

BUILDING THE CASE FOR SEA-BASED NUCLEAR DETERRENT

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This paper undertakes the task of engaging with the concept of nuclear deterrence and the debates surrounding the efficacy of various nuclear delivery vectors, in order to flag the role of the sea-based nuclear deterrent role carried out by SSBN (Ship Submersible Ballistic Nuclear) submarines. The paper accomplishes this task by measuring the utility of all three nuclear delivery vectors against the gradient of strategic stability. Strategic stability is defined as an equilibrium situation where the belligerents have no incentive for launching a preemptive attack against one another. The ideal stabilising weapons would have two characteristics: high probability of pre-launch survival and high Circular Error Probability (CEP), so that they cannot be used for counter force missions. This paper maintains that the inherent value of nuclear weapons is to deter the use of such weapons and nuclear weapons are not meant for nuclear war-fighting. With this axiom in place, the paper asks the following questions: is a nuclear triad absolutely necessary to have a valid nuclear deterrent? How have the technological advancements in submarine design, missile accuracy, and anti-submarine warfare capabilities impacted on SSBNs from carrying out their traditional role of nuclear deterrence?

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BACKGROUND

The last days of World War II saw the introduction of two new weapons, namely, the missile and the nuclear bomb. The subsequent years saw the inevitable mating of these two weapons into one system, revolutionising warfare and shaping the national defence strategies of almost all major nation-states. It is important to note that the point of departure was post mating of the nuclear warhead and ballistic missile delivery system, and not when long-range bombers were the sole means of nuclear delivery. Although Stanley Baldwin in 1932 famously predicted in the British Parliament that “the bomber will always get through”, the experiences of World War II have shown the limitations of bombers in delivering gravity bombs. The early days of Allied bombing runs inside Germany, especially day-time bombing, saw heavy losses inflicted on low-flying bombers by anti-aircraft guns and fighters.¹ The survival increased significantly after long-range fighter escorts were provided and the bombing ceiling was raised to avoid flak; which, however, greatly reduced the accuracy of the bombs.² To compensate for lower accuracy, a greater number of bombers was allocated to each target. This strategy could not be adopted in the case of nuclear weapons, at least in the initial years after World War II, as neither the United States nor the Soviet Union had sufficient numbers of nuclear weapons to arm hundreds of bombers, and the technological development of fighters (with jet engines and swept wings) was ahead of the bomber technology.

1. Several studies have shown that most pilots released their bombs way short of their designated target in order to escape heavy anti-aircraft fire near vital target locations. Furthermore, the rudimentary Norden bombsights in these bombers were highly inaccurate, not guaranteeing a high confidence in hitting the target even when the bombs were dropped in their designated weapons release points.
2. Horst Boog, Gerhard Krebs, and Detlef Vogel, *Germany and the Second World War: Volume VII The Strategic Air War in Europe and the War in the West and East Asia 1943-1945* (Oxford: Clarendon Press, 2006), pp. 46-47.

It was only after the nuclear bomb was mated with a missile did offence gain superiority over defence and the following lessons were driven home: first, there was no high confidence defence against incoming missiles and no large-scale shelter for the population against a nuclear blast. Although the Soviet Union and United States, along with Britain, engaged in building nuclear shelters and talked about nationwide Anti-Ballistic Missile (ABM) shields, it was widely believed that a few warheads would always get through, and although the top leadership could be protected for a limited time period in underground bunkers, there were no concerted nationwide efforts to build underground bunkers for the population.³Second, since active defence against incoming nuclear missiles became difficult, nation-states began to contemplate deterrence strategies for national defence.⁴

One of the primary reasons given by experts for the utility of nuclear bombers was their long flight time and theoretical ability to be recalled at the last minute, thereby allowing negotiations to be carried out till the moment of weapon release, and diplomatic signalling.

Deterrence theorists have been grouped together into three succeeding waves of thought by scholars, even though their works differ significantly in scope, content, and conclusions. The first wave theorists, writing at the dawn of the nuclear era, such as Bernard Brodie, Arnold Wolfers, and Jacob

3. The Soviet Union tried to build large-scale nuclear bunkers for a certain percentage of its population, a relatively earnest effort compared to that undertaken by the US and Britain, at least until the mid-1960s. For an informed analysis on the issue, see Tricia Ann Vislay "A Comparison of US and Soviet Strategic Defensive Doctrine," Master's Thesis (Monterey: Naval Postgraduate College, 1987).

Later, there was a convergence in Soviet and American thinking on nuclear war and the Soviet Union's preference for the nuclear war-fighting doctrine was debunked for the American doctrine of nuclear deterrence. See Donald W. Hanson "Is Soviet Strategic Doctrine Superior?" *International Security*, vol. 7, no. 3, Winter 1982-82, pp. 61-83.

4. Although Bernard Brodie contemplated way back in 1946 in his book *The Absolute Weapon*, that the chief purpose of the military has changed from winning wars to preventing them, and that the only defence against a nuclear attack was a retaliatory strike in kind, the American leadership was still under the hysteresis of a conventional war mindset. This is evident from US nuclear strategy during the 1950s, which contemplated using nuclear weapons on Soviet cities and industrial hubs to prevent Soviet expansionism in Western Europe and Gen McArthur's demand to President Eisenhower to use nuclear weapons against China during the Korean War, etc.

Viner, accepted the awesome power of nuclear weapons as a marked point of departure in our thinking on war, and propagated a deterrence strategy as being superior to nuclear war-fighting. However, these theorists were largely ignored by the American political leadership.⁵ The second wave theorists such as Thomas Schelling, Glen Snyder, and Albert Wohlstetter emerged in the late 1950s, with the maturity of the Soviet nuclear arsenal and the emergence of bipolarity and the undermining of the United States' credibility in meeting a Soviet aggression with nuclear retaliation. These theorists promulgated the rational choice theory as the analytical tool to understand nuclear deterrence. The third wave theorists such as Robert Jervis, Alexander L. George and Richard Smoke who emerged during the 1970s and 1980s criticised the hyper-rational actor model of the previous wave theorists. These theorists instead used the case-study approach and drew on the recent breakthroughs in social-psychology to emphasise the behavioural and organisational deviations of decision-makers from established patterns of rationality. According to some scholars, there is a new wave, termed as the fourth wave in deterrence research, which breaks away from the realist paradigm of previous waves. These fourth wave scholars use the constructivist and interpretative approach to question the classical empirical issue of state versus nuclear deterrence and to focus on new emergent threats such as terrorism, rogue states, ethnic conflicts, etc. While this paper recognises the valuable contributions made by the first and fourth waves to deterrence literature, the topic of this paper concerns itself primarily with the theories of the second and third waves.

The primary difference between defence and deterrence is that the latter hinges on an expectation that hostilities would not break out, while the former is a strategy to mitigate damage when hostilities do break out. Defence is about limiting the damage done to oneself by the adversary, while deterrence is a psychological attempt to prevent the enemy from attempting to harm oneself in the first place. There are two kinds of deterrence: first, deterrence by denial incorporates defence strategies to blunt an enemy's

5. Robert Jervis "Deterrence Theory Revisited," *World Politics*, vol. 31, no. 2, January 1979, pp. 289-324.

attack and extract heavy costs from him on the battlefield, so that he does not contemplate an attack for fear of being unsuccessful; second, deterrence by punishment aims to deter an aggressor by making him believe that his attack would invite retaliatory actions which would offset any expected gains from his attack. The similarities between the two kinds of deterrence is that they both rely on convincing the opponent that the deterrer has the capability and resolve to deter, and the expectation that the opponent is rational and there is no information asymmetry (private information, perceptual biases, etc.) regarding the threat issued. The difference between the two is that while deterrence by denial entails active defence and battlefield failure as the plank on which deterrence success is based, deterrence by punishment relies on convincing the adversary to abstain from initiating an attack for fear of punitive strikes. In the age of nuclear weapons, the ultimate guarantee from a nuclear attack rests on the ability of a state to absorb a nuclear first strike and still have enough surviving nuclear capability to deliver a debilitating nuclear strike on the attacker.

MUTUALLY ASSURED DESTRUCTION AND ASSURED SECOND STRIKE CAPABILITY

Two technological developments ushered in the golden era of nuclear deterrence when economists and mathematicians made forays into the erstwhile domain of political scientists and military professionals. First, during the 1950s and early 1960s, the United States became increasingly aware of the Soviet nuclear forces which surpassed American estimates. Furthermore, the growth of the Soviet nuclear arsenal coupled with conventional Soviet superiority in Europe created doubts about the credibility of the American nuclear guarantee to Western Europe. How could the threat of massive retaliation ever be credible when carrying it out would definitely result in a devastating counter-retaliation? The American threat of massive retaliation against a Soviet aggression in Western Europe or damage limitation strikes against American soil lost credibility as any aggressive move on the part of the Soviet Union would mean mutual suicide. American decision-makers felt that in the absence of a credible nuclear deterrent, they would fall prey

to the Soviet Union's 'salami-slicing tactics'. Schelling recognised that the credibility of the United States' nuclear arsenal depended on creating fear in the Soviet Union that any escalation could result in an explosive escalation to general nuclear war. In the case of a Soviet aggression, the United States would take steps which would increase the likelihood of a general nuclear war.⁶ The fulcrum of this deterrence strategy rested on making threats that left "something to chance". Schelling suggested that both belligerents should create an array of limited options each of which could serve to raise the risk of an explosive escalation to a general war. No single option would by itself mean such a war, but would merely increase the risk of a spasmodic nuclear release. By incorporating the risk of a general war built into the array of options, the risk of escalation to a general war could be manipulated, thereby offering the adversary a spectrum of risk. This created space for competitive risk-taking by demonstrating resolve and, thereby, allowed bargaining during a crisis.⁷

The second development was the maturation of the Inter-Continental Ballistic Missile (ICBM) capability of both the United States and Soviet Union, along with nascent SSBNs, which rendered at least some weapons invulnerable to a first strike. The inability of either state to carry out a successful disarming first strike became the hallmark of the modern nuclear age. This invulnerable nuclear force meant that the state could retaliate in nuclear kind even after suffering a debilitating nuclear first strike; thereby possessing assured second strike capability. The usual weapons of retaliation are ballistic and cruise missiles launched from fixed land-based silos, Transport Erector Launchers (TELs), SSBNs, and bombers or attack aircraft. The value of any nuclear delivery vector has to be measured against the gradient of its survival factor. The higher the survival factor, the more stabilising effect the delivery mechanism possesses. Contrarily, vulnerability to the enemy's first strike makes a weapon system strategically unstable.

6. Thomas Schelling, "Nuclear Strategy in Europe," *World Politics*, April 1962, p. 428. Also see Bernard Brodie, *Escalation and the Nuclear Option* (Princeton, New Jersey: Princeton University Press, 1966), p.25; Glenn Snyder, *Deterrence and Defense* (Princeton, New Jersey: Princeton University Press, 1961), pp.104-110.

7. Schelling, *Ibid.*, pp.421-428.

STRATEGIC STABILITY

Traditionally, strategic stability has been defined as the absence of meaningful incentives for preemption by either belligerent. For any weapon system to be classified as strategically stable, it should fulfill two criteria: first, it must be invulnerable to an enemy's attack; and, second, it should not threaten the adversary's nuclear weapons.⁸ Bernard Brodie wrote way back in 1946 in *The Absolute Weapon* that once deterrence fails, the pressure to use the bomb might reach unbearable proportions as either side would feel that its relative position regarding its ability to use the bomb might deteriorate as the war progresses, and that if it fails to use the bomb while it has the chance to, it might not have the chance later on.⁹ Building on Brodie's work, Thomas Schelling, in 1958, using a mathematical model, showed the instability in the deterrence relationship between two adversaries even if there is a modest temptation (due to the probability of carrying out a successful first strike) for each side to carry out a preemptive strike.¹⁰ According to Schelling, the only solution to dispel the fear of preemption is to exchange hostages as collateral.¹¹ To achieve a level of strategic stability, Schelling proposed increase in the survivability of the US retaliatory capacity by increasing the size and alertness level of the US' nuclear arsenal, and stalling the development of first strike weapons which might be used for damage limitation against the Soviet arsenal.¹² Schelling's recommendations became the major source for the change in the US nuclear strategy towards Mutual Assured Destruction (MAD), which till date remains the fundamental rubric of every nation's nuclear strategy.

After establishing the fundamental concepts of nuclear deterrence, this paper will now tackle the primary question posed at the beginning

8. Robert D. Glasser, "Ending Misconception of Strategic Stability: The Role of Nuclear Missile-Carrying Submarines," *Journal of Peace Research*, vol. 29, no. 1, February 1992, pp. 23-37.

9. Bernard Brodie, *The Absolute Weapon: Atomic Order and World Order* (New Haven, Connecticut: Yale Institute of International Studies, 1946), p.46.

10. Thomas Schelling, *The Reciprocal Fear of Surprise Attack* (Santa Monica, California: RAND Corporation, 1958).

11. Ibid.

12. Thomas Schelling, "Surprise Attack and Disarmament," in Klus Knorr, ed., *NATO and American Security* (Princeton, New Jersey: Princeton University Press, 1959), p.194;

Thomas Schelling, "Reciprocal Measures for Arms Stabilization," *Daedalus*, vol. 89, no. 4, Fall-1960, pp.892-914.

While land-based ICBMs are excellent counter-force weapons, they are also reciprocally susceptible to enemy attack. The high accuracy and high vulnerability nature of land-based ICBMs fosters strategic instability and impedes stable nuclear deterrence.

of the paper. The following sections will make brief forays into the technology and strategy of each nuclear delivery vector to synthesise an understanding on the efficacy of the nuclear triad.

Air-Delivered Nuclear Deterrent

The first platforms to deliver nuclear weapons were propeller driven bombers from land bases and aircraft carriers. In the mid-1950s, jet powered bombers replaced the propeller driven bombers, reducing the nuclear delivery transit duration to 6-10 hours. Despite the development of Inter-Continental Ballistic Missiles (ICBMs) and Sea-Launched Ballistic Missile (SLBMs) in the late 1950s and early 1960s, the nuclear bombers were retained for the nuclear delivery role by all nuclear weapon states. One of the primary reasons given by experts for the utility of nuclear bombers was their long flight time and theoretical ability to be recalled at the last minute, thereby allowing negotiations to be carried out till the moment of weapon release, and diplomatic signalling.¹³ Another reason for retaining nuclear capable bombers during the early days of missiles was their warhead delivery accuracy (as missiles lacked terminal guidance), ability to carry diverse warheads, and flexibility of use under various war-fighting scenarios. Furthermore, in the initial days of liquid-fuelled ICBMs, the bomber was considered more survivable than the missile. George J. Rufuto draws two interesting scenarios to illustrate the synergistic relationship between ICBM silos and bombers.¹⁴ According to the first scenario, the varying flight time (depending on the location of the missile launch) of ICBMs and SLBMs, and the inaccuracy of

13. Scott Sagan and Jeremy Suri showed how President Richard Nixon ordered the Strategic Air Command to increase the alertness level of bombers to signal to the Soviet Union to exert its influence on Vietnam during the Paris Peace Talks in 1969. See Scott D. Sagan and Jeremy Suri, "Madman Nuclear Alert: Safety, Signaling, and Safety in October 1969", *International Security*, vol. 27, no. 4, Spring 2003, pp.150-183.

14. George J. Rufuto, *Evolution of the US Sea-Based Nuclear Missile Deterrent* (United States: Xlibris Corporation), pp.67-68.

SLBMs (at least, until the Trident) meant that the SLBMs would be used against air bases and not ICBM silos. When the SLBMs are detected, the ICBMs would still be en route, thereby giving the adversary enough time to launch a counter-strike. In the second scenario, the ICBMs are launched ahead of the SLBMs to enable the simultaneous arrival of ICBM and SLBM warheads at their respective target groups. The long flight time of the ICBMs and their detection by multiple early-warning satellites, air and ground-based radars would make the bombers become airborne in anticipation of impending SLBM strikes on air bases. These two scenarios demonstrate the necessity of retaining bombers, at least before SLBM

Morganstern's central argument was that the presence of strategic bomber and ICBM bases within the continental United States readily created a sizeable counter-force target (leaving aside high-priority counter-value targets, such as the seat of the US leadership, important industrial and population centres, etc.), resulting in potential warhead saturation over the US mainland.

accuracy increased to carry out counter-force strikes. The Strategic Air Command (SAC) retained control over both land-based missiles and nuclear bombers under its command so that in case of a Soviet first strike, at least one more leg of the triad would survive, along with the sea deterrent. Another use of the nuclear bombers was as a "slow" counter-force weapon during the inter-war period (if negotiation breaks down and fighting resumes) to bomb Peak Overpressure Vulnerability Number (PVN) targets which were unused during the first exchange or are/could be reloaded by reserve ICBMs.¹⁵ As technology progresses, bomber survivability increases with increased speed, lower radar signatures, ability to terrain-mask (low level penetration), stealth, and, lastly, the ability to deploy long-range stand-off nuclear munitions. The main argument against keeping nuclear bombers is that they need a base to operate from which cannot be hardened against a nuclear attack or sabotage.

15. Ibid., pp.68-69.

Land-Based ICBM Deterrent

Historically, the land-based ICBM in hardened underground bunkers has been the most accurate and survivable nuclear delivery mode. These nuclear silos containing ICBMs or cruise missiles are built conformal to the earth and hardened by layers of cement and steel and have very high PVN characteristics, requiring the direct ground-burst nuclear detonation to be neutralised. Table 1 shows the Single-Shot and Double-Shot Kill Probabilities (SSPK and DSPK) for the US ICBM and SLBM warheads attacking active Russian silo types¹⁶:

Table 1

Warhead	Yield	CEP	SSPK (SS-18, Silo Type III-F)	DSPK (SS- 18, Silo Type III-F)	SSPK (SS- 11/19, Silo Type III-G	DSPK (SS- 11/19, Silo Type III-G	SSPK SS(SS-11/19, Silo Type III-G MOD)	DSPK SS(SS-11/19, Silo Type III-G MOD)
W76 (Trident I)	100	500	0.022	0.044	0.024	0.047	0	0
W76 (Trident I)	100	229	0.103	0.195	0.112	0.211	0	0
W76 (Trident II)	100	183	0.155	0.286	0.169	0.309	0	0
W76 (Trident II)	100	129	0.286	0.490	0.309	0.523	0	0
W62 (MM III)	170	183	0.230	0.407	0.254	0.443	0.183	0.333
W78 (MM III)	335	183	0.360	0.590	0.403	0.644	0.299	0.509
W88 (Trident II)	475	183	0.442	0.689	0.496	0.746	0.375	0.609
W88 (Trident II)	475	129	0.687	0.902	0.744	0.934	0.608	0.846
W87-O (MX)	300	91	0.805	0.962	0.848	0.977	0.726	0.925

Courtesy: The U.S. Nuclear War Plan: A Time for Change, National Resources Defence Council (2001).

16. For Trident I and Trident II warheads, a range, if given, for Circular Error Probability (CEP).

Table 1 shows that the warhead yield and accuracy of land-based ICBMs exceeds those of modern SLBMs and they have high kill probability even for the most hardened Russian nuclear missile silos. While land-based ICBMs are excellent counter-force weapons, they are also reciprocally susceptible to enemy attack. The high accuracy and high vulnerability nature of land-based ICBMs fosters strategic instability and impedes stable nuclear deterrence. While ICBMs impede nuclear deterrence, they have excellent nuclear war-fighting qualities. The high number of land-based ICBM silos ensures that they will absorb a huge quantity of the enemy's nuclear arsenal, and thereby deplete their nuclear stockpile in counter-force operations, leaving precious little to be used against counter-value targets. However, in reality, targets are not purely counter-force or counter-value, and often nuclear silos, air bases, and submarine bases are located close to population centres, thereby, blurring the counter-force and counter-value targets dichotomy. A major disadvantage of land-based ICBMs are that they are expended after firing a single shot and since pre-launch survival is low, they are on launch on warning alert status.

While silo-based ICBMs might be vulnerable to first-strike weapons, the canister launched ICBMs on TELs have higher probability of survivability due to their mobility. The invulnerability of such weapon systems from enemy attack is not conditioned on the accuracy of the enemy's missiles but on precise intelligence on their position. However, such systems when deployed are susceptible to theft by non-state actors, sabotage from covert enemy forces or peace groups, etc.¹⁷ Furthermore, if these weapons are deployed during times of crisis, they can be interpreted by the adversary as attempts at coercion by aggressive signalling, or worse, as an indication of an imminent nuclear strike, increasing the probability of preemption.

Hardening Draws Fire Thesis

While the previous two sections elaborated on the various advantages and disadvantages of air-delivered nuclear warheads and land-based ICBMs,

17. RAdm Raja Mohan (Retd.), *A Nuclear Strategy for India* (New Delhi: Sage Publication, 2000), pp.220-224.

there is a common disadvantage shared by both these two nuclear delivery vectors. Oskar Morganstern, who was a mathematical economist from Yale University, forwarded an argument for the sea-based nuclear deterrent. He propounded that there was a fundamental problem with hardening of strategic bomber and missile bases within what he referred to as the Zone of Interior (ZI)¹⁸, or continental United States, in order to achieve invulnerability against a Soviet first strike.

It was shown how hardening of SAC and missile bases draws fire and how the better the hardening, the more the fire increases. Heavier and heavier bombs with yields in the high megaton range have to be used. The better our anti-air and anti-missile defense becomes, the more bombs will be used in any onslaught. This goes for fixed installations. Air bases will always be fixed, and if the placements of planes are to be made mobile, they will have to travel from one base to the other, requiring many bases. Or they will have to be kept in the air. At any rate, they retain their dependency on fixed bases that they must use at intervals of a few hours.

Missiles could conceivably be moved around within the country. This would be a formidable operation and is out of the question at present, since the missiles require large towers, complicated electronic gear and long count-down periods before being ready for firing.

The attacker's fire is drawn into the Zone of Interior if we hold out the main force there and harden it. This is the tendency now developing. We also hold some of our retaliatory forces in allied countries.¹⁹

Although Morganstern was writing at a time when the primary mode of nuclear delivery comprised the lumbering B-47 and B-52 bombers located throughout the continental United States along with non-silo configured SM-65D Atlas D ICBMs, the thesis is still valid the modern day. Although basing of strategic bombers and ICBMs allied in countries can dissipate some of the first strike threat, they are subjected to lengthy diplomatic

18. Oskar Morganstern, *The Question of National Defense* (New York: Random House, 1959), p.82.

19. *Ibid.*, pp.81-82.

parleys, domestic political considerations, and are the focus of the anti-nuclear lobbies of neighbours.

Morganstern's central argument was that the presence of strategic bomber and ICBM bases within the continental United States readily created a sizeable counter-force target (leaving aside high-priority counter-value targets, such as the seat of the US leadership, important industrial and population centres, etc.), resulting in potential warhead saturation over the US mainland. In other words, any attempt to create passive or active defence of the US nuclear deterrent force within the continental United States would increase enemy efforts (in terms of increased warhead allocation to each target)²⁰. Morganstern recommended moving the strategic nuclear deterrent or retaliatory force out of the ZI and into the oceans:

Basically, this amounts to moving our main strategic retaliatory force out of the United States, out of the Zone of Interior, but not into the lands of our allies. This is the alternative to hardening the Zone of Interior.

Holding our main retaliatory force at sea makes the greatest immediate contribution to the defense of the country: it protects the force proper and it frees the country thereby from direct and indirect effects of a possible attack on the force itself.²¹

Morganstern's suggestion translated into theoretically minimising the nuclear strike impact on the continental United States by removing counter-force targets such as bomber bases and ICBM bases from the mainland and alternately deploying them on sea-based platforms. Morganstern believed that this shift of fixed bases on land to mobile bases at sea was to be accomplished by nuclear-armed and jet-propelled sea planes (somewhat like the Soviet era's Erkanoplanes) and nuclear armed submarines. Although the former nuclear delivery method was never pursued seriously, the United States followed the second suggestion in great earnest.

20. This is based on the assumption that the US and USSR nuclear strike forces are of comparable technological level. Otherwise, better technology in terms of higher penetrability probability would make part of the argument null.

21. Morganstern, n.18, pp.81-82.

The increased accuracy of SLBMs has urged many scholars to refute the status of the SLBM as a strategically stable weapon system.

Sea-Based Nuclear Deterrent

SSBNs are nuclear powered and carry long range SLBMs, and their deployment schedules and deployment areas are kept secret, guaranteeing high confidence in pre-launch survival. Furthermore, SLBMs can be fired at depressed trajectories from close to the enemy's coast, thereby limiting missile flight-time and decreased detection and response time. Both these components paired with

the increased accuracy of SLBMs, make the SSBN the most potent nuclear delivery mechanism. The high confidence in the deterrent role performed by SSBNs can be gauged by Britain's decision in 1982 to retire its nuclear capable Avro Vulcan bombers and make the Vanguard Class SSBNs the sole means of Britain's nuclear delivery mechanism.

The exceptional pre-launch survivability of a deployed SSBN and inability of SLBMs for counter-force strike roles made many deterrence theorists, especially the proponents of MAD, support the idea that both United States and Soviet Union should move their entire retaliatory capability into the ocean. The enthusiasm for SSBNs as the sole nuclear deterrent rested on the assumptions that SSBNs enhanced strategic stability. Thomas Schelling and Morton Halprein stated:

...there is a growing recognition that the Polaris submarine may embody many of the qualities that we and our potential enemies would be seeking through arms control to embody in our strategic weapon systems...it may prove to be an ideally 'retaliatory' and 'deterrent' weapon, particularly if possessed by both sides...²²

EVALUATING THE STRATEGIC STABILITY VALUE OF SSBNs

The initial enthusiasm for SSBNs as weapons promoting strategic stability was based on the erroneous assumption that the submarine technology of

22. Thomas Schelling and Morton Halprein, *Strategy and Arms Control* (New York: Twentieth Century Fund, 1961), p.53.

the United States and Soviet Union was at the same level. Soviet analysts had little reason to be confident that any of their own submarines would survive in a war with the West; at least in the initial phase of SSBN deployment. McNamara states that in 1965, the Soviets had only 8 to 10 nuclear powered submarines, of which only 2 or 3 carried SLBMs (the 700 nautical mile range SS N-5) that could be launched under water.²³ However, these submarines were very noisy and they could only launch their weapons on the US from areas that had a high concentration of US Anti-Sea Warfare (ASW) assets.²⁴ The Soviet

submarines based at Murmansk had to transit the Greenland-Iceland-UK gap to reach the open waters, while those based at Vladivostok had to travel through the Kunashir Channel. The ability of Soviet submarines to gain access to the open waters became even more difficult after the United States set up sonar arrays under the Sound Surveillance System (SOSUS). This could be one of the primary reasons for the Soviet bastion strategy for their SSBNs; the fear of detection and thereby constantly being trailed by US nuclear powered hunter killer submarines. Moreover, Soviet ASW capabilities were abysmal compared to those of the United States, which, during times of crisis, would put asymmetrical pressure on submarine commanders of the US and Soviet Navies to launch their SLBMs; thereby creating incentive for preemption. Another reason for the Soviet Union's limited reliance on SSBNs was the fact that Soviet SLBMs had electro-mechanical locks to prevent submarine crews from firing their missiles

All matured nuclear powers either have SSBNs or canister-launched ICBMs on TELs, or both, which guarantee the survival of sufficient numbers of nuclear weapons to fulfill the deterrent role. This invulnerability of land-based nuclear weapons is independent of missile accuracy.

23. Robert McNamara, Statement of Secretary of Defense Robert McNamara before a Joint Session of the Sub-Committee on Department of Defense Appropriation on Fiscal Year 1968-72 Defense Program and 1968 Defense Budget (Washington, D.C.: US Government Printing Office, January 23, 1967), pp.59-61, in Robert Glasser, "The Role of Nuclear Missile-Carrying Submarines", *Journal of Peace Research*, vol. 29, no. 1, February 1992, pp.23-37.

24. Tom A. Stefanik, *Strategic Antisubmarine Warfare and Naval Strategy* (M.A.: Lexington, Books, 1987), p.279.

without first receiving an 'unlock' code from the Soviet Naval Command.²⁵ In this case, a successful counter Command, Control and Communications (C3) strike would render the SLBNs inside Soviet SSBNs unusable.²⁶ The clinching argument against the strategic stability value of SSBNs actually comes from within the US Navy. The SLBM production programme was neglected by the US Navy for fear of diverting funding from other high-priority navy projects. The US Navy's interest in acquiring SLBMs peaked only after the report of the Technological Capabilities Panel (also referred to as the Killian Report) of 1955 concluded that the US nuclear deterrent was seriously threatened by Soviet nuclear weapons, and recommended rapid deployment of land-and sea-based ballistic missiles. The Killian Report suggested that land-based ICBMs were more cost-effective than SLBMs; it was the fear that funding would go to the air force that made the US Navy emphasise the importance of force survivability.²⁷ Furthermore, the lengthy maintenance schedules on SSBNs ensures that even during times of high alert, a certain percentage of the SSBN fleet would remain at port, thereby vulnerable to attack.

It should also be mentioned that although the nuclear powered submarines can theoretically remain at sea for decades, in reality, they need frequent maintenance at port facilities. Robert Glasser states that during peace-time, 50 percent of the US SSBN fleet and only 25 percent of the Soviet fleet is deployed.²⁸ This number can be increased to 80 percent for the US fleet and 60 percent for the Soviet fleet during times of high alert. This means that SSBNs are also susceptible to sneak attacks. Glasser also states that if a Soviet first-strike wipes out 50 percent of the US SSBN force, which equates to 720 vulnerable warheads at each of the four SSBN bases by devoting two warheads per base, they can destroy about 2,100 warheads

25. Robert D. Glasser, "Ending Misconception of Strategic Stability: The Role of Nuclear Missile-Carrying Submarines," *Journal of Peace Research*, vol. 29, no. 1, February 1992, p.26.

26. An alternative explanation for Soviet reliance on land-based ICBMs (silo-based and on transporter erector launchers) could be accredited to the geography and low population density of Soviet Union, when compared to countries such as the Britain, France, and United States.

27. Harvey M. Sapolsky *The Polaris System Development, Bureaucratic Pragmatic Success in Government* (Cambridge, M.A: Harvard University Press, 1972), p.41.

28. Glasser, n.25, p.27.

at a cost of only eight to ten warheads.²⁹ The vulnerability of SSBNs at port drives home the lesson, “An SSBN not at sea, is not a nuclear deterrent”. The induction of SLMBs with Multiple Independent Reentry Vehicles (MIRVed) has made the sea-based nuclear deterrent more robust. For example, the UGM-133 Trident II or Trident D5 can potentially carry 14 thermonuclear warheads (W88 and W76 warheads of 100 KT yield) and even if a modest force survives, it can deliver a punishing retaliatory strike; thereby fulfilling its deterrent role. The increased vulnerability of the SSBN at port is offset by increasing the destructive capacity of an individual boat.

While invulnerability from enemy attack is only half the criteria necessary for achieving strategic stability, the other criteria is the inability to target the enemy’s nuclear weapons; which translates into limited accuracy of the weapon system. SLBMs suffered from high Circular Error Probability (CEP) due to the inability of the SSBN to accurately measure its position and velocity relative to its environment. This made land-based ICBMs more accurate relative to SLBMs; at least, until the deployment of the UGM-133 Trident II (Trident D5) which uses astro-inertial guidance with inputs from global positioning satellites, and brings its CEP under 90 m after travelling a distance of 12,000 km. The increased accuracy of SLBMs has urged many scholars to refute the status of the SLBM as a strategically stable weapon system. The lack of accuracy is an unwarranted criterion for a weapon to qualify as a stable system for two primary reasons: one, as technology progresses, missiles are bound to have increased range, higher speeds, increased accuracy, be more portable, etc. It is unrealistic to assume that technology would remain constant. Two, all matured nuclear powers either have SSBNs or canister-launched ICBMs on TELs, or both, which guarantee the survival of sufficient numbers of nuclear weapons to fulfill the deterrent role. This invulnerability of land-based nuclear weapons is independent of missile accuracy. This paper posits that the invulnerability of a weapon system from first strike weapons, when deployed, should be a sufficient condition for a weapon system to enhance strategic stability.

29. Ibid.

CONCLUSION

The paper started with the assumption that the primary purpose of nuclear weapons is to maintain nuclear deterrence and the deterrent value of any nuclear weapon system is measured against the gradient of strategic stability. The paper challenged the criterion of 'reduced accuracy' of the nuclear weapon system as a necessary condition for strategic stability and demonstrated that the 'invulnerability' criterion is a sufficient condition for strategic stability. In this light, long range bombers and attack aircraft are the most destabilising weapon systems because air bases cannot be hardened against a nuclear attack by passive defence, and active defence systems (such as anti-ballistic missiles) have not yet achieved the desired level of kill probability. Although the advancements in stealth technology, low level penetration, electronic counter-measures, use of long range stand-off munitions, etc. have increased the survivability of bombers/attack aircraft on missions, the air bases remain vulnerable to the enemy's first strike. The strategy of keeping a few squadrons of bombers/attack aircraft on continuous nuclear deterrence patrol is not cost-effective, and is susceptible to accidents. However, the efficacy of the air leg of the nuclear triad dramatically increases in the inter-war period. Unlike missiles which are spent after a single use, bombers and other nuclear aircraft can be used again during a limited nuclear war. The silo-based nuclear deterrent is vulnerable to the enemy's attack and the TEL-based ICBMs cannot be deployed without signalling escalation to the adversary during times of crisis, and are vulnerable to accidents, theft, and sabotage if continuously deployed. In contrast, deployed SSBNs are invulnerable to the enemy's first-strike and can retaliate from anywhere with high confidence in carrying out the mission. This makes the sea-based nuclear deterrent the most potent and stable system.