Richard L. Garwin

A Defense that Will Not Defend

Most Americans are unconcerned that anthrax or nuclear weapons might be delivered to the United States by long-range missiles from North Korea. If asked, they feel protected by some kind of defense; and they are—by the U.S. nuclear deterrent. Nevertheless, U.S. leaders in Congress are determined to defend against this threat by deploying a national missile defense (NMD). Unfortunately the program as planned will not defend against even the minimal threat of four or five North Korean missiles if they are suitably equipped to penetrate the defense, which can be achieved with a fraction of the effort and skill required to build the missiles themselves.

This summer, the Department of Defense is scheduled to conduct its Deployment Readiness Review of the National Missile Defense Program, and President Bill Clinton has committed himself shortly thereafter to decide whether the United States should deploy the proposed NMD. He will do so on the basis of four criteria:[1] (1) whether the threat is materializing; (2) the status of the technology based on an initial series of rigorous flight tests, and the proposed system's operational effectiveness; (3) whether the system is affordable; and (4) the implications that going forward with NMD deployment would hold for the overall strategic environment and our arms control objectives, including efforts to achieve further reductions in strategic nuclear arms under START II and START III.

The Long-Range Missile Threat

Since 1949, when the Soviet Union exploded its first nuclear weapon, the

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United States has been vulnerable to strategic attack. The Soviet Union still has more than 6,000 strategic nuclear warheads to use against the United States (and vice versa). Their use not only would destroy the United States as a nation, killing more than 200 million people, but also could imperil civilization on earth by the worldwide effects of nuclear explosions—radioactive fallout and destruction of the ozone layer.

I served from 1958 to 1973 on the Strategic Military Panel of the President's Science Advisory Committee. The Strategic Panel met for two days every month in Rooms 206-208 of the Old Executive Office Building to analyze and advise on U.S. strategic offensive and defensive missile systems.[2] Every month or so, we heard from the Army (in charge of antimissile defense) on the status of its ongoing developments and tests of defenses against ballistic missiles. We were frequently briefed by the contractors that were building test hardware and that would build a deployed system. We also heard from the national laboratories and other facilities that were carrying out sophisticated tests of radar to detect warheads and to discriminate them from the fuel tanks of ballistic missiles or from decoys that might be sent along to divert interceptors from the actual warhead.

Because the nuclear warheads of the interceptors might have an effective kill range of 10 kilometers against an incoming nuclear warhead, decoys that were close to the offensive warhead would not help its survival. Therefore, they were deployed farther away, in a long "train" that would reenter the atmosphere as if they were to land on the same target. There was no good way to distinguish decoys from warheads after the missile got up to speed and arched through space in its fall toward its target. Multiple light decoys could be deployed to resemble the warhead. This was particularly feasible when one considered the use of "antisimulation," in which the warhead was dressed to resemble an easily fabricated decoy.

Without antisimulation, a decoy would need to resemble the conical warhead, which is carefully fashioned and has a surface coating to survive the fiery heat of reentry without damaging the warhead contained within. Certainly one could make a lightweight decoy of the same shape and hope to give it the same radar cross section, but it is far easier to use as a decoy a simple balloon to resemble an inflated one around the warhead. These analyses were the daily meat of the Strategic Panel and of the reports we gave to the president. Each year, we assessed the status of our capability to defend against Soviet ballistic missiles (or against Chinese ballistic missiles) and judged that we could not mount an effective defense against nuclear warheads. The problem was not ideological; it was technical. It was far easier to add a modest amount of payload capacity for decoys (and jammers to emit radio noise to distract or to blank out the ground-based radar) than to build a system that could cope with such an attack. Large potential attacks also could be directed against the defensive system itself.

Having committed in 1969 to deployment of Sentinel—the Johnson administration's version of a defensive system—the Nixon administration was astonished to find that the U.S. populace was not standing in line, city after city, asking to be among the first to be defended. In fact, the citizenry made it perfectly clear that they did not want "bombs in the backyard," such as the nuclear warheads on the ballistic missile defense (BMD)—also called antiballistic missile (ABM) defense—interceptors. Nixon changed course and deployed the Sentinel hardware to defend our own land-based intercontinental ballistic missiles (ICBMs)—the Minuteman missiles housed in silos in North Dakota. Only the name was changed—to Safeguard. By 1974, two ABM radars and 100 interceptors were deployed there to defend a fraction of the U.S. land-based missile force.

Short- and intermediate-range ballistic missiles have become commonplace.

Twenty of these interceptors were large Spartan rockets armed with 5-megaton nuclear explosives which would sweep a large region of space free of nuclear warheads and decoys. But 20 individual rockets, armed with warheads or not, could exhaust this supply of Spartans. The interceptor force was supplemented by 80 Sprint interceptors—small, fast-reacting rockets carrying kiloton-yield neutron bomb warheads. These small nuclear explosives would have an adequate kill radius within the atmosphere to destroy an incoming warhead as it fell through the atmosphere and slowed. In reality, warheads aimed at the radar that was essential to the system could have destroyed it and rendered the system impotent long before the interceptor stock had been exhausted.

This prospect of an enormous force directed against the defense itself kept us from building any kind of effective system against the Soviet Union. Against a light force such as China's, the problem was that antisimulation and decoys would prevent the intercept of these warheads in space. To catch them within the atmosphere would require country-wide deployment of interceptors and radar. Even now, the Chinese ICBM force is reputed to number approximately 20, which could in no way threaten the survival of the United States as a nation or its population, but it could destroy that many cities and, with their reputed 3-megaton warheads, could kill 25 million Americans. If one deployed a defense of successive cities with interceptors that would work within the atmosphere—where decoys would be stripped away to reveal the warheads—other cities could be targeted in their stead.

With the gradual evolution and spread of technology, with the digital revolution in which the personal computer on your desktop is capable of a billion multiplications per second—compared with a few million in a large computer in the early 1970s—and with the continued tension and warfare throughout the rest of the world, it is no wonder ballistic missiles of short and intermediate range have become commonplace articles of commerce. In particular, the Soviet Union in the 1950s built the so-called Scud missile that could carry a ton of high explosives to a range of 300 kilometers (200 miles). These missiles were gradually improved and sold to Warsaw Pact members and then to Egypt and many other countries. They found their way to North Korea and through various indigenous developments emerged as longer-range missiles of 600- or 900-kilometer range, such as those used against Israel and Saudi Arabia by Iraq in the 1991 Persian Gulf War. Hundreds had previously been used by Iraq against Iran (and vice versa) in their conflict. North Korea further developed Scud technology to make the larger No Dong missile, of 1,300-kilometer range, which it tested in 1993. North Korea has apparently sold many of these missiles to other countries and maintains that it does this to earn irreplaceable foreign exchange. Pakistan in 1998 tested the Ghauri missile—which appears to be a No Dong—with which it can threaten much of India.

The proposed system will surely fail because it has not accounted for countermeasures.

After a good deal of controversy about the emerging missile threat, the Commission to Assess the Ballistic Missile Threat to the United States (the Rumsfeld Commission) was created and was to report in July 1998 after a six-month study. The commission identified three nations—North Korea, Iraq, and Iran—as enemies of the United States with an interest in building long-range missiles that could threaten the United States. I was a member of this nine-person commission, chaired by former Secretary of Defense Donald H. Rumsfeld. Our unclassified summary[3] stated that any of these nations, given a high-priority program, enough money, and technology could obtain within five years—by exchange among themselves, or from China or Russia—the abilty to build a few unreliable, inaccurate ICBMs that could carry a nuclear warhead or biological warfare agent to the United States. We did not judge whether such ICBM development programs were under way, but said that for several of those five years we might well have no hard evidence that such a program existed. We thought that at least one test would be required before such a weapon could be used.

Six weeks after our report on August 31, 1998, North Korea fired its

Taep'odong 1, which U.S. intelligence agencies expected to be a test of a two-stage missile. This would have demonstrated one of the essential technologies for making a long-range missile—that of "staging." The simple understanding of rocket propulsion is based on a rocket engine that accelerates the rocket by expulsion through a nozzle of hot gas from burned rocket fuel. The momentum of the gas gives an equal and opposite momentum to the rest of the rocket. A bit of algebra shows that the ultimate speed of a rocket is determined by its initial mass and its final mass (that is, the initial mass less the expended fuel) and the speed of the exhaust gases. A typical Scud exhaust gas speed is 2.25 km/s, and that rocket has an empty weight (engine plus tankage, with no payload) of approximately 22 percent of its loaded weight. This fraction will result in a velocity gain of the empty rocket of approximately 3.4 km/s.[4] To reach intercontinental range requires some 7 km/s. (To put a payload into orbit requires approximately 8 km/s.) So a single-stage rocket of this technology cannot possibly achieve ICBM range, even without a warhead.

For more than 100 years, it has been known that the solution to this problem is to "stage" the rocket. Much of the structure, tankage, and engines are thrown away after the rocket achieves some reasonable speed and has burned all the fuel of the first stage. This can readily be done by clustering rockets in parallel or by "stacking" a rocket on top of another one. The Scud technology involves steel tankage, fuel that does not have a very high exhaust velocity, and engines that are quite heavy. At this technology level, a two-stage rocket cannot achieve ICBM speed, and a true ICBM would require three stages.

North Korea claimed that the Taep'odong 1 test put a small satellite in orbit. It was a three-stage rocket with that intent, but a malfunction during the firing of the third stage probably prevented the satellite from entering orbit. Nevertheless, North Korea demonstrated the separation not only of a first and second stage but also of a second and third stage. It also demonstrated that the United States, with all of its intelligence capability, had no idea that this would be a three-stage rocket test. It would take a much larger rocket—the Taep'odong 2, which is perhaps four times the size of the Taep'odong 1—to send a significant amount of biological warfare agent to the United States. According to the Rumsfeld Commission, a "lightweight variation" of the Taep'odong 2 would be needed to deliver a nuclear warhead to the United States. This might be a missile of high-strength aluminum alloy rather than the steel of the Scud technology, and it would require testing.

First-generation ICBMs are likely to be armed with first-generation nuclear weapons of yield on the order of 10 kilotons—similar to or somewhat less powerful than those that destroyed Hiroshima and Nagasaki. But the ICBMs are likely to be wildly inaccurate, perhaps with a 100-kilometer uncertainty along their track and 10-kilometer uncertainty right to left. They are therefore unlikely to directly hit a region with the largest population density where 100,000 people might be killed in a successful rocket flight and nuclear explosion. Perhaps 2,000 people in areas of average population density would have been likely. A few such warheads constitute the threat against which the national missile defense (NMD) would be deployed.

Technological Readiness and Operational Effectiveness

On March 18, 1999, the House of Representatives passed a bill stating "That it is the policy of the United States to deploy a national missile defense."[5] The previous day, the Senate had passed a similar bill, stating,

> It is the policy of the United States to deploy as soon as it is technologically possible an effective national missile defense system capable of defending the territory of the United States against limited ballistic missile attack (whether accidental, unauthorized, or deliberate) with funding subject to the annual authorization of appropriations and the annual appropriation of funds for national missile defense. [and] It is the policy of the United States to seek continued negotiated reductions in Russian nuclear forces.[6]

On July 23, the president signed the Senate version of the resulting legislation. The schedule set by the Ballistic Missile Defense Organization (BMDO) in the Pentagon leads to a deployment readiness review in June 2000. In late 1999, BMDO said that it would judge itself ready to deploy if it had two successful NMD interceptor flights in which the interceptor destroyed a mock warhead.

The three-stage interceptors to be deployed with the NMD are not available and will not fly for more than a year. The actual kill vehicle (KV) that is to destroy the warhead by colliding with it at a speed of typically 10 km/s is not ready either, but a functionally similar KV is to perform the hit-to-kill role in these tests. The KV contains what is essentially a fancy video camera that transmits infrared, and a focal plane—similar to the film in an ordinary camera or to the charge-coupled device sensor in a video camera—that forms an image using the heat radiated from the warhead. In October 1999, an NMD interceptor was launched from Kwajalein Atoll to intercept a mock warhead delivered by a Minuteman missile launched from Vandenberg Air Force Base in California. BMDO announced that the trial was a success. In January 2000, a similar test was conducted, but this time with additional system communications to the interceptor. The KV was unable to see the warhead (or anything), and the test was clearly a failure. It was revealed that the coolant had frozen water vapor in the system, blocking the tubing so that the infrared imager could not work. It was blinded by its own heat from the detectors that were at room temperature instead of being extremely cold.

The infrared focal plane has a modest number of detectors (perhaps 256 by 256 pixels) and observes in several bands of wavelengths ("colors" of infrared). The infrared imager is thus able, in principle, to determine the temperature of the object that it sees in a single pixel and also its area. But not every object at room temperature radiates the same amount of heat, even if it is the same area. A blackbody is one that absorbs all the light or heat falling on it and by the same token radiates the maximum amount at any given temperature. A body that is coated with aluminum foil radiates only about 4 percent as much, and one that has a thin layer of gold only approximately 3 percent as much. Furthermore, various coatings radiate a different fraction of the blackbody emission in different color bands, so that a false temperature may be inferred by the imager.

We have already met the nemesis of the proposed NMD system.

In January 2000, it was revealed that in the October intercept test, the KV did not initially see the mock warhead, but instead observed a balloon that was significantly larger and brighter than the warhead it accompanied. Only after the KV identified the balloon as the warhead and maneuvered to attack it did the mock warhead itself come into view in the infrared image and was successfully attacked.

On March 21, 2000, Lieutenant General Ronald Kadish, head of the BMDO, announced that the third interceptor test would be postponed until June 26. He also provided a life-cycle cost estimate of $38 billion for the NMD containing a single site of 100 interceptors. That price includes upgrades to five early-warning radars; deployment of an X-Band radar at Shemya, Alaska; and the communication system necessary to link satellite warning to the radars and to the interceptors.

Evidently, Clinton expects to make the deployment decision without a single test against countermeasures. Yet countermeasures are the key to the performance of a defensive system. It is natural to ask: if we can make rockets carrying hydrogen bombs, if we can have gone to the moon in the 1960s, if we can put a cruise missile through a specified window in a building, why can't we defend against long-range ballistic missiles?

The answer is that nature does not observe what we are doing and try to counter it. The moon does not hide, jump out of the way, or shoot back.

Eric Burgess's 1961 book, *Long-Range Ballistic Missiles*, contained the following:

> It certainly cannot be concluded that an attacker will merely use simple warheads, letting his ballistic missiles perform like high-altitude research vehicles. We must expect that the warhead will be protected by countermeasures against the AMM (anti-missile missiles), including decoys, missiles launched in front of the actual ICBM, and expandable radar reflectors ejected from the ICBM afterbody or from the reentry body itself. ... The reentry body itself might be supercooled by refrigerants before reentry to upset the infrared detectors.

The key problem is that the proposed NMD system relies on intercept in the vacuum of space, where a feather follows the same path as a nuclear warhead. Even nuclear-armed interceptors are outdone by the multiple lightweight decoys in space, as evidenced by the dependence of the 1974 Safeguard defense system on intercept within the atmosphere.

There is not sufficient testing built into the program to justify the assumed reliability.

We have already met the nemesis of the proposed NMD system—the hundreds of bomblets containing anthrax or other disease-producing agents that would be liberated by the missile as soon as it reached its full speed and that would fall separately through space to their targets. A nuclear warhead would be enclosed in a balloon, with similar balloons nearby.

Antisimulation is a simple but powerful tool. Rather than have all warheads identical and pose the problem for the decoy balloon to resemble the warheads so accurately as to deceive a precision sensor on the interceptor, the offense would enclose the reentry vehicle (RV) containing the nuclear warhead in a balloon chosen at random from a range of sizes, shapes, and surface treatment. A motley set of decoy balloons need not resemble one another closely, but should reasonably overlap the spread of sizes, shapes, and surface treatments chosen for balloons surrounding the warheads. Of course, the offense does not want to devote approximately 1,000 pounds of payload to each of the decoys, but in the vacuum of space, a featherweight balloon will do just as well. The heavy warhead stays warm during its flight, while an attack in which the payload is in the shadow of the earth would allow the decoy balloons to cool. The solution is unfortunately simple: wrap the warhead in multilayer aluminized plastic insulation to limit the amount of heat that it would transfer to the enclosing balloon, and provide a one-pound battery and heater to provide comparable heat to each of the decoy balloons during its half-hour flight time. Or, it turns out, that one could use a warhead wrapped in shiny silver foil inside a balloon painted white over its aluminized plastic film, which will achieve a temperature in the Earth's shadow that in no way can be distinguished from that of an empty balloon.[7]

The Rumsfeld Commission notes specifically the potential for using bomblets as a biological warfare agent, even in the absence of defenses, as a means to improve military effectiveness. Rather than a single plume of biological agent carried by the wind through the city (with lethal impact on all those within the plume), bomblets provide multiple plumes over the city and will likely increase casualties or fatalities by factors of 4 to 10. This is no minor matter, because it allows, for a given effectiveness, the use of a missile 4 to 10 times smaller or a similar economy in number of missiles.

Had the Rumsfeld Commission been given the task of evaluating a responsive threat, it would have had to evaluate countermeasures. But it would have taken our group of nine far longer to do that job than the six months we thought we needed for a responsible evaluation of the potential threat. That simple countermeasures will defeat the proposed NMD system is not difficult to assess, if one lifts one's head out of the sand. The September 1999 National Intelligence Estimate states:

> We assess that countries developing ballistic missiles would also develop various responses to U.S. theater and national defenses. Russia and China each have developed numerous countermeasures and probably are willing to sell the requisite technologies.
>
> Many countries, such as North Korea, Iran, and Iraq probably would rely initially on readily available technology—including separating RVs, spin-stabilized RVs, RV reorientation, radar absorbing material (RAM), booster fragmentation, low-power jammers, chaff, and simple (balloon) decoys—to develop penetration aids and countermeasures.
>
> These countries could develop countermeasures based on these technologies by the time they flight test their missiles.[8]

Two remarkable reports by a committee chaired by Gen. Larry D. Welch, USAF, Ret., advised BMDO on its program. The February 1998 report is generally known as "Rush To Failure" because of its characterization of the theater high-altitude area defense (THAAD) theater missile defense program. The report faulted BMDO for far too little testing and for relying excessively on simulation to the exclusion of including "hardware in the loop" to exercise and validate sensors, even in situations in which the sensor was not flown on an actual interceptor. It judged successful execution of the NMD program on the planned schedule to be "highly unlikely."

The second report of November 1999 emphasized the problems caused for the BMDO program by the reluctance to abandon the 2003 date for deployment (although Secretary of Defense William Cohen in January 1999 had postponed the initial operational capability from 2003 to 2005). The compressed nature of the NMD program (even with the 2005 deployment date) may be appreciated from the fact that THAAD is not scheduled to be operational until 2008, even though we have been working on it for five years. The report concluded that BMDO could conduct a meaningful deployment readiness review no earlier than 2003, although it might conduct a technological feasibility review in 2000.

The specific reliability goals of the NMD interceptor are classified, but it is clear that there is not sufficient testing built into the program to justify the assumed reliability. In particular, NMD designers appear to be counting on an 85 percent probability of kill from a single intercept attempt. For a series of 20 tests of the complete system against the countermeasures that could be used by an attacker, all 20 would have to be successful to provide 95 percent confidence that the kill probability was 85 percent or greater. If there were three failures in a test series, 47 tests would need to be successful to provide the same confidence in the same single-shot kill probability.

The proposed NMD may fail because the contractors cannot build reliable interceptors. But it will surely fail because it has not taken into account the feasible countermeasures that could be deployed and will be deployed by North Korea with its first ICBM.

Cost of the NMD Program

The March 2000 BMDO cost estimate of $38 billion does not include the planned expansion of the system to two sites and more interceptors and the deployment of seven additional X-Band radars, more communication systems, and a new constellation of low-altitude space-based infrared satellites (SBIRS low). I believe that the cost will also include essentially scrapping the NMD system to develop and deploy something that might be effective against the countermeasures that will defeat the proposed system. There are just no good estimates of the program cost, which is likely to exceed $100 billion. A Congressional Budget Office estimate is due soon.

Side Effects of Deployment of NMD

For the sake of discussion, let us assume that the NMD would somehow "work" against a few North Korean ICBMs armed with nuclear warheads and that it is also effective in countering "limited ballistic missile attack (whether accidental, unauthorized, or deliberate)," as stated in the legislation.

In 1972, the United States and the Soviet Union signed the ABM Treaty limiting defenses against strategic ballistic missiles to avoid expansion of the offensive missile threat, which in any case would have overcome the defensive system deployed to counter it in that era. In particular, the ABM Treaty banned a "defense of the national territory." It permitted (according to a 1974 protocol) only a single site with no more than 100 interceptors and with a few radars deployed all within a circle of 300-kilometer diameter centered either on the national capital or on a deployment field of ICBMs.

The Soviet Union chose to defend Moscow, whereas the United States declared that it would defend Minuteman missiles from a base at Grand Forks, North Dakota. The 20 high-yield nuclear-armed Spartan interceptors of the ill-fated Safeguard system had some potential for defending the national territory, but the system was vulnerable to attack on its radar, and the few interceptors had no significant impact on the Soviet strategic offensive force. The deployment of the Moscow system greatly increased the number of U.S. warheads targeted against Moscow and impelled British and French military planners to deploy penetration aids to nullify the Moscow system.

The START II Treaty ratified by the Duma in April 2000 limits deployed strategic warheads to 3,000-3,500. At the time of writing, Russia (nuclear heir to the Soviet Union) wants to adopt a START III Treaty that will limit deployed strategic warheads to 1,000-1,500, whereas the United States would like a START III in the 2,000-2,500 range.

Russia maintains that, even in the first phase of the NMD, the United States is building an infrastructure capable of handling many more interceptors and thus poses a substantial threat to Russian strategic effectiveness. There is no doubt that Russia can deploy forces sufficient to overcome and penetrate such an expanded NMD system, but it does not want to spend the money to make the changes in its armory to do so. The United States is spending a good fraction of a billion dollars annually in Russia to provide security for its material excess to the nuclear weapons program and to provide employment for its high-tech people. Otherwise they might look for employment with countries that are enemies of the United States and that want nuclear weapons, long-range missiles, or both. Russia is a member of the Missile Technology Control Regime (MTCR) and limits its transfer of missile technology to rockets with a range of more than 300 kilometers and payloads of more than 500 kilograms.

By far the biggest threat to the survival of the United States is the 6,000 or more deployed strategic warheads in Russia, many of which are on hair-trigger alert. Because there is no significant defense against such weapons, Russia, as the United States does, relies on deterrence by threat of retaliation. The United States foolishly (to my mind) in the 1970s improved the accuracy of its ICBMs and, particularly, its more numerous SLBM (submarine-launched ballistic missile) warheads, so that they have a very good chance of destroying a hardened Russian ICBM silo. Russia fears that its submarines are vulnerable to preemptive destruction by antisubmarine warfare and that their silos could be destroyed in a preemptive strike by the United States.

Accordingly, Russia maintains a warning system so that in case of massive attack by the United States that might constitute a disarming strike, Russian missiles would be launched before they could be destroyed. This launch would be massive, constituting most of the Russian deterrent. I have maintained for decades that U.S. security would be improved if our missiles were too inaccurate to hold Russian silos at risk, and I still believe that. In those circumstances, Russia would have no interest in putting its missiles in a launch-on-warning posture. Currently the Russian warning system is degraded by age and failures. Because of the breakup of the Soviet Union, many of its early-warning radars are on the territory of other states, and the constellation of warning satellites has some gaps. With the threatened NMD deployment, Russia fears not only a disarming strike but also the likelihood that the relatively few Russian warheads that might survive to be launched would be destroyed by the U.S. NMD system.

We are far from ready this year, or in 2001 or in 2002, to make a decision.

China is not a party to the ABM Treaty, but it has benefited from the limitations on missile defense in Russia and the United States. China now has approximately 20 ICBMs, each with a single 3-megaton warhead. These ICBMs are based at fixed locations and have their nuclear warheads stored separately from the missiles, which in turn are unfueled. Since China has no warning system, it is impossible for these missiles to be launched before they are destroyed. Accordingly, China has a program to deploy mobile ICBMs which cannot be destroyed in this way.

According to my arguments thus far, it should be simple for China to defeat the planned NMD system. It could do so by using its bomblets to deliver biological warfare agents (although in violation of their undertaking in the Biological Weapons Convention of 1972), by an antisimulation balloon and decoy balloons, by a large enclosing balloon, or by a cooled shroud around the warhead. Unless Chinese political leaders are capable of more restraint than are the leaders of a democracy, it is highly likely that their military will also use U.S. deployment of an NMD to obtain funds for more missiles and warheads, rather than rely solely on countermeasures.

Both Chinese and Russian authorities hope that the United States would not be so wasteful as to deploy a costly NMD system that will not be effective against a threat of a few warheads or a few tens of warheads. They are not clear, however, as to how the United States will accomplish this task.

It has been argued that even a few hundred interceptors could not seriously interfere with the Russian long-range missile force, but there is more to the possession of a missile force than its use in an all-out response to nuclear attack. For example, in the 1970s and 1980s, Paul Nitze and others forcefully argued that deterrence by threat of assured destruction was not enough for the United States to restrain the Soviet Union. We needed something called high-quality deterrence, which was variously interpreted as the ability to destroy the Soviet retaliatory force, or the ability to use a few missiles at will to destroy targets anywhere in the Soviet Union. Spending many billions of dollars to achieve high quality deterrence was proposed. It must be assumed that Russia still has the remnants of a similar requirement and that a system with the explicit goal of negating a "light attack" of a few tens of warheads would, if successful, eliminate this prized capability from the Russian force. Even Russian warheads launched in accident, however, will be equipped with effective countermeasures and will not be destroyed by the proposed NMD.

A Better Option? Intercept Missiles in Their Boost Phase

Evidently, these countermeasures that plague the proposed NMD system—intercept in midcourse while warheads and decoys are falling through space—would be ineffective if intercept could take place while the ICBM is still accelerating.[9] Interceptors of a size comparable with those to be used in the NMD system (14 tons) would be deployed either on Russian territory south of Vladivostok and abutting North Korea or on U.S. military cargo ships in the Japan Basin. A vast deployment area of these interceptors would allow them to strike the thrusting ICBM after it had been launched from North Korea and before it could reach full speed to attack Washington, Chicago, San Francisco, Alaska, or Hawaii.

The seeker on the interceptor would not need to be cooled, because its purpose is to detect the intense flame of the rocket rather than the heat radiated by a small warhead in space. The interceptors would be launched on the basis of information from the satellites of the defense support program that have existed for 30 years and have detected every ballistic missile launched in the 1991 Gulf War from their positions at a distance of 40,000 kilometers. The interceptor from a distance of 1,000 kilometers would have 1,600 times as much signal to work with and could use a very simple ground-based radar to aid the interceptor in colliding with its target. The system would be a lot simpler and less expensive than the planned NMD.

Rather than putting a lid over the entire United States and much of the eastern Pacific Ocean as proposed, it seems more reasonable to put a lid over North Korea, a country slightly smaller than Mississippi. Such a system could not be frustrated by deployment of bomblets containing biological weapons or by balloon decoys around nuclear warheads. It would be much less expensive than the proposed NMD system, because it uses hardly any of the components. But whether the challenging task of intercepting an accelerating ICBM stands up to analysis and demonstration remains to be seen.

Missiles that might be developed later and launched from Iraq could be handled from a single site in southeastern Turkey, whereas those from Iran (four times larger than Iraq) could be countered by interceptors based on the Caspian Sea and the Gulf of Oman.

It is not clear that supporters of NMD are really concerned with North Korea. The initial deployment of the NMD system was to consist of 20 interceptors in Alaska or North Dakota, to counter four or five ICBM warheads from North Korea, or later perhaps from Iraq or Iran. In testimony on October 13, 1999, Under Secretary of Defense for Policy Walter Slocombe stated that the president has decided on an architecture to be used for planning and negotiating purposes that would counter "the most immediate threat, that from North Korea. It would be capable of defending all parts of all 50 states against the launch of a few tens of warheads, accompanied by basic penetration aids." This system "would include 100 ground-based interceptors based in Alaska." Such a system feeds suspicions that the real purpose of the NMD system is to counter not North Korea but China, and that suspicion is supported by testimony to the Senate precisely to that effect. The boost-phase interceptors that I propose will be much more capable against North Korean missiles. They would pose no threat to Russian ICBMs, no matter where the interceptor ships might be, and so Russia might be more amenable to modifications to the ABM Treaty, that would not in any way imperil the strategic deterrent.

Conclusion

According to the National Missile Defense Review by the committee chaired by General Larry D. Welch, we are far from ready this year, or in 2001 or in 2002, to make a decision to deploy an NMD. I am persuaded that the Joint Chiefs do not believe that the ICBM threat from emerging missile powers is worth the expenditure of defense dollars, compared with other threats we face—even from those same countries. Additionally, the system as proposed will not be effective against the strategic threat of attack by biological weapon agents in bomblets and can readily be defeated by feasible countermeasures.

If I were president, I would heed advice from both supporters and opponents of the NMD system not to make a deployment decision in 2000 but to leave that decision for the next administration and Congress. I would also direct the Pentagon to work full speed to bring boost-phase intercept along as a prime candidate for meeting a North Korean ICBM threat—if it emerges—and those from Iran and Iraq as well.

Notes

1. 1999 National Security Strategy Report (January 4, 2000).
2. Strategic aircraft and air defense systems were handled by the Military Aircraft Panel, which I chaired for many of those years.
3. See <http://www.fas.org/irp/threat/bm-threat.htm>.
4. The "rocket equation" gives the required initial mass M_i in terms of the mass of the rocket at burnout M_f, the velocity of the exhaust gases E, and the velocity gained by the rocket, V, as M_o/M_f = eV/E.
5. H.R. 4, March 18, 1999.
6. "The Cochran-Inouye National Missile Defense Act of 1999," S. 257, March 17, 1999.
7. An extensive technical treatment of countermeasures and their implication for the NMD program is to be found in "Countermeasures: A Technical Evaluation of the Operational Effectiveness of the Proposed U.S. National Missile Defense System" (April 11, 2000) available at <http://www.ucsusa.org> from the Union of Concerned Scientists (UCS) and the Security Studies Program at the Massachusetts Institute of Technology. I am an author of that report, in which a far more extensive analysis of antisimulation balloon decoys may be found.
8. Central Intelligence Agency, National Intelligence Estimate "Foreign Missile Developments and the Ballistic Missile Threat to the United States Through 2015," unclassified version available at <http://www.cia.gov/cia/publications/nie/nie99msl/html> (September 1999).
9. See my proposal for such a system, "Cooperative Ballistic Missile Defense" at <http://www.fas.org/rlg> (November 17, 1999).