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Rajaram Nagappa
N Ramamoorthy

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Article

Changing Nature of Deterrence: The Challenge of Asymmetric Threats

Rajaram Nagappa

N Ramamoorthy

Abstract

In spite of massive reduction in the nuclear weapon holdings in recent years, both Russia and the US hold impressive quantities of nuclear arms. Other nuclear weapon (P5) countries hold relatively limited number and some of them (France and UK)have not added significant numbers. Some of the late entrants in Asia continue to increase their arsenal in significant ways. New weapon systems, geopolitics (including nature of governments, leadership and economic disparity), unsettled borders, non-state actors, technology proliferation, lack of progress in disarmament, etc., are all contributing to the erosion of deterrence and strategic stability factors. As a result, in the world today, there are many unsettling factors, which are not only impacting the nature of deterrence but are also influencing the stabilizing/destabilizing criterion.

Ever since the fateful nuclear bombing of Hiroshima and Nagasaki on 6 August 1945 and 09 August 1945, respectively, the world has been spared a repeat of such devastation, though the world has, on more than one occasion, come close to a nuclear confrontation. Over a two decade span, the then Soviet Union (August 1949), United Kingdom (October 1952), France (February 1960) and China (October 1964) carried out nuclear tests. These five declared nuclear weapon states also happen to be the permanent members of the UN Security Council (UNSC) and for some years in the 1970s there was no addition to the membership. In their own way, these countries exercised measures to avoid horizontal proliferation of nuclear weapons technology. Side by side, both bilateral – especially between USA and USSR – and multilateral treaties created controls and proliferation constraints.

Rajaram Nagappa, Honorary Visiting Professor, National Institute of Advanced Studies, Bengaluru.

N. Ramamoorthy, Adjunct Professor, National Institute of Advanced Studies, Bengaluru.

These treaties and arms control regimes can be considered as reasonably successful, as the world has not seen any significant increase in the nuclear weapon states. It is seen that (Dannreuther, 2011, 199)[3] in the 1960s, 23 countries had nuclear weapons or weapon related research in progress; the number had come down to 19 countries in the 1980s; and further in 2005 the number stood at 8 states with nuclear weapons and 'an almost there' Iran faced with a dysfunctional JCPOA (Joint Comprehensive Plan of Action worked out between P5+1 and Iran) and under tight economic sanctions imposed by UNSC.

Both US and Russia have significantly reduced their stocks of nuclear weapons, but still have numbers large enough to annihilate the world many times over. At the same time, both countries have in recent times energised their nuclear modernisation programmes. China, not constrained by the US-Russia Intermediate-Range Nuclear Forces (INF) treaty has developed nuclear capable missiles and put into practice *Anti-Access/Area-Denial (A2AD)* measures. India and Pakistan carried out nuclear tests in May 1998 and have declared a unilateral moratorium on further testing. North Korea did its first nuclear test in October 2006 and followed it up by five more tests, the last one being in September 2017. Israel has not carried out a test but is acknowledged to possess nuclear weapons.

Fissile Material Stocks and Weapon Holdings

The International Panel on Fissile Materials (IPFM), an independent group of arms-control and non-proliferation experts from both nuclear weapon and non-nuclear weapon states, puts out information on estimated/reported fissile material stocks held by countries. The latest data available on their web site corresponds to 31 December 2016 (International Panel on Fissile Materials, 2016)[4] and is reproduced in table-1.

Country	Material holding, t		Warhead	Warhead allotment		Fissile stockpile, t	
	HEU	Mil Pu		Deployed	Reserve	HEU	Pu
Russia	646	128	7000	4300	2700	679	128
USA	463	79.8	4018	1700	2100	574.5	87.8
UK	20	3.2	215	120		19.8	3.2
France	29.7	6.0	<300			31±6	6±1
China	14.0	2.9	240	180		14±0.3	29±0.6
Pakistan	3.6	0.3	120-130			3.4±0.4	0.28
India	4.4	7.3	110-120			4±1.4	0.58±0.15
Israel	0.3	0.9	80				900±130
North Korea	0	0.6	10-20			Enough material for 60 warheads	
Others	15	-					

Table 1: Nuclear material stocks (IPFM 2016)

In the case of Russia, of the 4300 deployed warheads, about 2460 warheads are assigned to strategic delivery vehicles and the remainder – about 1850 – are for shorter range delivery vehicles and other non-strategic systems. The US arsenal of nearly 6500 warheads includes 2500 warheads awaiting dismantlement; about 1700 meant for strategic missile and bomber delivery systems; 150 identified with non-strategic systems located in Europe; and 2100 warheads held in reserve. All the other countries' weapons do not even add up to the quantities held by Russia and US. Russia, USA, France and UK have all stopped production of fissile materials for weapons. China has not officially declared the stoppage of fissile materials for weapons, but it has ceased production of HEU in 1987 and Plutonium in 1990.

Status of Arms Control and Arms build up

The world nuclear order has been governed by a number of multilateral and bilateral treaties. Some of the multi-lateral treaties have overarching connection with treaties in other domains like space and oceans. The important and relevant multi-lateral treaties include:

- Comprehensive Test Ban Treaty (CTBT): The treaty prohibits nuclear weapon test explosions. The treaty was opened for signature on 24 September 1996 but has not come into force as three states – India, Pakistan and North Korea – have not signed it and five states are yet to ratify the treaty. The treaty can come into force only with the signature and ratification of all the 44 states named in Annexe 2.

- Treaty banning Nuclear Tests in the Atmosphere, in Outer Space and Under Water, also known as the Partial Test Ban Treaty (PTBT), entered into force on 10 October 1963. Parties to the treaty are required to abstain from carrying out nuclear explosions in any environment where such explosions cause radioactive debris outside the limits of the State that conducts an explosion.

- Treaty on the Non-Proliferation of Nuclear Weapons (NPT) has entered into force on 05 March 1970. As the name suggests, NPT aim is to limit the spread of nuclear weapons through the three pillars of non-proliferation, disarmament and peaceful uses of nuclear energy. India, Pakistan and Israel are not members of NPT; North Korea withdrew from the NPT in January 2003, due to perceived security threats from USA.

- Treaty on the prohibition of the emplacement of nuclear weapons and other WMDs on the seabed and ocean floor and in the subsoil thereof (Seabed Treaty) entered into force on 18 May 1972.

The former Soviet Union and USA have a long history of arms control negotiations, which resulted in agreements and treaties. The US-Russia bilateral agreements had built-in verification requirement and served multiple functions – confidence building as treaty adherence could be verified and contributed to deterrence as well as stabilizing factors. The agreement between the two superpowers also served as an informal guideline for other countries to follow. Some of the treaties have lapsed either due to non-renewal or due to withdrawal of one or both parties. The status of some of the major US-Russia bilateral treaties (White, Little and Smith, 2005)[5] is summarised below:

- Anti-Ballistic Missile (ABM) Treaty, restricting the number of ABM launchers and systems came into force on 03 October 1972. The USA withdrew from the treaty in June 2002 in order to pursue its plans for Ballistic Missile Defence (BMD) and Russia followed suit with its own new BMD system.

- Intermediate Nuclear Forces (INF) Treaty, aimed at eliminating ground launched ballistic and cruise missiles of intermediate range between 1000 km and 5500 km and short range between 500 km and 1000 km (Nuclear Threat Initiative, 2019)[6], came into force on 01 June 1988. The treaty ceased to exist with the withdrawal of US from the Treaty 02 August 2019.

- The New Start Treaty entered into force on 05 February 2011 with a ten year duration. US and Russia have been continuously engaged in arms control negotiations the New Start replaces the 2002 Strategic Offensive Reduction Treaty (SORT).

Based on the facts described in the preceding paragraphs, it is evident that some of the multilateral treaties have not come into force as they require consensus of all the Annexe-2 countries. Keeping the discriminatory nature between the original nuclear weapon states and later entrants in view, it is unlikely that a consensus would emerge. The US-Russia bilateral ties are witnessing significant uncertainties and independent nuclear development paths. Consequent to such developments, a certain level of destabilizing parameters in the mutual deterrence equations are to be but expected.

The fallout of withdrawal from some of the arms control treaties has resulted in positive as well as undesirable gains. Technology has definitely advanced and new precision weapon systems have been developed. Extension of the weapon systems into other domains has added new security dimensions with its attendant risks, counters and arms race. For example, the withdrawal from the ABM treaty accelerated the development of Ballistic Missile Defence systems not only in the US and Russia but also in China and to a lesser extent in India. Advanced air defence systems can double as ballistic missile

defence in the terminal phase of ballistic missile flight. Sale of such systems contributes to proliferation, even if they conform to the MTCR performance constraints. Boost-phase intercept is feasible but poses enormous coordination and execution challenges. Mid-flight interception has been demonstrated by US, China and Russia and few countries are able to counter an incoming missile in the terminal phase of flight. The technology is now extended to target satellites in space and *Direct Ascent Anti-Satellites (DA-ASAT)* are here to stay in spite of their undesirable space debris producing attribute.

The INF treaty has ceased to exist after the withdrawal of US from the treaty in August 2019. While not going into the merits of the reasons the parties to the treaty may have in abandoning it, it must be noted that there are countries other than Russia and US in possession of missiles with 1000-5500 km range. China, India, Pakistan, North Korea, Israel and Iran all possess ballistic missiles with this range capability; there are more countries with the shorter-range missiles in the 500-1000 km range. China, not constrained by INF treaty, has deftly employed the DF-21D missile with manoeuvring warhead as anti-ship ballistic missile (ASBM) (Chandrashekar, Ganesh, et.al, 2011)[7]. In the process, China has displayed and put into action *Anti-Access, Area Denial (A2AD)* capability. Others may be tempted to follow suit.

The New Start Treaty expires in February 2021. The treaty can be renewed by 5 years if both the US and Russia agree. However, as this is an election year for the US, the extension of the treaty is not a priority agenda for Washington and may get attention only after the US presidential elections. Also, the US and Russia would like to bring China on board for further arms limitation talks. China, however, has not shown any inclination to be part of any arms limitation treaty in view of the vast disparity between the nuclear stockpiles of US and Russia in comparison to that of China. As of now, the extension of the treaty does not appear very likely, and in such a situation, there will be no binding limits on the size of US and Russian arsenals. These arsenals are as it is, rather large.

The **Chinese** nuclear strategy is to maintain a credible deterrence against other nuclear weapon states. China issues Defence White Papers from time to time and the 2006 white paper lays out that China pursues a self-defensive nuclear strategy. According to the White Paper, "fundamental goal is to deter other countries from using or threatening to use nuclear weapons against China". China follows a policy of no first use of nuclear weapons and also says it will not use or threaten to use nuclear weapons against non-nuclear weapon states (National Defense Policy, 2006).[8] China has deployed land, air and submarine based missiles with different range capabilities to complete its nuclear triad. As of 2019, it had 218 land-based missiles, 48 on board its 4 SSBNs and 48 deployed on aircraft. The number of

warheads has shown a modest increase and China is estimated to possess 290 warheads in 2019 – an increase of 50 warheads since 2012 (Kristensen, 2019).[9] An assessment carried out (Chandrashekar, 2019) [10]shows that in 2016, the Chinese missile strength of all ranges was 1679, of which 213 were nuclear armed, and the bulk were equipped with conventional warheads. More than 50% of the conventional armed missiles were of short range and meant for Taiwan operations. Some increase in the strategic warheads can be further expected when the missiles under development – DF-26, DF-41 and JL-3 are completed and deployed. JL-3 is being developed for use in the new Type 096 submarines being built. In addition, China has cruise missiles of different ranges to be used for both ground launch and air launch operations.

India's nuclear test of 18 May 1974 was essentially test of 'physics' package. On 11 and 13 May 1998, India carried out a series of 5 tests and declared itself as a nuclear weapon state. India's nuclear doctrine was enunciated in a draft report released by the National Security Advisory Board in August 1999 (India. Ministry of External Affairs 1999).[11] In addition to statement of no first use, the salient points of the document are that, a) India shall pursue a doctrine of credible minimum deterrence; b) any threat of use of nuclear weapons against India shall invoke measures to counter the threat: and c) any nuclear attack on India and its forces shall result in punitive retaliation with nuclear weapons to inflict damage unacceptable to the aggressor. A qualification of the no-first use appears in the Government of India statement of January 2003 with the addition that India retains the right to use the nuclear option in the event of a major attack against India or Indian forces anywhere, by biological or chemical weapons (India. Ministry of External Affairs 2003).[12] The 2003 statement further carries an assurance of non-use of nuclear weapons against non-nuclear weapon states.

The IPFM estimate of Indian nuclear warheads as of end 2016 is 110-120. This modest number is in keeping with the Indian doctrine of managing minimum credible nuclear deterrence. India has made major progress in terms of the delivery vehicles and is aiming to put a triad in place. It has short range (150-250 km) capability with Prithvi missile, while the Agni series of missiles provide a range coverage anywhere from 700 km to excess of 5000 km. With the successful flight trial of the 3500 km range submarine launched ballistic missile (SLBM), K-15 on 24 January 2020, India is in the process of achieving Triad status. K-15 along with the 750 km range K-4 missile will be integrated with the nuclear powered Arihant submarine and its sister submarines. India also has indigenously developed ballistic missile defence with interception capability in the exo-atmospheric region and endo-atmospheric region. Prithvi Air Defence (PAD) system can intercept incoming missiles at altitudes of 80 km and above, while the Advanced Air Defence (AAD) can intercept missiles at 25 to 40 km

range. In March 2019, India also tested and qualified a Direct Ascent Anti-Satellite weapon system.

Pakistan carried out its nuclear test on 28 May 1998. Pakistan considered the acquisition of nuclear weapons an absolute necessity after the outcome of the 1971 war with India and the superiority India always enjoyed in the sphere of conventional weapons and warfare. The need for military parity with India was always a serious matter of contention for Pakistan. In 1965, in an interview to Manchester Guardian, ZA Bhutto, who was then the Foreign Minister of Pakistan stated "If India makes an atom bomb, then even if we have to feed on grass and leaves – or even if we have to starve – we shall produce an atom bomb as we would be left with no other alternative. The answer to an atom bomb can only be an atom bomb." (Khan 2012).[13] Thomas Reed and Danny Stillman in their book *The Nuclear Express: A Political History of the Bomb and its Proliferation* have described the Chinese assistance to Pakistan of providing details of CHIC-4 nuclear device as well as testing the Pakistani bomb in China in 1990 besides providing training to Pakistani scientists. This is brought out in an interview Reed gave to Alex Kingsbury of US News (Kingsbury 2009).[14] The short time gap of two weeks in May 1998 between the Indian tests and Pakistan tests is a clear evidence of the much advanced preparedness of Pakistan with continual support from China. Pakistan similarly derives its ballistic and cruise missile capability to Chinese transfer of missiles as well as providing training and equipment.

Pakistan nuclear approach is India-centric, and it has over time developed ballistic missiles for nuclear weapons that are capable of reaching deep into Indian Territory. Pakistan has closely followed the development of nuclear forces in India and developed what it considers as appropriate responses. For example, in response to the Indian ballistic missile defence system, Pakistan developed and flight tested a platform carrying multiple independently targetable re-entry vehicles (MIRV). This missile has been named as *Ababeel* in Pakistan.

The development of Babur land attack cruise missile (LACM) perhaps started as a response to India's supersonic cruise missile Brahmos. Over time Pakistan has not only increased the range of LACM Babur-2, but also developed Babur-3, a submarine launched version. Pakistan claims Babur-3 provides it with second strike capability. The range claimed for Babur-3 is 450 km, but may only be in the region of 250 km (Nagappa et al. 2018).[15] Pakistan has also recently flight tested a longer version of its air-launched cruise missile - Ra'ad-2. The claimed range of 650 km provides certain stand-off distance advantage.

While the missile capabilities of India and Pakistan along with confidence building measures such as a) Prohibition of Attack against Nuclear Installations and Facilities, b) Pre-Notification of Flight Testing of Ballistic Missiles and c) Reducing the Risks from Accidents Relating to Nuclear Weapons, have aided deterrence stability, Pakistan has upset the situation by the introduction of a battlefield nuclear weapon - Nasr in 2011. With the introduction of Nasr, Pakistan claims it has achieved full spectrum deterrence. What it has really done by fielding Nasr is to lower the nuclear threshold. Introduction of a nuclear weapon in a conventional conflict scenario is open to major miscalculation and escalation risk.

North Korea has been on the threshold of nuclear testing for a long time and perhaps was exercising restraint based on advice by China. North Korea became a party to NPT as a non-nuclear weapon state in 1985. North Korea also entered into safeguards agreement with IAEA in 1992 but withdrew from the agreement in 1994. North Korea announced its withdrawal from NPT on 10 January 2003 citing threat to its security posed by the hostile policy of the United States. Between 2006 and 2017, North Korea carried out six nuclear tests of yields. North Korea also claimed that it has miniaturized the nuclear device that could be fitted on to ballistic missiles and that the September 2017 test was that of a hydrogen bomb. Analysis of the first five tests (Vishwanathan et al. 2016)[16] appears to indicate the first test was a failure and the others successful. The test history indicates improvement in the weapon system with yield touching 10 kT in the 3rd and 4th test. Seismic evidence shows that the 4th test could have been a thermonuclear device.

North Korea has a record of missile development and missile technology proliferation. They have modified and improved on the original Scud missile to realise an indigenous missile called NoDong. Besides selling the missile and missile technology to Pakistan, Iran and other countries, North Korea made improvements and variants for both missile and satellite launch vehicle applications. Their Hwasong series of missiles have been designed and realized with capability to deliver nuclear weapons to Mainland USA. Analysis shows that Hwasong-12 has a range of 4385 km with a Re-entry Vehicle (RV) of 650 kg. This missile may have been tested for MIRV capability. This also means that Guam and Japan are within the reach of Hwasong-12 with even heavier payloads.

In November 2017, North Korea demonstrated capability to target US mainland with the launch of Hwasong-15. This missile was flown on a 'lofted trajectory' and reached an altitude of 4475 km and a range of 950 km. The missile flight path was over Japanese territory and impact was 250 km west of Aomori. (Aomori is in the northern part of Japan's main island of Honshu). When flown on a normal trajectory mode, the range will translate

to reaching the West Coast of US with a payload of 500-600 kg; Chicago with a payload of 400 kg; and New York with a payload of 300 kg (Chandrashekar et al. 2018).[17] While Korean capability to miniaturize a weapon to 300 kg may be questionable, a weapon weighing 500-600 kg to target the West Coast of US is doable. Following the Trump-Kim summit, an uneasy truce prevails with no progress either towards denuclearisation of the Korean Peninsula or towards easing of sanctions on North Korea.

Challenges in maintaining deterrence stability

From the commentary in the foregoing section, it is apparent that deterrence stability has decreased substantially among all the nuclear weapon states. The US-Russia-China equation has spawned new weapon technologies; the India-Pakistan tensions, resulting from state sponsored cross-border terrorism from Pakistan, continue to be on the rise; unresolved talks on the denuclearisation of the Korean Peninsula; and the deteriorating situation in Iran after the US negation of JCPOA have all impacted the deterrence stability adversely. USA, Russia and China are all pursuing nuclear modernisation plans vigorously. The three countries have their own motivation for modernisation – and not to be left behind is a prime reason, accentuated by the general absence of an arms control consideration. The motivation for the modernisation plans is captured in the table below:

...it is apparent that deterrence stability has decreased substantially among all the nuclear weapon states.

USA	Russia	China
• Deter attack – both nuclear and non-nuclear • Assure allies and partners • Hedge against technical risks • Develop delivery systems appropriate for these goals	• Deterrence to prevent aggression on any scale, nuclear or otherwise • Intent of all nuclear weapon delivery systems is to evade missile defence • Escalate-to-deescalate doctrine	• Enhance survivability of the Force • Improve the ability to penetrate missile defence • Create force size to meet above goals

Table 2: Focus of modernization plans

The three countries have modernized their weapon stocks as well as developed new ones to meet their focussed objectives. The US approach is documented in the Nuclear Posture Review 2018; the Russian approach could be ascertained by statement by Russian public figures; and the Chinese approach can be derived from their 2019 White paper.

US Modernization Programme

Extract from the Nuclear Posture Review (Nuclear Posture Review 2018)[18] states "there is no 'one size fits all' for deterrence". Consequently, the United States will apply a tailored and flexible approach to effectively deter across a spectrum of adversaries, threats, and contexts. Tailored deterrence strategies communicate to different potential adversaries that their aggression would carry unacceptable risks and intolerable costs according to their particular calculations of risk and cost. U.S. nuclear capabilities, and nuclear command, control, and communications (NC_3), must be increasingly flexible to tailor deterrence strategies across a range of potential adversaries and threats, and enable adjustments over time. Accordingly, the United States will maintain the range of flexible nuclear capabilities needed to ensure that nuclear or non-nuclear aggression against the United States, its allies, and partners will fail to achieve its objectives and carry with it the credible risk of intolerable consequences for potential adversaries now and in the future".

To cater to this objective, US will continue to depend upon the Triad, non-strategic nuclear forces and supporting Nuclear Command, Control and Communication (NC_3) to tailor needed diversity and flexibility in US strategies for deterrence, assurance and objective realization. Consequently, all the elements of the Triad are being improved, modified or replaced. These include:

- Replacement of Ohio class SSBNs with twelve Columbia class SSBN
- Silo based Minuteman III missiles will be replaced under Ground Based Strategic Deterrent (GBSD) programme in 2029. GBSD will have 450 modernized ICBM launch facilities to support fielding of 400 ICBMs
- Development of next generation Bomber B-21 Raider is initiated
- B61-12 gravity bomb will eventually replace present stock of gravity bombs.
- Air launched Long-Range Stand-Off (LRSO) cruise missile will retain the capability to deliver stand-off weapons that can penetrate advanced integrated air defence systems
- Prompt response option using low yield SLBM warhead

Simultaneously, US is advancing hypersonic technologies and developing systems for Conventional Prompt Global Strike (CPGS).

Russian Modernization Programme

President Putin in his annual address to the Federal Assembly in March 2018 announced five new nuclear delivery systems. A year later, an additional system, which may be dual-capable, was announced. The six systems are stated to be able to penetrate adversary integrated air defence systems and enhance Russia's deterrence capability. The six systems comprise a) Sarmat ICBM, b) Kinzhal, Avangard and Tsirkon hypersonic delivery systems and c) Poseidon and Burevestnik, which form the Advanced Strategic Weapon Delivery systems (Hruby 2019). [19]

Sarmat ICBM is designed to carry multiple warheads (likely 10-16) with a total yield of 8 MT. The range of the missile is anticipated to be 16000 km which will permit a southern approach to targets in US. The southern approach will help avoid the presently located US missile defence systems. The missile's short boost phase is also likely to render launch detection and verification difficult. The ICBM system can also carry the new Avangard hypersonic system. Deployment is planned by 2027

Kinzhal is an air-launched hypersonic missile and can be used with both conventional and nuclear warhead. Taking the aircraft provided distance into account, the missile has a range of 2000 km and can travel at Mach 5-10. The missile is a qualified system and its trail deployment has started.

Avangard is a hypersonic boost-glide vehicle capable of speeds exceeding Mach 20 and a range of 6000 km. The missile is expected to carry a 150 kT warhead. The vehicle has been tested three times and is likely to be deployed in 2020.

Tsirkon is a scramjet powered hypersonic cruise missile expected to reach speeds of Mach 5-6 and a range of 600 km. The missile is expected to be deployed aboard Kirov class destroyers by 2022. The missile is expected to be difficult to intercept because of its speed and manoeuvring capability.

Poseidon is a nuclear-powered and nuclear tipped torpedo designed for submarine release in safe waters. The missile subsequently travels at depth of 1000 m and at 111 kmph. The range of the missile is 5000 km.

Burevestnik is a long-range nuclear powered subsonic cruise missile. The missile is said to have a range of 23000 km and technologically complex. It is still under development.

Chinese Modernization Programme

China is pursuing a Triad of nuclear delivery vehicles and is already having this capability. China's modernization trends include:

- DF-31 series and DF-41 road-mobile ICBMs for improving survivability. Some ICBMs will be equipped with MIRVs
- Development of Type 096 SSBN, supposed to be quieter than the current JIN class SSBN
- Development of JL-3 SBM
- Development of nuclear capable H-20 strategic bomber. The aircraft will carry two air-launched ballistic missiles (ALBM)
- Dual capable hypersonic glide vehicle which can be launched on either DF-17 or DF-31 ballistic missile

Comments

All three major powers are modernizing and adding more sophisticated weaponry to their arsenals. A principal focus behind modernization is to enhance survivability and to penetrate adversary ballistic missile defences. This adds to the asymmetry, as present early warning systems are rendered marginal and the situation will continue, till alternate early warning system is put in place. Defence against hypersonic weapons are challenging because of the high speeds and manoeuvring characteristics. Features of the new weapon systems like dual-capability, high manoeuvrability and destination uncertainty add to ambiguity of purpose, destabilization status and asymmetry.

Knowing the importance of space in any future war, anti-satellite weapons are a significant contributor to asymmetry. China, Russia and US have full spectrum anti-satellite capabilities. China and Russia have deployed kinetic kill systems and cyber as well as electronic warfare systems are potential tools. All three countries have created specific commands – Space Force in the US, PLA Strategic Support Force in China and the Russian Aerospace Forces to integrate the strategic components.

Arms control talks between US and Russia obviously is inadequate – the New Start is due for renewal in February next year. Russia has indicated its readiness for extension of the treaty, but little action is expected from the US till the presidential elections are over. Also the US would wish to bring China on board in future arms limitation negotiations. China has

not shown any great interest keeping the large disparity in its weapon holdings *vis-a-vis* the other two countries.

Indian Modernization Programme

With a stated no-first-use policy, it is imperative for India to be in the Triad league. India is progressing towards this. India has a range of operational ballistic missiles and is adding a few additional capabilities. The performance of Indian missiles is captured in Figure1.

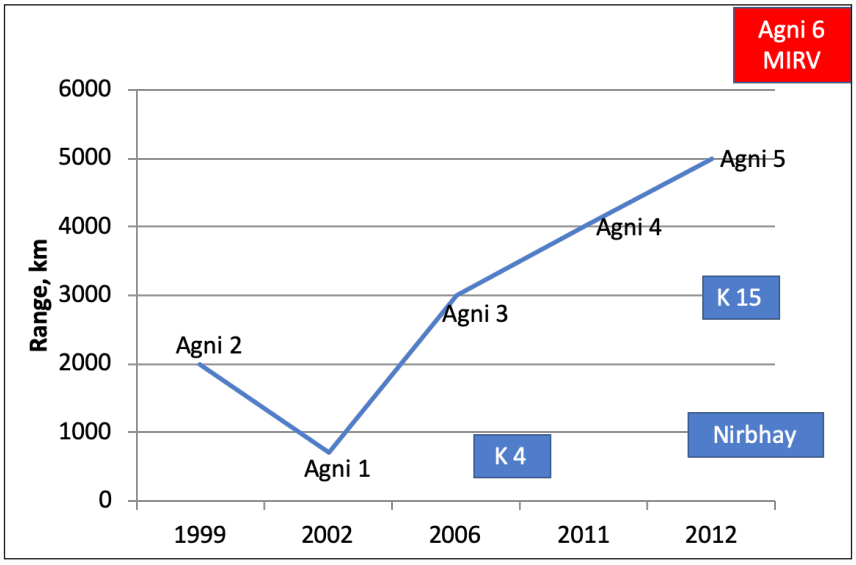

Figure 1: Performance of Indian Missiles

India has a set of operational missiles with range capability of 700 to 5000+ kilometres. The development of Agni 6 with MIRV capability was expected to be completed in 2017 (Shukla 2013).[20] Its exact status is not known. For enhancing the survivability of the force, India has developed K4 and K15 SLBMs of range 750 km and 3500 km, respectively. These missiles have been qualified and integration with the platform is proceeding. Nirbhay is a long range subsonic cruise missile and is not yet deployed.

India has substantial space capabilities. Its space programme is a civilian one, but its dual-use products have served security interests too. Growing militarization and weaponization of space has prompted India to look at defence space needs and last year, the Government took steps to create organisations which will address the defence space requirements. In April 2019, the Government announced the formation of the Defence Space Agency (DSA) and followed it up with the creation of Defence Space Research Organisation (DSRO) in June 2019. The DSA will command the space assets of Defence

Forces including the military's anti-satellite capability. DSA will also formulate a strategy for the protection of Indian space assets as well as assess space-based threats (Raghuvanshi 2019).[21] For protection of its space assets, India has taken deterrence steps. India carried out a Direct Ascent Anti Satellite Test (DA-ASAT) on 27 March 2019. Called Mission Shakti, an Indian satellite Microsat-R was successfully intercepted at an altitude of 274 km using a kinetic kill vehicle launched on a ballistic missile.

Pakistani Modernization Programme

On the weapon side, Pakistan claims to have miniaturized the nuclear warhead to fit into their cruise missiles, MIRV needs and tactical missile NASR. The miniaturized warhead has necessarily got to be plutonium based. Consequently, the natural question that comes to mind is with what confidence is Pakistan fielding a weapon system with no (apparent) test history, since the 1998 Pakistani nuclear tests were all HEU-based systems.

Pakistan's initial ballistic missiles – Ghaznavi and Shaheen-1 – were products of Chinese technology assistance and transfer and relate to M-11 and M-9 missiles, respectively. Pakistan has subsequently developed multi-stage ballistic missiles with higher ranges and one missile with claimed MIRV capability. The MIRV development is in answer to India's BMD capability. The details of Pakistani ballistic missiles are shown in table 3 below:

Missile	Stages	Length (m)	Diameter (m)	Range (km)	Remarks
Abdali (Hatf-2)	1	6.5	0.56	80-100	Modified and improved version of Hatf-1
Ghaznavi (Hatf-3)	1	8.5	0.8	300	Indigenous version of Chinese M-11 missile
Shaheen-1	1	12.0	1.0	750	Based on Chinese M-9
Shaheen-1A (Hatf-4)	1	12.0	1.0	900	RV is modified and uses Post-Separation-Attitude-Control (PSAC) system
Ghauri (Hatf-5)	1	15.9	1.35	1300	Based on North Korean No Dong missile
Shaheen-2	2	17.2	1.4	1500	Based on Chinese DF-18.
Shaheen-3	3		1.4	2750	Essentially modified Shaheen-2 with an additional liquid stage
Ababeel	3	22.1	1.4 /1.7	2200	The missile is said to be MIRV capable.

Table 3: Pakistani Ballistic Missiles *(Source: Personal Notes)*

Pakistan has made significant progress with the development and deployment of subsonic cruise missiles (Nagappa et al. 2007).[22] These missiles can be hosted on land, air and submarine platforms taking Pakistan closer to Triad capability. Pakistan's Land Attack Cruise Missile (LACM) Babur-2 has a range of 750 km and its Air Launched Cruise Missile (ALCM) Ra'ad was originally developed with range of 350 km. This range, which did not provide an undue standoff advantage, has been rectified by the recent flight test of increased range Ra'ad II ALCM (Gady 2020).[23] The enhanced range of 600 km and aircraft release provides Pakistan with good standoff capability. Pakistan claims a range of 450 km for its submarine torpedo tube launched cruise missile – Babur-3. As mentioned earlier, the estimated range of 250 km does not offer a major standoff advantage.

Pakistan has also developed and deployed a tactical nuclear weapon Nasr with a range originally of 60 km (Nagappa et al. 2013).[24] The range has subsequently been increased to 70 km which does not alter the field scenario to any significant extent.

Comments

In terms of ballistic missile diversity and reach, both India and Pakistan have matching capability (though Pakistan's Shaheen-3 and Ababeel are still in the development phase) and this aids mutual deterrence. The missile systems of both countries are road-mobile, which adds to the survivability. In India's case, with the burden of no first use, this becomes all the more important. Some of India's long distance missiles are canisterised and even rail-mobile. Confidence building measures like pre-launch notification of ballistic missiles adds to a stabilized working system.

Pakistan seems to have an advantage in respect of LACM and ALCM, which are operational. These missiles, if properly designed with stealth and manoeuvrability have the capability to evade air defence systems. India's multi-layer air defence systems – both indigenous and procured high capability systems –may be able to neutralise the cruise missile attacks. India and Pakistan do not have a pre-launch notification protocol in respect of cruise missile flight tests.

India's constellation of dual-use earth observation satellites have frequent revisit capabilities. India's Cartosat series satellites have resolution better than one metre and revisit time can be pruned to one day. The Radar Imaging Satellites (RISAT) provide day and night all weather imagery. These eyes in the sky can monitor sensitive locations for preparedness and early warning. Further, India has taken steps to create organisations to address the defence space requirements. In April 2019, the Government announced the formation of the Defence Space Agency (DSA) and followed it up with the creation of

Defence Space Research Organisation (DSRO) in June 2019. The DSA will command the space assets of Defence Forces including the military's anti-satellite capability. DSA will also formulate a strategy for the protection of Indian space assets as well as assess space-based threats.

There is a large asymmetry between the two countries in respect of space capabilities and utilization of data from space for strategic purposes. Pakistan's space capability is just coming up. In July 2018 Pakistan had its first earth observation satellite PRSS-1 with panchromatic and multispectral imaging resolution of 1m and 4 m, respectively, launched into orbit. The satellite and its launch was assisted by China. Notwithstanding, the limited indigenous space resources, it is likely that Pakistan may seek/obtain crucial earth observation data from China.

Pakistan's introduction of tactical nuclear weapon Nasr has introduced major asymmetry, lowered the nuclear threshold and upset the strategic stability. In a study carried out earlier (Nagappa et. al 2013)[25], it was argued that Nasr poses dangers for the robustness of nuclear deterrence between India and Pakistan. Besides the credibility issues of an untested weapon system, there is a doctrinal issue. Employment of Nasr will signify a shift from 'first use' policy to 'first strike' policy. This may lead to situations where Pakistan could threaten to use nuclear weapon even when it may not be warranted. The escalation danger flows from the Indian nuclear doctrine, which does not differentiate between tactical or strategic weapon. In either case, the response, in case nuclear weapons are used against it or its forces anywhere would be massive. Pakistan claims that Nasr will, like the strategic systems function under its Nuclear Command Authority. However, for such a weapon to be effective, pre-delegation to the local commanding officer is most likely to happen. Short-range battlefield weapon systems, like Nasr fielded near the borders are prone to "use them or lose them" pressures when under attack. Under such conditions, it will become problematic to exclude/prevent unauthorized use of the weapon. It is best to avoid introduction of tactical nuclear weapons in a conventional battle.

Nasr poses dangers for the robustness of nuclear deterrence between India and Pakistan

Conclusions

A nuclear weapon resurgence is evident in the international scenario. The USA-Russia and the USA-China dynamic has a cascading effect and impacts on the other country technology status and 'catch up' tendency. Unless progress is made on the denuclearisation of the Korean peninsula, there could be cascading effect on nuclear weapon thinking in Japan and South Korea. The Chinese have not reacted favourably to the US-South Korea

plans to locate Terminal High Altitude Area Defense (THAAD) missile defence system to counter North Korean ballistic missiles. In the India-Pakistan dynamic, continued technology proliferation and technology assistance to Pakistan from China is also impacting strategic stability apart from forcing India to come up with matching or alternate strategies. Space, Cyber and Artificial Intelligence are adding to both capacity building as well as increasing the asymmetries. There is need for bilateral and multilateral dialogue addressing all issues to manage strategic stability.

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