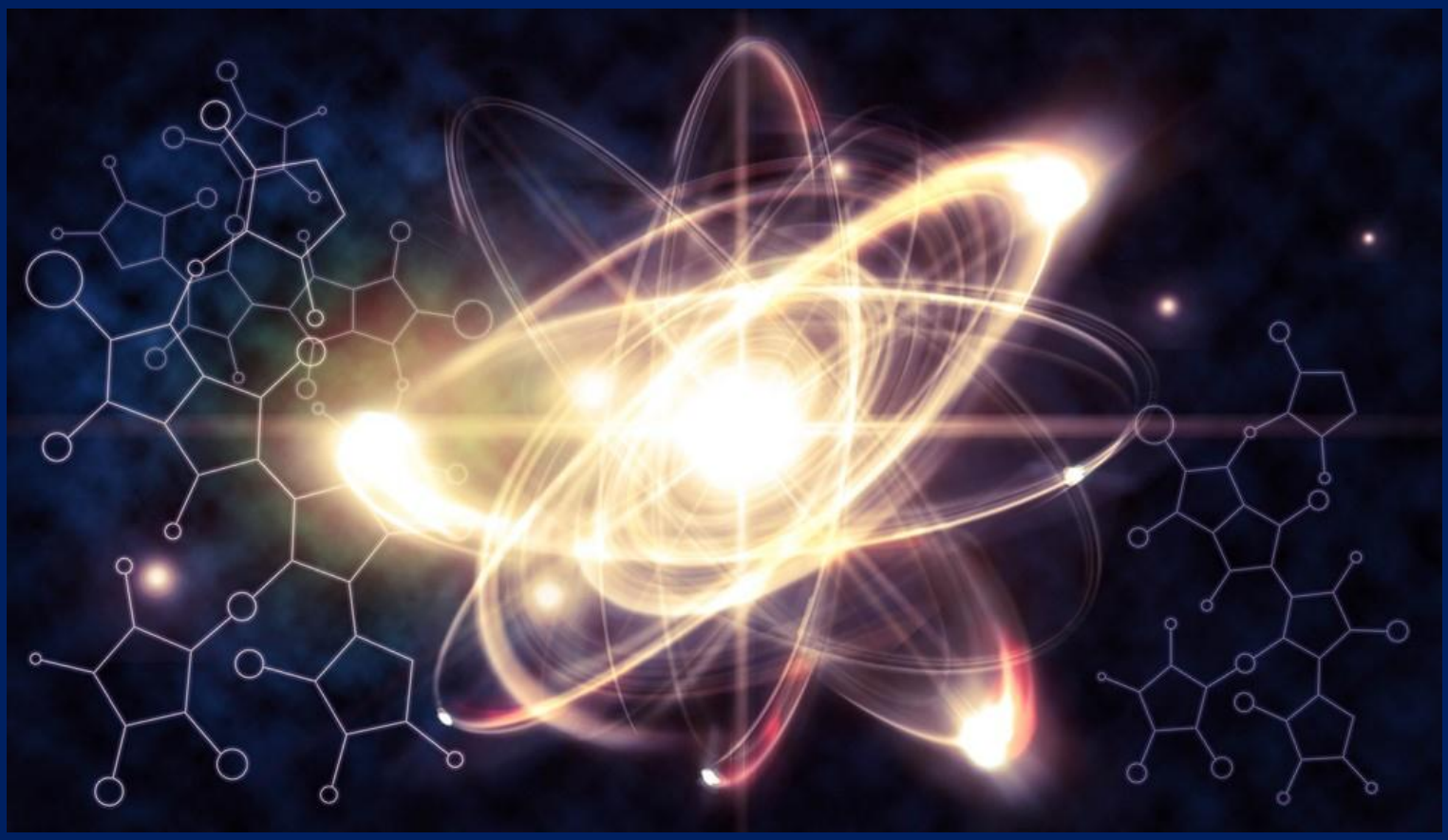
Centre for Air Power Studies (CAPS)
Forum for National Security Studies (FNSS)

Nuclear Wrap-up 2019



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The Nuclear Mood in 2019 – Dangerous and Grim

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2019 started on a grim note when the symbolic clock face maintained by the Bulletin of Atomic Scientists (BAS) remained at two minutes to midnight. It has been there since 2017. The tradition of the Doomsday clock to represent the gravity of nuclear dangers being faced by humanity started in 1947. In more recent times, climatic conditions have also been added as a criterion in deciding the time – a metaphor for how near or far mankind is from annihilation.

In Jan 2019, the Bulletin's Science and Security Board described the world as experiencing a "new abnormal" and found no reason to shift the hand of the minutes away from the closest it had come at two minutes to midnight. Many nuclear factors have brought humanity to this pass since 2017. These include the risks created by President Trump's casual approach to nuclear weapons and disregard for arms control treaties, dramatic deterioration in security relations amongst major nuclear weapons possessors, their continued modernization of weapon systems, the signalling of the feasibility of a limited nuclear war involving the use of low yield nuclear weapons, the inability of USA and North Korea to arrive at any mutually acceptable agreement, the stress being felt by the Joint Comprehensive Plan of Action (JCPOA) as US withdrew from its commitment and signalled a stand-off with Iran.

All these trends that had begun to become visible from 2017 onwards and contributed to the time being set at two minutes to midnight at the start of 2019 have not altered over the last twelve months. In fact, if anything, the two nuclear norms that only a few years ago were considered rock solid – the norm of non-proliferation and that of non-use of nuclear weapons – are today perceived to be under severe stress.

Norm of Non-proliferation

The forthcoming NPT Review Conference (RevCon) in mid-2020 is expected to bear the brunt of the many fissures that have begun to surface amongst participant nations. These exist amongst the five nuclear weapon states (NWS) on the modernization of their weapons, between the nuclear and non-nuclear weapon states (NNWS) on the imbalance between non-proliferation and disarmament

commitments, and within the NNWS on the issue of the treaty on prohibition of nuclear weapons.

Moreover, owing to the continued tensions over North Korea's nuclear programme, nascent debates on acquisition of nuclear weapons have emerged in South Korea and Japan. While much hope had been pinned on the US-DPRK presidential meetings in Singapore and Hanoi, neither of them yielded anything of significance. Rather, DPRK continued to improve its nuclear and missile capabilities in 2019 and placed the onus on President Trump to make the right moves, which in his view included the lifting of economic sanctions on his nation.

Meanwhile, proliferation concerns began to brew once again in West Asia. Once the US announced its withdrawal from the JCPOA in mid-2018, Iran continued with its compliance in the hope that other signatories to the agreement – UK, France, Germany, Russia and China – would find a way out. But, disappointed with their inability to provide for its rehabilitation into the global commercial and trade order, Iran had begun to exhibit its frustration by the middle of 2019. Phased non-compliance with the JCPOA has since been its preferred mode of action. A consequent increase in tensions has taken place in the region with Saudi Arabia and Turkey making noises, presently low level, about their compulsions for possession of nuclear weapons. While none of this indicates that these countries will or can easily move towards nuclear weapons, the stresses on the non-proliferation regime are certainly visible.

It is against such a backdrop that the NPT RevCon will take place in 2020. Given the lack of respect shown by the current US administration for multilateralism and even non-proliferation, not much is expected at the Conference by way of a final document or commitment to constructive actions. In fact, nations that still look upon the NPT as the cornerstone of the non-proliferation regime, such as several in Europe are already beginning to temper expectations on the final outcome. The view being passed around is that the lack of a final consensus document should not be seen as a failure of the Conference! What finally transpires in New York around the middle of 2020 will be interesting to watch.

Norm of Non-use of Nuclear Weapons

The famous statement made by Presidents Reagan and Gorbachev in 1987 – a nuclear war cannot be won and must not be fought – had significantly contributed to the narrowing of the role of nuclear weapons. The statement underlined the folly of a

nuclear exchange and contributed towards strengthening the nuclear taboo or the norm of non-use of nuclear weapons. Over the next almost three decades, it became a sort of an organising principle for nuclear deterrence and encouraged nuclear reductions since the utility of the weapon for war fighting was seen to be self-defeating. The norm was perceived to have taken deep roots.

Alas, this perception received a strong jolt when the US Nuclear Posture Review (NPR), released in Feb 2018, expressed an inclination for new nuclear weapons and more ways to use them to deter large scale conventional threats, cyber-attacks or those against space assets. Tailored nuclear response for execution of 'limited' nuclear strikes was underlined. Of course, the US justified this by pointing to the first step that had been taken by Russia in this direction when its military doctrine of 2014 had claimed the right to use nuclear weapons in response to aggression with non-nuclear weapons. Russia counter-argues that it was compelled to counter US conventional global prompt strike involving the use of long-range, high precision non-nuclear weapons against critical nuclear arsenal or infrastructure by signalling "limited nature of initial nuclear impact... [so] designed not to embitter but to sober the aggressor, making it stop the attack and get down to negotiations". The US too has adopted a similar view with the latest NPR.

Nearly three decades since the historic Reagan-Gorbachev statement, it seems to be yesterday once more. Voices in the nuclear world arguing in favour of possibilities of *use* of nuclear weapons appear to be becoming more voluble. Irrespective of which nation first set down this path, the fact of the matter is that such pronunciations and pursuits are today challenging the norm of non-use of nuclear weapons.

Adding to this sentiment is the emergence of new technologies. While the march of technology is a universal constant, two particular advances that made their potential felt more sharply in 2019 are the use of hypersonics for weapons delivery (DF-17 missile displayed by China in its annual military parade) and that of artificial intelligence in autonomous weapon systems (Poseidon unmanned underwater drone of Russia). While it could be argued that these technologies will only add a few attributes to existing delivery systems, but the real danger from such systems lies in the risks of inadvertent escalation that will be created by the ambiguities attached to them.

During the Cold War period, the Superpowers made a conscious effort to

keep conventional and nuclear systems separate from each other. But, in contemporary times, countries believe that creating ambiguity through dual use weapons could enhance their deterrence. While this may be true, it nevertheless also creates enormous risks of misperception and miscalculation, especially in times of crisis. In the overall game then, while the risk of nuclear use through a deliberate, pre-meditated decision might be less, but the inadvertent use of such weapons owing to miscalculation and misperception has become higher.

Towards 2020

No major encouraging nuclear developments took place in 2019. Rather, apart from the dismal trends outlined in the above sections, the year also saw the abrogation of the INF treaty and the fate of the New START looks far from promising. The destabilizing nuclear trends that made their presence starkly felt in 2019 could only become sharper in 2020 since there is little possibility of a positive change in inter-state relations moving towards better trust or confidence. Consequently, there is little hope that the clock would be able to shift its minute hand away from doomsday.

In view of this reality, the BAS Board could decide to retain the hand of the minutes where it has been since 2017. Or, it could take it further, perhaps by another thirty seconds, in order to further drive home the gravity of the situation. Given that the NPT RevCon will bring together a large grouping of nations whose business it is to focus on nuclear concerns, this could be one way of drawing attention to the desperate situation and subjecting them to greater pressure for meaningful action. The choice before the BAS is a difficult one and it will be worthwhile to monitor how the clock face fares under the circumstances. It would be a fair indication of the nuclear mood that one can expect in 2020.

2019: A Year of Missed Opportunities for Crucial Non-Proliferation Issues

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The year 2019 was truly a damp squib moment for nuclear non-proliferation issues. The year began with a lot of promises for the Iran deal and North Korean denuclearisation. President Trump had withdrawn from the JCPOA in 2018, however, the deal transcended to P4+1. There was still some hope that the EU's Special Payment Vehicle mechanism would be able to generate some incentives for Iran to remain within the JCPOA. On the other hand, the follow-up of Singapore Summit, at Hanoi, was not already dead. Sure, the start to the Hanoi had not been perfect in terms of setting agendas for the broader goal of denuclearisation. But everything wasn't lost. Both the heads of State remained willing to talk to each other and subsequently in the year the possibility of another summit was expressed. Yet, by the end of the year, both non-proliferation promises seemed to have lost. In both cases, the issue of sanctions relief remained the prominent point of contention.

Iran

The JCPOA's future in Trump's Administration was already overshadowed by the Republican opposition in the US Congress and President Trump's personal dislike for Iran. However, the events that unfolded in the Persian Gulf towards mid-2019 - such as Iran's alleged shooting of the US drone leading to the possibility of US retaliatory strike further complicated the prospects. The crisis in Persian Gulf had escalated to an option of military action with President Trump's decision of stationing '1500 troops'[1], which was withdrawn only at the last moment.

However, all this should actually be seen as a manifestation of the tensions and not the cause of the real issue. The real problem can be attributed to Iran's increasing frustration with regard to sanctions relief. Iran maintains that it has kept its end of the promise by remaining in compliance with the JCPOA, (2018-2019) which the IAEA had successfully verified; the United States on its part has not upheld the JCPOA's spirit. The deal was essentially concluded between the 'P5+ Iran'; the US as one of the most important P5 in the JCPOA

[1] "US to send 1,500 extra troops to Middle East amid tensions", *BBC News,* 24 May 2019, Available at https://www.bbc.com/news/world-us-canada-48404141, Accessed on 17 December 2019.

was to refrain from hurting the implementation.

The text of the JCPOA clearly states – "… the E3/EU+3 and Iran commit to implement this JCPOA in good faith and in a constructive atmosphere, based on mutual respect, and to refrain from any action inconsistent with the letter, spirit and intent of this JCPOA that would undermine its successful implementation…"[2] Furthermore, it categorically mentions that "… the E3/EU+3 will refrain from imposing discriminatory regulatory and procedural requirements in lieu of the sanctions and restrictive measures covered by this JCPOA…"[3] The American effort of maximizing pressure, that included 'going all after Iran' on imposing unilateral sanctions was already setting the groundwork for something undesirable. This included US sanctions on the Iranian Supreme Leader and his office, on the Iranian Revolutionary Guards, and its oil and banking sector this year. One can argue that technically unilateral sanctions were imposed post the US withdrawal of the JCPOA. However, one cannot ignore that even pre-withdrawal, the Trump Administration's unnecessary interagency review of the deal, the continued US opposition of Iran's ballistic missile tests and labeling it as non-compliant with JCPOA were in clear violation of the spirit of the JCPOA.

Albeit, some positives were noted in 2019 such as the initiation of the "Instrument in Support of Trade Exchanges (INSTEX)" by March; Iran still remaining in compliance with the deal; US extension of "…waivers for the Arak reactor conversion, the Fordow facility conversion, the Bushehr nuclear reactor and the Tehran research reactor for 90 days…"[4] A Joint Commission[5] was also set up to look into resolving financial difficulties. However, it is the US unilateral sanctions and the EU's lack of being able to do anything substantial about it that led to Iran's step by step un-following of the JCPOA. Until June 2019, Iran was still under full compliance (despite its notifications on what it could possibility do). However, from July onwards, Iran not only announced but conducted four major breaches towards JCPOA that included exceeding the limit of "300 kilogram limit

[2] Joint Comprehensive Plan of Action Vienna, 14 July 2015 JCPOA, Full Text of the Deal, Available at https://www.europarl.europa.eu/cmsdata/122460/full-text-of-the-iran-nuclear-deal.pdf, Accessed on 15 December 2019

[3] Ibid.

[4] Timeline of Nuclear Diplomacy with Iran, *Arms Control Association,* November 2019, https://www.armscontrol.org/factsheet/Timeline-of-Nuclear-Diplomacy-With-Iran#2019, Accessed on 19 December 2019.

[5] "JCPOA Joint Commission to Convene in Vienna on Dec. 6, *Financial Tribune,* 27 November 2019, Available at https://financialtribune.com/articles/national/100951/jcpoa-joint-commission-to-convene-in-vienna-on-dec-6 , Accessed on 23 December 2019.

on uranium gas enriched to 3.67 percent"[6], "enrichment of uranium to "about 4.5 percent" , introducing, in September 2019, UF6 to cascades of 20 IR-4 and 20 IR-6 centrifuges, exceeding the number of machines permitted in a cascade under the JCPOA"[7], and then in November, injecting UF6 into 1,044 IR-1 centrifuges at the Fordow facility…"[8] On 23 December 2019, Iran "unveiled a redevelopment of part of its Arak heavy water reactor"[9]. It is to be noted that under the JCPOA the core of Arak reactor was to be completely destroyed. Has Iran withdrawn from the JCPOA? No! But is it in robust compliance? Absolutely not!

North Korea

After what transpired in Hanoi and thereafter, it is not surprising that North Korea, which is yet to even begin negotiating the larger agenda of denuclearisation, is looking forward to present the US with a "Christmas Gift'.[10] In the beginning of 2019, the supreme leader's New Year message to the US had spelt a fresh start after the derailing of Singapore Summit of 2018. The second Summit at Hanoi took place not much after that in February 2019. However, nothing substantial came out as DPRK's call for full sanctions relief in exchange for partial denuclearization was rejected by the US. Subsequently, the US even renewed some of the sanctions that were to expire. Post Hanoi, specifically since April 2019, the DPRK continued to conduct ballistic missile tests, including one of a submarine launched ballistic missile (SLBM) in October 2019. Interestingly, for most of these tests, President Trump maintained that North Korea wass not in breach of the spirit of Singapore Summit. On the SLBM test (Pukkuksong-3 Missile with a range of 450km), US State Department asked DPRK to refrain from provocation and abide by the UNSC resolution. In fact, right after the test, the US initiated a working level negotiation with DPRK in Sweden. However, the talks failed as the US remained true to its position of no sanctions relief.

It is to be noted that without addressing the issue of economic and military security in the region, no possible outcome in terms of denuclearisation can be envisaged for the DPRK. While sanctions relief may be the first step towards economic security, without security guarantees that involve American reciprocal measures, it would be difficult to bring any negotiation to a closure on denuclearisation.

[6] Ibid.
[7] Ibid.
[8] Ibid.
[9] "Iran announces redevelopment of Arak reactor ", *Al Jazeera,* 23 December 2019, Available at "https://www.aljazeera.com/news/2019/12/iran-announces-redevelopment-arak-reactor-191223164210766.html, Accessed on 23 December 2019.

What 2019 Meant for the U.S-Russia Nuclear Dyad and the World At Large?

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The year 2019 heralded a renewed look by USA and Russia with respect to arms control, which has imposed a cost on strategic and nuclear stability. Beginning with the Trump administration's Ballistic Missile Defense Review, the mutual exit from the INF Treaty mid-year sent alarm bells ringing around the world with another treaty exit ie; from New START looming large as this year closes. This prognosis offers a round-up of the implications of each of these developments on the nuclear arms control architecture and its resultant impact on international relations in the upcoming years.

Ballistic Missile Defense Review 2019

At the beginning of 2019, the Trump administration revealed the Ballistic Missile Defense Review (BMDR), which set the tone for enhanced future US missile defence capabilities in an increasingly complex geopolitical scenario. In the Rumsfeld Commission Report of 1998, the United States had made the first assessment of the likely threat of ballistic missiles tipped with nuclear payload, which paved the way for the development of its national missile defence program. Consequently, the U.S exit from the Anti-Ballistic Missile (ABM) Treaty in 2002 became a foregone conclusion. Taking forward the identification of threats from the offensive missiles of China and Russia as articulated in the US National Security Strategy and Nuclear Posture Review of 2018, the latest BMDR acknowledged the pressing need to adopt Integrated Air and Missile Defense (IAMD). While unveiling the 2019 BMDR, President Trump went as much to say that the goal is "to ensure that we can detect and destroy any missile launched against the United States—anywhere, anytime, anyplace."[11] Indeed, with the ongoing expansion of Russia's and China's advanced ballistic, cruise missiles and hypersonic missiles, the U.S considers ramping up its defensive systems as vital for its deterrence. However, the current review has both -- important continuities as well as innovations -- when compared to the previous BMDR. Nevertheless it does heighten the perception that there is an

[11]"Assessing the 2019 Missile Defense Review", Arms Control Today, March 2019, https://www.armscontrol.org/act/2019-03/features/assessing-2019-missile-defense-review

ongoing arms race among the major nuclear powers.

Firstly, the BMDR reiterates reliance on 'nuclear deterrence for strategic nuclear attack.'[12] It also identifies the spectrum of air and missile threats including from UAVs, cruise missiles, hypersonic glided vehicles (HGVs) etc. This is part of the complex strategy of IAMD that is still in its infancy. The reference to HGVs is to potentially counter the threat of Russia's new class of missiles, which can promise rapid accurate delivery with the 'combined attribute of the speed of ballistic missiles and the maneuvering capabilities of cruise missiles.'[13] The current U.S missile defense systems are incapable of withstanding hypersonic missiles.

Secondly, in close relation to the rapid advancement of hypersonic missile technology, the highlight of the BMD review is the endorsement of a Space Sensor Layer (SSL). However, there is currently nothing concrete as far as a timeline or architectural framework is concerned. Nevertheless, the emphasis is on space-based interceptors, with its birth-to-death trajectory tracking, which will serve as a deterrent against HGVs. In light of China's smaller strategic nuclear arsenal and the resultant threat of BMD, the former has stepped up its pursuit and development of wide-ranging mobile air and missile defense capabilities including the purchase of S-400 BMD systems from Russia. The outcome of these developments is the familiar spiral of defense-offense advancements with the added spectre of an uncertain arms control regime.

Termination of the INF Treaty

After the U.S and Russia formally withdrew from the INF Treaty in August of this year, a nuclear arms control agreement negotiated by then-US President Ronald Reagan and Soviet leader Mikhail Gorbachev in 1987, fell by the wayside. The INF Treaty had helped to keep a check on the missiles with ranges between 500 and 5,500 kilometres. It also required the destruction of around 2,692 missiles – 1,846 by Russia and 846 by U.S - enabling the combined decrease in nuclear stockpiles from almost 70,000 in 1986 to just under 15,000 today.[14] However, even

[12] Thomas Karako, "The 2019 Missile Defense Review: A Good Start." *Centre for Strategic & International Studies*, January 17, 2019. https://www.csis.org/analysis/2019-missile-defense-review-good-start

[13] Trevor English, "How Hypersonic Missiles Work and Why They're Starting a Global Arms Race." *Interesting Engineering*, December 11, 2019, https://interestingengineering.com/how-hypersonic-missiles-work-and-why-theyre-starting-a-global-arms-race

[14] Lori Esposito Murray, "What the INF Treaty's Collapse Means for Nuclear Proliferation." *Council on Foreign Relations*, August 1, 2019, https://www.cfr.org/in-brief/what-inf-treatys-collapse-means-nuclear-proliferation

the most ardent supporters of arms control would agree that the evolution of new weapon technologies and the expiration of verification provisions were always going to shake the foundations of arms control treaties. Given Russia's perceived weakness in light of U.S missile defense upgradation and U.S concerns over China's offensive and advanced sea and air-launched cruise and hypersonic missiles, the current geopolitical scenario warrants a renewed look at arms control regimes.

The demise of the INF Treaty, in the eyes of the U.S administration, was triggered by Russia's deployment of 9M729 missiles - known to NATO as SSC-8, which the trans-Atlantic alliance believed posed a threat to continental security. The fear compounded with the increased knowledge about Russia's new missiles, which are said to be 'nuclear-capable, mobile, very hard to detect with the ability to reach European cities within minutes'.[15] The U.S has already conducted two conventionally-configured ground-launched ballistic missile tests, which would not have been permitted under the INF Treaty. The lack of limitations on U.S and Russia's missile development will escalate an already volatile arms race. The immediate implication of this is that not only would these developments threaten existing arms control regimes but they would also undermine the post-Cold War progress towards non-proliferation efforts.

The New START

New START was conceived by the Obama and Medvedev administrations in 2010. It was ratified by the two parties for a period of 10 years and is renewable by five years upon mutual agreement. It curbs the number of 'nuclear launchers and deployed land- and submarine-based missiles and nuclear-capable bombers' each party can have.[16] It also limits the number of strategic nuclear warheads deployed. The New START is currently the only remaining arms control agreement between the two super powers. But it appears vulnerable to the whims of the increasingly unstable arms race underway.

In addition, the current trend is not to increase arsenal quantities but to improve existing technologies and the rapid adoption of autonomous weapon systems. This is resulting in an uncertainty caused by the 'total loss of transparency, predictability and information exchange', which Ulrich Kühn calls "strategic

[15] "NATO chief calls on Russia to save INF nuclear missile treaty". BBC News, July 18, 2019, https://www.bbc.com/news/world-europe-49026227

[16] Tom Balmforth, "Russia says it's already too late to replace new START treaty." Reuters, November 1, 2019, https://in.reuters.com/article/uk-russia-usa-missiles/russia-says-its-already-too-late-to-replace-new-start-treaty-idINKBN1XB3NQ

blindness".[17] While Russia has, at least, offered to begin extension talks, the fact that the U.S continues to insist on having China on board certainly complicates the situation. Needless to say, China would not consider any reductions to its relatively small nuclear arsenal unless 'both U.S and Russia give up parts of their own material military power'.[18] However, the most alarming fall-out from the prevailing climate of arms control uncertainty is how it is perceived by the non-nuclear states in their commitment towards NPT. Therefore, it is not only prudent for both U.S and Russia to agree to New START extension, albeit under less-politically volatile conditions, but it would help salvage the need to undergo dangerous escalation of threats.

The three nuclear developments that took place in 2019 in U.S-Russia relations are inter-linked. In fact, one tends to impinge on the other. The unilateral U.S exit from the Anti-Ballistic Missile (ABM) Treaty in 2002 paved the way for much of the uncertainty being witnessed today. It does not help matters that Russia was found to have repeatedly flouted INF Treaty obligations, despite U.S diplomatic manoeuvres. However the New START, negotiated during a brief period of U.S-Russia rapprochement, has the potential to undercut the misgivings of both parties.

The current state of arms control is a grim reminder that Superpowers are more interested in being disruptors than in maintaining the status quo. Despite the numerous arms control agreements signed during the heyday of the Cold War, the current state of play is also a throwback to a time when the arms race was underway in full throttle with little appetite for nuclear 'maturity'. With both Russia and China modernizing their nuclear force capabilities, especially hypersonic weapons technology, it is a clear sign that arms control regimes need a revival. In a prevailing atmosphere of mutual trust deficit, it is difficult to fathom how these states will acknowledge the benefits of existing arms control architecture. Perhaps the recent outreach by Russian President Vladimir Putin to 'unconditionally extend the New START' is a step in the right direction.[19] Will the Trump administration see virtue in it or does it wish to first see China in it? The upcoming year might turn out to be one of promise. Or, it could lead us to unprecedented peril.

[17] Ulrich Kühn, "Expert Survey: Is Nuclear Arms Control Dead or Can New Principles Guide It?." Russia Matters, July 30, 2019, https://www.russiamatters.org/analysis/expert-survey-nuclear-arms-control-dead-or-can-new-principles-guide-it

[18] Ibid

[19] Kingston Reif & Shannon Bugos, "Putin Puts Ball in Trump's Court on New START Extension." Arms Control Today, December 20, 2019, https://www.armscontrol.org/blog/2019-12-19/us-russian-nuclear-arms-control

Nuclear China in 2019

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Four years after its last White Paper on National Defence, China released a fresh version in July 2019 titled '*China's National Defense in the New Era'*. It allows a look at China's strategic plans and offers insights into its current nuclear thinking. It states that the current global order is marked by rising international strategic competition; Adjustments in the national security and defence strategies of the United States have undermined global strategic stability. It argues that the intensified competition among major countries has pushed for additional capabilities in nuclear, outer space, cyber and missile defence. Within this context, the White Paper asserts that China's nuclear capabilities remain a strategic cornerstone in safeguarding its national sovereignty and security.[20] It reiterates China's nuclear policy in the following statement:

> *"China is always committed to a nuclear policy of no first use of nuclear weapons at any time and under any circumstances, and not using or threatening to use nuclear weapons against non-nuclear-weapon states or nuclear-weapon-free zones unconditionally. China advocates the ultimate complete prohibition and thorough destruction of nuclear weapons. China does not engage in any nuclear arms race with any other country and keeps its nuclear capabilities at the minimum level required for national security. China pursues a nuclear strategy of self-defense, the goal of which is to maintain national strategic security by deterring other countries from using or threatening to use nuclear weapons against China."*[21]

China's hasn't introduced changes to its basic nuclear policy and principles it adopted when it first tested its nuclear weapons in 1964. However, rapid modernisation of its nuclear capabilities is evident. The build-up of China's nuclear capabilities is largely a response to the developments in the nuclear programme of the United States. In its Nuclear Posture Review released in 2018, the United States

[20] The State Council Information Office of the People's Republic of China. *China's National Defense in the New Era*. 2019. http://english.www.gov.cn/archive/whitepaper/201907/24/content_WS5d3941ddc6d08408f502283d.html.

[21] Ibid.

laid out its tailored strategy for China, whereby it took note of China's efforts to counter the U.S. power projection operations in the Asia-Pacific region and deny the United States the capability and freedom of action to protect U.S., allied, and partner interests. It stated that the United States will maintain the capability to credibly threaten China if it seeks to secure an advantage through the limited use of its theater nuclear capabilities.[22]

China's insecurities continue to compound as the United States recently evinced plans to deploy medium and intermediate range ground-based missiles in the Asia Pacific region following its announcement to withdraw from the Intermediate-Range Nuclear Forces (INF) agreement it had signed with the erstwhile Soviet Union in 1987. The deployment of these missiles allows the United States to effectively encircle China. A potential counterforce use of such missiles against China poses threat to the survivability of its nuclear weapons.[23] Further, The United States has already deployed the Terminal High Altitude Area Defense (THAAD) - a globally transportable ballistic missile defence system in South Korea.[24] For China, it not only challenges its nuclear deterrent capabilities, but also disrupts the regional balance of power.[25] China also views the developments in Russia's nuclear programme with caution. Although both the countries remain strategic partners, China notes Russia's deployment of tactical nuclear weapons in its neighbourhood as particularly troubling.[26]

In 2019, China demonstrated a sharp accretion to its nuclear weapons capabilities. On the 70th anniversary parade held on October 1st, 2019, China showcased the world's longest-range intercontinental ballistic missile (ICBM) Dong Feng 41 (DF-4I) that offers an operational range exceeding 14,000 kilometres. This enables China to reach the United States within the time frame of thirty minutes. It also allows China to surpass the range of the latter's longest ICBM LGM-30 Minuteman that has a reported range of 13,000 kilometres. Further, the British think tank, the

[22] Department of Defence United States of America. *Nuclear Posture Review*. 2018. https://media.defense.gov/2018/Feb/02/2001872886/-1/-1/1/2018-NUCLEAR-POSTURE-REVIEW-FINAL-REPORT.PDF.

[23] Zhao, Tong. "Why China Is Worried About the End of the INF Treaty." Carnegie-Tsinghua Center. Last modified November 7, 2018. https://carnegietsinghua.org/2018/11/07/why-china-is-worried-about-end-of-inf-treaty-pub-77669.

[24] Michael D. Swaine. "Chinese Views on South Korea's deployment of Terminal High Altitude Area Defense (THAAD)." Carnegie Endowment for International Peace. Last modified February 2nd, 2017. https://carnegieendowment.org/2017/02/02/chinese-views-on-south-korea-s-deployment-of-terminal-high-altitude-area-defense-thaad-pub-67891.

[25] Ibid.

[26] Eric Heginbotham et al., China's Evolving Nuclear Deterrent: Major Drivers and Issues for the United States (Santa Monica: Rand Corporation, 2017), 74.

International Institute for Strategic Studies (IISS) has reported that the DF-41 is reportedly capable of carrying multiple-independent re-entry vehicles (MIRV) or jammers and penetration aids.[27] The Chinese Communist Party-run *Global Times* claims that DF-41 has the capacity to carry about ten independently targetable nuclear warheads.[28] However, some experts suggest that the purpose of the MIRVs is to ensure penetration of the US ballistic missile defence system than maximising its warhead capacity.[29]

At the parade in 2019, China also debuted the submarine-launched ballistic missile (SLBM) Ju Lang-2 (JL-2) that forms a standard weapon component for China's Jin Class nuclear armed submarines. However, it has been long suspected that China has already been conducting tests of the JL-2 from trial submarines since 2002 and the weapon became operational in 2014.[30] The JL-2 has a range of 7.200 kilometres, and therefore is designed to respond to threats emanating in China's neighbourhood, especially as the United States continues to assert its military presence in the region. Further, China demonstrated the Dong Feng 17 (DF-17), which is a type of ballistic missile capable of carrying a hypersonic glide vehicle (HGV) that can penetrate the missile defence systems deployed by the United States and its allies.[31]

These developments signal a shift towards a more assertive and transparent nuclear posturing. The debut of DF-41 and JL-2 demonstrate China's efforts to offset the United States' strategic superiority, at least in the region that matters the most to China, as well as its presence in China's neighbourhood.

Notwithstanding these developments, China is unlikely to deviate from its stated nuclear policies or principles of 'minimum deterrence', wherein it maintains limited nuclear arsenals.[32] China has repeatedly

[27] "China's PLA: New Weapons, New Approaches." IISS. Accessed October 12th, 2019. https://www.iiss.org/blogs/military-balance/2019/10/china-national-day-parade-pla.

[28] "China Debuts Most Advanced ICBM DF-41 at Parade." Global Times. Last modified October 1st, 2019. http://www.globaltimes.cn/content/1165931.shtml.

[29] Hans M Kristensen and Matt Korda. "Chinese Nuclear Forces, 2019." Bulletin of the Atomic Scientists 75, no. 4 (July 2019), 171-178. Accessed October 12th, 2019. https://doi.org/10.1080/00963402.2019.1628511.

[30] "China Showcases JL-2 Submarine-launched Ballistic Missile at 70th Anniversary Parade." Defence & Security Intelligence & Analysis | Jane's 360. Last modified September 30th, 2019. https://www.janes.com/article/91614/china-showcases-jl-2-submarine-launched-ballistic-missile-at-70th-anniversary-parade

[31] "Check Out China's New DF-17 Hypersonic Glide Vehicle: A Real Killer?" The National Interest. Last modified October 1st, 2019. https://nationalinterest.org/blog/buzz/check-out-chinas-new-df-17-hypersonic-glide-vehicle-real-killer-84946.

[32] Xia, Liping. *"China's Nuclear Doctrine: Debates and Evolution."* Carnegie Endowment for International Peace. Last modified June 30th, 2016. https://carnegieendowment.org/2016/06/30/china-s-nuclear-doctrine-debates-and-evolution-pub-6396

asserted that it has no intention to attain nuclear parity with the United States as far as the number of nuclear warheads is concerned. According to the latest Stockholm International Peace Research Institute (SIPRI) report, China possesses about 280 nuclear warheads as compared to 6,450 held by the United States.[33]

Going forward, China is expected to modernise its nuclear force in a lean and effective manner. According to a report by RAND Corporation, China's nuclear modernisation is not constrained by the limits of defence spending. Instead, it has reportedly invested less on its nuclear force build-up than what its resources allow.[34] Modernisation of China's nuclear capabilities is likely to be in the fields of missile defence systems or the incorporation of new penetration capabilities such as HGVs, decoys, or MIRVed systems with an eye to maintain survivable retaliatory capabilities.

It is worth paying attention to the workings within the People's Liberation Army Rocket Force (PLARF) that has been tasked with managing China's conventional and strategic missiles and enhancing China's nuclear deterrence and counter-strike capacities. As of 2016, half of the PLARF's brigades have been armed with conventional missiles even as PLARF continues to be involved in nuclear missions.[35] The co-location of conventional and strategic missiles and the lack of firewall between the conventional and nuclear warfare poses risk of inadvertent nuclear escalation.

India and China continue to be involved in territorial disputes. Although the two are unlikely to engage in a nuclear exchange given their 'No First Use' doctrines, the build-up of China's nuclear capabilities in the absence of a strategic dialogue on stability issues poses the risk of sucking India into an offence – defence spiral. For instance, developments in China's nuclear capabilities could put pressure on India to to maintain technological parity with China. India needs to carry out its own security audit and choose its own nuclear capability prudently. Meanwhile, proliferation of technologies from China to Pakistan will have to be under a close watch too.

[33] "Modernisation of World Nuclear Forces Continues Despite Overall Decrease in Number of Warheads" SIPRI. Accessed October 13th, 2019. https://www.sipri.org/media/press-release/2019/modernization-world-nuclear-forces-continues-despite-overall-decrease-number-warheads-new-sipri.

[34] Heginbotham, China's Evolving Nuclear Deterrent, 146.

[35] Ibid, 71-72

An Analysis of Pakistan's Missile Tests in 2019

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Pakistan continues to expand its nuclear arsenal with growing technological sophistication. 2019 was a moderately busy year for Pakistan during which it conducted four missile tests. With four operational plutonium production reactors, uranium enrichment facilities and frequent tests of nuclear capable missiles, Pakistan's nuclear and missile programmes are on their way to building Pakistan's version of full spectrum deterrence. According to a report on 2019 global nuclear warhead inventories by Arms Control Association[36], the country has 140 to 160 warheads which include sophisticated miniaturized warheads. Currently the country has seven types of nuclear capable ballistic missiles with two more such missiles under development: Shaheen III and Shaheen 1A. The last test of 2019, on 18 November 2019 was that of the short-range ballistic missile, Shaheen 1. It was the country's fourth missile test of the year. Before this test, Pakistan had test fired the tactical missile Nasr/Hatf 9 in January, medium range ballistic missile Shaheen II in May, and the surface to surface ballistic missile Ghaznavi in August. In April 2019, Pakistan had also tested an indigenously developed unidentified anti-ship/ land attack cruise missile in the Arabian Sea, although details of the missile type have not been revealed by Inter Service Public Relations (ISPR).

While explaining the ballistic missile tests, the official press releases by ISPR have broadly specified a few objectives as can be culled from their various press releases – the tests were conducted to augment full spectrum deterrence posture of the country, to meet Pakistan's strategic needs towards maintenance of desired deterrence stability in the region and to ensure Pakistan's credible minimum deterrence while enhancing the operational readiness of Army Strategic Forces Command of Pakistan. In order to comprehend the significance of these missile tests and what they mean for the nuclear posture of Pakistan, a brief account of each missile would be helpful.

The first test of 2019 was conducted when Pakistan tested the very short-range ballistic missile (SRBM) Nasr (Hatf IX) in January 2019; which included launching of quad salvo on 24 January and single shots on 28 & 31 January respectively. The Haft 9

[36] Kelsey Davenport, "Nuclear Weapons: Who Has What at a Glance", Fact sheets and briefs, Arms Control Association at https://www.armscontrol.org/factsheets/Nuclearweaponswhohaswhat, accessed on 4 December 2019

or Nasr is a surface to surface, battlefield usable, solid fuelled, quick reactionary shoot and scoot missile, which claims to have ability of in-flight manoeuvrability. The missile is claimed to have high accuracy which indicates that the missile could be used for counterforce targeting in the theatre of military operations. Nasr is capable of delivering low-yield nuclear weapons to a range of up to 70 km. Previous successful flight test of the missile was conducted in July 2017 with improved range and according to the ISPR press release of the time, the test was conducted to re-validate the desired technical parameters. Moreover, the notion of full-spectrum deterrence (FSD) in Pakistan's nuclear posture came to the fore in the official press release[37] when Pakistan conducted first flight test of the Nasr (Hatf IX) in April 2011.

Test flight of medium range ballistic missile (MRBM) Shaheen II was conducted on 23 May 2019. It is a road mobile, two stage solid propellant missile with a range up to 1500 km. The test was conducted after a long gap of four and half years. The last announced test of Shaheen II had taken place on 13 the November 2014. One of the significant points to notice about test launches of this missile is that when the missile was tested in April 2008, the range of the missile was claimed to be 2000 kms, whereas in the subsequent tests in 2014 and 2019 the range has been toned down to 1500 kms. Moreover, the latest press release also describes Shaheen II as a "highly capable missile which meets Pakistan's strategic needs towards maintenance of desired deterrence stability in the region", while in the 2014 press release the test was described as a significant step towards achieving "full spectrum credible minimum deterrence".

The third test took place on 29 August 2019 when Pakistan carried out night training launch of surface to surface short range ballistic missile Ghaznavi. The missile is capable of delivering different types of warheads up to the range of 290 km and claimed to confer special operational and tactical level capability[38]. The SRBM can carry greater payload than the Nasr (800 kg payload in case of Ghaznavi and 500 kg payload in case of Nasr), and hence can be armed with higher-yield warheads while covering the same range as Nasr if launched in the lofted trajectory.

On November 18, 2019, Pakistan conducted a test of another short-range surface-to-surface ballistic missile Shaheen

[37] ISPR press release No. PR-94/2011-ISPR, Inter Services Public Relations, 19 April 2011, accessed on 29 November 2019

[38] ISPR press release No. PR34/2012-ISPR, Inter Services Public Relations, 5 March 2012, accessed on 1 December 2019.

1 with range of 650 km. According to the press release[39] by ISPR, the launch was part of a training exercise "aimed at testing the operational readiness of Army Strategic Forces Command". The missile is claimed to be capable of carrying both conventional and nuclear warheads and ensures Pakistan's deterrence. The last flight test of the missile had been conducted almost nine years before in May 2010. The official statement indicates no significant development in the current version of Shaheen 1. Presently, an extended range version of the missile, Shaheen 1A is under development and expected to have a range of 900 kilometres.

As mentioned before, it can be observed that there are primarily three objectives that trigger these tests and related technology development. One of the main arguments is to enhance the full spectrum deterrence posture of the country. The concept of FSD has been at the forefront since Pakistan conducted the first flight test of its short range tactical missile Nasr in April 2011 and declared that "the NASR Weapon System now provides Pakistan with short range missile capability in addition to the already available medium and long range ballistic missiles and cruise missiles in its inventory"[40]. Pakistan explains its need for FSD to cater for a threat to deter India with all kinds of ranges of missiles and at all levels of the threat spectrum. Pakistan's military experts are of the view[41] that through full spectrum deterrence, Pakistan essentially seeks to plug the gap of conventional force imparity vis-à-vis India. They also believe that by developing such a weapon system, Pakistan has been able to cover the complete spectrum (full spectrum) i.e. strategic, operational and tactical levels of nuclear weapons use and therefore able to deter aggression at all levels.

The press release[42] after the latest test of Nasr in January 2019 claims that the FSD posture is developed within the ambit of credible minimum deterrence. However, the doctrine of full spectrum deterrence envisions achieving escalation dominance[43] by using limited nuclear option to gain

[39] ISPR press release No PR-194/2019-ISPR,Inter Services Public Relations, 18 November 2019, at https://www.ispr.gov.pk/press-release-detail.php?id=5507, accessed on 26 November 2019.

[40] ISPR press release No. PR-94/2011-ISPR, Inter Services Public Relations, 19 April 2011, accessed on 29 November 2019

[41] 'A Conversation with Lt. Gen. Khalid Kidwai' (Transcript), Carnegie International Nuclear Policy Conference 2015, 23 March 2015, at http://carnegieendowment.org/files/03-230315carnegieKIDWAI.pdf, p. 09

[42] ISPR press release No. PR-32/2019-ISPR, Inter Services Public Relations, 24 January 2019, accessed on 10 December 2019

[43] Evan Braden Montgomery & Eric S. Edelman (2015) Rethinking Stability in South Asia: India, Pakistan, and the Competition for Escalation Dominance, Journal of Strategic Studies, 38:1-2, 159-182, DOI: 10.1080/01402390.2014.901215, accessed on 14 December 2019

leverage over India's conventional force superiority. As the concept makes the possibility of nuclear escalation a reality and further destabilises the deterrence scenario in South Asia, the question remains on whether the concept of full spectrum deterrence comes within the domain of credible minimum deterrence, as claimed by Pakistan.

In view of the open ended idea of its FSD, Pakistan will likely continue expanding its missile inventory. With the development of solid fuelled medium range ballistic missile (MRBM) like Shaheen- III with improved range of 2750 km, that claims to be able to target almost entire mainland India and Andaman and Nicobar island in the Bay of Bengal[44], MRBM Ababeel which is reportedly capable of carrying multiple independently targetable re-entry vehicles (MIRVs), etc Pakistan's quest to achieve FSD to stabilises and strengthen deterrence scenario in South Asia might actually risk escalating conflict situation than providing credible deterrence. 2020 promises to be another busy year for Pakistan's missile programme for sure.

[44] n.41

Nuclear Energy Review 2019: The Global Picture

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2019 proved to be an eventful year for the nuclear industry. It witnessed several highs such as fresh breakthroughs in nuclear technology, signing of new cooperation agreements, and for the first time since 2011, removal of radioactive fuel rods from the wrecked Fukushima nuclear power plant. However, the year was also marked by the slackening of a few nuclear power projects, as well as the sad demise of the IAEA Chief Yukiya Amano in harness. The overall trajectory, however, can be described as largely positive as nuclear power receives favourable attention from the climate change perspective.

Development of Civil Nuclear Capabilities and Nuclear Cooperation

Currently, the nuclear energy industry is witnessing resurgence after the hiatus post-Fukushima in 2011. In 2019, several countries moved towards developing their civil nuclear capabilities. Uzbekistan, which had intended to build 2 nuclear power units, decided to increase the number to 4.[45] Australia has witnessed extensive debates and discussions on nuclear power and is contemplating to rescind its ban on nuclear energy. On December 16, 2019, a report published by the parliamentary committee suggested that the Australian government should consider lifting the moratorium partially.[46] In the West Asian region, in November 2019, Iran began construction of a second nuclear reactor at the Bushehr power plant facility while announcing plans of constructing a third one soon; UAE's Barakah nuclear power plant announced completion of all pre-start checks, signalling that the plant could go operational once it receives the operating license early next year.[47] The Federal Authority for Nuclear Regulation (FANR) in July 2019 stated that the first group of UAE National Senior Operators and Reactor Operators had already gained official certification to operate the nuclear power plant.[48] In Europe, the Czech government

[45] "Uzbekistan adds second plant to nuclear power goal", *World Nuclear News,* July 12, 2019. http://world-nuclear-news.org/Articles/Uzbek-expands-nuclear-plans. Accessed on December 10, 2019.

[46] "Australian Committee Calls For Partial Lifting Of Nuclear Moratorium", *Eurasia Review*, December 16, 2019. https://www.eurasiareview.com/16122019-australian-committee-calls-for-partial-lifting-of-nuclear-moratorium/. Accessed on December 16, 2019.

[47] "UAE's nuclear power plant operating license likely in Q1/2020 – regulator", *Reuters*, November 27, 2019. https://af.reuters.com/article/energyOilNews/idAFD5N22H024. Accessed on December 05, 2019.

[48] "15 Emiratis ready to operate UAE nuclear reactor", *Gulf News,* July 08, 2019.

granted preliminary permission for a plan on building a nuclear power station.[49] Poland signed an MoU with the United States on strategic civil nuclear cooperation. Bulgaria began the process of inviting investors to resume work on their second nuclear power plant. The Finnish government finally authorised an operating permit for the Olikiluoto Three nuclear reactor being built with French collaboration, which has been delayed for over a decade. The operating permit is the final requirement for the plant before it becomes operational in 2020. In another remarkable step, on 13 December 2019, the leaders of the European Union came to an understanding that nuclear energy will be part of their solution towards achieving a carbon-neutral economy by the year 2020.[50]

Meanwhile, the key players in the civil nuclear industry - India, China, Russia, and the US - showed continued commitment to development of nuclear energy. India kick-started the new year by establishing a world record in nuclear power generation. On 31 December 2018, India's Kaiga Atomic Power Station set a world record of continuous, uninterrupted operation for 962 days. In March 2019, at the conclusion of the 9th round of India- US Strategic Security Dialogue, India and the US announced plans to build six new nuclear power plants in India.[51] In addition, at the 63rd General Conference of the IAEA, Mr KN Vyas, Secretary of the Department of Atomic Energy, India, announced that 21 new nuclear reactors were at different stages of construction and planning, and are estimated to add 15,000 MWe worth of power generating capacity. India has also been making significant progress in promoting radioactive technology for public benefit. To further this, KN Vyas launched the "NCG Vishwam Cancer Care Connect", at the side-lines of the IAEA conference. This is a global cancer care network of various institutes and centres, which facilitates other countries to access Indian technology in conjointly working towards curing cancer.[52]

https://gulfnews.com/uae/15-emiratis-ready-to-operate-uae-nuclear-reactor-1.65103345. Accessed on December 10, 2019.

[49] "Czech government approves framework plan for new nuclear plant", *Prague Monitor,* July 9, 2019. http://praguemonitor.com/2019/07/09/czech-government-approves-framework-plan-new-nuclear-plant. Accessed on December 10, 2019.

[50] Samuel Petrequin, "EU leaders include nuclear energy in green transition". *www.wvnstv.com*, Dec 13, 2019, https://www.wvnstv.com/science/eu-leaders-include-nuclear-energy-in-green-transition/. Accessed on December 14, 2019.

[51] "India, US agree to build 6 nuclear power plants in India", *India Today*, March 14, 2019. https://www.indiatoday.in/india/story/india-us-agree-to-build-six-nuclear-power-plants-india-1477602-2019-03-14. Accessed on December 10, 2019.

[52] "21 new nuclear reactors to add 15000 MW capacity: DAE secy", *Economic Times,* September 18, 2019. //economictimes.indiatimes.com/articleshow/71189279.cms?from=mdr&utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst. Accessed on December 10, 2019.

China has been rapidly developing its civil nuclear capabilities too. Currently, it has 45 operational nuclear reactors and 12 more under construction.[53] In June 2019, China signed a contract for construction of a Russian designed nuclear power plant project for its Xudabo nuclear power plant in Liaoning.[54] In an effort to diversify its nuclear sector, China also began a small modular reactor (SMR) project at Hainan province. Chinese scientists have also developed a software system called Virtual4DS which helps in assessing nuclear plant safety.[55]

Russian nuclear industry made news when on September 14, 2019, the world's first floating nuclear power plant reached the remote, Russian city of Pevek. This Russian vessel is equipped with two nuclear reactors with a capacity of 35 MW and is expected to provide electricity to Pevek by replacing an old coal plant and a nuclear plant. It is also designed to support the mining operations there. Although this project has raised several concerns on nuclear safety and liability in case of an accident, it nevertheless also appears to have several benefits. If successful, the project could be replicated to provide electricity to far-flung places around the world that face electricity accessibility problems.[56]

The United States too saw a jump in its efforts towards development of nuclear energy, with the Department of Energy's announcement that it will be funding nearly $11 million for advanced nuclear technology projects.[57] *NuScale,* an energy start-up company in the United States has developed a modular nuclear power reactor whose dimensions are 1/100th of a conventional nuclear reactor. In addition, with its enhanced safety features, it is claimed to be safer than a traditional nuclear reactor as well. [58] The United

[53] "Nuclear Power in China", *World-Nuclear.org.*https://www.world-nuclear.org/information-library/country-profiles/countries-a-f/china-nuclear-power.aspx. Accessed on December 18, 2019.

[54] "China and Russia sign general contract for two Xudabao units", *World Nuclear News* ,June 06, 2019 http://world-nuclear-news.org/Articles/China-and-Russian-sign-general-contract-for-two-Xu. Accessed on December 1, 2019.

[55] "China Focus: Chinese scientists develop virtual nuclear power plant for safety assessment", *Xinhuanet,* May 09, 2019. http://www.xinhuanet.com/english/2019-05/09/c_138046011.htm. Accessed on December 04, 2019.

[56] "Russia launches floating nuclear power plant Akademik Lomonosov*", Al Jazeera,* August 23, 2019. https://www.aljazeera.com/news/2019/08/russia-launches-floating-nuclear-power-plant-akademik-lomonosov-190822145809353.html. Accessed on December 01, 2019.

[57] "The Department of Energy's announcement that it will be funding nearly $11 million for advanced nuclear technology projects", *energy.gov,* May 23, 2019. https://www.energy.gov/ne/articles/us-department-energy-further-advances-nuclear-energy-technology-through-awards-106. Accessed on December 03, 2019.

[58] Caroline Delbert, "The Tiny, Simple Nuclear Reactor That Could Change Energy", *popular mechanics,* December 13, 2019. https://www.popularmechanics.com/technology/infrastructure/a30225278/tiny-nuclear-reactor/, accessed on December 14, 2019.

States has also indicated its intention to send nuclear reactors to space. As part of the Kilopower project, NASA and the US Department of Energy is working on using experimental fission reactors to power crewed outposts on moon and Mars, which would enable scientists to stay longer on planetary surfaces.[59]

The Nuclear Lows

However, not all things went absolutely right for the nuclear industry either. The Kudankulam nuclear power plant in India faced a cyber-attack in October 2019. Although officials of NPCIL, the operators of the plant, have stated that the attack did not compromise the security of any sensitive systems, the incident did raise concerns about nuclear safety and security of critical infrastructure.[60] Bill Gates' TerraPower which has ambitious plans to revolutionise nuclear power with concepts such as traveling wave reactors (TWR) and molten chloride fast reactors among the others also hit a deadlock. Terrapower was supposed to take this project ahead with China, but the trade war between the United States and China seems to have brought it to a standstill, at least for now.[61] Meanwhile, the shadow of Fukushima has still not completely withdrawn from the nuclear industry. But, growing concerns over the environment are drawing attention once again towards nuclear energy.

All in all, 2019 appears to have been a relatively good year for the nuclear industry. With more reactors due to go operational next year and innovations in nuclear technology such as China's HL-2M nuclear fusion research device scheduled to become active, 2020 too looks promising. In addition, it will be worthwhile to see what new developments unfold under the leadership of Rafael Grossi as the new director of IAEA.

[59] Haley Zaremba, "The U.S. Plans To Send Nuclear Reactors To Space", *oilprice.com,* August 17, 2019. https://oilprice.com/Energy/Energy-General/The-US-Plans-To-Send-Nuclear-Reactors-To-Space.html Accessed on December 02, 2019.

[60] Binayak Dasgupta and Sudhi Ranjan Sen, "Cyber attack at Kudankulam; critical system safe", *Hindustan Times,* October 30,2019 https://www.hindustantimes.com/india-news/cyber-attack-on-kudankulam-plant-network-not-possible/story-4b5QiRVGuTtTi4MlOexadL.html. Accessed on December 08, 2019.

[61] Amy Harder, "Bill Gates faces "daunting" nuclear energy future", *Axios.com,* July 15, 2019, https://www.axios.com/bill-gates-faces-daunting-nuclear-energy-future-6bafb442-d2a1-48c9-acd7-5492d62789a4.html. Accessed on December 02,2019.

Nuclear Weapons and International Law: What was it Like in 2019?

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At the end of 2019, its time we revisit the developments that took place in terms of nuclear weapons and their current status under the international legal umbrella. According to the data released by the Arms Control Association at the end of 2019[62], it is seen that an estimated 14,000 nuclear warheads are possessed by the nuclear weapon states (NWS) of the world, of which more than 90% belong to Russia and the United States. Approximately 9,500 warheads are in military service and the rest are awaiting dismantlement. As per the March 2019 New START declaration, the US has 1,365 strategic warheads deployed on 656 intercontinental ballistic missiles, submarine-launched ballistic missiles, and strategic bombers; Russia has 1,461 strategic warheads deployed on 524 intercontinental ballistic missiles, submarine-launched ballistic missiles, and strategic bombers. The total stockpile of the United Kingdom is estimated to be around 200 warheads of which 120 are strategic warheads with 40 deployed at sea on a nuclear ballistic missile submarine at any given time. France has 300 and China has 290. Amongst the non-NPT nuclear weapon possessors, India possesses between 130-140 nuclear warheads, Israel has an estimated 80-90 nuclear warheads, with fissile material for up to 200, and Pakistan has between 150-160. Modernization efforts continue in all states and the prospect of disarmament does not look bright at all at the end of 2019.

This is despite the fact that the Treaty on the Prohibition of Nuclear Weapons or the TPNW, which is the first globally applicable multilateral agreement to comprehensively prohibit nuclear weapons that was adopted by a United Nations diplomatic conference on 7 July 2017 and opened for signature on 20 September 2017, received many endorsements in 2019. As of December 2019, the TPNW has got 80 signatories out of which 34 state parties have ratified the treaty. 12 states ratified the treaty in 2019 and these included Antigua & Barbuda, Bangladesh, Bolivia, Dominica, Ecuador and El Salvador, Kazakhstan, Kiribati, Panama, Maldives and South Africa. Twelve States joined this treaty on International Day for the Total Elimination of Nuclear Weapons in 2019,

[62] Kelsey Davenport. "Nuclear Weapons: Who has what at a Glance?" Arms Control Association. July 2019. https://www.armscontrol.org/factsheets/Nuclearweaponswhohaswhat.

and five nations including Bangladesh, Kiribati, Laos, Maldives and Trinidad & Tobago ratified the treaty[63] to mark that day.

Meanwhile the Comprehensive Test Ban treaty that bans explosive testing of nuclear weapons received its 168th ratification from Zimbabwe in February 2019. Executive Secretary of the Comprehensive Nuclear-Test-Ban Treaty Organization, (CTBTO), Lassino Zerbo, noted the importance of this signature by highlighting that the participation of African States was an essential step toward ensuring a regional nuclear free zone. However, the treaty has still not entered into force due to its onerous Article XIV provision, which requires that 44 specific states sign and ratify it. Currently there are eight "hold out" states—China, the Democratic People's Republic of Korea (DPRK), Egypt, India, Iran, Israel, Pakistan, and the United States. In the Conference on Facilitating the Entry into Force of the CTBT, which followed in September 2019, 85 nations around the world gathered to participate. The Conference produced a final document reinsuring the importance of the CTBT as "*one of the key pillars of the disarmament and nonproliferation architecture"* and committed signatories to *"spare no effort"* in encouraging signature and ratification from outstanding Annex 2 States. Nevertheless, the CTBTO continues to be active. Amongst other activities, in Nov 2019, the CTBTO conducted a major on-site inspection exercise with some 70 participants from the signatory states. The last exercise of this kind was held five years ago. This iteration featured two brand-new or refurbished facilities, the Vienna Operations Centre and the Technology Support and Training Centre (TeST) in Seibersdorf, Austria, both of which will continue to be used in 2020 through subsequent exercises[64].

On the NPT RevCon, the final Preparatory Committee (PrepCom) to the 2020 Nuclear Non-Proliferation Treaty Review Conference took place for two weeks starting from 29 April 2019. However, the PrepCom could not agree on an agenda for the RevCon and several disputes broke out between Iraq, Syria, Russia and United States. Russia assailed the United States on issues ranging from its withdrawal from the JCPOA to its inability to issue adequate visas for Russian representatives to come for the PrepCom. Iran, Syria and the United States had disagreements on issues of Syria's compliance with its IAEA safeguard obligations, U.S. compliance with the NPT's prohibition on transfer of nuclear weapons

[63] Ibid.

[64] Nuclear Threat Initiative, October 31,2019. https://www.nti.org/learn/treaties-and-regimes

and U.S. weapons modernization. Nevertheless, the PrepCom cleared up procedural hurdles, ranging from deciding on the confirmation of Review Conference President-Designate Rafael Grossi. States have also emphasized that the success of the upcoming RevCon would largely depend upon the activities that the states undertake during the interim period. They were called upon to respect their commitments to the NPT and work towards developing common consensus on the need to reinforce the integrity and authority of the treaty and its full implementations alongside the concurred commitments from the 1995, 2000 and 2010 review conferences. The NPT RevCon is due to take place in New York from April 27 to May 22, 2020, to celebrate the 50th commemoration, the Golden Jubilee, of the treaty and to chart the course for the following five years (2020-2025).

The Conference on Disarmament (CD), which is the successor to the ten nation committee on Disarmament and which was formed in 1979 as the single multilateral disarmament negotiation forum of the international community, had another lack lustre year in 2019. Its first session was opened on 21st January 2019. The first part of the Presidency of the 2019 was shouldered by Ukraine who focused on the importance of multilateral diplomacy with respect to nuclear disarmament and the need to regulate emerging technologies and weapons systems and current arms control measures was discussed. The second part of the presidency was held on 18th February, 2019, with the United Kingdom and Northern Ireland assuming the leadership role. During this season, the Secretary-General of the United Nations, Mr. Antonio Guterres, warned in his speech that arms control initiatives, especially those related to nuclear and chemical weapons, were collapsing. He emphasized the importance of preserving the Intermediate-Range Nuclear Forces (INF) Treaty and the importance of extending the New START Treaty between the U.S. and Russia. Finally the US assumed the presidency of the Conference on 18th March, 2019.

The second part of the Conference on Disarmament was opened on 13th May 2019, under the continuing presidency of the US. [65] On 27 May, the Venezuela assumed presidency of the Conference. In this, the representatives from the People's Republic of China and the Russian Federation issued a joint statement on 11 June recognizing recent international security challenges and criticizing the actions of some States acting in their own security or commercial interests and for dismantling the existing arms control

[65] Ibid.

regime. The United States' withdrawal from the INF Treaty and the Joint Comprehensive Plan of Action (JCPOA)[66] were specifically mentioned. Apart from statements, the CD managed little else.

Meanwhile, another important event that took place in 2019 with regard to nuclear disarmament was a push by the UN for a Nuclear-Weapons-Free Zone in the Middle East. A Conference on the Establishment of a Middle East Zone Free of Nuclear Weapons and Other Weapons of Mass Destruction held its First Session from 18 November to 22 November 2019 at United Nations Headquarters in New York under the presidency of Ambassador Sima Bahous of Jordan. While acknowledging the efforts of the UN, Director at the Middle East Treaty Organization (METO) and a former director at American-Iranian Council, Emad Kiyaei mentioned that this "aim is not a fantasy and that is based on the goodwill of states from within the region to reach an agreement." [67] The Conference was attended by all the states of West Asia. The Conference also called upon all the states of the region to refrain from any measures that preclude the achievement of any objectives decided in the conference. Over all this Conference was important as it was the first time the Middle Eastern countries had taken the initiative of establishing nuclear weapon free zone. However, the ultimate success of the Conference will be when this objective is achieved.

Overall, it was not a very positive year from the disarmament point of view. National security strategies continue to uphold the centrality of deterrence. Treaties are under a cloud. International law remains hostage to big power politics. Will 2020 see any major breakthroughs? While the chances don't look bright, international politics can change quickly. Hope remains.

[66] "Conference On Disarmament (CD)." Nuclear Threat UInitiative (NTI). October 31, 2019. https://www.nti.org/learn/treaties-and-regimes/conference-on-disarmament/.

[67] Dev Kovaleski. "Home Land Preparedness News." December 12, 2019. https://homelandprepnews.com/stories/41140-nuclear-threat-initiative-releases-report-on-nuclear-weapons-use/.

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