Nuclear Weapons in the 1980s: MAD VS. NUTS: The Mutual Hostage Relationship of the Superpowers

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Since World War II there has been a continuing debate on military doctrine concerning the actual utility of nuclear weapons in war. This debate, irrespective of the
merits of the divergent points of view, tends to create the perception that the outcome and scale of a nuclear conflict could be controlled by the doctrine or the types of nuclear weapons employed. Is this the case?

We believe not. In reality, the unprecedented risks of nuclear conflict are largely independent of doctrine or its application. The principal danger of doctrines that are directed at limiting nuclear conflicts is that they might be believed and form the basis for action without appreciation of the physical facts and uncertainties of nuclear conflict. The failure of policymakers to understand the truly revolutionary nature of nuclear weapons as instruments of war and the staggering size of the nuclear stockpiles of the United States and the Soviet Union could have catastrophic consequences for the entire world.

Military planners and strategic thinkers for 35 years have sought ways to apply the tremendous power of nuclear weapons against target systems that might contribute to the winning of a future war. In fact, as long as the United States held a virtual nuclear monopoly, the targeting of atomic weapons was looked upon essentially as a more effective extension of the strategic bombing concepts of World War II. With the advent in the mid-1950s of a substantial Soviet nuclear capability, including multimegaton thermonuclear weapons, it was soon apparent that the populations and societies of both the United States and the Soviet Union were mutual hostages. A portion of the nuclear stockpile of either side could inflict on the other as many as 100 million fatalities and destroy it as a functioning society. Thus, although the rhetoric of declaratory strategic doctrine has changed over the years, mutual deterrence has in fact remained the central fact of the strategic relationship of the two superpowers and of the NATO and Warsaw Pact alliances.

Most observers would agree that a major conflict between the two hostile blocs on a worldwide scale during this period may well have been prevented by the specter of catastrophic nuclear war. At the same time, few would argue that this state of mutual deterrence is a very reassuring foundation on which to build world peace. In the 1960s the perception of the basic strategic relationship of mutual deterrence came to be characterized as "Mutual Assured Destruction," which critics were quick to note had the acronym of MAD. The notion of MAD has been frequently attacked not only as militarily unacceptable but also as immoral since it holds the entire civilian populations of both countries as hostages.

As an alternative to MAD, critics and strategic innovators have over the years sought
to develop various war-fighting targeting doctrines that would somehow retain the use of nuclear weapons on the battlefield or even in controlled strategic war scenarios, while sparing the general civilian population from the devastating consequences of nuclear war. Other critics have found an alternative in a defense-oriented military posture designed to defend the civilian population against the consequences of nuclear war.

These concepts are clearly interrelated since such a defense-oriented strategy would also make a nuclear war-fighting doctrine more credible. But both alternatives depend on the solution of staggering technical problems. A defense-oriented military posture requires a nearly impenetrable air and missile defense over a large portion of the population. And any attempt to have a controlled war-fighting capability during a nuclear exchange places tremendous requirements not only on decisions made under incredible pressure by men in senior positions of responsibility but on the technical performance of command, control, communications and intelligence functions-called in professional circles "C3I" and which for the sake of simplicity we shall hereafter describe as "control mechanisms." It is not sufficient as the basis for defense policy to assert that science will "somehow" find solutions to critical technical problems on which the policy is dependent, when technical solutions are nowhere in sight.

In considering these doctrinal issues, it should be recognized that there tends to be a very major gap between declaratory policy and actual implementation expressed as targeting doctrine. Whatever the declaratory policy might be, those responsible for the strategic forces must generate real target lists and develop procedures under which various combinations of targets could be attacked. In consequence, the perceived need to attack every listed target, even after absorbing the worst imaginable first strike from the adversary, creates procurement "requirements," even though the military or economic importance of many of the targets is small.

In fact, it is not at all clear in the real world of war planning whether declaratory doctrine has generated requirements or whether the availability of weapons for targeting has created doctrine. With an estimated 30,000 warheads at the disposal of the United States, including more than 10,000 avowed to be strategic in character, it is necessary to target redundantly all urban areas and economic targets and to cover a wide range of military targets in order to frame uses for the stockpile. And, once one tries to deal with elusive mobile and secondary military targets, one can always make a case for requirements for more weapons and for more specialized weapon designs.
These doctrinal considerations, combined with the superabundance of nuclear weapons, have led to a conceptual approach to nuclear war which can be described as Nuclear Utilization Target Selection. For convenience, and not in any spirit of trading epithets, we have chosen the acronym of NUTS to characterize the various doctrines that seek to utilize nuclear weapons against specific targets in a complex of nuclear war-fighting situations intended to be limited, as well as the management over an extended period of a general nuclear war between the superpowers.2

While some elements of NUTS may be involved in extending the credibility of our nuclear deterrent, this consideration in no way changes the fact that mutual assured destruction, or MAD, is inherent in the existence of large numbers of nuclear weapons
In the real world. In promulgating the doctrine of "countervailing strategy" in the summer of 1980, President Carter's Secretary of Defense Harold Brown called for a buildup of nuclear war-fighting capability in order to provide greater deterrence by demonstrating the ability of the United States to respond in a credible fashion without having to escalate immediately to all-out nuclear war. He was very careful, however, to note that he thought that it was "very likely" that the use of nuclear weapons by the superpowers at any level would escalate into general nuclear war. This situation is not peculiar to present force structures or technologies; and, regardless of future technical developments, it will persist as long as substantial nuclear weapon stockpiles remain.

Despite its possible contribution to the deterrence of nuclear war, the NUTS approach to military doctrine and planning can very easily become a serious danger in itself. The availability of increasing numbers of nuclear weapons in a variety of designs and delivery packages at all levels of the military establishment inevitably encourages the illusion that somehow nuclear weapons can be applied in selected circumstances without unleashing a catastrophic series of consequences. As we shall see in more detail below, the recent uninformed debate on the virtue of the so-called neutron bomb as a selective device to deal with tank attacks is a depressing case in point. NUTS creates its own endless pressure for expanded nuclear stockpiles with increasing danger of accidents, accidental use, diversions to terrorists, etc. But more fundamentally, it tends to obscure the fact that the nuclear world is in fact MAD.

The NUTS approach to nuclear war-fighting will not eliminate the essential MAD character of nuclear war for two basic reasons, which are rooted in the nature of nuclear weapons and the practical limits of technology. First, the destructive power of nuclear weapons, individually and most certainly in the large numbers discussed for even specialized application, is so great that the collateral effects on persons and property would be enormous and, in scenarios which are seriously discussed, would be hard to distinguish from the onset of general nuclear war. But more fundamentally, it does not seem possible, even in the most specialized utilization of nuclear weapons, to envisage any situation where escalation to general nuclear war would probably not occur given the dynamics of the situation and the limits of the control mechanisms that could be made available to manage a limited nuclear war. In the case of a protracted general nuclear war, the control problem becomes completely unmanageable. Finally, there does not appear to be any prospect for the foreseeable future that technology will provide a secure shield behind which the citizens of the two superpowers can safely observe the course of a limited nuclear war on other people's territory.
So much has been said and written about the terrible consequences of nuclear war that any brief characterization of the problem seems strangely banal. Yet it is not clear how deeply the horror of such an event has penetrated the public consciousness or even the thinking of knowledgeable policymakers who in theory have access to the relevant information. The lack of public response to authoritative estimates that general nuclear war could result in 100 million fatalities in the United States suggests a general denial psychosis when the public is confronted with the prospect of such an unimaginable catastrophe. It is interesting, however, that there has been a considerable reaction to the campaign by medical doctors in several countries (including the United States and the Soviet Union), which calls attention to the hopeless plight of the tens of millions of casualties who would die over an extended period due to the total inability of surviving medical personnel and facilities to cope with the situation. One can stoically ignore the inevitability of death, but the haunting image of being among the injured survivors who would eventually die unattended is a prospect that few can easily accept fatalistically.

It is worth repeating the oft stated, but little comprehended, fact that a single modern strategic nuclear weapon could have a million times the yield of the high explosive strategic bombs of World War II, or one hundred to a thousand times the yield of the atomic bombs that destroyed Hiroshima and Nagasaki, killing 250,000 people. The blast from a single one-megaton weapon detonated over the White House in Washington, D.C. would destroy multistory concrete buildings out to a distance of about three miles (ten pounds per square inch overpressure with winds of 300 miles per hour)-a circle of almost complete destruction reaching the National Cathedral to the northwest, the Kennedy Stadium to the east, and across the National Airport to the south. Most people in this area would be killed immediately. The thermal radiation from the same weapon would cause spontaneous ignition of clothing and household combustibles to a distance of about five miles (25 calories per centimeter squared)-a circle of raging fires reaching out to the District line. Out to a distance of almost nine miles there would be severe damage to ordinary frame buildings and second-degree burns to exposed individuals. Beyond these immediate effects the innumerable separate fires that had been ignited would either merge into an outward-moving conflagration or more likely create a giant fire storm of the type Hamburg and Tokyo experienced on a much smaller scale in World War II. While the inrushing winds would tend to limit the spread of the fire storm, the area within five to six miles of the
explosion would be totally burned out, killing most of the people who might have escaped initial injury in shelters.

The point has been forcefully made recently by members of the medical community that the vast numbers of injured who escape death at the margin of this holocaust could expect little medical help. But beyond this, if the fireball of the explosion touched ground, the resulting radioactive debris would produce fallout with lethal effects far beyond the site of the explosion. Assuming the prevailing westerly wind conditions, a typical fallout pattern would indicate that there would be levels of fallout greater than 1,000 rems (450 rems produce 50 percent fatalities) over an area of some 500 square miles, and more than 100 rems (the level above which there will be significant health effects) over some 4,000 square miles reaching all the way to the Atlantic Ocean. In the case of a single explosion the impact of the fallout would be secondary to the immediate weapons effects, but when there are many explosions the fallout becomes a major component of the threat, since the fallout effects from each weapon are additive and the overlapping fallout patterns would soon cover large portions of the country with lethal levels of radiation.

Such levels of human and physical destruction are difficult for anyone, layman or specialist, to comprehend even for a single city, but when extended to an attack on an entire country they become a dehumanized maze of statistics. Comparison with past natural disasters is of little value. Such events as dam breaks and earthquakes result in an island of destruction surrounded by sources of help and reconstruction. Nuclear war involving many weapons would deny the possibility of relief by others.

When General David Jones, Chairman of the Joint Chiefs of Staff, was asked at a hearing of the Senate Foreign Relations Committee on November 3, 1981 what would be the consequences in the northern hemisphere of an all-out nuclear exchange, he had the following stark response:

We have examined that over many, many years. There are many assumptions that you have as to where the weapons are targeted. Clearly, the casualties in the northern hemisphere could be, under the worst conditions, into the hundreds of millions of fatalities. It is not to the extent that there would be no life in the northern hemisphere, but if all weapons were targeted in such a way as to give maximum damage to urban and industrial areas, you are talking about the greatest catastrophe in history by many orders of magnitude.
A devastating attack on the urban societies of the United States and Soviet Union would in fact require only a very small fraction of the more than 50,000 nuclear weapons currently in the arsenals of the two superpowers. The United States is commonly credited with having some 30,000 nuclear warheads of which well over 10,000 are carried by strategic systems capable of hitting the Soviet Union. It is estimated that the Soviet Union will soon have some 10,000 warheads in its strategic forces capable of hitting the United States. An exchange of a few thousand of these weapons could kill most of the urban population and destroy most of the industry of both sides.

But such figures are in themselves misleading because they are already high on a curve of diminishing returns and much smaller attacks could have very severe consequences. A single Poseidon submarine captain could fire some 160 independently targetable nuclear warheads (each with a yield several times larger than those of the weapons that destroyed Hiroshima and Nagasaki) against as many Soviet cities. If optimally targeted against the Soviet population, this alone could inflict some 30 million fatalities. One clear fact of the present strategic relationship is that the urban societies of both the United States and the Soviet Union are completely vulnerable to even a small fraction of the other side's accumulated stockpile of nuclear weapons.

III

The theme that nuclear weapons can be successfully employed in war-fighting roles somehow shielded from the MAD world appears to be recurring with increasing frequency and seriousness. Support for Nuclear Utilization Target Selection-NUTS—comes from diverse sources: those who believe that nuclear weapons should be used selectively in anticipated hostilities; those who believe that such capabilities deter a wider range of aggressive Soviet acts; those who assert that we must duplicate an alleged Soviet interest in war-fighting; and those who are simply trying to carry out their military responsibilities in a more "rational" or cost-effective manner. The net effect of this increasing, publicized interest in NUTS is to obscure the almost inevitable link between any use of nuclear weapons and the grim "mutual hostage" realities of the MAD world. The two forces generating this link are the collateral damage associated with the use of nuclear weapons against selected targets and the pressures for escalation of the level of nuclear force once it is used in conflict. Collateral effects and pressures for escalation are themselves closely linked.

To appreciate the significance of the collateral effects of nuclear weapons and the
pressure for escalation, one must look at actual war-fighting scenarios that have been seriously proposed. The two scenarios that are most often considered are Soviet attempts to carry out a disarming, or partially disarming, attack against U.S. strategic forces in order to force the surrender of the United States without war, and the selective use of nuclear weapons by the United States in Western Europe to prevent the collapse of NATO forces in the face of an overwhelming Soviet conventional attack. One can expect to hear more about the selective use of nuclear weapons by the United States in the Middle East in the face of an overwhelming Soviet conventional attack on that area.

The much discussed "window of vulnerability" is based on the fear that the Soviets might launch a "surgical" attack against vulnerable Minuteman ICBM silos—the land-based component of the U.S. strategic triad—to partially disarm the U.S. retaliatory forces, confident that the United States would not retaliate. The scenario then calls for the United States to capitulate to Soviet-dictated peace terms.

Simple arithmetic based on intelligence assessments of the accuracy and yields of the warheads on Soviet missiles and the estimated hardness of Minuteman silos does indeed show that a Soviet attack leaving only a relatively small number of surviving Minuteman ICBMs is mathematically possible in the near future. There is much valid controversy about whether such an attack is in fact operationally feasible with the confidence that a rational decision-maker would require. But what is significant here is the question whether the vulnerability of Minuteman, real or perceptual, could in fact be exploited by the Soviets without risking general nuclear war. Would a U.S. President react any differently in response to an attack against the Minuteman force than to an attack of comparable weight against other targets?

Despite the relatively isolated location of the Minuteman ICBM fields, there would be tremendous collateral damage from such an attack, which under the mathematical scenario would involve at least 2,000 weapons with megaton yields. It has been estimated by the Congressional Office of Technology Assessment that such an attack would result in from two to 20 million American fatalities, primarily from fallout, since at least half the weapons would probably be ground burst to maximize the effect of the attack on the silos. The range of estimated fatalities reflects the inherent uncertainties in fallout calculations due to different assumptions on such factors as meteorological conditions, weapon yield and design, height of burst and amount of protection available and used. Estimates of fatalities below eight to ten million require
It seems incredible that any Soviet leader would count on any President suing for peace in circumstances where some ten million American citizens were doomed to a slow and cruel death but the United States still retained 75 percent of the strategic forces and its entire economic base. Instead, Soviet leadership would perceive a President, confronted with an incoming missile attack of at least 2,000 warheads and possibly many more to follow in minutes, and with the action options of retaliating on warning with his vulnerable land-based forces or riding out the attack and retaliating at a level and manner of his own choosing with substantial surviving air and sea-based strategic forces.

It is hard to imagine that this scenario would give the Soviets much confidence in their ability to control escalation of the conflict. If the Soviets did not choose to attack U.S. command, control, communications and intelligence (C3I) capabilities, the United States would clearly be in a position to retaliate massively or to launch a more selective initial response. If vulnerable control assets were concurrently attacked, selective responses might be jeopardized but the possibility of an automatic massive response would be increased since the nature of the attack would be unclear. But even if these control assets were initially untouched, the Soviets could not be so overly confident of their own control mechanisms or so overly impressed with those of the United States as to imagine that either system could long control such massive levels of violence, with increasing collateral damage, without the situation very rapidly degenerating into general nuclear war.

The question of nuclear war-fighting in Europe has a long and esoteric history. Tactical nuclear weapons have been considered an additional deterrent to a massive Soviet conventional attack by threatening escalation to general nuclear war involving strategic forces—the so-called coupling effect. At the same time, tactical nuclear forces have been looked on as a necessary counterbalance to Soviet conventional forces in a limited war-fighting situation. To this end, the United States is said to have some 6,000 to 7,000 tactical nuclear weapons in Europe. The existence of this stockpile has been public knowledge so long that it is largely taken for granted and the power of the weapons, which range in yield from around a kiloton to around a megaton, is not appreciated. It is interesting to note that we have in Europe one nuclear weapon (with an average yield probably comparable to the weapon that destroyed Hiroshima) for every 50 American soldiers stationed there including support troops. Tactical nuclear weapons
are, of course, no longer a U.S. monopoly. The Soviets are building up comparable forces and have had for some time long-range theater nuclear missiles, earlier the SS-4 and SS-5, and now the SS-20, for which the United States does not have a strict counterpart. In this regard, it must be remembered that it is always feasible for the United States or the Soviet Union to employ some of their long-range strategic missiles against targets in Europe.

There is now a great debate, particularly in Europe, about the proposed deployment on European soil of U.S.-controlled long-range Pershing II and ground-based cruise missiles capable of reaching the territory of the Soviet Union, in response to the growing deployment of Soviet SS-20 mobile medium-range ballistic missiles. This discussion tends to consider the SS-20s and the proposed new forces as a separate issue from the short- and medium-range nuclear weapons already deployed in Europe. There is indeed a technical difference: the proposed Pershing II missile is of sufficient range to reach Soviet territory in only a few minutes, and the SS-20 is a much more accurate and flexible weapons system than earlier Soviet intermediate-range nuclear systems. Yet, the overriding issue which tends to be submerged in the current debate is the fact that any use of nuclear weapons in theater warfare in Europe would almost certainly lead to massive civilian casualties even in the unlikely event the conflict did not escalate to involve the homelands of the two superpowers.

Calculations of collateral casualties accompanying nuclear warfare in Europe tend to be simplistic in the extreme. First, the likely proximity of highly populated areas to the combat zone must be taken into account. One simply cannot assume that invading enemy columns will position themselves so that they offer the most favorable isolated target to nuclear attack. Populated areas could not remain isolated from the battle. Cities would have to be defended or they would become a safe stepping-stone for the enemy's advance. In either case, it is difficult to imagine cities and populated areas remaining sanctuaries in the midst of a tactical nuclear war raging around them. Then one must remember that during past wars in Europe as much as one-half of the population was on the road in the form of masses of refugees. Above all, in the confusion of battle, there is no control system that could assure that weapons would not inadvertently strike populated areas. Beyond immediate effects, nuclear fallout would not recognize restrictions based on population density.

The common feature of the above examples is that specialized use of nuclear weapons will as a practical matter be difficult to distinguish from unselective use in the chaos of
tactical warfare. A case in point is the much-publicized neutron bomb, which has been promoted as a specialized anti-tank weapon since neutrons can penetrate tank armor and kill the crew. It is frequently overlooked that the neutron bomb is in fact a nuclear weapon with significant yield. While it does emit some ten times as many neutrons as a comparable "ordinary" small nuclear weapon, it also kills by blast, heat, and prompt radiation. For instance, one of the proposed neutron warheads for the Lance missile has a one-kiloton yield, which would produce the same levels of blast damage experienced at Hiroshima at a little less than one-half the distance from the point of detonation.

An attack on tanks near a populated area or a targeting error in the heat of battle would clearly have a far-reaching effect on civilians and structures in the vicinity. Moreover, the lethal effects of the neutrons are not sharply defined. There would be attenuation by intervening structures or earth prominences, and there is a wide gap (from 500 to 10,000 rems) between a dose which would eventually be fatal and that which would immediately prevent a soldier from continuing combat. Under actual war conditions no local commander, much less a national decision-maker, could readily tell whether a neutron weapon or some other kind of nuclear weapon had been employed by the enemy. Thus, the threat of escalation from local to all-out conflict, the problems of collateral damage of nuclear weapons, and the disastrous consequences of errors in targeting, are not changed by the nature of the nuclear weapons.

In short, whatever the utility of the neutron bomb or any other "tactical" nuclear weapon in deterring Soviet conventional or nuclear attack, any actual use of such weapons is extremely unlikely to remain limited. We come back to the fundamental point that the only meaningful "firebreak" in modern warfare, be it strategic or tactical, is between nuclear and conventional weapons, not between self-proclaimed categories of nuclear weapons.

IV

The thesis that we live in an inherently MAD world rests ultimately on the technical conclusion that effective protection of the population against large-scale nuclear attack is not possible. This pessimistic technical assessment, which follows inexorably from the devastating power of nuclear weapons, is dramatically illustrated by the fundamental difference between air defense against conventional and nuclear attack. Against bombers carrying conventional bombs, an air defense system destroying only 10 percent of the incoming bombers per sortie would, as a practical matter, defeat
sustained air raids such as the ones during World War II. After ten attacks against such a defense, the bomber force would be reduced to less than one-third of its initial size, a very high price to pay given the limited damage from conventional weapons even when over 90 percent of the bombers penetrate. In contrast, against a bomber attack with nuclear bombs, an air defense capable of destroying even 90 percent of the incoming bombers on each sortie would be totally inadequate since the damage produced by the penetrating 10 percent of the bombers would be devastating against urban targets.

When one extends this air defense analogy to ballistic missile defenses intended to protect population and industry against large numbers of nuclear missiles, it becomes clear that such a defense would have to be almost leakproof since the penetration of even a single warhead would cause great destruction to a soft target. In fact, such a ballistic missile defense would have to be not only almost leakproof but also nationwide in coverage since the attacker could always choose the centers of population or industry he wished to target. The attacker has the further advantage that he can not only choose his targets but also decide what fraction of his total resources to expend against any particular target. Thus, an effective defense would have to be extremely heavy across the entire defended territory, not at just a few priority targets. The technical problem of providing an almost leakproof missile defense is further compounded by the many technical measures the attacking force can employ to interfere with the defense by blinding or confusing its radars or other sensors and overwhelming the system's traffic-handling capacity with decoys.

When these general arguments are reduced to specific analysis, the conclusion is inescapable that effective protection of the population or industry of either of the superpowers against missile attack by the other is unattainable with present ABM (anti-ballistic missile) defense technology, since even the most elaborate systems could be penetrated by the other side at far less cost. This conclusion is not altered by prospective improvements in the components of present systems or by the introduction of new concepts such as lasers or particle beams into system design.

These conclusions, which address the inability of ballistic missile defense to eliminate the MAD character of the strategic relationship, do not necessarily apply to defense of very hard point targets, such as missile silos or shelters for mobile missiles. The defense of these hardened military targets does offer a more attractive technical opportunity since only the immediate vicinity of the hardened site needs to be defended and the survival of only a fraction of the defended silos is necessary to serve
as a deterrent. Thus, the technical requirements for the system are much less stringent than for population or industrial defense and a much higher leakage rate can be tolerated. When these general remarks are translated into specific analysis which takes into account the many options available to the offense, hard site defense still does not look particularly attractive. Moreover, such a defense, even if partially successful, would not prevent the serious collateral fallout effects from the attack on the population discussed above. Nevertheless, the fact that these systems are technically feasible, and are advocated by some as effective, tends to confuse the public on the broader issue of the feasibility of urban defense against ballistic missiles.

The United States has a substantial research and development effort on ballistic missile defenses of land-based ICBMs as a possible approach to increase survivability of this leg of the strategic triad. The only program under serious consideration that could be deployed in this decade is the so-called LOAD (Low Altitude Defense) system. This system, which would utilize very small hardened radars and small missiles with small nuclear warheads, is designed to intercept at very close range those attacking missiles that might detonate close enough to the defended ICBM to destroy it. This last ditch defense is possible with nuclear weapons since the defended target is extremely hard and can tolerate nuclear detonations if they are not too close. While such a system for the defense of hard sites is technically feasible, there has been serious question as to whether it would be cost-effective in defending the MX in fixed Titan or Minuteman silos since the system could be overwhelmed relatively easily. In the case of the defense of a mobile MX in a multiple shelter system, the economics of the exchange ratios are substantially improved if the location of the mobile MX and mobile defense system are in fact unknown to the attacker; however, there are serious questions whether the presence of radiating radar systems might not actually compromise the location of the MX during an attack.

Looking further into the future, the U.S. research program is considering a much more sophisticated "layered" system for hard site defense. The outer layer would involve an extremely complex system using infrared sensors that would be launched on warning of a Soviet attack to identify and track incoming warheads. Based on this information, many interceptors, each carrying multiple, infrared-homing rockets with non-nuclear warheads, would be launched against the cloud of incoming warheads and attack them well outside the atmosphere. The warheads that leaked through this outer exoatmospheric layer would then be engaged by a close-in layer along the lines of the LOAD last ditch system described above.
It has been suggested that the outer layer exoatmospheric system might evolve into an effective area defense for population and industry. Actually, there are many rather fundamental technical questions that will take some time to answer about the ability of such a system to work at all against a determined adversary in the time frame needed to deploy it. For example, such a system would probably be defeated by properly designed decoys or blinded by nuclear explosions and, above all, may well be far too complex for even prospective control capabilities to operate. Whatever the value of these types of systems for hard site defense to support the MAD role of the deterrent, it is clear that the system holds no promise for population or industry defense and simply illustrates the technical difficulty of dealing with that problem.

While the government struggles with the much less demanding problem whether it is possible to design a plausible, cost-effective defense of hardened ICBM silos, the public is bombarded with recurring reports that some new technological "breakthrough" will suddenly generate an "impenetrable umbrella" which would obviate the MAD strategic relationship. Such irresponsible reports usually rehash claims for "directed energy" weapons which are based on the propagation of extremely energetic beams of either light (lasers) or atomic particles propagated at the speed of light to the target. Some of the proposals are technically infeasible, but in all cases one must remember that for urban defense only a system with country-wide coverage and extraordinarily effective performance would have an impact on the MAD condition. To constitute a ballistic missile defense system, directed energy devices would have to be integrated with detection and tracking devices for the incoming warheads, an extremely effective and fast data-handling system, the necessary power supplies for the extraordinarily high demand of energy to feed the directed energy weapons, and would have to be very precisely oriented to score a direct hit to destroy the target—as opposed to nuclear warheads that would only have to get in the general vicinity to destroy the target.

There are fundamental considerations that severely limit the application of directed energy weapons to ballistic missile defense. Particle beams do not penetrate the atmosphere. Thus, if such a system were ground-based, it would have to bore a hole through the atmosphere and then the beam would have to be focused through that hole in a subsequent pulse. All analyses have indicated that it is physically impossible to accomplish this feat stably. Among other things, laser systems suffer from the fact that they can only operate in good weather since clouds interfere with the beam.
These problems involving the atmosphere could be avoided by basing the system in space. Moreover, a space-based system has the desirable feature of potentially being able to attack missiles during the vulnerable launch phase before the reentry vehicles are dispersed. However, space-based systems involve putting a very complex system with a large power requirement into orbit. Analysis indicates that a comprehensive defensive system of this type would require over a hundred satellites, which in turn would need literally thousands of space shuttle sorties to assemble. It has been estimated that such a system would cost several hundred billion dollars. Even if the control mechanisms were available to operate such a system, there are serious questions as to the vulnerability of the satellites to physical attack and to various measures that would interfere with the system’s operation. In short, no responsible analysis has indicated that for at least the next two decades such "death ray weapons" have any bearing on the ABM problem or that there is any prospect that they would subsequently change the MAD character of our world.

Defense against aircraft further illustrates the inherently MAD nature of today’s world. Although the Soviets have made enormous investments in air defense, the airborne component of the U.S. strategic triad has not had its damage potential substantially reduced. Most analyses indicate that a large fraction of the "aging" B-52 fleet would penetrate present Soviet defenses, with the aid of electronic countermeasures and defense suppression by missiles. It is true that the ability of B-52s to penetrate will gradually be impaired as the Soviets deploy "look down" radar planes similar to the much publicized AWACS (Airborne Warning and Control System). However, these systems will not be effective against the air-launched cruise missiles whose deployment on B-52s will begin shortly; their ability to penetrate will not be endangered until a totally new generation of Soviet air defenses enters the picture. At that time, one can foresee major improvements in the ability of both bombers and cruise missiles to penetrate through a number of techniques, in particular the so-called "stealth" technology which will reduce by a large factor the visibility of both airplanes and cruise missiles to radar.

In short, there is little question that in the defense-offense race between air defenses and the airborne leg of the triad, the offense will retain its enormous damage potential. For its part, the United States does not now have a significant air defense, and the limited buildup proposed in President Reagan’s program would have little effect on the ability of the Soviets to deliver nuclear weapons by aircraft against this country. Consequently, the "mutual hostage" relationship between the two countries will
It is sometimes asserted that civil defense could provide an escape from the consequences of the MAD world and make even a general nuclear war between the superpowers winnable. This assertion is coupled with a continuing controversy as to the actual effectiveness of civil defense and the scope of the present Soviet civil defense program. Much of this debate reflects the complete failure of some civil defense advocates to comprehend the actual consequences of nuclear war. There is no question that civil defense could save lives and that the Soviet effort in this field is substantially greater than that of the United States. Yet all analyses have made it abundantly clear that to have a significant impact in a general nuclear war, civil defense would have to involve a much greater effort than now practiced on either side and that no amount of effort would protect a large portion of the population or the ability of either nation to continue as a functioning society.

There is evidence that the Soviets have carried out a shelter program which could provide fallout and some blast protection for about ten percent of the urban population. The only way even to attempt to protect the bulk of the population would be complete evacuation of the entire urban population to the countryside. Although to our knowledge there has never been an actual urban evacuation exercise in the Soviet Union, true believers in the effectiveness of Soviet civil defense point to the alleged existence of detailed evacuation plans for all Soviet cities. Yet, when examined in detail, there are major questions as to the practicality of such evacuation plans.

The U.S. Arms Control and Disarmament Agency has calculated, using a reasonable model and assuming normal targeting practices, that even with the general evacuation of all citizens and full use of shelters, in a general war there would still be at least 25 million Soviet fatalities. Such estimates obviously depend on the model chosen: some have been lower but others by the Defense Department have been considerably higher. The time for such an all-out evacuation would be at least a week. This action would guarantee unambiguous strategic warning and provide ample time for the other side to generate its strategic forces to full alert, which would result in a substantially greater retaliatory strike than would be expected from normal day-to-day alert. If the retaliatory strike were ground burst to maximize fallout, fatalities could rise to 40 to 50 million; and if part of the reserve of nuclear weapons were targeted against the evacuated population, some 70 to 85 million could be killed. Until recently little has been said about the hopeless fate of the vast number of fallout casualties in the absence
of organized medical care or what would become of the survivors with the almost complete destruction of the economic base and urban housing.

Finally, there is no evidence that the Soviets are carrying out industrial hardening or are decentralizing their industry, which remains more centralized than U.S. industry. This is not surprising since there is nothing they can do that would materially change the inherent vulnerability of urban society in a MAD world.

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In sum, we are fated to live in a MAD world. This is inherent in the tremendous power of nuclear weapons, the size of nuclear stockpiles, the collateral damage associated with the use of nuclear weapons against military targets, the technical limitations on strategic area defense, and the uncertainties involved in efforts to control the escalation of nuclear war. There is no reason to believe that this situation will change for the foreseeable future since the problem is far too profound and the pace of technical military development far too slow to overcome the fundamental technical considerations that underlie the mutual hostage relationship of the superpowers.

What is clear above all is that the profusion of proposed NUTS approaches has not offered an escape from the MAD world, but rather constitutes a major danger in encouraging the illusion that limited or controlled nuclear war can be waged free from the grim realities of a MAD world. The principal hope at this time will not be found in seeking NUTS doctrines that ignore the MAD realities but rather in recognizing the nuclear world for what it is and seeking to make it more stable and less dangerous.
3 See Harold Brown, Speech at the Naval War College, August 20, 1980, the most authoritative public statement on the significance of Presidential Directive 59, which had been approved by President Carter shortly before.
The Pontiff and the Pariah
What Putin and Pope Francis Discussed in the Vatican

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