The Case for Submarine Launched Non-Nuclear Ballistic Missiles

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1. Introduction

A serious problem for the United States is the nexus between terrorist groups and a number of minor powers capable of acquiring weapons of mass destruction. President Bush is committed to destroying terrorist networks and to deploying an antiballistic missile (ABM) system. The Afghanistan phase of the war on terror is coming to an end, and the United States has announced that it is withdrawing from the ABM treaty. The Bush Administration is giving these two related problems the attention they deserve.

Several minor powers, – frequently called "rogue states" – pose a two-prong threat to the United States. First, they are within reach of possessing both unconventional weapons , whether nuclear, biological/bacteriological, chemical, or radiological, and ballistic missiles or other means of their delivery. Such weapons might not represent a direct challenge to the United States in a strictly military sense; United States superiority in the number, sophistication and throw-weight of nuclear missiles would be overwhelming. However, weapons of mass destruction could prove to be politically effective in limiting the options of the United States.

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Second, these rogue states shelter terrorist groups. The threat posed by these terrorist groups is no longer hypothetical. In September of 2001 terrorists killed almost 4,000 people in New York and Washington. In recent months, the American political establishment and media have been targets of a limited anthrax attack. The source of the anthrax is still not known. The anthrax attack, however, has demonstrated the vulnerability of the United States communications and transportation network to biological weapons.[3] What is more, while the United States may not yet be especially vulnerable militarily to these threats, its economic and social fabric clearly is. The economy suffered a serious blow following the terrorist attacks on September 11th and the American people have been put on edge more so than at any time since Pearl Harbor was attacked sixty years ago.

Our main contention in this paper is that a useful weapon that could address both of these related problems would be heavy conventional warheads launched from Trident II missile submarines. Such weapons are not presently part of the U.S. inventory of weapons, but they could be prepared relatively easily and inexpensively. These missiles can carry a 4,500 kilogram warhead a distance of 2,500 nautical miles. This would permit the United States to destroy almost any man-made structure on earth. Since the flight time of such a missile is less than fifteen minutes, this would enable the United States to respond rapidly to new intelligence.

2. Proposal

Recent events in Afghanistan have demonstrated the effectiveness of modern precision guided weapons. Cruise missiles can deliver small warheads with considerable precision. They are relatively slow and would require over an hour to reach their targets. If aircraft can circle,

[3]The United States economy depends on the free movement of people and goods within its borders and is becoming more dependent on international trade. If this free movement of people and goods is impaired by some terrorist action, the economic consequences could be serious. In this age of "just in time" inventory control, a serious impairment of the transportation system could be disastrous. International trade is even more vulnerable. At present, only about two percent of containers shipped to the United States are physically inspected. It would be very difficult to monitor containers before they are loaded and it would not be difficult for a terrorist group to contaminate a container. Imagine the chaos that would result if every container entering the United States had to be inspected by customs inspectors wearing biologically protective gear.

they can deliver larger warheads such as the GBU-28, Even larger warheads such as the BLU-82 can be delivered by C-130 aircraft. Rapid delivery of large warheads, however, requires air superiority. At present, the United States does not have the ability to deliver a large warhead rapidly without control of the air.

The Trident II missile can be reconfigured to deliver a large warhead rapidly without requiring the support of third countries for basing or overflight rights. Our proposal is that the United States reconfigure its Trident II missiles to deliver a 4,500 kilogram kinetic energy warhead. This warhead would have the energy of about 20 tons of TNT.[4]

A Trident II missile in its current configuration can carry a payload of 2,800 kilograms with a range of over 4,000 nautical miles. The velocity of the missile at the end of the second stage burn is 6,000 meters per second. If we include the weight of the third stage engine and the bus, the gross payload is between 4,000 to 5000 kilograms. This suggests that a Trident II missile should be able to carry a 4,500 kg. warhead a distance of 2,000 to 2,500 nautical miles. Such a warhead carrying modern non-nuclear explosives or depleted uranium kinetic weapons can destroy most man-made structures. It may be possible to deploy such a weapon without much delay.[5]

It is possible to modify the GBU-28 to that it can be launched by the clear deck version of the Trident II, and it may be possible to so in a relatively short time.The United States Air Force

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[4] The BLU-82 is a 15,000-pound warhead that is dropped from a C-130 and the GBU-28 is a 2,800-pound laser guided weapon that was developed during the Gulf War to destroy hardened targets. A kinetic energy warhead such as the one we are proposing would have more explosive power than the BLU-82 and could penetrate at least as well as a GBU-28. Essentially what we are proposing is a larger version of the Army's anti-tank sabot round which uses a depleted uranium flechette. Depleted uranium is used because of it high density, and it is not a "nuclear" weapon. We have consulted with Richard L. Garwin on this issue. The only problem he sees is that ionization during reentry may cause the warhead to lose the GPS signal, however, at this point the INS system can take control.

[5] The Trident II has an aerospike that extends at the time of launch to reduce frontal drag. If this is a problem, the submarine can surface prior to launch and attach the aerospike. Given Iraq's lack of ASW capabilities, this should not endanger the submarine.

was able to develop the GBU-28 in less than a month during the Gulf War. The GBU-28 is basically an 8 inch howitzer barrel filled with explosives and a guidance unit attached. Modern GPS-INS guidance units have a CEP (circular error probable) of under 25 meters. If the GBU-28 can be cut down to about 100 inches and filled with depleted uranium, the warhead would weigh 4,500 kilograms. If this warhead is traveling at a speed of 6,000 meters per second, it would have the kinetic energy of over 20 tons of TNT. If such a warhead can be delivered with a CEP under 50 meters, it would be able to destroy almost any man-made structure. It would also make a very effective decapitation weapon as its flight time is under fifteen minutes.

3. Use of Heavy Conventional Submarine-Launched Ballistic Missiles (HC-SLBM) against States that support Terrorists

In the near future the United States may have to confront Iraq. Should that occur, the United States may have to proceed without the support of the countries in the region and some of the countries that supported its action in Afghanistan. Some of these countries may be intimidated by the Iraqi threat or by the fear of the "Arab street." Other countries may prefer the status quo or have commercial ties with the current Iraqi government.

The United States could be denied the use of bases in the area and overflight rights. If the United States is limited in its ability to use force, the conflict could be prolonged, and if the conflict is prolonged, countries in the Middle East could be pressured to use the oil weapon. Thus, any military confrontation with Iraq may have to be short enough so that it is over before the oil weapon could be used.

The use of nuclear weapons is politically very expensive. Nuclear weapons have only been used in very special circumstances. While the decision to use the atomic bomb is still a subject of great controversy, this decision was in many ways a logical extension of existing practices.[6] It was not that different from the attacks on the populations of London, Hamburg, Dresden, and Tokyo. The atomic bomb did no more than what was already being done with conventional weapons by both sides in the war. In fact, more people were killed in the firebomb

[6] See L. Giovannitti and F. Freed, (1965).

raids on Tokyo than by both atomic bombs used against Japan. In the year 2002, the political cost of using nuclear weapons is very high, and it may be impossible to use them in any circumstance short of national survival. Consider the following thought experiment: would we use nuclear weapons on Iraq to avenge the loss of 3,000 people if we had solid proof that Iraq was a party to the attack? We believe not, and we further believe that what is needed is a weapons system that has the capacity to inflict great damage without crossing the nuclear threshold and that does not require the support of third parties.[7]

Ballistic missiles also have substantial political and psychological value. They could strike out of nowhere without warning, and there are no counter weapons available. This is surely obvious to anyone who watched or experienced the Iraqi missile attacks on Haifa and Tel Aviv. Had it not been for the misperceived effectiveness of the Patriot missiles in destroying the Iraqi Scuds, the political damage that these attacks would have inflicted on the coalition would have been much greater, possibly leading even to the breakup of the coalition if Israel had retaliated against Iraq.[8]

This weapon may never have to be used. Before the start of the Gulf War, Secretary of State James A.Baker III warned Tariq Aziz of Iraq that the use of weapons of mass destruction by the Iraqis "would result in the destruction of Iraq as a modern state". This threat was a credible one.[9]

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[7]The taboo may be more inclusive than nuclear weapons. It would be very difficult for the United States to use nuclear weapons or any weapon with potential collateral casualties in the tens of thousands to punish a military dictator like Saddam Hussein. In the Gulf War, the destruction of the dams on the Tigris and Euphrates was ruled out because of possible civilian casualties. (James A. Baker III, personal communication.)

[8] See James A. Baker III, (1995) for a discussion of the political implications of an Israeli reaction to Iraqi Scud attacks. See also Ze'ev Schiff, (1991)

[9] James A. Baker III, personal communication.

Having heavy conventional submarine-launched ballistic missiles would give the United States the power to destroy any man-made structure within fifteen minutes of the decision to do so without using nuclear weapons and without needing the cooperation of any third party.

4. Role of HC-SLBM as part of an ABM system

The United States has already invested heavily in developing an ABM defense. These efforts, in the past, have been limited by various treaty obligations which do not permit it to deploy weapons systems capable of destroying missiles during their vulnerable boost phase. Efforts to develop ABM systems to attack warheads after the boost phase have proven to be technologically difficult, expensive and politically controversial. A number of NATO allies, as well as Moscow and Beijing, oppose the deployment of ABM defense systems. Finally, the rogue states may be able to deploy credible ICBM's before the United States is able to deploy an ABM system.

Many of these problems can be mitigated by modifying the submarine-based Trident II missiles to carry heavy conventional warheads. These missiles can serve three purposes. First, they can be used to attack ICBMs in the pre-launch phase. Second, they would substantially increase the effectiveness of the ABM shield once it is deployed. Third, they can serve as a means of attacking the military and economic infrastructure of an aggressor without crossing the nuclear threshold or leaving the long-term environmental degradation that would follow a nuclear attack. If the United States does not have to cross the nuclear threshold, the credibility of its threats to retaliate is greatly enhanced. This would serve as a deterrent to the political use of nuclear weapons against the United States by minor powers. Inasmuch as these weapons are less attractive, the incentive to acquire them is reduced.

Given the vulnerability of liquid fueled missiles on the launch pad, a counterforce weapon capable of striking within fifteen minutes of the decision to launch would be almost as effective as one that would be able to destroy a missile in its launch phase. At the present time the United States can destroy these missiles, but it would require using missiles that have nuclear warheads. However, heavy conventional warheads on Trident II missiles can accomplish this

mission without using nuclear weapons. This reduces the time pressure on the United States and thus strengthens its negotiating position in efforts to modify or abrogate the ABM treaty.

5. HC-SLBM as Counterforce Weapons

Since the time between designating a target and the arrival of a warhead could be less than fifteen minutes, a Trident II missile armed with conventional warheads would be very effective against a liquid-fueled missile in the pre-launch phase. A liquid-fueled ICBM on a launch pad would be a soft target that could be attacked by cluster bombs or fuel-air explosives carried in the warhead. Further, the ability to attack the enemy's missile prior to launch would reduce the burden on the ABM system after that system is deployed.[10] A party considering using ICBMs to threaten the United States would now have two hurdles to overcome. The first would be concealing the missiles prior to launch and the second would be penetrating the ABM shield.

Consider the following simple example. Suppose the United States had an ABM shield that was 95 percent effective and that the threshold to deter United States freedom of action was a ten percent probability that an American city would be hit by a nuclear warhead. Then an ICBM force of less than three missiles would be sufficient to accomplish this purpose. If, however, the rogue nation has to consider the possibility of United States preventive strikes and the HC-SLBMs were also 95 percent effective, it would have to deploy a force of 40 missiles to meet the ten percent threshold needed to deter the United States.[11] A force of HC-SLBMs backed by an ABM shield would make it substantially more expensive for a rogue nation to field an ICBM force that would limit the United States' freedom of action.

A rogue nation's problems would not be solved if it were able to acquire the technology to harden its missile sites. A 4,500 kg. depleted uranium warhead can destroy a hardened missile

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[10] Kinetic energy warheads such as those discussed above are probably not the best weapons to use against soft targets such as liquid-fueled ICBMs and their support.

[11] Given that liquid-fueled ICBMs are soft targets and that it is possible to target rogue nations' ICBMs with multiple missiles, this is a conservative number if the target has been located. We do not know how difficult it is to locate a liquid-fueled ICBM and its support at the present time.

silo. The United States could destroy the missile silos anytime it felt threatened by targeting a sufficient number of warheads to ensure destruction. Thus, ICBMs based in hardened silos would not survive a U.S. first strike. They would not be useful as a force in being and thus would have little political value. The incentives to acquire them would be greatly reduced, if not eliminated.

The one contingency which is more difficult to address is that of mobile ICBMs. Such weapons would be more difficult to conceal than IRBMs such as the SCUDs. If they are liquid fueled, they would still be vulnerable to attack by a weapon with rapid respond time. A rogue nation attempting to use such a weapon to deter some action by the United States incurs the risk that the United States will locate and destroy the weapon. Since the purpose of having a weapon capable of hitting the United States is to force some concession from the United States, the rogue nation must have confidence that it can deploy and conceal this weapon for a considerable period of time. Thus, the use of submarine-based ballistic missiles with heavy conventional warheads (HC-SLBM) as counterforce weapons may be an effective substitute for an ABM system until rogue nations are able to develop mobile solid fueled ICBMs.

After the rogue nations are able to produce or acquire solid fuel mobile ICBMs, a HC-SLBM force would increase effectiveness of an ABM system. The rogue nation could not be sure that it would be able to conceal all of its mobile ICBMs, and it would run the risk of having a portion of its missile force destroyed prior to launch. The key question is the ability of the United States to track solid fuel mobile ICBMs, since a solid fuel mobile ICBM whose location was known would be very vulnerable to an attack by an HC-SLBM.

6. The Use of HC-SLBMs in Deterrence: Countervalue Targeting

Nothing made by man is ever perfect and there will always be the possibility that an ABM shield will fail to stop all attacking missiles. Thus, deterrence will have to remain a key element in the United State's strategic doctrine. Deterrence is based on the assumption that the

other party behaves in a rational fashion and weighs the costs and benefits of their actions.[12] This doctrine must have two key elements. First is making the probability of a successful attack on the United States sufficiently small that the expected gains to the attacker are outweighed by the expected costs following an American response. Second is making the cost of using ballistic missiles against the United States -- either militarily or politically-- high and credible. This implies that credibility requires that the United States would retaliate, not only for a successful attack on an American city, but also for a failed one..

At the present time, the United States has the capability to destroy most of the population and infrastructure of any country in the world using nuclear weapons. However, the use of this power is not politically feasible. The massive bombing of population centers by the Allied Powers was feasible in World War II only because the enemy became identified as Germany and Japan. A distinction was not made between Hitler and the German people or Tojo and the Japanese people. This is no longer the case. It would be very difficult for the United States to use nuclear weapons with potential casualties in the tens or hundreds of thousands as a political instrument. In the Gulf war, the destruction of the Al Firdos bunker in Baghdad, which was being used as an air-raid shelter by civilians, had very adverse political implications and influenced subsequent targeting and strategy.[13]

It may even be very expensive politically for the United States to retaliate with nuclear weapons in response to a successful attack on an American city. The argument will be made that it is punishing innocents for the sins of their masters. However, the United States has

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[12] See Bueno de Mesquita (1981) for a discussion and defense of this assumption. He also uses the assumption of rationality to analyze past wars. The details of his study are controversial, but he is persuasive in arguing that wars are consistent with rational decision making. Of the 58 major wars fought since the Congress of Vienna, the initiator won 42 of them. Bueno de Mesquita argues that if wars were nonrational events then there should be no systematic relationship between the initiator of a war and the victor. Using the historical record he computed that such an event could have occurred at random only one in 2,500 times. He also computed benefit/cost ratios and found that when wars have occurred it was usually in the interest of one party.

[13]. See Powell, (1995), p. 513.

demonstrated that it will retaliate with conventional weapons. Heavy conventional warheads provide a means of retaliation without crossing the nuclear threshold. One hundred heavy warheads targeted on critical infrastructure such as electrical generation, dams, and other such facilities can impose a high cost on any aggressor without large casualties among the civilian population or long-term environmental consequences.

Many of the possible rogue nations are very vulnerable to attacks on their electrical generation infrastructure. For example, Iran consumes 95 billion kilowatt hours a year and Iraq consumes 27 billion kilowatt hours a year. Iran is reported to have 25,000 megawatts of generating capacity, so this suggests that Iraq has 7,000 megawatts of generating capacity. If we assume that a heavy warhead can destroy 250 megawatts of generating capacity, then100 warheads can destroy all of Iran's electrical generating capacity while 30 warheads can destroy all of Iran's electrical generating capacity.[14] Since the lead time on a large turbine is on the order of two years, the amount of economic punishment that could be inflicted on an aggressor would be enormous.[15] Further, if the boats were on station, the retaliatory attacks could be carried out in a matter of hours, if not minutes. It would not be necessary to get permission from any ally to use its facilities to launch the attack, and it would not be possible to mobilize world public opinion against the attack.

7. The China Question

[14]. The source for the consumption figures is the CIA World Factbook, and the source for Iran's for generating capacity is the United State Energy Information Agency web page. The generating capacity was calculated under the assumption that Iran and Iraq have the same ratio of generating capacity to consumption. Iraq was reported to have 9,000 megawatts of generating capacity before the Gulf War.

[15] In the past the United States has tried to avoid destroying the generating facilities of nations it is attacking by using graphite or metallic filaments to short the transmission lines without destroying the generation plants. However, some reports suggest that as much as 80 percent of Iraq's generating capacity was destroyed during the Gulf War.

The implications of the deployment of HC-SLMBs on United States-China relations are far too complicated to be addressed completely in this paper. However, there are some observations that can be made. First, the most important purpose of Chinese ICBMs, if not their raison d'être, is to limit the freedom of action of the United States (and Russia). Conventional wisdom is that China will respond to a United States deployment of an ABM system by deploying more ICBMs. If the purpose of the ABM shield is to reduce the probability that an American city is hit by a nuclear warhead to an acceptable level, economics favors the Chinese in an ABM-ICBM arms race. Economies of scale suggest that it will be less expensive for the Chinese to deploy more missiles than it will be for the United States to defend against a larger missile force. As the number of warheads launched is increased, the probability that at least one will get through increases rapidly. The law of large numbers is also on the side of the Chinese.

The strategic problem faced by the Chinese becomes significantly more difficult if the United States deployed HC-SLBMs as part of its ABM system. The relevant force then becomes the number of Chinese missiles that would survive a United States preemptive strike.The economics would then favor the United States. The cost of converting the Trident II missiles to HC-SLBMs will be far less than the cost to China of deploying sufficient mobile ICBMs to survive a United States preventive strike in sufficient numbers to penetrate a United States ABM shield.

Consider the following mind experiment. Suppose China endures the economic costs of building enough missiles so that it is capable of launching a limited attack against the United States such that a few of its missiles would penetrate America's ABM defense. This is, as we have noted, a big cost to China as compared to the U.S. The United States has economic advantage in the production of HC-SLBMs as compared to the price China must pay to produce additional ballistic missiles. Under the hypothetical scenario, China retains a limited ability to retaliate against aggression initiated by the US. Except under the most extreme circumstances, the losses the United States could anticipate from a Chinese response to an American attack, while limited, probably would be greater than the benefits expected from initiating aggression against China. The partial leakiness of American defenses alone, then, can help improve stability

between the US and China by diminishing China's fear of an American attack. At the same time, if the Chinese launched a nuclear attack against an ABM-defended United States, the US retaliation is likely to do severe damage to China's more limited economic infrastructure. This fact makes the risk that China would initiate an attack against the United States very low. Thus, by adding HC-SLBMs to an ABM defense, relations between China and the US probably would be stabilized at an economically acceptable cost, while rogue states would be neutralized.

8. Remarks

It would not be economical to develop new ballistic missile submarines to carry conventional warheads, but the cost of developing missile subs has already been incurred and the need for submarine-launched nuclear missile is less pressing. It is likely to be less expensive to convert the Trident II missiles to carry conventional warheads than it would be to convert the submarines to carry cruise missiles. Since the submarines do not need escorts, they can remain on station at a lower cost than a carrier task force and thus may reduce the cost of projecting power if they can serve as a substitute for carriers in some functions.

The ability to deliver a warhead on target in fifteen minutes means that HC-SLBMs could be used as a decapitation weapon that would require less intelligence resources than the weapons now in the inventory.[16] It would eliminate the need of having to be able to predict where the target will be hours in the future and the size of the warhead would make it feasible to attack fortified command and control centers.

9. Conclusions

The deployment of heavy conventional submarine-launched missiles has four major advantages. First, it gives the United State a means of delivering large warheads rapidly without requiring the consent of other nations either for overflight rightsor for basing. Second, it permits the deployment of a counter weapon early, while the ABM system is being perfected. Third, after

[16] The *Washington Post* on December 23, 2001 reported that the United States was tracking Osama bin Laden, but the intelligence could not provide his location six to ten hours in the future needed to use Tomahawk missiles from a ship or submarine in the Arabian sea.

the ABM system is deployed, it complements such a system as a potential aggressor now faces two hurdles.The first would be concealing the missiles prior to launch and the second would be penetrating the ABM shield. Its missile force can be attacked prior to launch and the burden on the ABM system is decreased as it only has to stop enough of the missiles that survive to make an attack not worth it in the first place. Finally, it creates a credible deterrent to the political use of ICBMs against the United States. The United States can threaten to punish a nuclear threat against it by an attack on a substantial part of the aggressor's infrastructure. Since this threat could be carried out quickly and without crossing the nuclear threshold, the threat should be a credible one.

A world in which minor powers have ICBMs with nuclear warheads is not a return to Mutual Assured Destruction (MAD). However, it is still a world in which an expected value calculus is an important element of strategic behavior. Nuclear weapons in the hands of minor powers are not intended to be used and their only strategic value is as means to deter the United States' freedom of action. The decision on the part of these states to use these weapons depends on their perceived effectiveness and the perceived cost that would result from using these weapons, as well as well as the importance of the issue involved.

At the moment the United States has the ability to launch a preemptive nuclear first strike against any country that threatens it with nuclear weapons and to inflict as much damage as it wishes on that country's economy and infrastructure. A nation that uses nuclear weapons to threaten the United States is making the calculation that whatever is at issue is not important enough for the United States to pay the political price of crossing the nuclear threshold. An ABM shield alone decreases the magnitude of the threat to the United States. An ABM shield that includes ballistic missiles with conventional warheads reduces the threat substantially, by.a factor of ten more than the ABM alone. It also introduces the possibility that the United States could punish the aggressor without having to cross the nuclear threshold. The strategic value for minor powers of ICBMs with nuclear warheads would drop sharply.

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