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Is More Nuclear Testing a Deterrence Necessity?

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Based on satellite images taken by Planet Labs, an American Earth imaging company, some recent reports seem to indicate that each of the three countries, Russia, the United States, and China, have built new structures such as roads, storage facilities, and tunnels at their nuclear test sites in the last 3 to 5 years.[1] USA has, in fact, been open that it has added nearly 1000 square feet of underground laboratory space for conducting sub-critical nuclear experiments at its nuclear test complex at U1a, Nevada.[2] Meanwhile, expansions are also evident at Lop Nor, China's test site in the far western region of Xinjiang, and at Novaya Zemlya, the Russian site in an Arctic Ocean archipelago. While one may not directly infer from these developments that a nuclear test by any of them is imminent, the heightened activity can be interpreted as a form of nuclear signalling at a time when relations between the major nuclear nations are highly stressed. Each maintains a state of preparedness to respond quickly in case any of the other were to conduct a test.

Why would the major nuclear powers need to return to nuclear testing? After all, the USA has conducted 1030 tests, Russia has done 715 tests, and China has conducted as many as 45 nuclear tests, which carried on till the conclusion of the Comprehensive Test Ban Treaty (CTBT) in 1996. In fact, the three countries have not undertaken any tests since then. Russia stopped its testing programme in 1990, USA in 1992, and China in 1996. The three signed the CTBT in 1996. But only Russia ratified it. The USA and China are amongst the eight holdouts, and the treaty looks irretrievable at this point in time.

Nevertheless, an elaborate network of monitoring stations and laboratories spread across 89 nations has been built by the CTBT Organization to verify any activity indicative of explosive testing. Over the last two decades, North Korea is the only country to have conducted six underground explosive nuclear tests between 2006 and 2017. Meanwhile, the P-5 countries are known to conduct sub-critical experiments and advanced computer simulations to refine and maintain their stockpiles.

Evidently, the recent buzz around the need for a fresh round of testing is to communicate a political message. Russia may like to undertake such an action to indicate resolve without having to resort to actual nuclear use. In the case of the USA, President Trump had spoken about nuclear testing as a way of putting pressure on Russia and China to join arms control. During his term, additional money was authorised to reduce the time to execute a nuclear test if necessary.[3] President Putin's response has predictably been that "… if the United States conducts tests, then we will. No one should have dangerous illusions that global strategic parity can be destroyed."[4] Meanwhile, today's China, too, yearns for nuclear parity. So, as things stand, if any of the nuclear weapon states were to break the norm on nuclear testing, others are likely to follow, more for political than purely military reasons.

India's Nuclear Tests and Related Opinions

In contrast to the motivations for nuclear testing by the major powers, if India ever felt the need to conduct nuclear tests again, it might be more for military reasons. In 1998, India conducted five nuclear tests. According to information in the public domain, these tests included designs of plutonium-based fission weapons with yields of 10 and 20kT and sub-kiloton weapons of 0.2 and 0.6kT. One of the designs was also that of a 45kT thermonuclear device.

In 2009, a debate broke out on whether India's thermonuclear test had been successful or not. Some scientists from the Defence Research and Development Organisation (DRDO), which is responsible for building missiles for nuclear delivery, and the Department of Atomic Energy (DAE) claimed that the test had failed and that India did not have a credible hydrogen bomb. Doubts were cast on the veracity of the results announced on the thermonuclear yield of the test. Bharat Karnad, a vocal sceptic of India's thermonuclear capability, too has opined that the "lone low-yield thermonuclear tests of May 1998 was, for all intents and purposes, a dud, an insufficient data base was created for 'benchmarking' computer simulations. And that, this in turn meant that Indian

scientists cannot reliably correct tested design, modify or refine it, nor change its power-to-yield characteristics, and even less upscale the design for much higher, leave alone megaton yields."[5]

Having an arsenal with megaton weapons has been deemed essential for the sake of credible nuclear deterrence, especially against China. In recent times, this argument has been especially pressed by Ashley Tellis in his book *Striking Asymmetries*. Describing the emergence of China as *a "daunting strategic danger" for* India, he notes that "India's biggest nuclear deficiency" is the "absence of reliable high-yield weapons in its inventory".[6] Citing the data put out by India on its 1998 tests and subsequent expressions of views by some scientists, he questions the weapons design base. He argues that India does not have the "cutting-edge sophistication that would be needed for their reliability in real-world conditions". He, therefore, argues that India may feel the need to do more explosive testing in order to validate advanced nuclear designs. Tellis even recommends to Washington that when India decides to test, it should indirectly help by not applying sanctions or invoking the suspension or termination of the Indo-US nuclear agreement. For him, this would be "the best US contribution toward enhancing geopolitical stability in the wider Asian region at a time when Chinese assertiveness will be increasingly harder to deter".[7] Tellis obviously espies American interest in a stronger Indian nuclear deterrent.

The above set of views, however, make up only one part of the story. These arguments have been refuted by scientists involved in the conduct of the tests in 1998. Most notably, Dr. R Chidambram has often reiterated that the thermonuclear test did produce the stated yield through the thermonuclear technique. Proof of this has been proffered in the presence of sodium 22 and manganese 54, both by-products of a fusion rather than a pure fission reaction. Meanwhile, three reasons have been given for keeping a low yield of the thermonuclear weapon: one, the geological structure of the testing range; second, the fact that the existing shafts could not be dug any deeper for fear of detection (a task that would have been necessary if a greater yield was to be obtained); and third, the villages close to the test site had to be protected against possible physical damage or venting of radioactivity. The DAE has claimed that the H-bomb established the efficacy of the design concept. In fact, a Press Statement by Dr. Anil Kakodkar and Dr. R. Chidambaram on Pokhran-II tests was specially released on September 24, 2009 which reiterated the conclusion that "Thermonuclear weapons of various yields up to around 200 kt can be confidently designed on the basis of this test."[8] Elsewhere, Dr. Chidambram has also stated, "In a large complex system like a nuclear weapon, the performance of an integrated test nowadays is the culmination of a

large number of precise laboratory tests of subsystems and validation of individual parts of the computer simulation package through benchmark experimental data."[9]

Given the opposing views on the credibility of India's thermonuclear tests, a definitive conclusion for a person outside the system is nigh impossible. However, irrespective of who one chooses to believe, the more important issue is evaluating the importance of hydrogen bombs for nuclear deterrence. Should India's deterrence not be considered credible in the absence of megaton weapons? Do larger yield weapons deter more?

Appeal of Thermonuclear Weapons and the Indian Context

The appeal of thermonuclear weapons primarily lies in the economy of fissile material, their compact size and relative ease of delivery. According to one assessment, a 200kT fission weapon would require about 60kg of plutonium and 4000 to 8000lbs of chemical explosives. But, with the same amount of fissile material, one could make ten thermonuclear weapons, each of the megaton variety and weighing less than 1000 lbs.[10] Therefore, they provide better yield-to-weight ratios and can be more compact. However, besides these technical considerations, there are other political dimensions that need to be considered before reaching any conclusion on whether India's deterrent is compromised without such weapons and conduct of more testing.

Firstly, doubts raised on the credibility of India's nuclear deterrence purely on the basis of the difference between fission and fusion or kiloton and megaton weapons tend to overlook the regional reality of high densities of population in today's megacities. Modern understanding of intelligent targeting based on detonation at optimum heights to cause the desired kind of damage has much improved since 1945. Relatively sparsely populated and built American and Soviet cities may have necessitated thermonuclear weapons to cause unacceptable damage. This is certainly not the case with India's adversaries.

Let us not forget that the *w*eapons dropped on Hiroshima and Nagasaki were only 15-20kT in yield. Yet, these fission weapons caused 80,000 deaths immediately and 200,000 later in Hiroshima, and 74,000 deaths and 75,000 casualties in Nagasaki, thereby affecting the lives of two-thirds of the city population. Describing the destructive potential of the nuclear weapons, McNamara wrote, "They indiscriminately blast, burn, and irradiate with a speed and finality that are almost incomprehensible."[11] It is not surprising that they scarred the human mind enough not to

merit a repeat performance. According to one study, the potential fatalities from a single 15kT detonation on the highest-density city of China would be 7,60,000 people with an air burst, 5,92,000 in case of the second highest density city, and 4,50,000 fatalities with ground burst blast and fire.[12]

If these figures look like acceptable damage, more lethality can be added by making the missiles more accurate. As explained by a strategist, "Increasing the warhead explosive yield and decreasing the miss distance both improve the lethality of a warhead."[13] "Making a weapon twice as accurate has the same effect on lethality as making the warhead eight times as powerful... making the missile twice as precise would only require one-eighth the explosive power to maintain the same lethality. Hence, miniaturisation of warheads and precision of delivery has been the course of US nuclear weapons development."[14] While this is not easy, repeated testing of missiles for accuracy is more feasible than nuclear warheads testing.

Secondly, it is also a scientifically established fact that a number of strategically dispersed fission weapons can cause higher damage. Multiple warheads mounted on missiles that are capable of carrying multiple independently retargetable vehicles (MIRVed), a capability that India has shown, offer a way of multiplying damage with kiloton weapons.It is also believed that nuclear weapons around 150-200kT would be far more effective than megaton sizes, which would only make the nuclear rubble bounce. Also to be noted is the trend that nations are moving towards lower yields as part of their idea of being able to fight 'limited nuclear wars'.

Thirdly, over the years, advances in real-time computational power, algorithmic sophistication, and data analysis have aided weapons' improvements. Further, given India's three decades of experience in fusion and plasma physics, it is unlikely that an adversary could risk taking its thermonuclear weapons capability lightly.

What if India Were to Test Again?

At the end of its round of nuclear testing in 1998, India offered a unilateral moratorium on nuclear testing. This was reiterated in 2008 in the context of the conclusion of the Indo-US nuclear agreement. Apart from these voluntary commitments India would not be violating any agreement if it were to decide to undertake fresh round of hot testing. So, legally, it would be within its rights to test.

However, it would be breaching a norm of non-testing that has been in place since 1996. Expectedly, there will be a diplomatic fallout from the action. Of course, if the US, Russia, or China were to reopen the trend of nuclear testing and India were to follow their example, the situation would be completely different compared to if New Delhi were to suddenly take such a call of its own. In the latter case, the Indian action would impact its many strategic partnerships with nations across the world. Economic sanctions and diplomatic backlash are certain, and there is a high possibility that Pakistan will follow suit. Pakistan currently has untested tactical nuclear weapons and would welcome the opportunity to establish their reliability with some more testing. Besides, it may also like to demonstrate its thermonuclear capability, especially since many members of the Pakistani strategic community have rued the fact that they need an arsenal big enough to be able to effectively deter a geographically expansive and materially more secure India.

Finally, it may be said that the question of whether India needs more nuclear tests for credible deterrence is a complex one. While additional tests could bring technical benefits, they would also carry significant diplomatic and geopolitical costs. Meanwhile, alternative means of achieving credible deterrence exist. Given the circumstances, while more tests may be *desirable* if international circumstances make them possible, they are not *essential* for the credibility of nuclear deterrence. This rests on a number of other factors besides the yield of the nuclear weapon.

(Disclaimer: The views and opinions expressed in this article are those of the author and do not necessarily reflect the position of the Centre for Air Power Studies [CAPS])

Notes:

[1] Jeffrey Lewis, "Nuclear Test Sites are too Damn Busy", *Arms Control Wonk*, September 23, 2023. https://www.armscontrolwonk.com/archive/1218750/nuclear-test-sites-are-too-damn-busy/. Accessed on October 23, 2023.

[2] For more on U1a complex, *Nevada National Security Sites*, https://nnss.gov/mission/stockpile-stewardship-program/u1a-complex/. Accessed on September 23, 2023.

[3] Eryn Macdonald, "Is the United States Planning to Resume Nuclear Testing?", *The Equation*, Union Of Concerned Scientists, Jul 1, 2020. https://blog.ucsusa.org/emacdonald/is-the-united-states-planning-to-resume-nuclear-testing/. Accessed on September 23, 2023.

[4] Guy Faulconbridge, "Russia's Putin Issues New Nuclear Warnings to West over Ukraine", Feb 22, 2023, https://www.reuters.com/world/putin-update-russias-elite-ukraine-war-major-speech-2023-02-21/.

[5] Bharat Karnad, *Nuclear Weapons and Indian Security: The Realist Foundations of Strategy* (New Delhi: Macmillan, 2005), p. 416.

[6] Ashley J. Tellis, *Striking Asymmetries*: *Nuclear Transiitons in Southern Asia*, (Carnegie Endowment for International Peace: 2022).

[7] Ibid.

[8] Department of Atomic Energy, "Press Statement by Dr Anil Kakodkar and Dr R Chidambram on Pokhran II Tests", *Press Information Bureau*, September 24, 2009.

[9] Chidambram, "The May 1998 Tests", p. 19 as cited in Karnad, n. 5, p. 416.

[10] Karnad, n 5, p. 628

[11] Ibid.

[12] O. B. Toon, et al, "Atmospheric effects and societal consequences of regional scale nuclear conflicts and acts of individual nuclear terrorism", *Atmospheric Chemistry and Physics Discussions*, April 19, 2007 https://doi.org/10.5194/acp-7-1973-2007. Accessed on October 1, 2023.

[13] Robert C. Aldridge, *First Strike: The Pentagon's Strategy for Nuclear War* (London: Pluto Press, 1983), p. 62.

[14] Ibid, p. 62.

Recommended Readings:

- Bharat Karnad*, Nuclear Weapons and Indian Security: The Realists Foundations of Strategy* (Delhi: Macmillan, 2005).
- Ashley Tellis, *Striking Asymmetries: Nuclear Transitions in Southern Asia* (Washington DC: Carnegie Endowment for International Peace, 2022).
- Michael Frankel, James Scouras and George Ullrich, "The Uncertain Consequences of Nuclear Weapons Use", *National Security Report* , John Hopkins University Applied Physics Laboratory, 2015.