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The Nuclear Numbers Game: Getting it Right

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No. 4

30 April 2023

If nuclear deterrence is the primary purpose of nuclear weapons, then how many does one need to deter? What is that magical number for credible nuclear deterrence? Why did China, at one stage, think six weapons were enough, while the USA and USSR went up to 30,000 and 40,000, respectively? Why has India chosen 'credible minimum deterrence' as the guide for its arsenal while Pakistan seeks 'full spectrum deterrence'?

Issues pertaining to the 'right' size of one's arsenal continue to be deliberated in every nuclear-armed state. The spotlight shines on the subject every time a report is published on the nuclear holdings of a country. While the USA, Russia, UK, and France have been officially furnishing their warhead numbers, in the case of China, India, and Pakistan, the figures in the public domain are guesstimates based on their assumed fissile material production and missile launchers.

Every nuclear-armed country determines the size and pace of growth of its nuclear arsenal based on an assessment of a number of factors, such as its approach to nuclear deterrence, the availability of fissile material, its assessment of the adversary's damage tolerance capacity, and other relevant technological capabilities. As these change, so can arsenal sizes.

Own Factors Determining the Size of Nuclear Arsenal

Practice of Deterrence

Countries that choose to deter by showcasing their ability to fight and win a nuclear war obviously require a large and variegated arsenal. Practising this approach the USA accumulated tens of thousands of nuclear warheads of varied yields atop different delivery systems, improved

accuracies for counterforce targeting, and built damage limitation capabilities in the form of ballistic missile defence (BMD). The first two commanders of the US Strategic Air Command (SAC), the American nuclear force, Generals Curtis LeMay (1949-1956) and Thomas Power (1957-1964), planned to win a nuclear war. General Power said, "At the end of the war, if there are two Americans and one Russian, we win."¹ Indeed, nuclear use theorists (jocularly known as NUTS) held sway over US nuclear thinking for many decades and pushed it towards a large arsenal. So did American extended deterrence commitments towards NATO and some Asian countries.

The USSR, US' main adversary during the Cold War, pretty much mirror-imaged the US build-up. Rough parity between the two was considered necessary for deterrence so that neither could enjoy the advantage of launching a first strike without bringing about 'mutual assured destruction.' In 1985, the combined total of the two countries was 61,000 nuclear warheads.

The realisation that such large numbers were not needed for deterrence and that they rather increased concerns about warheads' safety and security, including risks of inadvertent escalation, led to efforts towards reciprocally coordinated reductions, albeit keeping numerical symmetry intact. The last such agreement to be negotiated, the New START treaty, concluded in 2021, allows both sides to deploy 1550 nuclear warheads and 700 delivery systems. As per the latest available figures, Russia has 1674 deployed nuclear warheads and keeps an additional 2815 in reserve;² the USA has 1770 deployed and 1978 nuclear warheads in reserve.³ Even at reduced numbers, parity has been maintained as a prerequisite for credible nuclear deterrence.

None of the other states that acquired nuclear weapons during and after the Cold War have opted for maximalist nuclear arsenals. Basing their deterrence strategies on the ability to inflict unacceptable damage, the UK and France, as well as China, India, and Pakistan, have built much smaller warhead holdings. As per current estimates, the UK has around 200-225 nuclear warheads, though in 2021, it announced that it would increase its nuclear inventory to 260 warheads in the coming years.⁴ Despite this change, the arsenal would still be a small one. As is the case with France, which has remained stable for a decade now at 300 warheads.⁵

Of the other nuclear-armed states in southern Asia, when China first tested nuclear weapons in 1964, its Premier Mao Zedong directed his country to steer clear of excessive nuclear build-up in favour of an arsenal that would be just enough to inflict unacceptable damage. Beijing followed the minimalist philosophy, as its nuclear numbers remained roughly around 250-300

during 1980-2020. However, in 2021, the construction of hundreds of silos were reported. Current estimates of China's nuclear arsenal indicate an increased number of 410 warheads.⁶ According to the latest annual Pentagon report on military and security developments related to the People's Republic of China, the country could have 1000 nuclear weapons by 2030 and 1500 by 2035.⁷

India's draft nuclear doctrine of 1999 articulated the concept of credible minimum deterrence, which abjured large-scale accumulation of nuclear warheads or the need to match those of the adversary. With a view to building enough to be able to cause unacceptable damage to the adversary, the doctrine offered a "dynamic concept related to the strategic environment, technological imperatives and the needs of national security". The force size was directed to be "effective, enduring, diverse, flexible and responsive" to the requirements of deterrence, while the numbers would be the minimum necessary for signalling credible deterrence. According to unofficial estimates, India's nuclear stockpile is the smallest in southern Asia, at 160 weapons in 2022.⁸

Pakistan started its nuclear journey by following the Indian lead of credible minimum deterrence. However, over the last quarter century, it has moved the goalpost to full spectrum deterrence. This is supposed to "comprise of a large variety of strategic, operational and tactical nuclear weapons on land, air and sea."⁹ It was estimated to have 165 nuclear warheads in 2021, with projections that it could grow to 200 by 2025.¹⁰

Material Availability & Delivery Reliability

The availability of weapon-grade fissile material is a primary requirement for building nuclear warheads. The pace at which a nation can produce enriched uranium or plutonium, and their quality, determine the numbers a nation can build. Another important consideration is confidence in the reliability of the yield of one's warheads. While no nuclear detonation has been seen to be yieldless, credible nuclear deterrence rests on the confidence to cause damage of a kind that has been calculated as necessary for a particular target. In case of low reliability of warheads, the size of the arsenal may need to be larger, as more numbers may be necessary per target.

Similarly, the accuracy and reliability of delivery systems are factors to be considered. While counter-value targets do not require highly accurate delivery systems, the same is not true of counterforce systems that demand precision delivery since they are meant to neutralise

hardened targets such as silos or command and control structures. Finally, besides all the technological considerations, fiscal resources are an important determinant of the size of the arsenal.

Sophistication of Survivability Measures

Given the centrality of the assuredness of being able to cause unacceptable damage, the survivability of warheads for retaliation is an important consideration for determining the size of the total inventory. The greater the confidence in the survivability of one's own arsenal, the smaller it can be. Therefore, besides numbers, a nation needs to focus on measures such as mobility, deception, and dispersal, including taking the arsenal out to sea on SSBNs. The level of sophistication of survivability impacts the size of the arsenal.

Linkage with Status

In the conduct of international relations, nuclear weapons tend to be seen as harbingers of respect and status. So, several analysts have linked China's recent nuclear expansion to its aspiration for great power status. In an apparent desire to 'beat' the US on every parameter, Beijing has felt the need to do so on nuclear stockpiles too. Xi Jinping himself had designated the PLA Rocket Force (PLARF) as "the strategic support for the country's status as a major power".¹¹ China appears to believe that a big arsenal will help it win the respect of the US and get it to accept mutual vulnerability with China.

Factors of Adversary Affecting the Size of Nuclear Arsenal

Adversary's Threshold of Unacceptable Damage

Credible deterrence rests on the promise of being able to cause unacceptable damage to the adversary. This requires an accurate calculation of the damage threshold of the adversary. For example, during the Cold War, in order to arrive at an empirical calculation of its arsenal, the USA propounded that if it could destroy 50 per cent of Soviet industry and 25 per cent of its population, it would cause unacceptable damage to the USSR. But this figure could be different for different countries. In the case of the US itself, President Kennedy's hesitation to lose even one American city during the Cuban missile crisis revealed America's low damage threshold.

Among the many factors that can help calculate the damage tolerance levels of a nation, five are particularly relevant. The first is to understand the historical experiences of a country, since those have a bearing on the number of losses it can take. For example, a country that has been through more wars and experienced more damage would have a higher damage tolerance threshold. Secondly, damage acceptability depends on the nature of the political system, with the assumption being that a closed, authoritarian system would be able to take more damage than a democracy. A third factor is the level of national economic development, since an economically well-off and materially aspirational society would likely have a weak stomach for destruction. Fourthly, the threshold would depend on the value a country places on the objective it seeks. The more a country is politically, economically, and emotionally invested in an objective, the greater its willingness to bear damage. Lastly, the nature of the leadership can push the threshold up or down. For example, highly nationalist, risk-prone leaders could motivate a nation to accept greater damage. An objective analysis of these aspects can help calculate the 'right' size of one's nuclear arsenal.

Adversary's Defences

Another important factor in determining one's ability to cause unacceptable damage to the adversary is one's air and missile defence capabilities. If a country can protect itself against incoming vectors, then the numbers required to saturate the missile defence would have to be higher. Thus, even an apparently defensive measure such as deploying BMD can lead to an offensive build-up on the other side (besides equipping the arsenal with other penetration aids) due to a reassessment of the numbers necessary to cause enough punishment to deter.

Adversary's Technological Capabilities

Two other technological developments affect one's determination of nuclear force size. The first relates to the technological sophistication of the adversary's capability, which may threaten one's retaliatory capability. For instance, if it has highly accurate conventional delivery systems that may be used to neutralise one's nuclear forces, and if this is further coupled with a BMD for its own protection, it would inevitably lead to a need for increasing one's own stockpile to ensure the survivability of enough to cause retaliatory damage. China's resizing of its arsenal in current times is happening precisely due to this factor. Moreover, given the advancements in US BMD capabilities, and its focus on conventional global prompt strike (CGPS), including the development

of conventional hypersonic missiles that can potentially destroy nuclear assets, China has perceived an erosion in its ability to cause unacceptable damage. Therefore, numbers are expanding to signal better survivability of its retaliatory capability.

A second development that may cause numbers to expand is the adversary's acquisition of a high level of intelligence, surveillance, and reconnaissance (ISR) capability that makes one's own nuclear forces more transparent and hence vulnerable to first strike. In such a scenario, there is an inevitability of force size changes to ensure redundancy for credible retaliation.

Nuclear Numbers - A Complex Calculation

As is evident, national nuclear arsenals are determined by a complex calculation of many factors. It is not a simple case of matching the adversary's arsenal. Transformations in other capabilities matter too. In fact, in the game of nuclear deterrence, national stockpiles do not have to match warhead for warhead because, even in the case of numerical asymmetry, nuclear deterrence exists. More than the large size of the arsenal, its survivability is essential. Even small arsenals can deter owing to the distinct nature of nuclear weapons. Therefore, overspending on building large arsenals is not only unnecessary but also increases safety and security burdens. Prudence demands due consideration of all factors identified above to get the nuclear numbers right.

(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 As cited in Fred Kaplan, *The Wizards of Armageddon* (Stanford, CA: Stanford University Press, 1991), p. 246.

² Hans Kristensen and Matt Korda, "Nuclear Notebook: Russian Nuclear Weapons 2022," *Bulletin of Atomic Scientists*, Vol. 78, no. 2, pp 98-121.

³ Hans Kristensen and Matt Korda, "Nuclear Notebook: US Nuclear Weapons 2023," *Bulletin of Atomic Scientists*, Vol 79, no.1, pp 28-52.

⁴ Hans Kristensen and Matt Korda, "Nuclear Notebook: United Kingdom Nuclear Weapons 2021," *Bulletin of Atomic Scientists*, Vol. 77, no.3, 2021, pp 153-158.

⁵ Hans Kristensen and Matt Korda, "Nuclear Notebook: French Nuclear Weapons 2019," *Bulletin of Atomic Scientists*, Vol. 75, no., 2021, pp 51-55,

⁶ Hans Kristensen, Matt Korda and Eliana Reynolds, "Nuclear Notebook: Chinese Nuclear Weapons, 2023," *Bulletin of Atomic Scientists*, Vol. 79. No.2, pp 108-133.

⁷ Military and Security Developments involving the People's Republic of China 2022, US Department of Defense, <https://media.defense.gov/2022/Nov/29/2003122279/-1/-1/1/2022-MILITARY-AND-SECURITY-DEVELOPMENTS-INVOLVING-THE-PEOPLES-REPUBLIC-OF-CHINA.PDF>, Accessed on

⁸ Hans Kristensen and Matt Korda, "Nuclear Notebook: Indian Nuclear Weapons, 2022," *Bulletin of Atomic Scientists*, Vol. 78, no.4, pp. 224-236.

⁹ Khaled Kidwai, "Deterrence Stability", in Feroz Hassan Khan, *Subcontinent Adrift: Strategic Futures of South Asia* (Amherst, NY: Cambria Press, 2022).

¹⁰ Hans Kristensen and Matt Korda, "Nuclear Notebook: Pakistani Nuclear Weapons, 2021," *Bulletin of Atomic Scientists*, Vol. 77, no.5, pp. 265-278

¹¹ Xi Jinping, "Secure a Decisive Victory in Building a Moderately Prosperous Society in All Respects and Strive for the Great Success of Socialism with Chinese Characteristics for a New Era," Speech delivered at the 19th Party Congress, October 2018.

Recommended Readings:

- Robert McNamara, *Blundering into Disaster: Surviving the First Century of the Nuclear Age* (Pantheon, 1986)
- Richard Rhodes, *Arsenals of Folly: The Making of the Nuclear Arms Race* (Knopf, 2007)
- *SIPRI Yearbook 2022: Armaments, Disarmament and International Security*
- Nuclear Notebook, *Bulletin of Atomic Scientists*
- Keir A Liber and Daryl Press, "The New Era of Counterforce: Technological Change and the Future of Nuclear Deterrence", *International Security*, vol. 41, no.4, Spring 2017, pp 9-49