Trends in India's Nuclear Force Modernization: Regional and Global Implications

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Abstract

India announced its nuclear doctrine in 2003 after testing its nuclear weapons in 1998 and issuing a draft nuclear doctrine in 1999. Since 2003, India has developed ten new nuclear capable missile systems. The attributes of these systems indicate diversification in ranges of Indian nuclear delivery systems - a shift from liquid fuel missiles to solid fuel missiles, canisterization of missiles, and possibly MIRVing some of the systems. These technologies remind one of the Cold War strategic competition between the US and USSR. This paper presents expert opinions on these emerging trends and analyzes the implications they could possibly have for future Indian nuclear posture, South Asian deterrence stability, arms control, and the nuclear non-proliferation regime. In most cases, these developments do not appear to be driven by security considerations or deterrence requirements. The uncertainty over the nuclear role of certain missiles (Prahaar and BrahMos) is likely to exacerbate misperceptions and miscalculations during crises thus adversely affecting regional stability, besides affecting the prospects of arms control and non-proliferation measures at the regional and global level.

Keywords

Nuclear weapons, Canisterization, Non-proliferation, MIRV, Deterrence, Strategic stability, Ballistic missiles.

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Introduction

Possession of adequate delivery means is a pre-requisite for the credibility of nuclear deterrence, and the credibility of deterrence lies in the demonstration of this capability. India tested its first nuclear weapon in 1974, but claimed possession of a nuclear deterrent in 1998 after conducting a series of tests. Initially it possessed a limited number of nuclear delivery systems and these limitations were reflected in its nuclear doctrines declared in 1999 and later in 2003. India has since developed a number of land, air, and sea based nuclear delivery systems – primarily missiles. These developments are often rationalized under Indian threat perception vis-à-vis China and Pakistan.

After formally notifying its nuclear doctrine in 2003, India has tested at least ten new missile systems that are of strategic significance. These systems include submarine launched ballistic and cruise missiles, shorter- and longer-range missiles, variants of cruise missiles and canisterized missiles. Indian scientific community has also indicated development of missiles with even longer ranges along with the possibility of carrying Multiple Independently Targetable Re-entry Vehicles (MIRVs). While the statements from Indian leadership indicate possible changes in its nuclear doctrine, an analysis of these trends in ranges and types of missiles can provide further insights into the direction that the Indian nuclear doctrine may be heading.

This paper endeavors to elicit opinions on these trends to assess the possible geo-strategic implications of Indian nuclear force modernization at the regional and global levels. Historically, India has justified its strategic developments in the context of its threat perception vis-à-vis China. However, due to the antagonistic relations between India and Pakistan, these developments, according to Indian policy makers, have exacerbated latter's threat perception. In response, Pakistan is reacting to what it perceives as destabilizing developments in a bid to stabilize deterrence. Both, India and Pakistan, are developing more advanced weapon systems to deter

each other but this continuous build-up of nuclear forces may further complicate the quest for deterrence and exacerbate instability in the region.

India's plan to develop Intercontinental ballistic missile (ICBM) Agni-VI with a range of 10,000 km[1] and deployment of nuclear capable submarine launched ballistic missiles (SLBMs) with ranges up to 3500 km[2] will provide India with a global reach, far beyond what India realistically needs against China or Pakistan. This modernization in nuclear delivery systems will increase India's requirements for nuclear warheads and fissile materials. There could also be pressure on the Indian scientific and political leadership to resume nuclear testing in order to validate their effectiveness for use with new delivery systems which significantly differ from what India had in 1998. Modernization process in Indian nuclear forces will not only determine the future of South Asian stability but could also affect the future of global non-proliferation regime and arms control arrangements.

The initial part of the paper takes stock of new systems inducted in Indian nuclear forces since 2003. Based on the data and distinguishing features of these systems, several trends have been identified that include simultaneous development of shorter and longer ranges of missiles, canisterization of these systems, shift from liquid to solid-fuel missiles, and MIRVing. In the latter part of the paper, these trends are assessed with the help of interviews with experts looking at these issues. Based on these assessments, an attempt is made to assess how Indian nuclear force modernization may affect regional stability, global non-proliferation regime and future prospects of arms control.

1. Indian Nuclear Forces 2003-2019

India started to demonstrate its capability to deliver nuclear warheads in late 1980s by testing different variants of Prithvi and Agni missiles. Prior to the release of Indian Draft Nuclear Doctrine (DND) in 1999, India had only tested its Prithvi-I, Prithvi-II, Agni

(technological demonstrator) and Agni-II missiles. The minimum range at that time was 150 km and the maximum available range to India was 2000 km. Of these two, the Prithvi series was liquid fuel while the missiles from Agni series were solid fuel. At that time, India was simultaneously pursuing both solid and liquid fuel missile systems. But till 2003, it did not test any new missile type with the exception of Ground Launched Cruise Missile (GLCM) Brahmos.

The table below maps the missile systems that India had tested since 2003 after announcing the official Indian Nuclear Doctrine (IND). The 2003 IND called for developing a triad of nuclear forces to meet the requirements of massive retaliation and No-First Use (NFU). As a result, there appears to have been increased development and testing of different land, air and sea based ballistic and cruise missiles.

Ser.	Delivery System	Type	Date of First Test	Range	Warheads	Propellant
			LAND			
1.	Prithvi-III	Ballistic	23 Jan 2004	350km	1	Liquid
2.	Agni-III	Ballistic	9 July 2006	3,500km	1	Solid
3.	Agni-IV	Ballistic	15 Nov 2011	3,000-4,000km	1	Solid
4.	Agni-V	Ballistic (Canisterized)	19 April 2012	5,000+ km	Multiple (up to 12)	Solid
5.	Prahaar	Ballistic (Canisterized)	19 July 2011	150km	1	Solid
6.	Nirbhay	Cruise	12 March 2013	1000km	1	Solid

AIR						
7.	BrahMos	Cruise	14 July 2018	290, 450km	1	Solid
SEA						
8.	BrahMos	Cruise	20 March 2013	290,450 km	1	Solid
9.	K-15	Ballistic	27 Jan 2013	750km	1	Solid
10.	K-4	Ballistic	26 March 2014	3500km	1	Solid

Table 1

2. Identifying the Trends

Table 1 identifies that India has developed ten new missiles systems including both ballistic and cruise missiles suitable for launching from different platforms (land, air and sea).

Diverse Ranges

With these developments, the new range bracket for India comes to 150km – 5,000+ km from the earlier maximum range of 2000 km. With a range of 5,000 km, the Agni-V is capable of bringing entire China within its range.[3] The maximum range of Agni-V remains contested. Some assessments indicate that it may be capable of hitting targets up to 8,000 km.[4] Even though Agni-V can cover entire China, the Indian DRDO is working on developing even a longer range missile Agni-VI capable of carrying warhead beyond 10,000 km.[5]

Shift from Liquid to Solid Fuel Missiles

Another aspect reflected in the table is that India has only introduced one new type of liquid fuel missile in the form of Prithvi-III. This indicates that India is only focusing on basing its nuclear forces on

solid fuel missile. The Indian decision of replacing Prithvi series with newly introduced solid fuel Prahaar missile further corroborates this proposition.[6] The solid fuel missiles require lesser maintenance and are readily available for use as compared to liquid fuel missiles and reflect Indian focus towards higher readiness levels of their nuclear forces. This was also indicated in one of the former DRDO Chief's interview who had stated that he was tasked to reduce the reaction time of Indian nuclear forces from hours to minutes.[7]

Canisterization

Of the new missile systems introduced, India has tested its Agni-V[8] and Prahaar[9] missile in a canisterized mode. Canisterization is another method to further reduce the readiness time for any missile system by reducing the maintenance and the need for preparing the missile before launch. Furthermore, in a canisterized mode it is believed that a missile has to be mated with the nuclear warhead. India was otherwise known to have a policy of maintaining warheads and delivery systems in a de-mated form.[10] However, it is not clear whether introduction of canisterized missiles has changed the earlier policy. India's nuclear capable submarine INS Arihant's deterrent patrols indicate that this policy has already been compromised - at least in part - as the nuclear missiles on board the nuclear submarines (SSBNs) have to be kept in mated and canisterized form. These developments raise questions over centrality of India's nuclear command and control in the absence of information about how India may be addressing the related issues.

MIRVing

India has not yet demonstrated the capability to deliver multiple warheads on any of its missile systems. However, its scientific leadership has, indicated at multiple occasions, that at least Agni-V and Agni-VI missiles would be capable of carrying multiple warheads.[11] India's placement of multiple satellites, in different orbits, using a single launch vehicle is seen as a demonstration of a potential

Indian MIRV capability.[12] MIRVs technology will also complement India's pursuit of counter-force targeting particularly when it has already signaled the desire to launch comprehensive first strike.[13] MIRVs were essentially developed during the Cold War as a potent counter-measure against enemy's BMD capabilities. China has demonstrated a limited BMD capability but has not expressed any intent to operationalize it against India. Also, Pakistani officials have stated that Pakistan consciously decided not to pursue a BMD system. Therefore, pursuit of this technology is not driven by operational requirements of deterrence.

3. Eliciting Opinions on Trends in Indian Nuclear Delivery Systems

Ranges

The trend in ranges of Indian nuclear delivery system points to different rationales for development of shorter and longer range missiles. The longer range missile systems can be viewed in terms of India's stated and actual threat perceptions. The trend of shorter range missile systems could possibly be indicative of Indian employment of nuclear weapons in a war.

Sitakanta Mishra, Visiting Scholar at the Cooperative Management Centre of the Sandia National Laboratory, believes that, like threat perception and national security preparedness, military modernization is dynamic in nature.[14] In case of missile ranges that go beyond Pakistan and China, this could mean a possibility of Indian deterrent relationship with states other than these two. Some Indian leaders have been demanding a capability that could eventually deter the United States.[15] Mishra further explains that "India is not preparing its missile capability aiming at any particular country, geo-political imperatives and its aim to become a global power prompt it not to lag behind in any technological evolution."[16] He further adds that "given [India's] bitter past with China and latter's current massive military modernization process, India's endeavor to achieve

12,000 km range for its ICBM is rather modest and prudent."[17] Anything exceeding the stated objective of deterrence vis-à-vis China would indicate either a technological competition driven by status or catering for a deterrent capability to address potential threats from across the globe.

Frank O' Donnel, postdoctoral fellow at the U.S. Naval War College and nonresident fellow at the Stimson Center, holds a similar assessment of the issue. He believes that "Agni-VI missile, with a potential range of 8,000 to 12,000 km, is difficult to justify in terms of filling a retaliatory capability gap in India's nuclear deterrence."[18] Michael Krepon, Director of South Asia and Space Security program at Stimson Center believes that India is unlikely to pursue capabilities beyond China and that the requirement for ranges should be calculated from farthest point in the operating country till the farthest point in adversary's landmass.[19] However, the same criterion is not applied when analysts assess the rationale for development of Pakistan's Shaheen-3 missile that barely reaches farthest points in India. [20]

On the Pakistani side, the development of India's longer range missile systems is seen in a different context. Dr Adil Sultan, Visiting Research Fellow at the War Studies Department at King's College argues that "ICBMs are being built mainly to demonstrate India's missile reach and for prestige considerations." He further contends that, "India does not face any existential threat from its immediate neighbors or any other country around the world." [21] In the absence of any significant deterrent value that Agni-VI adds vis-à-vis Pakistan or China, it appears that this development is driven by an Indian desire to match in status with the global players. Alternatively, it could mean India is working towards eventualities where it may find itself in a deterrent relationship with states other than Pakistan and China.

There are a lot of differing perspectives on the attributes of India's shortest range and solid fuelled ballistic missile – Prahaar. The diversity of views on this particular missile system emanates out of

ambivalence and deliberate ambiguity created by Indian officials statements concerning this system. While Pakistan's official statement following testing of its own SRBM – Nasr, explicitly stated it as capable of carrying nuclear warheads; but Indian statement following test of Prahaar called it a "tactical missile" "capable of carrying different kind of warheads."[22] While some analysts were of the opinion that it was conventional missile,[23] the DRDO Chief publicly stated that India will replace nuclear capable liquid fuel Prithvi with the "more capable" solid fuel Prahaar.[24] These statements are also linked with Indian DRDO Chief's statement that he was tasked to reduce Indian response time to minutes.[25] In combination, these statements point to a requirement for more ready and "tactical" nuclear delivery options available for use in minutes. This reduction in response times is also supported by the canisterized configuration of Prahaar that has been tested.[26] Liquid fuel Prithvi would have been ill-suited to support this role and fulfill the requirement of higher readiness.

O' Donnel thinks that Prahaar is unlikely to be nuclear armed.[27] He believes, "their [Prahaar's] role is rather to help continue Indian ambitions to widen the strategic space for conventional warfare before approaching Pakistan's nuclear threshold… By eradicating Pakistan's nuclear Nasrs with conventional Prahaars, followed by a conventional Indian cross border ground force operation, India can credibly claim that it is upholding its NFU commitment."[28] A similar assessment was shared by Vipin Narang, at the Carnegie Nuclear Policy Conference, where he asserted that as Pakistan prepares for using Nasrs, India will take them out in a "comprehensive counterforce strike."[29] Vipin's statement does not specify whether this counter-force strike would be conventional or nuclear. In any case irrespective of what Clary or Vipin may believe or advocate, the chances of success of conventional counter-force strike against Nasr or any other pin point target would not be very high given the Circular error of probability (CEP) of Prahaar. The nuclear warheads can cover these inaccuracies but conventional warheads cannot.[30] Therefore, a

counterforce strike can well be a nuclear first strike given the cannisterization of Prahaar and it being a replacement for the nuclear capable Prithvi missiles.

Michael Krepon holds a different view, he believes that India is likely to maintain its policy of NFU as India is a stronger country and it does not suit its interest to abandon NFU and cross the nuclear threshold first.[31] However, the recent nuclear signaling from the Indian leadership is not indicative of a behavior of a stronger country. Furthermore, Krepon's assessment only reflects tendency to give a benefit of doubt to Indian nuclear developments. On massive retaliation, he maintains that it is not a credible doctrine for any country with a sizable arsenal to follow.[32] Moreover, Dr. Sultan offers a different perspective as he believes that Indian introduction of TNWs is to offer "an option for a 'tit-for-tat' kind of response which could also mean moving towards nuclear war fighting rather than responding massively to use of Nasr which would have been disproportionate.[33] Christopher Clary, assistant professor of political science at the University at Albany, also seems to subscribe to the assessment that this could be an Indian response to match Pakistan's Nasr.[34] To date there are no verifiable means to ascertain whether Prahaar will be used in a nuclear or a conventional role. In light of conflicting Indian statements, ambiguity regarding this system's role, shorter warning times, and Indian recent signaling of a pre-emptive first strike; this system only furthers misperceptions and miscalculations in times of crises.

Shift from Liquid to Solid Fuel Missiles

Another trend that is specific to Indian Prahaar is that of a shift from liquid fuel to solid fuel missiles. India has not tested a new liquid fuel missile since 2003 and plans to replace its existing land-based liquid fuel missiles (Prithvi series) with the solid-fuel Prahaar (which will also be cannisterized). Clary acknowledges that solid fuel missiles offer greater readiness but are also more survivable.[35] Based on the survivability aspect, Clary argues that this shift is not necessarily

indicative of a desire for prompt strike.[36] Survivability of these solid fuel missiles is improved by their mobility, and their readiness possibly deters a pre-emptive strike. The Indian threat perception vis-à-vis the possibility of preemption against its short-range liquid fuel ballistic missiles is not clear. Therefore, readiness would seem a more likely consideration given DRDO Chief's statement regarding his mandate to reduce response time.[37]

Sitakanta Mishra believes that the Indian move from liquid to solid fuel missiles is only prudent given how the latter are considered more safe and secure.[38] He also adds that the more swift and reliable solid-fuel missiles are also required for India's Cold Start Doctrine (CSD).[39] Commenting upon the command and control implications of such a ready arsenal, Mishra argues that India has a well-established command and control system but there is always scope for improvement or readjustment if situation demands.[40] Along the same lines, Michael Krepon underscores that the liquid fuel Prithvis were never a prudent option and that better technological capacity is a better option to replace the existing missiles.[41]

Contrarily, Dr Adil Sultan views this trend in the context of DRDO working to reduce response time and that these solid-fuel missiles could be put on higher alert levels. He does not see this translating into a delegative command and control as India does not foresees a scenario where Pakistan would launch military aggression against it across the international border.

Canisterization

India has tested its shortest and longest-range missiles (Prahaar and Agni-V) in canisterized mode. Canisterization is considered to be a solution for obviating the need to prepare and mate the missile system with warhead which can potentially be a time consuming exercise in times of crises. Michael Krepon believes that higher readiness also prompts higher alert levels.[42] Frank O' Donnel shares a similar assessment of the development as he observes that

canisterization does technically mean that Indian nuclear forces are held at higher readiness as it moves away from the previous peacetime posture of keeping warheads and delivery vehicles geographically separated.[43] This policy of keeping the warheads and delivery vehicles de-mated, was necessary as the time lag between an order to mate warheads to delivery systems and the completion of this task. This provided additional time for decision makers to obtain a clearer picture of the strategic reality and perhaps reconsider an initial nuclear use decision. Hence this situation created a cushion for making an informed decision.

O' Donnel contests the idea that this could possibly lead to unauthorized or accidental launch since India could still make use of technological solutions like access codes and administrative solutions like two person rule.[44] Dr Sultan views canisterization as a step towards higher alert status to coerce smaller neighbors like Pakistan. He adds that this situation could prompt Pakistan to increase alert levels to prevent India from contemplating a 'pre-emptive counterforce strike" against Pakistan.

Higher levels of readiness and alert can be dangerous in a crisis prone region like South Asia.[45] O' Donnel suggests that there is need for a series of strategic dialogues between India Pakistan, and, China around their mutual strategic perceptions, platform missions, and expected areas of operation for their emerging seaborne nuclear forces to deconflict these.[46] Dr Sultan also believes that there is need to encourage both India and Pakistan to consider measures that could provide a degree of predictability in order to avoid misperceptions and miscalculations.[47] However, he highlights Indian disinterest in discussing any CBMs with Pakistan.[48]

MIRVs

Although India has not tested this capability yet, Indian scientific leadership has claimed that it is incorporating it in the existing (Agni-V) and upcoming (Agni-VI) missiles. Dr Sultan believes that India has

no plausible security oriented justification for pursuing this capability given the fact that Pakistan has taken a conscious decision not to pursue BMDs and China too has not demonstrated a keen interest in pursuing a missile shield, unlike India.[49] Michael Krepon, however, seems to view this as a technological competition as he thinks that Indian scientific community is as competent as Pakistan's.[50] India is looking at Pakistan and China with MIRVs[51] and probably does not want to be seen as lagging behind the two.

Commenting upon the operational utility, O' Donnel remarks that "there is no greater deterrent effect that will be generated by a MIRVed or even MRVed (Maneuverable Reentry Vehicle) Agni-V force as compared to a single-warhead Agni-V force.[52] He also observes that given ongoing Indian developments of MIRVs, as well as other projects such as the nuclear fuel needs for its emerging SSBN force; make this Indian determination [on concluding FMCT] a distant prospect.[53]

Unlike O' Donnel, Sultan, and Krepon, Christopher Clary provides a different rationale for Indian pursuit of MIRVs. He believes that MIRVs provide an economically cost effective and cheaper alternative to larger number of single-warhead missiles.[54] That said, it needs to be seen as to how MIRVing of one or two missiles, out of an arsenal that features fourteen types of missiles can provide any significant economic value outweighing the strategic stability objectives.

4. Regional and Global Implications of Indian Nuclear Force Modernization

The detailed analysis of the identified trends in Indian nuclear delivery systems indicates that India is making qualitative and quantitative improvements in this critical component of its nuclear triad by developing a variety of missile systems. These new missile systems allow India to adopt doctrines that can be detrimental for the deterrence stability. This section will discuss the impact of Indian

nuclear force modernization on the fragile state of deterrence stability in the South Asian region and beyond.

Doctrinal

The identified trends in Indian nuclear delivery systems have a high impact on the existing Indian nuclear doctrine. The 2003 document of Indian nuclear doctrine states that India will stick to the policy of no-first use of nuclear weapons; while retain the option of retaliating with nuclear weapons in the event of a major attack against India, or Indian forces anywhere, by biological or chemical weapons.[55] However, the identified trends reflect some inconsistencies with the stated doctrine. For instances, the currently pursued nuclear use options (like Prahaar) seem to be misfit in a strategy of massive retaliation that is historically associated with counter value targeting. Credible Minimum Deterrence (CMD) also remains one of the central elements of the 2003 document. However, the missiles with ranges up to 10,000 km clearly go beyond what may be required for maintaining a credible minimum deterrent vis-à-vis China and Pakistan. Similarly, in the absence of a threatening BMD capability with China or Pakistan; or other deterrence requirements; Indian MIRV capability appears beyond minimalism. While commenting upon Indian dilemma, vis-à-vis maintaining credibility and minimalism of its nuclear deterrent against both China and Pakistan, Narang argues that (for India) what may be credible against China would not be minimum against Pakistan and what may be minimum against Pakistan cannot be credible against China.[56] However, in case of Indian development of MIRVs and longer range missile systems, neither helps to increase the credibility of Indian deterrent or indicate its commitment to minimalism towards either China or Pakistan.

Indian nuclear doctrine catered only for counter-value targeting policy;[57] however, India maintains weapon systems that allow it to have both counter-force and counter-value targeting options. While the longer-range Agni missiles may be used in a counter-value role, the shorter range missiles like Prithvi, Prahaar, (the upcoming

Pralay), Dhanush and Brahmos offer weapons for use in counter-force role.[58] Given India's ever increasing I2SR capabilities counter-force nuclear operations cannot be ruled out.[59] Chris Clary and Vipin Narang argue that a shift from counter-value to counter-force targeting options would mark a seismic shift in Indian nuclear strategy.[60] Counterforce capabilities complement a doctrine based on the flexible use of nuclear weapons, which is clearly not in line with Indian NFU pledge that requires a state not to pursue the weapons or technologies that could be used to carry out a first strike.[61]

Canister launched missile systems are another feature of Indian missile modernization. It allows the possessor to maintain its nuclear warheads mated with the delivery system in a ready to use state. This becomes increasingly worrisome when such technologies are employed in South Asia where the warning times are too less to constitute a 'warning," and the crises are frequent.

This particular trend indicates that India is moving away from its earlier known policy of keeping the warheads and delivery systems in a de-mated form. If so, this could possibly challenge the sole authority of civilian leadership over the use of nuclear weapons hinting towards delegation of command unless Indian authorities provide greater details on how they intend to ensure centralized control. Such command and control system – if it fails – will have deadly consequences because it increases the possibility of un-authorized and accidental use.

Canisterization along with India's move from liquid fuel to solid fuel missile systems indicates a focus on greater readiness which can possibly prompt higher alert levels. Besides these developments, Indian policy makers, officials, academics and politicians – have made ample statements hinting at changes in Indian NFU policy, while also arguing that India will not hesitate from launching comprehensive first strikes against Pakistan.[62] Such statements from political and military leadership and analysts by academia timed well with the new

developments in the Indian missile systems; only strengthen the concerns that India has shifted from its earlier stated policies of NFU and massive retaliation.

Deterrence Stability

Modernization in Indian nuclear delivery systems can impact deterrence equation between India and Pakistan. Except Agni-V and Agni-VI, all Indian delivery systems are relevant against Pakistan. Even the Agni-V becomes relevant against it as this missile can be deployed against Pakistan while staying invulnerable to Pakistani offensive capabilities.[63]

The shortest-range ballistic missile Prahaar, poses peculiar challenges to deterrence stability between India and Pakistan. The missile is scheduled to replace the liquid fuel Prithvi missiles. This will increase the readiness level of Indian ballistic missiles available for shorter ranges. Furthermore, Prahaar is being tested in canisterized mode. This missile's canister-based deployment would mean that it would be mated with the nuclear warhead; making it a readily usable nuclear delivery system available with Indian strategic forces.

There are already indications that India might opt for a 'comprehensive first strike' to neutralize the nuclear capable missiles deployed on the Pakistani side.[64] Attempts to achieve a successful first strike and to defend against a surprise first strike were the primary reasons that pushed the U.S. and the USSR to cumulatively amass as much as 62000 nuclear weapons at the peak of Cold War. India will not only have to increase its nuclear forces significantly to develop means for a successful first strike, it will also force Pakistan to increase its nuclear forces in order to ensure survivability of its forces in such an eventuality.

Another worrisome aspect of Prahaar's deployment is related to the ambiguity regarding its payload. Prahaar is generally presented as a conventional missile.[65] However, the DRDO press release specifies that the missile can carry "different types of warheads."[66] This is an

implicit reference to its dual capability. As the missile replaces Prithvi series, there is no evidence to suggest that India is considering non-use of nuclear weapons at these ranges. For all intents and purposes, any adversary – whether China or Pakistan, will consider Prahaar to be a nuclear capable missile. Once deployed in times of crises, its shorter range and canisterization (being mated with the nuclear warhead) will make it an attractive target for pre-emption; thereby increasing the chances of inadvertent escalation caused by misperceptions and miscalculations.

Like Prahaar, Brahmos hypersonic cruise missiles development by India also infuses ambiguity. Logically the missile should only be used in a conventional role by virtue of it being a joint venture between an NPT recognized nuclear weapon state (Russia) and an NPT outlier nuclear weapon state (India). Being an Indo-Russian joint venture, the range of Brahmos missile system was carefully kept at 290 km, i.e. just 10km under the range allowed by the MTCR. But after Indian membership of the MTCR, India is increasing the missile's range. An even worrying development is the fact that the missile will be capable of carrying nuclear warheads[67] – something that the MTCR is set out to discourage through limitations on payload and range. Indian analysts point out that there is no political limitation in using Brahmos, Nirbhay, and Prahaar in a nuclear role.[68] The delivery[69] of 42 Su-30 aircraft armed with Brahmos cruise missiles to Indian Strategic Force Command (SFC) leaves no uncertainty that the missile will be deployed in a nuclear role.

Designation of a nuclear role to Brahmos should constitute a clear violation of the MTCR guidelines. More so, the arrangement would raise questions over Russian adherence to the NPT under which it is not supposed to help a non-nuclear weapon state (India – as per the NPT definition) with nuclear delivery systems.

In a conflict situation, deployment of Brahmos equipped fighter jets would only increase the chances of misperceptions and

miscalculations. Indian adversaries would likely assume that the missile is meant for a nuclear role even if India means otherwise. Some analysts have observed that Brahmos missiles could be useful in Balakot-like strikes.[70] It is not clear if India would use nuclear warheads for such strikes and how would these strikes comply with Indian policy of NFU of nuclear weapons.

Arms Control

India has so far developed almost every technology that can be traced back to the Cold War. Whenever India tests a new technology, be it BMD, SSBNs, or an Anti-Satellite capability, mainstream Indian media and analysts mention how India has joined an 'elite club' of nuclear haves.[71] In its eagerness to enter the elite club, India appears to be dismissive of regional realities in the form of fragile deterrence stability, existing disputes and a perpetually dysfunctional state of relationship with its nuclear armed neighbor – Pakistan.

Like the Cold War antagonists, India is moving towards pre-emption based strategies in the pursuit of damage-limitation.[72] Increased number of nuclear warheads and their delivery systems was the outcome of such strategies during the Cold War. As the USSR realized US intentions of considering preemptive first strikes, it responded by increasing and modernizing its nuclear forces contributing to a nuclear arms race.[73] If such trends follow in South Asia, the vulnerable states will realistically respond by increasing and modernizing their nuclear forces. As a consequence of such strategies, an arms race would be the most likely outcome. This will reduce any likelihood of arms control arrangements in the region. India has already missed on Pakistani proposals under the strategic restraint regime of non-introduction of certain destabilizing technologies like BMD and bilateral commitment, and, non-testing of nuclear weapons. Deliberations and subsequent agreement on such restraint measures could have allowed the two South Asian nuclear adversaries to eschew the Cold War route to armament before agreeing to arms control measures. Several of the unnecessary developments could

have been avoided had the two states not exhibited the trait of, what Dr Naeem Salik terms as a case of, 'unlearning.'[74]

India has assumed a central role in US' policies of containing China. As a result, the United States is facilitating Indian military buildup. Continued Indian strategic and conventional military buildup and experimenting with the problematic strategies of the Cold War is likely to affect Chinese strategic choices in the near future. This will further complicate the already struggling bilateral and multilateral arms control arrangements like the abrogation of the INF treaty and future extension of the New START. Some analysts have pointed out that abrogation of INF served the mutual US and Russian interest of roping in China in future arms control arrangements.[75] Although India has made a commitment in its nuclear doctrine to work towards global nuclear disarmament and maintains this stance at international forums, these actions, however, lead the way to arms race which runs counter to the objective of disarmament.

Non-Proliferation Regime

India had expressed its commitment to negotiating a FMCT at several ooccasions. However, after securing a Nuclear Suppliers Group (NSG) waiver and civil nuclear cooperation agreement, its stance on the subject changed visibly in 2009 when New Delhi asserted that it will not negotiate such a treaty [FMCT] if it is against its national security interests.[76] If some of the current calculations [which estimate Indian weapons capability to be much more than it is generally understood] on Indian fissile material stockpiles are close to reality, Indian opposition to FMCT might change.[77] If not, India will continue to increase its nuclear warheads in order to support its pre-emptive first strike nuclear strategies. Such circumstances will further diminish the likelihood of a treaty restricting production of fissile materials.

Development of a diverse array of nuclear delivery systems will also necessitate Indian resumption of nuclear testing. Since 1998, India has tested different delivery systems in the form of SRBMs, cruise

missiles, SLBMs, and possibly MIRVs which would require significant miniaturization of the warheads that can only be validated through nuclear testing. Furthermore, ICBMs like Agni-V and Agni-VI with respective ranges of 5,000 and 12,000 km are not suitably complimented by the currently claimed maximum yield of 30 KT. As has been the case with BMD, ASAT and SSBNs, India might go for thermonuclear testing for prestige and to become a part of the "nuclear elite." There are significant domestic pressures on India regarding the success of its claimed thermonuclear tests.[78] Consequently some scientists suggest that India should not sign a CTBT and keep its options open.[79]

The trends in modernization of Indian nuclear delivery systems are worrisome. Some of these trends risk regional deterrence stability while others go beyond its requirements against China. Such a situation negatively impacts the regional deterrent relationship and has the potential to threaten global arms control and non-proliferation arrangements.

Conclusion

An assessment of developments in Indian delivery systems between 2003 and 2019 reveals that India has developed ten new types of missile systems. All the new missile systems are solid fuel and some of these are scheduled to replace the existing liquid fuel missiles. India's longest and shortest range missiles (Agni-V and Prahaar) have been tested in canisterized mode and are likely to be mated with nuclear warheads.

The opinions on longer range Indian missile systems hold that there may be limited justification for the potential 10,000 to 12,000 km in terms of any retaliatory gaps. These missiles are either pursued to compete with China and other global players or else are aimed at catering for potential threats – other than China or Pakistan. The trend in development of shorter range solid fuel ballistic missiles – along with their canister basing is indicative of a desire to reduce

response time for Indian nuclear forces. While the opinions reflect that despite Prahaar being mated with nuclear warheads, the system will remain centrally controlled; however, higher readiness will reduce the time for Indian decision makers to make an informed decision. Owing to ambiguity surrounding this platform's (Prahaar's) mission, the system's deployment in times of crises will further increase chances of misperceptions and miscalculations.

India has not yet demonstrated MIRV capability in any of its missiles. Nonetheless, statements and its ability to launch multiple satellites through a single launch vehicle indicate that India has developed this capability but chooses not to demonstrate it. In the absence of a Pakistani BMD or lack of Chinese interest in pursuing a missile shield like India, Indian MIRVs do not improve the deterrent effect of its nuclear capability and economic considerations for pursuit of MIRVs are debatable. MIRVing one or two missile systems, from a total of fourteen systems, does not seem to be driven by such considerations.

Some developments in Indian nuclear forces seem to be inconsistent with its policies of massive retaliation and NFU. These systems provide India with greater flexibility in terms of employment of nuclear weapons in a conflict. With these capabilities, India may be able to devise employment options other than under NFU and massive retaliation as is also evident in the contemporary debate over Indian doctrinal restructuring.

By reducing response time, mating the shorter-range delivery systems with nuclear warheads, and canister basing some of the systems; deterrence instability is likely to grow. Reduction in response time will also reduce room for mediation as any crisis in South Asia escalates. In a region where there is no formal dialogue between the two nuclear armed neighbors, such developments will only exacerbate crisis instability and compromise deterrence stability.

The Indian development of a 10,000 to 12,000 km ICBM and MIRV capability is beyond Indian threat perception vis-à-vis China and

Pakistan. These developments also raise questions over Indian proclamation of credible minimum deterrence. As India qualitatively and quantitatively modernizes its nuclear forces, the prospects of arms control and non-proliferation will further reduce in an international environment headed in the direction of strategic competition.

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