SURVIVABILITY OF THE ARSENAL: THE ESSENCE OF SUCCESSFUL NUCLEAR DETERRENCE

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Existential nuclear deterrence is derived from the basic reality of the existence of nuclear weapons—irrespective of their yield or numbers[1]. The mere fact that there is some sort of nuclear capability that can impose a cost far higher than the value of the benefit sought is believed to be enough to deter. Deterrence practised by North Korea (DPRK) against the USA is an example of this. Through the conduct of a nuclear test in October 2006, however imperfect or unreliable, Pyongyang has managed to inject a seed of doubt and uncertainty in the mind of Washington, thereby raising the risks, complicating US calculations, and constraining its actions. Existential deterrence suffices in the case of DPRK for two reasons: one, because it seeks to deter the United States, a country that is perceived to have a low damage tolerance threshold; and, secondly, because from the American perspective, the stakes in any conflict with DPRK would never be high enough to justify any loss, however limited, that America could suffer from DPRK's nuclear use. Therefore, for Pyongyang, the power of mere suggestion of presence of

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1. There are several interpretations of the term "existential deterrence". Its first use is attributed to McGeorge Bundy who opined that as "as long as each side has thermonuclear weapons that could be used against the opponent, even after the strongest possible pre-emptive attack, existential deterrence is strong..." But there are other versions of the term, such as by Marc Trachtenberg that premise it on "the mere existence of nuclear forces," which is enough to create a fear of escalation that must always be factored into political calculations. Still others like Devin T. Hagerty suggest that existential deterrence works even in the absence of openly acknowledged nuclear forces, as long as the adversaries believe that the opponent has nuclear forces. The term as used in this paper leans closer to Trachtenberg's definition of existential deterrence. Bundy's definition of the term, in the view of the author, corresponds better to credible nuclear deterrence as used in this article.

nuclear weapons is good enough to impose deterrence.

None of the other nuclear deterrence relationships, however, has been satisfied with existential deterrence, except in the very early years after the acquisition of the nuclear capability. Thereafter, each one of them has built, or at least aspired to make, deterrence more credible and stable by developing capabilities, establishing systems, adopting procedures, and evolving organisations that are capable of mounting convincing threats of assured nuclear use, if it ever became necessary. The attempt has been to ensure that chances of deterrence breakdown, or the possibilities of use of nuclear weapons are minimised, if not completely obviated, by communicating to the adversary that there are capabilities and strategies in place that would not only prevent him from achieving his objective, but also cost him dear.

The imposition and sustenance of this type of nuclear deterrence, one that is credible and stable, in contrast to merely existential, is particularly important for a country like India that has territorial conflicts with its eastern and western neighbours, both of which are nuclear armed. Given the almost pedestrian possibility of 'routine' border skirmishes escalating to nuclear exchange as a result of deliberate choice, accident, or miscalculation, reliance on the mere psychological assurance of existential deterrence cannot be enough to prevent deterrence breakdown. Therefore, enhancing the credibility of deterrence in order to make it more stable, and, hence, less prone to meltdown, is the basic endeavour of India's nuclear strategy. This is sought through the extrapolation of a lucid nuclear doctrine that clearly identifies a narrow, political role for India's nuclear weapons through the establishment of a precise command and control system that minimises risk of nuclear exchange due to miscalculation or unauthorised use; and by ensuring assured retaliation in case of a nuclear attack in order to compel the adversary to well calculate the dangers of his nuclear use.

The strategy of assured retaliation seeks to impose deterrence by punishment. The credibility of deterrence in this case is predicated on the communication of the absolute certainty that nuclear use by the adversary would be met with retaliation that would cause damage of the kind that the adversary would find unacceptable. For this to happen, an essential prerequisite is the existence of sufficient amount of

nuclear capability. In the case of a first use doctrine, a nation would have the option to choose what to target and how much. But even then, for deterrence to function even after the first use, it becomes contingent upon the country undertaking the first strike, which it hopes would be sufficiently degrading if not completely disarming, to ensure that it can make survivable a sufficient capability even after absorbing a counter-strike. This implies making the nuclear arsenal capable of avoiding, repelling, or withstanding an attack in order to be available for a second strike. The first strike, however expansive or weak, can hope to deter a counter-strike only if it is adequately supported by the ability to conduct another wave of retaliatory strikes that would wreak even further damage on the adversary. The US realised this as Soviet nuclear forces grew, adding to their worries of the vulnerability of their nuclear missiles and bomber bases to a Soviet first strike. This threatened to degrade their ability to mount massive retaliation to cause assured destruction because of the possibility that not much might survive a Soviet first strike. This affected the credibility of the threat of punishment because if the forces that were to carry out the act of punishment were not going to survive, then the threat lost credibility.

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In order to buttress deterrence in this situation, emphasis came to be placed on building a second strike capability or the capacity to survive an attack sufficiently to deliver devastating retaliation. Three approaches were adopted to achieve this objective. One, the US went into an overdrive of vertical proliferation, believing that the more the numbers in the nuclear arsenal, the greater the chances of their survival. The folly of this approach was either not evident, or ignored, in the arms race that ensued between the superpowers. Secondly, greater priority came to be accorded to the technical systems necessary for launch on warning (LOW) postures so that in case of a detection of a nuclear attack, the response would be automatic, ensuring, thereby, that the arsenal would not be destroyed before it launched itself. The third approach to making the nuclear weapons survivable was to secure their storage sites and launch platforms. Hence, the shift to silos and

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mobile delivery vehicles, including submarines capable of launching nuclear missiles. Owing to these measures, a US Congress study was able to conclude in 1978 that the US could count on having 4,900 thermonuclear warheads after a surprise Soviet attack. If the Americans had warning of that attack, about 7,500 warheads could be made to survive and be ready for retaliation. This was expected to give the US the capacity to destroy 90 per cent of the Soviet military targets, 80 per cent of its industrial targets, all government installations and 90 million people. This was assumed to be a credible second-strike capability.

As is evident from the above experience, a country with a first use nuclear doctrine found deterrence to be credible only when supported by a second strike capability (drawing lessons from this nuclear history, Pakistan is engaged in building such a capability) that could assure the nation that a sufficient amount of nuclear capability would survive even after the first nuclear attack. The logic behind this was to not only eliminate or degrade or dilute a retaliatory counter-strike but also further deter it by suggesting that the first user would still have enough to cause further damage even after the adversary's retaliation.

If credibility of deterrence in the case of a first use doctrine relies on the ability to ensure survivability of sufficient retaliatory capability to undertake a second strike, this is even more critical in the case of a no first use doctrine (NFU). In fact, once a country has committed itself to NFU, attention and energies need to automatically shift to making the nuclear arsenal survivable. What exactly does this entail? Which are the specific elements of the nuclear arsenal that need to be made survivable? How best can survivability be ensured? How much of the arsenal must be made survivable? This chapter takes an in-depth look at these survivability challenges in the context of India's nuclear strategy.

WHAT SHOULD BE MADE SURVIVABLE?

The success of a counter-strike nuclear strategy is based on the communication of a clear message that any use of nuclear weapons would trigger assured

punitive retaliation to cause "unacceptable damage" upon the attacker. If this message has been conveyed and understood properly, then it should be assumed that the aggressor would want to strike and neutralise those Indian capabilities that would enable India to mount a counter-strike. In other words, it would seek to disarm India through a disarming strike before India is able to retaliate. In order to accomplish this, the adversary would attempt to hit at one or both of two kinds of targets. One of these would be the country's nuclear forces such as missile launch silos, submarine and bomber bases, command and control nodes, etc., in order to degrade the retaliatory capability. The other target would be the nation's political will to retaliate. The aggressor would seek to disarm the country of this by undertaking counter-value strikes in the hope that the politico-psychological impact of nuclear attacks on population centres could paralyse the leadership into inaction, thereby reducing the chances of retaliation.

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However, if the credibility of deterrence is to rest on the certainty of retribution, then India needs to make these very elements survivable to ensure that it is not possible for the aggressor to degrade its capability to retaliate even after a devastating first strike. Rather, the signals to the adversary must convey that the chances of his being able to carry out either a disarming or decapitating strike against India are close to zero, thereby disabusing him of any notion of a "splendid first strike." However splendid the strike might be, in keeping with the adversary's capabilities, it would nevertheless not be able to guarantee destruction of India's retaliatory wherewithal. Such a perception of survivability would significantly enhance the credibility of deterrence not only by reining in the adversary's temptation for a first strike, but also by tilting the balance in favour of non-use of nuclear weapons.

For the above to translate into reality, however, measures towards increasing the survivability of the nuclear arsenal must be pursued in a systematic and planned manner. But this first calls for an identification of components that need to be made survivable. In fact, it must be understood that survivability challenges extend beyond merely keeping nuclear attack assets such as warheads or their delivery systems safe from attack. Of course, the atomic bomb is at the heart of the matter and must survive for 'nuclear' retaliation to be mounted. In fact, as and when international commitments such as the Fissile Material Cut-off Treaty (FMCT) constrain quantitative additions to the nuclear stockpile, guarding the available warheads will become even more critical. But survivability of the bomb alone cannot suffice.

Credible deterrence demands the survivability of other enabling mechanisms and supporting structures too. In fact, the nuclear weapon or its delivery mechanism would mean little in the absence of an alive and able decision-maker at whatever level, in a clearly defined chain of succession, a command and control system that provides relevant inputs to the decision-maker, and a communication network that carries the decision right down to the man in the field who is to execute the launch, besides providing him accurate targeting coordinates and other supporting logistic elements. Most importantly, inherent in this entire process is the survival of the will to undertake retaliation. This, in fact, is the most critical element because the others would be meaningless if the national will to retaliate does not survive a nuclear attack. And yet, its survival is the most difficult to ensure, given its intangible nature. Of course, as is explained in the following section, certain specific measures can enhance the chances of survival of all components of the nuclear arsenal, including political will. However, while mathematical modelling can help calculate the chances of survival of other components, nothing can guarantee, or even exactly assess, the survival of political will. Fortunately, though, this applies equally to the adversary since he cannot calculate the response of the leadership with any certainty either. Pakistan, for instance, has miscalculated on this count in the past wars, and especially in the case of Kargil, it assumed that a caretaker government would not have the will or the gumption to take any decisive action against the

Pakistani soldiers in the guise of Mujahideen. A strong belief in the martial superiority of its own nationals has often prompted Islamabad to undertake military adventures that have gone awry. However, an ill-conceived nuclear misadventure would cost both the countries dear. Pakistan does not have the capability to undertake a disarming first strike against India and it must not assume that New Delhi would not retaliate. Because such an assumption would spell catastrophe for the region.

HOW TO ENSURE SURVIVABILITY?

There are several ways by which to enhance survivability of the various constituents of the nuclear arsenal. Every nation makes its choices based on different considerations. However, while information on the exact *modus operandi* of ensuring survivability would naturally be classified, it is important that the adversary be made well cognisant of the fact that steps are being taken to this effect. Communication of this resolve through the right kind of signalling is critical for enhancing deterrence.

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Amassing a large stockpile of nuclear warheads or delivery systems is not in any way a guarantee of making them more survivable. Survivability requires, instead, a more intelligent approach that optimally mixes survival measures such as secrecy, deception, dispersion, concealment, mobility and defences. The determination of how much to conceal and where, or what to make mobile and how, and what to geographically disperse must be made on a considered assessment of the adversary's and own strengths and vulnerabilities. This co-relation will become clearer as several options of survivability, based on their costs and benefits, are examined in the following paragraphs.

Secrecy

Limiting access to information about the extent and location of nuclear attack assets by keeping low the number of people, and hiding their identity is one of

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the simpler and cheaper ways to ensure survivability. In fact, this tactic has been employed in every nuclear weapon state to foment perceptions without revealing actual facts on several matters nuclear.

In the case of India, the culture of secrecy has deep, historical roots, given that the 'wise ones' were never amenable to easily sharing their knowledge with others. The bureaucratic system developed by the British, and as it exists today, is also given to functioning with a high level of secrecy. Most scientific and defence organisations too work on a 'need to know' principle. While this mode of functioning can hamper the development of a more formal and institutionalised system for managing the nuclear deterrent, it nevertheless enhances its security because not everyone has sufficient information about the constitution, position, or disposition of the nuclear arsenal. This has its advantages, as was explained by Ashley Tellis[2],

> Since the entire organisational structure places a premium on extreme secrecy... potential adversary has to reckon with the prospect that there could always be some further strategic capabilities or technical resources held in reserve... unknown even to those few individuals otherwise thought to possess 'perfect' knowledge about the status and disposition of India's distributed strategic assets.

Thus, through a high level of secrecy, where the number of people in the nuclear loop is deliberately limited, India seeks to deny its adversaries the information they would need to perfect their targeting strategies for a devastating first nuclear strike.

Deception

If secrecy is a passive measure to maximise survivability, deception is a more active method to deliberately mislead the adversary. This may be done through

2. Ashley Tellis, *India's Emerging Nuclear Posture: Between Recessed Deterrent and Ready Arsenal* (Santa Monica: RAND, 2001), p 422.

wilfull communication of false information or deliberate ambiguity through contradictory statements. For instance, Soviet President Brezhenev contributed to the myth of a 'missile gap' in favour of the USSR when he made the statement that his country was producing missiles like sausages, even though the reality was very different. Besides, verbal misinformation, deception may also be practised by building dummy missiles or launch and storage sites in order to multiply targets and reduce the adversary's chances of being able to hit all, or even all the correct, targets.

While India has largely resorted to secrecy rather than deception in nuclear affairs, the production of dummy missiles or launch sites would be an effective and relatively cheaper way of ensuring survivability, especially of delivery vehicles. Presenting several targets to the adversary would sufficiently complicate his calculations to deter first use since he could never be sure that enough would not survive for retaliation.

Hardening

Shielding physical structures through use of special materials able to withstand nuclear attack is another way of ensuring the survival of critical assets. It amounts to increasing the ability of structures, systems and components to tolerate exposure to the effects of a nuclear detonation such as air blast, ground shock, electro-magnetic pulse (EMP), heat, pressure, and radiation. In an effective and widely prevalent use of this method during the 1960s and 1970s, the superpowers constructed hardened silos to keep their land-based nuclear forces (missiles and aircraft) safe from an attack. However, two technological developments have since reduced the efficacy of silos. Firstly, modern space-based systems have the capability to expose the position of silos for easy targeting; and, secondly, the development of precision munitions and earth penetrating weapons has eroded the survival chances of nuclear assets in a silo.

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In the case of India, however, silos have certain advantages and

disadvantages. For instance, given that neither Pakistan nor China yet has adequate space-based capabilities for accurate targeting, or even very reliable accurate missiles or earth penetrating weapons, hardened silos or storage in deep caves or tunnels remains an option for the near future. But, it must also be realised that Chinese missiles are rapidly moving towards greater accuracy through global positioning system (GPS) enabled systems. Given their focus on enhancing national military space capabilities, their ability to target silos would improve dramatically in the coming years. Meanwhile, silos are expensive and difficult to build, given the need for special materials and other considerations. It involves hardening not only the physical outer structure but also constructing the exact spaces for hosting nuclear assets in such a manner that even individual components can absorb violent ground motion. While the Department of Energy (DAE) and Defence Research and Development Organisation (DRDO), as custodians of nuclear weapons, are believed to already have specially constructed sites for storage of nuclear warheads, silos for delivery systems maintained with the military missile units would have to be specially constructed with suspension devices that can support ground motion and are made of materials hardened enough to withstand the effects of a nuclear blast. Power supplies, communication and launch control electronic hardware of the delivery vehicle would also have to be protected against thermal effects, ionospheric disruptions and radiation effects.

The location of silos would also have to be carefully considered on the basis of the range of adversary missiles/aircraft as well as proximity to own launch sites for quick reconstitution of retaliatory forces. Even though the NFU strategy reduces the pressure of immediate retaliation, unnecessary loss of time would not only raise the risks of another wave of nuclear strikes but could also adversely affect own resolve to counter-strike as international pressure to show restraint mounts, and news on the extent of damage flows in. The latter issue and its impact on decision-making are addressed in some detail in the section on preparation of resolve.

Besides silos for housing attack assets, one other major component of the nuclear arsenal that could be considered for placing in hardened structures in

times of crisis is the National Command Authority (NCA) and the National Command Post (NCP), as well as their alternates. The NCA is the decision-making body comprising the prime minister and other Cabinet ministers who are tasked with the responsibility of authorising nuclear use. The NCP, meanwhile, is a robust communication centre with the ability to receive information and disseminate it. Gen Sundarji distinguished the two as, "If NCA is the brain, NCP is the nervous system, including the sensory functions"[3]. Obviously, the survival of both is essential for retaliation, and to ensure their continued existence and ability to function, these command, control and communication nodes could be shifted to hardened, buried, deep underground bunkers. This facility would have equally hardened communication systems to other nodal points in the nuclear command chain. Obviously, technical, technological and financial complexities would be involved in constructing the facility and even more so in deeply burying the entire information distribution network over long distances. However, none of these challenges is insurmountable if the efficacy of such a structure is certain. The problem lies in the fact that as the accuracy and lethality of adversary missiles and weapons improve, the advantage of such hardened structures would rapidly erode. In view of this, what should be India's approach to using 'hardening' as a survival measure?

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Obviously, depending only on hardened structures cannot be possible given their cost, complexity and vulnerabilities that would only increase over time. In the case of those components of the arsenal that cannot be easily made mobile, silos could present a viable option. But for delivery vehicles that are road or rail mobile, or even national command and control structures, deep buried, hardened structures need not be the preferred choice. Mobility, therefore, is another significant survival measure that must be carefully examined.

3. Gen K. Sundarji, *The Blind Men of Hindoostan* (New Delhi: UBSPD, 1993), p. 89.

Mobility

One way of circumventing the vulnerability of nuclear assets in silos is to make them mobile. If these were frequently moved around on an elaborate road and rail network, it would be impossible for the adversary to constantly monitor and accurately target these forces. This, of course, would require making the nuclear assets smaller, missiles based on solid fuel and automated to the extent possible. If dummies were also added to the actual, mobile forces, it would further complicate the targeting requirements of the adversary and, thereby, enhance deterrence because he could never be sure of the numbers of real forces that would survive his first strike.

However, two parameters could constrain the extent of mobility: firstly, the ability to reconstitute forces quickly after attack. If the assets are too widely dispersed, it might prove to be logistically difficult to quickly bring them together for retaliatory launches. This, nevertheless, is not an insurmountable challenge and can be overcome through thorough pre-planning in peace-time and conduct of periodic simulation exercises to understand and overcome limitations; the second constraint on mobility is imposed by communication lines. Unless these are secure, hardened and sufficiently redundant, it could cripple the retaliatory system by the sheer inability of mobile units that have survived a first attack to link up with one another or the NCA. Therefore, degradation of communication systems could prove to be a particular point of vulnerability, and adequate attention must be paid to make these survivable so that the benefits of mobility of forces can be maximised.

Besides nuclear attack assets, making the NCA/NCP mobile, either on an airborne platform or on land transportable vehicles is also worthy of consideration in the Indian context, given the vulnerabilities mentioned earlier of deep buried, hardened, command posts. With the acquisition of the airborne warning and control system (AWACS) platform and with aerial refuelling capabilities, India does have the capacity of making the command post airborne in crisis situations. This may not be dismissed as preposterous because unlike the immediate mental link with American 24-hour air readiness, in the case of India, it would not be necessary to maintain such a facility on constant alert. It would only amount to

configuring a command force that would be available for such functions, as and when necessary, and for occasional exercises to maintain the capability. Similarly, on land, India's extensive rail and road network offers an option of a safe haven for the command authority to function from. It could be intelligently and safely knitted into the larger civilian network, though there would be a requirement for specially constructed camouflaged vehicles (whether rail bogies or road carriers) that can cater for sufficient reserves of power to run complex data and communication systems, sufficient fuel for adequate movement, and other logistic requirements to ensure independence of movement. Air, rail or road mobility could offer relatively less expensive and more readily available options for providing survivability of the NCA/NCP. Pre-planning with adequate forethought can equip these options with greater redundancy at much lower costs and levels of complexity, thereby ensuring a sanctuary for the national leadership to survive an attack, assess the damage, contemplate retaliatory options and order a counter-strike.

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Dispersion

There are two ways of exercising dispersion of nuclear assets in order to ensure their survival. One of these is to geographically distribute capabilities/systems over several locations in such a way that no complete strategic systems exist as transparent targets during normal peace-time deployments. In fact, that is the state in which the Indian nuclear doctrine mandates the forces be maintained. Weapon cores, weapon assemblies, missiles, and their launch vehicles are all maintained at different sites, to be brought together as "fully employable forces" only in case of a crisis. This proffers the obvious advantage of multiplying targets to complicate adversary calculations. As was explained by Gen Sundarji, "It is not just a question of [finding] 'needles in haystacks' but parts of many needles in many haystacks which might be brought together when required within hours to days, to form full needles in yet many more different haystacks."[4] Of course, this kind of dispersion does pose the

4. Gen K. Sundarji, "Indian Nuclear Doctrine -I: Notions of Deterrence," *Indian Express*, November 25, 1994. Part II of this article appeared in the same paper of November 26, 1994.

challenge of timely and effective reconstitution of the nuclear force after a nuclear attack has been suffered. It would call for elaborate planning and coordination among different agencies to remain networked in order to be able to mount retaliation within a reasonable time-frame.

The second mode of dispersion is to spread the nuclear assets over a range of delivery platforms. Historically, every state with nuclear weapons has used air delivery as the first option because of its ready availability. However, given the restricted range of aircraft and their limited penetration capabilities in a dense air defence environment, missiles—land-based and sea-based—have evolved as the preferred option. Of course, air-launched, supersonic cruise missiles like the Brahmos and its follow-on systems offer a credible option. While mobility is an important aspect of land-based missiles, the highest level of survivability is, nevertheless, believed to lie in placing nuclear tipped missiles with sufficient ranges on nuclear powered submarines (SSBNs). Indeed, every nuclear weapon state (NWS) has aimed for a triad of nuclear forces, and countries that have, over the years, in deference to their changing threat perceptions, given up some nuclear delivery platforms, have still maintained submarine-launched ballistic missiles (SLBMs) for their high survivability quotient. For instance, the UK presently maintains its nuclear forces only on its four submarines and France too maintains a dyad in the SLBM and air delivery platforms.

In the case of India, the nuclear doctrine provides for the constitution of a triad. Given the security scenario in the neighbourhood, the eventual induction of the SLBMs could indeed provide a higher guarantee of survivability. However, there are a few issues that must be examined with regard to sea-based deterrence. Firstly, given the large Indian landmass and the gigantic inland road and rail network that could be effectively used for mobile missiles with adequate ranges, could their survivability not be ensured on land any better than it could be at sea? In a situation of fast improving anti-submarine warfare (ASW) capabilities, are SSBNs that would be carrying concentrated clusters of strategic capabilities [at least 12-16 MIRVed (multiple independent reentry vehicle) missiles equalling 96 warheads] more or less risk prone? Of course, SSBNs are also most vulnerable when in port since they are difficult to hide. Moreover,

given that there are not too many Indian ports that could host the SSBNs, their targeting should be relatively simple. Above all, the sea-based leg of the triad does pose challenges of command, control, and communication, as well as those of delegation of authority. Unlike land-based nuclear capabilities that can be maintained in a distributed form, a sea-based deterrent pre-supposes complete systems on board at sea. Once this leg of the triad becomes operational, which should be some time in a decade or so, it would call for the development of technological and organisational arrangements to cater for chances of an accidental or unauthorised launch of a nuclear weapon from the sea. Even more than operational issues, once an SSBN force is ready, India will have to take the critical decision of graduating from the present posture where the civilian leadership exercises complete control over nuclear assets to one wherein custody of a number of nuclear weapons would reside with uniformed personnel even in peace-time. This transition from what Ashley Tellis describes as a "force in being" to a "ready arsenal" would bring its own sets of implications for India's nuclear strategy and civil-military relations.

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However, notwithstanding the above mentioned problem areas of sea-based deterrence, it still offers enough advantages that do not allow it to be dismissed as a viable and effective option for enhancing survivability. In fact, the mere fact that all NWS perceive greatest survivability in this leg of the triad is not without reason. Indeed, for a peninsular nation like India, the vast seas around it do provide large areas where SSBNs could remain hidden with a significant nuclear arsenal for long periods of time to mount retaliation, if and when necessary. In fact, the credibility of a counter-strike is ensured once an adversary knows that a fully armed SSBN is out at sea. To some extent, it makes counter-strike almost automatic, thereby asserting the certainty of retaliation. In any other situation, the first user could hope that international pressure or lack of domestic political resolve might ward off a nuclear response. But with SSBNs, harbouring such a

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hope would be foolish.

As far as other issues such as vulnerability in port or problems of command, control, comunications (C3) are concerned, these are not insurmountable challenges and the Indian Navy is engaged in resolving them. For instance, it is planned to have three SSBNs by 2015, of which one would be kept in reserve while two remain out at sea by rotation[5], thereby reducing chances of their being caught in port. Similarly, the possibility of unauthorised use of the weapon is resolved through electronic locks on weapons that can be operated by more than one person. In order to further ensure the survivability of SSBNs, some other precautions will also have to be worked at. The first of these is developing, and rigorous testing, of missiles with adequate ranges that would enable SSBNs to stay out of harm's way. The farther they would be from the adversary's coast to launch their own weapons, the greater would be the chances of their survival. As of now, the Indian advanced technology vehicle (ATV) would be equipped with a solid-fuelled 750 km range SLBM. But the DRDO has plans to equip the SSBNs with the extended range Agni III of 5,000 km. Secondly, development of adequate anti-ASW capabilities would be critical. Making the submarine as silent as possible and equipping it with some stealth features would certainly help, and efforts need to continue in these directions. At the same time, particular attention needs to be paid towards hardening the shore-based communication centres of the SSBNs because these are points of vulnerability.

Finally, it may be said that despite some vulnerabilities, sea-based deterrence certainly has the greatest chance of being survivable and providing the most credible deterrence through the right kind of power projection. And since deterrence is essentially a mind game, India will have to invest in some minimum level of sea-based nuclear capability as part of its credible minimum deterrence.

5. Sandeep Unnithan, "The Secret Undersea Weapon," *India Today*, January 28 2008, p.52.

Active Defences

The deployment of air and missile defences around critical points is another way to ensure survivability by intercepting incoming missiles or air attacks before they hit the target. Limited missile defences were used during the Cold War years for increasing survivability of land-based assets. However, to maintain vulnerability for mutual assured destruction, ballistic missile defence (BMD) was allowed only on a limited number of sites. After the abrogation of the Anti-Ballistic Missile (ABM) Treaty, this restriction has been lifted and the US is now engaged in deploying a multi-layered highly advanced national missile defence to eventually provide protection to the entire American landmass. This is envisaged through the establishment of an elaborate network of radars and interceptors at different sites within the country and outside. Obviously, such a system is technologically challenging as well as politically destabilising.

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The consideration of missile defence for India, from the perspective of survivability, needs to be examined here. Theoretically, of course, there can be no denying that a system that can intercept incoming enemy missiles and neutralise them before they hit the target, ensures the survival of what they are meant to protect. However, there can be little guarantee that every incoming missile will be intercepted in time. The financial and technological costs and complexities are not of any small dimension. These, in fact, are exacerbated by the more demanding geographical constraints and the more advanced capabilities with adversaries that an Indian BMD system must cater for in contrast to the situation of the USA. In fact, simple counter-measures can be used to defeat BMD and it is relevant to point out that in the Indian case, this is especially important since China, over the last decade, has concentrated on developing effective counter-measures to defeat a far more sophisticated BMD of the US.

In recent months, the DRDO has conducted some successful interceptions

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that have raised interest and confidence in the technology. Intelligently complemented with some imported systems, BMD could offer some enhancement of survivability for deterrence. However, its utility must be carefully tailored to the Indian security environment. For example, since survivability of retaliatory forces is a prerequisite for assured retaliation, erecting point or area defences over some types of nuclear assets such as over early warning systems, air bases for nuclear capable aircraft, command posts, submarine communication centres, nuclear production facilities, launch or storage sites in cases where mobility is not enabled, must be considered. But it would be unnecessary as well as unfeasible to opt for missile defences over cities. Of course, erection of BMD over critical points suffers from the disadvantage of exposing them to the adversary and, thus, subverting the advantage of concealment or deception. Yet, at the same time, erection of defences also injects uncertainty into the mind of the adversary and does complicate his targeting calculations and can be used to that extent.

Preparation of Resolve

Raising awareness and exposing decision-makers to simulated exercises in which escalation to the nuclear level is envisaged could be some of the preparatory tasks towards ensuring survival of the will for retaliation. As has been mentioned earlier, political will is the least tangible component of the nuclear arsenal and there can be no predictions on how it would react during nuclear war. For instance, the news of a very high level of damage could affect the decision-maker in two ways: on the one hand, it could send him into a state of shock and lead to action paralysis; on the other hand, it could also lead to immense anger and immediate action. Low damage tolerance of a nuclear attack could also make the decision-maker more susceptible to external pressures and constrain the scope of action. The location of attack could also influence the mental frame of the

decision-maker. An isolated nuclear attack on an air base, or a surface ship out at sea, or in a remote desert army unit would, in all certainty, would affect the decision- maker differently from a situation in which the adversary has mounted multiple counter-force attacks coupled with some counter-value ones too. Contrary to the proposal of the group of nuclear experts and the National Security Advisory Board, the Indian nuclear doctrine clearly mandates massive retaliation in both cases. But would the leadership be able to make the difficult decision, or have the necessary wherewithal in terms of informed people around to proffer advice to arrive quickly at a response that is equally able to meet the requirements of domestic expectations, international pressures and, at the same time, most importantly, send the necessary message to the adversary? The last criterion, in fact, is critical because this response would determine the credibility of deterrence for the future. Of course, the nature of response would have immediate implications for the country, but it would also influence perceptions for the future. In this context, it becomes extremely important to educate the political leaders about the intricacies of nuclear deterrence since they are the prime decision-makers in the Indian system and also need to convey credible nuclear signals in peace-time and war.

The key to credible deterrence through punitive retaliation lies in understanding and arriving at an approximate figure that must survive.

It is obvious that survivability is achievable through a number of measures. The challenge lies in making the right choices based on the most relevant parameters. The first of these must be an assessment of the adversary's intelligence, reconnaissance, surveillance, target acquisition and strike capabilities. For instance, in order to evade better human intelligence skills of the adversary, it would be necessary to maintain a high level of secrecy on information of assets and their locations, capabilities, etc. Compartmentalisation of information within the government, armed forces and even strategic organisations would be necessary, besides elaborate and sophisticated personnel reliability programmes in every establishment and at every level. On the other

China, even with a small nuclear arsenal, is able to effectively deter the thousands of weapons in the American nuclear armoury.

hand, a higher adversarial capability of surveillance would entail greater emphasis on deception and mobility. Or, the capability of the adversary to conduct effective electronic warfare would imply placing greater emphasis on making own communication networks more secure and redundant.

HOW MUCH TO MAKE SURVIVABLE?

In any kind of a first strike mounted by the adversary, a certain amount of attrition of the nuclear forces would be expected. However, the key to credible deterrence through punitive retaliation lies in understanding and arriving at an approximate figure that must survive. This, in turn, has to be a function of a considered assessment of how much would be required to impose an unacceptable level of punishment on the adversary. At least, that much has to be made absolutely survivable. However, the assessment of the damage threshold of the adversary is a complicated calculation. During the days of superpower rivalry, the US had arrived at a complicated number of destruction, that of 50 per cent of the Soviet population, and 25 per cent of its military and industry would be perceived as unacceptable to the USSR. But, seen in retrospect, this is today considered a horrendous over-assessment. With modern levels of development, it is assumed that countries would have lower damage tolerance thresholds. The greater role of public opinion enabled by an explosion in information and the media clearly indicates a weaker stomach for damage to life and property. However, in the case of India, three essential parameters, as described below, can be used to assess how much must be made absolutely survivable for assured retaliation.

Assessment of Unacceptable Damage

The first parameter that can help assess how much must definitely survive with India is the calculation of what would constitute 'unacceptable damage' for the adversary. Therefore, the stakes must be understood and considered from the

point of view of the adversary. Obviously, this cannot be an easy task. However, certain educated guesstimates can be made on the basis of the following factors.

Socio-Political System of the Country

This would have a deep impact on how decisions are taken in the country. A high level of democratic openness of society, a large number of stakeholders in decision-making, and freedom of the media can cast a constraining influence on an adventurous political leadership. In contrast, a system that is autocratic, shows little respect for public opinion, restricts and controls information dissemination and does not depend on others for its legitimacy would be more prone to taking nuclear risks. In the latter case, the level of damage that the nation would be willing to absorb would be much higher than in the case of the former. This is amply proved by the fact that China, even with a small nuclear arsenal, is able to effectively deter the thousands of weapons in the American nuclear armoury. This is because the socio-political system of the US cannot sustain damage to itself. It has a low damage tolerance threshold, low enough for China to threaten even with its relatively limited capabilities. For India, however, the situation is the exact opposite. Its deterrence has to be imposed upon a nation (China) that has a high limit of damage acceptability, in which the decision-making is confined to a very small number, and where the media is highly controlled. Therefore, there are no players in the system that can place limits on damage tolerance.

A revisionist power is more damage tolerant compared to a status quo nation.

Strategic Culture

The propensity for undertaking and absorbing military casualties is also influenced by the overall strategic culture of the nation. This, in turn, is significantly influenced by the country's historical experiences of war. A country that has a self-image of having been wronged in a war or having been deprived of something perceived as its own would be more acceptable to

An economically more developed country is normally expected to have a lower damage tolerance threshold.

bearing damage or 'costs' for righting the past action. Also, a revisionist power is more damage tolerant compared to a status quo nation. In the case of India, Pakistan and China are both revisionist and, hence, logically should be expected to be ready to bear more damage.

Issue at Stake

The level of acceptability of damage is also influenced by the value a nation places upon the issue at stake. Of course, it could well be argued that nothing can be valuable enough to merit the kind of destruction that a nuclear exchange would bring. By this logic then, the possession of Kashmir could not be worthwhile for Pakistan if it meant the loss of the rest of the nation, especially the Punjab. Or that China would not want to lose Beijing in exchange for gaining Arunachal Pradesh. However, nuclear use would seem acceptable in case the country was pushed into a corner and had to use it as a weapon of last resort.

Level of Economic Development

An economically more developed country is normally expected to have a lower damage tolerance threshold. This is because an impoverished country in any case has less to lose and is, therefore, willing to accept more damage. It is for this reason that it is assumed that China of today has more to lose and, hence, would be less willing to suffer damage to the level of development that it has got habituated to. As the level of economic development increases, nations become more attached to a certain way of living and, hence, develop a weaker tolerance level for any loss of their comfort zone. Those that have nothing to lose are more acceptable of even higher levels of damage.

Reliability of Own Arsenal

The second parameter on the basis of which the quantum of arsenal survival can be assessed is the reliability of own nuclear warheads and delivery vehicles. The

higher the reliability that the missile would be able to carry the nuclear weapon to the desired target, and that the weapon would explode to provide the expected yield, the less need be the amount that needs to survive. More reliable systems can infuse greater confidence that whatever survives would be able to do the necessary damage and there would be less requirement for building redundancies into calculation of numbers. However, reliability needs to be established at various levels. For instance, missile reliability should imply the ready availability of a deliverable missile at a given moment in time. It cannot include missiles that are under repair or maintenance or not ready for immediate action. Communication reliability would have to stem from the quick and efficient dissemination of orders to launch. Launch reliability would require that the missile lifts off when so ordered. Booster reliability would entail their igniting in time to send off the missile. Also, having done that, the boosters must also ensure separation reliability so that they can disengage from the missile in flight instead of hanging on to it and interfering with its ballistic flight. Thereafter, penetration reliability must assure that the missile would be able to home in on the pre-determined target. Lastly, detonation reliability would imply the absolute certainty that the warhead explodes over the target and provides the correct yield to inflict the kind of damage that was considered necessary. Therefore, through a considered calculation of these combined individual reliabilities, it could be established as to how much of the arsenal a nation must make survivable.

Ensuring the survivability of the nuclear arsenal, therefore, in this scheme of things, is the most critical basis for establishing and sustaining credible deterrence.

Purpose of Own Nuclear Weapons

The last essential parameter that can be used to decide how much must survive the adversary's first use of a nuclear weapon would be the purpose of one's own nuclear retaliation. Is it to wreak punishment on the first user for his act? Or, is it to bring about total destruction of the adversary as a form of revenge? In the

case of the former, the survivability requirements can be less stringent than in the case of the latter. Imposing punishment could be possible with the use of a few fission weapons in counter-value mode. Of course, this is affected by the adversary's determination of how it perceives its own damage. But, in the case of most modern societies, and given the densities of populations in the region that India inhabits, even a score of nuclear weapons could bring untold destruction of life and property. On the other hand, if the purpose of the nuclear arsenal is to completely decimate the first user, then obviously more would need to be made survivable.

Given the purpose of the Indian nuclear weapon, as established in the country's nuclear doctrine, it exists to impose deterrence. As has been reiterated several times, the nuclear weapon is perceived as a political tool to ward off nuclear blackmail or coercion. Therefore, India does not visualise any situation in which the weapon could actually be used for war-fighting. However, in order to keep it that way, it becomes important to make the necessary arrangements and convey to the adversary that the country is ready for any kind of deterrence breakdown. Ensuring the survivability of the nuclear arsenal, therefore, in this scheme of things, is the most critical basis for establishing and sustaining credible deterrence.