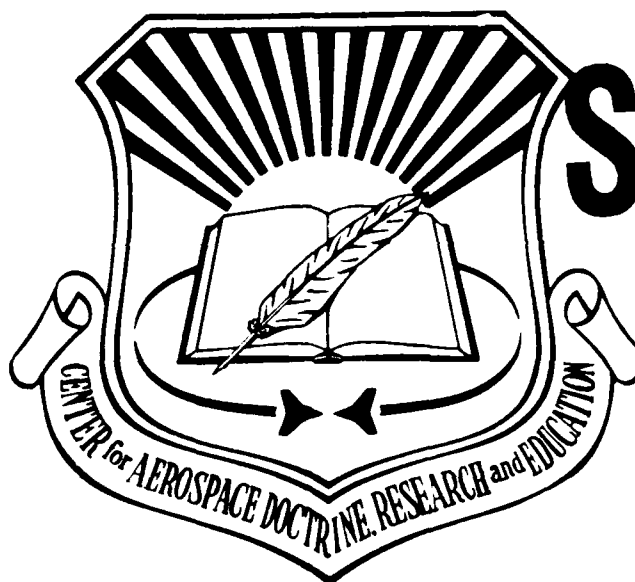


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CADRE PAPER

**NUCLEAR WINTER:
ASYMMETRICAL PROBLEMS
AND
UNILATERAL SOLUTIONS**

CENTER FOR AEROSPACE DOCTRINE, RESEARCH, AND EDUCATION

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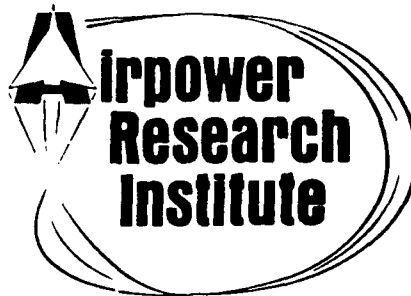
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NUCLEAR WINTER:
ASYMMETRICAL PROBLEMS
AND
UNILATERAL SOLUTIONS

by

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ABSTRACT

↓ Nuclear winter creates a dilemma for policymakers. Awareness of that dilemma may not be new, however. Long before the phrase "nuclear winter" became popular, policymakers may well have been aware of the possibility that the indirect effects of a nuclear exchange could be more damaging than the direct effects. Nevertheless, the more widespread public awareness of such a possibility deepens the dilemma and makes it more apparent. The policymakers' dilemma arises from their requirement to create a perception of security from any and all threats. To do this they must be able to credibly threaten to use nuclear weapons in order to deter their use by others. These threats can be tacit, arising from the very existence of nuclear delivery systems, or direct, as evidenced by the instances of missile rattling that have occurred over the years. In either case, such threats begin to ring hollow if the policymakers are known to believe that carrying them out could result in nuclear winter. If policymakers keep secret their personal beliefs about nuclear winter they can still credibly threaten to use nuclear weapons but they have difficulty believing their own threats. Further, they cannot capitalize on the deterrent value of nuclear winter and must live in fear that their bluff may some day be called or that any of the other nuclear powers could cause a nuclear winter out of ignorance.

(K R)

This dilemma and its solution are the subject of this paper. Through the analysis of "nuclear winter asymmetries," it uncovers systematically the nature of the problem we face and shows why joint efforts to solve it are in the best interest of both superpowers. Such joint activity would be one part of a two-part solution to the nuclear winter problem. The second part of the solution would be accomplished by force structure changes. These changes could be made without first developing detailed knowledge of what it would take to cause a nuclear winter and to make sense whether or not a nuclear winter is possible. Since joint activity between the superpowers may not be possible, it is also important to understand that these force structure changes may be made independent of bilateral cooperation.

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(Note: This paper is the first in a series that will outline a new nuclear doctrine called "dynamically stable deterrence," a concept that will be developed in more detail in forthcoming CADRE publications. If adopted, dynamically stable deterrence holds the potential of providing a unilateral route to much greater stability and security in the nuclear age.)

NUCLEAR WINTER: ASYMMETRICAL PROBLEMS
AND UNILATERAL SOLUTIONS

"Nuclear winter" is nothing new. Fear that nuclear weapons could cause an environmental catastrophe dates back to the dawn of the nuclear age when some scientists were concerned that the initial nuclear test might set the atmosphere on fire. Although that fear seems incredible now and was obviously unwarranted, another more demonstrable fear led to a change in nuclear policy in the early 1960s when worries over the effects of radiation resulted in a ban of atmospheric testing. The recent manifestation of environmental fears under the rubric of nuclear winter reveals still another possibility that seems to be just as catastrophic as the original environmental fears and just as much a basis for serious concern as the fears that led to the ban of atmospheric testing. The use of nuclear weapons could lower temperatures hemispherically, if not globally, disrupting the environment to the point that the ability of the ecosystem to support modern civilization would be in question.

At present the United States is engaged in a scientific effort to determine whether the nuclear winter concept is valid. There is no doubt that nuclear war would create severe environmental consequences. The research is to determine the extent of those consequences--their cause, expanse, duration, and long-range effects. The most important question, but one not easy to answer, is: would

the environmental consequences of a nuclear war be significant when compared to the death and destruction caused by the direct effects of blast and fire? The initial results of of this research suggest that the scientific study of nuclear winter will be a long one. The nuclear winter phenomena are extremely complex and understanding them is in many ways beyond our present scientific capabilities. Thus, it may be a long time before we can prove the nuclear winter theory of the TTAPS¹ study right or wrong. The ability to quantify the theory in some useful way may never be possible. This realization is unsettling enough, but we must also consider that TTAPS may have significantly underestimated the situation. The ecosystem may be even more sensitive to the use of nuclear weapons than the TTAPS study postulated.

The United States must also determine the policy implications of the nuclear winter concept. A study done by a group of civilian and military scholars at the Center for Aerospace Doctrine, Research, and Education (CADRE) was an attempt to do this.² It concluded that there is a direct relationship between the sensitivity of the environment to the use of nuclear weapons and the implications nuclear winter has for policy. The greater the sensitivity is perceived to be, the greater the policy implications of nuclear winter are. As the sensitivity increases, the options that exist for the use of nuclear weapons decrease. As one goes from low to high sensitivity, the first options

that disappear are those that would require the use of large numbers of nuclear weapons; in particular, those that would result in the greatest amount of smoke and debris injected into the atmosphere over a short period. Thus even very low environmental sensitivity means that large-scale countervalue attack options are eliminated, and any nuclear war that does occur must be controllable.

This situation creates a dilemma for policymakers. They must create a perception of security from any and all threats. To do this they must be able to credibly threaten to use nuclear weapons in order to deter their use by others. These threats are hollow if policymakers suspect such use could result, either directly or indirectly (through failure to control escalation), in a nuclear winter. Moreover, they must take into account the new general awareness of these indirect effects in the aftermath of widespread publicity about nuclear winter. This widespread publicity further restricts their ability to make such threats even as it reinforces their doubts that such threats are credible in their own minds. If policymakers keep secret their own beliefs about nuclear winter and attempt to mitigate public beliefs about the phenomena, they can still credibly threaten to use nuclear weapons, but they will have difficulty believing their own threats. Further, they cannot capitalize on the deterrent value of nuclear winter and must live in fear that their bluff may some day

be called or that any of the other nuclear powers could cause a nuclear winter out of ignorance.

This dilemma and its solution are the subject of this paper. Through the analysis of what I call nuclear winter asymmetries, I will try to uncover systematically the nature of the problem we face and to show why joint efforts to solve it are in the best interest of both superpowers. Such joint activity would be one part of a two-part solution of the nuclear winter problem. The second part of the solution would be accomplished by force structure changes. These changes could be made without first developing detailed knowledge of what it would take to cause a nuclear winter, and they make sense whether or not a nuclear winter is possible. Additionally, they may be made independent of bilateral cooperation.

Nuclear Winter Asymmetries

The asymmetries inherent in the nuclear winter concept fall into two categories. In the first, or "objective asymmetries," category are those asymmetries that would exist even if there were complete knowledge of and agreement on the relationships between the use of nuclear weapons and their environmental effects. These asymmetries consist of different sensitivities to nuclear winter effects and the different degrees to which such effects would occur in different locations around the world. Size of continental land mass, buffering effects of oceans, prevailing winds,

and prewar climates are some of the factors that give rise to this category of asymmetries. They also include differences in political, technical, economic, and geographic factors that shape and limit superpower options in dealing with nuclear winter.

The second, or "subjective asymmetries," category includes those differences in perception that will exist simply because complete knowledge of and agreement on the nuclear winter phenomena can never be achieved. The differences arise from the inability of scientists to fully understand the complexities of the nuclear winter phenomena, asymmetric acceptance on the part of policymakers of that understanding, and the suspicious interpretations that either superpower might give to any policy decision the other might make in response to nuclear winter.

Both categories of asymmetries will be analyzed to explore the important and complex relationships between them and to discover their implications for superpower policy. The general hypothesis is that the dilemma nuclear winter creates is in part due to the effects of these asymmetries. Cooperative scientific and policy studies of nuclear winter are one way to reduce their effects and escape from the dilemma.

Substantial cooperation between the two superpowers requires trust and goodwill, two elements that have been noticeably absent in US/USSR relations. It may well be impossible to conduct cooperative studies until nuclear

winter is seen as a common threat. Because cooperative efforts may not materialize or be productive, it is essential that we give careful study to a second way to resolve the dilemma. Certain unilateral actions could obviate the effects of asymmetries and lead both sides to evolve force structures and employment strategies that are consistent with the constraints created by nuclear winter. The general thesis of this section is that the other part of the nuclear winter dilemma arises from the way strategic forces are structured and the influences those structures have on employment strategies for those forces. Changing that structure will lead to revised employment strategies and is the second way to escape the nuclear winter dilemma.

Objective Asymmetries

Objective asymmetries may arise because of both geography and climate. Geography is important because the Soviet Union is downwind from Europe and the United States and is less protected by the buffering effects created by large bodies of water. As a result, the Soviet Union would have to contend not only with its own smoke but also with that from the destruction in Europe and the United States.³ Thus, temperature drops in the Soviet Union may be greater and more prolonged than those that would occur in the United States. Conversely, in the United States once the smoke of its own destruction had blown away, smoke from the Soviet Union and Europe might not present such a serious problem.

Having crossed the broad expanses of western Asia and the Pacific, the smoke would have had more time to disperse and rain out. Additionally, the oceans that surround America on three sides constitute tremendous heat reservoirs that could mitigate temperature drops in North America. Since the Soviet Union has a colder climate and already has problems growing the food it needs, a small drop in the average temperature of the earth could have drastic effects on Soviet food production. Thus, geography and climate may create important objective asymmetries.

Objective asymmetries may also arise because of economic, technical, geographic, and political factors that will influence the policy decisions. For example, the Soviet Union would seem to have geographic and political advantages in fielding the types of force structure modifications that nuclear winter requires. It has more land available for dispersing and concealing weapons systems and a domestic political structure that makes it easier to deploy and provide security for such systems. On the other hand, economic and technical advantages favor the United States.

Objective asymmetries are unique because they are concrete. No amount of superpower cooperation can remove them. On the contrary, cooperation between the superpowers, by helping uncover and establish their existence, would also help uncover and establish their political and military importance. Therefore, if objective asymmetries exist that could be both significant and exploitable, mutual

cooperation in discovering and understanding them would not seem to be in the best interests of both superpowers. For example, if the Soviets thought that a nuclear winter would affect the Soviet Union much more than the United States, a logical Soviet strategy would be to conceal such beliefs. Therefore, they might deny the validity of the entire nuclear winter concept and refuse to cooperate in its scientific investigation. It might even be possible that the Soviets would feign cooperation and attempt to hinder progress in understanding the phenomena. On the other hand, if the Soviets believed that there were no exploitable asymmetries, a logical Soviet policy would be to promote scientific cooperation and mutual understanding of the common danger.

Fear of exposing exploitable objective asymmetries to the opponent is a natural reaction. However, for objective asymmetries to be important they would have to be the result of a nuclear exchange that caused relatively mild nuclear winter effects. Extreme nuclear winter effects such as those described by TTAPS would threaten all life everywhere, and any objective asymmetries in them would be meaningless. Since it is only with the occurrence of relatively mild nuclear winter effects, hereafter referred to as nuclear autumn, that objective asymmetries can be important, fear of them is unfounded, at least until force structures and force employment strategies evolve that give us confidence that nuclear warfare can be controlled and limited.

To illustrate this point, let us assume that the environment is insensitive to nuclear effects; that is, only an all-out nuclear exchange could cause a nuclear autumn. In this situation, objective asymmetries would pale to insignificance compared to the direct damage done by the nuclear weapons themselves. In all likelihood, there would be little to exploit and no interest in exploitation.

If we reverse the assumptions, the asymmetries become no more exploitable. If the environment is sensitive, a limited nuclear exchange could cause the same nuclear autumn situation. In this case, objective asymmetries might be significant compared to the direct damage. However, they would not be exploitable unless there were high confidence that the situation was under control. Without high confidence that the exchange could be kept limited, both the autumn effects and the direct damage that had already taken place would be the harbingers of much worse to come. They would inspire extreme fears of both nuclear winter and catastrophic direct damage that would overshadow the significance of any objective asymmetries. Efforts to avert these threats by terminating the war would dominate and totally preclude efforts to exploit asymmetric effects.

Similar reasoning can be applied to the broad range between the extremely insensitive and extremely sensitive situations; in this range, objective asymmetries are neither significant nor exploitable. Regardless of sensitivity, objective asymmetries cannot be exploited without full

confidence that nuclear war is highly controllable and its environmental consequences are well understood. At this point, neither condition seems to be a very likely possibility. These observations suggest that neither superpower should avoid cooperative efforts that might uncover objective asymmetries.

We now turn to the analysis of subjective asymmetries. Although they may also seem to be exploitable, they are not. Their existence simply lessens everyone's security.

Subjective Asymmetries

By definition, this category of asymmetries includes those differences in perception that will inevitably exist simply because knowledge and agreement concerning the nuclear winter phenomena can never be achieved.

At the core of subjective asymmetries will be the lack of a common scientific understanding of nuclear winter. The preliminary scientific efforts to gain understanding of the nuclear winter phenomena have yielded consensus on at least one fact: the phenomena and their causes are extremely complex. At this point it is difficult to believe they will ever be fully understood. More likely they will always be plagued by considerable ambiguity. The larger the degree of ambiguity, the more difficult it will be for either superpower to develop satisfactory policy alternatives and the more likely it will be that significant subjective asymmetries will exist.

One can imagine many ways in which a lack of scientific understanding of the nuclear winter phenomena could complicate and compound the policymakers' problems. One side might be confident that it understands the complexities of nuclear winter phenomena but lacks confidence in the other side's understanding. At the same time, the other side may be in exactly the same situation or may have concluded that the scientific complexities are essentially unsolvable. To complicate matters further, either superpower may suspect that any expression of confidence in or denial of understanding on the part of the other superpower is a declaratory ruse. Both sides could believe they understand the scientific relationships while disagreeing significantly on what they are. Such an asymmetry would not only magnify distrust and suspicion, it would also assure that at least one side, if not both sides, held a perception of reality that might be disastrously in error.

Superimposed on the asymmetries that arise from a lack of understanding of scientific relationships are those that arise from asymmetric acceptance of that which is understood. On each side, factions undoubtedly will develop that espouse different views of what it would take to cause nuclear winter effects. Ritual disarmers would likely envision an extremely sensitive environment. Those who favor larger arsenals might adopt an opposite view. These factions will compound and distort the honest disagreement that will occur among scientists. Each will likely try to

find scientists whose views support theirs. Policymakers may not know whom to believe and will likely disagree among themselves as to which scientific perception should form the basis for policy decisions.

Asymmetries of acceptance may also occur among policymakers because of their disposition toward the concept of deterrence. Some may react by denying the concept of nuclear winter because they believe it undermines long-standing policies that have prevented general war since 1945. On the other hand, those who see assured destruction as a bankrupt strategy may view the concept as a reflection of reality in the hope that nuclear winter will lead away from a deterrent posture based on assured destruction.

At this point we can see the importance of joint policy analysis between the United States and the Soviet Union. Superpower policy decisions will determine whether or not nuclear war or nuclear winter will occur. Further, policy decisions achieve their desired effects only when they are interpreted properly by the group they are supposed to affect. Thus, asymmetries due to lack of scientific understanding of nuclear winter, or differences in accepting that understanding, achieve their importance in two ways: by undermining the bases for both policy decisions and policy interpretations. To the degree that they exist, they make it less likely that the interplay of policy decisions and

interpretations will be successful in reducing the possibilities of both nuclear war and nuclear winter.

To illustrate the problems that can arise without joint policy analysis, we can examine five different reactions to nuclear winter that could result even if shared scientific understanding and common acceptance of that understanding have been achieved. This range of reactions demonstrates how difficult it would be to interpret properly an opponent's policy decisions. Each reaction can be interpreted in a variety of ways and attributed to very different policy decisions. Of course, it is simplistic to think of only five reactions. An endless number can be created by combining elements of the five I will discuss.

One reaction could be to see nuclear winter as reinforcing deterrence. Thus, nuclear winter becomes the ultimate threat, taking assured destruction to its logical extreme.

An opposite reaction is possible from those who believe that nuclear war, once begun, cannot be limited. From their perspective, any use of nuclear weapons would escalate uncontrollably and result in a nuclear winter. Therefore, nuclear weapons are unusable and should be discarded.

In between these extremes there are at least three other possible reactions, all of which attempt to maintain deterrence by finding ways to credibly threaten the use of nuclear weapons by reducing the possibility that their use would lead to a nuclear winter. One reaction would be to

reduce arsenals to a level that could not cause a nuclear winter. A second would be to develop effective strategic defenses to defend against the weapons that could cause nuclear winter. The third would be to adopt strategies and force structures for limited, protracted, and slow-paced exchange scenarios in order to avoid nuclear winter.

All of these reactions recognize that if a nuclear winter is possible the superpowers have mutually and inadvertently developed and deployed a doomsday machine. It is important to recognize that the force structures of the superpowers do not constitute separate doomsday machines. Individually they are obviously controllable. It is only during a nuclear war, when the structures interact with each other, that they combine in ways that cause very serious concern about controllability. Relating these nuclear winter reactions to the doomsday machine concept, the first reaction views a doomsday machine as the ultimate deterrent. We should, therefore, keep it. The other reactions view the doomsday machine as a threat that we should, respectively, eliminate because it is uncontrollable, scale down so that it doesn't have to be, defend against so that it is no longer viable, or replace with substitute force structures that are more credibly controllable.

When the possibility of differences between declaratory strategies and operational strategies is folded into the equation, it becomes clear that a suspicious enemy could interpret these reactions in a variety of ways and attribute

them to very different policy decisions. For example, in addition to being interpreted as an attempt to prevent nuclear winter by deterring nuclear war, a decision to keep a doomsday machine could be perceived as (a) a lack of acceptance of the nuclear winter concept, (b) an inability to understand the threat or restructure forces and strategies to deal with it, (c) a lack of sanity, (d) a declaratory ruse, or (e) simply no decision at all.

If a policy decision were made to eliminate the doomsday machine by discarding nuclear weapons altogether, the mutual suspicions that normally surround arms control activities would be present and be amplified by the magnitude of the policy change that such a goal would encompass. In many ways a decision to eliminate the doomsday machine is more improbable than a decision to keep it. Extreme domestic political pressure would probably be necessary to evoke such a decision. However, the Soviets would not necessarily interpret a Western policy that called for nuclear disarmament as a proper response to nuclear winter. Instead they might see it as (a) a domestic political ploy that would be slowly reversed as nuclear winter hysteria died down, (b) a utopian dream impossible to achieve because of verification but one they might be able to exploit, (c) an inability to understand the threat of nuclear winter or to restructure forces and strategies to deal with it, or even (d) preparation for a

return to the disastrous major power bloodbaths that preceded the era of nuclear deterrence.

Suspicious interpretations are also likely to surround any policy decision designed to put nuclear winter beyond reach by paring down strategic arsenals. These suspicions could arise from at least two factors. First, the size of a nuclear arsenal is only one of many parameters that would determine whether its use would cause a nuclear winter. A small number of weapons used to firestorm cities could cause the same degree of environmental effects as that caused by a much larger number of weapons used in ways that did not cause fire storms. Second, at some point in the paring process the stability of deterrence becomes very sensitive to the relative size of the arsenals. This is because, other factors being equal, bigger arsenals provide a greater assurance that a sufficient second strike capability will survive an enemy first strike. Therefore, maintaining stability and paring arsenal size sufficiently to put nuclear winter beyond reach may be mutually exclusive goals. Achieving both goals would require elaborate verification procedures that may be impossible to establish. However, without such verification, arsenals could not be reduced far enough before fears arose that the reductions themselves were increasing the danger of nuclear war even if they were reducing the danger of nuclear winter. Because of these factors a decision to reduce the size of the doomsday machine to put nuclear winter beyond our capability could be

misinterpreted. It could be seen as a ruse to gain some temporary but exploitable advantage. It might also be perceived as an impractical idea but at least a step in the right direction. It could also be seen as a good faith attempt to deal with nuclear winter that can be exploited or simply as a dangerous step that undermines stability.

A variation of this idea would be to put nuclear winter beyond reach by eliminating or minimizing the contributions that individual weapons could make toward nuclear winter. We could continue and accelerate the trend away from large nuclear weapons that has been underway for many years. There is the possibility of substituting nonnuclear weapons in many of the roles now played by nuclear weapons.⁴ Where nuclear weapons must still be used, terminal guidance precision should allow the use of weapons of much smaller yield. Earth-penetrating warheads could be used against both hardened point targets and urban industrial area targets in ways that minimize dust and smoke generation. In this case, arsenals would probably not be reduced in terms of numbers of weapons but would be greatly reduced in terms of megatonnage and, more to the point, in terms of their potential to create nuclear winter collateral effects. This variation will certainly be a part of the solution to the nuclear winter dilemma but it is only a part. To eliminate the possibility of a nuclear winter, the other nuclear powers would have to follow suit. Such weapons would introduce extreme stability problems and they,

especially the nonnuclear ones, might be too inflexible, because of their specialized designs, to support unforeseen or changing war requirements. Further, there would always be the fear that these new weapons and employment strategies were an addition to, rather than a substitute for, present weapons and strategies.

Ballistic missile defense systems could be subject to similar problems of interpretation. Recent interest and debate concerning strategic defenses suggest quite clearly the interpretations that might be given to a decision to defend against nuclear winter. Either superpower fielding area defenses could make its adversary suspect it was preparing to fight a nuclear war rather than attempting to deter one. Thus a decision to defend against the doomsday machine would not necessarily indicate to an enemy that one was simply attempting to reduce the chances of a nuclear winter occurring. Ironically, if the firestorming of cities is considered to be the major cause of nuclear winter and if the strategic defense of cities continues to be seen as impractical, one could even conclude that the deployment of strategic defenses would have little effect on the probability that a failure of deterrence would lead to a nuclear winter.

At this point we have looked at four of the five possible reactions to the nuclear winter concept. It is reasonably clear that without joint US/USSR policy studies of nuclear winter, and without the confidence in each

other's intentions that such studies could build, the policy decisions those reactions engender are likely to be misinterpreted. Those misinterpretations will reduce the security of all.

We now come to the last reaction to nuclear winter--adopting strategies for limited, protracted, and slow-paced exchange scenarios. Simply stated, it calls for basing strategic weapons in such a manner that they do not constitute targets and for supporting those forces with a command and control system that can reconstitute itself after an attack. With such forces and command and control systems in place, there would be no advantage for initiating either a counterforce or a beheading attack, no matter how deep the crisis that would otherwise make such options plausible. Further, many of the theoretical advantages for escalating an ongoing exchange would disappear. Therefore, such a deployment strategy not only reduces the possibility that a nuclear war will occur but also increases the chances of keeping escalation under control if one does. Also, it makes sense whether or not one believes a catastrophic nuclear winter is possible. Therefore, we do not have to wait until nuclear winter is fully understood or until we achieve a consensus as to its implications before adopting the strategy. I call this strategy "dynamically stable deterrence."

Dynamically Stable Deterrence

Dynamically stable deterrence exists when individual weapons are deployed in ways that make them untargetable. Under this concept, weapons do not depend in any way on the existence of other weapons for their protection. That is, their vulnerability does not depend on the synergistic relationships between major weapon systems, the proliferation of individual systems, or on defensive weapon systems. Dynamically stable deterrence is achieved by developing and deploying weapon systems that use concealment, mobility, or both to make them unattackable. Weapons so based are unattackable because no enemy can know where they are or where they will be when his attack arrives. When such basing modes characterize the forces of both sides, dynamically stable deterrence exists.⁵

Dynamically stable deterrence differs from traditional concepts of stable deterrence in a number of ways. First, dynamically stable deterrence would continue to operate in a protracted nuclear war, thereby contributing to escalation control and war termination efforts. This would be the case because dynamically stable forces would not be subject to attack and thus could be used as the basis for intrawar deterrence. Therefore, to the extent that dynamically stable deterrence can be built into strategic force structures, it makes uncontrolled nuclear war a less likely result of a failure of deterrence. Second, dynamically stable deterrence makes even a partial failure of deterrence

less likely by eliminating the advantages of striking first, thereby maximizing crisis stability. Third, dynamically stable deterrence can lead to smaller force structures by eliminating the incentives for increasing the number of weapons in nuclear arsenals. It does this by eliminating the other side's counterforce targeting opportunities and reducing the importance that now attaches to the relative size of opposing arsenals. Thus, it contributes to arms race stability as well as deterrence stability and crisis stability.

Some examples of dynamically stable forces may help the reader better understand the concept. Instead of being based in known locations in fixed hardened silos, ICBMs could be mobile. Missile carriers could depend on speed to escape attack much as a B-52 on alert launches to protect itself, or they could depend on a combination of concealment and mobility so that an enemy would never know where the weapons were. In the first case, mobile missiles might be carried on semihardened vehicles that could move far enough and fast enough under attack to survive. Or they might be carried by faster but less-hardened vehicles such as ground-effect machines or helicopters. In the second case, missiles could be hauled by ordinary-looking tractor trailers so that their movements and locations would be impossible to determine. Another class of weapons that lends itself to concealment and mobility is cruise missiles. Of course, submarine launched ballistic missiles (SLBMs)

have capitalized on concealment and mobility for many years. The common denominator of these basing modes is that they are not vulnerable to attack and it is unlikely that a potential attacker can achieve any weapons system improvements that will make them vulnerable. When such systems dominate strategic force structures, they have revolutionary effects on nuclear strategies, deterrence stability, and escalation control.

To appreciate the implications of dynamically stable deterrence, imagine a world in which the nuclear powers have their strategic nuclear forces based so that no other nuclear power can destroy them or even contemplate attacking them. Thus, any adversary who might use nuclear weapons must be willing to accept retaliation in kind. He would have no way to disarm his enemy and, at the same time, he would have no fear that his enemy could do anything to disarm him. This suggests that such forces would be used only modestly, if at all, and then only after extreme provocation. Further, the rate of use of such forces can remain under control because they are not subject to the damage-limiting counterforce attacks of opposing forces.⁶ Under such conditions there are no advantages in striking first, and any nuclear power can always afford to wait to see if his adversary will opt for war. Additionally, the advantages and fears that are associated with a sudden escalation to a strategic counterforce option also disappear. Therefore, the incentives for using strategic forces slowly, if at all,

far outweigh the incentives for using them quickly. Such forces, by providing a much more credible deterrent umbrella to control escalation, revitalize the role of strategic forces in extended deterrence. I suggest the following as a partial list of the implications of dynamically stable strategic forces.

Because such forces when mutually deployed would not possess strategic counterforce capabilities, first-strike fears would be minimized. Furthermore, sufficient second-strike capabilities could be maintained with far fewer weapons than is presently true. Facing no opposing strategic counterforce capability and having no such capability means that crisis stability is greatly enhanced. Such forces completely remove the fears of vulnerability that could play a major role in leading the world into a nuclear war that no one seeks.

Dynamically stable strategic systems support both deterrence by punishment and deterrence by denial better than present strategic systems. The threat that supports deterrence by punishment would continue to be based on assured destruction but at a modified pace. Rather than a spasm response as is now popularly perceived, assured destruction could be carried out at a much slower pace. When strategic weapons cannot be attacked, incentives for increasing the pace of destruction will not outweigh those for keeping it slow. Furthermore, a threat of slow-paced destruction would be more credible because it would allow

time for war termination efforts to succeed. Of course, if the ongoing destruction did not convince leaders that the war must be stopped, the war would continue to run its course. Thus, dynamically stable systems, do not preclude a total disaster. They only allow the war to proceed more slowly and possibly provide enough time to stop it before it runs its course.

The threat that supports deterrence by denial is also modified. By definition, mutually deployed, dynamically stable strategic systems would have no strategic counterforce capability. However, because they give escalation control and war termination efforts more chance to succeed, they increase the likelihood that the United States would use battlefield and theater nuclear weapons in response to a successful conventional attack. Thus, dynamically stable strategic systems increase the ability of battlefield and theater nuclear weapons to deter conventional attack. Additionally, if a conventional attack occurs, dynamically stable strategic systems could be used to destroy attacking forces without coming under attack themselves. Thus, they provide a much stronger basis for deterrence by denial.

Dynamically stable systems would not depend on bilateral arms limitation agreements to achieve their benefits. The central issue would no longer be how many strategic weapons and delivery systems a country has but how they are based. Instead of using national technical means

of verification to assure compliance with number limitations, the nuclear powers might use them to ensure that no strategic weapons could be located. Although an agreement between the nuclear powers to do everything possible to hide their strategic weapons from each other would be helpful in managing and understanding the transition to dynamically stable systems, it might not be necessary. As mobile missile and cruise missile technologies proliferate and mature, an arms race to such dynamically stable systems may develop on its own, thereby obviating the need for such an agreement.

As dynamically stable strategic systems were deployed, arms control efforts would focus on their more important traditional roles of lowering the likelihood and destructiveness of war. Arms control techniques and issues would move away from determining precisely how many weapons were deployed and what type they were. Of far greater importance would be issues related to the probability that any of them might be used, how many might be used, how fast they might be used, and the value of the targets they might be used against. Arms control measures, either tacit or formal, that assist in the transition to dynamically stable systems can push all of these numbers significantly lower.

As a further corollary, dynamically stable strategic systems make flexible response and countervailing strategies more viable. By eliminating the incentives for fast-paced scenarios, it becomes more realistic that the necessary

decision-making time will be available to carry out such strategies. Also, ideas such as launch on warning, launch under attack, pin down, escalation dominance, rapid response, and prompt hard target kill will play increasingly smaller roles as the transition to dynamically stable forces takes place.

All of this means that many of the demands for improving present command, control, communications, and intelligence (C³I) capabilities--improvements that are needed to support those strategies that arise from the vulnerabilities both sides have to counterforce attacks--would be changed by a transition to dynamically stable forces.

A C³I system for dynamically stable offensive weapons would not have to operate under attack except to provide warning to offensive systems as necessary for them to enhance their survivability. Therefore, launch under attack strategies can be discarded and the mission for C³I becomes less demanding. Dynamically stable forces can be adequately supported by a C³I system that cannot be disconnected for more than a few days from the forces it controls. The appropriate system would be highly redundant, mobile, and able to reconstitute itself after an attack. Deceptively based mobile forces can survive to wait out interruptions in their chain of command. No enemy would be able to have any confidence that he could destroy them before their C³I system could be reestablished. Therefore, it would be

impossible to avoid retaliation by using a beheading attack strategy.⁷

Another role for C³I might be to exploit nuclear winter in support of efforts toward escalation control and war termination. A system of sensors could be deployed to measure the amount of particulate material that was being introduced into the atmosphere, the density and distribution of that material, and the cooling effects that it was causing on the earth's surface. In the event of a limited or slow-paced exchange, such a system would allow scientists to collect the empirical data needed to validate and quantify the theory of nuclear winter. With such data in hand, they could make a much more accurate forecast of what continuing the war would do to the environment. If the forecast based on empirical data supports the type of nuclear winter fears that the theoretical TTAPS study has generated, it will be an additional powerful incentive to stop fighting. Of course, such a system would not make sense unless the environment was considered to be extremely sensitive to the use of nuclear weapons and significant nuclear winter effects were expected to occur from relatively small exchanges.

Finally, dynamically stable strategic systems can support long-term progress in improving superpower relations. Such systems do not mutually threaten but they do command mutual respect. Each side can view the other's systems as clearly defensive in nature and as absolutely

necessary to and unambiguously in support of the other's stated policy goal of not having a nuclear war. With this view established, the continuous poisoning of superpower relations that comes from strategic nuclear systems that are too often interpreted as threatening can be reduced. This is not to argue that transitioning to such systems will constitute a cure-all for superpower relations. Rather, with such systems, nuclear issues will not continuously occupy center stage and therefore will not contribute to our differences to the degree that present systems do.

There are also arguments against the mutual deployment of dynamically stable strategic systems. Such a deployment would eliminate our strategic counterforce capability. In the past, such a capability has been seen as supporting extended deterrence and as the basis of escalation dominance at the strategic level. However, our transition to dynamically stable strategic systems only denies our enemy his strategic counterforce capability. Our capability is not necessarily affected until our enemy makes the same transition. Certainly strategists who favor counterforce can appreciate the advantages of denying adversaries their capabilities. We really have no option other than deploying dynamically stable systems. We certainly cannot let our enemy deny us our counterforce capability while we allow him to retain his.

Because crisis stability is greatly enhanced, it can be argued that the number of confrontations and crises may

increase. Ever since the Cuban missile crisis, the superpowers have been very wary of direct confrontations. This wariness is often attributed to the prospect of uncontrolled nuclear war. Therefore, one could argue that a transition to dynamically stable forces will make the superpowers less wary of confrontation. Such systems, by this argument, might decrease the risk of all-out nuclear war at the expense of increasing the likelihood of limited nuclear war. However, this argument does not withstand close scrutiny. Such systems increase the credibility of nuclear threats and that increased credibility will not allow the superpowers to lessen their fears of confrontations and crisis. It may even increase fears of confrontation for those who see present arsenals of nuclear weapons as pretty much unusable because of their doomsday nature. Dynamically stable systems are "escalation neutral" because they will not affect escalation one way or the other. With such systems, national command authorities will not be pushed toward escalation out of fear their forces will be destroyed by enemy action. Neither will they be afraid to respond out of fear that escalation cannot be controlled. Such conditions will not lessen superpower fears of crisis.

Dynamically stable strategic systems will demand a radical change in the perspectives of those who support arms control limitation agreements. For example, instead of demanding that ICBM launchers not be hidden so that they

can be counted, arms control agreements for dynamically stable systems may demand that launchers be hidden, and it may not be possible to count them. Of course, the Soviets have already demonstrated launcher reload capabilities that have led to speculation that they may have built ICBM inventories that are not countable today. There has been speculation regarding the number of mobile ICBMs the Soviets may have and their latest ICBM developments are expected to be deployed in mobile versions. These thoughts suggest the Soviets may have already begun a transition to dynamically stable strategic forces. Hopefully, arms control negotiators can focus on the idea that mobile ICBMs and cruise missiles do not eliminate the possibility of arms control agreements making an important contribution to national security. They just require the negotiators to focus their efforts on the other traditional objectives of arms control as previously discussed. Because the exact location of individual mobile weapons has a very fleeting utility, it may even be possible to apply arms limitation-type agreements to such systems. The superpowers could agree to allow on-site verification for the purpose of ensuring that they are complying with number limitations. Verification procedures could be designed that would exclude the possibility of revealing weapon locations in a timely enough manner to make them attackable. Some verification would be required to ensure that each superpower is aware of the existence of the

other's dynamically stable forces. Such knowledge is a necessary element of deterrence.

Dynamically stable systems may be opposed by our European allies. A major theme in the defense of NATO has been the close coupling of strategic nuclear forces to theater and battlefield nuclear forces. This coupling was to ensure that the superpowers could not use Europe as a battlefield for a limited nuclear war. This theme may constitute a major obstacle to European appreciation of the argument that dynamically stable strategic systems strengthen extended deterrence by increasing the credibility of their use as well as that of battlefield and theater weapons. If the concept of dynamic stability could be applied to theater nuclear weapons as well, European resistance might be lessened.

Such systems will most likely be more expensive than present strategic systems. The expense of dynamically stable strategic systems may not be acceptable without first generating public support for them. At the same time, if the public relations for such systems are mishandled, it might become politically impossible to deploy them. Also, the other nuclear powers may find such systems to be economically prohibitive. The more the other nuclear powers follow suit in deploying such systems, and the more these systems characterize the strategic force structures of all nuclear forces, the greater their benefits will be. Factors such as land area available for deployment and the need to

provide security for the deployed systems will certainly affect their cost. France and the United Kingdom may, therefore, need US economic help in order to deploy them. These same factors may make their deployment relatively more attractive for the USSR and the People's Republic of China.

There are several counterarguments to the increased expense of such systems. First, in a world in which arms control may not be able to perform its traditional role of limiting the size of nuclear arsenals, economic limitations may be able to assume part of that role. Second, some people think that excessive vertical proliferation has occurred in part because nuclear weapons have been too cheap. Third, because dynamically stable strategic systems make extended deterrence more credible, they can save money by reducing the presently seen need of raising the nuclear threshold by increasing expensive conventional forces. Fourth, by slowing the pace of exchange, they could significantly decrease the cost and feasibility of strategic defenses. Fifth, because DSD systems reduce counterforce possibilities, fewer such weapons would be necessary. Finally, there really are no other options. Whatever their cost, some combination of passive and active counterforce denial is necessary so that strategic nuclear weapons can continue to provide security in an age of increasingly accurate counterforce systems.

At first glance, there appear to be problematic moral implications for dynamically stable strategic systems. It

can be argued that such systems would more clearly target cities and threaten their destruction. The moral justification in favor of these systems is twofold. First, they make nuclear war less likely. Second, if nuclear war should occur, they hold out a much better hope of maintaining intrawar deterrence, limiting the type and pace of destruction, and terminating the conflict before widespread city destruction--or, for that matter, any city destruction--occurs. Therefore, on both counts it can be argued that they are relatively more moral than strategic systems that are not dynamically stable.

Based on these counterarguments, dynamically stable strategic systems might encounter formidable domestic political resistance. A well-informed public awareness of the pros and cons of dynamically stable deterrence is the key to overcoming such resistance. However, it may be difficult to develop the rather broad and sophisticated knowledge of nuclear issues that is a prerequisite for appreciating this concept. Without such knowledge, political support for such systems would be vulnerable to the rhetoric of those who are either categorically opposed to nuclear weapons or who might see dynamically stable systems as unnecessary or too expensive. The situation requires an open debate and this effort should be seen as an initial step toward that end.

Whether or not we like the concept of dynamically stable strategic weapon systems, two dominating forces are

pushing the concept on us. First, the increasing ability of both superpowers to conduct counterforce operations results in vulnerable weapon systems that have less deterrent value. Further, the kind of nuclear war that increasing counterforce capabilities make more likely is the rapidly escalating, fast-paced variety rather than the controlled and limited variety. Second, belief in the nuclear winter⁸ theory makes any use of nuclear weapons that is not controlled and limited a useless policy option no matter how extreme the situation is and no matter what our other policy alternatives may be. These two factors will combine to make us opt for dynamically stable strategic systems so that the use of nuclear weapons can remain a viable policy option and, as such, one that supports deterrence and helps achieve national security objectives. The following pages will explain the logic behind this assertion.

Increasing awareness of nuclear winter will add to the demand for increased accuracy so that weapons with greatly reduced yields can be substituted for present systems. It will be argued that such weapons are needed to provide military capabilities that do not carry with them the collateral environmental consequences that fall under the rubric of nuclear winter. Perfectly accurate, small-yield weapons can fulfill this need. Furthermore, any acceptance at all of the nuclear winter theory's validity should be sufficient to deter the kind of attacks that could be effective against land-based dynamically stable systems.

Barrage attacks could destroy such systems, but even if they were totally successful and unanswered, nuclear winter would make the victory short lived. My earlier advocacy of joint discussions and studies of nuclear winter was in part based on the need to ensure that all the players held sufficient belief in nuclear winter to render barrage attack options incredible.⁹

The needed technology is already at hand, as demonstrated by the advent of cruise missiles that have shown a capability to achieve near-perfect accuracy. There seems to be no reason why similar technology cannot be used to provide ICBMs with essentially perfect accuracy.

Such ICBMs will be far more usable for counterforce attacks than present systems are. Such systems equipped with low-yield warheads suggest less civilian death, less collateral damage, and less radioactivity that is, at the same time, much more restricted to the target area. They also suggest increased confidence that the attack could be totally successful and 100 percent effective against locatable targets. Thus, near-perfect accuracy overcomes many of the self-detering aspects of using such systems in large numbers and in doing so suggests that any use of nuclear weapons would be more likely to rapidly escalate to a fast-paced counterforce exchange. I see two possible results of such an exchange. The first is that it would expand to include countervalue targets and continue until weapons inventories were exhausted or destroyed. The second

is that one or both sides would rapidly use or lose all their vulnerably based forces and the war would automatically enter a slow-paced phase as each side was pared down to the dynamically stable component of their strategic forces or ran out of counterforce targets to hit. The pace of the war would slow as each side rationed the use of remaining forces; attempted to maintain intrawar deterrence to preserve cities, population, and other assets; tried to avoid nuclear winter; and sought war termination.

Regardless of which option occurs, logic suggests that the counterforce exchange cannot determine a winner, nor can it limit damage. Even if it goes heavily in favor of one side, it does not imply victory. In the first result, it causes both sides to lose control, thus suffering total devastation, with or without nuclear winter. In the second, the supposed loser still retains the invulnerably based portion of his forces and thus the winner cannot prosecute his victory very far before suffering grievous consequences. In either case, it is the existence of vulnerably based weapons that allows the counterforce phase of the war to be conceivable. Of course, a transition to dynamically stable strategic systems precludes the counterforce phase altogether.

Increasing counterforce accuracy is decreasing nuclear stability. While the growing acceptance that the indirect effects of a nuclear exchange in the form of potential global or hemispheric ecosystem damage demands that if

nuclear war occurs, it must remain controlled and limited. This can be resolved by a transition to dynamically stable strategic systems. Earlier we demonstrated how the counterforce phase of a nuclear war consists of a fast-paced exchange that pares strategic forces down to their dynamically stable components. By conducting this same paring down through a peacetime restructuring of our strategic forces, we can most certainly preclude the fast-paced phase of a nuclear exchange. Perhaps, with the fast-paced phase precluded by force structure changes, the slow-paced phase will never take place; and if it does, it is much more likely to be controllable. Thus, the transition to dynamically stable strategic systems can resolve the tension and allow the use of nuclear weapons to remain a viable policy option that supports deterrence and helps achieve national security objectives. Although a unilateral decision by either superpower to deploy dynamically stable strategic systems would leave the opposing superpower few choices but to follow suit, such a transition would better serve our security interests and could be accomplished more quickly, at less expense, and more completely if it enjoyed the full support of all nuclear powers.

Conclusion

The dilemma that nuclear winter creates can be escaped in two ways: through joint studies of nuclear winter and through unilateral force structure modifications. They are

mutually reenforcing and should be used in concert. Through joint scientific study and joint policy analysis of the nuclear winter concept, both sides can develop confidence that each knows the dangers inherent in nuclear winter and the new rules that it invokes. Knowing the new rules is one part of escaping the dilemma.

The second part of escaping the dilemma lies in force structure modifications. In order to derive security from their nuclear force structures, both superpowers must have confidence that those structures can be used without causing some form of ecological disaster. One way to do this is for each side to deny the other its strategic counterforce capabilities. This can be done unilaterally, if necessary, by adopting dynamically stable strategic force structures. As one side does this, the other will be forced to follow suit.

Most important, the concept of dynamically stable deterrence can also be adopted without waiting for proof that nuclear winter is or is not possible--proof that may never be forthcoming. It is fully consistent with long-standing US policies that make preventing nuclear war our first priority and, if we fail in that effort, terminating any nuclear war that does occur on conditions favorable to the United States. If a nuclear war ever occurs that is not limited and controlled, terms favorable to the United States or anyone else will simply not exist whether or not a nuclear winter is possible. The prospect that the nuclear

winter concept may have validity just makes this fact more obvious. Further, it raises the possibility that even if theories of escalation dominance lead to a successful termination of hostilities short of widespread urban destruction, the result may still be a severely altered ecosystem on a hemispheric if not a global scale.

In a world that suspects a nuclear winter may be possible, a world in which nuclear deterrence must still operate, nuclear weapons can provide security only when there is confidence that nuclear war will not happen and confidence that, if it does, it can be limited and controlled. Joint studies of nuclear winter and the deployment of dynamically stable strategic forces are two possible methods of providing this confidence.

NOTES

1. TTAPS is an acronym for the authors of the study that introduced the concept of nuclear winter--R. P. Turco, O. B. Toon, T. P. Ackerman, J. B. Pollack, and Carl Sagan. See "Nuclear Winter: Global Consequences of Multiple Nuclear Explosions," Science 222 (23 December 1983): 1283-1292. Hereafter referred to as TTAPS. To capture a feel for the scientific uncertainties that surround the study of nuclear winter, see the National Research Council (NRC) 1985 report "The Effects on the Atmosphere of a Major Nuclear Exchange" (Washington: National Academy Press). The environmental consequences of nuclear war which I include under the rubric of "nuclear winter" encompass far more than cold and dark. The most complete study to date is A. Barrie Pittock et al., Environment Consequences of Nuclear War, SCOPE 28, vol. 1, Physical and Atmospheric Effects and Mark A. Harwell et al., vol. 2, Ecological and Agricultural Effects (New York: John Wiley & Sons, 1986). These latter two studies drop the term nuclear winter because the phrase has "come to be associated primarily with the most severe possibilities. Although it is a convenient metaphor for use in describing the generic consequences . . . it does not, in a strict scientific sense, properly portray the range, complexity, and dependencies of the potential global scale environmental consequences of a nuclear war." Citation is from the Author's Note at the beginning of volume 1.

2. See Lt Col Dennis M. Drew et al., Nuclear Winter and National Security: Implications for Future Policy (Maxwell AFB, Ala.: Air University Press, 1986). Hereafter referred to as the CADRE study.

3. This assumes that winds would continue to prevail from the west. With our present understanding of nuclear winter, this may not be a valid assumption. One effect of nuclear winter might be to disrupt global circulation patterns.

4. See Carl H. Builder, Strategic Conflict Without Nuclear Weapons, Rand Report no. R-2980-FF/RC (Santa Monica, Calif., April 1983).

5. The possibility of a barrage attack will be discussed later.

6. This assumes reconstitutable command and control. This subject will be discussed later.

7. Command and control for dynamically stable forces is as important as the forces themselves. See Bruce G. Blair, Strategic Command and Control (Washington, D.C.:

Brookings Institution, 1985). In his concluding chapter, Blair advocates command and control system improvements that would be appropriate.

8. This is the first mention of nuclear winter in support of the strategy of dynamically stable deterrence. I point this out to reenforce the idea that such a strategy can be adopted and such systems can be deployed without first developing full understanding of the nuclear winter phenomena or without even admitting that we believe in the nuclear winter concept.

9. Barrage attacks are not a likely option for other reasons also: uncertainty of success, degree of escalation, numbers of weapons needed.

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