



DEFENCE AND DIPLOMACY

IN PURSUIT OF NATIONAL SECURITY

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Special Issue: Nuclear Dynamics

- Pakistan's Nuclear Positioning
Shalini Chawla
- "New Era" Nuclear Debates in China
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Book Review

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➤ EDITOR'S NOTE

In 1997-98, while I was undergoing the Air War College (USA), I had written my dissertation on “Relevance of the Main Battle Tank and Aircraft Carrier in 2020 and beyond”. I had referred to them as ‘lumbering giants’ that had little place in a future, fast-moving battlespace. Over the years since then, development of anti-ship cruise missiles, as well as anti-ship ballistic missiles, has reached a very advanced stage. China had begun development of its Anti-Access/Area-Denial (A2/AD) capability in earnest ever since the Third Taiwan Strait crisis of 1996, with a view to keeping US ships outside its ‘near shores’. The arrival, then, of one Carrier Battle Group (CBG) of the US Navy into the Taiwan Straits—with another on the way—had sent a strong signal to the PRC leadership to call off the missile firings (that were being carried out to intimidate the Taiwanese people into electing a ‘pro-unification’ President). The Chinese were forced to relent as they did not have the capability to challenge the US military in a shooting match over Taiwan. The shore-based DF-21D Anti-Ship Ballistic Missile (ASBM) was the first serious development of China’s A2/AD capability, albeit with a limited range of about 1,500-1,700 km. Attempts were continuously made by China to increase the range of anti-ship weapons so as to keep the US’ CBGs beyond the First Island Chain. With the recent introduction of the H-6N, with its ability to carry the DF-21D (also dubbed the ‘Carrier Killer’) on its belly station, the Chinese now have the capability to put US Navy ships at risk at ranges greater than 3,000 miles from China’s shores. In addition, development of the hypersonic cruise missiles—the DF-17 and the DF-100 that were displayed

during the October 1 Parade in 2019—completes the picture for putting US carriers at risk, should they venture into the South/East China Seas.

How have the military leaders of the US responded to this threat?

Presently, the US Navy has no capability to defend against the threat posed by the hypersonic cruise missiles, although several developmental plans are afoot to increase the chances of US CBGs—along with its Air Wings—to be able to venture closer to China's mainland. These programmes, however, are only at the planning stage and would take several years to fructify.

With the US Navy presently unable to come up with answers to protect its aircraft carriers from the threat posed by hypersonic weapons of the adversary, a military intervention into Taiwan by the Chinese in the near term should not be ruled out. The smokescreen offered by the present Covid-19 pandemic facing the world—and with the PRC having returned to 'business as usual', including some recent air exercises around Taiwan—does not bode well for the safety of the island nation.

The US Navy finds itself in a difficult situation while justifying additional aircraft carriers for itself. The quandary presently is that if carrier-borne aviation is unable to be effective against an adversary, then why should funds be allocated for additional carriers; instead, different capabilities should be sought that would ensure a modicum of an offensive posture, particularly against China.

Therefore, to summarise, my prediction of 1997-98 about the relevance of at least the aircraft carrier in the year 2020, was unerringly accurate. Being a military man, it was my job to make such assessments, the likes of which would probably have been made by hundreds of others, who would all be feeling equally satisfied today with the accuracy of *their* prognosis!

So far, so good.

However, what I failed to predict was the non-traditional security threat that could, in the year 2020, envelop the entire world in the form of a pandemic, the likes of which now threatens humanity itself.

The last day of the year gone by would be remembered for the reporting of "a pneumonia of unknown cause detected in Wuhan, China" to the WHO Country Office in China. The 2019 novel Corona

Virus (2019-nCoV) was reported by WHO to have “initially occurred in a group of people with pneumonia who had been associated with the seafood and live animal market in the city of Wuhan.” The disease subsequently spread from those who were sick to family members and healthcare staff. On January 13, Thailand reported its first case of 2019-nCoV.

With no test kits available to doctors in Wuhan, the virus spread rapidly. Test kits were made available only on the 13th of January; sufficient kits were provided only by the end of the month. However, strict screening and lockdown measures were eventually able to arrest further spread of the disease in China. With more than 80,000 people affected and more than 3,100 dead, China scrambled to contain the spread of the deadly disease. The actual numbers affected and the number of deaths, however, remains unclear.

China reportedly imported two billion face masks in a five-week period starting from January. It also imported 400 million pieces of other protective gear, from medical goggles to biohazard coveralls.

On January 30, WHO Director-General, Dr. Tedros Adhanom Ghebreyesus declared the 2019-nCoV outbreak a ‘*Public Health Emergency of International Concern*’. To prevent its further spread, early detection, isolating and treating cases, contact tracing and social distancing measures—in line with the level of risk—were identified as measures to interrupt the spread of the disease.

On February 11, 2020 the Corona Virus disease was given a formal name—COVID-19. The name was arrived at after due deliberations to ensure that the disease did not refer to a geographical region, e.g., MERS, which referred to the Middle East; was not attributed to an animal, an individual, or a group of people. In short, the name of this disease was to be such that it did not attach stigma to any individual or region.

Outside China, Italy was the worst affected nation—with Spain close on its heels—till March 31 when it had recorded more than 1,00,000 COVID-19 positive cases and 11,591 deaths. The large number of flights to and from China—till January 31 when a Chinese tourist to Italy was tested positive, after which flights to China were stopped—was the possible cause for the high rate of infection among the Italian population. With Italy being the oldest country in the

world, it has also recorded the highest number of deaths outside China. The average age of those succumbing to COVID-19 in Italy is believed to be 80 years! At the time of writing this Note, the US is the worst affected country in the world going purely by the number of people affected (more than 1,60,000 as of March 31). The death toll, however, is higher in countries like Spain and Italy.

Surgical masks, ventilators and surgical garments in very large quantities were sent to China by the US in January and February as a goodwill gesture. Once the corona virus spread to the US, an acute shortage of personal protective equipment (PPE) was felt for frontline workers—doctors, nurses and paramedics—who needed them the most. It reached a stage that citizens began sewing masks and donating them to hospitals for use by the health staff.

At the time of writing this Note, almost a million cases have been reported worldwide, with more than 50,000 deaths.

With most countries resorting to lockdowns to ensure social distancing, only time will tell whether these measures—along with the mandatory hygiene protocols of frequent washing of hands with soap and water, etc.—would prove adequate to curb further spread of the pandemic.

That the nCoV-19 is not as 'novel' as is being made out has surfaced after scientists at the Wuhan Institute of Virology found similar strains of the virus to have affected people living in areas close to bat caves in a province 1,000 miles southwest of Wuhan as early as 2017. These Scientists warn that the danger from such viruses would likely continue in the future too, as long as trade in wildlife for food continues. As this quarter draws to a close, it is believed that the markets selling wild animals and dogs have reopened in some parts of China. This appears to be extremely irresponsible behaviour that needs to be curbed by the leadership in China.

Back home in India, the country has been under a lockdown since March 25 for a 21-day period. Personal quarantine and social distancing appeared to be the watchword, which was, however, flouted when the Tablighi Jamaat held its annual congregation at the Markaz (global headquarters) in Nizamuddin, New Delhi from March 13 to 15. Thousands attended the congregation from all regions of the country; some religious preachers also came

from countries like Thailand, Indonesia, Kyrgyzstan and China, among others. This congregation took place despite the Delhi government's orders that were issued on March 13 itself forbidding gatherings of more than 200 people at one place. It has now emerged that hundreds of those who attended the congregation have tested positive for COVID-19; the more serious issue is that many have since returned to their homes across the country, and there has been a spike in the number of cases all over the country since the event. This irresponsible behaviour on the part of the leadership of the Jamaat has put the population of the country at risk. The Tablighi Jamaat has held meetings in Malaysia, Indonesia, Bangladesh and Pakistan in the past two months; these have led to a spike in corona virus cases in all these countries.

Now for some happenings in our near abroad during the quarter. Before the impact of the corona virus had reached foreign shores, the US President, on January 3, ordered the execution of General Qassem Soleimani, the leader of the Iranian Revolutionary Guards Corps' (IRGC) elite Quds Force. It was believed that the General was planning major attacks against Americans and had to be stopped; this was the justification for his execution. The attack was carried out by an MQ-9 Reaper medium altitude long endurance (MALE) armed drone of the US. This unleashed a reprisal from the Iranians who, on January 8, carried out missile attacks against two military bases in Iraq where US troops were stationed. However, despite the attacks being extremely accurate, no American soldiers lost their lives; some were later treated for concussion injuries sustained during the attack. This event led to a rapid de-escalation and nothing untoward has been reported thereafter from this flashpoint since. Of course, the Iranians have continued to suggest that reprisal for the killing of their most admired General is not yet over. The pandemic—which has seen a large number of cases in both countries—appears to have put a hold on any further action for the time being.

This issue of the D&D is a thematic one that deals with nuclear issues. Fears that were circulated globally after the Fukushima disaster led to closure of several nuclear power plants in countries across the world, particularly in Europe. However, if one is to

compare the number of human casualties due to nuclear disasters—including the one at Chernobyl—it would emerge that these figures pale in comparison to what we are seeing in the ongoing pandemic. Also, the result of a nuclear disaster is localised to the region in most cases. Does this then indicate that the nascent nuclear renaissance would see the world approaching the goals set out at Paris during the COP 21 meet? An optimistic thought, which, hopefully would be buttressed by reading the many articles in this issue.

Meanwhile, STAY SAFE, STAY HEALTHY, STAY HOME.

Happy reading.

A handwritten signature in black ink, appearing to be 'James', with a stylized flourish underneath.

PAKISTAN'S NUCLEAR POSITIONING

SHALINI CHAWLA

Prime Minister Imran Khan has repeatedly flagged the possibility of a 'nuclear war' post revocation of Article 370 by the government of India. Highlighting the nuclear factor by Pakistan displays Pakistan's immaturity and desperation to attract global attention towards Kashmir. Abrogation of Article 370 by India did leave Pakistan surprised and the state has been reacting furiously on various fronts displaying its anxiety to deal with Jammu and Kashmir's new status. Pakistani leadership has aggressively attempted (and will continue) to utilise every single opportunity to raise Kashmir at the global platform.

Pakistan relies on the nuclear card vis-à-vis India and has consistently tried to counter crisis between the two countries by using the threat of nuclear weapons and probability of a nuclear war. India's nuclear objectives are focused on deterring a nuclear war and it does not see nuclear weapons as weapons of warfighting. New Delhi's choice of "No First Use Doctrine" and its continued adherence to a restrained and responsible doctrine patently demonstrate India's nuclear objectives. Pakistan, on the other hand, developed nuclear weapons with the objective of neutralising India's superior conventional capability and conducting covert war in India without fear of Indian military retaliation. Given these objectives,

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choice of first use doctrine can be well understood in Pakistan's case. The paper analyses Pakistan's nuclear doctrine to be able to have an understanding of its current nuclear positioning (especially after Balakot strikes and revocation of Article 370).

GENESIS OF THE NUCLEAR PROGRAMME

After the overt nuclearisation in 1998, Pakistan pronounced some notions regarding its nuclear thinking which form the basis of its doctrine and strategies. Doctrine does acquire a significant reference in the context of Pakistan's nuclear programme given its clandestine nature and lack of empirical evidence to support critical propositions. Although Pakistan has consistently claimed that it developed its nuclear programme in response to security threats from India, more specifically, Pakistan traces the genesis of its programme to India's peaceful experiment in Pokhran, in 1974. But the fact is that Bhutto was seriously thinking of nuclear weapons much before India's peaceful experiment which became an immediate excuse for Islamabad. Pakistan's nuclear weapons are certainly not in response to India's nuclear weapons programme, but Pakistan's ruling elites believe that nuclear weapons are the only means to match India's conventional military superiority. Zulfikar Ali Bhutto had openly announced Pakistan's ambition for the nuclear bomb in January 1972 (well before May 1974). Pakistan has subsequently endeavoured to use the nuclear weapons to carry on and intensify its proxy war in Kashmir claiming the valley to be the "nuclear flashpoint". Pakistan's strategic aim has been to pursue its grand strategy of "bleed India through a thousand cuts" under the nuclear umbrella.

THE GRAND STRATEGY

The nuclear strategy of Pakistan cannot be viewed in isolation and has to be analysed in the context of its "grand strategy". The military's grand strategy—and hence Pakistan's strategy—has been formulated and evolved over the decades on account of the perceived Indian threat, which has allowed the army to emerge as a "nation builder", legitimising the military's multidimensional role in the state. The military's grand strategy (against India) has rested on maintaining the centrality of the covert war (guerrilla war—war through terrorism)

strategy. Pakistan's reliance on covert war through terrorism is unlikely to change in the coming years, although tactics and intensity of the covert war may undergo changes. The acquisition of nuclear weapons has been rationalised as a deterrent to Indian conventional military superiority and also as an umbrella to conduct a proxy war through terrorism.

Pakistan's grand strategy has been centred around hostility against India. The threat perception of "India being a hegemonic state which would not allow Pakistan to survive" has been created and nurtured by the deep state in Pakistan. Desire to match India's conventional military build-up has motivated Pakistan to acquire high technology weaponry and nuclear weapons. Pakistan's military strategy over the last six decades has relied on following factors:

- Perceived threat projections have been an integral part of the grand strategy. Portrayal of India with hegemonic ambitions did help Pakistan to garner support (military and financial assistance) from the West, China, and also the Muslim world.
- Pakistan sought external assistance mainly from the United States and China to build up its military capability and to project itself as an ally of major powers.
- Pakistan has relied more on high-technology weapons to seek competitive military advantage.
- Pakistan believed/believes in offensive aggressive strategies and has had a deep-rooted belief that by taking the initiative and going on the offensive, smaller size forces in history have won wars against bigger enemies.

PAKISTAN'S NUCLEAR DOCTRINE: CONTINUED PROJECTION OF A LOW THRESHOLD AND UNCERTAINTY

In the pre-nuclear test period, Pakistan's doctrine was that of ambiguity. Although Pakistan even today does not have an officially announced doctrine, statements made by responsible policymakers in Pakistan have outlined basic elements of its nuclear doctrine. There is an unofficial code adopted by the Pakistani leadership, based on *Indo-centricity*, *credible minimum deterrence*, *strategic restraint* and *first use*. Very interestingly and rather ironically, the code asserts on the principles of peaceful programme revolving around maintaining a

balance against the Indian force build-up, but it includes making a first strike in response to not only a conventional attack by India but also a posed threat from India.

Minimum Nuclear Deterrence

This is one of the basic tenets of Pakistan's nuclear doctrine. The concept of credible minimum deterrence is not based specifically on the numbers but it is the weapon arsenal—including the nuclear weapons, delivery systems, command and control and the doctrine and strategy—that is based on the perceived threat perception from India. Pakistan's credible minimum deterrent force intends to build a minimum force capable of inflicting nuclear destruction on India. Prime Minister Nawaz Sharif very distinctly talked about it in May 1999 when he highlighted the key elements of Pakistan's nuclear policy at the National Defence College:

Nuclear restraint, stabilisation and minimum credible deterrence constitute the basic elements of Pakistan's nuclear policy.¹

The reasons for Pakistan's adoption of credible minimum deterrence are obvious. Pakistan desires a financially viable nuclear arsenal as the whole logic of going nuclear was Pakistan's inability to cope with India's conventional build-up, primarily due to the financial constraints. The term 'minimum' begs definition and can be interpreted differently by the respective states. Pakistan's minimum deterrence appears to be based on the capability to inflict unacceptable damage or assured destruction. Although Pakistan talked about minimum deterrence but has one of the most rapidly growing nuclear arsenals.

First Use Doctrine

Pakistan has long held the belief that being the weaker state it can compensate that weakness by taking a bold initiative, preferably with strategic surprise, to attack Indian military capability and thus reduce the adverse margin of capabilities. This was the military

1. "Remarks of the Prime Minister of Pakistan, Nawaz Sharif, on Nuclear Policies and the CTBT", National Defence College, Islamabad, May 20, 1999.

strategy it practised in all the wars it waged against India, including the last one in Kargil in 1999, and more importantly the war through terrorism across the border for a quarter of a century. Seen in the context of this strategic mindset, it is not surprising it has adopted a nuclear doctrine of "First Use". In fact, it has often claimed that it would/could use nuclear weapons at the very beginning of the war with India if the Indian military even crossed the international border.

Rejecting India's proposal for a joint no-first-use pledge in the aftermath of the nuclear tests Pakistan took the stand that it will be the first to use the nuclear weapons to counter India's conventional capability. Lt Gen Sardar Lodhi (ret'd) has justified Pakistan's dismissal of India's offer:

India's offer of a treaty to be signed by the two countries, agreeing not to be the first to use nuclear weapons against each other is one-sided and would benefit India only, as it has a superior conventional force. It may be more apt for both countries to sign a mutual test ban treaty to start with, followed by a no-war pact.²

Pakistan's argument has been that in the likelihood of a conventional attack, or in a situation when India has breached the defence line causing major setback to the defence and security arsenal of Pakistan, then, due to the fear of being defeated in a conventional war against India, Pakistan would resort to the first use option. Pakistan maintained that it would go for the nuclear weapons first even if the attack from the Indian side was with conventional weapons. Thus, a first use policy, according to Pakistani leadership, provided credible security guarantees to their national sovereignty.

The same logic for the first use was used by NATO during the Cold War when they suggested that they will be the first one to use nuclear weapons in a conflict as they perceived that a hostile Soviet Union had an overwhelming advantage in conventional forces. Following the collapse of the Soviet Union, NATO has tried to play down the role of nuclear

2. Lt Gen F.S. Lodhi, "Pakistan's Nuclear Doctrine", *Defence Journal*, <http://www.defencejournal.com/apr99/pak-nuclear-doctrine.htm>. Accessed on January 1, 2017.

weapons but it maintains the doctrine which gives them the leverage to use the nuclear weapons first in case of a conventional attack.

Pakistan intends to continue the sub-conventional war without fear of Indian retaliation using the nuclear shield. Islamabad felt the need to assert on *First Use* more ever since India's assertion of the possibility of a conventional war in the nuclear environment.

Possibility of Pre-emption

Pakistan's obsessive reliance on the doctrine of first use seems to be emerging from two factors. First, Pakistan wants to keep an option open for "Pre-emptive nuclear strikes" against India and it is convinced that its pre-emptive strikes would lead to the destruction of India's retaliatory capabilities and/or paralyse the Indian political decision-making. Secondly, Pakistan has also failed to consider the consequences of the Indian retaliation. Pakistan seems to assume that India would not use nuclear weapons against it even after getting hit.

India, in its nuclear strategy and doctrine, has adopted 'restraint' as a responsible and politically mature nation-state. But the Indian restraint cannot be read by Pakistan as an unending and open-ended policy of the Indian national state. India shall resort to retaliation to a Pakistani nuclear strike given the situation and the consequences for Pakistan would be fatal.

The scenarios in which Pakistan would opt for nuclear weapons have been spelled out by Pakistani elites who have cultivated the posture of 'irrational rationality' to try and enhance the effect of this posture.

Lt Gen Khalid Kidwai, the former head of the Strategic Plans Division, in 2002, in an interview to the Italian journalists, claimed that nuclear weapons would be used only "if the very existence of Pakistan as a state is at stake." But he went on to state that Pakistan would definitely use nuclear weapons in case the deterrence fails and:

- If India attacks Pakistan and conquers a large part of its territory (space threshold);
- If India destroys a large part either of Pakistan's land or air forces (military threshold);

- If India proceeds to the economic strangling of Pakistan (economic strangling);
- If India pushes Pakistan into political destabilisation or creates large-scale internal subversion in Pakistan (domestic destabilisation).³

Scenarios outlined by Lt Gen Khalid Kidwai projected a low threshold and tried to create uncertainty by covering a wide range of situations and potential actions by India during crisis.

The objective of Pakistan's nuclear weapons is to deter any form of Indian military response, and thus Pakistan has deliberately adopted a posture of irrationality. Pakistani leadership is convinced that they have managed to deter India with their posture of irrationality and uncertainty more than once. This interpretation came out very clearly in President's Musharraf's December 2002 statement. Although Musharraf did not specify the nuclear threat in his speech to the army corps union in Karachi, but he said that he was ready to take a decision and act during the 2002 crisis:

In my meetings with various world leaders, I conveyed my personal message to Indian Prime Minister Vajpayee that the moment Indian forces cross the Line of Control and the international border, then they should not expect a conventional war from Pakistan. I believe my message was effectively conveyed to Mr. Vajpayee.⁴

Weapon of Last Resort

Most of the Pakistani writings pre-1998 pointed towards build-up of the nuclear capability against the Indian conventional forces, and thus implied first use. But there was seemingly a shift in the Pakistani thinking regarding the use of nuclear weapons and adoption of a relatively moderate stand by claiming nuclear weapons as the 'weapons of last resort'.

3. As cited in Paolo Cotta-Ramusino and Maurizio Martellini, *Nuclear Safety, Nuclear Stability and Nuclear Strategy in Pakistan*, Landau Network–Centro Volta Report.

4. Peter R. Lavoy, "Islamabad's Nuclear Posture: Its Premises and Implementation", in Henry D. Sokolski (ed.), *Pakistan's Nuclear Future: Worries Beyond War* (Strategic Studies Institute, 2008), p. 137.

Abdul Sattar (former Pakistan Foreign Minister), Agha Shahi and Zulfiqar Ali Khan jointly authored an article in *The News* on October 5, 1999, which stated:⁵

The exigency under which Pakistan army may use nuclear weapons is spelt out as: 'although the precise contingencies in which Pakistan may use nuclear weapons have not been articulated or even defined by the government, the assumption has been that if the enemy launches a war and undertakes a piercing attack to occupy large territories or communications junctions, the *weapon of last resort* would have to be invoked'.

In April 2002, in an interview published in the German magazine, *Der Spiegel*, Musharraf said:

If the pressure on Pakistan becomes too great then as a last resort, the [use of] atom bomb is also possible.⁶

Musharraf's statement of last resort was made in 2002 and in the same period in his address to army Corps Union in Karachi, he said that war with India was averted due to his repeated warnings for using "unconventional" means (interpreted mostly erroneously as nuclear weapons) in case of India breaching the red lines. This no doubt (also) implied use of large number of guerrilla/jihadi fighters rather than nuclear weapons. There is contradiction in Pakistan's stance where on one side it claims to use its nuclear weapons as a last resort and on the other side, is convinced that the threat of nuclear weapons was successful in deterring Indian military posture.

Weapon of last resort can be logically interpreted towards the scenario where no other means are left with the nation to defend itself. Although the weapon of last resort option stood in contradiction to Pakistan's earlier statements (which projected extremely low threshold) and appeared moderate, but on the other hand, it also

5. Agha Shahi, Zulfiqar Khan and Abdul Sattar, "Securing Nuclear Peace", *The News* (Islamabad), October 5, 1999.

6. Cited in H. S. Rao, "Pak may use nukes in the event of war: Musharraf", *rediff.com*, April 6, 2002, at <http://www.rediff.com/news/2002/apr/06pak2htm>

projected a mindset for self-destruction, where complete destruction of the nation is preferred over all other possible options.

Nuclear Policy Based on Restraint and Responsibility

In the mid-2000s Pakistan's endeavour had been to project itself as a *responsible* nuclear power. The need to do so was exacerbated by India and the US signing the nuclear deal. Pakistan has been keen for a similar nuclear agreement with the US and thus, projection of a responsible nuclear posture became inevitable. In 2006, Lt Gen Khalid Kidwai, in his address to the Naval Postgraduate School, Monterey, said that Pakistan has dealt with formidable challenges by developing a nuclear policy based on 'restraint and responsibility' with four salient features:

- (1) deterrence of all forms of external aggression; (2) ability to deter a counterstrike against strategic assets; (3) stabilization of strategic deterrence in South Asia; and (4) conventional and strategic deterrence methods.

Gen Khalid Kidwai's talks with reference to 'deterrence to all forms of external aggression' (possibly) indicates deterrence against both conventional and nuclear aggression. This is in line with the statements made by the Pakistani policymakers in the past.

Deterring India's conventional posture remains the prime objective of Pakistan's nuclear weapons. Kidwai talks about building ability to deter counterstrike against strategic assets. Pakistan has expanded its arsenal and the delivery systems substantively in the last ten years in order to threaten a disarming strike to wipe out—or at least drastically reduce—India's retaliatory capability.

Full Spectrum Deterrence

Pakistan's posturing in the last eight years has been focused towards building up Full Spectrum Deterrence (FSD) capabilities. The rationale for *full spectrum deterrence* has been strengthened with India's stated position on "space for a limited military confrontation under the nuclear umbrella."

On April 19, 2011, Pakistan tested its short-range surface-to-surface multitube ballistic missile Hatf-9 (NASR). The official press release for NASR said:

[The NASR Weapon System] has been developed to add deterrence value to Pakistan's Strategic Weapons Development programme at shorter ranges. NASR, with a range of 60 km, carries nuclear warheads [emphasis added] of appropriate yield with high accuracy, [and] shoot and scoot attributes. This quick response system addresses the need to deter evolving threats.⁷

Although a missile of 60 km range is more likely to be a free flying rocket, Pakistan has claimed the missile to be nuclear capable, which is possible. In all probability the missile is a four-tube adoption of a Chinese-design multiple rocket launcher (MRL), possibly the A-100 type, on an eight-wheeler truck, capable of carrying four ready to fire ballistic missiles.⁸

The NASR provides Pakistan with short-range missile capability in addition to the long-range ballistic missiles and cruise missiles. Also, according to the Pakistani military officials Hatf-9 belongs to the category of Tactical Nuclear Weapons (TNWs) and is a low-yield battlefield deterrent, capable of inflicting damage on armoured brigades and divisions.⁹ According to Pakistan, Hatf-9 is their counter to India's Cold Start Doctrine which envisioned limited conventional response from the Indian side in response to the sub-conventional attacks on India originating from the Pakistani territory.

Pakistan has been extremely proud of the Tactical Nuclear Weapons (NASR/Hatf-9) and does believe that it has managed to enhance deterrence by acquiring the TNWs. However, there are significant security risks with the TNWs owing to the nature of the weapons and also the turbulent nature of the Pakistani state.

7. Rodney W. Jones, "Pakistan's answer to Cold Start?" *The Friday Times*, May 13-19, 2011, <http://www.thefridaytimes.com/13052011/page7.shtml>. Accessed on March 10, 2017.

8. Ibid.

9. "Pakistan successfully test-fires nuclear capable Hatf-9", *The Express Tribune*, April 20, 2011.

Pakistan claimed that it is developing a sea-based nuclear force to be able to match India's nuclear triad. The Naval Strategic Force command was announced in 2012. In January 2017, Pakistan conducted the first test of its SLCM, the Babur-3, from a submarine. It is estimated that Babur-3 has a range of 450 km and will be carried on Pakistan's diesel-powered Agosta 90B submarine.

Pakistan is seemingly proud of the full spectrum deterrence and it claims to have developed the nuclear capability to be launched from all the three platforms—land, air and sea. FSD, for Pakistan, also implies full spectrum of scenarios, since it maintains a projection of low nuclear threshold and an element of uncertainty. Pakistan's nuclear positioning clearly indicates that it relies on the threat of use of nuclear weapons to deal with a wide range of crises vis-à-vis India.

CONCLUSION

Pakistan's nuclear posture does reflect some distinct contradictions. It talks about being a restrained and responsible nuclear power but at the same time relies on a *first use* doctrine and boasts about the *TNWs* and *Full Spectrum Deterrence*. It continues to assert that it does not want to start a war with India, highlights the disastrous consequences of a nuclear war but repeatedly flags the threat of nuclear conflict, creating a war hysteria in the region. It would not be incorrect to state that Pakistan has very *rationality adopted the posture of irrationality*.

Pakistan's nuclear posturing did suffer a blow to some extent with India's airstrikes in Balakot on February 26, 2019 in retaliation to the terror attack in Pulwama claimed by Jaish-e-Mohammed (JeM) on February 14, 2019. But it seems that Pakistan's reliance on nuclear weapons to serve its strategic objectives has not been altered. Its reliance on nuclear deterrence has intensified with constantly growing asymmetries between India and Pakistan over the last two decades. At this point of time Pakistan's repeatedly flagging of nuclear threat can be attributed to mainly two factors:

- First, Pakistan has spent an enormous amount of national resources in the build-up of the nuclear arsenal on the pretext that nuclear weapons are the ultimate weapons for the state's survival and security. Pakistan has always prioritised its defence expenditure even though it has been at the cost of socio-economic

development of the country. The leadership at this point wants to justify the enormous nuclear build-up to its own population and assure them that nuclear weapons will ultimately guard Pakistan's fortunes.

- Second, Imran Khan wants to remind India and the international community about the presence of nuclear weapons in the region and the dangers emanating from a potential nuclear war. Pakistan is certainly trying hard to get international attention on Kashmir by flagging the nuclear threat.

“NEW ERA” NUCLEAR DEBATES IN CHINA

MANPREET SETHI

China released its new Defence White Paper, *China's National Defence in the New Era*, in July 2019. This was almost a year and a half after the US announced its Nuclear Posture Review in which it proclaimed Russia and China as its nuclear adversaries and expressed a need to develop new capabilities to address a perceived credibility gap to meet the advances the other two had made. Reflecting this sentiment, China's White Paper described its own sense of the state of international relations in these words:¹

“International strategic competition is on the rise. The US has adjusted its national security and defense strategies, and adopted unilateral policies. It has provoked and intensified competition among major countries, significantly increased its defense expenditure, pushed for additional capacity in nuclear, outer space, cyber and missile defense, and undermined global strategic stability.”

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1. The full official English translation of the 2019 Chinese Defense White Paper, *China's National Defense in a New Era*, can be found at: <http://www.xinhuanet.com/english/download/whitepaperonnationaldefenseinnewera.doc>, p. 3. Russia too is mentioned in the White Paper for “strengthening its nuclear and non-nuclear capabilities for strategic containment, and striving to safeguard its strategic security space and interests.”

In the face of such a world view, China has evinced the need to develop its own military capability commensurately. However, as far as the country's nuclear doctrine is concerned, the White Paper continues to echo the long-standing tenets that continue largely unchanged from the time they were first enunciated by Premier Mao Zedong. So, the White Paper states:

"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."²

As is evident from this, the philosophies of minimalism and defensiveness continue to be associated with the country's nuclear strategy. It is evident that Beijing has steered clear of an excessive build-up of nuclear warheads. It has thereby belied US Defence Intelligence Agency estimates that for many years have predicted a sharp rise in China's nuclear warhead numbers. For instance, as far back as in 1999 the DIA had published *A Primer on the Future Threat* that "projected an increase of the Chinese stockpile from 140-157 warheads to 358-464 warheads in 2020."³ It is now 2020 but China's arsenal is widely estimated to be around 290 nuclear warheads. Of course, these are only guesstimates since Beijing has never declared any figures officially. But, it can be seen to have maintained the basic approach of having a nuclear arsenal that is considered sufficient to inflict unacceptable damage on the adversary. China maintains that it is not engaged in an arms race with anyone, building its capability at its own pace.

2. Ibid.

3. Hans M. Kristensen, "DIA Estimates for Chinese Nuclear Warheads", *Strategic Security*, May 31, 2019, Federation of American Scientists. Available at <https://fas.org/blogs/security/2019/05/chinese-nuclear-stockpile/>. Accessed on February 24, 2020.

Nevertheless, there is no denying that the country's strategic capability has been steadily advancing. With China's significant investment in scientific and technological research and development over the last few decades, facilitated by a buoyant economy, this progression was inevitable. And having gained in confidence, it is no longer shy to display its new military capabilities. Therefore, instead of a past posture that relied on complete opacity on its nuclear arsenal, China has begun to maintain a relative transparency, even as it now uses ambiguity as a strategy to enhance its nuclear deterrence.

This paper examines such changes by exploring the contemporary debates in China on nuclear issues. As President Xi Jinping leads his country to fulfil his 'China dream', there is a distinct emphasis on 'new era' that China perceives as one that is full of challenges and opportunities. Xi seeks China's national renewal as also a rising international influence based on 'mutual respect' and 'fair treatment'. In this vision, what role does Xi Jinping envisage for China's nuclear capability? Will the country continue to remain loyal to Mao's initial articulation of the attributes of China's nuclear doctrine—small numbers of nuclear warheads, no first use and enough capability to cause unacceptable damage—in the face of emergence of new thinking on some aspects which is beginning to make itself felt? What impact is the transformation in nuclear capability going to have on the debates on China's nuclear doctrine and strategy? The paper seeks answers to these questions.

XI JINPING'S VIEW OF CHINA'S NUCLEAR CAPABILITY

Soon after his elevation to the post of President of the People's Republic of China on March 14, 2013, Xi Jinping revealed his China dream of national rejuvenation. He has placed an emphasis on the idea of national security, to be guarded by a powerful military under the centralised and unified control of the Communist Party of China. In 2016, China's Military Commission in its guideline entitled "Deepening Military Reform of National Defense and the Armed Forces" emphasised "CPC's absolute leadership of the armed forces".⁴

4. Amrita Jash, "Xi Jinping's Control of the Chinese Army", *Strategic Analyses*, vol. 42, no. 6, p. 641.

At a speech delivered at the 19th National Congress of the Communist Party of China on October 18, 2017, Xi Jinping included a whole section on "Fully advancing the Modernisation of National Defence and the Military". His emphasis was particularly on "strengthening the military for the new era and the military strategy for new conditions" and "create a modern combat system with distinctive Chinese characteristics", at a time when the country is "confronted with profound changes in our national security environment and responding to the demands of the day for a strong country with a strong military".⁵

On the more specific issue of nuclear deterrence, in his address to the Party Congress, Xi Jinping identified three duties for the newly reorganised PLA Rocket Force (PLARF). It may be recalled that as part of the military reforms in the country, the Second Artillery Corps that was the earlier custodian of nuclear assets has now been rechristened PLARF and elevated to the position of the fourth arm of the military alongside the army, navy and the air force. The PLARF has been tasked with acting as the "core strength of China's strategic deterrence, the strategic support for the country's status as a major power, and an important cornerstone safeguarding national security."⁶ According to the interpretation of one senior Chinese nuclear analyst, this pronouncement clearly expands the role of the country's nuclear weapons from the earlier singular narrow role of the nuclear weapons which was to deter a nuclear attack.⁷ Whether this was intentional or not, Xi has certainly reinforced the centrality of nuclear weapons to China's national security and international status. Given his style, it is also clear that he is not going to follow the principles of Deng Xiaoping which lay emphasis on "avoiding brightness, cherishing obscurity". He prefers a "more visible and

5. 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.

6. Speech of Xi Jinping, n. 5.

7. Pan Zhenqiang, "A Study of China's No First Use Policy on Nuclear Weapons", *Journal for Peace and Nuclear Disarmament*, vol. 1, no. 1, p. 133, <https://doi.org/10.1080/25751654.2018.1458415>. Also see, "News Report: Xi Jinping's Speech—Striving to Build a Powerful, Modern Rocket Force", *Xinhua News Agency*, September 26, 2016.

activist posture”.⁸ Not surprisingly, then, China has leaned towards more display of military strength through well publicised tests and military parades.

CURRENT DEBATES ON FUTURE OF NUCLEAR CHINA

The future trajectory of China’s nuclear strategy, capability and posture are sure to be influenced by the contemporary ongoing debates in the country.⁹ A few of the prominent developments that can be identified for impacting these debates include: a greater sophistication of the available nuclear weapons and delivery capability; an overall deterioration in the political relations between Beijing and Washington; and a breakdown of arms control architecture between the US and Russia. The shadow of these factors is clearly visible on the three major debates that are evident in the country and can be espied in the statements of retired officials and writings of scholars within and outside China.

Debate on NFU

The first of the debates which has been visible for some time now is on whether China should continue to hold on to the concept of no first use. Having adopted a defensive position, China has always publicly eschewed the idea of nuclear pre-emption and articulated deterrence through the threat of assured retaliation. But, China-watchers such as James Johnson, an American scholar who closely monitors the country’s capability developments, believes that China has undergone a “de facto shift toward a limited nuclear war-fighting posture.”¹⁰ He explains this on the basis of the “increasingly commingled and diversified strategic missile forces [that] have already been incorporated into a limited war-fighting military posture.” In his view, the development of a range of dual capable missiles, BMD, and an offensive conventional force put China’s declaratory policy of NFU out of step with the military reality. And this reality, according to him, is one in which “military-technological

8. Yevgen Sautin, “A ‘New Type of Great Power Relations’ Revisited”, in “China’s New Era with Xi Jinping’s Characteristics”, *China Analysis*, European Council on Foreign Relations, December 2017, p. 7.

9. A portion of this section draws upon an article by the author that is to be published in Madhu Bhalla and Sanjeev Kumar eds. *A Time of Strategic Opportunity: Xi Jinping’s Chinese Dream* (New Delhi: ICWA, 2020).

10. James Johnson, “China’s Evolving Approach to Nuclear War-Fighting”, *The Diplomat*, November 22, 2017.

advancements have enhanced the accuracy, speed, precision, ranges, manoeuvrability, and survivability of Chinese nuclear weapons in a manner that appears incongruous with the requirements of minimum deterrence.”

While a majority of the Chinese nuclear strategists dismiss this assessment of China’s posture or that it casts a shadow on its doctrine of NFU, some of them do accept that there is indeed a debate on the subject. But, even the need for this debate is explained as a response to the Western offensive nuclear strategy. Pan Zhenqiang, for instance, a retired Army general and amongst China’s foremost nuclear strategists, argues that the new threats from the US could compel Beijing to rethink its NFU policy. US insistence on strategic flexibility through use of low-yield weapons or development of new offensive weapons from space and cyberspace and through robotics offer new ways of conducting “strategic blitzes”.¹¹ In case Chinese nuclear assets, infrastructure or command and control were to come under the attack of non-nuclear weapons, then, the General argues, how may China respond while upholding its no first use pledge? Should China not see this as a nuclear attack? Developments in the US, according to Gen Pan, have led to new considerations in China. He, however, describes this debate as a positive trend since “diverse voices help China to establish a more democratic process of decision making and assist the Chinese government in adopting better-informed policies with public support.”¹²

The proponents of the view that China should give up its NFU policy—who also include some PLA members—have taken recourse to “the rising tide of nationalism”. They believe that “China has reached a point at which it should no longer keep a low profile in its security policy and should instead dare to call the bluff of any world powers, including the most powerful US, who continue to bully China.”¹³ However, Gen Pan believes this is a minority view. Many, according to him, do understand that abandoning NFU would severely disadvantage China—it would make China repeat the mistakes of the Soviet Union—of exhausting itself in a nuclear arms race—and it would harm China’s carefully cultivated benign image.

11. Pan Zhenqiang, n. 8, p. 129.

12. *Ibid.*, p. 130.

13. *Ibid.*, p. 132.

Therefore, despite some divergent voices, no official policy changes have been made or are likely on NFU. However, Pan is also candid in admitting that the “international and domestic situation that had helped China shape the no-first use policy under the first-generation leadership has dramatically changed.”¹⁴ Whether China continues to retain the NFU will depend on the future of US-China relations. A constructive relationship between the two would reassure China and increase its comfort level in an NFU. But, a rift because of a growing power competition may strengthen the voices of those asking for a revision of the NFU.

Debate on Nuclear Force Posture and Force Structure

A second issue under debate is whether China should continue to maintain its nuclear forces on low alert levels that do not signal hair-trigger readiness or whether it should raise its alert levels to mimic the US and Russian postures of launch on warning (LOW) and launch under attack (LUA) as a way of enhancing its deterrence against new American capabilities and strategies. Some of this dilemma is captured in the writings such as those of Gregory Kulacki, a senior China analyst at the Union of Concerned Scientists in USA, who cites the 2013 updated edition of *The Science of Military Strategy*, a standard Chinese military text on strategy, to suggest that China’s nuclear forces could move towards a “launch on warning” posture: “under conditions confirming the enemy has launched nuclear missiles against us, before the enemy nuclear warheads have reached their targets and effectively exploded, before they have caused us actual nuclear damage, quickly launch a nuclear missile retaliatory strike.”¹⁵ Taking the argument further, he also cites some

“newly translated Chinese sources, [where] discussions of putting missiles on high alert appear to stem from increasing Chinese military concerns about retaining a credible nuclear retaliatory capability in the face of accurate U.S. nuclear weapons, the development of high-precision conventional weapons, and missile defenses. In addition, U.S. unwillingness to acknowledge mutual vulnerability in bilateral

14. Ibid., p. 133.

15. Ibid.

nuclear talks with China creates the impression that the United States is still seeking to render itself invulnerable to a Chinese retaliatory strike."¹⁶

As is evident yet again in this case, China believes the onus for its decision to retain or change its force posture would be dependent on how the US shapes its relations with Beijing. For China, these discussions are part of a broader conversation about the future of its nuclear forces in the face of US counterforce threats. The recent US Nuclear Posture Review and its mention of limited nuclear use, enabled by the development of low-yield submarine-launched nuclear weapons, does nothing to ease China's discomfort in this regard.

Several Chinese strategists also contend that a Chinese leadership, worried about the survivability of its small nuclear arsenal, might be compelled to take radical measures to build up its own nuclear capability. Tong Zhao, for instance, has stated that "It is highly likely that China would try to counter new US capabilities by doubling down on its own investments in similar technologies and other countermeasures. A broader arms competition that spills over into additional technological domains other than traditional ballistic and cruise missiles seems hard to avoid."¹⁷ With no dialogue between the two sides on each other's legitimate security interests and on basing their security on a general sense of mutual vulnerability, their perceptions of each other's capability and intentions threaten to make the situation difficult.

Debate on Participation in Nuclear Arms Control

The Cold War nuclear arms control architecture was crafted in a bipolar framework. But in recent times, the bilateral treaties have been gradually falling apart as the US and Russian threat perceptions

16. Gregory Kulacki, "China's Military Calls for Putting its Nuclear Forces on Alert", *Report of Union of Concerned Scientists*, January 2016, p. 1, <https://www.ucsusa.org/sites/default/files/attach/2016/02/China-Hair-Trigger-full-report.pdf>. Accessed on August 9, 2019.

17. Tong Zhao, "Why China is Worried about the End of the INF Treaty", *Commentary*, Carnegie-Tsinghua Center for Global Policy, November 12, 2018, <https://carnegietsinghua.org/2018/11/07/why-china-is-worried-about-end-of-inf-treaty-pub-77669>. Accessed on August 9, 2019.

have changed and mutual allegations of violations have increased. The Intermediate Nuclear Force treaty was the latest casualty, and at the time of writing this article there appears little chance of a grant of extension to the New START which is due to expire in 2021. While the current state of US-Russia relations, marked as they are with a high level of mistrust, is to blame for the crumbling arms control edifice, there is no doubt that growth in China's nuclear and missile capabilities—unrestrained as it has been of any treaty restrictions—is also a matter of concern for the US. In fact, China's high number of missiles in the medium-range category is widely believed to have been the reason for US abandonment of the INF treaty. As articulated by one American strategic analyst,

“Beijing must be mindful that China's growing nuclear arsenal—as well as its general military modernization and territorial pursuits—can serve to limit US willingness to reduce its arsenal further and may even lead to decisions to increase the capabilities. The Trump administration's plan to abandon the INF treaty with Russia and add a nuclear sea-launched cruise missile to the arsenal are just two examples; they have China written all over it.”¹⁸

On the issue of nuclear arms control for the future, Washington has expressed the need for inclusion of China. But, Beijing has made it amply clear that it is not interested in arms control for the moment. Speaking at the CD in May 2019, the Chinese representative dismissed any possibility of a trilateral arrangement involving USA, Russia and China. He said, “The premise of and basis for the so-called trilateral arms control negotiations do not exist at all and China will definitely not participate in them.”¹⁹ Even more recently, a spokesperson of the Chinese foreign ministry blamed the “US' unilateralism and building up of military power using all its resources” as posing a great obstacle to the international arms control process.²⁰

18. Hans M. Kristensen and Matt Korda, “The Pentagon's 2019 China Report”, Federation of American Scientists, May 6, 2019, <https://fas.org/blogs/security/2019/05/chinareport2019/>. Accessed on February 24, 2020.

19. *Global Times*, n. 22.

20. Zhang Hui, “US military build-up threatens global arms control: Chinese FM”, *Global Times*, February 12, 2020.

Even though the government position on the subject looks negative at the moment, some Chinese scholars have been making a case for China to engage in strategic stability talks, including some kind of arms control that can offer it better security. In a recent article in *Arms Control Today*, for instance, Tong Zhao has argued that "over time, China's own interest will align with arms control for several reasons."²¹ He therefore recommends, "Beijing and Washington should set some basic boundaries to their competition... To this end, they both must commit to maintain strategic stability, avoid a repetition of a Cold War-style arms race, and agree on red lines and basic rules of major power competition."

However, on this issue too, the suggestion from Chinese scholars is that it is the US that holds the key to shaping Chinese behaviour. It is rather interesting that Chinese strategic analysts are placing the onus of how China develops its future nuclear trajectory and uses its capabilities on the developments that take place in the USA and on their bilateral relations. They appear to indicate that external factors would frame the need and scope of China's ongoing strategic modernisation. By following this line of argument, China is making the US an equal stakeholder in China's future nuclear behaviour.

IMPLICATIONS FOR INDIA

While the high stakes nuclear game is largely between the USA and China, India becomes the affected party at the downstream level. As regards the China-India nuclear equation, the former obviously has a lead over India in nuclear and missile capability. The balance on the number of nuclear warheads, fissile material stockpile, the number of missiles, their range, accuracy and their being equipped with countermeasures against missile defence is all skewed in favour of Beijing. However, this should not automatically lead to a conclusion that China could prevail upon India in a nuclear war.

Of course, China's nuclear preponderance does raise the prospect of India having to face a more assertive China in the coming years. With a general rise in its own perception of its comprehensive

21. Tong Zhao, "Opportunities for Nuclear Arms Control Engagement with China", *Arms Control Today*, January-February 2020.

national power (nuclear capability being one component of this), China does believe it carries more weight today. A Chinese official quoted in a recent article articulated China's sense of its position as, "Being a great power means you get to do what you want, and no one can say anything about it."²² This gives it the confidence to actively participate in international rule making, or rule breaking, both aspects that India must watch out for.

Under Xi, China is also far more confrontational and overt in exploiting its political clout and economic muscle to counter the efforts of others who might like to contain or constrain it. China's nuclear force may be small by Cold War standards, but it has become modern enough to be used as a tool of deterrence to shape China's security environment to better safeguard its national interests and assist in its rise to great power status.

India needs to be aware of China's likely ambitions in Asia and the Indo-Pacific. But, it does not need to match China's capability piece for piece. New Delhi should put its focus on building its own military strength (conventional and nuclear) and political influence, including through the use of its unique soft-power appeal. While on the one hand, India must undertake conventional modernisation to raise the nuclear threshold, on the other, it needs to enhance the credibility of own nuclear deterrence through a programme aimed at increasing the survivability of its nuclear forces.

At the same time, India must also look for opportunities to engage in political dialogue with China on nuclear issues. An understanding of each other's nuclear policies, capabilities and doctrines would reduce chances of misperception or miscalculation during a crisis. In their individually articulated but similar approaches to nuclear deterrence, both already have ground for several nuclear convergences. In their unilaterally and voluntarily declared NFU too there is a good instrument of strategic stability. Any change in these positions that is compelled upon China by American actions could raise stresses on India's doctrine and capability build-up. This would only lead to creation of more security dilemmas. It is, therefore, in the interest of China and India to cement their nuclear understandings to

22. Oraina Skylar Mastro, "The Stealth Superpower", *Foreign Affairs*, January-February 2019, p. 31.

avoid mutual risks that may arise from misperceptions and help set an example of responsible nuclear behaviour before others at a time when destabilising developments are peaking.

A PROGNOSIS OF THE US–RUSSIA–CHINA NUCLEAR TRIANGLE

CARL JAISON

With the doomsday clock currently set at 100 seconds to midnight underlining the dangerous potential for nuclear misfortune, it is worth recounting the actions of both the US and Russia in contributing towards the current predicament. Moreover, China's conspicuous absence from any arms control treaty negotiations has been cited as one of the reasons for the dire straits of the US-Russia nuclear arms control architecture. The year 2019 heralded a renewed look by both US and Russia with respect to arms control, albeit at the cost of strategic and nuclear stability. The 'China factor' in all these developments provides an interesting layer to the conversation around strategic stability and great power rivalry. Beginning with the Trump administration's Missile Defence Review, the mutual exit from the INF Treaty mid-year sent alarm bells ringing around the world, primarily in China, with a likely exit from another treaty, i.e., the New START, looming large. Given that China is rapidly expanding its capabilities—which had been guaranteed throughout the years of strategic nuclear arms reduction between US and Russia—it is imperative to consider the changing arms control and weapons capability landscape and Beijing's response to these developments.

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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 decade.

MISSILE DEFENSE REVIEW 2019

At the beginning of 2019, the Trump administration revealed the Missile Defense Review (MDR), 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 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 programme. Consequently, the US' 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 MDR acknowledged the pressing need to adopt Integrated Air and Missile Defense (IAMD). While unveiling the 2019 MDR, President Trump went as much as to say that the goal is "to ensure that we can detect and destroy any missile launched against the United States—anywhere, anytime, anyplace."¹ Indeed, with the ongoing expansion of Russia's and China's advanced ballistic and cruise missiles, the US considers ramping up its defensive systems as vital for deterrence objectives. However, the current review has both—important continuities as well as innovations—when compared to the previous BMDR (Ballistic Missile Defense Review). Nevertheless, it does heighten the perception that there is an ongoing arms race among the major nuclear powers.

First, the MDR posture furthers an already entrenched element of US strategic capability, i.e., reliance on "nuclear deterrence for strategic nuclear attack".² In addition, the MDR seeks to identify the spectrum of air and missile threats, including from UAVs, cruise

1. "Assessing the 2019 Missile Defense Review", *Arms Control Today*, March 2019, <https://www.armscontrol.org/act/2019-03/features/assessing-2019-missile-defense-review>. Accessed on November 5, 2019.
2. 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>. Accessed on November 5, 2019.

missiles, hypersonic glide vehicles (HGVs), etc. This is part of the complex strategy of Integrated Air and Missile Defense (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".³ The current US missile defence systems are incapable of withstanding the might of hypersonic missiles with Russia and China that are developing both conventional and nuclear payloads for these new missiles.

Second, the highlight of the MDR is the endorsement of a Space Sensor Layer (SSL) to defend the US from the threat of hypersonic missiles. However, there is currently nothing concrete as far as a timeline or architecture framework is concerned. Nevertheless, the emphasis is on space-based interceptors, with their birth-to-death trajectory tracking, that would serve as a deterrent against HGVs. In light of its smaller strategic nuclear arsenal and the resultant threat of the MDR, China has stepped up its pursuit and development of wide-ranging mobile air and missile defence capabilities, including the purchase of S-400 ballistic missile defence systems from Russia. Although the US missile defence capabilities are still at a nascent stage for providing deterrence from HGVs, "Russian and Chinese investments in modernized, new capabilities will be built on the assumption that one day these capabilities will threaten their deterrent."⁴

Russia's development of the 'Avangard' hypersonic glide vehicle was touted as a direct consequence of US advances in missile defence capabilities. Moreover, Russia's refurbished missile defence system known as A-235 will "include enhanced short-range interceptors while the longer-range S-500 in development is rumored to have a capability to intercept ICBM warheads during reentry."⁵ China, on

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3. 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>. Accessed on November 5, 2019.
 4. Ankit Panda, "Trump's Missile Defense Review Will Be Read Closely in China", *The Diplomat*, January 26, 2019, <https://thediplomat.com/2019/01/trumps-missile-defense-review-will-be-read-closely-in-china/>. Accessed on November 5, 2019.
 5. Matt Korda & Hans M. Kristensen, "US ballistic missile defenses, 2019", *Bulletin of the Atomic Scientists*, vol. 75, no. 6, pp. 295-306, 10.1080/00963402.2019.1680055.

the other hand, has been rapidly developing MIRVs for its limited ICBM force (e.g., the glide vehicle DF-17) as a counter to the US' planned regional missile defence. China fears that US deployment of missile defence systems in Asia like the THAAD, similar to Russian fears of US BMD interceptors stationed in Europe, could be used to intercept nuclear as well as conventional weapons. In this regard, the MDR provides recommendations for the development of satellites, radars, and other technologies to complement its missile systems, raising concerns over the effectiveness of China's defence capacity. The challenge for Beijing, as noted by various experts, is to figure out "what constitutes reliable nuclear deterrence relative to the U.S. systems, how to build up its defense technologies and address questions on how to finance the systems."⁶

The outcome of these developments is the familiar spiral of defence-offence advancements with the added spectre of an uncertain arms control regime. For instance, the DARPA-funded Glide Breaker programme seeks to develop and demonstrate technologies to enable defence against hypersonic missiles. It has already been termed as 'counter-hypersonics'.⁷

TERMINATION OF THE INF TREATY

After the US and Russia formally withdrew from the INF Treaty in August 2019—the nuclear arms control agreement negotiated by then-US President Ronald Reagan and Soviet leader Mikhail Gorbachev in 1987—arms control experts were broadly alarmed at the state of arms race between the two Cold War rivals. The INF Treaty had helped to keep a check on the elimination of conventional and nuclear warheads on 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 the US—enabling the combined decrease in nuclear stockpiles from almost 70,000 in 1986 to just under 15,000

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6. Tong Zhao & Li Bin, "Missile Defense and U.S.-China Strategic Stability", Carnegie-Tsinghua Centre for Global Policy, July 10, 2019, <https://carnegietsinghua.org/2019/07/10/missile-defense-and-u.s.-china-strategic-stability-event-7157>. Accessed on November 5, 2019.
 7. Michael Peck, "Meet DARPA's 'Glide Breaker': A Hypersonic Missile Killer?" *The National Interest*, January 20, 2019, <https://nationalinterest.org/blog/buzz/meet-darpas-glide-breaker-hypersonic-missile-killer-42117>. Accessed on November 6, 2019.

today.⁸ However, even the most ardent supporters of arms control would agree that the evolution of new weapon technologies and the expiration of verification provisions was always going to shake the foundations of one of the most historic non-proliferation treaties ever negotiated. Given Russia's perceived weakness in light of the US missile defence upgradation and US 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 US administration, was triggered by Russia's deployment of 9M729 missiles—known to NATO as SSC-8—which the trans-Atlantic alliance believes pose a threat to continental security. The fear compounded with the increased knowledge about Russia's missiles that are said to be “nuclear-capable, mobile, very hard to detect, with the ability to reach European cities within minutes.”⁹ The US has already conducted two conventionally-configured ground-launched ballistic missile tests which would not have been permitted under the INF Treaty. China's negative reaction to these missile tests, since the INF Treaty exit, is based on the reality that the US can possibly deploy ground-based intermediate-range missiles in Asia. Beijing is responding by “investing in the survivability of its nuclear forces: moving over to new types of mobile ICBMs, using multiple independently targetable reentry vehicles for its missiles, paying closer attention to the development of strategic submarines, successfully experimenting with hypersonic boost-glide vehicles, building a radar network, and consulting with Russia over the creation of China's early warning system.”¹⁰

While China continues to remain less worried about the quantity of US nuclear arsenal rather than its quality, it is avowedly opposed to

8. 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>. Accessed on November 6, 2019.

9. “Nato chief calls on Russia to save INF nuclear missile treaty”. BBC News, July 18, 2019, <https://www.bbc.com/news/world-europe-49026227>. Accessed on November 6, 2019.

10. Andrey Baklitskiy, “What the End of the INF Treaty Means for China”, Carnegie Moscow Center, December 2, 2019, <https://carnegie.ru/commentary/80462>. Accessed on December 26, 2019.

a trilateral arms control framework because “China follows national defense policies that are defensive in nature” and that “nuclear disarmament should adhere to the internationally recognized principle of ‘undiminished security for all’ concerning arms control.”¹¹ However, China is mighty cautious about US deployment in Asia as it already upsets the balance of nuclear force advantage with Washington despite the impressiveness of Beijing’s missile capability. Given that as much as “90% of China’s ballistic and cruise missile arsenal falls within the range of the INF Treaty”, primarily as an anti-access/area denial strategy against the US Navy within the first island chain, the costs for China in entering any arms control framework is huge.¹² However, China’s rising power status must seriously consider the benefits of arms control negotiations with the US as a means of stabilising its surrounding strategic environment.

Given Russia’s and China’s rapid development of hypersonic cruise missiles, which can render US missile defence useless, the Trump administration is on course to build more missiles and strengthen missile defence. The lack of limitations on US and Russia’s missile development programmes, not to forget China’s expanding capabilities, will escalate an already arms race. The immediate implication of this is that the casual attitude towards these destabilising weapons would threaten existing arms control regimes and undermine the post-Cold War progress towards non-proliferation efforts.

THE NEW START

The New START was conceived of as an area of cooperation during the Obama and Medvedev administrations in 2010. It was ratified by the two parties for a period of 10 years and renewable by 5 years upon mutual agreement. It limits the number of “nuclear launchers and deployed land- and submarine-based missiles and nuclear-capable

11. Yan, “China reiterates opposition to multilateralization of INF Treaty”, *Xinhua Net*, July 30, 2019, http://www.xinhuanet.com/english/2019-07/30/c_138270534.htm. Accessed on November 10, 2019.

12. Ankit Panda, “China Won’t Join the INF Treaty—But Can It Forever Dodge Arms Control?”, *The Diplomat*, February 25, 2019, <https://thediplomat.com/2019/02/china-wont-join-the-inf-treaty-but-can-it-forever-dodge-arms-control/>. Accessed on November 10, 2019.

bombers” that each party can have.¹³ A fairly straightforward treaty that also limits the number of strategic nuclear warheads deployed, the New START is the latest and currently the only remaining verifiable arms control agreement between the two superpowers. But it currently appears vulnerable to the whims of an increasingly unstable arms race.

In addition, the current trend is not to quantitatively engage in an arms build-up but to improve on existing technologies and the rapid adoption of autonomous weapon systems. The result of this dual uncertainty is the “total loss of transparency, predictability and information exchange,” which Ulrich Kühn calls ‘strategic blindness’.¹⁴ While Russia has at least offered to begin extension talks, the fact that the US continues to insist on having China on board certainly complicates the situation. The Trump administration also draws attention to another area where the New START extension must address such as “Russia’s large arsenal of shorter-range ‘tactical’ nuclear weapons.”¹⁵ 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.”¹⁶ However, the most alarming fallout 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 the US 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.

Similar to the INF Treaty, the US extends its argument on China’s absence from the New START as reflecting the futility of

13. 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>. Accessed on December 29, 2019.

14. 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>. Accessed on November 10, 2019.

15. Leanne Quinn, “China’s Stance on Nuclear Arms Control and New START”, *Arms Control Today*, August 23, 2019, <https://www.armscontrol.org/blog/2019-08-23/chinas-stance-nuclear-arms-control-new-start>. Accessed on November 10, 2019.

16. Kühn, n. 14.

bilateral arms control negotiations in today's geopolitical landscape. Former US NSA John Bolton opines that the prevailing situation of a multipolar nuclear order should engage China, which is outside all arms control frameworks. Given China's insistence on the defensive nature of its nuclear forces and the relatively small nuclear arsenal compared to the US and Russia, there is a strong likelihood that the inability to agree on a New START extension is now a foregone conclusion.

As US, Russia and China do not want to limit their capabilities and are even speeding up their respective missile development programmes, the New START could face extinction. However, there are some who argue that to involve China in future nuclear risk reduction processes, the US and Russia must extend New START which "could help put pressure on China to provide more information about its nuclear weapons and fissile material stockpiles."¹⁷ Further, with the need to manage great power competition in an era of destabilising weapons upgrade and attain strategic stability in the most conflict-prone areas of the world, counter-pressures will be on China to involve itself in new trilateral arms control frameworks.

Since the signing of the New START treaty in 2010, experts have been divided over the role of China in nuclear arms control architecture. While some¹⁸ have called out China's 'strategic build-up' and 'rush for nuclear parity' under the guarantee of the New START restrictions put on US and Russia, others believe that, even at the time of signing, the attempt to link China's less-than-300 nuclear warheads (one-fifth of what the US deployed) as contributing to instability was purely based on domestic political compulsions despite transparency concerns over the former's nuclear capabilities.¹⁹

17. Daryl G. Kimball, "Trump Arms Control Gambit: Serious or a Poison Pill?", *Arms Control Today*, May 2019, <https://www.armscontrol.org/act/2019-05/focus/trump-arms-control-gambit-serious-poison-pill>. Accessed on November 15, 2019.

18. Peter Brookes, "New START Treaty's China Challenge", The Heritage Foundation, September 20, 2010, <https://www.heritage.org/arms-control/commentary/new-start-treatys-china-challenge>. Accessed on November 15, 2019.

19. Jeffrey Bean, "New START Is Not About China", *CogitAsia*, December 16, 2010, <https://www.cogitasia.com/new-start-is-not-about-china/>. Accessed on November 15, 2019.

CONCLUSION

In a way, the three crucial developments within the nuclear dimension of US-Russia relations are interlinked; in fact, one tends to impinge on the other. The unilateral US exit from the Anti-Ballistic Missile (ABM) Treaty in 2002 paved the way for much of the uncertainty being witnessed today. According to US intelligence, Russia was found to have repeatedly flouted INF Treaty obligations, despite diplomatic manoeuvres on the part of both the Obama and Trump administrations. In that sense, the New START extension, negotiated during a brief period of US-Russia rapprochement, has the potential to heighten the misgivings of both parties.

With regard to China's entry into the arms control fray, it is fair to assume that the country would consider any erosion of its strategic deterrence, especially in the South China Sea, with serious consequences if the US decides to station its ground-based missiles that are within the INF Treaty range. Moreover, it would motivate China to accelerate its weapons capability and bring the East Asian conflict theatre into the wider geopolitical canvas. It is no secret that the Chinese are uncompromising in their efforts to combat the presence of US missile defence in its strategic sphere of influence and have even taken measures to pressurise its neighbours, Japan and South Korea, in this regard. Further, the Chinese development of the DF-21D, the controversial anti-ship ballistic missile, has threatened US Navy assets and allies in the region. China's aversion to monitoring and verification issues is destined to keep them outside any treaty obligations for now, but it is the concern over the "survivability of its nuclear deterrent due to the twin developments in new hypersonic missiles and investments in ballistic missile defense that worries Beijing's political class."²⁰

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 heydays of the Cold War, the current state of play is also a throwback to a time when the arms race was

20. "Why China Will Steer Clear of a New START on Arms Control", Stratfor, May 14, 2019, <https://worldview.stratfor.com/article/why-china-will-steer-clear-new-start-arms-control>. Accessed on November 15, 2019.

underway in full throttle with little appetite for nuclear ‘maturity’. With both Russia and China modernising their nuclear force capabilities, with respect to 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 superpowers can sensitise themselves on the benefits of on-site verification and inspections found in 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.²¹ Will the Trump administration see virtue in it or does it wish to first see China in it? Strategic wisdom would predict that the more great power challengers (China) chip away at the foundational ideas of stability through its unchecked rise, declining great powers (Russia) and status-quo great powers (US) respond in ways that ensure their capabilities are always at par. It would take astute trilateral diplomatic channels to impress upon each other the virtues of nuclear threat reduction and arms control. Perhaps the year 2020 might hold out a pleasant promise as much as it presents an unprecedented peril. Whatever happens, there is no doubt that the nuclear triangle comprising USA, Russia and China will be central to it.

21. Kingston Reif and 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>. Accessed on December 30, 2019.

UAE'S NUCLEAR ENERGY QUEST: STRATEGY IN WEST ASIA

ANU SHARMA

INTRODUCTION

With the plans to be fully functional by 2020 for the four-reactor nuclear power plant, the United Arab Emirates (UAE) will emerge as the first Gulf state to develop a peaceful civilian nuclear programme in the West Asian region. This development has definitely led to an unending public debate on the fear of nuclear weapons proliferation in the West Asian region. Not only that, the UAE's declaration to opt for developing a civilian nuclear-power programme has raised speculations not only in the region but also in the world about the probable motivations behind such a move. However, since then, the UAE has aggressively moved forward and signed various bilateral agreements with nuclear-supplier countries as well as increased cooperation with the International Atomic Energy Agency (IAEA) in its endeavour to augment nuclear power in its national energy portfolio. In this regard, this paper will trace the UAE's path to the acquisition of nuclear energy. It will also try to assess the reasons behind its quest to acquire nuclear technology.

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There is a persuasive case that can be made in favour of the UAE's development of nuclear power for diversifying its energy basket and developing this technology not only for meeting the growing demand for electricity generation but also for various other economic reasons. The diversification of power sources will underwrite energy security, at the same time, circumventing the destabilising oil and gas price fluctuations. For nations like the UAE, expansion into nuclear power also helps to conserve resources that will be more profitable to export rather than be used for domestic energy generation. Nuclear energy can serve the domestic market and can itself be an exportable resource in the form of electricity through the appropriate distribution network of electricity lines. Additionally, shifting to carbon-neutral energy sources is becoming a chosen policy imperative for the nations of the West Asian region that are concerned about the effects of environmental deterioration.

It cannot be refuted that the interest in nuclear power is on the rise around the world. However, there are some who argue that despite the dynamic political and regional situation in West Asia, this region is better suited than others to actually build reactors. The reason often cited relates to the fact that where, on the one hand, various nations in other parts of the world—including a few western powers—struggle to raise the funds needed for establishing, running and maintaining a nuclear power plant, the economically self-sufficient Gulf States do not face this limitation. In this respect, it can be said that the Gulf region represents one of the most stimulating and favourable nuclear markets in the world. At the same time, the region's rapidly expanding economies and the need for fresh and potable drinking water are pushing a lot of nations in this vulnerable region to opt for the nuclear option for power generation and desalination of water. There are other factors such as environmental concerns, concerns related to the public acceptance of nuclear energy and fluctuating oil prices affecting the economy of several nations. All these factors influence countries like the UAE, Saudi Arabia, Turkey and Jordan regarding their decision on whether or not to use nuclear energy. The debates on the issue also extend to how much nuclear energy is needed once the decision for its utilisation is made.

WHY DID UAE OPT FOR NUCLEAR ENERGY?

The UAE's nuclear energy programme is based on its two short-term—yet very important—goals, i.e., diversification of energy and desalination of water and converting it into potable water. This also means that the UAE will reduce its dependence on oil and natural gas. The UAE was using the major share of oil and gas for these purposes.¹ Not only that, due to its rapidly increasing energy demand and overdependence on hydrocarbons, the UAE wants to come off the list as one of the top few emitters of Carbon Dioxide emissions. At the same time, it will eventually reduce the UAE's dependence on Qatar's natural gas. It may be recalled that ever since Saudi Arabia, along with seven other Arab states, severed ties with Qatar in 2018, relations remain strained due to the economic impediment in place. Here it is important to mention that the UAE imports natural gas to fulfil its domestic requirements.

The economic development all across the country has led to a massive increase in the demand for electricity. With limitations on how much and how fast conventional energy resources such as natural gas can be brought to the market, as well as concerns about climate change, the UAE Government launched a study aimed at identifying alternative means of producing the power needed to fuel its economy. Each emirate controls its own oil production and resource development. The UAE's proven oil reserves were 97.8 billion barrels in 2017. Abu Dhabi holds 94 percent of UAE's oil resources, i.e., approximately 92.2 billion barrels. Dubai contains an estimated quantity of 4 billion barrels. This is followed by Sharjah and Ras Al Khaimah, with 1.5 billion barrels and 500 million barrels of oil, respectively.² This forms the primary basis for the UAE's pursuance of a peaceful, civilian nuclear energy programme. Besides, the UAE's nuclear energy programme upheld the highest standards of safety, security, non-proliferation and operational transparency. In the UAE's drive for clean energy and sustainable development—

1. John Defterios, "The Core of UAE's Nuclear Aspirations", Gulf News, September 15, 2017, <https://gulfnews.com/business/analysis/the-core-of-uaes-nuclear-aspirations-1.2090418>. Accessed on February 16, 2020.
2. "United Arab Emirates", *IAEA Country Nuclear Power Profiles*, 2019, <https://cnpp.iaea.org/countryprofiles/UnitedArabEmirates/UnitedArabEmirates.htm>. Accessed on February 17, 2020.

apart from other renewable sources of energy generation—nuclear energy accounts for almost 6 percent share. At the same time, this clean energy plan aims to achieve a target of 27 percent by 2021 and a 50 percent reduction in CO₂ emissions by 2050.³

The geographical location of the UAE in the desert leads it to be the highest water consumer in the world. Due to this, water production is a key issue for the UAE government to contemplate and for the same reason, it figures prominently in the country's energy strategy.⁴ In this regard, nuclear energy can play an effective role besides proving to be comparatively more advantageous than other energy sources. Nuclear power, when combined with water desalination, can be very efficient because the natural heat residue that a nuclear reactor produces can be used to power the desalination plants. Most desalination techniques use fossil fuels, thus contributing to increased levels of greenhouse gases. Total global capacity of potable water⁵ in 2016 was 88.6 million cubic metres per day (m³/d) which constitutes almost 32,300 Gigalitres per Year (GL/yr).⁶ Combining power generation and water production by desalination is economically advantageous and is extensively used in West Asian and North African countries. A lower cost of production of desalinated water makes nuclear power a more attractive option than other power sources.⁷ As seawater desalination technologies are fast evolving, there is an increase in the number of countries that are opting for dual-purpose integrated power plants. This has, in turn, generated the need for advanced technologies suitable for coupling

3. "UAE and the 2030 Agenda for Sustainable Development", National Committee on Sustainable Development Goals, 2017, https://sustainabledevelopment.un.org/content/documents/20161UAE_SDGs_Report_Full_English.pdf. Accessed on February 17, 2020.
4. "Energy", Government of UAE, October 23, 2019, <https://government.ae/en/information-and-services/environment-and-energy/water-and-energy/energy->. Accessed on February 18, 2020.
5. Potable water means water that is safe for drinking. Through desalination, seawater is made potable for drinking purposes.
6. "Desalination", World Nuclear Association, January 2019, <https://www.world-nuclear.org/information-library/non-power-nuclear-applications/industry/nuclear-desalination.aspx>. Accessed on February 18, 2020.
7. *Ibid.* Desalination can become a process to change largely the amount of electricity supplied from the plant to the grid operating at full power continuously, regarding the varying demand. Surplus power is supplied to an RO desalination plant when it is available. At the same time, it is easier to store potable water than electricity.

to nuclear power plants and leading to more efficient and economic nuclear desalination systems.

It is estimated that in the next few years, the UAE is going to see an increase in its share of electricity generation through nuclear power plants with the instantaneous benefits of low pollution and low carbon emissions. This is also in harmony with the UAE government's efforts to reduce its carbon footprint and global warming. At the same time, this comes with the supplementary benefit of electricity and water supply. There are chances that the UAE will follow South Korea's pattern of nuclear energy development. South Korea acquired it, owned it, learnt it, modified it and finally was able to sell its own technology to the UAE.

The programme serves as a role model for any country that wishes to develop a new peaceful nuclear energy programme. It is believed that the programme will bring about an increase in employment opportunities which can foster development in the financial sector. The almost immediate positive impact will also lead to the additional benefit of being able to export services to the nuclear sector and create a skilled workforce that will help the economy as a whole in the distant future. At the same time, the utilisation of nuclear energy indicates the development and modernisation in the nations of this region. This has also provided the philosophical and ethical justifications for the UAE's nuclear energy programme.

UAE'S QUEST AND SPECIFICATIONS OF ITS NUCLEAR POWER PLANTS

The UAE took its first steps toward a nuclear power programme in 2008 to address its rapidly increasing demand for electricity, which is likely to be around 40 gigawatts annually by 2020. All the factors discussed in the above section related to the increase in energy and water demands led the UAE Government to conduct a study in 2007 regarding its growing energy demands and electricity generation capacity.⁸ In this survey, nuclear energy emerged as the correct option owing to its safe, clean and proven technology. Various aspects such as nuclear technology being commercially viable and at the same time

8. "Nuclear Energy in the UAE", Emirates Nuclear Energy Corporation, <https://www.enec.gov.ae/discover/nuclear-energy-in-the-uae/>. Accessed on December 12, 2019.

delivering substantial volumes of baseload electricity with virtually zero emissions, shifted the balance in favour of nuclear energy as an efficient source for electricity generation.

In order to assuage the rising concerns of nuclear proliferation in the West Asian region, the UAE government released a white paper in 2008 which discussed its comprehensive policies regarding the development of peaceful nuclear energy. With the Barakah nuclear power plant being operational in the year 2020, it can be safely said that the UAE is the only nation among the Arab states in the region which is leading in reaching its nuclear power goals. At the same time, the UAE government's initiative through this has provided a plausible option that it requires nuclear power to address its increasing demand for energy, reduce its reliance on fossil fuels, and make more oil available for exports.⁹ Abu Dhabi made a commitment to relinquish uranium enrichment. This was reflected in its 2009 "123 (nuclear cooperation) agreement"¹⁰ with the US (termed after Section 123 of the US Atomic Energy Act of 1954), whose language barring enrichment and reprocessing is often referred to in the nuclear community as the "non-proliferation gold standard." That agreement paved the way for international cooperation, and from 2008 to 2013, the UAE signed various agreements with Argentina, Australia, Canada, France, Japan, Russia, and the United Kingdom which included the transfer of technology, experts, nuclear materials, and instruments. After proclaiming their interest in bidding for the UAE nuclear-power contract, nine companies and consortiums were reduced to a list of three serious bids in 2009: a French consortium consisting of AREVA, Suez and Total; GE-Hitachi; and a group led

9. Yoel Guzansky, "The UAE's Nuclear Push", *Foreign Affairs*, February 19, 2017, <https://www.foreignaffairs.com/articles/iran/2017-02-19/uaes-nuclear-push>. Accessed on December 13, 2019.

10. "The United Arab Emirates and the United States Sign Bilateral Agreement for Peaceful Nuclear Energy Cooperation", January 15, 2009, <https://www.uae-embassy.org/news-media/united-arab-emirates-and-united-states-sign-bilateral-agreement-peaceful-nuclear-energy>; "U.S.-UAE Nuclear Cooperation", August 13, 2009, <https://www.nti.org/analysis/articles/us-uae-nuclear-cooperation/>; "UAE Government releases comprehensive policy white paper on the Evaluation and Potential Development of Peaceful Nuclear Energy: White paper product of extensive international consultation", April 2008, http://uae-embassy.org/sites/default/files/Press_Policy_Paper_Peaceful_Nuclear_Energy.pdf. Accessed on December 13, 2019.

by the Korea Electric Power Corporation (KEPCO).¹¹ In 2009, the Korea Electric Power Corporation gained the contract to build the reactors for the UAE.¹² In this backdrop, it is necessary to mention that the UAE has been a member of IAEA since 1976. It had joined the Non-Proliferation Treaty (NPT) in 1995, and is an IAEA member and cooperates with Missile Technology Control Regime (MTCR). Additionally, while discussing the case of the UAE it should be noted that UAE is a partner-nation in the Global Initiative to Combat Nuclear Terrorism and a signatory to the Proliferation Security Initiative, which is aimed at stopping shipments of weapons of mass destruction, their delivery systems, and related materials worldwide. Along with that, it supports the establishment of an international nuclear fuel bank¹³ under the support of the IAEA, as proposed by the Nuclear Threat Initiative.

The UAE's first nuclear power plant, which was supposed to be operational in 2017, will be operational in early 2020. In July 2018, the UAE Department of Energy issued an electricity-generating licence for the four units at Barakah. As of June 2019, the construction of this nuclear power plant was almost 93 percent completed.¹⁴ The Federal Authority for Nuclear Energy (FANR)

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11. Ali Oguz Dirioz & Benjamin A. Reimold, "The Strategic Context of the UAE's Nuclear Project: A Model for the Region?" *Middle East Policy Council*, vol. XXI, no. 3, <https://mepc.org/strategic-context-uaes-nuclear-project-model-region>. Accessed on December 14, 2019.
 12. Sami Zaatari, "Operating licence approved for Abu Dhabi's Barakah Nuclear Plant", *Gulf News*, February 17, 2020, <https://gulfnews.com/uae/operating-licence-approved-for-abu-dhabis-barakah-nuclear-plant-1.69761978>. Accessed on February 19, 2020.
 13. Nuclear Fuel Bank—a nuclear fuel bank is a stock of low enriched uranium (LEU) for nations that need the reserve source of LEU to fuel their nuclear reactors. Countries with enrichment technology would donate enriched fuel to a 'bank', from which the countries that do not have enrichment technology can get fuel for their power reactors. The aim of this international fuel bank is to help make the delivery of nuclear fuel supplies more secure from the international market to the nations that are in full conformity with their non-proliferation obligations and there is a secure access to a nuclear fuel reserve under IAEA control in case their fuel supply is disrupted. Countries like the UAE, the US, Norway and the European Union have made financial commitments to this initiative. <https://www.iaea.org/topics/iaea-low-enriched-uranium-bank>. Accessed on December 13, 2019.
 14. "Nuclear Power in the United Arab Emirates", updated in June 2019, *World Nuclear Association*, <https://www.world-nuclear.org/information-library/country-profiles/countries-t-z/united-arab-emirates.aspx>. Accessed on December 13, 2019.

approved the operating licence for this plant in February 2020.¹⁵ The Barakah Nuclear Power Plant's four APR1400 design nuclear reactors will supply up to 25 percent of UAE's electricity needs once fully operational. On the issue of nuclear waste management and disposal, the national system for storing and removal of the waste was developed in the UAE following the examples of the European Union nations. UAE's nuclear waste for disposal will be gathered and transported to South Korea.

CONCLUSION

The UAE is a nation in the West Asian region with adequate energy resources; however, it was unable to cope with sudden population growth, leading to high electricity consumption. Electricity was being generated chiefly by using natural gas. At the same time, the UAE became a net importer of natural gas, in order to fulfil its energy shortfall. In such a circumstance, nuclear energy can become the baseload—the permanent minimum load that a power supply system is required to deliver. Through this, there are chances that the UAE can cope with its growing demand and reduce its dependency on external sources for natural gas imports.

Also, the geographical location of the UAE on the Persian Gulf makes this nation extremely dependent on the Strait of Hormuz for its trade with the outside world. In this context, the narrow Strait of Hormuz is a risk factor for UAE. However, with the UAE developing both a nuclear power plant and alternative routes via Fujairah, it tries to reduce its vulnerability. Through this alternative source of energy, the UAE can reduce the risks for local electrical supply and hydrocarbon exports and re-exports. Also, through this, there is a signal for the other West Asian nations that the UAE is indulging in best practices in the areas of transparency and security. The UAE attaches great importance to this issue as a matter of national prestige, and thereby uses this opportunity to further consolidate its national image as a stable regional commercial hub.

15. Sami Zaatari, "Operating licence approved for Abu Dhabi's Barakah Nuclear Plant", Gulf News, February 17, 2020, <https://gulfnews.com/uae/operating-licence-approved-for-abu-dhabis-barakah-nuclear-plant-1.69761978>. Accessed on February 19, 2020.

It is believed that the UAE has gained from the experiences of previous nuclear accidents and has attached utmost importance to the safety and security of the nuclear power plants, inhabitants and the environment. The country also abides by international conventions and guidelines relating to nuclear reactors. At the same time, emerging as the new and developing provider of nuclear energy, the UAE creates an opportunity for other West Asian states to consider peaceful uses of nuclear energy, in a region that is ridden with turmoil, destruction and violence. At the same time, being the first nation in the region to be the provider of nuclear energy, it is necessary for the UAE to clearly assess the potential pitfalls and liabilities associated with this important and potentially hazardous activity. Around the world, all eyes of nuclear experts are fixed on the Barakah nuclear power plant to become a prominent example in order to convince governments around the world that nuclear energy has a lot to offer, including a reliable, safe and cost-effective way of producing electricity with low CO₂ emissions. With a majority of the population in the UAE being in favour of building and operating the nuclear power plant to satisfy its energy needs, it clearly indicates the Emirati population's willingness to adopt technology to overcome the challenges facing the nation. Through this, Abu Dhabi hopes that it will raise its status from a middle-level player in the region to be a regional leader, at the same time diversifying its economy away from hydrocarbons and adding the technological and engineering accomplishment of nuclear power generation to its commercial successes.

PAKISTAN'S CRUISE MISSILES

NASIMA KHATOON

INTRODUCTION

After the unveiling of the cruise missile in World War II in the form of the deadly V-1, further development of the missile, particularly in terms of required accuracy and range, was stalled for a few decades due to the limitation of technology at the time. Nevertheless, improvement of engine, propulsion and guidance systems of the cruise missile took place at a slow pace during the early Cold War period. By the 1980s, with the invention of the computer and improvement in propulsion technologies, guidance systems were developed to a significant level. As a result, both the US and Russia (then the Soviet Union) had developed many models of a diverse range of dual capable cruise missiles which could be launched from land, air or sea-based platforms. These missiles with precision strike capability and difficult to detect features posed a threat to the nuclear balance due to the uncertainty that their deployment could bring about; this escalated the nuclear arms race between the arch rivals—the US and the Soviet Union. Hence, during this period, several treaties and agreements such as the INF Treaty (1987) and the START Treaty were signed to prohibit and limit the use of ground launched (GLCM), air launched (ALCM) and sea launched (SLCM) cruise missiles. With these limitations, attention was paid to produce short range and less

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advanced versions of cruise missile systems, which were used later during many conflicts like the Falklands War, Operation 'Prairie Fire', etc. Since the last two decades, with the growing relevance of limited war, the requirement of high precision, advanced and integrated air defence systems to achieve air superiority against a superior force has led to advancement in cruise missile development to use as strategic and tactical weapon systems. The use of cruise missiles for precision strike role is the best option available to any state to subjugate its adversary with surprise and shock. The scope of this paper is to highlight the development of cruise missiles in Pakistan.

The rivalry between two nuclear power states in South Asia—India and Pakistan—has led to frequent missile developments and tests by these two adversaries. Pakistan sees India's superiority in conventional forces as the key driver behind the development of missiles for delivery of nuclear weapons. Recently, in the past one decade, Pakistan has been focused on developing cruise missiles as a response to India's indigenous development of Ballistic Missile Defence (BMD) systems. BMDs are not designed to target cruise missiles whose low altitude terrain hugging capability, manoeuvrability and stealth capability make them extremely difficult to be detected by radar and hence to be intercepted. Missile test data compiled by the James Martin Center for Non-proliferation Studies (CNS) shows that a growing proportion of missiles tested by Pakistan in recent years are cruise missiles. The number of test flights for cruise missiles, and the recent addition of new systems in its cruise missile inventory, hints at how important these systems are for Pakistan. It is reflective of the views in Pakistan that cruise missiles have a growing strategic role, most importantly in the context of developing a sea-based platform for its nuclear triad.

PAKISTAN'S CRUISE MISSILE DEVELOPMENT PROGRAMME

Pakistan's missile development programme commenced with the development of ballistic missiles. It is widely believed that both its ballistic and cruise missile programmes received foreign assistance. It tested Hatf-1 and Hatf-2 ballistic missiles in 1989, a year after India's Prithvi missile test; this was followed by a test flight of Hatf-3 missile in 1997, and the liquid fuelled Hatf-5 test in 1998. The missiles were

developed by Pakistan’s Space and Upper Atmosphere Research Commission (SUPARCO) and the controversial Khan Research Lab (KRL). Analysts observed that Pakistan took substantial technical assistance from China and North Korea to develop missile technology in exchange for nuclear secrets.¹ Subsequently, in August 2005, Pakistan carried out its first cruise missile test—the Babur (Hatf-7).

Presently, Pakistan has three types of cruise missiles: Ground Launched Cruise Missile (GLCM), the Babur (Hatf-7) and Babur-2/1(B); the Air Launched Cruise Missile (ALCM), the Ra’ad (Hatf-8) and Ra’ad-2; and the Submarine Launched Cruise Missile (SLCM), the Babur-3. Among these missiles, the Ground Launched Cruise Missile Babur-2/1(B), Submarine Launched Cruise Missile (SLCM) Babur-3 and Air Launched Cruise Missile Ra’ad-2 are under development, while some analysts claim that the GLCM Babur has been deployed in 2014 and Ra’ad (Hatf-8) might enter service shortly.²

Table 1: Pakistan’s Cruise Missile Arsenal

(Three types of cruise missiles with land, air and sea launch capabilities)

Missile	Type	Year tested	Remarks
Babur/Hatf-7	Turbojet-powered, subsonic, ground launched cruise missile (GLCM) Range: 500–700 km	First test: August 2005	It is designed to fly at low altitudes (terrain hugging capability) to avoid radar detection. The storage facility of Babur at the Arabian seaport of Ormara in Baluchistan province has recently been expanded massively.

1. Gordon Corera, “Shopping for Bombs: Nuclear Proliferation, Global Insecurity, and the Rise and Fall of the A. Q. Khan Network” (New York, USA: Oxford University Press, 2009).
2. Hans M. Kristensen, Robert S. Norris and Julia Diamond, “Pakistani nuclear forces, 2018”, *Bulletin of the Atomic Scientists*, 74:5, 348-58. Accessed on January 7, 2020.

Babur-2/1(B)	Ground launched cruise missile (GLCM) Range: 700 km	First test: December 14, 2016	An enhanced range version of Babur/Hatf-7. Under development.
Babur-3	Submarine-launched cruise missile (SLCM) Range: 450 km	First test: January 9, 2017	Most likely based on the American Harpoon missile. The missile range might be shorter (250 km) than the claimed range. Under development.
Ra'ad/Hatf-8	Turbojet powered, Subsonic Nuclear capable air launched Cruise Missile (ALCM) Range: 350 km	First test: August 2007	Terrain hugging high-precision missile with stealth capability. The missile has air delivered strategic stand-off capability on land and at sea.
Ra'ad-2	Nuclear capable air launched cruise missile (ALCM) Range: 600 km	First test: February 18, 2020	An enhanced range version of Ra'ad (Hatf-8) missile. Under development.

PAKISTAN'S CRUISE MISSILES

Babur. The development of the missile began in the 1990s, at a time when India's cruise missile programme was developing. Although the extent of foreign assistance to develop Babur (Hatf-7) remains unclear, it is widely believed by analysts that the missile was developed by reverse engineering of US Tomahawk cruise missile which had previously crash-landed in Pakistan in May 1998 and has significant design similarities with Babur missile.³ The missile

3. For a comparative technical analysis of Tomahawk and Babur missiles refer to Rajaram Nagappa and S. Chandrashekar, "An Assessment of Pakistan's Babur-HATF 7 Cruise Missile", *NIAS study-2007, R5-07*, <http://issp.in/wp-content/uploads/2013/04/An-Assessment-of-Pakistans-Babur-HATF-7-Cruise-Missile.pdf>. Accessed on January 10, 2020.

was developed by Pakistan's National Engineering and Scientific Commission (NESCOM).

The first test of the missile took place in August 2005. It is a subsonic, dual capable (i.e., capable of delivering conventional and nuclear warhead) and ground launched cruise missile. Initially, Pakistan claimed that the range of the missile is 500 km and that the missile has the most advanced and modern navigation and guidance systems which "enable it to penetrate undetected through any hostile defensive system"—an obvious reference to India's air and missile defence system.⁴ It was also stated that the missile could be launched from any platform, including surface ships, submarines and aircraft.⁵ This test came as a surprise to observers as the various stages of missile development went undetected. The range of the missile has been enhanced over the period of its development and the range varies from 500 to 700 km. In March 2007, the range was claimed as 700 km—200 km more than the first test. During the February 2011 test its range was mentioned as 600 km, and again in October 2011 it was upgraded to 700 km, although many analysts believe that the range is not more than 350 km.⁶ Since 2011, the missile has been test launched four times and presently it is believed to have been operationalised with Pakistan's armed forces.

Babur has a road-mobile launcher which appears to be a unique five-axle Transporter Erector Launcher (TEL) with a three-tube box launcher that is different from the quadruple box launcher used for its static display. Since October 2011, the missile was launched from a multitube missile launch vehicle (MLV) that reportedly "enhances targeting and deployment options in the conventional and nuclear mode."⁷ It was also claimed that "With its shoot-and-scoot capability,

4. "Pakistan test fires nuclear-capable cruise missile", *The New York Times*, August 11, 2005, <https://www.nytimes.com/2005/08/11/world/asia/pakistan-test-fires-nuclearcapable-cruise-missile.html>. Accessed on February 5, 2020.

Arshad Sharif, "Pakistan test-fires its first cruise missile", *Dawn*, August 12, 2005, <https://www.dawn.com/news/152009/pakistan-test-fires-its-first-cruise-missile>. Accessed on February 15, 2020.

5. *Ibid.*

6. Hans M. Kristensen, Robert S. Norris and Julia Diamond, "Pakistani nuclear forces, 2018," *Bulletin of the Atomic Scientists*, 74:5, 348-58, DOI: 10.1080/00963402.2018.1507796. Accessed on February 8, 2020.

7. ISPR report No. PR-256/2011-ISPR, October 28, 2011 at <https://www.ispr.gov.pk/press-release-detail.php?id=1889>. Accessed on February 9, 2020.

the MLV provides a major force multiplier effect for target employment and survivability.” Babur TELs are being fitted at National Defence Complex of Pakistan, but recent reports have claimed it to be seen at Arko garrison, northeast of Karachi, which indicates the missiles are probably being stored at the same place at an underground facility. The Babur has a Turbojet powered engine, capable of carrying a single warhead of 400-500 kg. The missile’s length and diameter are estimated to be 6.2 m and 0.52 m respectively.⁸

The guidance and navigation system is one of the most important parts of a cruise missile system; this was the most serious technological hurdle during its initial phase of development. According to an ISPR press release, Babur missile “incorporates the most modern cruise missile technology of Terrain Contour Matching (TERCOM) and Digital Scene Matching and Area Co-relation (DSMAC).”⁹ Terrain-contour-matching (TERCOM) is a missile guidance system in which a map stored in the missile’s computer is continuously compared with the actual terrain to locate the missile’s position relative to the target. The radar altimeter measures altitude above the terrain presently beneath the missile and provides a coarse means of detecting surface features by their height, which can then be compared with stored data concerning expected land contours along the missile flight path. The missile guidance system contains expected land elevation values to the left and right of the missile’s intended ground track. The guidance system ensures that the missile is located at a position where the stored data most closely matches the observed altitudes.

Once the direction of turn and the distance required to correct the error have been determined, the missile turns to resume the intended track. This method is called Terrain Contour Matching or TERCOM. Even the most capable TERCOM system has insufficient memory to perform contour matching throughout a flight path of several hundred miles. Therefore, the missile is provided with a series of small areas known as TERCOM maps along the route to the target. The number of TERCOM maps and their separation is determined by the quality

8. “Hatf 7 (Babur)”, in *IHS Jane’s Weapons: Strategic 2015-2016*, ed. James C. O’Halloran (United Kingdom: IHS, 2015).

9. ISPR report No. PR-256/2011-ISPR, October 28, 2011, <https://www.ispr.gov.pk/press-release-detail.php?id=1889>. Accessed on February 24, 2020.

of information available on the area and the accuracy of the missile's inertial navigation system. Sufficient data is available from various sources to support TERCOM such that aerial reconnaissance of most of the target areas is not required prior to the engagement. TERCOM has sufficient accuracy to find, for example, a large military base within a region; however, it could not provide the accuracy to hit a specific section of that base, such as a group of hangars at an airfield.

The precision required by a cruise missile to hit a target can only be provided by some form of optical device in the terminal stage of flight. A cruise missile flies at altitudes and ranges that would prevent transmission of images back to the launch point. Advances in digitalised imagery permit computer storage of grey-shaded scenes in the vicinity of the target. The digitalised scene can be compared to data from a television camera in the missile and values of grey shading matched to determine actual position relative to desired position. The missile can correct its flight path to that desired and even finally pick out its target. This method, called Digital Scene Matching Area Correlator or DSMAC, is sufficiently accurate to permit the use of a conventional high-explosive warhead. The DSMAC technique would be used only for the last few miles to the target, with the TERCOM method being used for the majority of the flight path. Both methods are limited by the accuracy of information used to create the digital TERCOM maps and DSMAC scenes that are loaded in the missile's memory.¹⁰ Building and formatting these data files for cruise missiles requires considerable support facilities. Since the TERCOM system scans the terrain, this system is responsible for a cruise missile's "terrain hugging" feature, which makes it difficult for radars to locate and intercept a cruise missile.

An enhanced range version of Babur missile known as Babur-1(B) or Babur-2 is under development phase.¹¹ It was test launched twice in December 2016 and April 2018. As the range of both Babur and "enhanced range version" Babur-1(B) are reported as 700 km, it

10. "Guidance and Control" in *Fundamentals of Naval Weapons Systems*, Weapons and Systems Engineering Department, United States Naval Academy, <https://fas.org/man/dod-101/navy/docs/fun/part15.htm>. Accessed on January 15, 2020.

11. ISPR report No. PR-482/2016-ISPR, December 14, 2016, <https://www.ispr.gov.pk/press-release-detail.php?id=3632>. Accessed on January 17, 2020.

can be estimated that the range of the initial system might be shorter than the stated range (700 km). A recent report has speculated that Pakistan's nuclear storage facility at the Arabian Sea port of Ormara has undergone massive expansion; it is believed that the facility is used to store Babur missile system.¹² According to the report a recent satellite image has shown that the facility has expanded from an initial size of 425 acres in 2018 to almost 1,000 acres post 2018. As per an official statement, the Babur-1(B) weapon system has "advanced aerodynamics and avionics that can strike targets both at land and sea."¹³ The Babur-1(B) system with almost the same features and advanced capability might replace the relatively older version—Babur (Hatf-7).

Ra'ad (Hatf-8). The Air launched cruise missile (ALCM) Ra'ad (Hatf-8) is being developed by Pakistan and it was test launched for the first time on August 25, 2007. The 4.85 metre-long missile has a stated range of 350 km. It has been flight tested four times since 2011 from Mirage III combat aircraft, although some reports indicate that the missile might have been integrated with JF-17 aircraft.¹⁴ Ra'ad is claimed to have low altitude terrain hugging capability with high manoeuvrability, which enable it to avoid detection by missile defence systems. The missile system is claimed to have enabled Pakistan to achieve air delivered strategic stand-off capability on land and at sea.¹⁵ While during the latest test of the missile in January 2016 it was mentioned by ISPR that the missile system is equipped with advanced navigation and guidance system, no particular information regarding the type of the guidance system has been stated yet.

The ISPR press reports no. PR-204/2012 and no. PR-16/2016 stated both the Babur and Ra'ad missile systems are "low altitude terrain hugging missiles with high manoeuvrability" with "pin point

12. Col. Vinayak Bhat (Retd.), "Pakistan Navy's nuke storage facility at Arabian Sea port of Ormara sees massive expansion", *The Print*, December 3, 2019, <https://theprint.in/defence/pakistan-navys-nuke-storage-facility-at-arabian-sea-port-of-ormara-sees-massive-expansion/329370/>. Accessed on January 13, 2020.

13. ISPR report No. PR-482/2016-ISPR, December 14, 2016, <https://www.ispr.gov.pk/press-release-detail.php?id=3632>. Accessed on January 17, 2020.

14. *SIPRI Yearbook 2018: Armaments, Disarmament and International Security*, p. 277, <https://www.sipri.org/sites/default/files/SIPRIYB18c06.pdf>. Accessed on January 21, 2020.

15. ISPR report No. PR-135/2012-ISPR, May 31, 2012, <https://www.ispr.gov.pk/press-release-detail.php?id=2080>. Accessed on January 25, 2020.

accuracy” and “stealth capability”. The ALCM Ra’ad’s air delivered strategic stand-off capability makes it a unique system. The Ra’ad missile series bears resemblance to several South African stand-off missiles, including the MUPSOW cruise missile and Torgos long-range guided weapon.¹⁶

In its 2017 military parade, Pakistan displayed the Ra’ad-2 ALCM for the first time. The range of the missile was initially claimed as 550 km.¹⁷ The missile system was tested for the first time in February 2020 with a stated range of 600 km which “significantly enhances air delivered strategic standoff capability on land and at sea.”¹⁸ Pakistan’s need to develop longer range cruise missiles with terrain hugging capability and high accuracy to avoid detection might be driven by India’s modernisation of its air defence system by procuring systems such as S-400. Some reports suggest that the Ra’ad-2 missile system might have undergone significant design changes to make it suitable to integrate with other aircraft, for instance JF-17.¹⁹ Similarly, in 2017 the Pakistan Aeronautical Complex, which manufactures JF-17 combat aircraft, mentioned about integration of stand-off weapon with JF-17. This makes the possibility of using JF-17 for Ra’ad missile launch even stronger in future. Both the Babur and the Ra’ad missile systems are structurally much smaller and slimmer than Pakistan’s ballistic missile systems. This might be an indicator of Pakistan’s capability of warhead miniaturisation based on plutonium instead of uranium.

Babur-3. In order to build a secure second-strike capability and complete nuclear triad, Pakistan is developing the Submarine Launched Cruise Missile (SLCM) Babur-3 with a range of 450 km,

16. Franz-Stefan Gady, “Pakistan Test Launches Ra’ad II Nuclear-Capable Air-Launched Cruise Missile”, *The Diplomat*, February 19, 2020, <https://thediplomat.com/2020/02/pakistan-test-launches-raad-ii-nuclear-capable-air-launched-cruise-missile/>. Accessed on February 19, 2020.

17. Bilal Khan, “Pakistan Officially Unveils Extended Range Ra’ad 2 Air-Launched Cruise Missile.” *Quwa Defence News & Analysis Group*. March 23, 2017, <https://quwa.org/2017/03/23/pakistan-officially-unveils-extended-rangeraad-2-air-launched-cruise-missile/>. Accessed on February 19, 2020.

18. ISPR report No. PR-27/2020-ISPR, February 18, 2020, <https://www.ispr.gov.pk/press-release-detail.php?id=5625>. Accessed on February 19, 2020.

19. Hans M. Kristensen, Robert S. Norris and Julia Diamond, “Pakistani nuclear forces, 2018,” *Bulletin of the Atomic Scientists*, 74:5, 348-58.

which is a sea-based variant of the GLCM Babur-2 missile.²⁰ The first test of the missile was conducted in January 2017 from an undisclosed location in the Indian Ocean. The missile is under development and was tested twice in January 2017 and March 2018. According to the Inter-Services Public Relations (ISPR) of the Pakistani military, the missile is also capable of carrying various types of payloads and it will provide Pakistan with a credible second-strike capability. During the March 2018 test the missile was launched from “an underwater dynamic platform”²¹ and some studies predict that the missile was most likely launched from the diesel-electric Agosta-90B (Khalid class) submarine in service with the Pakistan Navy.²² The missile is claimed to have an advanced guidance and navigation system and underwater controlled propulsion, as well as sea-skimming flight capabilities and stealth technology.²³ ISPR press release further claimed that successful development of SLCM Babur-3 will enable Pakistan to build its nuclear triad and therefore Pakistan will have land, air and sea-based nuclear strike capability; although in the absence of a nuclear propelled submarine the potential of the SLCM might not be fully realised.

CONCLUSION

In recent years Pakistan has made significant strides in its cruise missile development programme. Three new variants of Pakistan's cruise missiles—Babur-3, Ra'ad-2 and Babur-2/1(B) have been tested in less than five years' time (Table 1). At the same time significant advancement in missile technology has taken place. Apart from existing technology, this time period has witnessed emergence of technologies like advanced guidance and control system, submarine launched cruise missile capability and air launched strategic stand-off capability. Similarly, the February 2020 test of Ra'ad-2 missile

20. ISPR report No. PR-10/2017-ISPR, January 9, 2017, <https://www.ispr.gov.pk/press-release-detail.php?id=3672>. Accessed on February 19, 2020.

21. ISPR report No. PR-125/2018-ISPR, March 29, 2018, <https://www.ispr.gov.pk/press-release-detail.php?id=4660>. Accessed on January 21, 2020.

22. Rajaram Nagappa, et al., “Babur-3—Pakistan's SLCM: Capability and Limitations”, *Air Power Journal*, vol. 13, no. 3, Monsoon 2018 (July-September).

23. ISPR report No. PR-10/2017-ISPR, January 9, 2017, <https://www.ispr.gov.pk/press-release-detail.php?id=3672>. Accessed on February 19, 2020.

has given rise to the speculation that the missile's airframe has been modified to make it fit for delivery from a diverse range of combat aircraft, including the JF-17 fighter. Till date, Ra'ad-2 has been launched from Mirage-III combat aircraft only.

In view of the present scenario and existing tensions between India and Pakistan, it is likely that Pakistan's nuclear missile development programme will continue to expand in the near future. Missile systems like the Submarine Launched Cruise Missile Babur-3 and Air Launched Cruise Missile system—Ra'ad—are likely to undergo extensive development besides advancement of delivery systems and launch platforms.

ASSESSING ANTI-NUCLEAR DEBATES

ZOYA AKHTER FATHIMA

INTRODUCTION

In 1998, the *Nucleonics Week* remarked “nuclear needs climate change more than climate change needs nuclear.”¹ Similarly, there have been many indictments against nuclear energy such as, it is an economically unviable, dangerous form of technology. The Fukushima nuclear disaster of 2011 aggravated concerns of nuclear safety. Recently, on December 31, 2019 the Philippsburg 2 pressurised water reactor unit in Germany was permanently shut down. This was done as a part of Germany’s nuclear phase-out policy which was formulated in reaction to the Fukushima accident, fearing the threat of a nuclear accident. Germany was not the only country to react so strongly to the Fukushima accident. Post-Fukushima, support for nuclear power wilted. The IAEA’s annual report of 2015 revealed that the number of countries that had showed interest in starting nuclear programmes in 2010 had fallen by fifty percent in 2015!²

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1. David Elliott (ed.), *Nuclear or Not? Does Nuclear Power Have a Place in a Sustainable Energy Future?* (England: Palgrave Macmillan, 2007), p. 4.
2. Manpreet Sethi, “The Asian Nuclear Power Landscape: A Contemporary Examination”, *Asian Strategic Review 2017: Energy Security in Times of Uncertainty* (New Delhi: Pentagon Press, 2018), p. 119.

However, currently, the global energy deficit and climate change crisis is such that the nuclear energy industry is witnessing resurgence after the hiatus post-Fukushima. Projections of nuclear energy development appear to be optimistic, and a “nuclear renaissance” appears to be imminent. While several countries in the West are phasing out nuclear energy, numerous countries in Asia, Africa and West Asia are in the process of developing their civil nuclear programmes. Thus, the current global scenario has once again put nuclear energy in the forefront of energy debates. However, concerns about nuclear safety still loom large and public opinion about nuclear energy is clouded by scepticism and fear.

Concerns regarding nuclear power are not completely unfounded. But the judgements passed on it require a more in-depth examination. In this regard, the paper analyses the various criticisms pitched against nuclear energy and examines if these arguments hold any merit.

COMMON ISSUES PERCEIVED AGAINST NUCLEAR ENERGY

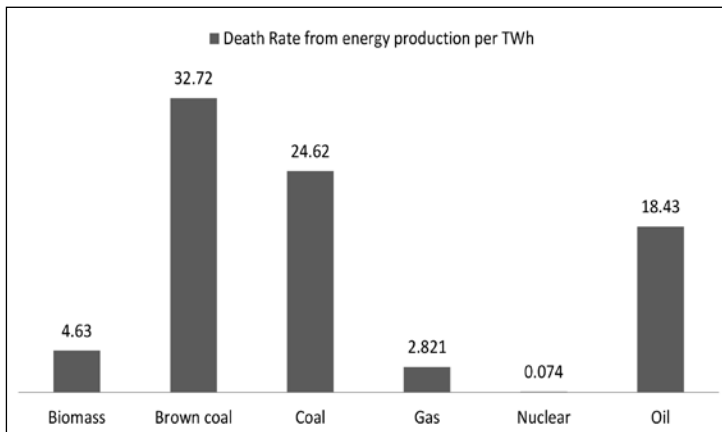
Perceptions of Nuclear Safety

No energy mishap in the world has received as much attention from the media and from people around the world as nuclear accidents have. Among the energy generating technologies nuclear energy in popular perception is considered risky. But contrary to popular belief, nuclear energy is a safer form of energy in comparison to other electricity producing technologies. It is interesting to note that among all energy fatalities in the world, nuclear energy accidents have resulted in the least number of casualties. The following illustration gives a well-defined picture of the fatal casualties caused because of air pollution and accidents due to energy production.

Coal is the most prevalent (contributing to 41.1 percent of global electricity share by fuel source, as of 2014)³ and evidently also the most dangerous form of energy production. Nuclear energy, (which contributes to 10.78 percent of global electricity share by fuel

3. “Electricity Share by Fuel Source, World”, *Our World in Data*, <https://ourworldindata.org/grapher/world-electricity-by-source>. Accessed on March 21, 2020.

Death Rate from Energy Production per TWh



Source: Our World in Data.⁴

source as of 2014),⁵ on the other hand, is marked as a comparatively safer form of energy. The burning of fossil fuels and biomass in itself causes over three million deaths annually.⁶ The coal industry is the most dangerous energy occupation as is evident across the many coal related accidents in history including the explosion at Benxi Colliery and the great smog of London among others. It is recorded to have killed more than 1,00,000 miners in the past century in the United States alone!⁷ Hydroelectric accidents have also resulted in a large number of casualties as in the case of the Banqiao Dam accident in China which resulted in the death of about 2,30,000 people.⁸ This is one of the many catastrophic energy fatalities related to hydroelectric power generation. Pipeline, oil

4. "Death rates from energy production per TWh", *Our World in Data*, <https://ourworldindata.org/grapher/death-rates-from-energy-production-per-twh>. Accessed on December 2, 2019.
5. Ibid.
6. Arati Halbe and Spoorthy Raman, "Wiping off fossil fuels could save 3.6 million lives". *Research Matters*. March 26, 2019, <https://researchmatters.in/news/wiping-fossil-fuels-could-save-36-million-lives>. Accessed on August 18, 2019.
7. "Coal Mining Steeped in History", ABC News, January 5, 2006, <https://abcnews.go.com/Primetime/Mine/story?id=1475697>. Accessed on September 3, 2019.
8. Justin Higginbottom, "Banqiao dam accident in China which resulted in the death of about 250,000 people". *Ozy*. February 17, 2019, <https://www.ozy.com/flashback/230000-died-in-a-dam-collapse-that-china-kept-secret-for-years/91699>. Accessed on September 11, 2019.

rigs and gas explosions too have resulted in extensive loss of lives. In fact, if anything, one may even go as far as to say that nuclear energy has helped in preventing deaths. A study undertaken by *Goddard Institute for Space Studies* and *Columbia University* reveals that about 1.8 million deaths which would have been caused due to air pollution since 2009 were avoided by the replacement of coal plants by nuclear power plants.⁹

There have also been apprehensions with regard to nuclear facilities being unable to withstand natural calamities. These obvious risks are well acknowledged by authorities and several stringent systems have been put in place to prevent damage in case of a disaster. Radiation leakage, for example, was well contained during the Fukushima accident. More recently, Hurricane Harvey in Texas and Hurricane Dorian are examples of how nuclear power plants can withstand natural calamities. In fact, in the case of Hurricane Harvey, many power facilities were severely impacted, except for the nuclear facility. Considered to be the “most costly” natural disaster in America, power generation through wind and solar energy was disrupted, several refineries were closed.¹⁰ The nuclear power plants there, however, functioned well. These nuclear power plants are designed in such a way that they can brave storms and hurricanes. It is even said to be able to resist an airplane flying into it.¹¹

Despite the fact that other energy disasters have had more grave and fatal outcomes, it is nuclear energy that has been perceived by the majority as a dangerous form of technology. The nuclear scare in this regard has been exaggerated. For a seven decades old industry, there have been only three nuclear accidents, out of which only one resulted in casualties. This is not to downplay the graveness of the Chernobyl accident, but to point out the comparatively safer track record of the nuclear industry vis-à-vis other forms of electricity generating technologies. It is also important to take note that the

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9. “Nuclear Power Has Prevented 1.84 Million Premature Deaths, Study Says”, *Yale Environment* 360, May 30, 2013, https://e360.yale.edu/digest/nuclear_power_has_prevented_184_million_premature_deaths_study_says. Accessed on July 4, 2019.
 10. James Conca, “Hurricane Harvey Makes the Case for Nuclear Power”, *Forbes*, September 1, 2017, <https://www.forbes.com/sites/jamesconca/2017/09/01/hurricane-harvey-makes-the-case-for-nuclear-power/#1c50af43625f>. Accessed on October 15, 2019.
 11. *Ibid.*

Chernobyl accident is more reflective of the maladministration in Soviet Russia rather than just the dangers of nuclear energy.

Disposal of Nuclear Waste

Safe disposal of nuclear waste is often considered to be a weak link in nuclear technology. What isn't commonly known is that nuclear energy is not the only source that discharges dangerous wastes. Many industrial wastes such as mercury and cadmium are also highly dangerous and remain hazardous for undetermined periods of time. In comparison, nuclear wastes have a finite radiotoxic lifetime and can be managed effectively.¹² Jonathan Lesser, the president of Continental Economics, a consulting firm, describes the problem to be a political issue rather than a technical one. This is true as safe disposal of nuclear waste has proven to be technologically feasible. Nuclear wastes are largely classified into three types based on the level of radiation and the way they are treated and disposed: low level wastes (LLW), intermediate level wastes (ILW) and high level wastes (HLW). Most nuclear wastes are of low or intermediate level. In fact about 97 percent of nuclear wastes are graded as LLWs and ILWs.¹³ However, HLWs contribute to 95 percent of all radioactivity from nuclear power.¹⁴

LLWs are mildly contaminated wastes and comprise items such as contaminated protective clothes and protective gear, cleaning materials, etc., which are flecked with radioactive particles. Nuclear wastes have a definite radiotoxic lifetime and are known to decay naturally. LLWs take a few decades to decay and are disposed at near-surface repositories. Stringent regulations make sure that these items never come in contact with the external environment.¹⁵ They are usually incarcerated before they are buried. ILWs such as steel

12. Except Plutonium 239 which has a half-life of 24,000 years and is considered a 'High Level Waste' whose disposal has to be carried out methodically by countries from their nuclear plants.

13. "Radioactive Waste—Myths and Realities". World Nuclear.org, <https://www.world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-wastes/radioactive-wastes-myths-and-realities.aspx>. Accessed on September 30, 2019.

14. "What are nuclear wastes and how are they managed?", World Nuclear.org, <https://www.world-nuclear.org/nuclear-basics/what-are-nuclear-wastes.aspx>. Accessed on September 29, 2019.

15. n. 12.

components from the reactors, reprocessing discharges, etc., contain more radioactive wastes than LCWs.¹⁶ They are usually shielded before being disposed. HLWs are highly radioactive waste materials such as the uranium spent fuel. The radioactivity in HLWs degenerates from an average period ranging from one thousand to ten thousand years or more (based on the level of concentration) to the same ore state that it was originally mined from. Currently, interim storage facilities are used to contain the spent fuel before its final stage of disposal. The spent nuclear fuel is very hot and harmful and hence requires cooling and shielding, both provided by water. Once the fuel is removed from the reactor underwater, it is then moved to a storage pool. After a couple of years (or indefinitely, depending on the waste), it is shifted to dry ventilated concrete containers. Final stage of disposal is envisaged deep geological repositories. This form of disposal has achieved consensus about being safe and ecologically sound.

Several countries such as India, Japan, China and France even reprocess the spent fuels which have several benefits. Reprocessing enables retrieval of uranium and plutonium up to almost 97 percent (96 percent of uranium and 1 percent plutonium). This not only helps to avoid wasting of such valuable resources which can be further recycled into new fuels, but also reduces the volume of high level wastes to just 3 percent.¹⁷ At present there are no permanent, deep underground facilities to store nuclear wastes. Safe and permanent underground repositories are being designed currently. Countries like Finland and Sweden have reached an advanced stage in this regard and are close to operationalising them soon. As the advancement of nuclear technology is rapidly developing, newer options to manage nuclear wastes are also emerging. In 2006 Bill Gates founded a company called "Terrapower" which builds travelling wave reactors (TWR) which use depleted uranium as fuel.¹⁸ The new technology

16. n. 13.

17. "Processing of Used Nuclear Fuel", World Nuclear.org, <https://www.world-nuclear.org/information-library/nuclear-fuel-cycle/fuel-recycling/processing-of-used-nuclear-fuel.aspx>. Accessed on November 10, 2019, <https://www.world-nuclear.org/information-library/nuclear-fuel-cycle/fuel-recycling/processing-of-used-nuclear-fuel.aspx>

18. Alan Boyle, "Inside the lab where Bill Gates' TerraPower is inventing the future of nuclear energy", *Geekwire*, August 11, 2019, <https://www.geekwire.com/2019/inside-terrapower-nuclear-lab/>. Accessed on October 3, 2019.

seems very promising but is in a deadlock currently because of the United States trade wars with China, with whom Terrapower had signed an agreement to build prototype of Travelling Wave advanced reactors. Thus, future technologies are also promising better ways of handling nuclear wastes.

Proliferation Concerns

Another common concern about nuclear energy is that a civil nuclear programme could also enable a nuclear weaponisation programme. At a surface level this may seem possible since nuclear technology has dual-use applicability. However, it is not as simple. To begin with, the safeguard system placed on civil nuclear programmes by global regulatory agencies is extremely strict and thoroughly implemented and thus is not easy to violate. Several global initiatives, international institutions and treaties have been set up to prevent, limit or detect proliferation of nuclear weapons. The primary treaty that prevents proliferation is the Nuclear Non-proliferation Treaty (NPT). Signed by 189 countries (plus Taiwan), the NPT aims to achieve eventual denuclearisation of nuclear weapons. The NPT works along with the International Atomic Energy Agency (IAEA), which was set up in 1956 to promote nuclear energy for peaceful purposes, to facilitate checks and safeguards. The IAEA conducts frequent inspections of civil nuclear facilities, verifies records, audits, examines inventories, does sampling of nuclear materials, etc., to ensure that there has been no diversion of nuclear materials from the civil nuclear programme to a nuclear weapons programme. In addition, materials required to build nuclear weapons are also strictly controlled under institutions such as the Nuclear Suppliers Group (NSG) which regulates the export of sensitive nuclear technology, and the Zangger Committee, which prevents the proliferation of nuclear materials from peaceful use of nuclear programmes to weaponisation programmes. Thus, any attempt to build a weapon is unlikely to go unnoticed.

These safeguards are supported by diplomatic and economic processes in the form of international sanctions, economic blockades, etc., which coalesce to be a major deterrent to develop a nuclear weapons programme. This is evident from the fact that none of the

countries that have developed civil nuclear programmes have built nuclear weapons, e.g., Belgium, Sweden, Canada, Japan, Spain, the Netherlands, Switzerland, Bulgaria, Austria, Poland, Romania, among others. Nicholas L. Miller's work titled "*Why Nuclear Energy Programs Rarely Lead to Proliferation*" validates this argument where he states that although political obstacles may not render it to be absolutely impossible to develop a nuclear weapons programme, it certainly does make it likely to be detected.¹⁹ In this regard Fred McGolrick, who has held high-ranking positions at the Energy and State departments and the US Mission to the IAEA, opines that most of the states that gained a nuclear weapons arsenal did so "primarily through dedicated stance from nuclear-weapon states," and not through civil nuclear energy programmes.²⁰

Many innovative mechanisms have also been developing to prevent proliferation. For example, the nuclear fuel banks, which maintain reserves of low enriched uranium (LEU). In 2017, the first low enriched uranium bank was opened in Kazakhstan. The mandate of this bank is to supply low enriched uranium to countries that are developing civil nuclear capabilities.²¹ This would not only help in lowering the costs for the recipient countries but would also minimise the risk of proliferation of nuclear weapons through their civil nuclear programmes.

High Cost of Nuclear Power Production

Nuclear energy is deemed to be an expensive form of energy production in comparison to other forms of energy. Studying the economics behind each of these energy resources to make a comparative assessment is not an easy task, since it requires factoring in many aspects such as the cost of construction, operation, installation, fuels, transportation, storage, back-up and decommissioning among many others. In addition, there also exist certain variables such as

19. Nicholas L. Miller, "Why Nuclear Energy Programs Rarely Lead to Proliferation", *Mitpressjournals.org*, https://www.mitpressjournals.org/doi/pdf/10.1162/ISEC_a_00293. Accessed on September 29, 2019.

20. *Ibid.*

21. Dave Kovaleski, "IAEA opens new low enriched uranium 'bank' in Kazakhstan", *Homeland Preparedness News*, October 21, 2019, <https://homelandprepnews.com/stories/38258-iaea-opens-new-low-enriched-uranium-bank-in-kazakhstan/>. Accessed on October 22, 2019.

subsidies which could differ from country to country. In recent times, assessment of economics of renewable energy have also included discussions on social costs such as rehabilitation of people in case of their displacement for plant siting. It also takes into account external factors such as environmental and ecological problems. For example, concerns about birds changing their migration patterns and the death of bats due to large-scale harnessing of wind energy is difficult to assess. In addition, there have been more recent realisations about the problem of dumping solar wastes at the end of their life. Since solar panels are made of hazardous elements such as cadmium and lead, these pose a risk to the environment. Rainfall could help in washing cadmium out of solar components, which tends to be a major environmental problem.²² Apart from cost to environment, the challenges to making an economic comparison of various energy production technologies would also include cost to health, to assess the number of people who have suffered from medical issues such as hearing troubles (including hearing loss) due to wind energy, air pollution related deaths due to fossil fuel industry and cancer related deaths due to nuclear energy, among others. This would also include the amount of money each country spends to mitigate these problems. These issues are important for a better assessment, but are usually not factored in. Thus, a complete economic comparison is not possible.

Mykle Schneider, founding Board Member and spokesperson of the International Energy Advisory Council (IEAC) with regard to the economics of nuclear power, states, "Nuclear energy went from the myth of 'too cheap to meter' to 'too expensive to matter'." So the first major barrier is very unfavourable economics. It is difficult, today, to build a new nuclear reactor under market economy rules. The second problem is that it has a high gestation period when compared to other energy resources. The third issue arises from the combined effects of the two factors described above: new-build nuclear is too expensive and too slow to represent a tool to combat climate change. In fact, *new* photovoltaic technology employing solar energy is now

22. Michael Shellenberger, "If Solar Panels Are So Clean, Why Do They Produce So Much Toxic Waste?", *Forbes*, May 23, 2018, <https://www.forbes.com/sites/michaelshellenberger/2018/05/23/if-solar-panels-are-so-clean-why-do-they-produce-so-much-toxic-waste/#2862f940121c>. Accessed on September 20, 2019.

competitive in India with *existing* coal, forget about new nuclear. In reality, in some countries like the US, new wind or solar *plus storage* is now getting competitive with *average* nuclear operating and maintenance (O&M) costs."²³

However, considering all the benefits of nuclear energy, high cost is a small price to pay to avoid the dire consequences of climate change. In addition, as nuclear technology has been developing at a rapid pace, it is estimated to become economically viable very soon. This should not be challenging considering its high fuel density and high capacity factor. Owing to advances in technology and liberalisation of markets, the performance of the reactors too has advanced, with most of the reactors operating at 90 percent of their capacity.²⁴ The extension of operating licences too have increased, which makes it more economical. Newer technologies in the nuclear energy field, such as the case of small module reactors (SMR), make smaller sized reactors possible, at a cheaper price.²⁵ This has generated a lot of interest in other countries. One other advancement in nuclear technology is the Scalable Liquid Metal-cooled small modular reactor, also known as the SLIMM. SLIMM has benefits such as, it is economical, has advanced safety features which prevents meltdowns, has greater security features owing to low refuelling requirements, and has the advantage of mobility since it can be deployed on portable platforms.²⁶

Even if nuclear energy is less economical than other forms of renewable energy, it is a small price to pay to avoid the disastrous effects of climate change. Thus, the issue of high costs does not stand up to scrutiny.

23. Email interview with Mycle Schneider dated October 29, 2019.

24. n. 1, p. 199.

25. Jonathan Lesser, "Can Nuclear Power Be Saved?", *National Review*, August 14, 2019, <https://www.nationalreview.com/2019/08/nuclear-power-clean-reliable-energy-us-should-embrace/>. Accessed on September 13, 2019.

26. James Conca, "A Very Fast, Very Safe, Very SLIMM Nuclear Reactor", *Forbes*, August 31, 2019, <https://www.forbes.com/sites/jamesconca/2019/08/31/a-very-fast-very-safe-very-sllim-nuclear-reactor/#4144f3cc2c5c>. <https://www.forbes.com/sites/jamesconca/2019/08/31/a-very-fast-very-safe-very-sllim-nuclear-reactor/#2fc34be2c5cf>. Accessed on October 5, 2019.

CONCLUSION

When it comes to electricity generating technologies there is no silver bullet that is free from imperfections. For example, natural gas may be the cleanest burning hydrocarbon, but it also faces the problem of methane leakages; solar energy is effective, but the disposal of solar panels is a hazardous problem that is yet to be satisfactorily resolved. Similarly, nuclear energy is efficient, but also has its own shortcomings. However, the criticisms pitched against it appear to be exaggerated. In addition, the benefits of nuclear energy appear to far outweigh its challenges. Nuclear energy is an efficient technology with enhanced safety features, high fuel density and high capacity factor, in addition to its attribute of producing emission-free electricity. It also does not require storage or back-up like in the case of intermittent energy sources and even ensures grid reliability. All these factors make nuclear energy capable of meaningfully contributing towards a greener and a more sustainable future.

The challenges to nuclear energy are summarised aptly by Stephen W. Kidd who says, "Each of the main arguments used against nuclear, such as safety, waste management, risks of proliferation and economics have been rebutted as far as possible, yet, the general anti-nuclear sentiment has been very hard to shift ... if the industry's case is so strong why has it not been more successful at rebutting its opponents? There are four main reasons: poor communications, the sheer number (if not quality) of arguments utilised against it, the deep emotional currents that often swamp consideration of the facts in people's minds, and finally the changes in the political process in key countries ..."²⁷

The energy revolution that is urgently needed is only possible with a realistic energy strategy. And any sound strategy in this regard is not complete without nuclear energy. This is because, although other forms of renewable energy such as hydro, wind, and solar energy are remarkable, their limitations do not qualify them to achieve the decarbonisation goals all on their own. Intermittent sources of energy not only require back-up and storage, but their capacity is also determined by variable factors such as the climate. Thus, a diverse and a mixed approach is needed. The need for energy

27. n. 1. p. 77.

diversity was demonstrated during the polar vortex in 2014. When coal and natural gas couldn't deliver effectively then, nuclear and wind energy made up for it.²⁸ Thus, nuclear energy should be an important component of the policy response to the threat of global warming and a vital component of an effective mixed energy basket.

28. James Conca, "Polar Vortex—Nuclear Saves The Day", *Forbes*, January 12, 2014, <https://www.forbes.com/sites/jamesconca/2014/01/12/polar-vortex-nuclear-saves-the-day/#1971650f6b08>. Accessed on October 20, 2019.

THE BAN TREATY: TREATY ON THE PROHIBITION OF NUCLEAR WEAPONS (TPNW)

SREOSHI SINHA

INTRODUCTION

Negotiations to draft a “legally binding instrument to prohibit nuclear weapons” were initiated at the United Nations on March 27, 2017. After a series of such negotiations, the legal instrument finally took shape on July 7, 2017, in the form of the “Treaty on the Prohibition of Nuclear Weapons (TPNW)”, colloquially known as the “Nuclear Weapons Ban Treaty”. As far as the voting is concerned, 122 countries at the UN voted in approval of the text of the proposed international treaty, while the Netherlands opted to vote against it; Singapore abstained from voting. According to its provisions, the treaty was officially opened for signature in September of the same year. For the treaty to become a legally binding instrument, 50 countries needed to ratify it within a span of 90 days and only after the 50th country submits its certification would the treaty enter into force.¹

This treaty, which took almost 73 years to come into existence—after the nuclear attacks on “Hiroshima and Nagasaki” in 1945—

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1. *The Guardian*, “Treaty banning nuclear weapons approved at UN: Supporters hail step towards nuclear free world”, July 7, 2017.

prohibits the “possession, deployment testing, exchange, stockpiling, and manufacturing of nuclear weapons.”²

Keeping in mind the significance of this multilateral treaty in absolute nuclear disarmament—as a part of a humanitarian initiative—this chapter analyses the emergence of this treaty, the prospects and possibilities for its implementation, the challenges associated with its entry into force, the role of both civil society and governments, and the treaty’s wider implications in addressing regional and global nuclear threats.

GENESIS

Birth of the Humanitarian Initiative

“The Humanitarian Initiative is a group of states that evolved within the framework of the Nuclear Non-Proliferation Treaty (NPT) and nuclear weapons diplomacy more widely. 159 states subscribed to the last iteration of the initiative’s Joint Statement in 2015. Since 2013, it led to a series of conferences exploring the Humanitarian Impact of Nuclear Weapons, culminating in the Humanitarian Pledge, issued by the Austrian Government, to fill the legal gap for the prohibition and elimination of nuclear weapons.”³ As of June 1, 2015 this Pledge has been approved by 108 governments. The Humanitarian Initiative is seen as a direct answer to the lack of progress in nuclear disarmament.⁴

The NPT, which is said to be the cornerstone of the current nuclear world order, was negotiated in 1968. Based on its three pillars of “*non-proliferation, peaceful use of nuclear energy, and most importantly, disarmament*”, the NPT had somehow provided the legal and political basis to eventually limit proliferation to the five nuclear weapon states (NWS). To its credit it has also largely managed to check proliferation and only four countries outside the NPT have additionally acquired nuclear weapons. However, in terms of disarmament, not much has been achieved so far. Though it has been successful in guaranteeing

2. Ibid.

3. Tom Sauer, “The NPT and the Humanitarian Initiative: Towards and Beyond the 2015 NPT Review Conference”, Deep Cuts Working Paper no. 5, April 2015.

4. Ibid.

peaceful use of nuclear energy, yet in terms of disarmament, mixed results were achieved. While NWS have described their nuclear weapons reductions as disarmament, there is no doubt that though comparatively fewer nuclear weapons exist now than during the cold war era, but yet the logic of nuclear deterrence continues to play a significant role in security strategies. Hence, without doubt, it can be asserted that nuclear weapons are still being developed and the arsenals of states are being modernised. Risk of nuclear terrorism has also grown.

May 2010: Non-Proliferation Treaty Conference

Fears stemming from the risks of nuclear weapons, along with unsatisfactory results of disarmament, led to a sense of discontentment. After the disaster of 2005 the formally successful 2010 NPT Review Conference oversaw 188 state parties which “adopted a consensus document, including language on the catastrophic humanitarian consequences any use of nuclear weapons would have and reaffirmed the need for all States at all times to comply with applicable international law, including international humanitarian law.”⁵ This was deciphered as an order to progress with the humanitarian perspective on nuclear weapons.

May 2012: First Preparatory Conference and Humanitarian Statement

At the first Preparatory Conference in Vienna in 2012 in preparation for the 2015 NPT Review Conference (NPT Rev Con), Switzerland, on behalf of 16 nations, delivered the Joint Statement on the humanitarian dimension of nuclear disarmament at the first session. It was originally started as a statement of 16 countries at the 2012 Prep-Com, but later on by April 28, 2015, 159 states had already formed a part of the initiative which was over eighty percent of the United Nations (UN) membership.

Oslo Conference: March 2013

On March 4 and 5, 2013, the first ever “Conference on the Humanitarian Impact of Nuclear Weapons” was held in Oslo by the NATO member Norway and was attended by 127 countries.

5. The “2010 NPT Final Document hosted by the United Nations”.

During this conference, researchers introduced new discoveries on the effect of nuclear weapons on entire humanity and environment. Organisations, including United Nations Development Program (UNDP), United Nations Office for the Coordination of Humanitarian Affairs (OCHA) and the International Committee of the Red Cross (ICRC) clarified that *“in case of an atomic explosion, neither would any association on the planet be capable enough to provide sufficient help, nor was it likely that a satisfactory capability could be built.”* Discussions pertaining to humanitarian consequences of nuclear weapons took place in this conference. To continue this discussion on nuclear ban, Mexico declared a subsequent meeting to be held in 2014.⁶

Nayarit Conference: February 2014

Around 146 member states attended the following conference that was held in Nayarit, Mexico in 2014. Notwithstanding the subjects of the Oslo meet, the conference examined the danger of inadvertent explosions. According to the Chair, as an essential precondition for achieving elimination, it was high time for the launch of a diplomatic process that would achieve the objective of negotiating a legally binding instrument to prohibit nuclear weapons. Requiring this procedure to finish up by the 70th commemoration of the bombings of Hiroshima and Nagasaki, the Chair depicted Nayarit as *“the final turning point”*.

Vienna Conference on the Humanitarian Impact of Nuclear Weapons: December 2014

The Vienna Conference on the Humanitarian Impact of Nuclear Weapons was the third conference in the Humanitarian Initiative Series. It was attended by delegates of 158 states, a wide range of worldwide associations from the United Nations framework, the Red Cross and Red Crescent Movement, as well as science and civil societies. This conference was the most remarkable in the sense that it was inaugurated by Austrian Foreign Minister Sebastian Kurz, the United Nations Secretary General, the President of the ICRC, and Pope Francis (who attended the Conference). The Conference addressed the short- and long-term results of use of nuclear weapons,

6. Norwegian Ministry for Foreign Affairs, *“Conference: Humanitarian Impact of Nuclear weapons”*, Norwegian Ministry for Foreign Affairs, 2013.

the ill effects of nuclear testing, and the hazard drivers for conscious or accidental nuclear weapons use, inadvertent situations of nuclear use and related challenges as well as existing legal mechanisms pertaining to the humanitarian consequences of such a use. The Conference also gave rise to scientific discoveries and talks affirming the humanitarian outcomes and dangers related to such a use that are far more serious than actually assumed. It also emphasised that they should therefore be set at the focus of worldwide endeavours on nuclear demilitarisation and non-proliferation.⁷

The Humanitarian Pledge: This Conference ended with the Chair's summary accompanied by the Vienna pledge issued by Austria. This pledge which was initially supported by 107 states actually called for a complete ban on the production, stockpiling and use of nuclear weapons. It was adopted by the UN General Assembly during its 70th session as Resolution 70/48, with 139 out of 168 states voting in its favour.⁸

STATE POSITIONS

The UNGA⁹ in New York adopted the Nuclear Weapons Prohibition Treaty (TPNW) on July 7, 2017. This was the first multilateral and legally binding instrument, which vowed to prohibit the "development, testing, manufacture, acquisition, transfer, possession and stockpiling of nuclear weapons along with the use or threat of use of nuclear weapons." Forty-eight countries registered their lack of support for this venture in December 2016, either by voting 'No' or totally abstaining. However, before the negotiations, only 113 countries had voted to make the negotiations happen. During the voting on the treaty text 122 states voted in favour of the treaty with one abstention (from Singapore) and one against (the Netherlands).

Apparently, according to the proponents of this ban treaty, a disruptive action as this was urgently needed to enhance the goal

7. "Vienna Conference on the Humanitarian Impact of Nuclear Weapons, Europe Integration and Foreign Affairs", Conference Report, Federal Ministry: Republic of Austria, 2014.

8. "Stigmatize, prohibit and eliminate nuclear weapons", International Campaign to Abolish Nuclear Weapons (ICAN), <https://www.icanw.org/pledge/>. Accessed on January 5, 2020.

9. United Nations General Assembly.

of nuclear disarmament, because “there has been little perceptible progress on the multilateral nuclear disarmament pillar under the NPT,” and hence, according to them, a complete eradication of nuclear weapons was an immediate humanitarian necessity. Apart from that, the immediate need for a legal mechanism for nuclear disarmament was based on Article VI of the NPT and the 1996 ICJ opinion on the Legality of the Threat or Use of Nuclear Weapons.¹⁰ The patrons of the prohibition treaty believed that a treaty of this kind might help in exerting international pressure on the Nuclear Weapons States (NWS) and the non-NPT NWS, which rely on “nuclear deterrence to conform to the new global norms.”¹¹

But critics are of the opinion that the “dynamics that surrounds the prohibition treaty will deviate the attention and effort from the non-proliferation regime” that has not only prevented a nuclear war since 1945 but has also inhibited nuclear proliferation to other states or extremist organisations. Hence, when proposals for a ban treaty first emerged in the 2010 NPT Review Conference, the five NPT recognised nuclear weapon state (NWS) parties (the US, Russia, Britain, France and China¹²) had boycotted the calls for the initiations of negotiations on a “comprehensive Nuclear weapons convention”. According to them a world without nuclear deterrence under the foreseeable strategic circumstances was impossible to imagine. Though the response of the non-NPT nuclear weapons states have come together in opposition of the treaty, but yet their emphasis on the various points of opposition differed to a great extent.¹³

The nine nuclear weapons possessing countries, along with the members of the NATO, were notably absent from the negotiations. Moreover, the US, UK and France specifically referred to themselves as the “persistent objectors” to the treaty making, who at no cost would agree or intend to either sign, ratify or even become party to it. According to them the requisite security considerations is something that the proposed treaty fails to take into account.

10. 1996 ICJ opinion on the Legality of the Threat or Use of Nuclear Weapons.

11. Manpreet Sethi, “The Ban Treaty and Non-NPT Nuclear-Armed States—Can India Make a Difference”, Policy Brief No. 47, Asia-Pacific Leadership Network for Nuclear Non-Proliferation and Disarmament and Centre for Nuclear Non-Proliferation and Disarmament, 2017.

12. The Treaty on the Prohibition of Nuclear Weapons.

13. Ibid.

To justify their decision of non-participation, these three major nuclear powers have also stated that instead of enhancing peace and security, the treaty unnecessarily creates division at a time when the world needs to actually unite in order to battle escalating dangers.

Russia had also additionally disapproved the negotiations right from the beginning and called it a “destructive” and “hasty” initiative that would undermine the 1968 NPT. In the case of China, though initially it was relatively calm and welcoming of the goal of an “ultimate and comprehensive ban”, but has currently refuted any compliance to the core prohibitions of the ban treaty.¹⁴

Apart from that, even though Japan—that had faced the first and the greatest brunt of a nuclear attack in 1945—was resistant to the ban treaty along with Australia, as they believed that US nuclear weapons enhance their security. According to Japan, “efforts to make such a treaty, without the involvement of nuclear weapon states, will deepen the schism and division between the NWS and the non-NWS.” Apparently, North Korea was the only nuclear state to vote for initiating ban negotiations.

Hence it is very clear from the above stated facts that all the five nuclear weapon states (NWS) recognised by the NPT had clearly opposed the new treaty and due to the current global strategic scenario, they have also shunned the idea of a world without nuclear deterrence. Apart from that, it was observed that the response of the non-NPT nuclear armed states were also like that of the five NWS, but each of the nine states have had divergent perspectives on the points of opposition. The next section of this paper shall individually analyse the differences of emphasis on the points of opposition to the treaty by the four non-NPT nuclear armed states.¹⁵

THE BAN TREATY AND THE NON-NPT NUCLEAR ARMED STATES

India: Since the beginning, India had played a pioneering role in the universal elimination of nuclear weapons. To enhance the journey towards this target, the country has presented several resolutions and concrete plans in different UN forums. However, the indeterminate

14. Ibid.

15. Ibid.

extension of the NPT in 1995 has more or less torn apart the hopes of India ever getting to nuclear disarmament, since it was clear that “by agreeing to legitimize the nuclear weapons of the NWS forever, the non-NWS had lost leverage over forcing the surrender of these weapons.” Nevertheless, India’s written nuclear doctrine continues to preserve the hope for a world without nuclear weapons. Keeping this in mind, India was expected to give a positive response towards the ban treaty. But the reality was different. India refused to participate in the negotiations and strongly opposed the treaty at the UN General Assembly. To inquire into the reasons behind such a refusal by India, it can be observed that the country was not adequately convinced that a measure outlawing nuclear weapons, in the absence of any security considerations, could actually lead to a nuclear free world.

Apart from that, though initially India had participated in the Humanitarian Initiative conferences on the humanitarian impact of nuclear weapons held in 2013-2014, but at a later stage like any other NWS, India started to disengage from the process when some non-NWS started diverting the discourse away from facts based conversations of nuclear use and ban processes.¹⁶

Pakistan: Pakistan’s decision regarding the acceptance of treaties relevant to nuclear non-proliferation and disarmament was largely dominated by the Indian position on it along with India’s assessment of the merits of the treaty in regard to Pakistan’s national interest. So clearly, when India declined to accept the ban treaty, Pakistan also did so. Additionally, apart from reiterating its distress over the verification and non-discrimination and compliance with the customary international law, the country also expressed its opposition to the treaty on the grounds that it did not include complementary conventional arms control too. The country opined that universal nuclear disarmament must also incorporate within itself the burden of conventional arms control. The reason behind taking such a position is because Pakistan acquired nuclear weapons in order to achieve strategic parity with India and to deny India’s conventional superiority which, according to Pakistan, has been a threat to its survival. Pakistan’s nuclear weapons are also supposed to be its protector against India’s conventional forces with which

16. Ibid.

the possibility of confrontation arises whenever Pakistan engages in cross-border terrorism against India. Hence, it is assumed that Pakistan can never seriously dedicate itself to nuclear disarmament unless and until it stops patronising terrorism against India, because with every terrorist attack against India, Pakistan's survival in the face of the huge Indian armed forces shall always be at stake.¹⁷

Israel: Israel's continuous policy of nuclear opacity has not allowed it to take any public stance on nuclear disarmament, not to mention the ban treaty. Given the threat perceptions and its security concerns, the country has always held the desire to retain deterrence capability and has never supported nuclear disarmament. Much earlier than the ban treaty negotiations, Israel had always been seen resisting pressures for the negotiations of a Middle East WMD-Free Zone. The country has always been concerned about its security dilemmas with Iran, as even after the "Joint Comprehensive Plan of Action (JCPOA)", Israel was not adequately convinced that Iran had given up on its nuclear weapon ambitions. This concern of Israel strengthened when US President Donald Trump openly displayed his contempt of the Iran nuclear deal (the JCPOA). Currently, it can be predicted that there might be no scope for improvement in Iran-Israel relations, and due to this absence of progress in the Middle East Peace process, there is no hope that Israel will favourably look at the ban treaty. It is evident from its security graph that even if the other eight nuclear-armed states were to try to take some collective actions in favour of elimination of nuclear weapons, Israel would still not have joined the brigade. Hence, for Israel to favour the NWPT looks like a distant dream.¹⁸

North Korea: From the beginning, North Korea was the only nuclear weapon state that had voted for initiating the treaty negotiations in 2016. This was probably because for North Korea, this forum might have been the one through which the state's nuclear weapons might have been legitimised in the international community. However, for North Korea, nuclear weapons have provided the greatest security assurances, especially against the US. However, Kim Jong-un, who faced a loss of his regime and perhaps

17. Ibid.

18. Ibid.

control over his country, decided to oppose the ban treaty at a later stage. Hence, it was unimaginable to expect the country to agree to nuclear disarmament unless the efforts came from all the other states to eliminate nuclear weapons, given that since 2016 onwards, the state has strengthened its position on nuclear weapons, conducting more missile tests, two nuclear tests, including a hydrogen weapon test. There are also other geopolitical and psychological reasons for which North Korea might have not joined the ban treaty.

UN MEMBER STATES

As indicated by the “International Campaign to Abolish Nuclear Weapons (ICAN)”, an alliance of non-governmental associations driving advocates of nuclear weapons ban treaty, incorporated “Ireland, Austria, Brazil, Indonesia, Mexico, Nigeria, South Africa and Thailand.”¹⁹ Each of the 54 countries of Africa and all of the 33 countries of Latin America and the Caribbean (as of now in an NWFZ under the 1967 Treaty of Tlatelolco²⁰) had endorsed the regional positions supporting a ban treaty. The 10 countries of the “Association of Southeast Asian Nations (ASEAN)”, which finished up the “Southeast Asian Nuclear-Weapon-Free Zone Treaty”, partook in the negotiations, yet Singapore swore off the vote. Many Pacific island countries were also likewise strongly in favour. A few NATO states published a statement (excluding France, the United States, and the United Kingdom, the atomic weapon states inside NATO), asserting that the treaty will be “insufficient in dispensing with nuclear weapons” and hence they rather called for strengthening the “implementation of Article VI of the Non-Proliferation Treaty.”²¹

ROLE OF CIVIL SOCIETIES

Amidst extensive disparities surrounding the prohibition treaty, some major civil society organisations have accepted it as a relevant challenge to the global nuclear order that was initiated from the

19. “Support for the Ban”, <https://www.icanw.org/>. Accessed on January 5, 2020.

20. Dominican Republic’s statement on Proposal by the Community of Latin American and Caribbean States (CELAC) on effective legal measures to attain and maintain a world without nuclear weapons. Working Paper, Geneva: United Nations General Assembly, 2016.

21. “Support for the Ban”, <https://www.icanw.org/>. Accessed on January 5, 2020.

Baruch Plan of 1946, through the creation of the International Atomic Energy Agency (IAEA) in 1957, the conclusion of the NPT in 1968 and the commencement of the nuclear arms control process along with the Strategic Arms Limitation Treaty (SALT) of 1972.²²

The International Campaign to Abolish Nuclear Weapons (ICAN),²³ a global coalition of NGOs in over 100 countries, has been the fundamental agency that is working closely along with the governments to accomplish a solid and successful ban treaty, for which it was awarded the Nobel Peace Prize in 2017. Along with the ICAN, the “International Red Cross and Red Crescent Movement”²⁴ has also likewise supported to forbid and eliminate nuclear weapons depicting the UN working group recommendation to negotiate a ban in 2017 as “potentially historic”.²⁵ It also assumed a significant role in structuring the interests for the dire action to progress nuclear disarmament negotiations. ICAN started in Australia and was formally propelled in Austria in April 2007. The founding members of the ICAN were aroused by the immense achievement of the International Campaign to Ban Landmines, that assumed a significant role a decade before in the negotiation of the Anti-Personnel Mine Ban Convention, also known as the Ottawa Treaty.²⁶

Since then, this organisation has attempted to fabricate an incredible worldwide web of public support towards absolute disarmament. Along with the ICRC the Red Crescent Movement has also contributed considerably towards shaping the discourse on nuclear weapons to enhance momentum towards its total elimination. In a July 2017 open articulation supported by more than 40 Buddhist, Christian, Jewish and Muslim pioneers and gatherings—communities concerned about Nuclear Weapons—called for widespread appropriation of the treaty. At a prominent Vatican meeting in November 2017, which was the principal international disarmament gathering following the

22. United Nations Security Council, “Strengthening the Non-Proliferation Treaty ahead of the Review Conference in 2020.” Briefing, New York: International Atomic Energy Agency, 2019.

23. Matthew Bolton and Elizabeth Minor, “The Discursive Turn Arrives in Turtle Bay: The International Campaign to Abolish Nuclear Weapons’ Operationalization of Critical IR Theories.” Special Section Article, Wiley Digital Archives, 2016.

24. International Committee of the Red Cross, “Nuclear Weapon”.

25. Ibid.

26. The Ottawa Treaty.

treaty's adoption in July, Pope Francis took a position more distant than his ecclesiastical antecedents to denounce the ownership of nuclear weapons and caution that nuclear deterrence policies offer a "false sense of security".²⁷

THE WAY AHEAD

In 2018, the NPT, which had been at the centre of the collective security mechanism, celebrated its 50th anniversary of signing. Though it was not able to prevent nuclear proliferation, yet its achievement in promoting the norms of nuclear non-proliferation and disarmament for over half a century cannot be denied. Today, only nine states possess nuclear weapons, which is far below the estimated range early in the nuclear age. Nevertheless, the adoption of the ban treaty in 2017 led to an increasing crack within the foundation of the NPT. While most of the states under the NPT have agreed not to develop nuclear weapons, five nuclear possessing states had tested nuclear weapons even during the drafting of the treaty. As per Article VI of the NPT, that calls on all the states to "pursue in 'good faith' negotiations toward eventual disarmament," these five states, namely, the United States, Russia, the United Kingdom, France, and the Republic of China, have been authorised to sustain their nuclear weapons. The disappointment over the lack of progress towards absolute disarmament still remained among many non-nuclear states. This very disappointment and the feeling that nuclear weapons are unethical and unsuitable to possess, initiated the "Humanitarian Initiative" and laid the foundation for the adoption of the Treaty on the Prohibition of Nuclear Weapons (TPNW) by 122 states at the United Nations in July 2017. After seventy years into the nuclear era this revolutionary ban treaty came into being. This Ban Treaty prohibits its signatories from engaging in any and all activities related to nuclear weapons and is meant to establish a global norm of nuclear non-possession. In doing so, this treaty will render nuclear deterrence as illegitimate.

The ban treaty had been supported by some and rejected by some important few. The nuclear weapons states did not engage in the negotiations of the Ban Treaty. According to the US and its allies

27. Ibid.

the new ban treaty “is at odds with the existing nonproliferation and disarmament architecture, risks undermining the NPT, is inconsistent with [NATO’s] nuclear deterrence policy and will not enhance any country’s security.” But, the proponents of the ban treaty have condemned nuclear weapons as inhumane and criticised its possessors for continuous dependence on these weapons.²⁸

However, in the years to come, the ban treaty will possibly enter into force and become an integral part of the nuclear disarmament canvas. Declining to engage with the process won’t really deny it legitimacy. Hence, the other ingredients of disarmament can actually coexist and in a way help re-enforce one another. But for this to happen, a number of legitimate and immensely important concerns should be taken care of.

Since the ban treaty had been faulted for many reasons like the lack of a definition, clarity, systems of verification, lack of a competent authority to oversee enforcement, etc., the Nuclear Weapons possessing states (NWS) shall not probably be in a mood to elaborate on operational details and disarmament. This would in a way deepen the gap between the NWS and the non-NWS at the Rev Con in 2020. To prevent that from happening, a “meaningful dialogue” amongst all the NWS is of utmost necessity to build trust and confidence in each other, and that can probably lead to global nuclear disarmament. An increase in transparency and verification system and fostering interactive discussion between nuclear-weapon (NWS) and non-nuclear-weapon states (NNWS) on some of the “hard questions” relating to major security concerns and reduction of threats, are necessary steps for the furtherance of the disarmament initiative.

Apart from that, if the ban treaty needs to be a success in nuclear prohibition, then a substantial progress should be made through a step-by-step approach or a building block process towards nuclear disarmament. Thus, there should be increased efforts in “reducing nuclear stockpiles, de-alerting weapons on ‘hair-trigger alert’, shifting nuclear doctrines towards sole purpose or no first-use, extending relevant agreements, such as the START Agreement, sustaining the

28. Michael Rühle, “The Nuclear Weapons Ban Treaty: Reasons for Scepticism”, *NATO Review*, May 19, 2017.

INF Treaty, ratifying the Comprehensive Test Ban Treaty (CTBT), commencing negotiations on the Fissile Material Cut-off Treaty (FMCT) and continuing disarmament verification research.”²⁹

Though the common criticism about the ban treaty that it will not eliminate a single nuclear weapon is probably right, yet it cannot be denied that this criticism misrepresents the strategy of the advocates of nuclear weapons ban. For the proponents of the treaty, it is just an interim step towards nuclear disarmament through its capacity in delegitimising nuclear weapons and the doctrines of nuclear deterrence and extended deterrence. The existence of such a treaty is a reminder for the final target of disarmament. All nations of the world should prioritise this target instead of focusing on security dilemmas and underlying political conflicts. For disarmament to succeed, political antagonisms between states should be set apart and welfare for entire humanity should be prioritised. Hence, the adoption of the ban treaty will produce definitive force for the nullification of nuclear weapons and it is thus important to be accomplished. Hopefully, if the Ban Treaty succeeds in accomplishing its mandate, we can take a step forward towards a world free of nuclear weapons.

29. “Proposed Fissile Material (Cut-off) Treaty (Fmct)”. NTI: Building a safer world.26, <https://www.nti.org/learn/treaties-and-regimes/proposed-fissile-material-cut-off-treaty/>.October 2018. Accessed on January 5, 2020.

WHY SANCTIONS ON NORTH KOREA REMAIN INEFFECTIVE?

HINA PANDEY

SANCTIONS AND NUCLEAR BEHAVIOUR

In international relations a State's behaviour can be influenced by various tools of statecraft. The approach can be incentive based such as offering of development aid, technology, expanding of bilateral cooperation or it could be based on coercion or arm-twisting through sanctions. States have frequently tried to compel another State into doing something they would otherwise not do. In this context economic sanctions have often been resorted to as one of the readily available instruments with a view to punishing another State and extracting compellence, where military action might be too extreme an option.

Sanctions are usually categorised as unilateral or multilateral. The end purpose of any sanction is to modify or change a State's political conduct by inflicting an unaffordable cost on the sanctioned country. Broadly, economic sanctions attempt to deny substantial contribution towards the economy of the targeted country. It is argued that sanctions "can make an impact on the target country by imposing more than two per cent economic cost to its gross national product (GNP)".¹

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1. Kapil Patil, "Sanctions as an Instrument of Non-proliferation Policy: The North Korean Experience", in Titli Basu, *Major Powers in the Korean Peninsula: Politics, Policies and Perspectives*" (IDSA and KW Publishers, New Delhi, 2019), pp. 65-91.

However, do sanctions really work in changing a State's nuclear behaviour? If one evaluates the record of how effective they have been in modifying the nuclear behaviour of a State, their efficacy can be seen as somewhat poor. In fact the existing literature on the efficacy of sanctions suggests that their success rate in reversing the State's behaviour has remained poor. Similarly, long ago, Robert Pape (1997) in his analysis of efficacy of sanctions has challenged the existing optimism (then) of sanctions. He had argued that, "... most modern states resist the external pressure ... pervasive nationalism often makes States and societies willing to endure, considerable punishment rather than abandon what are seen as the interest of the nation ... even weak States are unwilling to bend to the demands of the foreigners ..."² Pape further makes an argument highlighting that States are willing to absorb considerable punishment, including civilian suffering, rather than abandon their national interest.

Interestingly, this holds true especially for North Korea, as despite severe economic hardships for years, the country has shown an almost relentless resolve to strengthen its nuclear capability in the face of American as well as UN sanctions. It is to be noted that the UNSC Panel of Experts in its report has highlighted that the DPRK has been subjected to one of the most stringent and comprehensive sanctions regimes in the UN history, yet its nuclear capability has only advanced in scope and size along with an increasing sanctions regime that surrounds it. Currently, the UN sanctions of North Korea extend from dual use and sensitive materials to industry machinery, supply and transfer of copper, nickel zinc, silver, iron ore and lead, natural gas liquids. There is a ban on coal and limits are placed on petroleum and its products. The prohibitions also include sea food, limits on fishing rights and luxury goods. Sanctions have also been imposed on key individuals from the Workers Party. An obvious question then comes to one's mind: why have sanctions remained ineffective in case of North Korea? Three broad observations can be made in this aspect.

2. Robert Pape, "Why Economic Sanctions Do Not Work", *International Security*, vol. 22, no. 2 (Fall, 1997), pp. 90-136.

IS THE NORTH KOREAN ECONOMY RESILIENT TO SANCTION SHOCK?

Broadly, economic sanctions are aimed at expanding the economic hardships of the targeted country. Both unilateral as well as multilateral sanctions on North Korea have been applied with a view to convincing the country that it would be better off economically if it concedes to the demands. Essentially, it implies for North Korea that the cost of taking a political decision—such as the advancement of its nuclear capability in any manner—would not be worth it, considering the economic consequences. However, in the case of the North Korean economy one can argue that the country's economic isolation in many ways acts as a cushion to economic shocks that sanctions are intended to induce. The North Korean economy is not integrated into the global economy like others, thus there remain limits to the economic pressures that sanctions can have. What sanctions can affect is the ability of the North Korean regime to generate revenue and secure goods and services through exports and imports. Several available assessments suggest that North Korea might have made its economy resilient to economic shocks. The country is described by some as the “poorest advanced economy in the world” that has sustained the production environment in the country despite a continued low GDP. Even when the economy has shrunk in decades the production environment is such that capital goods production required to run everyday life, such as railroad, locomotives, cargo vessels, generators for power plants, etc., have continued to function.³ Furthermore, the rise of ‘*jangmadang*’ (a legal/semi-legal and illegal private market) for all goods in North Korea is said to have contributed to the country's economic development over the past few years. These *jangmadangs* form a large part of the informal economy in North Korea. It is reported that “more than 80 times can be earned at these *jangmadangs* (businesses) than a regular state run job. It is important to note that approximately 23 percent of employees at state-run enterprises in the country are also simultaneously involved with some unofficial form

3. N. Parthasarthi, “North Korean Economy: Failure of UNSC Sanctions”, in Titli Basu, *Major Powers in the Korean Peninsula: Politics, Policies and Perspectives* (IDSA and KW Publishers, New Delhi, 2019), pp. 91-119.

of business.”⁴ To gain some perspective, it is important to take note of these figures which highlight the wide gap that persists between formal and informal jobs. It is reported that “an average monthly salary for a state employee remains a little under 2,200 North Korean Won, however, on the other hand, the salary of those working in the ‘*jangmadang*’ can be estimated at 172,750 Won per month.”⁵ Anything can be sold at a *jangmadang* from food to luxury goods including couture fashion items.

Furthermore, a general perception about the North Korean economy is that it has been portrayed in a state of crisis, including food security. Yet, if one compares the available figures for rice production (2015) in North Korea with an economically stable South Korea, the former accounts for approximately 2.01 million tons of rice production in comparison with 4.32 million tons produced by South Korea. It is to be noted here that North Korea’s population was assessed to be half of South Korea—25 million as compared to 51 million—for the same year.⁶ Though dated, these figures suggest that the economy might not be in dire straits as projected in the popular narrative. It is noteworthy that despite sanctions, the growth of the economy has been estimated at an average rate of 1.2 per cent between 2012 and 2016, as per the data by the Bank of Korea (BoK). The same source has identified the GDP of the country at approximately US\$ 28.1 billion for 2016. Additionally, according to some South Korean figures, the inter-Korean trade figures for the year 2015 suggest that trade between the two countries peaked somewhere in the region of US\$ 2.714 billion.⁷ These figures comprise all the trade from and into the Kaesong Industrial Complex.

Former Indian Ambassador to South Korea, N. Parthasarathi, has highlighted that “the regime (of North Korea) is adept at transferring the pain of sanctions to its people.”⁸ Even when sanctions are

4. Travis Jeppeson, “Shopping in Pyongyang”, *New York Times Magazine*, February 14, 2019. <https://www.nytimes.com/2019/02/14/magazine/north-korea-black-market-economy.html?auth=login-google>. Accessed on March 7, 2020.

5. *Ibid.*

6. N. Parthasarathi, n. 3.

7. *Ibid.*

8. *Ibid.*

underway the available resources are reserved for the elite and civilian suffering is justified as part of economic warfare with the imperialist nations. Studies have concluded that military regimes during sanctions are known to increase taxes to generate revenue and reallocate their expenditures.⁹

One can note that in the past two years Kim Jong Un's regime has taken some measures in this regard. First, to regulate the falling circulation of foreign currency in the country, the regime is demanding donations to the regime's loyalty funds in foreign currency from wealthier citizens. The use of foreign currency is encouraged by promoting discounts for customers at shopping venues. Electricity fees have been raised in order to bring in money for the completion of state run construction projects such as Wonsan-Kalma Tourism zone. Taxes too have been raised 30 times higher as compared to 2005, on traders at consumer goods markets in many parts of the country. Additionally, fines have been levied on 30 percent of the profits by small businesses in the South Pyongyang Province.¹⁰ In case of North Korea, one can see that sanctions only increase the suffering of the governed, not the one who is governing. Thus, it does not affect nuclear decision-making by the elite or by North Korea's Supreme Leader.

North Korea is not new to sanctions, furthermore, the philosophy of *Juche* as a strategy of self-reliance, over the years, has somewhat managed to build a manufacturing base to meet its requirements, including the defence sector. In fact, the *Juche* ideology has acted as a strategy for enduring sanctions.

POOR IMPLEMENTATION

Economic resilience, however, does not fully explain why sanctions on North Korea remain ineffective. A part of the answer also lies in the poor implementation of these sanctions. This can be further understood from three aspects of poor implementation.

9. Kapil Patil, n. 1.

10. Ha Yoon Ah, "North Koreans turn to local currency due to foreign currency shortages", *Daily NK*, August 6, 2019. <https://www.dailynk.com/english/north-koreans-turn-to-local-currency-due-to-foreign-currency-shortages/>. Accessed on March 7, 2020; and Benjamin Katzeff Silberstein, "The North Korean Economy: Growing Resource Scarcity May Accelerate State Control Over Markets", *38th North*. <https://www.38north.org/2020/02/bkatzeffsilberstein021120/>. Accessed on March 7, 2020.

Inherent Weakness of Sanctions

Sanctions on their own remain meaningless if every country supporting them does not bear the responsibility of its strict execution. However, a lax attitude of States in executing them, and even the ambiguity of definitions in the UN resolutions, create gaps in effective sanction implementation. For instance, luxury goods are defined differently by China as compared to the US and EU. This has made way for China-North Korea trade in tobacco, cars, computers, etc., to flourish despite sanctions. In fact, post North Korea's third nuclear test in 2013, "as many as 100 countries failed to file reports in the UN on their trade with North Korea."¹¹ Another related and important aspect of inherent weakness of sanctions is their scope of implementation. Even the most stringent ones are binding on member states and not individual business firms. The Private sector, which is profit motivated, is less likely to cooperate fully with States on containing profit making activities for successful implementation of sanctions. Additionally, many States do not always engage in sanction busting activities of the private sectors.¹² Because of the poor implementation of sanctions not only has North Korea been able to export almost all of its prohibited goods from illegal networks, but from the period "January 2017 to September 2017, it was also able to generate nearly US\$ 200 million through such exports."¹³

The UN Experts Panel responsible for the monitoring of the UNSC sanctions on North Korea has noted in its report (2017):

The DPRK is already flouting the most recent resolutions by exploiting global oil supply chains, complicit foreign nationals, offshore company registries and the international banking system... illicit ship-to-ship transfers of petroleum comprising a multi-million-dollar business that is driving an international network of

11. Suk Hi Kim ad Mario Martin Hermosillo, "The Effectiveness of Economic Sanctions Against a Nuclear North Korea", *North Korean Review*, vol. 9, no. 2, Fall 2013, pp. 99-110.

12. Andrea Berger, "A House Without Foundations: The North Korea Sanctions Regime and its Implementation", *RUSI White Hall Report*. https://rusi.org/sites/default/files/201706_whr_a_house_without_foundations_web.pdf. Accessed on March 3, 2020.

13. Kapil Patil, n. 1.

brokers and ship charterers as well as unwitting global commodity trading companies and oil suppliers.¹⁴

A mention of North Korean 'Bureau 39' here is imperative because not only does it show the country's own ability to conceal activities that are prevented by sanctions but also suggests that a legit state machinery is in place that coordinates all these activities. The Bureau 39 has been identified as a key entity responsible for coordinating the operation of an illicit network of smuggling for the DPRK through front companies and illicit affiliates. Furthermore, it is the core point of "North Korean directed wheel network that has been involved in obtaining technology and components for its weapons programs."¹⁵ The illicit activity seemed to have generated significant revenue for North Korea's weapons activities.

Disparate Interests

The issue of poor implementation of multilateral sanctions can be further attributed to the lack of consensus among the targeting States. It is noteworthy that multilateral sanctions have been argued to be more effective in compelling the targeted country to change its behaviour. However, in case of North Korea, even multilateral sanctions have somewhat failed to deliver the desired objective. Many times North Korean sanctions have been rendered ineffective because not every country takes the same view of them. Countries such as South Korea and China have often held a different view from the US. They have disregarded pressure from the US on maximising the economic sanctions because of the possibilities of a regime failure. In the recent times too (post-2017 nuclear tests), China has expressed its intention to appeal for a "partial lifting of sanctions on North Korea to create a benign environment for the country to develop its economy"¹⁶ and carry out reforms and opening up (of North Korea's economy). It is important to note that "total trade volume between

14. UNSC Panel Report S/2018/171. <https://www.securitycouncilreport.org/un-documents/document/s2018171.php>. Accessed on March 3, 2018.

15. Sheena Chestnut, "Illicit Activity and Proliferation: North Korean Smuggling Networks", *International Security*, vol. 32, no. 1 (Summer 2007), pp. 80-111.

16. "China's role paramount in resolving NK issue", *Global Times*, June 25, 2019. <http://www.globaltimes.cn/content/1155668.shtml>. Accessed on March 3, 2020.

China and North Korea stood at \$1.25 billion in the first half of 2019, an increase of 14.3 percent compared with the same period in 2018.¹⁷ One may argue that if China, being North Korea's biggest trading partner, continues to cooperate in economic matters, there will remain little hope for reversing North Korean nuclear capability.

Diplomatic Ingenuity

It is to be noted that North Korea maintains diplomatic relations with "164 countries, 24 of which maintain embassies in Pyongyang, and 47 countries in which North Korea operates an embassy."¹⁸ Many other countries from the Middle East, Asia, Africa, Latin America continue to have sanction busting relationship with North Korea. The country continues to find customers from these countries. Institutes that monitor North Korea's trade relationships have often assessed that the country's trade relationship occupies a crucial part of the lifeline for the regime sustenance. North Korea's top export destinations, excluding China, include "Pakistan at \$43.1 million, Burkina Faso at \$32.8 million and a handful of other Asian countries at \$26.7 million, Russia at \$78.2 million, Thailand at \$73.8 million and the Philippines at \$53.2 million."¹⁹

ROLE OF CHINA

No discussion on inefficacy of sanctions and North Korea can possibly escape the mention of China. China, being one of the most important North Korean allies, continues to influence the North Korean nuclear behaviour through direct economic support to the country. This further acts as a tacit moral support to DPRK's nuclear resolve. Data shows that in 2016 North Korea-China trade accounted for "approximately 93 percent of North Korea's overall trade."²⁰ It is

17. Wang Sheng, "China's role in NK nuclear issue cannot be circumvented", *Global Times*. <http://www.globaltimes.cn/content/1163448.shtml>. Accessed on March 20, 2020.

18. Kent Boydston, "Sources: North Korea and the World", Peterson Institute For International Economics (PIIE), May 3, 2017. <https://www.piie.com/blogs/north-korea-witness-transformation/sources-north-korea-and-world>. Accessed on March 4, 2020.

19. Mahita Gajanan, "Which Countries Trade With North Korea?" *Fortune*, September 4, 2020. <https://fortune.com/2017/09/04/north-korea-countries-trade-partners-nuclear-tests/>. Accessed on March 4, 2020.

20. Kent Boydstone, "North Korea's Trade and the KOTRA Report", PIIE, August 1, 2017. <https://www.piie.com/blogs/north-korea-witness-transformation/north-koreas-trade-and-kotra-report>. Accessed on March 7, 2020.

not incorrect to assume that in the North Korean strategic calculus, the economic backing of China in times of the most stringent sanctions actually acts as a support to its nuclear resolve. Some recent assessments of the China-North Korea economic interaction suggest that “North Korean economy appears to be staying above water despite sanctions, even though the scope of its foreign trade is constrained and prospects for sustained growth are slim.”²¹ The Chinese contribution in this respect cannot be discounted. One can argue that if the current China-North Korea relations were to witness an upward trend, then the efficacy of current sanctions regime on North Korea would further remain questionable. Richard Haass is of the view that “Sanctions in themselves are not going to do what needs to be done,”²² the Chinese cooperation is essential in addition to the American pressure.

CONCLUSION

Ever since North Korea has been reprimanded through sanctions, it has also simultaneously strengthened its nuclear capability resolve. This is evident from the way the country has been able to demonstrate a capability of designing a hydrogen bomb, even though theoretically. North Korea has clearly transcended from being a “proliferation problem into becoming a deterrent problem”, and further managed to distance itself from the prospects of denuclearisation. This holds true post the failure of the recent (US-North Korea) bilateral talks at Hanoi in 2019. One can argue that North Korea has been able to manoeuvre the sanctions pressure in a way to hold on to its nuclear capability resolve in all these years. The country has managed to shield its economic vulnerability through various efforts—primarily through the Chinese economic aid—as well as devised innovative ways to bypass sanctions from time to time. However, it would be wrong to conclude that North Korea has not been hit by sanction pressure at all as the available information shows some signs of economic stagnation.

21. Daniel Werts, “China-North Korea Trade: Parsing the Data”, *38th North*, February 25, 2020. <https://www.38north.org/2020/02/dwertz022520/>. Accessed on March 3, 2020.

22. “Can Sanctions Change the Behavior of Governments?”, *NPR: Special Series—North Korea’s Nuclear Push*, October 16, 2006. <https://www.npr.org/transcripts/6277333>. Accessed on February 24, 2020.

It is reported that “actual rate of economic growth has reached its lowest value since 2006.”²³ Maybe, sanctions have been able to hurt the economy a little but will it translate into North Korea giving up its nuclear capability? Will this induce any change in the North Korean nuclear resolve? Maybe not, because when one takes the consolidated view of the sanctions and North Korea’s nuclear behaviour, one will find that they have in fact remained counterproductive. The North Korean nuclear resolve amidst the sanctions has only strengthened instead of becoming weak over these years.

23. Ruediger Frank, “The North Korean Parliamentary Session and Budget Report 2019: Signs of Economic Stagnation and an Open Claim to Leadership on the Korean Peninsula”, *38th North*. <https://www.38north.org/2019/04/rfrank041319/>. Accessed on March 7, 2020.

CHALLENGES TO PREVENTION OF NUCLEAR TERRORISM

ROSHAN KHANIJO

INTRODUCTION

Nuclear terrorism has become a reality due to terrorist organisations like the Al Qaeda, ISIS, etc., showing their proclivity to acquire nuclear weapons. In the past, this issue was discussed at the highest levels, at various international events, including the meeting of the Heads of States during the Nuclear Security Summits (NSS) who discussed this problem relentlessly. As a result, nations have now become more aware of this threat, however, challenges to nuclear safety and security of weapons, nuclear power plants and fissile material still remain. This is because safety and security is an ongoing process and requires multifarious interaction with various stakeholders both at the domestic as well as at international level. India, too, is vulnerable to this threat and has to address various internal and external challenges. This paper thus tries to analyse these challenges.

NUCLEAR TERRORISM

The definition of nuclear terrorism as per the 2005 United Nations International Convention for the Suppression of Acts of

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Nuclear Terrorism, is: “nuclear terrorism is an offense committed if a person unlawfully and intentionally uses in any way radioactive material ... with the intent to cause death or serious bodily injury; or with the intent to cause substantial damage to property or to the environment; or with the intent to compel a natural or legal person, an international organization or a State to do or refrain from doing an act.”¹ The cause of concern is not only the individuals but also the global terrorist organisations. Though some of these terrorist organisations have been weakened, but they still have the potential to unleash strikes by training and funding lone-wolf operators. Hence, the States need to address some of the following vulnerabilities:

- Attack/incident at nuclear power plant
- Terrorists disrupting nuclear transport and transit routes
- Theft of nuclear material for developing nuclear device
- Theft of radioactive material to make ‘Dirty Bombs’
- Theft of ‘Low-Yield Tactical Nuclear Weapons (TNWs)’
- Cyberattacks to damage plant safety.

India is more prone to these attacks as Afghanistan-Pakistan region is home to some of the major terrorist organisations like Al Qaeda, Lashkar-e-Taiba (LeT), Jaish-e-Mohammed (JeM), etc. This makes it imperative for India to not only address internal challenges but also remove external threats.

INTERNAL CHALLENGES

Increase in Civilian Nuclear Power Plants

India is set to harness her nuclear energy, and has an ambitious plan to construct nuclear parks. It is stated by Department of Atomic Energy (DAE) that the target set for installing about 20 GWe nuclear power by the year 2020 will be achieved; this target includes 2.5 GWe of Oxide fuelled FBRs and 8 GWe of LWRs.² In addition to this, seven reactors were under construction in India, with a combined

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1. “International Convention for the Suppression of Acts of Nuclear Terrorism—Article 1”, United Nations, 2005.
 2. “Meeting Demand Projections, Department of Atomic Energy”. <http://www.dae.gov.in/node/129>. Accessed on January 7, 2020.

capacity of 5.4 GWe.³ Also, India is trying to acquire Light Water Reactors (LWRs). It is to be noted that India already has an edge in the indigenous production of Pressurised Heavy Water Reactors (PHWR), and the development of Fast Breeder Reactors (FBRs) is at an advanced stage. This means that with the increase in number of nuclear power plants the challenge to maintain a high standard of nuclear safety and security for the nuclear power plants will also increase.

As per IAEA, Nuclear Safety is “the achievement of proper operating conditions, prevention of accidents and mitigation of accident consequences, resulting in protection of workers, the public and the environment from undue radiation hazards”, and nuclear security is, “the prevention and detection of, and response to, theft, sabotage, unauthorized access, illegal transfer or other malicious acts involving nuclear material, other radioactive substances or their associated facilities.”⁴ The various threats to nuclear safety and security are as under:

Threat and Its Mitigation

The challenge to the power plant can come from quite a few areas, namely, design-based threats, the ‘Insider threat’, drone attacks, threats during the transportation of fissile material, etc. With advances in technology, cheap and new weapons like drones are available to non-state actors. The major threat from these drones/swarms of drones is that they may be used to carry explosives, which can create problems not only for the plant itself but also can be used to scatter radioactive materials against a multitude of human congregations or critical infrastructure.

Secondly, chances of fissile material theft during transportation, as well as from the ‘Bulk Processing Facilities’, is a cause of concern. Hence, it becomes necessary that the security apparatus is strengthened with better surveillance and monitoring mechanisms, and adequate software systems made available for material accounting at the source level.

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3. “Nuclear Power in India, World Nuclear Association”, <https://www.world-nuclear.org/information-library/country-profiles/countries-g-n/india.aspx>. Accessed on January 7, 2020.
 4. IAEA, “Concepts and Terms”, <http://www-ns.iaea.org/standards/concepts-terms.asp>. Accessed on January 7, 2020.

Thirdly, insider threat as well as terrorists using land/aerial routes to damage nuclear power plants cannot be ruled out. Though security of nuclear power plants has been tightened by demarcating areas of strict no fly zones, however, incidents at Mumbai, Pathankot, and the Uri attack depict that transgressions can occur. Hence, it is essential that a specialised force which only looks after nuclear security should be created. At present security is looked after by the Central Industrial Security Force (CISF), for which specialised training to counter the threats listed above is considered.

Fourthly, the role of the private sector in future is going to increase as more and more private sector companies get involved in nuclear architecture. Currently their role is restricted to manufacturing, logistics, etc., which may change considerably in future. Hence, it is essential that there is greater interaction with the private sector in terms of organising workshops, so that they are aware of various security and safety guidelines, and legal provisions—especially the penalties which could be levied on breach of a contract or any accidents happening due to negligence.

Finally, the most important issue is that of having an ‘Independent Regulatory Authority’ to oversee the safety and security issues. Currently, India has Atomic Energy Regulatory Board (AERB), but this organisation has often been criticised that it is not a truly independent body, because the members of AERB have also worked in the Department of Atomic Energy, hence they may still have their allegiance to it. However, India is trying to formalise a Nuclear Safety Regulatory Authority that would be truly independent.

Dirty Bombs

A ‘Dirty Bomb’ or a ‘Radioactive Dispersal Device (RDD)’ is a conventional bomb spiked with radioactive material. The bomb generally consists of dynamite mixed with radioactive substances. This makes it dangerous as the blast caused when the dynamite or the other explosive elements of the bomb are set off carries radioactive material into the surrounding area as well.⁵ As per IAEA estimation there are more than 20,000 operators of significant radioactive sources: more than 10,000

5. Radiation Emergencies, National Center for Environment Health(NCEH), Emergency Management, Radiation and Chemical Branch, <https://www.cdc.gov/nceh/radiation/emergencies/dirtybombs.htm>. Accessed on January 7, 2020.

radiotherapy units for medical care are in use; about 12,000 industrial sources for radiography are supplied annually; and about 300 irradiator facilities containing radioactive sources for industrial applications are in operation.⁶ This makes the safety of radiological material vital.

Most countries are vulnerable to a 'Dirty Bomb' threat, due to the wide industrial usage of radioactive material in health sector, agriculture, scientific laboratories, etc. Security of this radioactive material is of paramount significance, and a database of this material needs to be maintained so that all the radioactive substances are accounted for, right from the source to the end-users; any shortage could be accounted for and action taken expeditiously in case a 'theft' is detected. A case in point is the detection of low grade radioactive material in Mayapuri from a scrapyards in 2010. It is apparent that the terrorists would like to use these 'Dirty Bombs' in market places/economic hubs to create confusion and stampede. Also, due to radioactive dispersal locally, that area would be out of action for a long period of time, impacting daily livelihood.

In India it is the National Disaster Management Authority (NDMA) which is responsible for any Chemical Biological Radiological Nuclear (CBRN) emergencies. They have mobile radiological monitoring units and further there are NDMA Guidelines for Management of Nuclear and Radiological Emergencies which state: "Even while we have an enviable and impeccable record of safety and virtually fail-safe arrangements in our nuclear establishments, the possibility, however remote it may be, of human error, systems failure, sabotage, earthquake and terrorist attacks leading to the release of radioactive matter in the public domain, cannot be entirely ruled out."⁷ Therefore, to address this limitation, NDMA states that "The Nuclear Emergency Management Framework will be supported on the prominent mainstay of strengths such as prevention, mitigation, compliance of regulatory requirements, preparedness, capacity development, response, etc., that constitute the Disaster Management continuum."⁸ In order to execute these they have instituted Disaster Management authority at all levels, namely,

6. "Inadequate Control of World's Radioactive Sources", IAEA, <https://www.iaea.org/newscenter/pressreleases/inadequate-control-worlds-radioactive-sources>. Accessed on January 25, 2020.

7. Ibid.

8. Ibid.

State Disaster Management Authorities under the Chairmanship of the Chief Ministers, District Disaster Management Authorities under the Chairmanship of the District Collectors/Magistrates, and further Local authorities to also deal with mitigation, preparedness and response.⁹ Further, Atomic Energy Regulatory Board (AERB) has the power for licensing use of radioactive substances; any violation could lead to shut down of that facility.

Cyber Threats

This is a major threat to nuclear power plants and nuclear command and control systems. Old nuclear power plants had analogue systems which were difficult to hack, however, with the advancements in technology, if the new power plants get digitised, then this will make them vulnerable to cyberattacks, because the terrorists could then hack into the systems to disable cooling functions, thus causing a severe meltdown. Furthermore, computers that operate on a closed network may also be compromised by various hacking methods, such as privilege escalation, roaming notebooks, wireless access points, embedded exploits in software and hardware, and maintenance entry points.¹⁰ Moreover, through an insider's help terrorists can bring in USB flash drives, and infect systems with viruses. Further, if terrorists destroy the plant's back-up functioning mechanisms and cut off the water and power supply, they might be able to create a whole new Fukushima crisis.¹¹ The US nuclear power industry has spent a total of \$1.2 billion on improving its facilities.¹² Thus, it is evident that India too needs to adopt a holistic approach, with special importance being given to awareness, surveillance and training.

EXTERNAL FACTORS

Low-Yield Nuclear Weapons

Countries are now opting for Tactical Nuclear Weapons (TNW). Pakistan has evolved its nuclear doctrine into a 'Full Spectrum

9. Ibid.

10. Ibid.

11. "Attacks on nuclear sites are best prevented by abolishing the plants", *The Asahi Shimbun, Asia and Japan Watch*, March 8, 2013.

12. Ibid.

Deterrence' where the objective is to have nuclear weapons at every level. Hence, they have gone in for TNWs. Further, considering that the fissile material used in this type of weapon is plutonium, Pakistan has expanded its main plutonium production complex at Khushab—which currently consists of four operational heavy-water nuclear reactors and a heavy-water production plant—and have constructed a new reprocessing plant.¹³ This increases the threat twofold, namely the theft of fissile material as well as of the weapon. They already have TNWs on land; the Pakistani Navy is now trying to develop its sea-based nuclear-armed cruise missiles, to be deployed on submarines/surface ships.

Pakistan is a hub of terrorist organisations like Al Qaeda, Haqqani Network, Jaish-e-Mohammed, Taliban (and all its affiliates), Lashkar-e-Taiba, etc. They have not only been provided physical space but also been given finance for asymmetric warfare against India; hence, this increases the threat for India. Also, since TNWs are dispersed and are deployed with the local commanders, therefore, the possibility of it being acquired by the terrorist increases. In the past there have been instances when terrorists had tried to infiltrate the security of defence infrastructures, e.g., the terrorist attack on the PNS Mehran base, Karachi Dockyard, etc. Similarly, the Internet is a potent medium for information (especially for information on 3-D printing).

Availability of Nuclear Fissile Material

The global community has been working to discourage the use of Highly Enriched Uranium (HEU) and instead is popularising the use of LEU (Low Enriched Uranium) in civilian nuclear power plants. These efforts involve the development of replacement LEU fuel, the conversion of the HEU-fuelled reactor to use the new LEU fuel; and the removal of fresh and spent HEU from the reactor site and its associated facilities.¹⁴ However, in spite of this, as on January 2017, the global stockpile of Highly Enriched Uranium (HEU) is estimated to be at about 1,340 tons approximately, 290 tons are in the civilian

13. "Trends in World Nuclear Forces, 2017", SIPRI Fact Sheet, July 2017, https://www.sipri.org/sites/default/files/2017-06/fs_1707_wnf.pdf. Accessed on January 25, 2020.

14. "Past and Current Civilian HEU reduction efforts", <http://www.nti.org/analysis/articles/past-and-current-civilian-heu-reduction-efforts/>. Accessed on January 25, 2020.

sector, and the rest presumably in military production. The global stockpile of separated plutonium is about 520 tons, of which about 290 tons are in civilian custody.¹⁵ With new civilian power plants coming up in West Asia the vulnerability of this sector increases, considering West Asia is a volatile region. As far as the Indian subcontinent is concerned India is trying to replace HEU with LEU; the same cannot be said about Pakistan.

Further, Uranium mines are found in Africa where countries like South Africa, Gabon, Namibia and Niger have abundant uranium deposits; however, security at the mining and port infrastructures is weak. Hence, this is another vulnerable area where the nations need to understand the seriousness of the threat and endorse the norms and security mechanisms as promulgated by International Atomic Energy Agency (IAEA).

Nuclear Proliferation

Considering more countries in West Asia are opting for civilian nuclear power plants, this increases the threat as safety and security is a state subject and often, due to lack of uniform standards/operating procedures, the challenge gets precipitated. The twin challenges which the countries here may come across are terrorist groups acquiring fissile material at some point in the supply chain, or sabotaging power plants. Further, there have been cases when fissile material from the civilian sector has been diverted for military use. Iran and North Korea are examples, therefore stricter monitoring by IAEA is required to prevent new nations from diverting fissile material for military use.

Nuclear Forensics

“Nuclear forensics is the examination of nuclear and other radioactive materials using analytical techniques to determine the origin and history of this material in the context of law enforcement investigations or the assessment of nuclear security vulnerabilities.”¹⁶ Recognising the importance of international collaboration in nuclear forensics, IAEA cooperates with the Global Initiative to Combat

15. “International Panel on Fissile Material”, <http://fissilematerials.org/>. Accessed on January 25, 2020.

16. “Nuclear Forensics”, IAEA, <https://www.iaea.org/topics/nuclear-forensics>. Accessed on January 25, 2020.

Nuclear Terrorism (GICNT), the International Criminal Police Organization (INTERPOL) and the International Technical Working Group (ITWG) to develop various forms of assistance, including enhancement of awareness, guidance and training.¹⁷ Nuclear fissile material, as also radioactive materials obtained from detonation sites/radiological debris, can be used by nuclear forensic scientists to ascertain the source. Nations are, therefore, encouraged to develop nuclear forensic libraries as with the help of the data available through these libraries the characteristics of the material can be analysed, and by decoding the material the potential supplier could be ascertained.

A Way Forward

Nuclear safety and security has been a global concern, hence a number of treaties have been formed like the Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT), United Nations Security Council Resolution 1540, Convention for the Physical Protection of Nuclear Material (CPPNM), INTERPOL, etc. Nations need to not only sign but also ratify these treaties. Fissile material has been a cause of concern and hence an initiative to control this was the Fissile Material Cut-off Treaty (FMCT), but it was blocked by Pakistan. The need of the hour is to have a strong monitoring and verifying mechanism with the legal caveat of penalties on violation.

IAEA has Integrated Regulatory Review Service (IRRS) which nations should make use of. As a neutral body it can help in reviewing the safety and security standards in an impartial manner. India understands the gravity of this challenge and has taken part in nuclear security summits, as well as signed most of these treaties. Further, India had also invited IRRS teams to review India's regulatory framework for safety of nuclear power plants (NPPs).¹⁸ India has also joined the International Atomic Energy Agency (IAEA) Response and Assistance Network (RANET), a group of states which offer assistance to mitigate

17. "Advances in Nuclear Forensics: Countering the Evolving Threat of Nuclear and other Radioactive Material out of Regulatory Control", IAEA, https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1706_web.pdf. Accessed on January 25, 2020.

18. "IAEA Mission Concludes Peer Review of India's Nuclear Regulatory Framework", IAEA, March 27, 2015, <https://www.iaea.org/newscenter/pressreleases/iaea-mission-concludes-peer-review-indias-nuclear-regulatory-framework>. Accessed on January 25, 2020.

the consequences of nuclear or radiological emergencies.¹⁹ Elena Buglova, Head of IAEA's Incident and Emergency Centre, had stated that "India's emergency preparedness and response capabilities can now be offered to countries during an emergency, if these countries ask for assistance. This shows a strong commitment by India to strengthen the international framework for nuclear and radiological emergency preparedness and response." New nations developing nuclear power plants may benefit from this organisation.

India internally has developed the Global Centre for Nuclear Energy Partnership (GCNEP) and its affiliated five schools, namely School of Advanced Nuclear Energy System Studies (SANESS), School of Nuclear Security Studies (SNSS), School of Radiological Safety Studies (SRSS), School of Nuclear Material Characterisation Studies (SNMCS), School of Studies on Application of Radioisotopes and Radiation Technologies (SARRT). All these schools are trying to enlarge the resource base as well as impart the necessary awareness about nuclear materials.

CONCLUSION

Nuclear safety and security is an ongoing process, and no country can become complacent. India on its part is trying to create a strong nuclear safety and security culture and trying to plug the loopholes. Nevertheless, the nature of the threat makes it exceedingly vital to ensure that safety and security parameters are constantly reviewed. Self-assessments, continuous training of customs officials, smart border controls, dedicated security details, and lessons from best practices are necessary to create a seamless security envelope.²⁰ Thus, India needs to reinforce its intelligence, surveillance, and monitoring systems. NDMA should carry out regular emergency drills and enforce a strong security culture amongst its various stakeholders, to prevent and prepare for any nuclear eventuality.

19. "IAEA Network for Emergency Assistance Grows to 35 Countries as India Joins", January 7, 2020.

20. Shri Rakesh Sood, "Charting the course for nuclear security: An Indian Perspective", Carnegie India, <http://carnegieindia.org/2016/03/23/charting-course-for-nuclear-security-indian-perspective-pub-63100>. Accessed on January 25, 2020.

NUCLEAR DYNAMICS
THROUGH THE COVID-19 LENS

CAPS NUCLEAR TEAM

NUCLEAR DYNAMICS THROUGH THE COVID-19 LENS

This was not to be. Not this pandemic. Not this state that we are in. And, not this publication. Early this year, the NuclearNerds, the group of scholars part of the Nuclear Security project at the Centre for Air Power Studies, had brought out a *Nuclear Wrap-up*. It encapsulated the major nuclear related developments of 2019. Each author examined and analysed the implications of all that happened in his/her subject of focus to provide the lay of the nuclear land.

The publication was appreciated for its breadth of scope and succinctness of approach. We decided to make it an annual publication. But, who knew then that just five months down the year we would be struck by a virus that would bring about a paradigm shift in our lives and interactions. The global pandemic has cast a shadow on the globe of the kind that had not been seen since World War II. Given the gravity of the situation, the NuclearNerds have felt the need for another wrap-up that can capture the impact of Covid-19 on the various nuclear issues—from nuclear geopolitics to nuclear energy. So, here we are with this second *Nuclear Wrap-up—Nuclear Dynamics through the Covid-19 Lens*.

Note: The *Wrap-up* has previously been published by the Centre for Air Power Studies and can be accessed at <http://capsindia.org/files/documents/5b14f009-25b9-4e7d-be5d-6cf462217619.pdf>.

ACCEPTANCE OF MUTUAL VULNERABILITY AND RESPONSIBLE BEHAVIOUR: EQUALLY NECESSARY FOR COVID-19 AND NUCLEAR DETERRENCE

MANPREET SETHI

The entire world has been in the grip of the novel Corona virus for more than a couple of months by now. The end of this fight is not yet in sight. Economies are in disarray, health facilities are over-stretched, and all scheduled events for 2020—from the personal to the international—stand postponed. While so much uncertainty hangs in the air, the only prediction that can be made with a sense of certainty is that a new kind of normal awaits us. This event marks a paradigm shift that will change our social, economic and political interactions.

For one, the current situation has made the wellbeing of each individual dependent on the good health and hygiene practices of the other. Each is beholden to the other for the security of his/her own health. Any weak link, or laxity in responsible sanitary actions, can lead to the spread of the virus and jeopardise a larger population. There is, therefore, a mutual vulnerability and a shared sense of risk.

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Each one of us is a prisoner to the other's sense of responsibility and rationality.

For analysts of nuclear strategy these concepts ring a bell. The possibility or risk of use of a nuclear weapon by the adversary is sought to be deterred by the idea that he too would not escape unscathed from nuclear damage. This state of mutual vulnerability and an ability to rationally calculate the costs and benefits of an action are supposed to undergird nuclear deterrence.

During the Cold War, the bilateral deterrent relationship was premised on the idea of both sides being able to cause unacceptable damage to each other in a nuclear exchange. Popular as the concept of mutual assured destruction or MAD, it is largely credited for having kept a nuclear war at bay. Since the US and USSR felt vulnerable to each other's damage, certain norms of nuclear behaviour evolved that helped establish crisis and arms race stability. The anti-ballistic missile (ABM) treaty, for instance, was central to formalising the idea of mutual vulnerability by prohibiting both sides from deploying missile defences that could offer protection from the nuclear attack of the other.

Interestingly, over the last couple of decades, the holders of the largest nuclear arsenals, USA and Russia, have been engaged in building capabilities and adopting nuclear postures that they believe can free them from mutual vulnerability. It is argued that mutual vulnerability checkmates the use of the weapon and thus makes it non-usable even for the purpose of deterrence. Therefore, in order to strengthen deterrence, one needs to signal invulnerability to the ability of the other to do nuclear damage. Two ideas of damage limitation have been developed in this context—missile defence (to make oneself impervious to nuclear attack) and limited nuclear war (to reduce one's damage by calibrating use).

The idea of BMD gained primacy in 2000 and the US decided to abandon the ABM treaty in 2001 to start deploying ballistic missile defence architecture—radars and interceptors to shoot down incoming nuclear missiles. The US repeatedly claimed that its BMD deployments were meant to defend its homeland and allies against a handful of missiles from nations like North Korea or Iran, who could not be deterred through the normal rational calculations of cost and

benefit of nuclear use. But, Russia and China, the near nuclear peers of USA, perceived from American capability a potential threat to their nuclear deterrence. Their response has been to go on improving their own offensive capabilities, such as by deploying countermeasures on missiles, making missiles capable of carrying multiple independently re-targetable warheads, increasing the speed and manoeuvrability of delivery systems through use of hypersonics, etc. The ensuing offence-defence spiral has ensured that both sides remain mutually vulnerable and hence away from the tendency to irresponsibly use nuclear weapons based on less than rational calculations of the damage they would cause or that they would suffer by initiating nuclear use.

The second way of minimising mutual vulnerability has been found in the idea of limited nuclear war, or the conduct of nuclear war in such a way that removes one's vulnerability to large-scale nuclear damage. A 'limited nuclear war' is expected to be fought with low yield nuclear weapons against military targets. Such thinking had been popular in the US in the 1960s-1980s when the strategy of flexible nuclear use was envisaged by using counterforce weapons of high precision and accuracy for a 'discriminate' nuclear war. Such use of the nuclear weapons was believed to liberate the nation from the tyranny of mutual vulnerability of unacceptable damage promised by the strategy of deterrence by punishment.

However, the folly of the idea of limited nuclear war and the inability to actually run such operations without risking escalation had been realised by the end of the 1980s. It was eventually conceptualised by Presidents Ronald Reagan and Mikhail Gorbachev in a joint statement that admitted that a nuclear war could not be won, and therefore, should not be fought. This asserted the centrality of mutual vulnerability and the illogic of a nuclear war and became the organising principle of nuclear deterrence. While the presence of nuclear weapons continued to pose risks, these were believed to be the least dangerous when nuclear equations recognised mutual vulnerability and hence the need for responsible behaviour.

From the mid-2010s, however, the US appears to have been rethinking the concept of limited nuclear wars. This tendency has emerged in the context of the advances in disruptive capabilities and strategies of Russia and China. Russia's ambiguity, cultivated or

otherwise, on its right to use low yield nuclear weapons in response to aggression with non-nuclear weapons, widely referred to as 'escalate to de-escalate',¹ is cited as the reason for Washington's search for a "range of limited and graduated options, including a variety of delivery systems and explosive yields."² The US also believes that China's rapid build-up of its anti-access, area denial strategy poses a challenge to the credibility of its ability to follow up on a strategy of nuclear punishment in case of small confrontations. So, the US has felt a credibility gap by not having the capability or doctrine to use lower order nuclear threats against limited war techniques. The US dilemma was aptly captured by an American analyst, "For Russia, 'jab and grab' land incursions; for China, the creeping militarisation of maritime zones. Both techniques operate below the threshold of deterrence by punishment and seek to create territorial *faits accomplis* that lower the costs of revisionism."³ In order to address such threats, the US NPR of 2018 recommends capabilities and options for 'limited' nuclear strikes.

While Russia and China have, not surprisingly, described these developments as destabilising and criticised them for lowering the nuclear threshold, they themselves have not shied away from developing similar or other asymmetric capabilities that would enhance their sense of invulnerability. The problem, however, with these developments is that they raise the risk of deterrence breakdown. This may happen through a deliberate action arising out of a sense of one's ability to handle escalation. Or, it may happen more accidentally or inadvertently as events unfold uncontrollably due to miscalculation and misunderstanding.

These risks are important to understand, particularly in today's times, when the largest possessors of nuclear arsenals are engaging with each other from positions of hyper-nationalism and non-

1. There is much confusion about whether Russia has ever claimed this as its nuclear strategy. For an insight into this debate see Olga Oliker and Andrey Baklitsky, "The Nuclear Posture Review and Russia De-escalation: A Dangerous Solution to a Non-existent Problem", *War on the Rocks*, February 20, 2018, <https://warontherocks.com/2018/02/nuclear-posture-review-russian-de-escalation-dangerous-solution-nonexistent-problem/>
2. Office of the Secretary of Defence, *Nuclear Posture Review*, February 2018, <https://media.defense.gov/2018/Feb/02/2001872886/-1/-1/1/2018-NUCLEARPOSTURE-REVIEW-FINAL-REPORT.PDF>, pp. 30-31.
3. Ibid.

transparency as they fight the virus. There is a sharp mistrust and stress on all kinds of engagements, significantly accentuated by the pandemic. Going by their current vibes towards each other, it seems that negative perceptions and misunderstandings will keep security concerns alive and military programmes afloat. Even as military spending will have to be rationalised in keeping with the sharp plunge in economies, none of the major nations has announced any shelving or even slowdown of any of the planned nuclear modernisation programmes.

Greater militarisation of international affairs and political relations is, therefore, likely to be the order of the day. Some of the events that have come to pass even as nations were in the midst of their fight against the virus substantiate this. A few examples should suffice. Russia conducted a test of a direct ascent anti-satellite weapon system, the Nudol, on April 15, 2020. It is claimed to be able to reach 1500 km above the earth and thus has the potential to hit earth observation satellites in the low earth orbit (LEO). The Russian test has been perceived by Washington as posing a clear challenge to its space systems though it has been working on addressing these already through the creation of a Space Force. China has continued to display assertive behaviour in the South China sea through conduct of military drills and deployment of new assets in the area. While the immediate targets of some of its actions were regional states like Vietnam and the Philippines, the message was also meant for others beyond the region too. In a most recent response to these moves, the US reported on May 2 that it had deployed 4 B-1 heavy bombers and 200 air crew to Guam to carry out deterrence missions.

In the wake of heightened misperceptions, faltering economies, and frayed nerves owing to the fight against the pandemic, it looks difficult to envisage a world imbued with greater international solidarity and cooperation, or empathy and ethics, in handling issues of global concern. Rather, one sees an accentuation of nationalist proclivities over internationalist predispositions. Consequently, concerns that need sustained global cooperative action, such as addressing risks of nuclear terrorism, non-proliferation, climate change, migration, poverty, etc., will not receive the priority they deserve.

Amongst the solutions that can get us to constructively address the risks has to be the realisation and acknowledgement of mutual vulnerability. An understanding that we share these risks is critical. Much like the highly contagious virus that has shown up our health interdependence, nuclear weapons too showcase our security interdependence. In the absence of the admittance that our destinies are tied to one another, irresponsible sanitary behaviour at the individual level could be as disastrous as irresponsible nuclear use at the national levels.

The crisis created by the virus has made us understand the nuances of mutual vulnerability and our dependence on the other's good behaviour. It also offers an opportunity to nations to rethink their concepts of security. Do we have the sagacity and the will to do so? While the realists will quickly nod their heads in the negative, let's not underestimate the shock that has been delivered by the pandemic. The current indicators may look gloomy, but the battered economies and cash crunches may lead nations along the paths of cooperative security and collective wisdom. The jury is still out. Meanwhile, there is little doubt that acceptance of mutual vulnerability and responsible behaviour is equally necessary for an individual's health as for international security.

PANDEMIC, PROLIFERATION AND PREVENTION

SANJANA GOGNA

The global crisis caused by the coronavirus has been likened to a slow nuclear war.¹ In the few months of its outbreak, it has infected almost thirty lakh persons and taken over two lakh lives worldwide.² Consequently, it has led countries to seal their borders and halt most of the social activities in order to contain its spread—which has further caused massive economic disruption worldwide. Its management has necessitated war-time mobilisation as various countries have come under lockdown, and the armed forces and paramilitary forces have been called in for maintaining law and order and execute mitigation operations in some nations.

The crisis has also exposed the various frailties of the liberal international order, which is believed to be a rule-based system defined by free, open markets and multilateral institutions. By defying the nature of such an order, several countries have steadily shut their borders and in some cases restricted the exports of essential

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1. "How the Coronavirus Outbreak is Like a Nuclear Attack: An Interview with Jeffrey Lewis." *Bulletin of the Atomic Scientists*. March 26, 2020, https://thebulletin.org/2020/03/how-the-coronavirus-outbreak-is-like-a-nuclear-attack-an-interview-with-jeffrey-lewis/?fbclid=IwAR3nN5KUJpiOOwxGcd_bbIxV9Lv18ua6xXilH575pjWSJokLrx8k1Efm54Y. Accessed on March 26, 2020.
2. Figures as of April 27, 2020.

medical supplies to cater to the rise in their domestic needs.³ At the domestic level, the pandemic has revealed the inefficiency of the healthcare systems, inadequacy of law and order, and the inflexibility of supply chains. In India, the sudden lockdown of the entire country sparked a worrisome mass movement of daily wage workers from cities to the villages. The country has also witnessed demand and supply shocks, and it is predicted that the economy will be headed towards a slowdown.⁴ Further, with a compromised healthcare infrastructure, Indian hospitals have reported the shortage of testing kits and protective health supplies for the healthcare force.^{5,6}

While the current pandemic has shown the world its limitations in responding to a war-like situation—an actual nuclear war would be far more destructive and deadly and take place in a much shorter timeline. Its management would be beyond the control of any country; its costs would far exceed what any country can bear. A study published in *Science Advances* in October 2019 gave some alarming facts and figures pertaining to a nuclear war between India and Pakistan.⁷ It posited that an exchange of a total 350 warheads ranging between 15-100 Kiloton would not only destroy entire cities and cause massive casualties (it is expected to vary between 5-12.5 crore in the subcontinent) but its after-effects would include fall in global average temperatures and precipitation as a result of the injection of soot into the atmosphere that would impact agriculture and cause famines across the world.

3. Jason Douglas, "As Countries Bar Medical Exports, Some Suggest Bans May Backfire." *WSJ*. April 4, 2020, <https://www.wsj.com/articles/as-countries-bar-medical-exports-some-suggest-bans-may-backfire-11585992600>. Accessed on April 7, 2020.
4. "Covid-19: How the Deadly Virus Hints at a Looming Financial Crisis." *The Economic Times*. March 22, 2020, <https://economictimes.indiatimes.com/news/economy/finance/covid-19-crisis-how-the-deadly-virus-hints-at-a-looming-financial-crisis/articleshow/74752200.cms>. Accessed on March 26, 2020.
5. Sachin P Mampatta & Sohini Das. "Doctors to Hand Wash: Why India Isn't Ready for Coronavirus Crisis." *Business News*, April 5, 2020, https://www.business-standard.com/article/current-affairs/coronavirus-india-s-readiness-a-concern-due-to-shortage-of-beds-drugs-120031401127_1.html. Accessed on April 5, 2020.
6. "COVID-19: India Looks at Importing PPEs to Meet Demand." *The Economic Times*, April 1, 2020, <https://economictimes.indiatimes.com/industry/healthcare/biotech/healthcare/covid-19-india-looks-at-importing-ppes-to-meet-demand/articleshow/74927892.cms?from=mdr>. Accessed on April 5, 2020
7. "Rapidly Expanding Nuclear Arsenals in Pakistan and India Portend Regional and Global Catastrophe." *Science Advances*, October 1, 2019, <https://advances.sciencemag.org/content/5/10/ea5478>. Accessed on March 26, 2020.

The resulting crises in water and food supply would further exacerbate the risk of conflict, societal breakdown, economic crisis and disease outbreaks.⁸

Days before the outbreak of the coronavirus pandemic, international security forums were worrying about the uncertainty regarding the extension of the New START treaty that puts a cap on the nuclear forces deployed by the US and Russia. Earlier, in 2019, the United States withdrew from the Intermediate-Range Nuclear Forces (INF) treaty it had signed with the erstwhile Soviet Union in 1988 to ban the use of missiles with ranges between 500 and 5,500 kilometres. Of late, the introduction of various technologies, such as hypersonic missiles and Multiple independently-targetable Re-entry Vehicles (MIRV) has pushed the states possessing nuclear weapons into an offence-defence spiral. Further, the failures of the world leaders in curbing the nuclear programmes of Iran and North Korea have added woes to the state of nuclear security. Thus, it was no surprise that, on January 23, 2020, the doomsday clock, maintained by the members of the Bulletin of the Atomic Scientists to signify the likelihood of a human-made global catastrophe was moved to 100 seconds to midnight.⁹ It is the closest the Clock has ever been to midnight.

To add to the challenges confronting the nuclear world today are the risks of 'nuclear entanglement'. The term refers to the intertwining of various non-nuclear weapons technologies, such as ballistic missile defences, dual-use missiles and hypersonic missiles, cyber weapons, and high-precision munitions with the nuclear weapons system. Nuclear weapons states often indulge in operational and geographical entanglement of their nuclear assets to confound the attempts of pre-emptive strikes by an adversary. This has inherent risks as it increases the chances of misperception and miscalculation during the fog of a war, and further raises the risk of inadvertent use of

8. "Coronavirus Has Changed the Future of National Security Forever. Here's How." *Euractiv*, April 1, 2020, <https://www.euractiv.com/section/defence-and-security/opinion/coronavirus-has-changed-the-future-of-national-security-forever-heres-how/>. Accessed on April 5, 2020.

9. "Current Time." *Bulletin of the Atomic Scientists*, April 5, 2020, <https://thebulletin.org/doomsday-clock/current-time/>. Accessed on April 5, 2020.

nuclear weapons.¹⁰ To illustrate, in an attempt to target conventional missiles, an adversary may unwittingly target facilities that house nuclear weapons; this situation may lead the conventional war to escalate to nuclear war.¹¹ In another likely scenario, a state might mistake an incoming hypersonic missile tipped with a conventional warhead from an adversary to be a nuclear weapon. Hypersonic missiles travel at speeds exceeding Mach 5 (6,199 km an hour), and therefore may cause warhead and destination ambiguities. Thus, the state might immediately respond by launching a nuclear weapon and thereby spark a nuclear war.¹²

Both pandemics and nuclear wars are threats of transnational nature as they cause dangers of large scale and incalculable probability, thus causing their effects spill to across borders. John Steinbruner, an American scholar on arms control, has defined such threats as ‘distributed threats’ as they emanate from distributed processes. These include the unseen interaction of deployed forces, the erosion of legal standards, the evolution of dangerous pathogens, or the tipping of vital environmental balances. He argues that strategy to manage such threats must shift from ‘contingency reaction’—which is the traditional way of responding to crises—to ‘anticipatory prevention’. He asserts that such efforts would require global collaborative efforts.¹³

However, the liberal international order is waning and steadily getting replaced with a system governed by realist thinking. States are getting distrustful of the international regimes; they are withdrawing from the collaborative efforts that resulted from the

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10. James M. Acton, Tong Zhao and Li Bin. “Reducing the Risks of Nuclear Entanglement.” *Carnegie Endowment for International Peace*, September 12, 2018, <https://carnegieendowment.org/2018/09/12/reducing-risks-of-nuclear-entanglement-pub-77236>. Accessed on March 26, 2020.
 11. “Drawing a Line Between Conventional and Nuclear Weapons in China.” *Bulletin of the Atomic Scientists*. May 5, 2015, <https://thebulletin.org/2015/05/drawing-a-line-between-conventional-and-nuclear-weapons-in-china/>. Accessed on March 26, 2020.
 12. James Acton, “The Weapons Making Nuclear War More Likely.” *BBC News*, February 8, 2019, <https://www.bbc.com/news/world-47117349>. Accessed on March 26, 2020. Also see Manpreet Sethi, “The Hype over Hypersonics.” *The Hindu*, January 27, 2020, <https://www.thehindu.com/opinion/op-ed/the-hype-over-hypersonics/article30659477.ece>. Accessed on March 26, 2020.
 13. John D. Steinbruner, *Principles of Global Security* (Washington: Brookings Institution Press, 2001).

rule-based order and are now emphasising the primacy of national interest. Consequently, the risks associated with nuclear weapons have reached an all-time high.

Thus, while the ongoing pandemic reveals the limitations of the international community in mitigating the crises of great magnitude; the current global trends suggest that the prospects of nuclear non-proliferation as well as the complete elimination of nuclear weapons through global cooperation remain bleak. Within this context, the world leaders need to rethink the logic of nuclear deterrence and become mindful of the risks associated with nuclear entanglement. They need to take preventive measures against inadvertent use of nuclear weapons which includes drawing a clear line between its conventional and nuclear delivery systems, and developing separate supporting capabilities for each type of system. Such efforts towards nuclear disentanglement would eliminate the risk of nuclear escalation to a great extent, and spare humanity a disaster that would be beyond its capacity to effectively manage.

IRAN'S NON-PROLIFERATION COMMITMENTS AND COVID-19: SOME LINKAGES

HINA PANDEY

Iran has emerged as one of the worst hit COVID-19 countries in the West Asian region. As on 27 April 2020, the death toll due to COVID-19 had surged to 5,806¹ in the country. The outbreak began in the city of Qom, and Iran soon became one of the epicenters of COVID-19 in the region. If media reports are to be believed, “at least six people die every hour in Iran from the pandemic”.² Indeed, Iran seems to have been hit harder by the ongoing pandemic due to the ongoing sanctions. This is evident from the emergency funding of \$5 billion³ Iran recently requested from the IMF in order to fight the pandemic. Furthermore, an assessment by the Sheriff University has estimated that if the current situation prevails, it could cost the life of 3.5 million in the country.⁴

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1. Mustafa Melih Ahishali, “Iran’s Coronavirus Death Toll Surges Past 5,800”, *Anadolu Agency*, April 27, 2020, <https://www.aa.com.tr/en/latest-on-coronavirus-outbreak/irans-coronavirus-death-toll-surges-past-5-800/1819878>. Accessed on April 27, 2020.
2. Why has the coronavirus hit Iran so hard?”, *AL Jazeera*, April 4, 2020, <https://www.aljazeera.com/programmes/upfront/2020/04/coronavirus-hit-iran-hard-200403042329181.html>. Accessed on April 25, 2020.
3. “Iran asks IMF for \$5 billion emergency funding to fight coronavirus” *Reuters*, 12 March 2020, <https://www.reuters.com/article/us-health-coronavirus-iran-imf-idUSKBN20Z17B>. Accessed on April 15, 2020.
4. Assal Rad, “The World needs to cooperate against the Coronavirus—So Lift Sanctions On Iran”, *National Interest Blog*, April 4, 2020, <https://nationalinterest.org/blog/>

Given this context, the calls for lifting sanctions on Iran as a humanitarian gesture have already gained traction. In the US, over 30 Congressional members including Senators Bernie Sanders and Edward J. Markey urged the President to “substantially suspend sanctions”⁵ to fight COVID-19. Already the pandemic has claimed the lives of some top officials in Iran such as Hossein Sheikholeslam,⁶ who was also the former advisor to the current Foreign Minister Javed Zarif, and Mohammad Mirmohammadi⁷—an Expediency Council member of Iran and one of the advisors to the Supreme Leader.

However, amidst the ongoing crisis, it is imperative that the non-proliferation commitments by Iran do not get sidelined. Attention to them becomes all the more important now because in March 2020, the IAEA Director General, Rafael Grossi raised concerns on Iran’s NPT commitments and urged clarification at the earliest. Furthermore, some non-proliferation watchers have even apprehended that any laxity in managing the aspects of the Iranian nuclear non-proliferation commitments due to the outbreak of COVID-19 might enable Iran to cheat on them.

It is to be reiterated here that Iran has come to occupy a significant spotlight in the discussions surrounding the non-proliferation commitments directly related to the NPT. Furthermore, its continued adherence to the terms of the Joint Comprehensive Plan of Action (JCPOA) as well as to IAEA’s Safeguards Agreement—including the Additional Protocol (AP)—remains paramount in ensuring that non-proliferation commitments are in place.

buzz/world-needs-cooperate-against-coronavirus%E2%80%94so-lift-sanctions-iran-140752. Accessed on April 15, 2020.

5. “US lawmakers press Trump to lift Iran sanctions amid ‘borderless’ pandemic”, *French Press TV*, April 1, 2020, <https://french.presstv.com/Detail/2020/04/01/622066/US-Congress-Trump-Iran-Sanctions-Sanders-Pompeo>. Accessed on April 15, 2020.
6. “Former Hostage Taker Of US Diplomats Dies Of Coronavirus In Iran”, *Radio Farda*, March 6, 2020, <https://en.radiofarda.com/a/former-hostage-taker-of-us-diplomats-dies-of-coronavirus-in-iran/30470975.html>. Accessed on April 25, 2020.
7. “Adviser to Iran’s Supreme Leader Dies after Falling Sick from New Coronavirus”, *Market Watch*, March 2 2020, <https://www.marketwatch.com/story/adviser-to-iran-supreme-leader-dies-after-falling-sick-from-new-coronavirus-2020-03-02>. Accessed on April 25, 2020.

Non-Proliferation Inspections & COVID-19

Iranian non-proliferation commitments under JCPOA as well as those emerging from its Safeguard Agreement with the IAEA are affected by the outbreak of the current pandemic. In both the cases, physical inspections are required in order to ensure complete adherence. More significantly, inspections in the latter case, that require the evaluation of the Safeguard Agreements including the Additional Protocol (AP), could be viewed as urgent because the request is made by IAEA on the basis of recently available information. This is separate from the JCPOA related inspections. However, Iran has refrained from accepting IAEA's demands for special inspection. In January 2020, Iran refused to allow an IAEA official's visit. If the impasse is prolonged it could spell trouble for the non-proliferation regime.

1) NPT Safeguards Agreement

On March 3, 2020, IAEA released two separate reports dealing with Iran's non-proliferation commitments. Report one, titled "NPT Safeguards Agreement with the Islamic Republic of Iran" by the IAEA DG to the IAEA Board of Governors sought clarifications relating to *'the correctness and completeness of Iran's declarations under its Safeguards Agreement and Additional Protocol'*. Iran being an NPT member is obligated to deliver on its NPT Safeguards Agreement.

The Agency identified few questions in relations to the possibility of *'undeclared nuclear material and nuclear-related activities'* at three separate locations in Iran. Three letters corresponding to each location, along with the geographical coordinates were sent to Iran on July 5, 2019, August 9, 2019 and August 21, 2019, respectively. While the Agency has not elaborated on the specificities, however, the public report highlights that clarifications were sought such as (a) whether natural uranium had been used in certain activities at an unspecified location in Iran and the location of such a material; (b) whether nuclear material had been stored/used or nuclear activities had been conducted at a location specified by the agency; and (c) whether Iran had used or stored nuclear material

at another location specified by the Agency.⁸ It may be noted that some of the information required by IAEA was in reference to the activities observed earlier in 2019. It is suspected that IAEA may have referred to the information “Israel stole from Iran in 2018 and later shared with the IAEA which could have details about Iran’s past nuclear weapons work.”⁹

IAEA has already sent reminder letters to Iran requesting access to the three locations that would clarify aspects relating to Iranian nuclear programme and let the Agency verify that it exists solely for peaceful purposes. One of the letters was sent on January 17, 2020 with subsequent follow-ups, to which Iran had responded on January 28, 2020 that “it will not recognize any allegation on past activities and does not consider itself obliged to respond to such allegations.”¹⁰

Following up on this, IAEA further expressed in its reply dated January 31, 2020, that Iran had not satisfied the Agency’s requests for clarifications, nor offered other means to resolve the issue. While a meeting in this regard between the Head of Atomic Energy Organisation of Iran and the IAEA DG took place in Vienna on February 11, 2020, the matter still remains pending.

Clarifications on these aspects are deemed significant by IAEA as they allow the Agency to resolve any compliance issue. It is to be reiterated that the clarifications sought specifically require environment sampling in geographical locations that might not be declared by Iran in relation to its nuclear programme. However, under the provisional application of AP the IAEA inspectors are authorised to conduct inspection at places where nuclear materials may not have been declared by a country under the requirement of the AP. The AP provides for “expanded access for inspectors, and allows for greater use of environmental sampling to test for the presence of nuclear materials”.¹¹

8. IAEA Report, (2020) “NPT Safeguards Agreement with the Islamic Republic of Iran”, GOV/2020/15, March 3, 2020, https://isis-online.org/uploads/iaea-reports/documents/IAEA_Iran_NPT_March_2020_report.pdf. Accessed on April 11, 2020.

9. Kelesy Davenport, “IAEA Urges Iran to Cooperate” April 2020, *Arms Control Association*, <https://www.armscontrol.org/act/2020-04/news/iaea-urges-iran-cooperate>. Accessed on April 27, 2020.

10. IAEA Report, (2020) “NPT Safeguards Agreement with the Islamic Republic of Iran”, GOV/2020/15, March 3, 2020, https://isis-online.org/uploads/iaea-reports/documents/IAEA_Iran_NPT_March_2020_report.pdf. Accessed on April 11, 2020.

11. Ibid.

In addition to this, the Agency also “has authority to inspect for hidden nuclear weapons-related activities that do not involve nuclear material”.¹² It, thus, remains with the IAA’s mandate to request for such clarifications. Furthermore, it is to be noted that, while the IAEA’s report published in 2015 had already concluded that “Iran had a nuclear weapons program prior to 2003 and no evidence of weaponisation activities after 2009 or any credible indication that nuclear materials had been diverted for those programs was found”,¹³ the Agency is still required to further investigate additional evidence of undeclared nuclear activities.

From the Iranian perspective, these requests by the IAEA appear to be politically motivated. The Iranian spokesperson for the Atomic Energy Commission called these verification requests “unprincipled questions and demands by the Agency lacking any legal basis”.¹⁴ Iranian Foreign Ministry, too, maintains that Iran reserves the right to only answer “legal and technical questions, rejecting any politically-tainted attempt by certain regimes to force the IAEA to put Iran under pressure”.¹⁵ Iran feels that the Agency is acting on behalf of information supplied by “spy agencies of Iran’s foes”.¹⁶

Iran’s refusal makes it a matter of ‘denial of access’. If unresolved, this would likely disturb the established cordiality between Iran and IAEA. This is important for the smooth functioning of JCPOA, which has already come under strain. Furthermore, the issue gets compounded because two influential members of the IAEA—the US

12. George Bunn, “Nuclear Safeguards: How Far Can Inspectors Go?” *Viewpoint, IAEA Bulletin*, 48/02, March 2007, <https://www.iaea.org/sites/default/files/publications/magazines/bulletin/bull48-2/48203494955.pdf>. Accessed on April 13, 2020.

13. Kelesy Davenport, “IAEA Urges Iran to Cooperate” April 2020, *Arms Control Association*, <https://www.armscontrol.org/act/2020-04/news/iaea-urges-iran-cooperate>. Accessed on April 27, 2020.

14. “Iran says IAEA questions and inspection demands must be legally valid”, *Tehran Times*, March 4, 2020, <https://www.tehrantimes.com/news/445853/Iran-says-IAEA-questions-and-inspection-demands-must-be-legally>. Accessed on April 15, 2020.

15. “Iran says IAEA Questions Should Be Technical, Legal” *Tehran Times*, March 11, 2020, <https://www.tehrantimes.com/news/446006/Iran-says-IAEA-questions-should-be-technical-legal>. Accessed on April 15, 2020.

16. “Salehi: Tehran has asked IAEA not to listen to spy agencies run by Iran’s foes”, *Tehran Times*, April 5, 2020, <https://www.tehrantimes.com/news/446513/Salehi-Tehran-has-asked-IAEA-not-to-listen-to-spy-agencies-run>. Accessed on April 15, 2020.

and Russia do not appear to be on the same page on the conduct of inspections based on third party information.

Thus, the emerging tensions between IAEA and Iran point to a deeper issue relating to the manner in which IAEA conducts its inspections and verification. As mentioned before, any tension at the moment between Iran and the Agency does not bode well for the future of JCPOA, which has already come under strain due to the American withdrawal, the P4's inability to generate economic benefits for Iran, and the subsequent breaches by Iran in a phased manner.

2) Iran's Commitments Under the JCPOA

The second report released by the IAEA on March 3, 2020, titled, "Verification and monitoring in the Islamic Republic of Iran in light of United Nations Security Council resolution 2231" discusses the implementation of Iran's nuclear-related commitments under the JCPOA. This report has highlighted that Iran has been "enriching uranium up to 4.5% U-235 and continues to conduct certain enrichment activities that are not in line with its long-term enrichment and R&D enrichment plan specified when the implementation of JCPOA began".¹⁷ Furthermore, it states that the total enriched uranium stockpile of Iran has exceeded 300 kg of UF₆ enriched up to 3.67 percent U-235.¹⁸ It is important to note that these observations by IAEA were made after Iran's ultimatum provided on January 5, 2020, that it's no longer obligated to "restrictions in the operation sphere"¹⁹ under the JCPOA.

Despite this, the IAEA has refrained from presenting an alarming view, and stated in its report that no changes in the implementation of the nuclear related commitments under the JCPOA have been observed. It has also acknowledged that Iran continues to cooperate with the IAEA like before. However, owing to these recent developments, anxiety concerning the "reduction of breakout time

17. IAEA Report, "Verification and monitoring in the Islamic Republic of Iran in light of United Nations Security Council resolution 2231", GOV/2020/5, March 3, 2020, https://www.iaea.org/sites/default/files/20/03/go_v2020-5.pdf. Accessed on April 11, 2020.

18. Ibid.

19. IAEA Report, n. 4.

for Iran to 3.5 months to develop a nuclear weapon” has surfaced.²⁰ Assumptions that Iran might utilise this time away from the spotlight when the world is fighting other urgent issues for advancing its nuclear programme have entered the narrative.²¹ Some experts worry that “suspending inspections, even temporarily could potentially leave a multi-month gap that could lead Iran to exploit, if it chose to fully break out of the nuclear agreement”.²² While it is not clear whether IAEA has suspended the visits in order to protect the health of its officials, it is plausible to expect such a move, as Iran is severely affected by the pandemic. Given the “depletion of roster of activities for IAEA inspectors”²³ in the current circumstances, the verification of JCPOA appears to be continuing through online surveillance.

As per the latest reports, IAEA has ensured the continuation of on-site inspections and monitoring activities in Iran despite the pandemic. But it is not clear whether this includes physical inspections too. While Tariq Rauf, in a recent piece for Bulletin of Atomic Scientists, highlighted that “all IAEA operations including safeguard inspections continue amidst COVID-19 but it is also pointed out that travel disruptions and in-person, on-site agency inspections may suffer some possible disruption”.²⁴ IAEA is mandated to report quarterly on the JCPOA implementation; should it choose online

20. Laurence Norman and Michael R. Gordon, “Iran’s Stockpile of Enriched Uranium Has Jumped, U.N. Atomic Agency Says”, *Wall Street Journal*, March 3, 2020, <https://www.wsj.com/articles/irans-stockpile-of-enriched-uranium-has-jumped-u-n-atomic-agency-says-11583243861>, Accessed on April 27, 2020 and <https://twitter.com/TheGoodISIS/status/1234887532942413824>, Accessed on April 27, 2020 in Mark Fitzpatrick, “Iran’s nuclear latency needs to be guarded, not goaded”, *IJSS*, March 6, 2020, <https://www.ijss.org/blogs/survival-blog/2020/03/iran-low-enriched-uranium-stockpile-iaea-report>. Accessed on April 27, 2020.
21. Majid Rafizadeh, “Amid Virus Crisis, Iran Focuses On Nuclear Program”, *Arab News*, March 8, 2020, <https://www.arabnews.com/node/1638566>. Accessed on April 15, 2020
22. George Moore, (2020), “One Potential Victim of Coronavirus? Nuclear Inspections In Iran”, *Bulletin of Atomic Scientists*, March 17, 2020.
23. Jonathan Tirone, “Coronavirus Puts Iran Nuclear Deal Monitoring at Risk”, *Bloomberg*, March 12, 2020, <https://www.bloomberg.com/news/articles/2020-03-12/coronavirus-goes-nuclear-in-iran-with-deal-monitoring-at-risk>. Accessed on April 14, 2020.
24. Tariq Rauf, “Round-The-Clock Surveillance Of Iran’s Uranium-Enrichment Sites Continues, Despite Coronavirus”, *Bulletin of Atomic Scientists*, March 25, 2020, <https://thebulletin.org/2020/03/round-the-clock-surveillance-of-irans-uranium-enrichment-sites-31continues-despite-coronavirus/>. Accessed on April 15, 2020.

monitoring as the basis of reports or is presence of inspectors on the ground mandatory? There is a lack of clarity on this.

Managing the effective implementation of the JCPOA under the current times with US-Iran, Iran-IAEA, US-Russia differences is a difficult proposition. Any disruptions in the commitments of JCPOA under the backdrop of heightened friction between the US and Iran can raise false alarms and might cause unwanted damage to the JCPOA.

Can COVID-19 Prompt a Détente?

The current pandemic is an exceptional situation that calls for exceptional responses. The rate of outbreak has caught even the most robust economy off-guard. This calls for inclusion of a humanitarian approach even more, especially towards a country that is already under years of stringent economic pressure. The times of COVID-19 can be used as an opportunity to offer détente to Iran for a limited period by easing sanctions. The calls for lifting sanctions in the current times include allowing Iran to “sell oil on the international market to purchase medical and other supplies needed to fend off the virulent epidemic”. IAEA is already engaged in sending out diagnostic machines and kits to more than 40 countries including Iran²⁵ to combat the spread of COVID-19. Can IAEA do more? In case some more helpful humanitarian actions can be taken, it would have the potential to positively impact the IAEA-Iran stand-off by reducing the animosity between the parties and also enable Iran to change its hard narrative. Finally, one can only hope that cooperation may breed cooperation. If there is time to bring US closer to Iran and Iran closer to non-proliferation, this is it.

25. IAEA to send RT-PCRs to Iran, *Tehran Times*, April 3, 2020, <https://www.tehrantimes.com/news/446435/IAEA-to-send-RT-PCRs-to-Iran>. Accessed on April 15, 2020.

NUCLEAR ENERGY IN TIMES OF COVID-19

ZOYA AKHTER FATHIMA

The COVID-19 coronavirus is having a tremendous impact on the world. Having spread to more than 185 countries, it has not only killed more than 2 lakh people, but affected more than 30 lakh worldwide, and led to the rest of the population to self-quarantining themselves. It has also triggered a severe economic crisis and social disruption. Declared a pandemic by the World Health Organisation, we are dealing with a crisis of a global scale. And, although, pandemics have happened in the past, the reality of dealing with it today is much different from before, as almost every aspect of a modern person's life is digitised today, whether it is travelling or paying bills, leisure activities or operation of critical infrastructure. We currently live in an era where societies are driven by technology, most of which is powered by electricity.

The importance to keep the power supply on now is felt more than ever, since hospitals have been working beyond their capacity to deal with the increasing number of patients. Ventilators and monitors cannot afford to go off even momentarily. Similarly, electricity is also important to ensure the continuity of banking services, businesses, etc. which are crucially contributing to the economy, at a time when a financial and economic crisis is looming large. The whole world

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is adapting to this crisis: business companies have their employees teleworking, schools have been organizing classes online, and political and corporate meetings are taking place through video-conferences. It is reliable supply of electricity that is enabling these adaptations.

Amongst the baseload sources of electricity, nuclear power has yet again shown its relevance in times like this. However, like in all cases, the nuclear power plants too have had to adapt some of their processes in keeping with the demand of physical distancing. While there is a huge amount of automation in nuclear power plants, the presence of humans in command centres is nevertheless a necessity for safe operations. Nuclear power utilities around the world are therefore trying to adapt themselves to deal with this challenge effectively.

Contingency Plans

High safety culture and emergency preparedness is the linchpin of the nuclear power industry. Nuclear power utilities already have contingency plans in place for many kinds of disasters, including pandemics. For example, the French utility company, Électricité de France (EDF) has a Pandemic Plan since 2009. EDF claims that in worse case scenarios it is equipped to ensure continuation of electricity generation for twelve weeks through its pandemic plan. Fortunately, it hasn't yet had to initiate this plan.¹ However, on March 23, EDF stated that it would be decreasing its previously set target of producing 275-390 TWh of nuclear production, due to production disruption that is caused with having its workers stay away from the worksite.²

The Director-General of the Russian Rosatom State Nuclear Energy Corporation (Rosatom) too has expressed the preparedness of his nuclear enterprise. He stated that additional measures had been taken not just at all the nuclear power plants in Russia, but also at plant construction sites. Rosatom has also envisaged several

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1. "French utility EDF says three employees test positive for coronavirus", Reuters, March 10, 2020, <https://www.reuters.com/article/us-health-coronavirus-edf/french-utility-edf-says-three-employees-test-positive-for-coronavirus-idUSKBN20X2E6>. Accessed on March 25, 2020.
 2. "French power group EDF sees 2020 earnings at lower end of forecasts", *Economic Times*, March 23, 2020, <https://energy.economictimes.indiatimes.com/news/power/french-power-group-edf-sees-2020-earnings-at-lower-end-of-forecasts/74771729>. Accessed on March 25, 2020.

scenarios that could occur due to the novel Corona virus outbreak that would impact their workers and has developed a number of contingency plans depending on how events unfold.³

In Belgium, Electrabel SA, an energy corporation, has developed a Corona Action Plan. This plan enables an arrangement of teleworking for staff members whose functions allow it, while ensuring that there is sufficient staff to carry out the critical activities at nuclear power plants. It has also taken several other precautionary measures such as postponement of non-urgent maintenance activities, increasing sanitization of the workplace, providing access to disinfectants and medical services, etc.⁴ Fortum's Loviisa nuclear power plant in Finland, too has preparedness plans in place.⁵ As is evident, therefore, nuclear plant operators in general have a high level of preparedness to handle the emergency.

Promoting Remote Working

Most nuclear power utilities are encouraging remote working, having only the critical staff workers, such as those involved with operation, maintenance and security asked to go to the work site. The spokesperson for US Nuclear Regulatory Commission, Scott Burnell said that about 75 per cent of their workforce is already prepared to work remotely.⁶ Neil Sheehan, spokesman of Region 1 of the NRC, which oversees NextEra Energy Seabrook nuclear power plant stated that their employees are able to access materials, monitoring and communication technology to ensure safe operations of the country's nuclear power plants and other related businesses.⁷ EDF Energy of

3. "ROSATOM Director General Makes Statement on COVID-19 Situation", *Rosatom.ru*, March 26, 2020, <https://www.rosatom.ru/en/press-centre/news/rosatom-director-general-makes-statement-on-covid-19-situation/>. Accessed on March 27, 2020.
4. "Corona crisis: Belgian nuclear power stations take the necessary measures", *Engie Electrabel.be*, <https://corporate.engie-electrabel.be/local-player/nuclear-3/doel/>. Accessed on March 28, 2020.
5. "Fortum's Loviisa nuclear power plant prepared for the corona virus epidemic", *Fortum*, <https://www.fortum.com/media/2020/03/fortums-loviisa-nuclear-power-plant-prepared-corona-virus-epidemic>. Accessed on March 30, 2020.
6. "Coronavirus and the U.S. grid: What to know", *eenew.net*, March 16, 2020, <https://www.eenew.net/stories/1062615349>. Accessed on March 25, 2020.
7. Angeljean Chiamrida, "Seabrook Nuclear Power Plant Following Pandemic Protocol", *Seacoastonline*, March 25, 2020, <https://www.seacoastonline.com/news/20200325/seabrook-nuclear-power-plant-following-pandemic-protocol>. Accessed on March 27, 2020.

France too has reduced its workforce by over 50 per cent at the Hinkey Point C nuclear power plant. Many nuclear power plant authorities around the world have followed suit.

Increased Sanitation

Another important aspect these utilities have been promoting is increased sanitation, by disinfecting the work places often. For example, RWE AG, one of Germany's largest utility companies has been disinfecting radiation meters that are used by the employees on a regular basis.⁸ Similarly, tools are being disinfected at the Plant Vogtle in Georgia, in addition to the other safety measures adopted by the authorities.⁹

Safety Measures

Other approaches adopted by nuclear power utilities for increased safety and social distancing among their staff includes staggering staff meal breaks, regular health check-ups of personnel, increased sanitisation of workplaces, temperature checks of people entering the site, suspension of business travel, alternate using of facilities, no-visitor policy, etc. In the United States, Maria Korsnick, president of the Nuclear Energy Institute stated that some operating reactors are even "considering measures to isolate a core group to run the plant, stockpiling ready-to-eat meals and disposable tableware, laundry supplies and personal care items."¹⁰

Application of Nuclear Technology in Combating Covid-19

In addition, nuclear technology is also being used directly to help in combating the corona virus through a nuclear derived technique,

8. "German grid and nuclear plant operators step up coronavirus precautions", *Clean Energy Wire*, March 9, 2020, <https://www.cleanenergywire.org/news/german-grid-and-nuclear-plant-operators-step-coronavirus-precautions>. Accessed on March 27, 2020.
9. Colin Demarest, "Two negatives, six waiting: A novel coronavirus update from Plant Vogtle", *Aiken Standard*, March 18, 2020, https://www.aikenstandard.com/coronavirus/two-negatives-six-waiting-a-novel-coronavirus-update-from-plant/article_5f337b70-694f-11ea-ab25-bbb56ff059b2.html. Accessed on March 25, 2020.
10. Valerie Volcovici and Scott Disavino, "US power industry may ask key employees to live at work if coronavirus worsens", *National Post*, March 20, 2020, <https://nationalpost.com/pmn/health-pmn/us-power-industry-may-ask-key-employees-to-live-at-work-if-coronavirus-worsens>. Accessed on March 25, 2020.

called the real time reverse transcription-polymerase chain reaction (real time RT-PCR). This technique enables the detection of coronavirus. Along with providing training on using this technology, the International Atomic Energy Agency (IAEA) has also dispatched these diagnostic kits and equipment to over forty countries.¹¹ Other uses of nuclear technology in this regard is the production of cobalt-60, an artificial radioisotope produced in a nuclear reactor, which can be used in the sterilisation of medical equipment. In this regard, countries like China have used their industrial irradiation facilities to handle disinfection and sterilisation of medical supplies.

Temporary Halt in Operations

Operations have been halted in a few facilities where it was deemed important. Placing utmost importance on safety, Ho Nieh, director of the NRC's Office of Nuclear Reactor Regulation stated that if a facility was incapable to meet regulatory requirements, the NRC had "a variety of mechanisms to consider," including plant closures. Examples of this include the Magnox reprocessing plant which is undergoing a controlled shutdown. After an employee tested positive for Covid-19, over 8 per cent of their staff began self-isolating to prevent the spread of the virus. Officials stated that "as a proactive measure, to retain the reprocessing stream in a sustainable state for the future, we are moving to a controlled shutdown of the Magnox reprocessing plant over the next few days... This approach will enable the best opportunity for an effective restart when circumstances permit. With safety in mind, similar measures may be necessary elsewhere across the business."¹² Production has also been temporarily discontinued at the Cigar Lake uranium mine in Canada. In addition, to ensure social distancing, the onsite workforce has been reduced from 300 workers to just 35.¹³ Uranium production at Cigar Lake uranium mine in

11. "Message: Nuclear power in the fight against COVID-19", *World Nuclear News*, March 27, 2020, <https://world-nuclear-news.org/Articles/Message-Nuclear-power-in-the-fight-against-COVID-1>. Accessed on March 30, 2020.

12. "Coronavirus: 1,000 Sellafield staff self-isolating amid pandemic", BBC.com, March 18, 2020, <https://www.bbc.com/news/uk-england-cumbria-51951984>. Accessed on March 25, 2020.

13. "Canadian uranium operations suspended in response to COVID-19", *World Nuclear News*, March 24, 2020, <https://world-nuclear-news.org/Articles/Canadian-uranium-operations-suspended-in-COVID-19>. Accessed on March 28, 2020.

Canada has also been suspended as the facility has been put under safe care and maintenance mode. Similarly, Orano Canada, a uranium mining, milling, and exploration company, where the ore from Cigar Lake is processed, has also halted operations. Operations at the La Hague reprocessing plant in France have also been temporarily put off, to protect employees, while only critical activities continue.

Conclusion

The Corona virus outbreak is proving that the nuclear industry is equipped to face novel and challenging operating conditions, as most nuclear power utilities continue to perform their critical missions. It is during times of such crises that we recognise more unsung heroes. The workers at these nuclear power facilities deserve credit for putting themselves at risk to ensure that the reactors are running, which has been tremendously helpful in ensuring uninterrupted availability of electricity.

Culture of preparedness and high safety is the hallmark of the nuclear industry. This trait automatically comes into play during pandemics. All nuclear power plants have emergency plans in place, which not only act as an additional layer of protection during an emergency but also provide a plan of action during crisis situations. This is being evinced during the ongoing corona virus. The sector appears to be well prepared having contingency plans in place. Covering a wide realm of issues, such as accidents, terror attacks, natural calamities, etc., these emergency plans keep getting revised. For example, the preparedness to deal with this Covid-19 stems from having experienced the SARS outbreak in 2003, which gave the power utilities some experience in preparing ahead in case of another such crisis.

Another characteristic trait of the nuclear industry is proactiveness, which was displayed with the planned emergency exercise that was conducted from March 24 to 26, 2020. Organised by the IAEA, this exercise was partaken by 35 countries and two Regional Specialised Meteorological Centres of the World Meteorological Organisation. The exercise focused on dealing with various emergency scenarios, including operations during a pandemic such as the ongoing one. IAEA Director General Rafael Mariano Grossi,

who chaired a mid-exercise meeting of the Incident and Emergency System Steering Group, stated: “We need to be prepared for the possibility that nuclear and radiological emergencies resulting from a safety or security event could be accompanied by natural disasters, pandemics or other crises.” He said that conducting the exercise during the coronavirus crisis demonstrates the IAEA’s determination to maintain its emergency response capability. “Regardless of the causes and circumstances of any crisis, the IAEA will act quickly to coordinate an effective international response.”¹⁴

Indeed, amidst this grim and unfortunate situation, the nuclear industry has shown its proficiency as a clean and reliable energy source. Its high capacity factor, in addition to the need for refuelling only once in one or one and a half years ensures security of supply and low maintenance requirements. The current crisis yet again highlights the importance of making right power choices.

14 “Pandemic adds to emergency exercise complexity”, World Nuclear News, April 1, 2020, <https://world-nuclear-news.org/Articles/Pandemic-adds-to-emergency-exercise-complexity>. Accessed on April 6, 2020.

NUCLEAR NON-PROLIFERATION AND DISARMAMENT IN TIMES OF THE PANDEMIC

SREOSHI SINHA

The 2020 coronavirus pandemic has caused a severe global disruption. Dealing with the pandemic has consumed energies of all nations over the last few months. It is said to have originated from the Wuhan province of China in December last year, and due to its severity has been declared by the World Health Organisation as a Public Health Emergency of International Concern on January 30, and a pandemic on March 11. As of April 29, 2020, more than 3.11 million cases of COVID-19 had been reported in 185 countries and territories, resulting in more than 2,17,000 deaths.¹ As a result of this, many existing challenges posed by nuclear weapons seemed to have been put on the back burner.

Amongst the many casualties of Covid-19 was the scheduled conduct of the Nuclear Non-Proliferation Treaty (NPT) RevCon, which would have marked the 50th anniversary of the treaty since its entry into force. The treaty is viewed as the foundation of the global endeavours towards exploitation of peaceful use of nuclear

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1. "COVID-19 Dashboard by the Centre for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU)". ArcGIS. Johns Hopkins University. Retrieved April 29, 2020.

energy, non-proliferation and disarmament of nuclear weapons. Abiding by Article VIII.3 of the NPT that states, “Five years after the entry into force of this Treaty, a conference of Parties to the Treaty shall be held ... in order to review the operation of this Treaty...”, the first review conference was held in the year 1975. Since then the committee decided to conduct quinquennial reviews in the form of RevCons every preceding five years. This year’s RevCon was to be the tenth in a series of such quinquennial NPT RevCons. Though its journey towards the goal of nuclear disarmament has not yielded much success, the NPT has survived many crises and has contributed to curbing horizontal proliferation of nuclear weapons even though the recognised five nuclear weapon states (NWS) or the P5 the US, Russia, the UK, France and China have continued to expand their respective arsenals without any constraints.

Though this year’s NPT RevCon was an extremely important event, it had to be postponed till 2021 due to the unexpected turn of events created by the outbreak of this pandemic. According to the decision makers, an yearlong gap would not only provide enough time for the COVID-19 to subside, but it might also have a prospect of developing a COVID-19 vaccine. On the other hand, other uncertainties related to international travel and global economy might also settle down during the given year. The April 2021 RevCon will be convened at Vienna.

The reasons for NPT Review Conference 2021 to be convened at Vienna, the capital of Austria, instead of in New York is because, Vienna is the headquarters of the International Atomic Energy Agency (IAEA)², which has been responsible for two of the three “pillars” of the NPT—nuclear verification (safeguards) security and safety, as well as the peaceful applications of nuclear technology. This city has also successfully hosted the first preparatory committee session of the series of quinquennial NPT review conferences since 2007, while the second PrepComs are hosted in Geneva and the third in New York. Additionally, the headquarter of Comprehensive Nuclear-Test-Ban Treaty Organisation (CTBTO) as well as the United Nations

2. Tariq Rauf. 2020. UN Insider. March, <https://www.indepthnews.net/index.php/armaments/nuclear-weapons/3351-relentless-spread-of-coronavirus-obliges-postponing-the-2020-npt-review-to-2021>.

Office for Disarmament Affairs (UNODA) are also located in Vienna. Given this, Vienna is well equipped from a Secretariat perspective to host an NPT review conference. Besides, in comparison to the US, the food, lodging and travel expenses are way cheaper in Vienna. Furthermore, complaints from Russian and Iranian delegates about denials of visa by the American authorities during this year's UN Disarmament Commission also contributed towards the decision of the venue change.

What to Expect from the 2021 NPT RevCon?

Given the increasing rift between nuclear armed states who vouch for nuclear deterrence and the many non-nuclear states who pledge for absolute disarmament of nuclear weapons, 2021's NPT RevCon will be a crucial one. It is not clear as to how the two would reconcile their positions. Meanwhile, there are also glaring rifts amongst the NWS. Lack of a shared vision will impact the conference. While efforts must be made by the NWS to preserve and strengthen the NPT so that it can provide an essential foundation for the prevention of further proliferation and realize its actual goal of absolute elimination, this looks difficult. Will the NPT crumble under extensive pressure as there might be a blame game on the state of nuclear arms control since the last RevCon? While such a situation may not come to pass—since many nations still see a stake in the continuance of the NPT—unless nations begin to build a habit of cooperation, a secure future for arms control and non-proliferation cannot be ascertained.

Covid-19 prompted the deferment of the NPT RevCon, but the period of the pandemic saw certain good news on the Treaty on Prohibition of Nuclear Weapons. In this regard, on January 23, 2020, Paraguay submitted its instrument of ratification, becoming the 35th state party to ratify the landmark treaty which puts an unmitigated restriction on nuclear weapons and has been touted by the member signatories as a pathway to their absolute elimination. On March 20, 2020, Namibia became the 36th nation to ratify it. Meanwhile, Belize, a country that had promoted universal adherence to the treaty by voting for its adoption in 2017 and by co-sponsoring a UN General Assembly resolution in 2019 that called upon all states to sign, ratify,

or accede to the treaty “at the earliest possible date”, signed the TPNW on February 6, 2020. It is yet to ratify it.³

Meanwhile, owing to the outbreak of the pandemic, the second round of Working Group meetings and the second Informal Preparatory Meeting of the Sixth Conference of States Parties to the Arms Trade Treaty which was supposed to take place from April 14 to 17, 2020 in Geneva, had to also be cancelled.

Meanwhile, on the general arms control front, the US and Russia appear to be backing away from bilateral treaties that had prevented nuclear arms racing. New START, the sole remaining nuclear arms control treaty between the United States and Russia, is likely to expire in February 2021.⁴ This follows the collapse of the Intermediate-Range Nuclear Forces Treaty (INF) after reports that Russia had violated it for several years. The Trump administration argues that China should join nuclear arms control treaties, including New START. China is not interested. If that prompts the United States to abandon New START, the Americans and Russians could begin a nuclear arms race. If New START is not extended, it will be a collapse of arms control in its current form. Combined with more dangerous weapons deployments and the Trump administration’s worst case assumptions of Russian and Chinese nuclear strategy, the major powers could easily stumble into dangerous misunderstandings.

What Lessons should Humankind learn?

The first quarter of 2020 has not gone very well from the disarmament point of view, due to increasing emphasis on the centrality of deterrence by arch rivals. On the other hand, the cancellation of the most significant nuclear conferences due to the COVID-19 outbreak augur a bleak picture. However, if we view nuclear weapons through the lens of the COVID-19, we might realise that if humanity can globally put in such tremendous efforts to slow down the pandemic and protect our future, then why can’t we do the same with nuclear weapons that can destroy everything and everybody until the end of time? Of the four great threats to humanity including pandemics,

3. ICAN. March 6, 2020, <https://www.icanw.org/namibia>. Accessed on April 12, 2020.

4. Gearan, Anne, Paul Soni and Carol Morello. 2019. “U.S. to withdraw from nuclear arms control treaty with Russia, raising fears of a new arms race”, *The Washington Post*, February 2, 2019.

climate, inequality, nuclear weapons, the last one is the most dangerous and it is high time the world makes an effort to strike it off from the list of threats. All that's needed to end this 75-year-old nightmare is political will.

Perhaps, like every cloud this pandemic too might have its own silver lining. It is helping humanity rediscover its core values. The fight against this pandemic is showing us that anything unthinkable is possible. It also shows up the need for collective effort to be directed towards finding the right kind of solutions. It gives us a clear message that a most difficult situation could be overcome only if we forget the "us vs them" divide and focus more on the "us vs disaster". The earlier we understand this and implement it against nuclear weapons too, the safer we will be.

BOOK REVIEW

Transfer of Defence Technology Understanding the Nuances and Making it Work for India

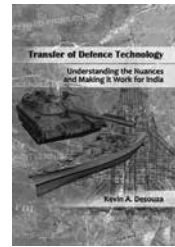
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ATUL PANT

Transfer of technology (ToT) is a sensitive issue for both the have and have-not nations—more for the have-nots who are aspiring to build a credible and affordable technological base through self-reliance. The issue becomes more sensitive when it comes to the defence technology and dual-use technology; especially when cutting-edge technology of the modern era is the core issue. It is a matter which has to be very carefully played out at various levels—both in government and private sectors—as stakes are huge and any improper handling of concerns or mistrust between the involved parties can result in broken aspirations or credibility losses.

With a surge in the economy, India too, as a developing nation, has been attempting to achieve self-reliance in defence sector for the

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last few decades through creation of a defence industrial base and aiming to command a certain level of prowess in cutting-edge defence technology in the near future. ToT has been pursued actively for the last few decades towards this purpose. However, a lot of people have questioned the gains made from ToT so far, as also whether it is being attempted the right way. The CAG has often made scathing observations on various aspects of defence procurements and industry, particularly self-reliance and modernisation and failure of successful ToT.

In defence matters, when ToT is talked about, it is generally assumed by a majority of the populace, and often by the intelligentsia too, that complete know-how of the subject technologies would be transferred. The author quotes Defence Production Policy 2011 (DPrP 2011) as an example where even the document seems to presume the same. New entrants to the game of procurement—and most of the end-users—general carry the impression that the ToT would give the desired breakthrough and can be used as a springboard to lift the transferee to a certain higher level of knowledge, expertise and technological base for achieving strategic autonomy in development of advanced weapon systems and defence equipment. However, this is far from the truth. This is what the author has tried to bring out in the initial chapters of his book.

This book takes the reader to deeper understanding of the subject of ToT, where one realises that the ToT issues mostly turn out to be a red herring due to a plethora of reasons. The ToT related issues are varied, muddled and often beyond the control of both the transferor and the transferee. There are governmental controls, external controls, intellectual property rights related apprehensions, competition worries, technological gaps and many other factors at work which very often turn out to the disadvantage of the transferee. ToT is often priced unaffordably high to be of any advantage to the transferee. Technology is becoming increasingly more protected and property-righted with increasing sophistication; this works to the advantage of the one who possesses or controls it.

The author has explained 'levels' of ToT very well along with the plethora of terms and clauses used when the question of ToT is being dealt with, explaining and defining each term, with examples, for ease

of understanding. Terms like Legacy document, process technology, tacit or implicit knowledge, etc., are generally the terms that would be essential knowledge for anyone dealing with procurement; often the gravity—of the meaning of the terms and how and where these could pose problems—may not be grasped while reading any official documents and processes. Very often such improper understanding is where ToT related aspirations and efforts of the transferee are defeated. The book includes a plethora of such semantics and clauses, explaining how these need to be looked at.

As the title of the book suggests, the author has kept the matter and the orientation of analysis India-centric. The author has given a good historical perspective in the first chapter and explained how India's attempts to indigenise defence equipment with ToT suffered due to refusals by OEMs, even though the suppliers ensured that gates were not fully closed for them by allowing Licence Manufacturing of some of the equipment. In subsequent chapters, he has focused considerably on analysis of the related national policy documents, namely, DPrP 2011 and Defence Procurement Policy 2016 (DPP 2016), with respect to the ToT. The author has critically analysed the Indian concepts and initiatives of Indigenously Designed Developed and Manufactured (IDDM), Make in India, etc., on the ToT testbed. The author seems to convey that a major source of problem in ToT to India is the language and clauses of the policy documents. Though many others also occasionally hint at the fact that the policy documents are more audit oriented than growth oriented, however, it may not be totally true.

These documents though seem to lay down strict boundaries at first look; they do leave sufficient scope for variances and are accommodative of deviations to quite an extent, i.e., the document lays down waivers where required. However, they do seem to have become more rigid in transparency of deals; this may be due to historical bad experiences, but clauses are still not prohibitive or unduly rigid.

He has tried to objectivise a subjective issue of fixing the desired level of technology for production ToT (including graphically), but here he seems to have taken the traditional factors. The arrival at the desired level of technology through transfers also does not seem to

be rightly done. Of late there are non-traditional factors that have come into play affecting the cost and curve of cost vs technology, e.g., falling costs of newer technology due to computer designing, modelling, and testing. These do affect the cost predictability. An example is the cost of the F-35 Block-IV which is far less than the Block-III in spite of newer technologies.¹ His argument against the offset policy in Chapter 5 (page 99) appears more like speculation.

In the Chapter 'Exploring All Avenues', the author has given good examples of methodologies adopted in other countries, mainly the US, China, and Turkey, which have led to successful technology transfers with the transferee nations covering major milestones. Many of these approaches need to be critically studied at governmental level. In India's case, it seems the best way forward is Joint Ventures (JVs) with reliable foreign partners for building a technological base for defence industries; this has also been argued for by the author. The Brahmos missile is a current example of a successful JV which has been advantageous to India's indigenous missile development capability.

There are other suggestions which the author has given—most of these are likely to be less demanding on involved parties than currently in practice. Some are good but many are not foolproof and could still leave the transferee vulnerable at the hands of transferor, or could lead to corruption, or may not bring about the desired benefits. A high demand approach and waiver route (waivers on case-to-case basis where needed) would be a better option, as in the case of the current policy. Another major issue is India's lack of readiness to absorb latest technologies, which the author has highlighted adequately. A brief analysis of the recent JV effort in the defence sector involving big Indian Industrial houses like Tata, Reliance, Larsen & Toubro, in the light of the issues brought out by the author, would have made the book more interesting.

Overall, the book is a good, thought-provoking compendium of explanations, issues, examples and arguments for the policymakers, analysts, end-users and anyone associated with technology transfers.

1. Valerie Insinna, "In newly inked deal, F-35 price falls to \$78 million a copy", Defence News, published October 29, 2019, available at <https://www.defensenews.com/air/2019/10/29/in-newly-inked-deal-f-35-prices-fall-to-78-million-a-copy/>, accessed November 18, 2019.

It was felt that substantiation of issues with more examples and case studies could have added to the value of the book. There are issues in defence ToT which fall into classified regime of the government and would be known only on need-to-know basis or could not be brought in open literature. The book is specially recommended for new entrants to the business of acquisition as well as industrial partners to the game.

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Articles submitted to *Defence and Diplomacy* should be original contributions and should not be under consideration for any other publication at the same time. If another version of the article is under consideration by another publication, or has been, or will be published elsewhere, authors should clearly indicate this at the time of submission.

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e.g., Douglas M. Fox, "Congress and the US Military Service Budgets in the Post War Period," *Midwest Journal of Political Science*, vol. 16, no. 2, May 1971, pp. 382-393.