. The concern in strategic doctrine is with a "disarming" first strike, namely an attack that destroys the ability to retaliate successfully. Destroying all or part of only one leg of the triad is not a disarming first strike, although it could have consequences for stability in a crisis.

8. The concept of the window of vulnerability never referred to the risks of a Soviet disarming first strike, since it was never posited that Moscow could also destroy all of the U.S. bombers, fighter bombers, cruise missiles, and missile-carrying submarines. Rather, the window of vulnerability related to possible behavior during a crisis short of nuclear war, in which a president, supposedly faced with the choice of being first to attack cities deliberately, would be in a weaker position, diplomatically. This theory always assumed that a Soviet anti-silo attack would be presumed to work and that there would be little so-called collateral damage (i.e., civilians killed incidentally to the attack on the silos). This latter assumption has never had much validity, and it is not clear that any U.S. president would be so intimated that there would indeed be a window of vulnerability.

9. These other purposes could include a desire to be able to preempt part of a nuclear attack, to prosecute a nuclear war once it has begun, to help shift the terms of crisis management, to compete with one another politically, including in symbolic terms, and eiher to keep a distance from third countries or to deal with smaller nuclear forces.

10. In theory, defense against attack of cities and silos should be equal, because SDI would begin intercepting with the boost phase, before attacking missiles are separated out by target. Yet an enemy might adopt different configurations for an attack against silos as opposed to cities, thus testing different parts of a defensive system.

11. The essence of strategic programs—arms, doctrine, and arms control—should be to provide for stability, both in the conduct of the arms race and in a crisis. How important these considerations are in actually preventing a nuclear war between the superpowers is debatable, however, and can never be proved except in failure. The importance of political caution in inhibiting either side from risking a nuclear war, regardless of calculations about relative advantage, can be seen in the difficulties faced by serious war gamers in creating credible scenarios that lead to the use of nuclear weapons.

12. The same has been true, of course, of every discovery of even a fledgling Soviet

progam in the field of strategic defense, from the so-called "Tallin Line" of the 1960s, which proved to be air defenses, to worries about the possible upgrading of SS-16s to an ABM role, to concern about the phased-array radar at Krasnoyarsk—a violation of the ABM Treaty that we must insist on seeing corrected, but not a serious threat to U.S. retaliatory capabilities. These points also illustrate the inherent difficulties of strategic defenses, in terms of each side's perceptions, as discussed below.

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(NEWSPAPER — EXPEDITE)

DEFENSE ISSUES

Vol. 1 No. 32

SDI: Today & Tomorrow

Remarks prepared for delivery by Director of the Strategic Defense Initiative Organization Lt. Gen. James A. Abrahamson, USAF, to the Forum Club, Houston, Texas, May 19, 1986.

I am delighted to be back in Houston. I have spent many pleasurable, stimulating moments here, especially at the Johnson Space Center, so I am honored to be the guest speaker at the Forum Club today.

As I look out over the dining room, I recognize many old friends and some new acquaintances, but proud Texans all! Texans are amazing: Their history, their determination and their spirit make them a very special people.

Those soothsayers who are predicting gloom and doom for Texas because of the decline in oil prices simply don't know you Texans very well. The frontier spirit that made this state and this nation great is still very much alive, and I quite agree with Texas historian T.R. Fehrenbach that ". . . hard times are not going to extinguish it."

Similarly, hard times are not going to extinguish the space programs that have made Houston the first city of the Space World. Hard times are not going to extinguish the dreams and sacrifices of those who came before us and the dreams and sacrifices of those who are among us.

In this vein, this afternoon I would like to tell you about SDI and my vision of what I believe it promises for mankind. In pursuing the Strategic Defense Initiative, I believe that, in Thomas Jefferson's words, "We act not just for ourselves alone, but for the whole human race."

When Jefferson spoke those words, our nation was weak in arms but rich in spirit. Today, we are the richest nation on earth. We are one of the world's two superpowers, with interests in every hemisphere. But our growth in wealth and strength hasn't guaranteed us peace.

Over the last 200 years, but especially in this century, war has touched every family in America. Some of you here may not have been fortunate enough to wear the uniform, but all of you and your families have been involved.

For all of us, war has been a learning experience. For some, war is an experience that is remembered for moments of glory; for others, it is distinguished by unforgettable examples of self-sacrifice and valor. But for all, war is an experience that is more often tragic than glorious. For all, war is an experience that teaches us, above all, that there is no security in weakness. Gen. George Catlett Marshall, the architect of the greatest military force in history and a man whom the world may better remember as a statesman than as a soldier, best expressed this truth when, in 1945, he stated, "We have tried since the birth of our nation to promote our love of peace by a display of weakness. This course has failed us utterly."

Since World War II, we Americans have become accustomed to thinking of national security perhaps too much in purely military terms. We sometimes have overlooked that our national strategy, to remain true to our heritage, must also embrace spiritual as well as material, industrial and political factors. President Reagan drew our attention to this in his first inaugural address when he stated that "no weapon in the arsenals of the world is so formidable as the will and moral courage of free men and women" and again in March 1983 when he asked if it would not be better to save lives than to avenge them.

War, and its consequences, has forced us to appreciate that we must establish whether there is a better way to conduct our national security affairs than to continue to rely indefinitely on keeping the peace by threatening retaliation with offensive nuclear arms.

In my heart and soul, I believe that this "better way" was offered by President Reagan in his nationwide address of 23 March 1983. The president's speech, delivered without much advance fanfare, offered to the world a program which he described as ". . . a vision of the future which offers hope." The president's initiative, which established SDI, was an enlightened and extraordinary act of historic significance.

While maintaining an active defense posture, the president challenged our scientists and engineers, our strategists and policy makers, to find the means to save lives, not destroy them, and to do it within the context of existing arms control agreements. At first, there was skepticism—followed by cynicism—that the president's challenge could be met. The skepticism ranged even among members of the distinguished group of scientists convened, at the president's request, to determine if strategic defense was indeed feasible. Close on its heels came cynicism in the glib and shallow-minded shorthand of the sobriquet "Star Wars." However, the skepticism turned to optimism

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when members of the scientific team rigorously examined our nation's capabilities and concluded that not only were the technologies necessary for a strategic defense initiative attainable, but that many of the technologies were already available. The scientists recommended that the U.S. embark on an in-depth research program that would increase our strategic defense options for the future. Their examination validated as fact what I, and I am sure what most of you, had long felt to be true: the unparalleled leadership of the United States of America in the development and application of technology.

Thus, the president's quest for a "better way" started the SDI program. We are currently conducting research in the development and potential application of technologies for defensive systems that would be capable of intercepting and destroying an aggressor's ballistic missiles after they have been launched and, consequently, preventing these missiles from hitting their intended targets. I am increasingly confident that, through a continuing effort, a future administration and Congress, if they so choose, will have the very real option to design, build and deploy an effective defense against ballistic missiles; they will have the option to implement a better way.

Our progress to date reinforces my belief that the SDI will create new opportunities for innovative operational concepts and new tactics. Please examine our progress with me:

- ❑ The Army's Ballistic Missile Command demonstrated the practicality of terminal defense by intercepting and destroying a dummy Minuteman re-entry vehicle off Kwajalein, approximately 4,000 miles distance from the Minuteman's launch point at Vandenberg Air Force Base. We equated this success to "hitting a bullet with a bullet."
- ❑ We have burned holes through remotely piloted vehicles and other laboratory test articles with high-energy lasers. In September, we blew a stationary Titan I booster apart.
- ❑ With the help of the space shuttle, we demonstrated that we could overcome the atmosphere's distorting effect on a laser beam. Some members of the scientific community had thought this problem to be insurmountable. They don't think that it's insurmountable now.
- ❑ We have significantly enhanced our technology and techniques for discriminating between warheads and penetration aids. Our advances in optical sensors provide us with a much greater capability to identify hostile missiles and warheads.
- ❑ Work on our particle beam weapons and hypervelocity (or railgun) launchers, including the one at the Balcones Lab at the University of Texas–Austin, is proceeding satisfactorily. It's truly amazing how big a hole can be made in a cast aluminum block by a tiny plastic projectile travelling several thousand miles an hour!
- ❑ Equally important, we are making great strides in terms of energy storage and high-speed computational capabilities. Over the last 20 years, electronic information hardware costs have decreased by a factor of three; size has decreased by a factor of three; and speed has increased by a factor as much as 10—every three or four years! Indications are that we will improve upon this record!

In short, ladies and gentlemen, SDI, like this great state and this great nation, is alive and well. We're proceeding deliberately, keeping in mind that a strategic defense system must be highly survivable. An aggressor must know that he cannot destroy our strategic defensive system and expect his own capabilities to remain intact. We are also mindful of the criterion that it must be as cheap or cheaper for us to increase our defensive capability as for an aggressor to add nuclear warheads to his arsenal.

With SDI, I believe that our generation has crossed the threshold of a new era in human history. In building a better way, we have accepted an awesome responsibility, a responsibility made possible by the continuing evolution of our science and technology. In the months ahead, we will have many additional technical achievements to report to the nation. Nonetheless, these achievements will only be the tip of the iceberg. There will be no way in which the spectrum of benefits—for defense, in direct stimulation of the economy, and for enhanced productivity—can be accurately measured. And, of course, there will be no way to accurately assess the sense of pride, hope and optimism that the SDI program and its celebration of scientific and technological discovery will give to each and every American.

With SDI, we have explicitly recognized our strength in the development and application of technology—and we have chosen this as the gateway to the third century of our existence as a nation. Survival and peace are the business of us all, and SDI, in my opinion, will significantly reduce the chances of war. In the long run, I am convinced that SDI will be a positive catalyst in promoting more cooperation on earth and in space with all nations.

I also consider it a natural corollary that our investments in SDI technologies will help foster new growth industries and build a more robust economy. This isn't a unique idea. Our nation's military and civilian aeronautics and space programs directly, or indirectly, have made us all beneficiaries of this process. The process has been going on for years, on a wide range of matters, including electronics, air transport and data automation. Military investment has traditionally sparked investment in the civil sector, and it has been a supportive foundation for the flexible and innovative elements of our industry.

A case in point is the jet engine: Where would we be today if Sir Frank Whittle, now a robust 78-year-old, hadn't persevered and if he hadn't been supported when, as a young RAF technician, he invented the jet engine 56 years ago? Today and every day, over a million people fly on jet-powered aircraft. As

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TESTIMONY OF
THOMAS DINE, EXECUTIVE DIRECTOR
DOUGLAS BLOOMFIELD, LEGISLATIVE DIRECTOR
AMERICAN ISRAEL PUBLIC AFFAIRS COMMITTEE (AIPAC)
BEFORE THE
SUBCOMMITTEE ON STRATEGIC AND THEATER NUCLEAR FORCES
SENATE ARMED SERVICES COMMITTEE
JANUARY 30, 1986

Mr. Chairman, the American Israel Public Affairs Committee appreciates the opportunity to submit testimony to the Armed Services Subcommittee on Strategic and Theater Nuclear Forces. The subject of this hearing, the threat of tactical ballistic missiles and the need to examine possible defenses against them, is of particular interest to those concerned about the supply of tactical missiles by the Soviet Union to its client-states in the Middle East. These missiles threaten American security interests and the security of our only reliable, consistent and democratic ally in that part of the world, Israel.

Israel's enemies are now being armed by the Soviet Union with a new generation of highly lethal surface-to-surface missiles, more accurate and more deadly than any previously available weapons. Unfortunately, there are no comparable defensive systems available today that Israel could obtain to protect its vulnerable cities from bombardment.

To further examine the increasing problems that these missiles pose for the security of Israel, we have prepared a detailed paper for submission to the committee on "The Threat to Israel from Tactical Ballistic Missiles." I request that it be included in the record of the Committee's proceedings on this subject.

The Threat to Israel from Tactical Ballistic Missiles

W. Seth Carus*

Circumstances have made Israel particularly sensitive to the dangers posed by tactical ballistic missiles. For more than two decades, Israel's leaders have recognized that their country could be attacked by hostile states using short range surface-to-surface missiles. In the early 1960s, Egypt launched a massive effort to design and build its own force of short and medium range ballistic missiles. Although this program failed, the Soviet Union stepped into the breach and supplied Arab armies with FROG and SCUD missiles. At least thirty of these missiles were fired at Israeli targets during the 1973 Arab-Israeli War. The Syrians fired about twenty-five FROG-7 missiles at sites in Israel, mainly against Ramat David and other Israeli air bases. The Egyptians reportedly fired a small number of FROGs and at least three SCUD-B missiles at Israeli targets.

Arab armies currently possess more than 200 Soviet-supplied SCUD-B, FROG-7, and SS-21 launchers, probably supported by an inventory of at least 1,000 surface-to-surface missiles. These missiles are now treated as conventional weapons and are routinely used in conflicts with other countries. Iraq has fired a substantial number of FROG and SCUD missiles against Iran, and Iran has recently reciprocated using missiles provided by Libya.

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* The author is the senior military analyst for the American Israel Public Affairs Committee.

The Threat of Surface-to-Surface Missiles

Based on their experience in 1973, Israeli military planners came to believe that the FROG and SCUD missiles did not endanger the security of their country. Although it was recognized that cities were vulnerable to attacks by such weapons, it was believed that the threat of retaliatory strikes would deter attacks on civilian targets and that the missile launchers could be destroyed before serious damage was inflicted. Also, with the warheads then available to the Arabs, damage to civilian targets would be limited. At the same time, it was recognized that the FROG and SCUD missiles could not destroy hardened military targets. Thus, the missiles could temporarily prevent Israeli aircraft from landing at an air strip, but could not destroy an air base.

The threat from tactical ballistic missiles is far greater today. The decision of the Soviet Union in 1983 to supply Syria with the new SS-21 surface-to-surface missile is largely responsible for the heightened awareness in Israel of the potential threat posed by such weapons. Unlike the FROG and the SCUD, the SS-21 has the range, accuracy, and lethality to destroy hardened targets deep inside Israel.

The SS-21 is part of a new generation of Soviet-built surface-to-surface missiles have appeared in the past few years that correct the weaknesses of the weapons they replaced. These new weapons, the Soviet SS-21, SS-22, and SS-23 family of missiles, are extremely accurate and can be armed with cluster munitions. Thus, unlike the SCUD-B and FROG-7 systems, they pose a considerable threat to all but the most mobile or best protected military targets.

Normally, the SS-21 is considered a tactical weapon, because of its relatively short range, but because of Israel's small size, strategically important targets are within close proximity to enemy ground forces. This

lack of strategic depth transforms short-range surface-to-surface missiles, like the SS-21, into strategic weapons able to strike targets throughout Israel, including air bases, command posts, equipment storage depots, surface-to-air missile batteries, radars, and other vital facilities.

Syria now has as many as 24 SS-21 missiles, and additional numbers are reported to have gone to Iraq. The 120 kilometer range of the SS-21 allows it to be used against targets that the FROG-7 cannot reach. When fired from Syria, the SS-21 can reach targets throughout northern Israel, including one of Israel's main air bases, Ramat David. If deployed in Jordan, however, all of Israel would be brought within range.

Currently, there are only a few SS-21 missiles in the Middle East, but even this small quantity is of concern to Israeli military planners. Past experience indicates that the Soviet Union will provide more of these weapons as time passes and Arab armies want to replace their existing FROG-7s. Similarly, it is highly probable that SS-23 missiles will begin to appear in the region before the end of the decade. Thus, by 1990 Israel will be faced by Arab arsenals containing large numbers of highly accurate surface-to-surface missiles armed with sophisticated warheads.

It is likely that in the 1990s Arab armies will acquire tactical ballistic missiles from other sources. Brazil is looking into building a medium range ballistic missile, with the development funded by foreign countries. Past experience indicates that Arab countries, Iraq or Libya, would be the likely sponsors and beneficiaries of such a project. Similarly, European countries are developing sophisticated weapons payloads that could be added to a tactical ballistic missile, providing further improvements in accuracy and lethality.

The increasing emphasis given to chemical weapons by Arab countries

makes even older missiles more of a problem for Israel. Iraq has used chemical weapons in battle, and Syria is known to have an extensive and sophisticated chemical warfare capability. Ballistic missiles armed with chemical warheads pose an obvious threat to Israeli population centers, but they also could effectively suppress Israeli air bases and other military installations and significantly reduce Israel's retaliatory capabilities.

The Lack of an Effective Response to the SS-21

Israel can defend against surface-to-surface missiles only by destroying their launchers before surface-to-surface missiles are fired. This was not a serious weakness when the missiles were inaccurate. If inaccurate missiles were used against civilian targets, Israel's air force could launch counter strikes in retaliation, and the missiles would probably inflict only minimal damage if targeted against Israeli military installations.

The arrival of the SS-21 has made it impossible to ignore the threat of surface-to-surface missiles. As the Arab inventory of SS-21 missiles grows, Israel may find that it can no longer tolerate the damage that could be inflicted by a strike from tactical ballistic missiles. Missile strikes at the outset of a war could inflict sufficient damage to vital Israeli installations to seriously weaken Israel's military capabilities during the critical first hours of a war, even if Israel knew in advance that an attack was about to take place.

For example, a successful missile attack against airfields would significantly reduce the number of aircraft that the Israeli air force could put into the air. After such a strike, Israel's ability to defend its borders during the critical opening hours of a conflict would be significantly weakened, since ground units deployed on the borders in peacetime may well depend on support from the air force until reserves are mobilized. Under such conditions, Israel

also would have fewer aircraft available to send on strike missions against surface-to-surface missile launchers, and could not count on preventing follow-on missile attacks. Accordingly, it appears that Israel can do little to stop Arab missiles from hitting and damaging air bases and other vital installations.

As a result, the Israeli military will be increasingly forced to identify and attack launchers before missiles are fired. If there is a danger of an Arab attack, Israel will be forced to strike first, because it will not be able to take the risks of waiting and absorbing an Arab attack. Although such a strategy will make the Middle East a more dangerous place, the absence of a viable defense against tactical ballistic missiles will leave Israel with no alternative.

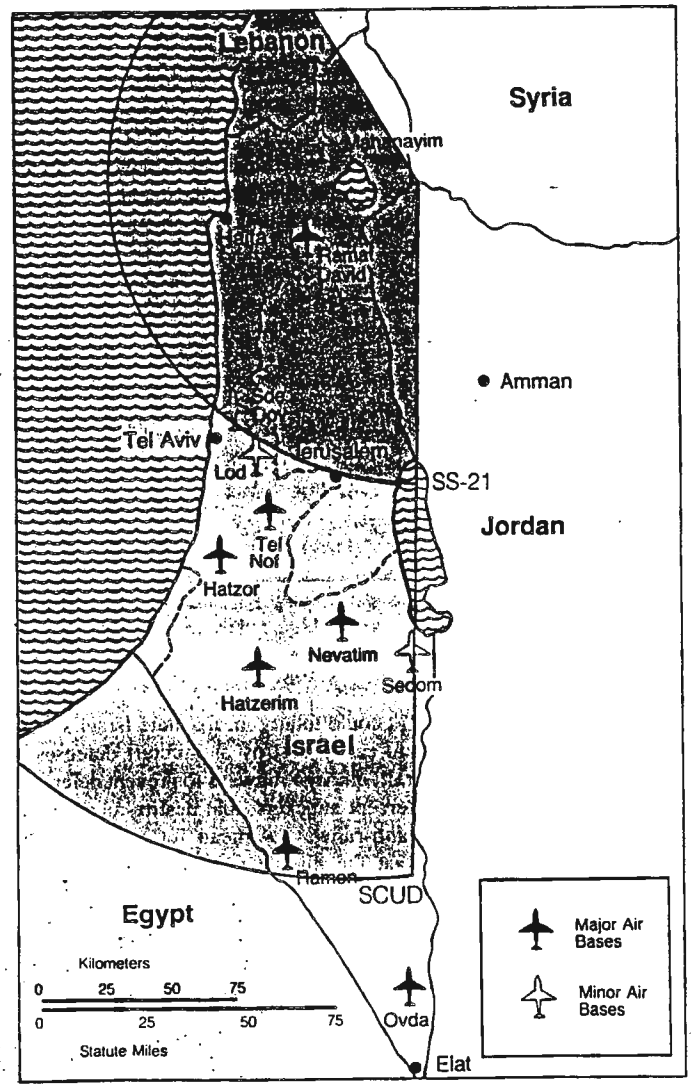
There appears to be a growing awareness in Israel that the enormous inventory of short range ballistic missiles available to Arab armies will make it difficult or impossible for Israel to locate and destroy all the launchers. Hence, even under ideal circumstances, a large number of missiles will strike military and civilian targets throughout Israel. As the Arabs acquire larger quantities of accurate missiles like the SS-21, and as Israel's ability to deter missile attacks diminishes, Arab armies will be able to employ their older and less accurate FROGs and SCUDs against urban centers. As a result, tactical ballistic missiles directed against cities potentially could easily result in 5,000 dead and wounded Israeli civilians in a future Arab-Israeli War.

Defending Against the Tactical Ballistic Missile

The lack of an effective defense against tactical ballistic missiles poses serious problems for Israel. For the moment, Israel might be able to tolerate such a weakness without jeopardizing its security. As additional new generation tactical ballistic missiles are deployed in the region the inability to defend against surface-to-surface missiles will become a serious one.

A defense against tactical ballistic missiles would significantly enhance Israel's security. Although the Israeli military could take steps to develop defenses on its own, the development of such systems is too great a challenge to be handled by one small country. Clearly, any progress made in the United States to develop answers to the dangers posed by tactical ballistic missiles could have a fundamental affect on Israel's future security. And, it should be stressed, the benefits resulting from the development of such a system would be shared by other American allies who also find that they must deal with the growing threat of tactical ballistic missiles.

The Missile Threat from Syria



A MISSILE DEFENSE FOR NATO EUROPE

MANFRED WÖRNER

THE AUTHOR: Dr. Wörner is the Minister of Defense of the Federal Republic of Germany. First elected to the German Bundestag in 1965, he served as Defense Speaker for the CDU/CSU in the 1970s and, prior to his present appointment in 1983, as the Party's Deputy Leader in the Parliament and Chairman of the Defense Committee. Previous articles by Dr. Wörner appeared in the Fall 1977 and Winter 1982 issues of *Strategic Review*.

IN BRIEF

Although definitive judgments must await the ultimate findings of the research effort, the U.S. Strategic Defense Initiative carries positive implications for the NATO Alliance as a whole, particularly in light of existing capabilities and continuing efforts by the Soviet Union in the arena of defenses against ballistic missiles. Meanwhile, however, a more imminent threat casts its shadow on NATO Europe: the growing Soviet capacity, afforded by technological advances, to employ their massive arsenals of mid- and short-range missiles as conventional firepower against prime NATO targets heretofore assigned to attacking aircraft or nuclear forces. This new dimension bodes to give the Warsaw Pact the capacity to launch an overwhelming attack beneath the nuclear threshold, while — in combination with active defenses — foreclosing or blunting NATO's nuclear options. The urgent and practicable answer to this threat is an anti-missile defense for NATO Europe, to be erected through incremental improvements upon existing air defense capabilities. Technology already points the way toward such a nonnuclear defense, consistent with both NATO's fundamental security requirements and arms limitation objectives.

Nearly three years have passed since President Reagan, in his speech of March 23, 1983, gave his vision of a strategic defense against nuclear missiles — a vision which subsequently inspired the U.S. Strategic Defense Initiative (SDI). For over two years, research has progressed under the direction of the Strategic Defense Initiative Office (SDIO). A multitude of contracts has been extended, and initial results of the research effort have been publicized.

The reasons which brought the United States to SDI are of significance also for the security of its NATO allies in Western Europe. Those reasons are related above all to the fact that the American concept of mutual arms restraints, which underlay the SALT Agreements of 1972, has not been realized in the meaningful limitation and reduction of strategic-offensive capabilities that had been anticipated by the United States and its allies. To the contrary: SALT I was followed by a large buildup in

the strategic capabilities of the Soviet Union, which inevitably forced a commensurate modernization of American strategic forces. The Soviet Union has not accepted — either in its declaratory policies or its weapons programs or deployments — the concept of deterrence through mutual assured destruction (MAD). Instead, the Soviets have continued energetic work on anti-missile defenses.

SDI and the Alliance

The condition of approximate parity in strategic-offensive weapons, along with Soviet anti-missile defense programs, carry direct implications for the security of the West as a whole and especially of Western Europe. In this situation the United States has determined to address a comprehensive research program to the question of whether technological advances offer the possibility that the nuclear threat may be neutralized no longer with the threat of retaliation, but with active defenses.

The Government of the Federal Republic of Germany issued the following statement on April 18, 1985: "The American research program is justified, politically necessary and lies in the interest of the security of the West as a whole."[1] This position of the Government of the FRG remains unchanged. It is clearly in the interest of the Federal Republic, and of Western Europe more broadly, that the SDI research program be pressed forward. Only on the basis of solid technological findings can the decision be made whether a defense system is technically feasible and financially practicable. Beyond questions of feasibility and practicality, the determination must be made whether a relationship can be fashioned between offensive and defensive weapons that can lead to greater stability in the strategic nuclear arena and favor the reduction of offensive arms.

The continuing, heated controversy over SDI cannot obscure the fact that these questions can be answered today neither with a confident "yes," nor an absolute, moralizing "no." Meanwhile, the participants in the debate must guard against the danger of denigrating, and thus undermining, a strategy of deterrence based on offensive weapons that must continue to be valid until an alternative becomes viable.

No one can predict today the likely developments — and decisions — over the coming years with respect to strategic missile defenses. Meanwhile in the NATO context, however, another development is imminent and fraught with significance for Western Europe's security. The Soviet Union is in the process of adding a new component to its offensive capabilities which has the potential of decisively shifting the military balance in Europe in Moscow's favor: namely, a massive threat exercised by nonnuclear missiles.

The Soviet Conventional Attack Potential

In the past two decades the Soviet Union has spared no effort in expanding and solidifying the military foundations of its global strategy. Those efforts have applied to nuclear as well as conventional armaments, to land and air forces as well as naval forces.

While the attention of the West was captivated, in the mid-1970s, by the buildup in Soviet strategic forces, as well as the dramatic rise in Soviet naval capabilities, the Soviets also inaugurated a substantial expansion and modernization of their ground and air forces, along with their mid- and short-range nuclear capabilities. NATO's deployment of Pershing-2 and cruise missiles, beginning in late 1983, has represented an at best limited counter to this massive, across-the-board Soviet missile buildup.

The Soviet Union has always endeavored to optimize all of its military forces for the successful offensive in the event of war: this has applied fundamentally also to Soviet nuclear forces. Still, a clear and abiding Soviet goal has been the ability to achieve victory in a European conflict with conventional forces.

Moscow has exploited its expanding conventional capabilities in its propaganda campaign against the NATO intermediate-range nuclear force (INF) deployments by repeatedly calling for the renunciation of a first use of nuclear weapons. Such a no-first-use agreement would have the effect of elevating the conventional superiority of the Warsaw Pact into a decisive strategic factor in Europe, thus increasing rather than diminishing the danger of a (conventional) conflict. Deterrence of conflict demands, however, the prevention of the use of any and all weapons. The NATO Alliance therefore gave the following, solemn affirmation in its Bonn Declaration of June 10, 1982: "None of our weapons will ever be employed except as a response to an attack."[2]

Soviet ground, air and naval forces are armed with a variety of weapons systems that can be deployed with conventional, chemical and nuclear munitions.[3] Beyond that, the Soviet Union possesses 441 mobile SS-20 missiles (not counting additional "reloads"), of which approximately 250 are targeted on Western Europe, each armed with three warheads, as well as a growing number of follow-on systems to the older Scaleboard, Scud and Frog missiles. These modernized SS-21, SS-22 and SS-23 missiles — with ranges of 150, 900 and 500 km, respectively — are distinguished by markedly improved accuracies. They can be employed more effectively than their predecessors with conventional — as well as chemical — warheads.

Emergent New Soviet Offensive Options

In the coming years, the Soviet Union can be expected to achieve substantial improvements in such realms as surveillance, target acquisition and weapons guidance, and to press ahead in the technologies of missiles and "smart" submunitions. In the process, all varieties of Soviet missiles will gain further potential for use as conventional weapons. Especially at the outset of a conflict, such conventionally armed missiles would decisively widen the spectrum of employment options for Warsaw Pact air and artillery capabilities against operational and strategic targets in NATO's depth.

In short, these advances are opening to the Soviets a potent alternative to the use of nuclear and chemical weapons. Marshal Ogarkov pointed to the advantages of this alternative already in May 1984, when he was still Chief of the General Staff of the Soviet Armed Forces:

> Rapid changes in the development of conventional means of destruction and the emergence in the developed countries of automated reconnaissance-strike systems, long-range high-accuracy terminally guided combat weapons, unmanned aircraft, and qualitatively new electronic control systems make many types of weapons global and make it possible to increase sharply (by at least an order of magnitude) the destructive potential of conventional weapons, bringing them closer . . . to weapons of mass destruction in terms of effectiveness. The sharply increased range of conventional weapons makes it possible to extend immediately active combat operations not just to the border regions, but to the entire [enemy] territory, [something] which was not possible in past wars.[4]

The Soviet Union is thus attaining a qualitatively new capability for executing the "conventional fire-strike" — namely, the capability to destroy with conventionally armed missiles a large number of important military objectives in NATO territory that must today be assigned to Soviet nuclear weapons or to fighter-bombers in a nonnuclear role. Such targets include NATO airfields, special weapons storage sites, radar installations and air defense systems — as well as ports and other infrastructure for NATO reinforcements, weapons and munitions stockpiles, command centers and headquarters.

If the Soviets were to try to engage these targets today by conventional means, they would first have to launch heavy air attacks in order to rip gaps into NATO's air defenses, while also knocking out NATO airbases that host fighter aircraft. Once the Soviets are in a position to carry out these missions with missiles, they will reduce NATO's effective response-time to the attack, while exploiting the greater penetration of missiles compared to aircraft. Moreover, in this scenario the Soviets will be able, in the decisive first phases of the battle for air superiority, to free their fighter-bombers for other important missions. It might be added that the option of "surgical strikes," which in the past has been attributed strictly to Soviet nuclear strategy, would thus gain ominous meaning in a conventional context as well.

By concentrating missile strikes on prime NATO targets over massively attacking Warsaw Pact air and ground formations, the Soviet Union could prevent, delay or obstruct numerous NATO response options in the critical initial phase of a conflict. Thus, an orderly mounting of NATO defensive operations with emphasis on forward defense, the inflow of ground and air reinforcements from abroad, freedom of maneuver in the rear areas, as well as the Alliance's capacity for nuclear response — above all, the air-delivered components of that response — could be substantially disrupted and compromised, if not prevented entirely.

In all, the enhanced capacity provided by conventional missile firepower would enable the Soviets to launch a devastating attack below the nuclear threshold. In the process, pressures would build on NATO to escalate to a nuclear response. The Alliance has long endeavored to reduce its reliance on early resort to nuclear options: this accounts for the high priority that has been assigned in recent years to improvements in NATO conventional defenses.

All these considerations give urgency to a search by the Alliance for the means to cope with the new threat represented by Soviet missiles armed with conventional warheads. The basic question to be confronted is whether the threat can be adequately countered with strictly passive defenses and heightened mobility, or whether it calls for active defenses.

The Defense Efforts of the Soviet Union

Beyond these augmented Soviet conventional attack options in Europe, another development casts its shadow on NATO's security. The Soviet Union enjoys today substantial advantages in all known categories of defensive measures and armaments — advantages that have accrued from systematic and comprehensive Soviet programs over the past twenty years. The spectrum of those Soviet efforts extends from a nationwide system of civil defense, over air defenses, to strategic defense against nuclear missiles.

Ringing Moscow today is the only operational ABM system in existence. The system has been steadfastly modernized in recent years in all of its components — radars, launchers and interceptors. The Soviets dispose over a comprehensive air defense system as a substantial barrier against NATO aircraft, notwithstanding the latter's partial equipment with penetration aids and anti-radiation missiles. Not only is the Soviet Union putting in place an extensive early warning system, but its modernized radar installations enhance the capability for identifying, tracking and targeting incoming ballistic missiles. It is possible that the combination of ground-to-air SA-10 missiles and modernized radars already is providing the Soviets with a defense capability of greater effectiveness than that represented in the present ABM system around Moscow. Moreover, the Soviets are testing the ground-to-air SA-X-12 missile — a mobile system which, according to Western analysts, is designed to defend against Lance, Pershing-1A and Pershing-2 missiles.

If the Soviets were able to put around the European part of Russia an anti-ballistic defense system of even limited effectiveness, NATO's capacity for exercising even its limited nuclear options could be substantially compromised — and the credibility of the Alliance's nuclear deterrent would thereby be seriously weakened.

Basic Counter-Alternatives for NATO

In combination, these looming developments on the Soviet side — offensive options augmented by conventional missiles, and defenses against ballistic missiles — portend decisive advantages for Soviet strategy in Europe. Those advantages could lead planners in Moscow to the calculation that a successful conventional attack can be launched in Europe, while any NATO measures of nuclear escalation would be prevented or minimized. In light of the approximate parity between the superpowers at the strategic nuclear level, the Soviets could thus transform their nuclear superiority in Europe into nuclear dominance.

How can NATO counter these threatening developments? In search of an answer, some basic considerations must be taken into account:

- A Soviet capability in effect to preempt nuclear escalation with a conventional offensive can be offset by the Alliance only through necessary improvements in NATO's conventional forces.
- A Soviet capacity to employ active defenses for blunting NATO's nuclear options — including selective options for "conflict termination" — could be countered by NATO, at least theoretically, with appropriate increases in offensive systems, i.e. Pershing-2 and cruise missiles. This solution, however, is ruled out on practical grounds: aside from its questionable strategic value, it is not politically viable.
- The only politically and strategically acceptable alternative for NATO, therefore, is a direct defense against Soviet missiles.

Criteria for a NATO Missile Defense

A defense against attacking missiles is consistent with — indeed, reinforcive of — the defensive cast of the NATO alliance. Such a defense could only contribute to the stability of the military relationship between the opposing blocs in Europe.

Acquisition of such a defense capability has to be a common Alliance initiative. It should be seen in the context of a strengthening of NATO's conventional defenses; thus it represents a special challenge to the European members of the Alliance. Yet, it cannot be a purely European decision or project. The United States must be involved, not only because she bears a substantial share of the integrated air defenses of Western Europe, but the large U.S. force presence on the Continent also yields a direct interest in safeguarding those forces from the enhanced conventional threat generated by Soviet missile capabilities.

Basically a defense against the Soviet missile threat might be accomplished in several ways:

- Through passive measures of protection for likely targets of a Soviet missile attack.
- Through the destruction of Soviet missiles before their launch.
- Through the interception of the oncoming missiles before they reach their targets.

These possible measures are not mutually exclusive, but rather complementary and mutually reinforcive.

A number of considerations seem to apply to questions of quality and priorities with respect to such defensive capabilities. Briefly enumerated, they are the following:

1. The anti-missile defense must be nonnuclear. It will be directed primarily against conventionally armed missiles; therefore, a nuclear defense — especially to the extent that it might entail first use of nuclear munitions — is out of the question.

2. The objective must be, in the first instance, a point-defense of priority targets on NATO territory based on the assumption that, within the framework of conceivable military operations, the Soviets will use conventionally armed missiles against such military targets.

3. The overall defense need neither be impenetrable, nor cover Western Europe comprehensively in order to have strategic effect. Even limited defense capabilities would fulfill the objective of introducing the needed, inhibiting uncertainties into Soviet calculations regarding the likely success of their offensive options.

4. The anti-missile defenses must possess high survivability. They must be tied into the NATO air defenses, so that neither the missiles themselves, nor their radars and guidance centers, can be put out of commission by attacking aircraft. In order that the anti-missile and related anti-air missions be carried out as flexibly as possible, the weapons systems should be made dual- or multi-capable for such missions to the extent possible.

5. The anti-missile defenses must be configured in such a way that the opponent cannot saturate them with only a part of his missile forces, and then use the remaining forces against prime NATO targets.

Technological Prospects

Fundamental to all these considerations, however, is the urgency for NATO to erect such defenses. The technological advances of recent years point to the feasibility of the endeavor: the necessary technologies for upgrading existing air defense capabilities for use against cruise missiles, including aircraft-delivered standoff weapons, as well as against medium and short-range ballistic missiles, are either available or within reach. And this projection can be made irrespective of the expectation that current research in SDI will yield innovative "spinoffs" applicable to theater defenses.

The task calls for a process of incremental steps proceeding from existing air defense capabilities. Relevant technologies could be harnessed to this process in complete conformity with current NATO guidelines covering the exploitation of new technologies for strengthening the conventional defenses of the Alliance.

Several examples already point the way. Thus the United States is developing for the Patriot air defense system a limited self-defense capability against tactical ballistic missiles. Similar self-defense capability is also under consideration for the successor system to the Hawk missile. For several years, the

United States and the Federal Republic of Germany have been engaged in the bilateral development of a new-generation air defense system for naval vessels effective against low-flying aircraft and anti-ship cruise missiles. The arming of available and planned airborne platforms with anti-tactical missiles (ATM) — or even anti-tactical ballistic missiles (ATBM) — could well come onto the technological agenda as well.

Key Questions to be Addressed

Given the lead-times of modern weapons development, the Alliance already must look ahead today to the projected threat environment of the next decade in order to set the requirements for an expanded NATO air defense — including anti-missile capabilities — in terms of weapons systems, means of surveillance and guidance systems. This task calls for the conceptual integration of existing assets and identification of the basic architecture of an anti-missile defense. Only in this fashion can the Alliance project the relevant systems requirements and research objectives, identify linkages between an anti-missile defense on the one hand and air defenses and SDI on the other, and thus determine likely overlaps, parallel factors, as well as contrasts.

A number of questions need to be faced in this conceptualization process:

1. Can the threat posed by missiles be met to any significant degree through improved measures of passive defense, including increased mobility?
2. Could a portion of NATO's air assets be assigned to the mission of attacking opponent missiles on the ground — especially to the extent that other current NATO air missions could be assumed by ground-to-ground missiles?
3. What would be the optimal mix — in terms of both operational effectiveness and financial considerations — of passive means of protection, designated air assets and anti-missile missiles?
4. What are the parameters of feasibility and likely effectiveness that can be projected for a terminal defense against short- and medium-range ballistic missiles?
5. To what extent might anti-ballistic missile systems — or components of such systems — be applied also to a defense against cruise missiles, including standoff weapons?
6. Could such systems also be given anti-aircraft missions — and thus dual- or multi-capabilities consonant with both technical criteria and financial means?
7. How might such systems, or their components, be "coupled" to a potential U.S. strategic defense system, with particular reference to the dimensions of surveillance, target acquisition and battle management?

The search for answers to these questions might well benefit from the results of the "architecture studies" in the second phase of the Strategic Defense Initiative.

The weighty question remains how the needed financial means for the proposed defense systems can be mustered by the NATO members. All of the NATO nations have recognized, and endorsed, the urgent requirement of strengthening the conventional defenses of the Alliance. It has been the burden of this analysis that the defense against attacking missiles is emerging as a central new element of this requirement.

In practical terms, there are two alternatives: the Alliance can provide new expenditures, or it can shift available resources in accordance with a new determination of priorities. Such difficult choices underscore the urgency for the Alliance to make a fresh assessment of the entire air defense question, and to arrive at a common concept and guidelines for its implementation.

The various strategic, economic, political and technological factors that have been discussed — including likely linkages between SDI and conventional defense in Europe — also argue that a common position be adopted particularly by the European members of the Alliance. However, such a common European stance would not, and should not, be prejudicial to the continuing and parallel development of bilateral and multilateral forms of technological cooperation between Europe and the United States.

Implications for NATO Strategy

For obvious reasons, active defenses in Western Europe against conventionally armed missiles cannot be limited to fending strictly against conventional warheads alone. The current and foreseeable technological state-of-

the-art does not provide the means for identifying the "quality" of an incoming missile — whether it is carrying a conventional, chemical or nuclear warhead. In this respect, however, the potential capability provided by anti-missile defenses will be no different from existing NATO means of defense against existing dual- or multi-capable weapons systems in the Warsaw Pact inventory, such as aircraft and artillery.

It needs to be stressed that, according to current projections, an upgraded air defense in Europe will be based on the ground and in the atmosphere. There is no discernible requirement for stationing weapons systems or components in space, such as may eventuate in SDI. In that connection, it needs to be posited as well that, given the imminent threat that has been described, it is imperative to proceed with the building-blocks of an anti-missile defense in Europe irrespective of the ultimate decisions that may be made in the United States with respect to SDI.

To the extent that the proposed anti-missile capability would bolster the direct defense of NATO Europe in a significant realm, it would make an additional contribution to the prevention of war. Indeed, it would mark a continuing evolution in the Alliance's deterrent strategy away from the concept of deterrence based on the threat of nuclear retaliation to a concept based on the credible ability to convince the Soviets that a conventional attack in Europe has no chances of success — in other words, the concept of "deterrence by denial."

Implications for Arms Negotiations

This basic thrust of "security through credible defense" also demands a thorough re-evaluation of the implications for the arms limitations and reductions policies of the Alliance. The key question is: How can a concept of arms limitations and reductions be fashioned consonant with the Western principle of undiminished security at the lowest possible level of weapons?

NATO must come to terms with the probability that East-West agreement may well be reached with respect to substantive strides in the limitation, or even reduction, of nuclear arms — particularly in the realm of ballistic missiles. This portends, in turn, that conventional forces — and the conventional balance — will assume an even more salient meaning. The Alliance must hew to the condition that "balanced measures" in arms limitations and reductions in the conventional realm be consistent with the geostrategic requirements of both alliances. From the Western perspective, a "total symmetry" cannot be equivalent with strictly numerically symmetrical limitations and reductions.

Therefore, it will be imperative to find incentives to the Soviets to limit or even reduce capabilities that are clearly in the category of "overarmament." Experience has demonstrated that unilateral Western reductions represent a futile road toward this objective. Therefore, NATO must act according to the principle that the military balance hangs by the recognizable military capabilities and options of the Warsaw Pact.

The Alliance's defense strategy — as well as its arms negotiation policies — must be geared to the key objective of neutralizing the conceivable attack *options* of the Warsaw Pact. Only on the basis of an assured Western defense capability can the dialogue with the nations of Eastern Europe be intensified and expanded in search of greater overall stability in the East-West relationship.

This can be the only viable framework for NATO's policies addressed to peace and security — a framework that was already established by the Harmel Report in 1967. The proposed anti-missile defense for NATO is consistent with this framework.

The Alliance must act to meet the clear challenges presented by Soviet arms policies. It must devise those measures, under the rubric of war-prevention, that can provide the needed elements of its defense capabilities, as well as the prerequisites for meaningful and equitable progress in the control and reductions of arms.

SDI

TEST BED...Continued

on the NTB dispute. "We don't have much we can say at this point," Palmer said.

Mary Farris, a spokeswoman for the Electronics System Division, said officials had no immediate comment.

According to an industry source, Abrahamson has been involved in a series of meetings throughout June in a bid to resolve the issue. The sessions included a June 19 meeting with Lt. Gen. Melvin Chubb, the commander of the Electronic Systems Division and several meetings late last week with officials from the air staff and Air Force Systems Command.

By week's end, there were reports Abrahamson may have wrung from the Air Force an agreement to increase the share of the NTB work paid for on a cost-plus basis. "The ground has shifted in the last 48 hours," the source said Friday.

The outcome of last week's closed-door get-togethers probably will not be known for certain until the RFP is released. The source said the document now is not expected until August, nine months behind the original schedule.

The contracting dispute dates to earlier this year when Rockwell International Corp. and Martin Marietta Corp., the competitors for the lucrative NTB job, examined the draft RFP. According to Rockwell's Michael Yarymovych, who directs the company's SDI work, both contractor teams had problems with the tasks assigned to a fixed-price contract.

"There was a concern on the part of both of us, Martin and ourselves, in terms of the fixed price provisions," Yarymovych said in a telephone interview. "We've discussed with the customer these provisions in the draft RFP and they're scratching their head."

Added a Martin Marietta official: "The nature of the NTB involved enough unquantifiables that getting into a fixed price set-up gives pause to any defense contractor."

Under a fixed price contract, the NTB could become bogged down in a labor rate "bidding war," according to the Martin Marietta official. Under pressure to cut costs, contractors would avoid high-riced, high-quality talent, dragging down the quality of the NTB, the official said.

According to the Martin Marietta official, the Air Force favors the fixed price set-up in part out of a legitimate desire to set limits on the shapeless NTB. "They want to put boundaries on what this thing is likely to become," the official said. "The customer has a 'camel's nose under the tent' concern."

Yarymovych also expressed concern over the vagueness of the NTB concept, which calls for a central computer center to link geographically dispersed SDI facities. "The whole idea of NTB, a lot of things are very soft, very undefined," he said. The fuzzy nature of the NTB makes it extremely difficult for contractors to estimate how much the job will cost and submit a reasonable bid based on that estimate, Yarymovych and other industry sources said.

Meanwhile, despite the RFP delay, SDIO is holding to the original schedule for bringing the NTB on line, Yarymovych said. The Martin Marietta source said the NTB is to become operational in 1988 at Falcon Air Station in Colorado Springs, Colo. Abrahamson has said repeatedly that it is important for the program to stick to its timetable to demonstrate progress and avoid endless research.

The protracted delay has been costly and difficult for both Rockwell and Martin. Both are currently working on the program under extensions attached to their $2.7 million phase II NTB contracts. Yarymovych said it was difficult to maintain a top-quality research team together on a program that is drifting. The Martin Marietta official said his company is "way in the hole to the tune of multi tens of millions" of dollars on the NTB.

Throughout the SDI's existence, there have been reports that the uniformed services are not sufficiently supportive of the program. Abrahamson has had differences with the Air Force before over his management of individual projects, including space-based sensors.

One industry source said the record of SDIO-service relations is mixed. But the source said the "delays and confusion" that have surrounded the NTB are particularly worrisome because the program is so central to SDI. "The lack of decisiveness in getting it underway doesn't bode well given the tight time lines SDI is operating under," he said.

NEW YORK TIMES 28 June 1987 Pg. 22

THE SECRETS OF SOVIET STAR WARS

By William J. Broad

FOR MORE THAN A YEAR, THE wizards of reconnaissance in the United States Government have been obsessed by the mystery of Dushanbe. As they peer into the Soviet Union with their spy satellites, what grips them is not the capital of the Tadzhik Republic itself, but an isolated site south of the city, not far from the Afghan border. There, under construction high atop the region's tallest mountain, is an elaborate complex, bristling with roads, buildings, laboratories and domes, and linked by heavy power cables to the nearby Nurek hydroelectric plant, one of the largest in the Soviet Union.

According to United States intelligence experts — who spoke to this reporter only after great hesitation and demands for anonymity — the domes of Dushanbe will one day house lasers that will flash their concentrated beams of light effortlessly through the thin mountain air into the depths of space. The question that divides the experts is how powerful the lasers will be — and, thus, their ultimate purpose when the complex becomes operational, probably near the end of this decade.

A relatively weak laser, used like a radar beam, could track man-made objects moving above the earth. A stronger laser could damage American communication satellites and "blind" those designed to flash an early warning of a nuclear attack. A very strong laser could destroy warheads

CONTINUED NEXT PAGE

William J. Broad is a science reporter for The New York Times, and author of "Star Warriors," published in 1985.

SOVIET...Continued

and missiles. During a war between the superpowers, the Soviet Union might bounce its laser beams off mirrors orbiting in space and toward American intercontinental missiles, destroying the missiles in flight and thus "mopping up" the ragged retaliation that could be expected after a pre-emptive Soviet strike.

No American official has publicly acknowledged the existence of the Dushanbe complex (map, page 28). But Secretary of Defense Caspar W. Weinberger recently has warned of powerful new Soviet lasers on the horizon. "We expect them to test ground-based lasers for defense against ballistic missiles in the next three years," he said in a major speech last January, concluding darkly, "I cannot envision any circumstance more threatening and dangerous for the free world than one in which our populations and military forces remain vulnerable to Soviet nuclear missiles while their population and military assets are immune to our retaliatory forces."

For years, highly placed American officials have hinted ominously about the size and scope of the Soviet antimissile effort, claiming that — as Secretary Weinberger has put it — the Russians are ahead of the Americans "in many important aspects," and making dire predictions about the consequences of Soviet beam weapons for the West.

And for years, with equal vigor, Soviet officials have dismissed such charges. "The U.S.S.R. does not work in this area," a group of senior Soviet scientists flatly asserted in "Weaponry in Space: The Dilemma of Security," a recent book critical of the United States' Strategic Defense Initiative, which is more commonly known as Star Wars.

The public war of words over the Soviet Union's antimissile program tends to generate more heat than light. But a four-month study drawing on Government reports, private studies and scores of interviews with American scientists, intelligence experts, White House officials and civilian sleuths — as well as Russian émigrés, defectors and an exclusive exchange with a senior Soviet official — has brought into focus an extensive Russian effort to develop laser and particle-beam weapons.

The Soviet effort, like the American one, focuses on "directed energy" weapons — beams of concentrated laser light, and streams of subatomic particles — that would destroy missiles and warheads in flight; space-based sensors, which would track the targets, and powerful computers, which would direct the battle.

The Soviet program is larger than the Administration's antimissile effort, and in some ways more scientifically creative. Nonetheless, it has achieved only a rough parity in developing laser and other exotic weapons, and a poor second in building the key devices, such as computers and sensors, that would coordinate an antimissile system. But whether or not the Soviet system could actually threaten incoming American missiles themselves anytime soon, it might achieve the much easier task of disrupting and crippling the satellites and sensors on which an American antimissile system would depend.

The judgment of how great a menace the program actually poses depends on who is viewing it, with perceptions often colored — even within the Government itself — by political leanings, institutional loyalties and varying familiarity with different aspects of the Soviet program. But a clear perception of that menace is essential to resolve the momentous conflict between those who want to forge ahead and deploy Star Wars as soon as possible — which would be the most expensive military program in history — and those who favor negotiating an arms-control agreement that would slow the race for antimissile weapons.

THE MOST STRIKING fact about the Soviet Star Wars program is its age and consistency. As Anatoly Fedoseyev, a winner of the Lenin Prize and the Hero of Socialist Labor Award for his designs of antimissile radars before he fled the Soviet Union in 1971, observed: "Since the beginning of Soviet S.D.I., about 35 years ago, this project has never been interrupted or delayed. And I'm sure it never will be."

Defectors like Fedoseyev, as well as secret agents and sophisticated spy satellites, provide the United States Government with essential insights into the Soviet program. This information is then analyzed in sober, lengthy, detailed — and normally top secret — reports, from which the Government makes public only sketchy details.

The most familiar conduit by which these details reach the public is "Soviet Military Power," a book published annually by the Defense Department that takes a consistently hard line on the Soviet military threat. In its 1987 edition, the book estimates that on their effort to develop lasers alone, the Russians spend $1 billion a year and employ 10,000 scientists and engineers working at more than a half-dozen major research and testing facilities.

American scientists working on the Strategic Defense Initiative program say Soviet theorists are unmatched in the world, producing brilliant papers in areas of basic science relevant to antimissile weapons. George Chapline, a physicist at the Lawrence Livermore National Laboratory in California, noted that the Russians pioneered the theory of X-ray lasers whose short wave length makes the beam more penetrating, and thus more damaging, than ordinary lasers: "The Soviets were the world leader, both in good ideas and the quality of their calculations," he said.

As far back as the 1960's, at a sprawling antimissile research center near the town of Sary-Shagan, in the wilds of Kazakhstan, Soviet scientists started tinkering with the laser — a discovery for which, in 1964, three scientists (two Russians and one American) were awarded the Nobel Prize. As early as 1965, an article in an unclassified Soviet military journal suggested lasers might solve

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SOVIET...Cont.

"the problem of destroying intercontinental missiles."

Today at Sary-Shagan, according to "Soviet Military Power," the Soviet Union is testing several large lasers meant to destroy planes, satellites and missiles. The Russians already have "some capability to attack" satellites with ground-based lasers and could put in orbit a "prototype" laser weapon to fire at satellites by the end of the decade, it says. According to the Pentagon, during the 1990's the Russians will also be able to loft particle-beam and kinetic weapons (which destroy their targets by smashing them with hardened projectiles moving at high speeds).

The Soviet effort to create futuristic antimissile arms is complemented by their intensive, and longstanding, work on more-conventional defensive weapons. The Soviet Union currently maintains a functioning antisatellite system and an antimissile network that rings Moscow, both centered around ground-based rocket interceptors. It also boasts a vast arsenal of antiaircraft guns, missiles and jet interceptors designed to shoot down enemy bombers and cruise missiles (but that failed to stop a 19-year-old West German pilot in a small plane who flew unimpeded into Moscow's Red Square last month).

William R. Graham, President Reagan's science adviser, noted that the Russians are currently upgrading their antimissile system. "That means that simultaneously they have ground-based defenses being designed, developed, tested, fabricated, deployed and operated," he said "That's an enormous technical capacity that feeds back information to them constantly. They test and improve. We don't have that capability in this country."

The Russians also possess a key prerequisite for deployment of space-based antimissile sensors and weapons — a vigorous space program. Last year, the Soviet Union successfully launched 91 rockets, while the United States, crippled by the Challenger disaster and the misfiring of several other rockets, launched only six. In May, the Russians began test flights of a giant new rocket, dubbed Energia, which can lift payloads about four times heavier than those of the American space shuttles.

THE CENTRAL INtelligence Agency, which often presents a less grim picture of Soviet military programs than the Pentagon, judges that in the race to develop exotic antimissile arms, despite Moscow's larger program, East and West are in a dead heat. In 1985, a 17-page C.I.A. analysis found that "the Soviets are in a comparable, or highly competitive position with respect to the United States" in the development of directed-energy technologies. In laser research, the C.I.A. found an "essential equivalence." In particle beams, the C.I.A. found that the Russians "may have the edge over the U.S. in some important areas."

In a brief but significant passage, the C.I.A. analysts said that the West led the Soviet Union in many of the ancillary technologies considered essential for building a defense system against incoming missiles — "computers, signal processing, command and control, and radar or electro-optical sensors and sensing systems."

Private analysts who are critical of the Strategic Defense Initiative program go further. They contend that many of the Administration's estimates of the extent of Soviet Star Wars achievements — and particularly estimates made by the Pentagon — are simply exaggerations that are intended to bolster its own aims during budget battles with Congress.

"The Soviets are five years behind us on lasers, five to 10 on sensors, and at least a decade on computerized battle management," said John E. Pike, head of space policy for the Federation of American Scientists, a private Washington group. "We're sitting here with something like 140 installed supercomputers. And they've got one that's considered to be at the very low end of the spectrum."

A common error in assessing the Star Wars balance, Pike added, is to assume that Soviet scientists are as productive as their Western counterparts. Not so, he said. Soviet researchers spend hours each day waiting in lines for laboratory supplies, personally fashioning hard-to-get equipment, and satisfying rigid bureaucratic demands. "The input into the Soviet Star Wars program might be bigger," he said, "but the output certainly isn't."

Other private analysts counter that Soviet researchers, if less productive, at least have stable, long-term goals. "The faddism over here is dangerous," said Stephen M. Meyer of the Massachusetts Instititue of Technology, an expert on Soviet defense and arms control. "We have this boom-bust cycle, which is an absolute waste. Meanwhile, they've got this long tradition of steady work."

Some experts point out that the Russians' steady application has yielded significant, if not brilliant, achievement. "Since the beginning, they've been behind in technology, and yet they were first to push man into space and surprised all Western observers by producing an A-bomb," said Valentin Turchin, a computer scientist who left the Soviet Union in 1977 and now teaches at the City College of New York. "An old Ford and a contemporary car are incomparable; still, that old car is not a horse — you can take a platoon of soldiers and achieve a military goal. Using their backward technology, [the Russians have] created a war machine that keeps the whole world in fear."

CIVILIAN SCHOLARS who study the Soviet antimissile enterprise tend to see it as far less threatening than do Pentagon officials, former Russian scientists or C.I.A. analysts. Lacking access to spy satellites, these high-technology sleuths comb thousands of Soviet books, documents and scientific papers. Though discovering no great secrets about weapon systems, the scholars gain something as important — a detailed understanding of how efficiently scientific ideas are turned into the exotic technologies that form the basis of the Soviet Star Wars program.

"They have a lot of good ideas, and can develop brute-force prototypes, but getting beyond that is hard," said Nikita Wells, a physicist with the Rand Corporation who has conducted several unclassified studies of Soviet particle-beam technology for the Pentagon. "They don't have the computers or materials. It's primitive. It's a rich country from the standpoint of basic science and natural resources. But whatever they do that's good, the system kills it one way or another."

An example of stymied innovation is the Radio Frequency Quadrupole, known as R.F.Q., a remarkably compact device for accelerating subatomic particles, making it ideal for use in light-weight, space-based beam weapons. Russian - scientists at the Soviet Institute of High-Energy Physics at Serpukhov, a sprawling science center south of Moscow, set amid thick stands of pine and birch, invented the R.F.Q. during the early 1970's. Scientists there announced the discovery in the "open literature," describing its characteristics in technical publications read around the world. "The Soviets did the first work, and then the West took over," said Wells, pointing out that the Russians are now behind in R.F.Q. research.

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SOVIET...Cont.

In 1978, scientists at the Los Alamos National Laboratory, in New Mexico, the birthplace of the atomic bomb, picked up the Russian idea and developed its potential. Today, the technology of the R.F.Q. is essential to the particle-beam weapons that Los Alamos scientists plan to test in space during the 1990's.

Simon Kassel, a senior scientist with the Rand Corporation and author of a study on Soviet Star Wars, said the West in general had an edge because of its economic strength and technical skills. "It's one thing to do basic research and have a lot of different concepts going, and another to translate it into weapons," Kassel said. "[The Russians'] technology base is not as rich as ours. Their machines are crude and their society closed. They are an extremely talented people, with enormous imagination. And yet the system prohibits the full fruition of talent."

Kassel said a crash Soviet program aimed at closing a key technology gap centered on computers, which are essential to all phases of Star Wars, including the design, development, testing, deployment and coordination of arms for antimissile war. The program is headed by Yevgeny P. Velikhov, vice president of the Soviet Academy of Sciences and a leading figure in Russian Star Wars development.

The Soviet lag in key technologies has made Moscow extremely apprehensive about competing with the West to deploy Star Wars systems, experts say. "Given the increasing demands on Soviet resources, not only from the economy at large but also the defense sector, the Strategic Defense Initiative threatens a new round of technological competition that the Soviets almost certainly would prefer to forgo," wrote Benjamin S. Lambeth, a senior analyst with the Rand Corporation, in "The Soviet Union and the Strategic Defense Initiative," a 55-page study of Soviet antimissile technology he undertook for the Air Force. "Moscow's discomfiture . . . seems genuinely rooted in an appreciation of the Soviet Union's own resource and technology limitations."

THE NEW YORK TIMES

SITES FOR RESEARCH AND TESTING

Secret facilities near Dushanbe may soon house a major laser weapon. North of that are the launching sites of Tyuratam, venerable laser testing at Sary-Shagan and nuclear testing at Semipalatinsk. To the west, Serpukhov and Troitsk concentrate on basic research.

THE UNITED STATES, after appropriating some $10 billion to date for a crash program of antimissile research, is moving vigorously ahead in many areas of the Star Wars race. The critical question is what to do with this leverage, especially with respect to the Anti-Ballistic Missile Treaty, signed in 1972 in an attempt to limit antimissile systems. The Administration's aim is to go beyond the treaty and deploy a Star Wars system as soon as possible. Caspar Weinberger, in a speech last January, said "we must seize this opportunity" to deploy arms in space because the chance to stay ahead of the Russians "will not remain with us forever." In the proposed system's first phase, envisioned for the mid-1990's, the Pentagon would deploy battle stations in space armed with small homing rockets — the most mature of the antimissile technologies now under development. In theory, these rockets would intercept Soviet missiles as they rose over Central Asia.

The alternative is for the United States to sign an arms accord that would combine cuts in the nuclear arsenals of both superpowers with an agreement to forgo intensive development of antimissile weapons for a specified period, perhaps 10 years.

Some experts say such an accord would pose risks for the West. "A Nobel Prize doesn't protect you from a hostile foreign power," said William Graham, President Reagan's science adviser. "You need more than technical strength. You need the will to pursue that technology, to develop it, to deploy it. Only then does it become militarily effective."

Moreover, a new treaty, by slowing the arms race, would allow the Russians time to modernize their industries and economy, paving the way for better antimissile work. "They're playing for time," said Kassel, of the Rand Corporation. "So far, the technological lag has been tolerable for them beause it was confined to traditional technologies that they have mastered. In the new ones, such as computers, their situation is very bad. ... An all-out race is something they dread. It would put an enormous strain on us. You can imagine what it would do to them."

A key question is whether the West, having signed a treaty limiting antimissile-weapons deployment, would continue to provide funds for research to maintain its technical edge, or whether it would be lulled into passivity on antimissile issues.

"Perhaps the worst outcome of all would be one in which the domestic consensus behind S.D.I. collapsed *after* enough momentum had gathered to drive the Soviets into vigorous offsetting measures," said Benjamin Lambeth, of the Rand Corporation. Such measures, he said, might include further development and deployment of antimissile arms and an increase in offensive nuclear warheads. Together, these steps "could give Moscow precisely what we originally sought to deny it through S.D.I. — a credible first-strike capability that could be invoked with great coercive effect in a crisis."

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NEW YORK CITY TRIBUNE 30 June 1987 Pg. 11

PRAVDA

Public Support of SDI Called a Result of 'Brainwashing'

MOSCOW, June 5:
What do the realities of the nuclear age tell us? First and foremost, that international security cannot be ensured by military means. . . .

However, the U.S. administration continues to declare its adherence to "nuclear restraint" and is accelerating the development of new types of weaponry, including, if not primarily, those intended for deployment in space.

Meanwhile millions of people all over the world, including many in America itself, are realizing ever more clearly what new obstructions the implementation of SDI can create on the path to nuclear disarmament. This is forcing the U.S. administration to make feverish efforts at ideologically and psychologically brainwashing the American public.

The proponents of SDI have successfully discovered the psychological mechanisms in the mass mentality that they can manipulate to mobilize fairly significant support within the country. And although many Americans understand the real motives behind the plans to militarize space and oppose their implementation, most U.S. residents are still imprisoned by traditional stereotypes and illusions.

It is the promise to create an impenetrable "shield" over the country, unrealizable but tempting to the "average American," that has found the most resonance in public consciousness. . . . Many Americans are ready to believe these pipe dreams. Over its entire two-century history America has been practically invulnerable in the military sense. This experience has become firmly rooted in the minds of Americans. It is precisely on this acute feeling of lost military invulnerability that the administration is playing . . .

Associated Publishers, Inc.

SOVIET...Continued

ALTHOUGH A NEW treaty would pose risks, the alternative, Star Wars deployment, is also fraught with problems, experts say. Current Soviet weapons, though perhaps too crude to prove effective against American missiles, might still be good enough to knock out American Star Wars systems in space. Antimissile sensors and battle stations, which are laden with delicate lenses and communication systems, as a rule are easier to disrupt and destroy than nuclear warheads, which are self-contained and "hardened" to withstand a variety of attacks.

Indeed, the mountain-top laser facility near Dushanbe might pose a serious threat to the low-orbit battle stations the Administration wants to place in space. "The electric power going into the facility suggests it may be a pretty powerful laser," said John Pike, of the Federation of American Scientists.

In an unusual departure, a senior Soviet science official recently agreed that large lasers could threaten space-based antimissile arms.

"At present, we have a kind of ... basic research in lasers, just to keep our hands in such things," said Roald Z. Sagdeyev, director of the Space Research Institute of the Soviet Academy of Sciences, during a recent visit to the United States. "But if there were a final decision in this country to go along with S.D.I., I suspect some of these technologies would be very helpful for countermeasures" — an obvious reference to the view, widespread among Star Wars critics in the West, that lasers and particle beams could be used to disrupt or destroy antimissile systems.

At an arms-control conference in Hamburg, West Germany, last year, Sagdeyev made an oblique reference to the Dushanbe site, noting that "some installations" that might have "rather volatile lasers" had become a topic of discussion in the arms-control community. These, he assured his audience, were not weapons but new lasers for tracking satellites.

"At a minimium, Sagdevey's explanation is not obviously wrong," said Pike. "The most charitable view is that it could be used for picture-taking of satellites at high altitudes and shooting them up — destroying them — at low altitudes." The ultimate purpose of the Dushanbe site may remain a mystery for some time, because the facility is not expected to be finished until the end of this decade.

Nonetheless, the threat of Soviet lasers and particle beams could put into question the feasibility of the Administration's proposed antimissile weapons system, experts say. The so-called "Nitze criteria," named after Paul H. Nitze, the Reagan Administration's top arms-control adviser, hold that any Star Wars system must be survivable against enemy attack and "cost effective at the margin," meaning it should be cheaper for the United States to add a unit of defense than for the Soviet Union to add a comparably effective unit of offense.

If the Russians can easily shoot down or otherwise neutralize American battle stations in space with their ground-based lasers, it seems unlikely such a system could satisfy either of Nitze's criteria. ■

WASHINGTON TIMES 30 June 1987 Pg. 5

SDI facing a crucial review and the rumble of skeptics

By Warren Strobel
THE WASHINGTON TIMES

After more than three years in the laboratory, the Strategic Defense Initiative this week for the first time faces the Pentagon's formal weapons-buying process in a review that could move the research program closer to deployment.

Scheduled to begin today, the review — which many officials expect to yield a more deployment-oriented research effort — is taking place against a background of increasingly divisive battles over SDI's direction, according to Defense Department officials.

A month of preparation for meetings of the Defense Acquistion Board, a senior panel that oversees all Pentagon weapons development programs, has brought out the latent skepticism about "star wars" common among military commanders,. the officials said.

The commanders' chief concern is SDI's price tag, which could impinge on other weapons development programs the military branches want to pursue.

"The people who have been talking about it are talking about it a lot louder now, because they know a decision's going to be made," a Pentagon official close to the program said yesterday.

"It may have risen to the top like cream," the official said of military skepticism, "but it is not a new concern."

The board, chaired by Richard Godwin, the powerful undersecretary of defense for acquisition, will not make a yes-or-no decision on deploying the ground- and space-based missile interceptors that SDI's managers see as the keystones to a first-phase strategic defense.

In its secret meetings, however, the board might give the go-ahead for a new phase of development, called "technology validation," in which basic SDI concepts are more rigorously analyzed and tested for several years.

That in turn will yield data from which "a future president or a future Congress could make a decision whether or not to deploy . . . whether it makes sense or not," Lt. Gen. John Wall, commander of the Army Strategic Defense Command, said in an interview yesterday.

The command oversees about a third of this year's $3.2 billion SDI research budget, including many of the prime candidates for first-phase deployment.

SDI officials have sketched out a basic missile defense that would include the missile interceptors, which are designed to smash into Soviet missiles and warheads in various stages of their flight, as well as ground-, air- and space-based sensors to track the enemy weapons.

Lt. Gen. James Abrahamson, director of the Pentagon's SDI Organization, in a Pentagon briefing earlier this year estimated the cost of this system at between $40 billion and $60 billion.

SDI "now begins to look real," a Pentagon official who supports deployment said yesterday. "That's when it starts scaring the ground-pounders [military ground units] and the [Air Force] fighter mafia."

"The military, I'm sure, is going to go in and take the position, 'We're not ready. We don't have a system that can stop all the incoming missiles'," the official said.

Resistance to strategic defense deployment also has arisen in Congress, where lawmakers have cut President Reagan's budget requests for the program and resisted his controversial "broad" interpretation of the 1972 ABM Treaty. The pact sharply limits anti-missile defenses.

"In view of the extremely contentious issues which are still under discussion in Congress, I am deeply concerned over the possibility that decisions resulting from this meeting could pre-empt the Congress and present us with a fait accompli," Sen. Albert Gore, Tennessee Democrat and a presidential candidate, said in a letter to Mr. Godwin.

Mr. Gore asked the acquisition chief whether Congress will "be suddenly confronted with a sea-change in SDI, moving it from a research program to a weapons system on the way to development and deployment."

The Pentagon, in a statement last week, said even in the new phase of research, SDI experiments will remain within the "narrow" interpretation of the treaty, which allows development and testing only of non-mobile, ground-based missile defenses.

An aide to a senator involved with SDI predicted the stalemate over deployment will lead to a compromise in which a decision on a new phase for the defense system is delayed in return for a "requirement," or formal statement of need for the program, which all weapons systems must have.

JANE'S DEFENCE WEEKLY
4 July 1987 Pg. 1440

Assessing the Soviet ability to counter SDI

By Jim Bussert

A COMMON counter-argument to SDI deployment is the possibility of cheap and simple counter SDI decoys or penetration aids.

What do the Soviets say about this technology and could penetration aids invalidate the exotic SDI defences?

The Military Publishing House in Moscow published *Star Wars Delusions and Dangers* in 1985. It was translated into English and widely distributed. The only Soviet military space research claimed, was in "space-based early warning, surveillance, communication, and navigation systems".

The pamphlet specifically denied developing a 'nationwide' missile defence system or 'space strike weapons'. Elsewhere, the Soviets claimed that SDI would force "the other side" to build up "means of defence" or offensive forces. On page 54 the booklet states the Soviet Union would "take countermeasures" that are "commensurate with the threat". Obviously, nowhere in this pamphlet did the Soviets specify technical countermeasures.

In 1986, Mir Publishers of Moscow published *Weaponry in Space: The Dilemma of Security*. It was written by the Soviet Scientists' Committee for the Defence of Peace Against Nuclear Threat.

Chapter six, entitled 'Countermeasures' was very detailed concerning active and passive countermeasures against a deployed SDI system. Interestingly, six of the seven references were from US sources.

Active countermeasures include neutralisation of space-based components with weapons including kinematic energy, lasers, high-energy radiation, fast-burn booster rockets, space mines and small pellets.

The Soviets said that eliminating SLBM-launched pop-up x-ray lasers would be a simple ASW job in the northern Indian Ocean and Norwegian Sea. The surveillance, acquisition, and tracking elements of the SDI

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WALL STREET JOURNAL
3 July 1987 Pg. 1
"Washington Wire"

"STAR WARS" MOVES AHEAD despite big cuts in proposed budgets.

Money continues to flow toward technologies that could be fielded soonest, while riskier and more exotic ideas absorb most of the cutbacks. A recent assessment by the once-skeptical Joint Chiefs of Staff is said to be more positive about the military usefulness of space weapons. Advocates say an arms accord would prove the project doesn't doom arms control.

Although there probably won't be a deployment decision before Reagan leaves office, the administration is determined to lay the groundwork. A first phase would probably involve space-based sensors and "weapons garages" to shoot high-speed projectiles at incoming missiles.

Administration planners fight Sen. Glenn's effort to block Star Wars contracts to foreign labs. A ban could undercut Allied support for the project.

SPENDING...Continued

spending for defense, and increasing taxes.

This Senator has been consistently critical of defense spending, but there is no question that we don't live in a Sunday school world. Gorbachev is not Mother Theresa. We do need a strong military force. And that brings us to the second point made by Defense News. With the limited funds we have for the military we cannot afford anything like the $5.8 billion budget that the administration has requested for SDI in 1988. Defense Daily calls that "unrealistic." Defense Daily is right. Defense Daily calls for funding SDI near the present level of $3.5 billion annually. It rightly calls that "sufficient for SDI to pursue its political, technological and defense goals." Defense Daily contends that it will be years before we know whether or not an effective missile defense system can be devised. They call SDI "not directly related to the present-day defense of the United States or its allies." And it concludes that "Crash programs and huge allocations are not justified."

Mr. President, this Senator is convinced that the great weight of scientific judgment in this country is that SDI will never meet the NITZE criteria. It will never be cost effective at the margin. The adversary will always be able to penetrate SDI at a far lower cost than the cost of researching, developing, producing, deploying, maintaining, operating and modernizing this star wars defense. But I am willing to concede that the great weight of competent scientific judgment may be wrong. So I would not object to the maintenance of "a substantial sum for continuing SDI research"—as Defense Daily puts it—near the present $3.5 billion level. With the horrendous deficits and national debt we face, we should spend no more than $3.5 billion on SDI in 1988.

Mr. President, I ask unanimous consent that the editorial to which I have referred from the June 8, 1987, issue of Defense News be printed in the RECORD.

There being no objection, the editorial was ordered to be printed in the RECORD, as follows:

AN IMMENSE SDI BUDGET IS UNWARRANTED

No one should be misled by the vigorous debate under way in the U.S. Senate over the goals and funding of the Strategic Defense Initiative (SDI).

The debate is important. It promises to affect the future of the SDI program in the United States, Germany, Great Britain, Israel and, perhaps, Japan. But it was not prompted by any decline in popular support for SDI. The American public's interest is not an issue.

There is no widespread support for this huge weapons program, aside from the public's visceral desire to give the president what he wants to conduct the nation's defense and foreign affairs. It is true that the nerve ends of a few space junkies have been set a-tingle by vivid dreams about galaxies of spy satellites and laser rays that might be placed in space. But SDI will not be a major factor next year in a single election in the United States.

The reservations by some of the Senate's most thoughtful members were sparked by the poor political tactics and voracity of the Defense Department. The request for an SDI budget next year of $5.8 billion—$2.3 billion over the 1987 figure—is unrealistic.

The top defense issue in the United States is not SDI. It is the budget deficit. Cutting it back would buttress the West's economic vitality and its long-term security. The Defense Department will be fortunate to emerge from the congressional deliberations this year without a budget reduction. Realists in Washington knew this in January before the 1988 request was issued. Those who defend the SDI spending plan are begging for the budget ax.

There are other defense matters far more important than an additional $2 billion for SDI. The air defenses of land and sea forces should be improved, for example, and the infantry is in dire need of light antitank weapons.

Funding near the present level of $3.5 billion annually is sufficient for SDI to pursue its political, technological and defense goals. It already has affected Soviet thinking about arms control. The money being sown into the program will bring forth at least a moderate harvest of innovative technologies. It will not be known for years whether an effective defensive system can be placed in space in this century.

SDI is not directly related to the present-day defense of the United States or its allies. Crash programs and huge allocations are not justified. SDI is an experimental effort that deserves public support. Stable funding and conservative management are fundamental to its bright promise.

COLORADO SPRINGS GAZETTE-TELEGRAPH 5 July 1987 Pg. D11

Interception of rocket shows SDI just might work

By **Ralph Kinney Bennett**

Everyone hopes it will never happen, but hope may not be enough. A Soviet SS-18 intercontinental ballistic missile (ICBM) blasts out of its launch silo, headed for the United States. Could it be stopped in its "boost phase," the first ten minutes before it releases its cargo of nuclear warheads? Does this country have the technological potential to build a defense against Soviet ICBMs?

Lt. Gen. James A. Abrahamson, director of the Strategic Defense Initiative Organization (SDIO), knew that the American aerospace community was not intimidated by the challenge of detecting, tracking and destroying ICBMs. But their research was gripped by bureaucratic caution and routine, typified by some plodding Air Force studies for a space intercept of an ICBM in the 1990s.

"Why should it take so long?" he asked his deputy, Brig. Gen. Malcolm O'Neill, one January day in 1985. "Well, sir," O'Neill answered, "they want to solve all the technical issues with a high degree of certainty."

"There comes a time," Abrahamson said, "you have to start doing something. Then you learn things you'll never learn in a laboratory."

Abrahamson felt it was time for a challenge — a real space intercept. "See what you can do," Abrahansom told O'Neill. "And see if it can be done in one year."

General O'neill began exploring the problems with Mike Griffin and Jon Dassoulas, two aerospace engineers at the Applied Physics Laboratory (APL) of John Hopkins University. The interceptor's task would be especially difficult since ICBMs climb at varying rates of acceleration mainly because of weight changes as fuel is burned off. There was also the plume problem. While in Earth's atmosphere, the mass of fiery gases blossoms out behind the ICBM. But when it reaches the relative vacuum of space, the plume spreads out until it envelops the missile. Could an interceptor's sensors find the "hard body" of the rocket within the gassy camouflage?

Dassoulas, whose experience with missiles dates back to the mid-1950s, went "rocket shopping." He chose the McDonnell Douglas Delta, which had been carrying payloads into space since 1960 with an enviable record of success — in 177

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COUNTER...Continued

could be blacked out by an upper atmosphere nuclear blast, or simply jammed.

The point is made that total destruction of a widescale SDI is not required, just attacking of a few vulnerable links or elements.

Enhancements to the strategic nuclear forces would be additional ICBMs deployed, deliberate concealment of launchers, additional MIRV warheads, decoys, and 'fake ICBMs'. ICBM launch tactics can degrade the SDI with mixed real and fake ICBMs, "various lofted and depressed forms of trajectories, and launches in various directions". Increased reliance upon cruise missiles and SLBMs would not be effectively defended by SDI either.

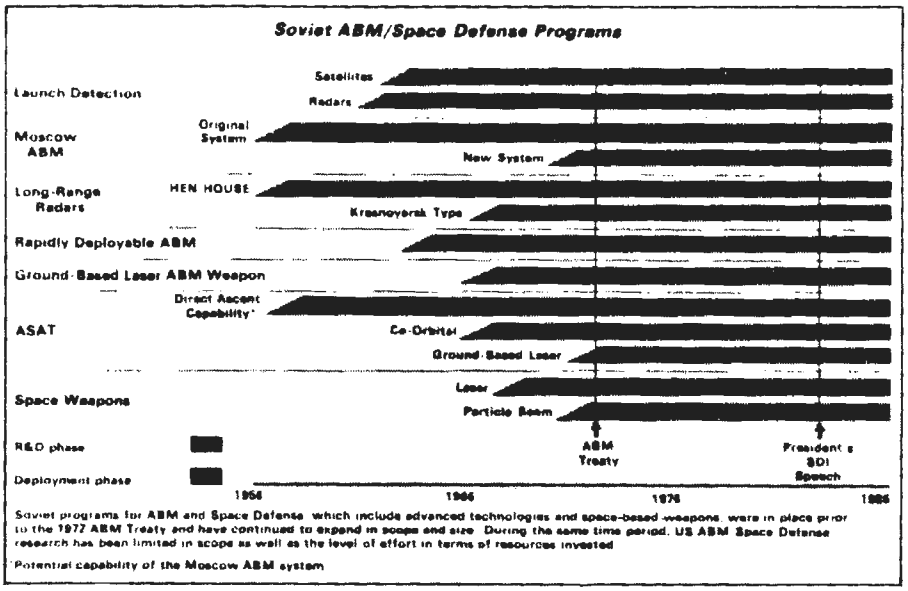
Modifications to ICBM launch characteristics such as shortening burn out times can minimise SDI acquisition and classification time, and changing exhaust plume brightness would throw off infra-red (IR) detectors.

Reflective or ablative coatings, cooling, aerosol screen, or missile rotation are all anti-laser protective countermeasures.

Counters to mid-course sensors include metal chaff, warheads inside metallised reflective balloons, and IR-emitting aerosols to conceal the warheads and decoys from tracking and aiming systems.

The decoys will lag the warheads during re-entry phase, but manoeuvrable high-velocity warheads and high-yield explosives are mentioned as SDI counters. The booklet points out that battle-management is not multi-layered like sensors or weapons, and damage to it would cripple all SDI components.

In summary, the Soviet scientists correctly point out that the SDI countermeasures are comparatively simple and low-cost, compared to the SDI itself. This does not mean that the USA should not continue research and development of the SDI, but the deployed system must be able to function despite the many Soviet active and passive countermeasures to the SDI elements.



(US DoD)