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DEFINING THE CONTOURS OF INDIA'S ROCKET FORCE

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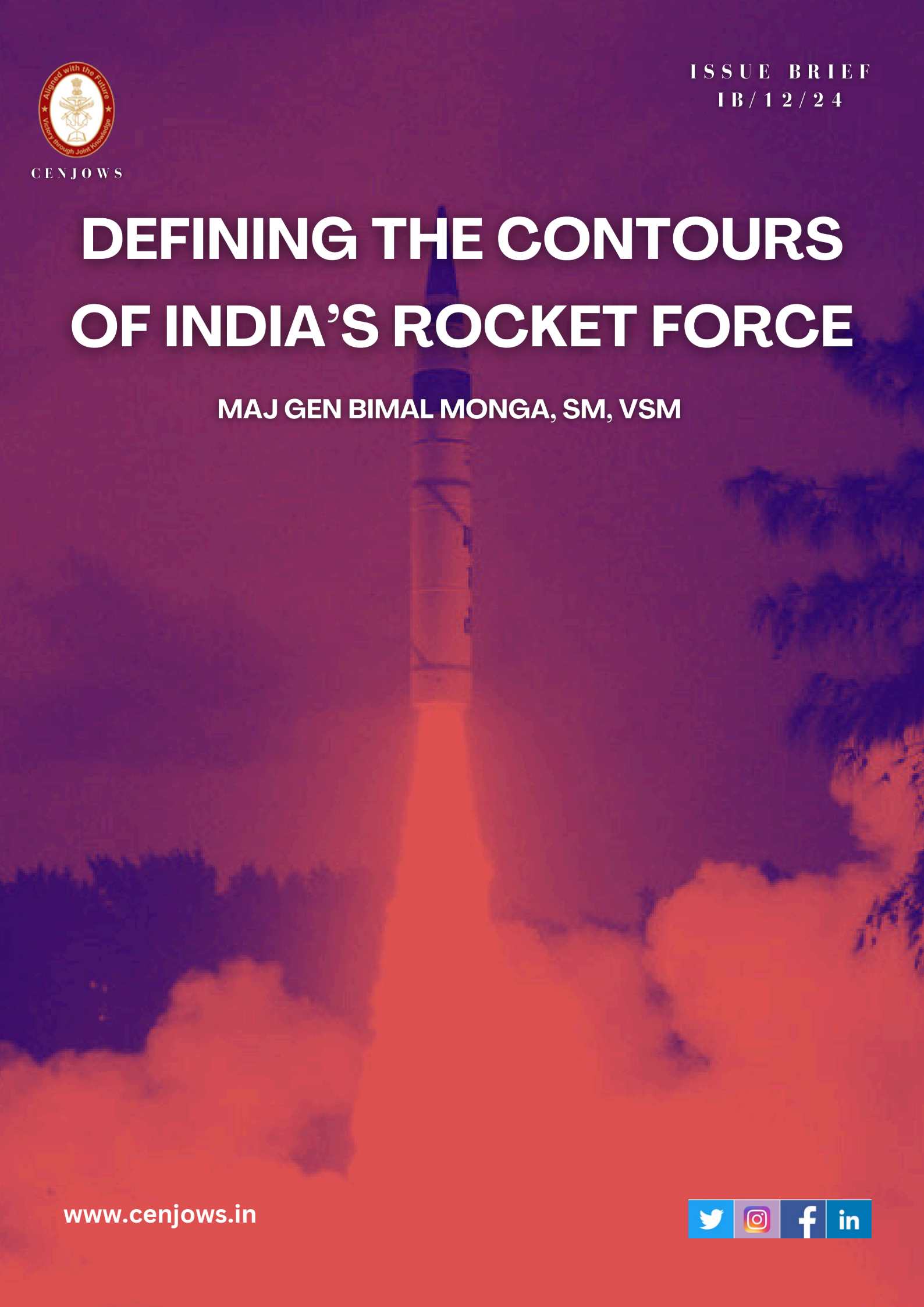

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DEFINING THE CONTOURS OF INDIA'S ROCKET FORCE

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"A separate IRF would lead to economies of scale, evolution of a suitable doctrine of employment and aggregation of massed fires. An IRF could truly catapult India into the era of non-contact warfare."

- V.K Saraswat, former DRDO Chairman, November 2021

Abstract

PLA in general, and PLARF in specific, has been deeply influenced by the Russian military concepts and doctrines, force-structuring and equipment. Infact, PLA's biggest takeaway from the Russians has been the establishment of PLARF, which mirrors the Russian Strategic Rocket Forces (RSRF). An analysis of the similarities between the two missile organisations - especially in the backdrop of the Russian Missile Campaign (RMC) and its effect during the ongoing Russia-Ukraine War will not only give us an insight into the expected employment of missiles by PLARF and its impact, but also invaluable inputs & pointers in framing the structures and inventory of our own nascent Rocket Force.

The Russia-Ukraine war has witnessed one of the most extensive missile and rocket campaigns in recent times and it is estimated that Russia fired between 6,100 to 8,000 missiles in the first 18 months of the war itself. The extensive use of SRBMs (Iskander M), hypersonic short range dual capability missiles (Kinzhal), and Cruise Missiles fired from the Caspian Sea (Kalibr), have been closely monitored by China and Western nations for their performance and impact.

However, overall, Russia's Missile Campaign against Ukraine was underwhelming as it failed to yield the desired and decisive results. Some of the reasons attributed to this

underperformance included limited and vintage inventory, inability to ensure dynamic targeting, lack of precision, vulnerability to AD and maintenance issues.

India's Rocket Force is now close to becoming a reality. It is imperative that in addition to assessing other similar organisations, lessons from recent missiles campaign be factored-in while finalizing our architecture and inventory, which of course, must be unique to our needs and in tune with the prevailing strategic realities. Aspects like tri-service raising, development of a holistic eco-system, systematic raising and prudent HR policies must be ensured. The granular structures, capabilities and the inventory will of course be dictated by the adversary, assessed objectives and the terrain of deployment and employment, amongst other factors.

The PLARF has a significant head start over us and their organization has matured over the years, the occasional hiccup, notwithstanding. However, it would be prudent for us NOT to mirror the PLARF-missile for missile or silo for silo, as it would only push us towards a ruinous 'excessive spending and spreading thin' trap. In fact, the IRF being at a nascent stage, has its own advantages; we can mould the structures and concepts to our requirements, based on recent global experiences, and also infuse the organization and inventory with the latest technology. This will help us avoid competing with the adversary's existing and legacy capabilities and instead empower us to leapfrog its capabilities.

Background

In my earlier article 'Is It Time for India's Rocket Force?' an effort was made to draw attention to the necessity of a Rocket Force for India. It was highlighted that "*China's short, medium and intermediate range conventional missiles have our entire country and the seas beyond, within striking range; and India has no answers to this threat, at present. The progressively precise PLARF missiles are capable of partially paralyzing and disrupting our critical military and civil infrastructure at the very onset of a conflict, while ensuring that the engagement is kept below the nuclear threshold; this indeed is a worrisome prospect for India. The omnipresent threat of Chinese conventional missiles is coercive, during normal times; and if a war does break out, it can cause unacceptable damage and casualties. Imagine a scenario, where China launches an offensive, preceded by an intense missile campaign, targeting and crippling vital military and civil infrastructure, thereby causing widespread destruction, loss of morale and shaping of public opinion against the government. What are the response options available with India? Air strikes? Naval action or blockade? Ground action to capture shallow objectives? Defensive measures over a wide canvas? Diplomatic outreach? Maybe, all of the above. Thus, a missile campaign, much expected, and in tune with the Chinese war fighting philosophy, will invite a whole of nation response right at the outset, which however, may still be ineffectual, and come with an attendant risk of escalating the situation. Now analyse the same scenario, if we had own credible conventional missile inventory? Would the Chinese still target us with missiles, fully aware that it may invite a similar and swift riposte?"*[1]

Since then, a lot of water has flowed in the Brahmaputra River, and the Government has not only accepted the necessity of raising a Rocket Force but also fast-forwarded action by approving acquisition of (two regiments) Pralay Ballistic Missiles.[2] Also, as

part of infrastructure development along the LAC, multi-purpose storage tunnels are being constructed in border states for storing the SRBMs.[3]

PLARF Mirrors the Russian Strategic Rocket Force (RSRF)[4]

PLA in general, and PLARF in specific, has been deeply influenced by the Russian military concepts and doctrines, force-structuring and equipment. Infact, PLA's biggest takeaway from the Russians has been the establishment of the PLARF in 2016, which mirrors the Russian Strategic Rocket Forces (RSRF), raised much earlier in 1966. It will, therefore be worth analysing the similarities between the two missile organisations - especially in the backdrop of the Russian Missile Campaign (RMC) and its effect during the ongoing Russia-Ukraine War. This may not only give us an insight into the expected employment of missiles by PLARF and its impact, but also invaluable inputs & pointers in framing the structures and inventory of own nascent Rocket Force.

Conceptually, PLARF, like the RSRF, has repeatedly underscored the centrality of conventional missile attacks in joint operations. The conventional missile force is therefore envisaged to be used against high-threat and high-value targets, either as an independent conventional Missile Strike Campaign or as a key part of joint campaign involving other services.[5] Towards this, the PLARF has developed capabilities to disrupt ISR, EW, AD, Command and Control, and logistics operations of adversaries, beside hitting challenging targets… it has also raised integral ISR and AD capabilities, and is fully equipped to fight 'an informatized' battle.[6]

Structurally, akin to the Russian Strategic Rocket Force which is divided into three Armies, PLARF is divided into six Bases, each corresponding to a geographic area. Taking the similarities further, just as the Russian Army is divided into three to five Divisions with each Division equipped with a particular type of missile system, the PLARF Base too has between four to seven Missile Brigades each with a specific type of missile.[7]

However this is where the similarities end; while RSRF has stagnated, PLARF has carried out an unprecedented expansion. Its Missile Brigades increased from 29 to 39 in a short span of time between 2017-19, representing a more than 33% increase in its size.[8] This was followed up by a massive expansion of the its silo-based ICBMs force in 2021.[9] According to *James Martin for Non-proliferation Studies* Report (June, 2023) ''the PLARF is now on track to deploy more than 1,000 ballistic missile launchers by 2028, including at least 507 nuclear capable launchers, 342 to 432 conventional launchers and 252 dual-capable launchers. At least 320 solid-fuelled fixed ICBM silos and 30 liquid-fuelled fixed ICBM silos are currently under construction in addition to China's growing arsenal of mobile ICBM launchers''.[10]

To support this expansion, PLARF has been building infrastructure to include a maze of tunnels in the mountains for its launchers and missiles, and connecting various launch sites by an underground rail and road network; "the Underground Great Wall of

China", is a 5000km tunnel system, extensively used for transporting and storing the missiles and warheads.[11]

Further, as far as the missile technology goes, Russia's response has again been sluggish; China in contrast has dramatically advanced the development of its conventional and nuclear armed hypersonic missile technology.[12] It has developed advanced capabilities like maneuverable anti-ship ballistic missiles, MIRVs and Hypersonic Glide Vehicles, which however are still under development in Russia.[13] A few of the Chinese missiles like the CJ-10 based on the Russian Kh-55, and DF-ZF based on Russian Avangard HGV still mirror the Russian ones; however, these are far & between, and most of the Chinese inventory now enjoys a substantial technological edge over the Russians. In fact, Lawrence "Sid" Trevethan aptly summarised, in Apr 23, "*by marrying great accuracy with numerous ballistic missiles, China may have developed a capability that the Soviet Armed Forces never had; the ability to strike effectively, in a matter of minutes, at the U.S. and allied bases, logistical facilities and command centers without resorting to the use of nuclear weapons, and without having established air superiority*".

PLARF however faces a number of challenges too, and its capability should not be given more than due. Unlike the war hardened Russians, the PLARF is yet to be tested in a real conflict. Reflecting the tumult within the organization, several high-ranking officials have been removed due to poor training standards, and top Generals, including the Chief of PLARF, have been shunted out on corruption charges.[14,15]

Russian Missile Campaign (RMC) & Takeaways

The Russia-Ukraine war has witnessed one of the most extensive missile and rocket campaigns in recent times; it is estimated that Russia fired between 6,100 to 8,000 missiles in the first 18 months[16] of the war itself, with a major portion of these strikes, aimed at Ukrainian critical infrastructure,[17] like power grids, Dams (Karachun), energy infrastructure, gas production facilities, missile plants (Pivdenmash), residential buildings, thermal & hydroelectric power stations and even unassuming civil infrastructures like hotels & fuel stations.[18] What, however is noteworthy, is that SRBMs have primarily been Russia's mainstay during the war. Timothy Wright, a research analyst with the International Institute for Strategic Studies (IISS) assesses, "Russia most likely (and most extensively) used its only SRBM in active service viz the Iskander-M". Iskander-M with a low trajectory, high manoeuverability, range of 500km and an accuracy of 2-5 metres, is considered a lethal and difficult to intercept missile. The use of such precise and accurate SRBM, which avoids large scale collateral damage and does not raise the threshold beyond a conventional war, is being closely watched by nations around the world.[19]

Also being observed with a lot of interest was the employment of its hypersonic short range dual capability missile Kinzhal (Dagger), in a conventional mode to attack strategic targets such as munitions and fuel storage facilities, and the employment of Kalibr Cruise Missiles from the Caspian Sea. Kinzhal's appearance in Ukraine has been Beijing's first opportunity to observe how such sophisticated, hypersonic missiles

fares in a battle against Western equipment. Infact, China hopes that ultimately, its own hypersonic missile, the Dongfeng, will be a game changer in its capacity to take down US aircraft carriers.[20]

However, overall, Russia's Missile Campaign against Ukraine has been underwhelming; it failed to yield the desired impact or decisive results. Some of the reasons attributed to this underperformance include[21] :-

- **Numbers**. Russia underestimated the scale of strike operations needed to accomplish its goals at the beginning of the war. To achieve mass, it tried to attack too many targets, with too few missiles, over a very short a period, leading to a dilution of effect. Lyle Goldstern, Director of Asia Engagement of Americans think tank Defense Priorities analyses" I think clearly a lesson for China (and others), is that they need massive inventories of missiles", [22] in addition to *prioritizing the* targets to be addressed by missiles.

- **Dynamic & Precise Targetting**.
  - Russia's intelligence, target acquisition and targeting capabilities were too slow and inflexible to keep pace with a dynamic, fast-changing battlespace.
  - RSRF was unable to quickly shift attack capability to high-priority targets and simply lacked the capacity to attack time-sensitive targets.
  - Frequent shift in targeting priorities and irregular and inadequate availability of Precision-Guided Munitions, further undermined the missile campaign.
  - The effort was acutely hampered by the absence of effective command-and-control processes to rapidly detect changes and execute strike plans.

- **Vulnerability to AD Assets**. Ukrainian military's extensive use of Air Defence assets, dispersion, mobility and deception, severely limited the number of Russian missiles reaching the targets. Infact, Kinhzal, touted by Kremlin as an 'unstoppable' hypersonic missile was repeatedly thwarted by the Patriot System and a number of times, simply missed its targets.[23]

- **Vintage & Maintenance Issues**. Russian missiles failed to hit the intended targets frequently and experienced higher-than expected failure rates. Old inventory, inadequate maintenance and storage procedures and aspects like arbitrarily replacing the nuclear warhead of missiles (like Kh-55) with conventional ones, adversely impacted the accuracy and performance of the missiles.

PLARF, like other countries, has kept a hawkeye on the RMC, its impact and shortcomings. It is therefore certain, that relevant lessons will be drawn and the shortcomings will be addressed in times to come. But at the same time endemic limitations of a prolonged Missile Campaign have been truly exposed.

Terms of Reference: India's Rocket Force

"*Conventional missiles have become an increasingly important constituent of military power, and hence a strong component of deterrence capabilities…"*

- Lt Gen (Dr) Rakesh Sharma (Retd), January 2023.

India's Rocket Force is close to becoming a reality. It is therefore imperative that in addition to assessing other similar organisations, lessons from recent missiles campaigns be factored while finalizing the architecture and inventory of an over-arching missile force eco-system, which of course, must be unique to our needs and in tune with the prevailing strategic realities. Certain imperative Terms of References, for own Rocket Force could be summarised as follows:-

- **Tri-Service Raising**. Abinito, an 'Integrated' Rocket Force must be raised, to ensure tri-services synergy, from the conception stg itself. As a starting pt, the existing conventional missile assets held by the three services must be surrendered into a 'common basket', for a balanced and need based re-allocation.

- **Eco-System**. An entire eco-system of inter-related capabilities including reliable ISR, secure and foolproof communication, a robust command and control structure and efficient logistics infrastructure must be raised concurrently. Piecemeal raising without critical support system will be self-defeating.

- **Phase Wise and Planned Raising**. It is reasonable to believe that the entire architecture, due to constraints of resources, capabilities and capacities, cannot be raised in 'one shot'; therefore, a well thought out phasing with timelines must be meticulously planned and diligently executed.

- **HR Aspects**. The organisational architecture must endeavour a balanced and fair allocation of appointments to the three services; however, under no circumstances the efficiency of the organisation should be held hostage/ subservient to HR aspects.

Important Parameters Dictating IRF Structures.

Real time ISR, precision, improved navigation system, varied ranges, rapid launch capability, survivability and related logistics are a pre-requisite for a holistic conventional missiles eco-system. The granular structures, capabilities and inventory of the Rocket Force will however be dictated by the following parameters:-

- **Adversary**. Threat and capabilities especially with respect to employment of missiles posed by the respective adversaries, to the North and the West, will require a different approach and inventory.

- **Objectives**. Type and spread of objectives, both laterally and in depth will require a specific approach.

- **Terrain**. The type of terrain, altitudes and accessibility for both deployment and employment, will have a major say in inventory planning.

- **Redundancy**. It will be important to have a 'traid' of conventional missile delivery platforms, to ensure adequate redundancy and surprise in the delivery of payload.

- **Size and Numbers**. It has been assessed that a small force of conventional missiles is not powerful enough to pose a credible conventional deterrence.[24] The minimum requirement of missiles will have to be assessed based on the targets to be engaged, degree of destruction or deterrence desired, and the number of re-visits / re-engagements envisaged.

- **Mix of Ballistic and Cruise Missiles**. It is widely accepted that a limited, state of art inventory of ballistic missiles, which are expensive but difficult to intercept, must be optimally employed as a first salvo, to punch holes in the adversaries' defences. A follow-up strike by a large number of cheaper cruise missiles, thereafter, has the potential to create opportunities for both ground and air-force to exploit, and to produce disproportionately impactful results. India has a variety of strategic, conventional & dual purpose missiles, both ballistic and cruise, in its inventory, and a number of them are actively under development too. Strategists expect that amongst the contemporary missiles, Nirbhay, Pralay (and Agni Prime) will create a comprehensive and composite package of missiles for the Indian Arsenal.[25]

Don't Copy or Compete PLARF – Leapfrog it

"IRF should not be considered solely as a deterrent to pre-emptive missile strikes or as a means to trade salvos with an adversary; it should be inherently capable of exploiting strategic standoff strike opportunities against enemy's Centres of Gravity such as their Command and Control Posts, Air Defence sites, force concentrations, staging areas and logistics nodes, which are relatively hard to intercept by ground-launched vectors."

-Saurav Jha[26]

The PLARF has a significant head start over us and their organization has matured over the years, in terms of numbers, technology, structures & concepts (the occasional hiccup, notwithstanding). It would therefore be prudent for us NOT to mirror the PLARF-missile for missile or silo for silo, as it would only push us towards a ruinous 'excessive spending and spreading thin' trap. In fact, the IRF being at a nascent stage, has its own advantages. We can mould the structures and concepts to our requirements, based on recent global experiences, and also infuse the organization and inventory with the latest technology. This will help us avoid competing with the adversary's existing and legacy capabilities and instead empower us to leapfrog its capabilities.

It is therefore imperative that any future aerospace strike capability should be forward-looking; we should not endeavor to restore a capability which existed decades ago in

Agni I, or 27 years ago in Prithvi-I.[27] While the IRF may still have to tread a portion of the beaten path, however it must keep pace with the technological advances and also foresee and incorporate future trends; we must ensure that IRF is raised and as a modern and agile force. Technological developments in the fields of propulsion, materials, sensor, war heads aerodynamics and component miniaturization, must be leveraged, to allow for production of effective, lethal, smaller sized, longer range weapon systems, at lower costs, thus enabling considerably bigger stockpiles.[28] Some areas of focus towards this aim could be[29]:-

- **Hypersonic Missiles**. Greater missile speed not only improves survivability but also reduces the time taken to reach the target. It is evident that the future missiles will predominantly be hypersonic; it is therefore important to not only master the hypersonic technology, but also associated issues of navigation, accuracy and cost. With BrahMos II, Agni V, Shaurya and other missile systems being developed indigenously, the future of Hypersonic Glide Vehicle and hypersonic cruise missiles in India, is no longer, a distant dream.[30] In fact, in October 2021, Shaurya hypersonic weapon test was conducted successfully; such weapons are likely to be highly effective in taking out enemy early warning radars and static military installations like airbases and Command and Control (C&C) facilities.[31] Even Brahmos, which travels at speeds of approximately Mach 3.0 is being upgraded to travel faster than Mach 5.0 for the hypersonic variant.[32] Possibility of upgrading the existing subsonic missiles to hypersonic speed, is an exciting prospect.

- **Swarm Missiles**. The importance of a viable inventory has been highlighted in the recent wars; there is therefore an inescapable need to maintain a good mix of high tech and basic missiles. While we spoke of high-tech missiles, there is a growing realization on the importance of developing “simple cruise missiles” which can be mass produced. The aim, amongst others, being to overwhelm the enemy AD (and other) assets by firing a swarm of such missiles from multiple directions. In fact, USAF under their AFWERX programme is already trying to develop low-cost missile with a 500 nautical miles range, high subsonic speeds and a cost of $150,000 per unit, for bulk order.[33] There are also ingenious efforts to manufacture ‘printed missiles’ towards the same aim. Pursuing a similar project, under own IDEX scheme has the potential to yield disproportionate results.

- **Percisionary**. Precision missiles are considered a particularly useful capability for a weaker nation to deter and create an element of doubt for a larger and more powerful nation; the navigation system is the most important component to achieve the desired accuracy. Our contemporary navigation satellite systems, amongst other parameters, could play a defining role in achieving enhanced accuracy. We not only require to focus on the precision of new missiles, but also concurrently improve the accuracy of existing inventory.

- **War Head**. **Missiles are ultimately carriers of warheads; it is evident that the effort in transporting the warheads over thousands of kilometers, accurately and at a high cost must be worth the effort in terms of impact. Therefore, aspects of lethality, minitiarisation, varying effects and impact of the warhead must be of prime focus.** More lethal warheads are being developed; aim being to pack a heavier punch in a lighter warhead. This can be further accentuated by the effects of the explosive, material of the war head, as also the speed of the missiles.[34] **Brahmos for example despite a smaller war head, but a speed four times that of Tomahawk, delivers more kinetic energy while striking a target and thereby causes much higher destruction.**[35]

- **Conventional Prompt Strike Conventional Prompt Strike (CPS)**. USA has been working on Conventional Prompt Strike (CPS) with aim to deliver a precision-guided conventional weapon airstrike anywhere in the world within an hour.[36] HGVs and very-high speed missile systems are going to be the backbone of such a system.[37] India should aim for a similar strike capability within our zone of regional influence and interest, to deter adversaries.

- **AI**. AI must be leveraged across the entire spectrum of missile eco-system, right from the propulsion system to fabrication materials, sensors to war-heads aerodynamics, component miniaturization to communication and navigation system, and even for testing and maintenance of missiles.[38] For example, in scramjet missiles, AI is already being leveraged by USA to incorporate the results of Computational Fluid Dynamic (CFD) to design the scramjet missile so as to give much faster speeds and longer ranges.

- **Counter Missile Technology**. The concept of a Ballistic Missile Defence (BMD) is increasingly being pushed into obsolescence even before its operationalisation due to the impact of hypersonic missiles, and the prohibitive cost of BMD over a large area (the estimated costs to meet our requirements are anywhere between Rs 50,000 cr to Rs 2,50,000 cr).[39] Though the effectiveness of the 'Iron Dome' in Israel has been spectacular; however the effectiveness of BMD is restricted to localised areas and the resources required for a country as large as ours, are humongous. Countries are therefore already working on building hypersonic defence capabilities based on space-based sensors which provide a wider and more elaborate coverage compared to terrestrial radars. The US is planning to launch six satellites for the same purpose.[40] We too must keep pace with technology and incorporate some of these aspects in our futuristic satellite programmes.

Conclusion

India possesses a good expertise in the field of missiles and a robust Strategic Missile Force architecture is already in place. Now that a decision to raise an IRF has been

taken, we must proceed with alacrity to ensure that the IRF structures so raised are reliable, robust and will survive the test of time and technology. It is evident, that technology will be a key driver in our endeavor to transcend the yawning gap with our adversaries, not to catch up, but leapfrog their capabilities. Maj Gen Ashok Kumar (Retd) aptly sums up "it is time we re-orient our energy and start developing our rocket-missile forces in a mission mode to ensure that India is capable of addressing the collusive threat from its adversaries".

DISCLAIMER

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