

# **Evacuations Instead of Nuclear War**

Carl Lundgren  
Jonah Speaks Organization  
2121 Columbia Pike, Apt. 301  
Arlington, VA 22204-4423  
(703) 521-1037  
Lundgren@valmarpro.com

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## ABSTRACT

This paper explains how to reduce significantly the potential damage from nuclear war. Nuclear weapons are best used coercively, to evacuate cities, rather than actually, to bomb cities or other targets. The procedure is to give “fair warning” before bombing, allow a city time to evacuate, and then not bomb the evacuated city. This allows nuclear nations to conduct a nonviolent nuclear war that neither kills people nor destroys property. After a diplomatic solution is reached that resolves the war, people may return to the evacuated cities. The paper also discusses international institutions and treaties that are highly desirable, and perhaps crucial, to ensure that the evacuation procedure works properly and effectively.

## PAPER

The problem of how to prevent war, or to reduce the violence and damage which results from war, has vexed humanity for centuries. This problem has been made more urgent because of the invention of nuclear weapons and other weapons of mass destruction. This paper explains and advocates a new procedure of war by which nuclear bombings can be replaced by evacuations. The paper also discusses how this method can be implemented at a practical level, so as to avoid the potential damage from nuclear weapons.

### I. Evacuations versus Bombings

**Conditional Use of Nuclear Weapons.** Outside of war, the power of the gun is most frequently used to coerce humans, not to kill humans. The robber uses a gun to coerce humans to give up their money. The police officer uses a gun to coerce the robber to give up his liberty. Whether used for good or ill, when the gun is used against people, it is most often used in a conditional manner: “If you do as I say, I will not shoot you. If you do not do as I say, I will shoot you.”

Similarly, a nuclear weapon can be used in a conditional manner to coerce a city: “If you do as we say, we will not bomb your city. If you do not do as we say, we will bomb your city.”<sup>1</sup> What conditions may we properly impose as part of a threat to use nuclear weapons? The answer includes both moral and practical components.

From a practical perspective, the condition to be imposed must be less costly to the enemy than the prospect of bombing his city. Otherwise, the enemy will not accept the condition. Proposing a condition that is too burdensome will fail to spare either life or property.

The condition, “Evacuate this city or we will bomb it,” fits this requirement. The requirement is not so costly that people would rather die than comply. Moreover, evacuation is a logical condition to combine with the threat to bomb a city. Evacuation is

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<sup>1</sup> An example of implied conditionality applied to a whole city can be found in the Bible Book of Jonah. In the story of Jonah, God threatens to destroy Nineveh. After Nineveh repents, God refuses to destroy Nineveh. See “Jonah Speaks to Nuclear War,” Lundgren (2007) for further details of this analogy between evacuations and repentance.

what most people in the city would want to do, if they received adequate warning and truly believed the threat.

If complied with, the condition to evacuate saves lives, so it has moral value. If the evacuation leads to the city not being bombed, then the condition also saves property. The condition, “evacuate the city,” is verifiable. It is possible to observe whether the city has been evacuated, partially evacuated, or not evacuated.

**Cold War Deterrence Doctrine.** During the Cold War, strategizing the possible conditional uses of nuclear weapons was little considered. Instead, the main strategizing focused on the unconditional and destructive use of nuclear weapons.

The only conditionality to emerge from Cold War strategizing is the concept of deterrence. Deterrence requires having the ability to retaliate sufficiently against an enemy who might attack. The conditionality is of the form, “If you don’t attack us, we won’t attack you. If you do attack us, we will retaliate against you so much that you will wish you had never attacked us.” In its most extreme form, the doctrine of deterrence requires mutual assured destruction (MAD).<sup>2</sup> Because we do not know for sure how much retaliation will deter the enemy, only by heaping upon the enemy the maximum possible retaliation can we be assured that the enemy is deterred.

For a number of reasons, this doctrine of nuclear deterrence is deficient. The most extreme form of deterrence, MAD, is completely lacking in proportionality. If the enemy bombs only one of our cities, is it rational or moral to bomb his whole country in return? Such a threat can deter an enemy, but only if it has “credibility” – meaning, the enemy must believe that this threat of massive retaliation will actually be carried out. However, such massive retaliation in response to the bombing of only one city would not be a rational threat to carry out, and the enemy would know this. In such a circumstance, the disproportionate threat is not highly credible, because bombing a whole country invites the enemy to bomb your whole country. Only a more proportionate threat is likely to have credibility.

Defining the right proportion for a proportionate threat is also problematic. If the enemy only bombs one city, how many cities should we bomb in return? How big should the cities be? Will the enemy cease the bombing, or will the enemy decide to bomb more of our cities? Multiple and repeated exchanges of nuclear weapons, even if each exchange is limited in scope, could easily lead to the same consequence of mutual assured destruction. The total effect of such repeated exchanges could be MAD, even if that is not the original intent of either nation.

The threat of MAD may deter the initial use of nuclear weapons, but not necessarily. The original intent may be only a limited use, even if the likelihood is that limited use may spiral into an unlimited exchange. A human leader may mistakenly believe that initiating a nuclear war is rational, even if it is not. Not all leaders are cautious; some leaders are risk takers, not risk avoiders. Not all human leaders have their country’s best interests at heart. Not all human leaders wish to avoid war. Not all human leaders are rational at all times. Irrational behavior may set off a nuclear exchange. Finally, there is the possibility that nuclear war may arise by accident, perhaps because of

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<sup>2</sup> A typical definition of MAD is “Severe, unavoidable reciprocal damage that superpowers are likely to inflict on each other or their allies in a nuclear war, conceived as the heart of a doctrine of nuclear deterrence.” *American Heritage*® (2000).

an accidental missile launch or perhaps because one nation mistakenly believes that the other nation has launched an attack.

An alternative approach to nuclear weapons is clearly needed.

**Two Nuclear Powers at War.** Suppose, just suppose, it would be possible for two nuclear powers to conduct a war by ordering evacuations rather than by exploding bombs. Each nation knows that the other nation could explode bombs, so each nation is prepared to allow the other nation to order evacuations.

Having the ability to order an evacuation does not mean that either nation would be eager to order evacuations. Evacuations are highly inconvenient. Moreover, if one nation orders evacuations, the other nation is likely to order retaliatory evacuations. Hence, even if two nations are at war, each nation must carefully consider, should it order any evacuations at all? If an evacuation is ordered, how many of the enemy's cities should be evacuated? How many evacuations is the enemy likely to order in response?

Normally, we would expect either that neither nation orders evacuations, or that both nations order evacuations. If both nations order evacuations, they could do so at a low level (only a few cities), a modest level (multiple cities), or a high level (maximum number of cities). Unlike nuclear explosions, evacuations are reversible. The nations can easily switch from a high level of evacuations to a modest level to a low level to no evacuations at all. Because evacuations take time, unlike in a real nuclear war, there is still time for diplomacy.

What is the maximum number of cities that might be evacuated? In theory, one might force the evacuation of a whole country. However, where would one put all the people? Should all the Americans be moved to Mexico? Should all the Chinese be moved to Siberia? Should all the Russians be moved to Ukraine? It makes more sense to evacuate people to other places within the same nation. Hence, a possible rule might be that no more than 50% of the people in a country can be ordered evacuated. The evacuated people would then be forced to move to places in the same country where the other 50% live. Of course, the rule could just as easily be 40% or 60%, so long as the warring nations agree to it.

**Economic Analysis of Maximum Evacuations.** If the maximum level of evacuations were performed, we would expect the measured gross domestic production (GDP) of a nation to decline by a significant fraction of its pre-war level. In addition, there would be the inconvenience to the evacuees who would be forced to move, and inconvenience to the non-evacuees who would be forced to live under more crowded conditions. This inconvenience has a utility cost that can be converted to monetary values and added to the directly measured loss in GDP. If we assume the maximum level of evacuations, the total cost of evacuations could rival the level of pre-war GDP.

For specificity of analysis, suppose each year of maximum evacuation has a cost to its citizens equal to one year of pre-war GDP. Then one year of maximum evacuations costs one year of GDP, ten years of maximum evacuations costs ten years of GDP, and so forth.

How does this compare with the possibility of maximum destruction from a full-scale nuclear war?<sup>3</sup> The economic value of a human life (to the person whose life it is)

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<sup>3</sup> The term "maximum destruction" is used here a bit loosely. Taken literally, and without further qualification, it would mean 100% destruction of a nation's people and property. This much damage

has generally been estimated to be more than 20 years of income, but less than 1,000 years of income.<sup>4</sup> For specificity, suppose this value is 250 years of income. In that case, the cost of maximum destruction would be 250 years worth of GDP to each country involved in the MAD war.<sup>5</sup> This does not count the costs to future generations or the external costs to other countries not directly involved in the war.

**Money Substitutes for Evacuation.** If the value of the war aim is rather low (not more than one or two years of GDP), it should be possible to substitute money for evacuations. That is, the warring nations could order each other to pay money rather than order evacuations. It is difficult to see how the warring nations could pay each other and still bear costs from a war. Nevertheless, it should be possible to pay uninvolved third nations the monetary value of evacuations that would otherwise be ordered. If money can be substituted for evacuations, this would reduce the cost of a war to the world as a whole.

In economic terms, evacuations impose what economists call a “deadweight loss” on the economy. This deadweight loss does not refer to the weight of dead bodies. Rather, it refers to losses in economic value for some people that are not compensated by gains in economic value for other people. When people are evacuated, the buildings in the city lose their economic value for the time period during which people cannot use them. In addition, people lose productive opportunities for generating goods and services and for earning income. Consequently, the total value of a nation’s capital and labor are reduced. The rest of the world does not gain from this economic loss.

If the warring nations order each other to pay money to uninvolved third nations, rather than conduct evacuations, this deadweight loss can be reduced significantly. The warring nations would still pay costs and suffer economic losses, but other nations would gain. The productive capacities of the two warring nations would remain intact. The economic gains to other countries would offset the economic losses to the warring nations, so that the deadweight loss to the world as a whole is reduced or eliminated.

There are undoubtedly limits to how much money can be effectively transferred across international borders. If too much money is transferred, the value of the goods and services (exported by the warring nations to the non-warring nations) may decline significantly. The monetary transfer might then provide significantly less benefit to the recipient nations than it costs the warring nations. For example, it may be impractical to transfer more than 5% (or 10% or 20%) of GDP to third nations. In that case, even a ten-year war would impose a cost of no more than one-half year (or one year or two years) of GDP. If the war aim is more important than this, then money transfers cannot support it; it will be necessary to conduct evacuations.

**Conditions Worse Than Evacuation.** If the value of the war aim is rather high (e.g., more than ten years of GDP), then evacuations alone may not cause the enemy to surrender within any reasonable period of time. It should be noted that evacuations are ineffective only if both nations value the war aim as very high. If one nation values its

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cannot be accomplished by nuclear weapons alone. Most likely, “maximum destruction from a full-scale nuclear war” exceeds 50% fatalities for each warring nation with the remainder living in poverty.

<sup>4</sup> A survey by Viscusi (1993, pp. 1926-27) of different value-of-life studies indicates that the median estimate of the ratio of the value of human life to the average income is 251.1 years. The full range of this ratio is 22.9 to 844 years, and the interquartile range is 126.4 to 361 years.

<sup>5</sup> 250 years GDP is an upper-bound estimate of the cost, assuming 100% fatalities, which is unlikely in an actual nuclear war. The numbers here are illustrative.

war aim at 25 years of GDP, while the second nation values its war aim at only 2 years of GDP, then evacuations are still effective. The second nation can be caused to surrender its war aim if the first nation orders up more than 2 years of maximum evacuation.

The circumstance where the war aim of both nations has such very high value (in excess of ten years of GDP) is likely to be rare or nonexistent. Nevertheless, it is logically possible that a future nation at war may wish to impose conditions worse than evacuation. By imposing conditions worse than evacuation, a nation may hope to bring about a more rapid closing of the war.

What conditions might be worse than evacuation, but not as bad as a bombed city? We can think of several non-lethal possibilities: Imprisonment, torture, slavery, sterilization. Torture and slavery do not appear to be good candidates, because we do not wish to reinstitute torture or slavery, even temporarily. Imprisonment of large numbers of people would require rapidly building large numbers of prisons for mere temporary use. Sterilization of large numbers to prevent child-bearing may not be effective if the sterilization is reversible.

Then there is the lethal possibility: Random execution of members of the population. If the number to be executed is less than the number who could die from being bombed, then ordering executions is a logical alternative to ordering evacuations. If 1% of a nation's population would be randomly executed, this would be equivalent to about 2.5 years of GDP. If 20% were executed, this would be worth about 50 years of GDP. These conditions worse than evacuation are simply logical possibilities, not necessarily moral or practical possibilities.

**Rationality of Small Probability.** There is no rational reason to threaten a nuclear war that might result in MAD, unless the intent is either to deter or to gain a concession from an enemy. It may first be noted that no deterrence or concession is worth obtaining MAD with certainty. Hence, the threat of MAD, if it is to be rational, must be a threat of MAD with some probability less than 100%. For most plausible war aims, this probability needs to be substantially less than 100%.

For example, if the war aim has a value equal to one year of GDP, then the probability of MAD must be less than 0.4% (one chance in 250). If the probability of MAD exceeds 0.4%, then the threat is not rational, because the expected cost of the threat exceeds the value of the concession or deterrent being sought. In addition, the probability of MAD must be more than the enemy can bear. If the enemy is only willing to bear a 0.2% probability of MAD, then a threat of MAD with 0.3% probability should be enough to gain the enemy's acquiescence. For the threat of nuclear war to be rational, the probability of nuclear war must always be greater than zero, but always less than some small percentage.

In other words, a rational nuclear threat must threaten an extremely disastrous outcome with a rather small probability of occurrence. There is a strong discontinuity between the small probability of complete disaster, and the much larger probability of no nuclear disaster. Threatening a small probability of nuclear disaster can be rational only if the objective probability of nuclear war can be carefully calibrated. Even in this rational, well-calibrated probabilistic scenario, the potential for error would seem to be rather high.

In reality, the probability of nuclear war is not carefully calibrated. The probability is not calibrated at all, except in gross terms. For example, a country may

choose whether, how many, and what type of nuclear weapons to possess, a country may utter words of threat or not, or a country may choose whether to hand over control of its nuclear weapons to commanders in the field. The true probability of a disastrous nuclear war is unknown and perhaps unknowable.

**Irrationality Creates Credibility.** In addition to being rational, a nuclear threat must also be credible. The credibility of MAD requires that there must be at least some small chance that a human leader will be sufficiently stupid or irrational as to start a nuclear war. There are plenty of examples of stupid and irrational humans. The methods currently used for selecting human leaders do not prevent the selection of human leaders who are stupid or irrational. Since the leaders of powerful countries can be stupid or irrational, the threat of nuclear war continues to have credibility.

Unfortunately, the probability that human leaders will be sufficiently stupid or irrational to start a nuclear war cannot be well calibrated. The true probability is likely to be either too large or too small. Hence, the credible threat of nuclear war cannot be made completely rational. Even if the rational probability might be around 0.3% the actual probability might be too low to be credible (say, 0.03% or 0.003%). Alternatively, the actual probability may be high enough to be credible, but too high to be rational (say, 3% or 30%). Given the nature of human irrationality (negative emotions including vengefulness and malevolence) and human stupidity (frequent inability to foresee even seemingly obvious consequences), the true probability of nuclear war is almost certainly too high.

The true probability is difficult to assess and any assessment is difficult to communicate. Human leaders often have incentive to prevaricate, either to exaggerate the probability so as to sound tough or to scare an opponent, or to minimize the probability so as to smooth tensions or hide intentions. This makes it difficult to judge true probabilities. One human leader may think the probability is quite small, while another human leader may think the probability is quite large. The result could be a disastrous outcome that neither leader actually sought.<sup>6</sup>

By contrast, mutually assured evacuations (MAE) do not lead to MAD. MAE provides a certainty equivalent for a small probability of MAD. It is a certainty equivalent that substitutes a known harm (evacuation) for an unknown probability of complete destruction. It is a certainty equivalent that can be both rational and credible. It is a certainty equivalent that does not risk disaster. Even if human leaders mishandle the number and type of evacuations compared to an optimal wartime strategy, the result can never be destruction on the scale of MAD.

**Individual Incentives to Evacuate.** Suppose most people leave a city, but some stay behind. Has the city been evacuated? Whether the city should be considered “evacuated” or not depends on how stringently the nuclear powers wish to define evacuation. For example, if these warring nations define 80% evacuated as an evacuation, then evacuation occurs even if 20% of the people remain in the city. If

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<sup>6</sup> This difficulty of communication can cause both conventional and nuclear wars. For example, one leader may threaten war, but intends it only as a bluff. The second leader takes the threat very seriously and attempts to pre-empt it, thereby causing a war that neither side actually wanted. As a second example, one leader seriously threatens war, but the other leader views it as only a bluff. If the second leader had known the threat was serious, the second leader would have offered a concession that could have avoided war.

evacuation is defined more stringently as 95% evacuation, then no more than 5% of the people may remain in the city.

From an individual perspective, an individual might ask, "If the city will not be bombed, why should I evacuate?" Of course, if no one evacuates, the city might be bombed. As is often the case, there is a contradiction between what is rational for the individual and what is rational for the common good of the community. That is why taxes are made mandatory, not voluntary. That is why crimes are punished, not merely scolded. Each country must define the incentives and sanctions that will make it rational for most citizens to evacuate a city when ordered.

Even without substantial sanctions, it is possible to motivate most individuals to evacuate a city. The nation that has jurisdiction over the city should take the lead in ensuring its evacuation. The government of such nation can provide transport to ensure that residents can easily leave. The government should provide guidance on where the evacuees should go, and provide material assistance so that evacuees have assurance of survival after they evacuate. These are the positive incentives to evacuate.

Negative incentives would include a significant reduction in living standards for those who choose to stay, despite an order to evacuate. Water, electricity, garbage disposal, and other services can be cut off. Businesses can be shut down, so that people find it difficult to buy food or other supplies, and have no jobs so they have no money to motivate smugglers to provide supplies. Guards can be posted around the city to make entry or re-entry difficult. Police or troops can patrol the city to prevent looting and to evict unauthorized persons. The practical need for such patrols means that a city cannot be 100% evacuated.

**National Incentives to Evacuate.** The agreement on how quickly a city must be evacuated should be reasonable in its terms. Forty days may be reasonable to evacuate a large city. Perhaps seven days is reasonable to evacuate a small city. Perhaps several months is needed to evacuate several cities simultaneously. These time limits must be negotiated between the nuclear powers based on what is reasonable, practical, and doable. If the agreement is negotiated prior to any war, this assures that the countries have carefully thought these issues through. If the agreement can be revised during the course of a war, this allows new information about what is practical to be taken into account.

An agreement must specify what penalties or compensation is due if one or both countries fail to evacuate fully to agreed-upon limits. If the agreement requires 90% evacuation, but a city is only 87% evacuated, it seems foolish to say that the city ought to be bombed. One possibility is to require monetary compensation to the other country for the 3% lapse in evacuation. Another possibility is to require an increase in the evacuations that the country must perform. For example, if the 3% lapse occurs in a city of 1,000,000 people, this is a lapse of 30,000 people. The lapsing country might be required to evacuate double or triple that number from some additional place. Alternatively, the non-lapsing country might be offered a reduction in its required evacuations.

Finally, if one or the other country cannot even come close to meeting its obligations to evacuate, that country ought to give up its war aims. It is illogical for a country to assert that it is willing to make the ultimate sacrifice, but is unwilling to accept a lesser sacrifice. It is absurd for a country to assert that it is willing to bomb and be

bombed, yet is unwilling to see to it that cities be evacuated. Such a country has shown that its war aims are not sufficiently important to warrant the risk of a nuclear war. That country has lost the war. The other country is entitled to view its nuclear threats, if it makes threats, as unworthy of serious consideration.

## **II. International Institutions for Implementation**

**Treaties among Nations.** Some of the above principles and suggestion can be implemented on an *ad hoc* basis, without any treaty or institutional mechanism for enforcement. For example, Country A could threaten to bomb a named city in Country B and order its evacuation. Country B might recognize its self interest and grudgingly organize an evacuation of the named city. Country B, in turn, might decide to order additional evacuations in Country A. While a reliance on last-minute decision making and recognition of mutual self-interest in a crisis may be possible, it would also be risky. It is easy to foresee that the two countries, already at war, might also dispute whether the evacuations had been fully performed in good faith.

It is better to conduct negotiations in advance among the main nuclear powers, among the minor nuclear powers, and with non-nuclear nations. Fortunately, the old Cold War is over and a new Cold War has not yet begun. All the major players are talking with each other. How best to handle nuclear weapons is simply another item to put on the diplomatic agenda. There are many different methods or forums for diplomatic negotiations, including negotiations between two or only a few nations to multi-national forums that may include several, most, or all nations. All reasonable forums for negotiation should be pursued.

There are a number of principles and details that any resulting treaties should encompass. First, the details of the procedures for ordering and implementing evacuations must be worked out and agreed upon. There must be international troops and monitors to ensure enforcement of the agreement, and there must be a method for funding the costs of the agreement. In short, there must be international institutions and procedures for implementing, monitoring, and enforcing the agreement.

Second, launch-on-warning policies and possible first-use policies must be abandoned. Those nuclear weapons that remain must be placed under international control, to prevent any possibility of a first strike. This likewise requires international institutions, troops, and monitors.

Third, the total destructive capacity of remaining nuclear weapons must be significantly reduced, so that the world does not remain at risk of being substantially destroyed. This includes limiting the number of nations possessing nuclear weapons, as well as the number and type of weapons that may be possessed. Methods for persuading or coercing recalcitrant nations must also be developed and utilized.

**International Troops and Fees.** While it would be the responsibility of each nation to evacuate its own cities if ordered, there would be a need for international troops or police to monitor whether and to what extent a city had been evacuated. If there is no independent monitor, then nations would be mostly on the honor system. Since there is too much mistrust between nations, particularly in wartime, disagreements are likely to occur as to how much evacuation actually occurred. Such disagreements could lead to a breakdown in the mutually desired coordination of behavior to replace bombs with evacuations. Hence, an independent monitor is highly desirable, and probably crucial, to

implementing this proposal. Only an international monitor can credibly say that it is independent of both warring nations.

Accordingly, there must be international troops that can be called upon at a moment's notice to monitor any evacuations that may be ordered. Since we presume that a war of evacuations will not occur very often, these are troops that must be trained and equipped and kept in reserve. There will be a significant cost to training and equipping these reservists.

Hence, any nation that wants the power of a nuclear weapon to order the evacuation of cities in other nations must bear this cost on a continuing basis. The agreement must firmly link this power to order evacuations with the payments needed to support the troops needed for such evacuations. The more "evacuation bombs" desired by a country, the more the country must pay to support the troops needed to monitor or enforce the evacuations. By negotiating the treaty in this manner, one can obtain a self-financing treaty. If a nation pays too little, or does not pay at all, it receives little or no right to evacuate cities in other nations. Only nations that pay up get the power to evacuate that they desire.

If the time comes when a nation goes to war and wants to order evacuations, there would be extra charges for activating troops and sending them to foreign nations. This is because the cost of an active-duty soldier or police officer is vastly greater than one who is simply being held in reserve. Naturally, we would expect the nations which order evacuations to pay up front for this privilege. The fee system for reservists and active-duty troops can be set so that something extra is collected for overhead. The overhead charges can then be used to pay all other expenses that would be required for this proposal.

**Virtual Nuclear Weapons.** If two or more nations agree to use evacuations, rather than detonations, as their agreed-upon method of nuclear warfare, then the nuclear weapons themselves become largely irrelevant. The nuclear weapons are relevant only as a possible method of enforcing the agreement or with respect to nations that have not joined the agreement. If we assume, ultimately, that all relevant nations join the agreement and adhere to the agreement, then the explosion of nuclear weapons need never be directly threatened.

The agreement specifies "evacuation rights", the method of acquiring evacuation rights, and the method for exercising evacuation rights. These evacuation rights can be referred to as "virtual nuclear weapons." The number of virtual nuclear weapons that nations recognize need not be the same as the number of actual nuclear weapons. The number of virtual nuclear weapons could be either higher or lower than the number of actual nuclear weapons. Moreover, the characteristics of virtual nuclear weapons need not be the same as the characteristics of actual nuclear weapons.

The main characteristic of a nuclear weapon is that it kills or injures almost everyone within a certain distance of its detonation. This suggests a somewhat circular area that a virtual nuclear weapon should mimic.<sup>7</sup> However, it is not essential that evacuation orders must prescribe circular areas. The areas of evacuation could just as easily be ellipses, rectangles, trapezoids, triangles, hexagons, or any other shape that the

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<sup>7</sup> Wind and weather patterns can spread radiation and other contaminants. These patterns are unlikely to be circular or fully predictable.

agreement permits. In principle, one could make the boundaries correspond to those of cities, states, provinces, streets, or rivers.

One possible agreement is that each virtual nuclear weapon corresponds to a rectangle with minimum height and minimum width, a total area measured in square kilometers, and boundaries corresponding to lines of longitude and latitude. The number of people who normally live within such rectangle determines the number of people who must be evacuated. The nation receiving the evacuation order might then determine an actual evacuation area, perhaps larger or smaller than the rectangle, not necessarily in the shape of a rectangle, fully contained within some specified vicinity of the rectangle, and containing the same number of people as the rectangle. The international umpire could permit such redrawing of boundaries, provided the total cost of monitoring and enforcing the evacuation area is not increased.

**Limits on Use of Virtual Nuclear Weapons.** There are various limits that could be placed on virtual nuclear weapons. These can be classified as limits on use and limits on possession.

One limit on use was previously mentioned: There should be a limit, presumably a percentage limit (say 50%), on the number of people within a nation who can be ordered evacuated. Such limit, if reached, corresponds to “maximum evacuation” under the international agreement. If we set the same percentage limit for each nation, this causes the cost of maximum evacuation of each nation to be proportional (as a small fraction) to the cost of destruction of each nation. The cost of maximum evacuation of a nation is a certainty equivalent for a small probability that the nation is destroyed.<sup>8</sup> This certainty equivalent does not risk any nation’s destruction.

Another limit on use is suggested by the logic of substituting inconvenient evacuations for mass death and destruction. When evacuations are ordered, the citizens of one warring nation should not be inserted into the evacuated cities of the other warring nation. In addition, the method of evacuations should not be used to cause death by other means. For example, if a nation were ordered to evacuate its food-producing agricultural areas, this might lead to starvation. As another example, if one ethnic group is evacuated into an area where another ethnic group plans to kill them, this could lead to genocide. Such misuses of the evacuation method can be banned by treaty and monitored by the international authority to prevent abuse.

**Limits on Possession of Virtual Nuclear Weapons.** Additional limits on evacuation rights are suggested by the nuclear Non-Proliferation Treaty (NPT). When the NPT was first opened for signature in 1968, there were only five nations that had developed nuclear weapons.<sup>9</sup> There was worry that if nothing was done, twenty or thirty nations could and would develop and possess nuclear weapons. The purpose of the treaty was to forestall this unwanted development. Only three nations refused to sign the treaty; these three nations currently have nuclear weapons.<sup>10</sup> One additional nation withdrew

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<sup>8</sup> A “certainty equivalent” is a value, cost, or utility that is obtained for sure and is equal to the expected value, cost, or utility of a gamble between two or more possible outcomes.

<sup>9</sup> These five nations were Britain, China, France, Soviet Union (now Russia), and the United States. These five are the only nations that may legally possess nuclear weapons under the NPT, subject to the provision of NPT Article VI that these five nations will mutually negotiate to reduce their nuclear armaments, perhaps ultimately to zero.

<sup>10</sup> The three non-signers are India, Israel, and Pakistan. India and Pakistan are declared nuclear powers. Israel is widely believed to be an undeclared nuclear power.

from the treaty so it, too, could develop nuclear weapons.<sup>11</sup> Hence, there are currently nine nations that have nuclear weapons. There is concern that as many as five additional nations may try to develop nuclear weapons.<sup>12</sup>

The desire to possess nuclear weapons is often described as defensive in nature. One reason to possess is the desire to deter other nations from using nuclear weapons. Another reason to possess is the desire to deter a conventional attack. Some nations may also desire nuclear weapons because of the “prestige” such weapons appear to offer. To be sure, there may be more offensive reasons for wanting nuclear weapons, but few nations will admit to such motives. Some nations feel these various motives more strongly than others.

Even though virtual nuclear weapons are much less dangerous than real nuclear weapons, it may still be desirable to limit the number of nations that possess the right to order evacuations in other nations. One way of limiting the number of such nations is to charge a fixed fee per year to any nation that chooses to pay for such evacuation rights. This fixed fee would be the same for all nations, and it would be in addition to the fees charged for the purchase of the evacuation rights themselves. The fixed fee can be adjusted up or down as needed, so that no more than ten to fifteen nations would possess such evacuation rights in any given year. The fixed fee allocates the right to evacuate to those nations, and only those nations, which desire it the most. In many cases, these will be nations that most fear attack from other nations.

The NPT links a nation’s willingness to refrain from developing nuclear weapons with foreign assistance to generate electricity using nuclear fuel. Nations that use nuclear fuel to generate electricity should, of course, be carefully monitored to ensure that the fuel is not being concentrated in a manner that could produce weapons. Unfortunately, a nation’s desire to possess nuclear weapons is not correlated with its desire for foreign assistance to generate electricity using nuclear fuel. Accordingly, this linkage does not provide a strong incentive for a nation to refrain from developing nuclear weapons.

Under an evacuations regime, a nation’s desire to possess evacuation rights is likely to be highly correlated with the desire to possess nuclear weapons. Accordingly, a nation’s possession of evacuation rights in an evacuations regime is a close substitute for actual possession of nuclear weapons. It is a substitute that the minor nations, some of whom desire nuclear weapons, should be obligated to accept.

**Limits on Possession of Actual Nuclear Weapons.** Just as with virtual nuclear weapons, there is a need for limits on actual nuclear weapons. Because of their greater destructive capacity, the limits on actual nuclear weapons must be more severe.

One way of limiting the number of nuclear nations is to charge a fixed fee per year to any nation that chooses to possess nuclear weapons. This fixed fee would be the same for all nations that choose to possess nuclear weapons, and it would be in addition to the fees charged for the purchase of evacuation rights.<sup>13</sup> The fixed fee can be adjusted

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<sup>11</sup> North Korea withdrew from the NPT in 2003 and subsequently exploded a nuclear device with mediocre success.

<sup>12</sup> If North Korea develops a significant nuclear threat, Japan and South Korea may follow. If Iran develops a nuclear threat, Egypt and Saudi Arabia may follow.

<sup>13</sup> A case can be made that the fixed fee should be made higher (even prohibitively high) for nations that are deemed to be unstable or untrustworthy, because their possession of nuclear weapons is too risky for other nations to allow.

up or down as needed, so that no more than four to six nations would possess actual nuclear weapons in any given year.

The NPT allocates, free of charge, the privilege to possess actual nuclear weapons only to the first five nations which developed nuclear weapons. Some nations which refused to sign the NPT (e.g., India) alleged that this aspect of the NPT was unfair. Under the fee system described here, such nations could choose to pay fees only for evacuation rights, could choose to pay additional fees to possess actual nuclear weapons, or could choose to forego the fees and accept a non-nuclear status.<sup>14</sup> The fee system suggested here is less arbitrary and more equitable than the current NPT.

In addition to paying the fixed fee, the nuclear nations should have additional restrictions on their nuclear weapons and delivery systems. These additional restrictions should include limits on the number and types of weapons. If nuclear weapons would ever be used, we should want to limit the total damage that the world might experience and also prevent the possibility of a crippling first strike that forecloses a retaliatory response.

**Realistic Nuclear Arms Control.** The NPT currently has provisions that obligate the nuclear powers to negotiate a mutual reduction in nuclear arms, perhaps ultimately to zero.<sup>15</sup> Unfortunately, in the present state of mistrust between nations, a reduction in nuclear arms all the way to zero is an implausible goal.<sup>16</sup> This is because, if all other nations actually reduced their nuclear armaments to zero, any nation that cheated on the agreement (by secretly keeping nuclear weapons) would have a significant advantage over the others. Hence, the nuclear nations will likely want to keep at least some nuclear weapons in reserve to forestall the possibility of cheating.

Likewise, because of mistrust among nations, there cannot be a single nation which monopolizes all the nuclear weapons. Nor does it appear possible to create a single international authority that would monopolize all the nuclear weapons. This is because many nations would fear the single nation or single international authority that possessed all nuclear weapons. These fearful nations would want nuclear weapons of their own.

Hence, a few nations, not many nations, must be allowed to possess actual nuclear weapons. These few nations deter each other from actual use of nuclear weapons against each other or against non-nuclear nations. Non-nuclear nations that feel the need to deter a nuclear nation can form alliances with other nuclear nations. There is no need for all nations, or even ten or twenty nations, to possess actual nuclear weapons. Possession by

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<sup>14</sup> Perhaps some portion of the fees can be distributed to nations that agree to a non-nuclear status, thus encouraging acceptance of the evacuations regime by all nations.

<sup>15</sup> NPT Article VI requires good faith nuclear negotiations for “a treaty on general and complete disarmament under strict and effective international control.” “Complete disarmament” may imply zero nuclear weapons, but it also may imply all remaining weapons are under international control. If zero is inconsistent with “effective international control” (because cheating is feared), then the retention of significant (but reduced) numbers of nuclear weapons may be consistent with the NPT.

<sup>16</sup> It is conceivable, in a future world that has been significantly transformed economically, politically, and socially, sufficient trust of abiding peace (or strictly nonviolent warfare) may exist among all nations that the small chance of nuclear cheating by any nation is regarded as a lesser risk than the possible theft and criminal misuse of remaining weapons. Such a future world might choose to eliminate nuclear weapons entirely.

numerous nations simply increases the odds that nuclear weapons will someday be used in war.

Although the goal of zero nuclear weapons is probably unachievable in present circumstances, the goal of zero deaths from nuclear war is fully achievable. This achievable goal of zero nuclear deaths is almost certainly the real goal of those who want zero nuclear weapons. This goal is achievable, if all nations with nuclear weapons agree to the terms of an evacuations treaty. Under an evacuations regime, nuclear weapons are merely kept in reserve, not used, while nations perform evacuations (if ordered) without the direct threat of nuclear weapons.

**International Prevention Measures.** Deterrence alone cannot fully prevent a nuclear first strike, because not every national leader will be deterred. Deterrence is not prevention, because it only punishes nations after they have behaved badly. Widespread knowledge of the evacuations procedure can substantially reduce the likelihood of a nuclear first strike, because it gives national leaders a safer alternative to direct use of nuclear weapons. This is a substantial positive reward for not behaving badly. Nevertheless, to fully prevent any possibility of a nuclear first strike, further measures must actively obstruct bad behavior before it happens.

These further measures include international control of the nuclear weapons possessed by the nuclear nations. By treaty, all such weapons can be manned by international troops and monitors to ensure that they cannot be immediately used by national authorities. This would be a negative control by international forces—a denial of use by national authorities. It would not be a positive control by international forces—it would not be permission for an international authority to command their use. This would assure other nations that there cannot be a first strike so long as this prevention measure is in place.

The treaty can require notice and waiting periods before a nation could legally regain control of the nuclear weapons it possesses. The international troops and monitors would impede the ability of a nation to forcibly and illegally take back control without notice or waiting. In either event, all other nations would have warning if any of the nuclear nations attempted to remove this prevention measure.

Another active prevention measure is international inspection of all nations that either possess nuclear weapons, or are suspected of trying to develop or harbor nuclear weapons. The inspections should be wide-ranging with no places off limits, to assure that no nation is cheating by harboring or developing any nuclear weapon that is not under international control. The inspection agency should be well-funded. Perhaps 30%-50% of the funds can be spent on the agency's own inspection initiatives. The remaining funds can be spent on inspections of places in other nations that are suggested by individual nations, since the individual nations may have additional intelligence or suspicions that may be useful to investigate.

**Counter-Proliferation Efforts.** Acceptance of a nation into the nuclear evacuations regime would require acceptance of all treaty obligations that belong to that regime. There may be a few nations that would refuse to accept that regime, and perhaps attempt to acquire or maintain nuclear weapons outside that regime. For major nuclear powers, refusal to abide by the rules of that regime means that MAD deterrence, rather than a guarantee of evacuations only, still applies to them. Continued reliance on MAD

is not in the long-run interests of any major nuclear power, so these nations have a strong incentive to join the regime and to enforce the regime on lesser powers.

The lesser powers have mostly accepted the nonproliferation regime that is currently in place. Only a few nations have refused to accept it. Hence, the current nonproliferation regime has been mostly successful, but partly unsuccessful. The evacuations method is not focused on nonproliferation as its main objective, but it is certainly compatible with that goal.

What can be done about lesser powers that refuse to accept a nonproliferation regime? Under an evacuations regime, the power of a nuclear weapon is limited to the power to order evacuations. An evacuations regime, by treaty, can grant this same power even to non-nuclear nations that pay for the privilege. This provides a positive inducement, which the current NPT lacks, for a lesser power to refrain from developing or possessing nuclear weapons.

Suppose some nations refuse to accept evacuation rights as an adequate substitute for actual possession of nuclear weapons? Certainly, with Iran and North Korea, various possible negative sanctions have been suggested, as well as positive inducements for compliance. An additional negative sanction that can be considered is the forced evacuation of one or more cities within the offending nation.

In some cases, an out-of-compliance nation causes fear in certain neighboring nations. For example, a nuclear-armed North Korea tempts Japan and South Korea to acquire nuclear weapons in response. One way to quell this temptation is to allow them temporary control of nuclear weapons in self defense. For example, a limited number of nuclear missiles in the U.S., Russia, or China, targeted solely at North Korea, can be placed under the temporary control of Japan and/or South Korea. If North Korea verifiably gives up its nuclear weapons, temporary control by Japan and South Korea can be relinquished.

**A Hypothetical War.** A major war that involved nuclear weapons, or other weapons of mass destruction, would be the most calamitous type of war. To eliminate nuclear war, it is only necessary to find a substitute for nuclear war that the nuclear nations can agree to. Substituting evacuations for bombings, if it can be successfully implemented by treaty, would effectively eliminate the threat of destruction from nuclear war.

It is well known that China has frequently threatened Taiwan and that the U.S. has pledged to defend Taiwan from Chinese attack. A hawkish Chinese general admitted that China cannot win a conventional war against the U.S., so he suggested China should use nuclear weapons. He is quoted as saying, “We Chinese will prepare ourselves for the *destruction* of all the cities east of Xian. Of course the Americans will have to be prepared that hundreds of cities will be *destroyed* by the Chinese.”<sup>17</sup> If we substitute “evacuation” for “destruction” in the recent words of this Chinese general, we get the following result: “We Chinese will prepare ourselves for the *evacuation* of all the cities east of Xian. Of course the Americans will have to be prepared that hundreds of [American] cities will be [ordered] *evacuated* by the Chinese.”

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<sup>17</sup> Kahn (2005), *italics added*. The vast majority of Chinese live east of Xian, which is a major city in central China. An alternate translation is, “We Chinese will prepare ourselves for the destruction of all cities east of Xi'an. Of course the Americans will have to be prepared that hundreds of, or two hundreds of, (or) even more cities will be destroyed by the Chinese.” McDonald (2005).

No claim is made here that it makes sense to threaten the evacuation of so many cities as part of a negotiation over the status of Taiwan. Nor is any claim made here that evacuating all those cities would be a sensible military strategy for either the U.S. or China, in the event of war between those two nations. The only claim made here is that it is more sensible to evacuate the cities than to bomb the cities.

Evacuations are reversible. Bombings are irreversible. If an accommodation between warring nations can be reached within a few months or a few years, life can simply return to normal if the warring enemies use evacuations rather than bombs. Life cannot return to normal after an actual nuclear war.

### **III. Conclusion**

These are the main elements of a possible treaty that would eliminate the threat of nuclear war: Nations give “fair warning” before bombing cities or other human targets. If cities are evacuated, cities are not bombed. To ensure trust that fair warning will be given, all nuclear weapons are controlled by international troops. In the event of war, international observers can verify whether and to what extent required evacuations are carried out.

Just as with a real nuclear war, an enemy who ordered up evacuations would have to consider the likelihood of retaliatory orders for evacuations. Hence, such nonviolent warfare is unlikely to be initiated on a whim. Evacuations are an adequate substitute for the seemingly rational, but ultimately irrational, threat to commit nuclear war.

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