National Security Strategy:
Thermonuclear War and Nuclear Deterrence

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Overview We have traced the development of U.S. strategic doctrine from the end of the Second World War to 1949 when the Soviets exploded their first nuclear device. As we have seen, NSC-68 prescribed drastic changes in American strategy. Before continuing with the overview of American foreign policy and strategic doctrine, we take a brief detour into the grisly world of nuclear warfare. We study the types of nuclear bombs, their effects, and their delivery systems. We then discuss the possibility for defense against nuclear attack, and finally turn to the fundamental problem of credibility caused by the nuclear revolution.

Before we continue with our excursion into the history of U.S. strategy, we take a brief, but crucial, detour into the dynamics of nuclear deterrence. Most of the high politics of the Cold War occurred in the shadow of nuclear weapons, and so we need to know a bit more about them, and the problems of credibility unique to their use for strategic coercion.

1 Thermonuclear War

1.1 Weapon Types

Conventional bombs rely on a chemical reaction for their explosion (that is, the rapid release of energy in an extremely brief period of time). Unlike chemical explosions that depend on rearranging atoms to form new molecules, nuclear weapons rely on changing the atoms themselves — either by splitting or fusing them to create new ones.

The Atomic Age arrived on July 16, 1945 with the Trinity Test in New Mexico when the U.S. successfully detonated a plutonium device of about 20 KT (kilotons).[1] This device, like the nuclear bombs dropped on Japan in August 1945, used atomic fission to produce the blast. These *atomic* weapons rely on splitting the nucleus of a heavy element, such as uranium (Hiroshima) or plutonium (Nagasaki), which produces vast amounts of energy. The atomic bomb relies on a rapid chain reaction caused by neutrons released at initial stages to trigger further fissions at a multiplying rate. Once the bomb has enough fissile substance (usually about 50 kg of uranium), called a critical mass, this chain reaction is self-sustaining.

The atomic bombs need either plutonium or enriched uranium to achieve the self-sustaining chain reaction. Most of the naturally occurring uranium (Ur238) is not suitable for nuclear weapons, and Ur235 which is, is quite rare. Special processing facilities are used to enrich the proportion of Ur235. Plutonium is even rarer, and most of the weapons-grade plutonium has to be produced in reactors through the fission of uranium. It is then extracted at a reprocessing facility to make it useable.

The amount of energy released by atomic weapons, although enormous, is limited because of the difficulty of storing fissile material without it becoming critical. Still, the 15 KT “Little Boy” blast above Hiroshima on August 6, 1945 killed about 140,000 people, while the 21 KT “Fat Man” blast above Nagasaki on the 9th killed about 74,000 (the difference is due to the hilly geography of the latter which provided some protection).

Thermonuclear weapons that rely on fusion, like the H-bomb, do not have such limits. In these bombs, deuterium and tritium (isotopes of hydrogen) are fused together to create heavier atoms, the same reaction that occurs in the center of stars.

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[1] A *kiloton* is equivalent to thousand tons of TNT, and a *megaton* is equivalent to a million tons of TNT. For reference, the Oklahoma City Bombing was equivalent to less than 2 tons of TNT.

This reaction can occur only under very high temperatures (hence the “thermo” in the name) and pressures. Usually, an atomic bomb is used to trigger the reaction, which has no theoretical limit. While the explosive force of a fission weapon is measured in kilotons, the explosive force of a fusion weapon is measured in megatons. These are usually 10 to 100 times as explosive as the bombs dropped on Japan.

Figure 1: The First H-Bomb Test (Mike), November 1, 1952.

It is very difficult to imagine the destructive force of thermonuclear weapons. The first test blast of the H-bomb on November 1, 1952 on the Enewetak Atoll in the Pacific Ocean was 10.4 MT, hundreds of times more powerful than the Hiroshima A-bomb. It produced a light 1,000 times brighter than the sun, and a heat wave that was felt 50 km away. The bomb vaporized the island on which it was exploded. Its creator, Edward Teller, knew that the Soviets were working on a similar device and was determined that the U.S. would have the lead. Unfortunately, this lead disappeared less than a year later when the Soviets followed suit with exploding their own fusion bomb. The era of virtually unlimited destructive power had begun. The largest bomb ever detonated is the Soviet 50 MT “Tsar Bomba,” which the Russians tested on October 30, 1961. The design was capable of a 100 MT yield but they scaled it back for fear of the consequences. The most powerful nuclear device detonated by the U.S. is the 15 MT Castle Bravo test on March 1, 1954 although in that case the yield was unexpected (projections had it at somewhere between 4 and 8 MT).[2]

1.2 Delivery Vehicles

Although almost every weapon can be equipped with a nuclear warhead, of greatest interest to us are strategic nuclear weapons; that is, nuclear warheads of very large yields loaded on a platform together with the system necessary to arm, fuze, and fire it. These differ from **tactical** nuclear weapons, "mini-nukes" with relatively small yields (less than 1 KT), that exist in large numbers and are unregulated.

1.2.1 Missiles

There are many ways of delivering a nuclear weapon to its target. The warhead can be carried in missiles, bombs, mines, torpedoes, and artillery, which can be air, sea, or land launched. Missiles are usually rockets, although some are propelled by jet engines. **Ballistic missiles** are rockets whose flight path is affected by gravity, their trajectory is a parabola. **Cruise missiles** are jet-propelled and fly like aircraft to their targets.

Missiles are usually divided into four classes depending on their range: (i) intercontinental, with ranges over 3,975 miles; (ii) intermediate range between 1,490 and 3,975 miles; (iii) medium range between 500 and 1,490 miles; and (iv) short range up to 500 miles. In addition, missiles can be grouped according to their launch vehicles into: (a) air-launched, (b) ground launched, and (c) sea-launched. Hence, an ICBM stands for "intercontinental ballistic missile," and SLBM stands for "submarine-launched ballistic missile."

Missiles normally travel at supersonic speeds. An ICBM firing at 7,500 miles, with a flight path that takes out of the earth's atmosphere, will take about 30 minutes to reach its target. For reference, the distance from San Diego to New York City is 2,437 miles; from New York City to Moscow it is 4,676 miles; and from San Diego to Beijing it is 6,377 miles.

If the missile will go out of the atmosphere, its warhead is contained in a **re-entry vehicle** which protects it from the thermal effects of re-entering the atmosphere (friction due to high speeds). A multiple re-entry vehicle (MRV) contains many nuclear warheads. Once it is back in the atmosphere, the MRV opens and allows the warheads to fall free and disperse around the target area, making them harder to destroy and increasing the inflicted damage.

The individual warheads can also be equipped with small rockets whose onboard computer can guide them to specific targets instead of letting them fall free. Such a MRV is called a **multiple independently-targeted re-entry vehicle (MIRV)** and

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[2] The most powerful warhead on active service in the U.S. has a 1.2 MT yield (the retired B53 bombs went up to 9 MT and the similarly retired B41 went up to 25 MT).

is extremely difficult intercept and defend against because each of the warheads is capable of its own maneuvering on final approach to target.

1.2.2 Bombs

Although people usually think of free-falling bombs when they talk about nuclear weapons and even though the U.S. stockpiles a large number of these, they are relatively less important today. This is mostly because of the vulnerability of the aircraft that is supposed to deliver them. Modern aircraft do not carry traditional bombs but missiles, either of the ballistic or cruise variety. The aircraft would normally carry air-launched cruise missiles (ALCM), which it drops before arriving in the danger zone, and the ALCMs' jet engines would take them the rest of the way.

1.2.3 The Strategic Triad

Generally, there are three strategic delivery systems, each of which has its advantages and disadvantages:

- Long-range Bombers: this is the oldest delivery vehicle and it still plays an important role. Pros: flexible range, can carry large payloads, precise delivery, able to be recalled at short notice, can be used for another strike. Cons: vulnerable on the ground and in the air, difficult to sustain at high alert for long periods, slow.

- Inter-continental Ballistic Missiles (ICBM): second oldest, land-based system. Pros: short flight time, high defense penetration capability, high accuracy, easy retargetability, flexible crisis management, relatively low vulnerability on ground (when in hardened silos, but this is diminishing). Cons: vulnerable to attack with ICBMs with high hard-target kill probability, not recallable, not reusable, cannot deliver very large payloads.

- Submarine-launched Ballistic Missiles (SLBM): the newest, sea-based, system. Pros: extremely low vulnerability to preemptive attack, short flight time. Cons: somewhat worse accuracy than ICBM, difficult communications, hard to manage flexibly in crisis, cannot deliver very large payloads.

The traditional U.S. Strategic Triad doctrine required that each of these delivery systems had to be capable of operating on its own, and destroy the Soviet Union independently of the other two. Even if two of these systems were knocked out by a surprise attack of the enemy, the third would still be able to deliver the punishing retaliatory strike. The concept of the **permanent strategic triad** remained throughout the Cold War.

1.3 Effects of a Nuclear Explosion

The damage caused by a nuclear explosion varies with the weapon's yield, its design, the location of the explosion (air, surface, underwater), atmospheric conditions, and the geographical features of the target. Regardless of these, a nuclear explosion always produces thermal and nuclear radiation, a blast, and fallout. The sudden liberation of energy causes a sharp increase in temperature and extremely high pressure. Everything present is vaporized and these gasses then expand at very high speeds, causing a "shock wave." This is true for underground bursts, where the effect is akin to that of a sudden impact, and for air bursts, where it causes hurricane-strength winds. In addition to these two types of burst, there are also high-altitude (above 100,000 feet), underwater, and surface alternatives.

The detonation of a nuclear device in the air over **ground zero** begins with a blinding flash of light that could be visible up to 700 miles away. Everyone looking directly at the flash in a radius of 100 miles would be temporarily blinded. The detonation then releases several forms of energy:

- **Explosive blast:** this is the main destructive effect and is due to the enormous pressures causing shock waves that send approximately half of the energy released outward at speeds faster than sound. It takes about 15 seconds for the wall of pressure from a 1 MT blast to travel 4 miles. It will destroy all structures in its path except perhaps underground facilities especially reinforced to withstand such pressure. In addition, winds with speeds up to 700 mph create additional damage, especially if the bomb is detonated higher up.

- **Thermal radiation:** about 35% of the energy is given out as direct heat. The temperatures are as high as at the center of the sun, and the heat wave travels at 186,000 miles per second, vaporizing everything within a 3 mile radius, and igniting many materials in the fire storm up to 8 miles. People caught in the open up to 11 miles would suffer severe burns.

- **Nuclear radiation:** the initial explosion creates several forms of radiation consisting mostly of neutron and gamma rays. Both of these are deadly because they can easily penetrate solid objects and require very thick and dense obstacles for protection. Alpha and beta particles are less dangerous.

- **Radioactive fallout:** caused by materials vaporized by the heat condensing back into radioactive dust. Earth and debris, made radioactive by the explosion, rise up and although the larger and heavier particles fall back to earth within several hours in a small radius of ground zero, many may remain in the atmosphere for weeks, even months, where they are dispersed by the wind before they descend to the ground. If the particles enter the stratosphere, they can remain there for years. There are hundreds of radioactive elements in fallout dust, of which the most famous is strontium-90. This element occurs in alpha and beta particles and is very similar to calcium. This similarity causes it to be absorbed by the body instead of calcium, producing cell mutations and cancers. Radiation is a stealthy killer, causing slow and agonizing death in those who do not die immediately.

- **Electromagnetic pulse (EMP):** the electromagnetic radiation can cause devastating effects, especially if it is released at high altitudes. It lasts a short time, but covers a large area (a burst at 200 miles above Kansas would cover the entire U.S.), and produces damaging current and voltage surges. Telephone communications systems, computers, radios, everything connected to things that conduct current (wires, antennas, metal objects) will suffer significant damage. This would cause extreme chaos in any modern society. The EMP effect was the reason the U.S. and the USSR signed the Atmospheric Ban Treaty in 1963 following the discovery of the seriousness of the EMP threat in the 1962 high-altitude test "Starfish Prime" that was exploded 800 miles from Hawaii, but damaged electrical equipment throughout Hawaii. The EMP need not be created by a nuclear blast. In fact, an E-bomb can be constructed easily for several hundred dollars with nothing more than obsolete 1940s technology.

In 1962, the *New England Journal of Medicine* described the effects of the detonation of a 20 MT thermonuclear ground-burst explosion over Boston. Today these effects can probably be achieved with a smaller-yield weapon due to better targeting, and the destruction is likely to be greater because of higher population density. The following summary assumes a city of 2.8 million during daytime:

- Ground Zero to 2 Miles: within 1/1000th of a second, a fireball forms enveloping downtown reaching two miles in every direction. Temperature rises to 20 million degrees Fahrenheit, and everything in the fireball — buildings, trees, cars, people — is vaporized. For reference, the surface temperature of the sun is about 10,000 degrees and the core temperature is estimated to be about 27 million degrees Fahrenheit.

- 2 to 4 Miles: blast produces pressures of 25 psi and winds in excess of 650 mph. (Most buildings will suffer moderate to serve damage at 5.15 psi, and the most intense storm on record had maximum sustained wind speeds of 190 mph.) These forces rip buildings apart, level everything, including reinforced concrete structures, and crushing deep underground bomb shelters.

- 4 to 10 Miles: as far as 6 miles from ground zero, the heat vaporizes automobile sheet metal and melts glass. Pressure drops to 10 psi and wind speeds to 200 mph. These forces level brick and wood buildings, and heavily damage reinforced concrete.

- 16 Miles: heat ignites all flammable materials — houses, clothes, paper — starting a firestorm more than 30 miles across and covering 800 square miles. Everything in this area is consumed by flames. Death rate is 100%. This area is about a fifth of San Diego county (not just the city), whose land area is approximately 4,200 square miles.
- Over 16 Miles: at 21 miles, the blast shatters glass windows and hurls fragments at 100 mph; at 29 miles, the heat causes third-degree burns on all exposed skin, and second-degree burns at 32 miles; at 40 miles, anyone who looks at the flash is blinded.

Within minutes after the explosion, 1,000,000 people die (total American casualties in the Second World War: 418,500), and among the survivors, more than 1,100,000 are fatally injured. Another 500,000 have serious injuries and are in need of immediate medical attention. Only about 200,000 people remain without serious injuries. Burn wounds are the most serious problem but intensive care is not available because most of the doctors have died. Similarly, help is not available for people with radiation sickness, stab wounds, and collapsed lungs. Most of the injured people die.

1.4 Defenses

The basic idea of defense is the same regardless of form of warfare: it is a combination of active and passive measures. First, one tries to minimize the number of enemy weapons that strike their targets. Second, one tries to minimize the damage caused by the ones that do strike.

- **Active defenses** refer to attempts to minimize damage of incoming enemy weapons by reducing the number of weapons the reach their targets. This can be done by either reducing the number of weapons the enemy manages to launch or spoiling their aiming so they miss their targets. Since nuclear weapons are delivered from the air, active defenses involve mainly shooting down enemy planes and missiles.

  Shooting down missiles is exceedingly difficult, especially if the missile carries MIRVs. The question here is *when to attempt interception*. The ballistic trajectory has four phases:

  1. *Boost* (few minutes): missile launched through atmosphere; best to destroy, too little warning time; must be done by spaced-based weapons and computer;
  2. *Post-boost* (few minutes): rockets no longer accelerating, some MIRVs may have detached but still flying alongside the bus; same as above for intercepting purposes;

    3. *Mid-course* (20-25 minutes): warheads, along with decoys, travel in different directions in space; time to react but too many flying objects (tens of thousands), unable to tell warheads from decoys;
    4. *Terminal* (less than a minute): warheads hurtle toward their targets through the atmosphere; defender can tell warheads from decoys and destroy them but even high-altitude explosions would level whatever's on the ground beneath; not useful for protecting cities;

- **Passive defenses** protect against the enemy weapons that get through the active defenses and hit their targets. These involve preparations to absorb the damage the weapons inflict. Passive defenses against nuclear weapons take three primary forms: concealment, hardening, and dispersal of targets. The question here is *what to protect*.

    - **Concealment** is simply the hiding of targets including measures to deceive the enemy. This can be quite difficult in an open society, and in the age of space satellites.
    - **Dispersal** of targets makes them difficult to destroy because they are either not kept together in one place (e.g. bomber force is scattered across the U.S., and so it is necessary to attack many bases to destroy it, strategically valuable plants are not concentrated in one area), or because they are mobile and difficult to find (e.g. missiles mounted on trucks or railcars that are constantly on the move). Protection of civilians is also possible through **evacuation**, but this is not feasible for large densely populated cities.
    - **Hardening** can be used to protect weapons (e.g. hardening missile silos) or civilians (e.g. building shelters). This involves putting a shield between the bomb and whatever is being protected. To protect people from nuclear bombs, one must worry not only about the thermal radiation and the blast (**blast shelters**), but also against nuclear radiation (**fallout shelters**).

      Because of interception problems, and difficulty of evacuation, defense of cities is impossible but that of hardened ICBM silos feasible. It takes 2 warheads to destroy a silo but 1 to obliterate a city. Moreover, defense of silos means ground-based weapons and interception in the terminal phase. However, the public usually does not like spending money on protecting rockets instead of cities.

Civil defenses in the U.S. have never been very good. On one hand, the country has more than enough fallout shelter spaces for the entire population, a good highway system that might facilitate evacuation, a sophisticated communications network, and enormous resources of medical supplies. On the other hand, the shelters are not well organized, and many lack basis necessities, like water. Evacuation plans are chaotic and are constantly reorganized. It is not even clear that a city the size of New York can be evacuated at all in anything less than a month. No civil defense training for the citizens.

The Russians, on the other hand, had devoted considerable attention to civil defenses, with compulsory training for all citizens. Each citizen is assigned to a specific evacuation area, and even back in 1978 the CIA reported that the Soviets were organizing a huge nationwide program for homeland defense. Of course, the very nature of the regime has facilitated population control. We shall study the implications of a good civil defense later on.

1.5 Warning Systems

The critical question for a successful defense is *early warning*. Warning is essential for most of the defensive systems to work, and in large part determines the amount of damage suffered in an attack. Note that "minimizing" expected fatalities still leaves us reckoning deaths *in the tens of millions*. The cities are extremely vulnerable to large-yield bombs that neither have to be accurate nor in large quantities to inflict absolute devastation.

2 Nuclear Deterrence

In the classical logic of war, force (or the threat to use force) is applied to coerce the opponent to concede. The pain makes the adversary's situation sufficiently unpleasant and its continuation reduces his chances of victory and increases the probability of more pain, all of which combine to get him to capitulate. We have studied various ways in which force can be used to bring coercive pressure to bear.

Deterrence and compellence are both forms of coercion that rely on the conditional threats and promises, and their success depends on the credibility of these moves. This credibility hinges on the players capacity to deliver on the threats, which involves both his capability to inflict damage and ability to absorb the costs of doing so. A state's *punitive capability* is its ability to impose costs on its opponent. A state's *defensive capability* is its ability to prevent the opponent from hurting it. The greater the punitive capability, the more a state can punish its opponent. The greater the defensive capability, the less its opponent can punish it.

Both capabilities can contribute to the credibility of threats and hence to the success of deterrence and compellence. The most obvious example is a good punitive capability coupled with a good defensive capability. The threat then essentially consists of two parts: (i) I can hurt you a lot, and (b) you cannot hurt me in return.

Before the advent of nuclear weapons, these two types of capabilities were related to each other: a state's punitive capability depended on its opponent's defensive capability. In other words, the ability of one state to impose costs on its opponent depended on the ability of its opponent to defend itself. Thus, even if one had an excellent army, a good defense would make it relatively less effective. Excellent planes can be rendered rather ineffectual by an equally good air-defense system. More generally, the military tended to combine both capabilities, and destroying the defenses would normally render the punitive capabilities ineffective.

As we have seen, in the classical logic of war, the purpose of fighting was to destroy the opponent's defensive strength through the military contest. In this process of mutual coercion each side attempts to impose great costs on the opponent and convince him that non-compliance would be more painful than capitulation. Once the military contest is over, the defeated state is at the mercy of the victor, who proceeds to exert coercive pressure through the latent use of force: now that the opponent is defenseless and at his mercy, the victor can threaten to inflict pain with impudence unless the opponent comes to terms.

The coming of the nuclear era undercut the classic logic of war by *separating the ability to punish the enemy from the ability to limit the punishment one might suffer*. With nuclear weapons, it is no longer necessary to overcome the enemy's defenses in order to inflict pain, which means that one can proceed to coercion without defeating him militarily. Furthermore, the enemy's inability to protect himself against nuclear weapons does not necessarily diminish his capability to inflict damage with nuclear weapons.

2.1 Preventive War

At first, the U.S. enjoyed a monopoly on nuclear power and it could exert coercive pressure on its opponents by threatening to use atomic bombs against which there was no recourse. The original strategy for containing the Soviets did rely on the nuclear threat explicitly because the U.S. lacked the conventional forces to oppose a large-scale invasion of Europe by the Red Army. Putting aside moral and ethical issues for the moment, such a threat would be credible because there was no punishment the USSR could inflict in return.

For some time, people discussed the possibility of launching a **preventive war** while the U.S. was ahead in the nuclear arms race. The logic is that (a) nuclear war with the Soviet Union is inevitable, (b) a surprise first strike would give the attacker incredibly good odds for winning, and therefore it is better to fight now from the position of strength rather than later. This particular idea never really got off the ground mostly because it is extremely difficult for a democracy to start with a surprise attack a nuclear war in cold blood, especially when such a war would mean the deaths of millions of civilians. The logic of the argument was further undercut when the Russians developed their own nuclear capability and stockpiled nukes in such abundance that it was dubious whether even a first strike would destroy a sufficiently large number of those.

2.2 Surprise Attack (Preemptive War)

However, in 1949 things changed with the Soviet acquisition of the atomic bomb. As NSC-68 duly noted, the fundamental strategy had to adapt to reflect this development. Although the USSR could not possibly hurt the U.S. for the time being directly (it had relatively few and limited means of delivering the nuclear weapons to America), it could threaten the European allies with nuclear destruction. Although the U.S. could still inflict great pain on the Soviet Union without it being able to reciprocate on American soil, the USSR could severely damage the Western powers. This threat would restrain the U.S. from relying on nuclear weapons for deterrence.

Because both sides had only limited stockpiles of nuclear weapons, and the means of delivery were restricted to bombers, a lot of thinking went into **crisis stability**, or the probability that a crisis will end in war. The problem with having a nuclear force *vulnerable to surprise attack* was simple: it gave incentives to the opponent to attack preemptively in order to destroy the retaliatory capability of its enemy.

If American retaliatory forces are vulnerable, the USSR would be tempted to remove the danger to itself they represent by launching a **preemptive attack**. If the USSR could launch such a premeditated surprise attack on the U.S., it could hope to destroy most of America's nuclear forces, and prevent retaliatory damage to itself. The ability to launch an attack that would eliminate the opponent's retaliatory punitive capability is called **first-strike capability**.

Of course, because the USSR would have such incentives, if a crisis starts, the U.S. would be tempted to preempt itself and strike first because it would reason that a Soviet strike is forthcoming. Thus, the vulnerability of one's own forces would tempt one to initiate nuclear war. But now the USSR would be aware of such incentives to preempt the preemption, and would itself try to jump the gun. These expectations would create a vicious spiral and make each opponent extremely nervous and trigger-happy. A crisis under such conditions would be severely unstable because it is very likely to end in nuclear war.

2.3 Crisis Stability

To ensure crisis stability, each side therefore had interests in making both its own nuclear forces *and the nuclear forces of its opponent* invulnerable to surprise attack. While the first is straightforward (you always want to protect your own forces), the latter requires some thinking: why should you want to help your enemy protect his forces? We have already seen the logic in *the dynamics of mutual alarm*. If your opponent's forces are vulnerable, you will be tempted to strike at them during a crisis. Knowing your incentives, your opponent would be tempted to preempt and strike first in order to neutralize some of your capability. We enter the expectations spiral again. The only way out is for both sides to feel secure that neither he nor the opponent have any incentives to strike first.

Some imperfect measures for improving the defenses of the retaliatory forces included airborne alert (some portion for strategic bombers are always in the air so they cannot be destroyed on the ground by a surprise attack), but this form of dispersal proved to be too costly and prone to accident. Another passive defense involved hardening of missile silos, and the development of active systems that would intercept incoming bombers and missiles.

Very soon, however, it was discovered that the prospect of a good defensive system would make crises unstable again. This is because a decrease in one's vulnerability would make one more likely to take on risks, increasing the dangers of escalation. The only way out was in stockpiling enormous quantities of nuclear weapons: the sheer number of warheads and multiple possibilities for their delivery would render any sort of first-strike futile because it could never hope to neutralize the retaliatory capability of the opponent given the size of its nuclear forces.

2.4 Mutually Assured Destruction

Both sides eventually acquired **second-strike capability**. That is, each could absorb a nuclear attack on itself and then retaliate with a devastating nuclear strike of its own. Each had enough nukes to survive an initial attack—either by sheer number of targets (too many nukes to destroy) or by making them relatively invulnerable—hardened silos for rockets could survive almost anything short of a direct hit, nuclear submarines were difficult to detect and hunt down, strategic air bombers were airborne and not easy to intercept. Notice that this leads to overkill: both sides stockpile enough weapons to destroy the entire world several times over. This has led many to criticize such behavior as wasteful and irrational. However, the criticism misses the point: nobody intended to use all weapons for a strike; the goal was to survive a strike with enough forces to launch the punishing counter-stroke. It does not matter if you can destroy the entire world when you expect to lose 80% of your capability before you even respond.

This was the **nuclear revolution**. Once both sides could annihilate each other even after a devastating attack of the opponent, the threat to use nuclear weapons lost all credibility. In terms of our discussion of the classical logic of war, having great punitive capability did not reduce the other side's defensive capability: destroying much of its military forces did not render it defenseless and did not protect from retaliation. Thus, the threat to hurt became incredible. How could the US threaten to launch a massive nuclear attack when doing so would inevitably bring its own destruction?

The era of **Mutually Assured Destruction (MAD)** had arrived, and with it, the problem of credible use of nuclear threats. We have already discussed several ways of dealing with the problem. You should recall the threat that leaves something to chance, and the strategy of limited war. MAD removes the fear of surprise attack, and therefore reduces the incentive to preempt: there's no need to go first when you would still get hammered even if you succeed. This made crises much more stable and reduced the risk of war by eliminating the fear of the opponent jumping the gun. It is worth noting, however, that this logic only works when both sides have second-strike capability. That is, it does not work against opponents such as North Korea or, eventually, Iran, who have a very small nuclear arsenal with very limited capabilities. Against such opponents, the U.S. still has a first-strike capability, which means crises are susceptible to destabilization through the fear of preemption. (This may explain, in part, why the North Koreans have long insisted on a formal pledge by the U.S. that we would not attack them.)

3 Accidental War

By accidental, or *inadvertent*, war we mean one that is caused either by a mechanical accident or by loss of political control due either to miscalculation or rapid military developments.

In January 1963, Secretary of Defense Robert McNamara argued that a full-scale nuclear war could be triggered by a **peacetime accident** similar to the crashes of American aircraft carrying nuclear weapons in North Carolina and in Texas. In the NC crash, all but one of the safety systems of the bomb failed, and a nuclear explosion was avoided almost by miracle. It is not exactly clear how such an accident could trigger a war but one might imagine that in the confusion surrounding the news of a nuclear explosion over American soil, the government may not be quite clear about its source, and may authorize escalation to full alert that will frighten the Soviets. However, it seems highly unlikely that the U.S. would launch an attack on the Soviets before ascertaining the facts, especially because a surprise attack by the USSR would not involve one isolated nuclear device.

Of more concern is the fact that there has been about 40 accidents (that we know of), and some of them resulted in nuclear warheads being lost at sea or contaminating with radiation significant areas. These serious accidents are not peculiar to either side although the West seems to lead the way with six out of the ten most dangerous air ones, and the Soviets have had a much poorer record with their submarines. However, it is very doubtful that a nuclear state would initiate full-scale war following an accident, not in the least because everybody is aware of the possibility of such accidents, so great precaution is taken to verify the genuineness of the threat.

A similar logic rules out wars triggered by a **false alarm of the early warning system**. The public used to be frightened by journalists reporting how a flock of birds caused a computer to go haywire, sending the nuclear bombers scrambling and getting the system to ready the missiles. Instead of increasing the public's confidence in the detection system, these events have generally caused fear that such accidents could send the missiles flying.

However, it is well-known that the early warning system is sensitive and prone to false alarms (after all, you would rather have a false alarm that turns out to be a flock of birds than no alarm that turns out to be a flock of nuclear missiles). No retaliation is possible on the warning of a single radar station, and the electronic hallucination of the early warning system can be confirmed by other devices that are less susceptible to it. Computers are constantly monitoring everything from aircraft movements, meteorological patterns, biological patterns (bird migration), orbital patterns, and are fed data from previous false alarms.

The whole system is so loaded with redundancy mechanisms and fail-safe devices that one may actually be forgiven for doubting its ability to retaliate if the real attack comes. There are safety devices guarding everything from physical access to the nuclear warheads, their loading on delivery systems, their arming, and the process of authorizing the launch.

This is not to say that close calls do not happen. During the Cuban Missile Crisis (October 28), NORAD was notified that a nuclear missile was launched from Cuba and was about to hit Tampa, Florida. A brief period of intense waiting for the detonation followed and after it failed to materialized, a quick investigation revealed that a radar operator had mistakenly inserted a test tape simulating an attack from Cuba into the system, causing the the control room officers who were unaware of this to trigger the alarm. It should be emphasized, however, that NORAD waited, probably because they thought that an unprovoked attack with a single missile from Cuba was highly unlikely.

The **unauthorized launch** of a nuclear device has been an enduring fear for many people. This is what most analysts have in mind when they talk about accidental war. Even McNamara in the above example was assuming that the problem would come from the inability to trust the military leadership not to jump the gun under pressure. This is most common nightmare scenario: the military overreacts to some accident and sends things spiralling out of control despite the best efforts of the civilian leadership to control them.

In one of these scenarios, a local commander goes crazy and launches the nukes on his own. In another, a local commander under the escalatory pressure of a crisis (and perhaps under conventional attack) retaliates in defense with nuclear weapons. In either case, it is not the intention of his government to start a nuclear war but one begins inadvertently anyway because of the **loss of political control**.

The system of checks, safeguards, and fail-safe mechanisms designed to prevent this is fairly extensive. First, the personnel safety measures subject each person involved with the launch of weapons to psychological tests and background checks to ensure his or her emotional and political stability. Although not absolutely effective, these tests do screen out potentially unsuitable candidates. These measures are also administered at frequent intervals while the person is on duty to ensure that new factors and the work stress have not changed the original assessment.

After the personnel measures come the physical safety devices that ensure that the weapon cannot be launched without confirmed authorization. The President is the only one who can authorize launch and he has randomly-generated security codes that are periodically changed that are necessary to start the process. Thereafter, every step involves additional sequences to be entered at precise time-limited intervals. A failure at any of these steps requires that the process be restarted at a high level. Finally, once the weapon launch crew receives the confirmed authorization, the actual launch requires the presence of at least two people who have to perform synchronized tasks in a short period of time. These tasks are designed in a way to make it impossible for a single person to accomplish them. This system is fool-proof, and the chance of mishap is vanishingly small.

However, this does not prevent the physical takeover of missiles and unauthorized launch. To this end, the physical security of the weapon and its launch system must be ensured. Usually, nuclear warheads are stored separately from their delivery systems and are transported in secret and under heavy guard when necessary. The NATO launch crews in Europe must be multi-national. Although the U.S. has stockpiled nuclear warheads in several countries in Europe, the treaties stipulate that they would not be used without the consent of the host governments. The Soviets have gone further: they have never given control of nuclear warheads to any of their allies. They have only installed launch systems but have kept the warheads and so none of their satellites was ever able to launch a nuclear strike. Given the nuclear proliferation in Europe (France, Britain), the U.S. did not have such control.

This does not rule out the last possibility: a commander under pressure launches nuclear weapons in self-defense. Although precautions for this eventuality are also common, they may not be very effective. For example, if the launch site is far from the center of control and there is a distinct possibility that communications between them could be severed in war, then the local commander may be authorized to use the nuclear weapons under his control. In peacetime, this would not normally constitute a grave danger, because of the safety devices, but in a crisis situation the commander might be given extended temporary authority.

Such an extreme danger existed during the Cuban Missile Crisis although the Americans were not aware of it at the time. When the U.S. went ahead with invasion plans, the administration did not know that many Soviet nuclear missiles were armed and operational, and, more importantly, their commanders could actually fire them. It is not difficult to imagine a commander who finds himself under fire, defending against a massive invasion by the Americans, with communications to Moscow cut, ordering the launch of the weapon under his control. It is precisely this danger, of which the Soviets were well aware, that caused Khrushchev extreme apprehension and stress. He knew that the two superpowers were running large risks and he further knew that the Americans did not know about it. Hence, he had to back down.

The U.S. also had a serious problem with a similar issue during the crisis. At Malmstrom Air Force Base in Montana, the local officers jerry-rigged the Minuteman missiles and gave themselves the independent authority to launch them. This was only belatedly discovered after the crisis.

Finally, there is the possibility of accidents occurring during the crisis. Unlike peacetime accidents, these may be very dangerous because the opponent, who acts under intense pressure, may overreact, sending the process spiralling out of control. A bomber loaded with nuclear weapons may crash and the safety devices may fail, resulting in an explosion. Or it may be taken out by an enemy fighter if it gets too close to the opponent's territory. Or a local commander might shoot down a plane causing the other side to suspect the beginning of a general attack and triggering a fatal escalatory step. But of course, this danger inherent in any crisis is used in part to generate the risk of war by the threat that leaves something to chance. It is difficult to quantify such risks and as a result it is probably impossible to use such a strategy with any precision, especially because failure is so final.

The Cuban missile crisis saw several such accidents. For instance, when the crisis began, SAC secretly installed nuclear warheads on nine of the ten ICBMs at Vandenberg Air Force Base which was normally an ICBM test site, and was probably known to be one to the Soviets. At the height of the crisis, they launched the tenth (non-nuclear) missile on a routine ICBM test over the Pacific without even pausing to think how the Soviets might react to this.

The Soviets themselves had problems with control when Khrushchev learned that an American U-2 spy plane was shot down over Cuba without his authorization. It seems that he was led to believe the Cubans had done it even though it was the Soviet local commander who had ordered it on his own authority. It is also sobering to learn that the Soviet commanders had planned a nuclear strike on Guantanamo in case of U.S. attack on the island.

Then there was the incident on the American side when a U-2 plane strayed into Soviet airspace during the crisis. The Russians launched fighters to get it, and the Americans scrambled interceptors to protect it and escort it back to safety. The problem was that because of the crisis alert, the interceptors were armed with nuclear missiles that the pilots could use. What if the Soviet fighters had gotten close enough to threaten the U-2 or the interceptors? What if the U.S. warplanes had shot down a Soviet fighter with a nuclear weapon? What if the Soviets thought the U-2 flight was a last-minute reconnaissance mission over the USSR as a prelude to an all-out attack? In the event, this did not happen and the U-2 returned safely to Alaska. As Kennedy remarked upon learning about this after the crisis, "There's always some son of a bitch who doesn't get the word."

The overall impression is that the danger of accidental war is quite slight, and whatever risks exist, the policy-makers have taken into account. The real danger therefore does not come from accidents, but from deliberate decisions that might be based on fear, pressure, misinformation, or plain bad luck. While the dangers of nuclear war should make everyone involved exceedingly cautious with any sort of brinkmanship, it may not necessarily do so, especially when it comes to taking risks that may cause the opponent to back down. Fortunately, the 1962 crisis taught both sides that brinkmanship is too nerve-racking and too volatile to be a useful policy instrument. It is perhaps no coincidence that it was never really attempted again in this form.