



# ISSUE BRIEF

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## Super Fuze: New Arms Race or a Scare?



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### Nuclear Dimension of the Third Offset Strategy

Rapid modernisation by the Chinese armed forces, a resurgent Russia and regional adversaries such as Iran and North Korea forced the strategic community in the US to come up with what the then Secretary of Defence Chuck Hagel referred to as the new Defence Innovative Initiative, including the Third Offset Strategy.\* This was in November 2014. While various institutions were working on the architecture of this strategy to include innovative technologies, improved weapon systems, modified doctrines, organisations and training, newly elected President Donald Trump added the nuclear dimension to the Third Offset Strategy! A proposal was mooted to boost federal spending on the production of nuclear weapons by more than \$1 billion in 2018. The federal spending increase by \$1.4 billion for the

\* The US' First Offset Strategy was thought of in the 1950s to counter the USSR's conventional superiority by building up the nuclear arsenal and the triad of delivery platforms. In the 1970s, to counter the Soviet Union's nuclear parity, the US developed Precision Guided Munitions (PGMs), Night Vision Devices (NVD) and stealth technology which was referred to as the Second Offset Strategy.

### *Key Points*

1. President Trump has added a nuclear dimension to the Third Offset Strategy mooted by the Obama Administration.
2. The super fuze, which is an integral part of this strategy can prove to be a game changer.
3. Russia and China are both adversely affected by the super fuze when seen in the light of the ABM systems being developed by the US.
4. This is likely to lead to a hair-trigger nuclear weapons launch readiness and a global/regional arms race.

## Super Fuze ...

National Nuclear Security Administration shall support an existing effort to modernise three types of warheads, so that these can be deployed by aircraft, and submarine-launched and land-based missiles.<sup>1</sup>

### Background of Warhead Modernisation

The US started inducting W-76 warheads meant for Submarine Launched Ballistic Missiles (SLBMs) in the year 1978<sup>2</sup> and these continue to be in service as of the year 2017. The W-76 is a thermonuclear warhead which is carried inside a Mk-4 reentry vehicle, with a yield of 100 kilotons (kt).<sup>3</sup> The W-76 is one of the warhead options for the Trident I/II SLBMs. The US Defence and Energy Departments conducted a study in the year 1994, wherein it was discussed that the lethality of the W-76 can be greatly enhanced by equipping it with a new fuze.<sup>4</sup> At that point in time, the W-76 had a fixed height of burst fuze (i.e. it was incapable of detonation at an optimal location if it were falling short or long of a target). Consequently, these warheads were aimed against softer targets (to be employed against a soft or hard target as a function of accuracy and not explosive content), being less effective against the hardened ones such as an Intercontinental Ballistic Missile (ICBM) silos or the nuclear command and control infrastructure.

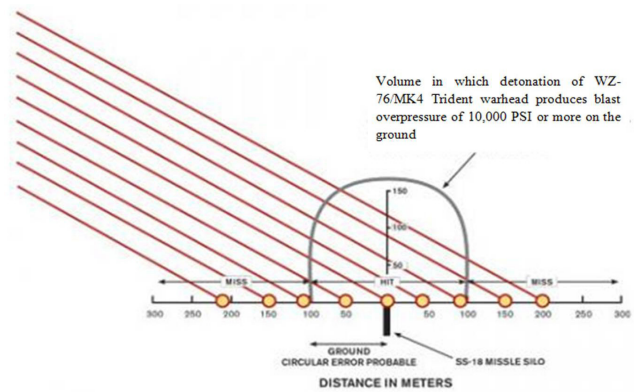
Post this study, the US started upgrading these warheads under the cover of a life extension project for the W-76.<sup>5</sup> The upgrades came with a **new fuze** which dramatically increased their lethality and made them capable of destroying hardened targets as well. Refurbishment of 800 of the warheads was approved by the US National Nuclear Security Administration (NNSA) in 2000, which was later increased to 2,000 by the Bush Administration. How many of these would eventually be upgraded remains classified.<sup>6</sup> However, as per Kristensen, 506 are currently deployed on ballistic missile submarines.<sup>7</sup> The project is scheduled for completion in 2018.

### Super Fuze

The most accurate ballistic missile warheads still have

a considerable Circular Error Probability (CEP).<sup>\*\*</sup> The warheads, having a pre-fixed height of burst, can explode outside the intended volume of space (see Fig I). However, the new super fuze employs a much better mechanism to detonate the warhead above the intended target. This happens due to the flexibility in varying the height of burst, allowing the fuze to detonate the warhead in the calculated lethal volume above the intended target (see Fig 2).

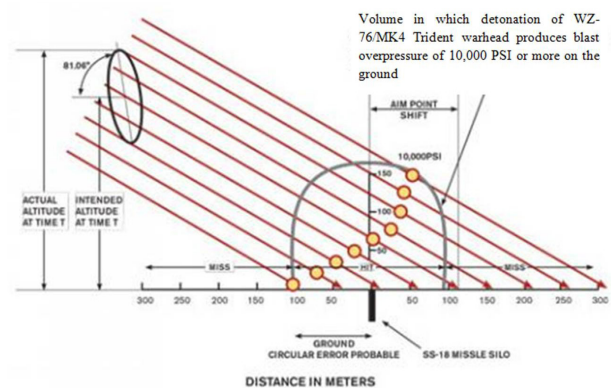
**Fig 1: Detonation Spread: Conventional Ballistic Missile Fuze**



Source: *Bulletin of the Atomic Scientists*<sup>4</sup>

It can be seen in the above figure that the warheads with fixed height-of-burst fuzes can overshoot or fall short of the “lethal volume” (shown here by a gray, dome-shaped line), limiting their ability to destroy hardened targets.

**Fig 2: Detonation Spread: Super Fuze**



Source: *Bulletin of the Atomic Scientists*<sup>4</sup>

<sup>\*\*</sup> CEP is defined as the radius of a circle around the aiming point of a target within which half of the warheads aimed are expected to impact.

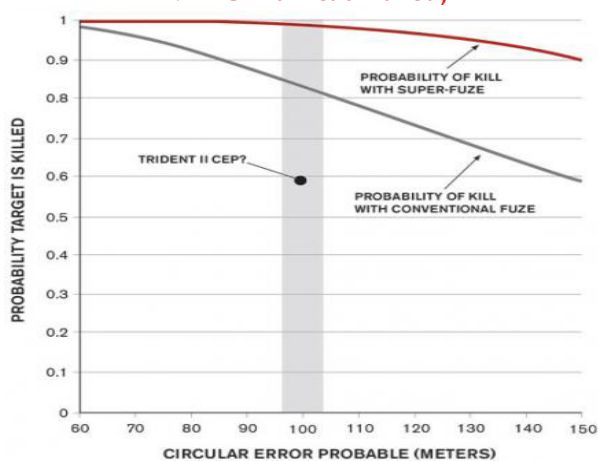
As explained by Kristensen in his analysis of the super fuze:<sup>4</sup>

*The tilted ellipse in the left upper corner of Diagram II depicts the spatial distribution of incoming warheads at the time the super-fuze measures its altitude. In this particular case, the orientation of the ellipsoid indicates that the errors leading to a miss at the target are mostly due to a mix of small discrepancies in the velocity and direction of the warheads when they are deployed from the rocket upper stage outside the atmosphere. The orientation and dimensions of this ellipse are well known to a ballistic missile designer, so the altitude measurement can provide information that leads to an estimate of the distance from the lethal volume above the target.*

The super fuze measures the altitude of the warhead much before it is to arrive at the target end. This happens at a time when the external forces such as drag are not acting on the warhead, and if the altitude measured matches the altitude intended, the trajectory would remain the way it was theoretically computed. However, if the altitude is more or less, the warhead is likely to overshoot/fall short of the aiming point. The super fuze caters for this and achieves a burst at varying heights inside the lethal volume of space, thus, enhancing the probability of a successful kill manifold.<sup>8</sup>

This is best explained with the help of Fig 3.

**Fig 3: KT Low Air-Bursts, 2,000 PST Target (MK4 or MK4S Warhead Fuzed)**



Source: *Bulletin of the Atomic Scientists*<sup>4</sup>

The Arming Firing and Fusing (AF&F) System or the super fuze is known as the MC4700 and is part of the life extension project of these warheads, expected to raise the shelf life from 20 to 60 years.<sup>9</sup> It is understood that all the ballistic missile submarines are equipped with this warhead and the kill capability of these submarines has been increased three-fold (see Fig 3). The probability of the super fuze detonating the warhead in the intended kill volume of space is 86 percent, i.e. a kill probability that would be achieved using three conventional warheads). US submarines currently deploy about 890 warheads, of which 506 are W76s and 384 are W88s. Earlier, only W-88s were considered to be good for employment against hardened targets. With the super fuze, practically, it means that the US is capable of taking out all the hardened targets such as the ICBM silos and the nuclear command and control infrastructure as well as the mobile launch platforms, using its submarines. In other words, Washington can destroy Russia's land-based nuclear weapons, while still retaining 80 percent of US warheads in reserve.<sup>10</sup> This is a significant improvement which changes the paradigm! The US can now think of launching a first strike and hope to win the nuclear war! And as if that was not enough, it is also believed that the super fuze has also been provided to the SLBMs being carried by British SSBNs<sup>11</sup> (Submersible Ship Ballistic Missile Nuclear).

### Threat to Russia and China

Russia and China are making huge progress in modernising their armed forces and are making deep inroads in niche technology areas such as hypersonic weapons, supersonic long range cruise missiles (both land attack as well as anti-shipping), anti-satellite weapons and cyber warfare. However, all this progress pretty much pales against the game changing development and deployment of the super fuze combined with the Anti-Ballistic Missile (ABM) systems that the US is trying to put in place. The combined offensive-defence nuclear threat is perceived as existential by certain defence analysts. Speaking at the St. Petersburg International Forum in June 2016,

Russian President Vladimir Putin charged that the US anti-missile systems in Poland and Romania were not aimed at Iran, but at Russia and China. “The Iranian threat does not exist, but missile defence systems continue to be positioned.” He added, “A missile defence system is one element of the whole system of offensive military potential.”<sup>12</sup>

It is evident from the above statement of the Russian President that both Russia and China are deeply concerned about both offensive and defensive nuclear capabilities of the US, and the Russian strategic community is likely to perceive these developments as a first step towards a viable “first strike” capability that Washington is trying to acquire. While the US has abided by the concept of Mutually Assured Destruction (MAD) in the past, it has never been averse to the idea of deploying a first strike capable infrastructure.

The super fuze induced threat is that much more pronounced for Russia and China, when seen through the prism of early warning systems possessed by them. Both these nations’ systems, when compared with the early warning mechanism of the US and its allies, provide much less warning time to initiate counter-measures. The combined result of short warning times, lack of real time situational awareness, hair-trigger nuclear readiness postures, and the super fuze comprise an arms race *a-la* the Cold War period. From China’s point of view, increased deployment of US anti-missile platforms such as the Terminal High Altitude Air Defence (THAAD) in its backyard in the Korean peninsula is a cause of serious concern as the radars deployed in the system can monitor the Chinese air space.

### Russian and Chinese Counter-Measures

Russia and China both have SSBNs of their own. These may not be as many and as lethal as those on the US naval ORBAT (Order of Battle); nonetheless, these are a potential counter-measure to the US first strike. It is simply not feasible for the US SSN (Submersible Ship Nuclear) and other anti-submarine platforms to find,

and neutralise, all Russian and/or Chinese SSBNs in case of a preemptive first strike by the US. Nor can it be claimed with 100 percent certainty that the US would know the location of all the SSBNs of Russia and China, at any given point in time. A futuristic look around the 2030-40 timeframe would suggest that Russia is capable of delivering 600-700 warheads targeting the continental US, but by then, the US would also have improved its Aegis ship-based ABM system deployed off the Atlantic and Pacific coasts. In pursuit of alternate delivery methods (so as to circumvent the US ABM defences), Russia also launched an Under Water Unmanned Vehicle (UUV) programme capable of launching a 100 megaton nuclear warhead aimed at counter-value targets in the US. Further, Russia and China possess long range cruise missiles/hypersonic glide vehicles such as the Kh-55SM, Kh-102, 3M-14K and YU-74 and DZ-ZF (WU-14) which have a more than significant chance of beating the ABM systems deployed by the US.

### Nuclear Arms Race in the Offing?

The available evidence suggests that! Both Russia and China are modernising their armed forces and restructuring their respective national security apparatus, based on both sustaining and disruptive technologies. This, in turn, would put a lot of strain on the existing arms agreements such as the Intermediate-Range Nuclear Forces (INF) Treaty. The entire geostrategic environment is further aggravated by the US-Russia and US-China diplomatic relations not looking very good. The recently released US National Security Strategy bears witness to this wherein both Russia and China have been addressed as competitors. It states, “China and Russia are developing advanced weapons and capabilities that could threaten our critical infrastructure and our command and control architecture.”<sup>13</sup>

### Implications for India

The improved offensive and defensive nuclear capabilities of China would have a direct impact on

India, as India, as such, is lagging in both these fields and has a lot of catching up to do. The Chinese Rocket Force is already a formidable threat in the Indian context and should China be able to put even an iffy ABM defence system in place, it would seriously jeopardise India's limited second strike capability. India needs to increase its efforts for acquiring SSBNs/SLBMs as an Arihant or two would not suffice, that too minus the MIRV (Multiple Independently Reentry Vehicle) capability. The Indian ABM defence system being developed by the Defence Research and Development Organisation (DRDO) remains a futuristic capability and information about the exact stage of its development is not available in the open domain. Therefore, India needs to leverage its improved strategic relationship with the US as also the shift of the world's attention to the Indo-Pacific region to acquire the relevant technologies in both realms i.e. offence as well as defence. While 'Make in India' is definitely the way to go, should India choose to reinvent the wheel, it simply would take too long to reach where the US, Russia and China currently are. In fact, China's reverse engineering methodology is also one of the options worth examining by Indian defence experts.

## Conclusion

At the end of the Cold War, the world had heaved

a collective sigh of relief as the chances of a nuclear exchange between the two superpowers went down drastically. However, the super fuze has provided the US with a revolutionary improvement in its first strike capabilities. When combined with the ABM defence systems of the US (even with limited capability), this has the capacity of ending the MAD (Mutually Assured Destruction) concept which has prevented the world experiencing a nuclear holocaust and has held the nuclear peace for so long. Although, the very idea that a sane and competent US President would order a nuclear first strike is quite incomprehensible, it, nonetheless, presents both Russia and China with an existential threat. A threat no nation can choose to overlook, and must hedge against. This invariably would lead to a nuclear arms race and would bring into question the existing arms treaties. Regionally, it would compel nations such as India to improve upon their own capabilities and would, in turn, threaten India's perennial enemy, Pakistan (supplied, equipped and propped by China), precipitating a regional arms race as well. Therefore, it is in the all round interest that the US initiate a dialogue on this new development and put on the table mutually acceptable measures to calm the Russian and Chinese concerns, aware fully of the fact that the super fuze is now a reality.

## Notes

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## ... New Arms Race or a Scare?

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