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EDITOR'S NOTE

Over the last few years, nuclear issues, that were for some time losing significance, started to gain salience once again. The world is increasingly becoming a more dangerous place. In view of the changing circumstances, this edition of *Defence and Diplomacy* comprises 12 articles on different aspects of the nuclear debate.

From the very beginning of Independent India, the need for scientific study was keenly felt. In the early years itself, much progress was made in trying to understand nuclear and allied sciences and associated technologies. In our lead article, **Ambassador Sheel Kant Sharma** traces the history of the progress that has now acquired worldwide recognition. The US-India Nuclear Deal brought India into the mainstream of nuclear activity but the author well recognises that there is a long road ahead. His views on the challenges ahead are particularly insightful.

Some major events in the nuclear realm occurred in the preceding year. **Manpreet Sethi** looks at five notable events that took place during the one-year period from May 2015. The article discusses the nuclear Non-Proliferation Treaty (NPT) Review Conference (Revcon) that got nowhere and, in fact, the impact was retrograde. The Joint Comprehensive Plan of Action that resulted after hard negotiations with Iran eased the sanctions for Iran and pushed back its nuclear ambitions but suspicions remain. The fourth nuclear test by North Korea on January 16 raised boasts, doubts, condemnations and greater sanctions but little else that would bolster international confidence towards non-proliferation. In a sea of gloom, a small silver lining was the increased commitment towards the security of nuclear weapons and fissile material, exhibited at the 4th Nuclear Security Summit in Washington but the level of security needed is

still some distance away. At best, the Summit was encouraging but nuclear security remains work in progress. The fifth event of note was President Obama's visit to Hiroshima. Although no apologies were made, the significance of the visit was not lost on the world.

Perforce, we in India have an abiding interest in Pakistan on at least two counts. Firstly, Pakistan continues its attempts at undermining our progress by state sponsored terrorism and drug trafficking. Secondly, and more pertinent to the subject matter of this issue of the journal, is Pakistan's build-up of its nuclear weapons arsenal and the stated doctrine on its use. **Shalini Chawla** looks at Pakistan's nuclear doctrine as it has evolved and its 'nuclear behaviour' over the last 30 years. It must be a sign of Pakistani under-confidence that as per some statements, its nuclear doctrine has been changed from the possession of nuclear weapons for deterrence and use as a last resort to what is now called 'full spectrum deterrence'. The suggestion is that Pakistan now places increasing reliance on nuclear weapons but if the intention is to intimidate us, it has not succeeded.

Nuclear terrorism continues to exercise our minds. The four Nuclear Security Summits bear testimony to the increasing salience of nuclear security. One outcome that was welcomed by all was the elimination of 1,500 kg of fissile material. Much more work remains. We did our bit by laying the foundation for a Global Centre of Nuclear Energy Partnership in 2014. **Reshmi Kazi** shares with us that we have already started off-site courses and the initiative has placed India amongst the countries that are keenly working towards education and research in the field, and in the dissemination of best practices to promote nuclear safety and security.

As opposed to Pakistan's portrayal of 'itchy finger on the nuclear trigger', our approach is one of credible deterrence and no first use. There is inherent wisdom in our approach. Based on Pakistani threats, there were opinions in India that we need a change of doctrine but better sense has prevailed. **Hina Pandey** argues that a 'first use doctrine' is counter-productive and it is best to maintain a deterrent posture. Doctrines, real or merely declared, are a function of a nation's power, capability and intent. Thus, doctrines will differ but the common theme must be that nuclear weapons are unusable.

The Iran nuclear deal of July 2015 deserves examination and **Arka Biswas** does that. The author recognises that it was a path-breaking event but also highlights the wide gap between NPT dictates and the more stringent norms that are sought to be applied. Three issues that are discussed are that the NPT does not proscribe nuclear enrichment; the essentiality of the Additional Safeguards Protocol, with authority for stringent inspections, including surprise inspections; and the limitations of the NPT, legal or otherwise. The author unequivocally states that the world community needs to go beyond the NPT to strengthen non-proliferation. .

The last few years have witnessed a disturbing increase in tension amongst the major powers. **Deep Jyoti Burman** discusses the nuclear arsenals of Russia and the USA, the New START Treaty and its limitations, differences in the nuclear strategy of the two countries, and the changes in the strategic posture of Russia after the break-up of the USSR. Russia has now embarked on a modernisation programme of more state-of-the-art Sea-Launched Ballistic Missiles (SSBMs) and Intercontinental Ballistic Missiles (ICBMs) leading to a ratcheting up of tension. He also makes an interesting point: if the USA decides to enter an arms race, Russia's inability to match the USA will force Russia to lower the nuclear threshold, an unwelcome occurrence. He recommends that both sides should maintain a strategic balance and eschew attempts to alter it.

The next two articles are on civil nuclear energy cooperation between India, on the one hand, and Russia and France, on the other. **Chandra Rekha** reiterates that India is committed to an increasing share of nuclear power in the total energy mix and suggests that the Indo-Russian cooperation in this field has been a success. On the other hand, **Manisha Chaurasiya** opines that even though France was the first country to enter into a serious dialogue with India post the Nuclear Suppliers Group (NSG) waiver, there are concerns regarding the financial health of AREVA and the viability of the European Pressurised Reactors (EPRs). On an optimistic note, she says that in spite of Fukushima, nuclear power is here to stay. There have been some demonstrations against nuclear power plants in India but that has largely been the result of a generally misinformed populace.

There is little empirical data on the impact of nuclear weapons on the planning and conduct of military operations. Yet much thought has been given to the subject and there are any number of conjectures and opinions advanced. The moot point is whether, given the massive destructive power of nuclear weapons, these weapons are usable even in an asymmetric situation, leave alone when both adversaries have a credible second strike capability. Taking a rather extreme view, it is also asked whether nuclear weapons are instruments of 'conflict avoidance'. The subject just cannot be ignored and **Vivek Kapur** describes the possible trajectory of India's nuclear deterrent.

Cyber attacks can cause major damage or disruption and such attacks could extend to civilian or military nuclear facilities. Given the damage potential, the requirement for utmost care needs no emphasis. **E Dilipraj** argues that there are many possible areas vulnerable to well-planned cyber attacks. Some possible modes of attack are mentioned and notable examples of successful attacks in the past make good reading. The salient message is that we can never be too careful.

In the last article, **Arjun Subramanian P** looks at the Chinese DF-41 missile and future ICBM capability of the PLA Rocket Force. He is of the opinion that a Multiple Independent Reentry Vehicle (MIRV) missile can create ambiguities as to the real and dummy vehicles and will give greater probability of a successful attack. The article is worth reading to elicit the technological advancements that have already been fielded or on the anvil.

Happy reading.

NUCLEAR ENTERPRISE AND DIPLOMACY: INDIA STORY

SHEELKANT SHARMA

Science and technology in today's world are in the middle of a historic transformation. Human understanding of the nature of the physical and biological phenomena and the structure of things spans dimensions smaller than nano centimetres and nano seconds, on one extreme, and larger than numerous light years, on the other – and technology is at hand to observe, interact and shape things in a manner unimaginable even in the last century. It is possible that in a decade from now, the shape of things might become unrecognisable considering the pace at which the frontiers of research are expanding. It is tempting to retrospect about how this has come about. One can possibly go back in time to another historic phase that obtained in the middle of the last century – when the great minds of the 20th century were engaged in their pursuits with revolutionary discoveries in basic physical and biological sciences. Richard Feynman, the physicist with a stellar reputation and one of the most popular professors in his time, wrote in a letter, replying to an 18-year-old in 1972,[1] when he himself was 18 in 1936, "I did not know what the future might bring, but I did know that I must be a scientist, that it was exciting, interesting and important." Richard Feynman may have expressed

Amb **Sheelkant Sharma** is a Distinguished Fellow at the Centre for Air Power Studies, New Delhi. He is a former Ambassador of India to Austria and Permanent Representative to the UN Office in Vienna and the IAEA.

1. Richard P Feynman, *Don't you have time to think* (London: Penguin Books, 2005), p. 263.

the inner yearnings of perhaps a whole generation that dealt with science in that epochal interval (i.e.1936-72) which has an indirect reference in the letter.

Nuclear and elementary particle physics was Feynman's métier and so it was for a generation too of leading Indian scientists of that period. They were witness to the unravelling of the inner secrets of the atomic nucleus and the enormous destructive power that lay trapped therein. While Feynmann had also worked in the American Manhattan Project for the atom bomb[2] during the years of World War II, Indian physicists were studying theoretical and experimental nuclear physics and were privy to what lay in store for humanity.

In the dawn of India's independence, these physicists and their colleagues in other interrelated disciplines, sought to include science and technology in general and nuclear physics and technology, in particular, in the nation-building project that the leaders of independent India were engaged in. The close friendship between then Prime Minister Nehru and Dr Homi Bhabha is widely recognised as instrumental in the launching of – what remained for decades for want of better words perhaps – the "Indian Nuclear Programme". The purpose of the brief foray into the history of 20th century science was just to outline the international perspective then and to underline that in those early years, it was almost a strategic imperative for the eminent scientists in India to initiate such a project. Their vision was to have a comprehensive capability and capacity in this crucial field – hand in hand with the wider faculties of science and engineering in the universities that already existed as well as those being set up.

What has been developed over the past seven decades has not only placed India in the forefront in the nuclear field but also catalysed broader development and attainment of capabilities in diverse frontiers of contemporary space science, advanced materials engineering, genetics, pharmaceuticals and information technology, to name just a few. India pursues today advanced technologies such as accelerators, lasers, supercomputers, robotics, areas related

2. Feynman was in the team of hundreds of eminent scientists who worked on the Manhattan Project. In reply to a 15-year-old's question about what his reasons were for working on the bomb, "knowing the consequences of your work," Feynman wrote, "I did work on the atomic bomb. My major reason was concern that the Nazis would make it first and conquer the world". Ibid., p. 268.

to fusion research, strategic materials and instrumentation, and its research institutions, among other things, actively encourage the transfer of technology to industry.

As regards the international dimension and diplomacy, it is ten years since the historic visit of US President Bush to India in March 2006. That visit set a major landmark in the transformation of India-US relations. This transformation was set in motion by the Washington Joint Statement of July 18, 2005, focussed on the nuclear field. This statement marked the end of many wasted decades in the relationship between India and the US. It also set the stage for a comprehensive and qualitative upgrade of the content of this relationship. Since the nuclear issue lay at the core of the problems which had strained bilateral ties, a mutual understanding on perceptions, intent and goals in the nuclear field was of far-reaching import. President Bush imparted enormous momentum to the process in March 2006. The past decade then witnessed a series of bilateral and multilateral steps, advancing this mutual understanding on the nuclear agenda. These steps have served to bring India into the global nuclear mainstream. At the very frontiers of advanced research, it is relevant to note that the international research team at CERN (the European Organisation for Nuclear Research) near Geneva which conducted measurements to validate the existence of the 'Ghost particle' or the Higgs Boson, had the active involvement of physicists at the Harish Chandra Institute in Allahabad, set up by the Department of Atomic Energy.

It is worth looking back to assess the transformation in the image and reality of the Indian nuclear enterprise.

Three areas pose recurring uphill challenges for Nuclear India, that is, the entire nuclear enterprise that sustains the nuclear power plants, the research reactors and all other nuclear facilities and research institutions covering activities ranging from mining to waste management and nuclear weapons. They are interconnected and essentially comprise:

- **Nuclear Science and Technology:** How to grow and keep it open and transparent, and still secure, safe and globally competitive,
- **Nuclear Power:** How much of it is desirable, affordable, safe and secure, and;

- **Nuclear Weapons:** To maintain a credible minimum deterrent.

One can variously describe these but at the core of each lies a set of problems to solve.

> India's tryst with nuclear Science and Technology (S&T), as already mentioned, began in the heyday of global science in the mid-20th century. Science then figured very high in the sacred list of human advancement – so high, in fact, that all kinds of political demagogues employed science for lending greater credibility to their narrative. The Soviets called their system the scientific socialism; the Americans and the West in general owned science as the hallmark of their wealth and power, and perhaps with ample evidence; while Nehru invoked a scientific temper to build and sustain his vision of the Indian Union. Notwithstanding the Manhattan Project and the horrors of the bombs over Japanese cities, there was considerable faith in nuclear S&T offering magical solutions in diverse fields such as energy production, medicine, industry and agriculture. Indian scientists were smart to see this.

Indian scientists convinced themselves that the nation must launch itself on the nuclear trajectory early on. The tension was palpable then between the inherent demands, on the one hand, of nuclear S&T which was rapidly growing and involving multiple branches of science and engineering, and, on the other hand, the default approaches and compulsions of India's political economy towards higher education, institution building and industry. Even under British rule, the Indian society, undoubtedly, produced brilliant scientists with fiery intellects, open and questioning minds, imagination and talent that inspired many more – all of whom had to live and flourish in a nation "long suppressed" finding utterance and a feudal elite imitating the British to rule their countrymen. This was the mixed legacy with which independent India's S&T, particularly in the nuclear arena, had to commence work.

Fortunately, Nehru's genuine regard for the towering figures of Indian science then managed to alleviate if not overcome this tension by making strategic choices. This comprised setting up

institutions and centres of higher learning, research and innovation and in the nuclear arena, a three-stage plan that visualised building nuclear power reactors using uranium in the first stage, then fast reactors using plutonium and, in the final stage, aiming at using for energy production, the vast thorium resources available in the beach sands of Kerala. This also entailed full development of indigenous capability in the entire nuclear fuel cycle from mining to waste disposal. Internationally, US President Eisenhower had launched the "Atoms for Peace" initiative in 1954. The International Atomic Energy Agency (IAEA) was subsequently set up in Vienna in 1957, and India, under Dr Homi Bhabha's leadership, played an active role in this process. He had chaired, for instance, the international conference that established the IAEA. He sought and forged international cooperation to develop a comprehensive indigenous Indian nuclear programme.

This process, however, evolved within Nehru's world view which guided India along the following strands:

- International profile as a leader of newly independent India, active role in the IAEA, and bilateral cooperation with the US, UK, Canada as also the then Soviet Union;
- Strong concern for the global peril inherent to nuclear weapons, a consistent voice for nuclear disarmament in the UN, and for banning nuclear tests; and
- Active diplomatic engagement towards that goal;
- India after Nehru continued these policies and worked in the UN for non-proliferation of nuclear weapons and nuclear disarmament as its preferred goal even after China's nuclear test in 1964;
- However, when that led to the Non-Proliferation Treaty (NPT),[3] India refused to sign that treaty, calling it discriminatory and inequitable;
- The Bangladesh War of 1971 drew India into closer relations with the Soviet Union and at the receiving end of US and Western pressure and coercion;

3. Over time, the hyphenation in the terminology would go away, thus, making 'nonproliferation' acceptable usage, albeit without modifying the famous acronym, NPT.

- The 1974 Peaceful Nuclear Explosion (PNC) was Indira Gandhi's cautious response to such pressure and coercion. It caused, nonetheless, an adverse global reaction;
- Then on, India had to pursue nuclear science and technology in a resulting isolation, compounded by the Nuclear Suppliers Group (NSG) and tightened US laws as well as an intensified Cold War.

What followed was a more difficult phase during which India maintained its policy of saying no to nuclear weapons, but keeping the option so long as global nuclear disarmament remained outside the reach and remit of the agenda of multilateral negotiations, and rejecting limited or partial measures such as regional nuclear free zones and full scope safeguards on its nuclear facilities as conditions for supply. Despite supply interruptions, it carried on with an ambitious nuclear programme with an indigenous route for nuclear power by reactors fuelled by natural uranium and moderated by heavy water. Although Pakistan, with clandestine Chinese collaboration and US complicity, acquired nuclear weapons by the middle of 1980s, India still pursued global nuclear disarmament and abolition as its preferred option for security. It kept up, at the same time, active engagement with the Non-Aligned Movement (NAM) and maintained a progressive profile on North-South issues.

It is to the great credit of the individuals involved with institutions like the Department of Atomic Energy (DAE), and Defence Research and Development Organisation (DRDO) and space research, that they steered the system despite the odds and showed results even as the institutional frameworks had to be on a roller coaster, up today and down tomorrow. Global advances in nuclear S&T, at the same time, have been astronomical. India was denied, for the major part of its story, adequate connectivity with these advances, but the Indian institutions have managed to overcome the challenges. These challenges were posed by international isolation, dwindling resources, self-doubting domestic supporters and even a human resource crunch because young aspirants to nuclear science and engineering, impressionable as they were, would fall under the influence of passing fads and fashions. For instance, while nuclear

energy was considered good in the first flush of global anxiety after the oil crisis during the 1970s, its attraction almost vanished after the horrible accident in Chernobyl in April 1986. The 1990s saw a sharp drop in oil prices, challenging nuclear power's economic viability. Even the heightening of environmental concerns about noxious emissions from hydrocarbon burning could not be translated to a better perception of nuclear power's role in a sustainable energy mix – the Rio Conference in 1992, completely ignored the nuclear option for clean energy, possibly also due to the enormous clout of the Organisation of Petroleum Exporting Countries (OPEC) lobby. The last decade of the 20th century only saw depressing prospects for nuclear power.

As for India, these developments presaged harder times and a rapid picture of subsequent evolution of the Indian nuclear enterprise after 1990 can be outlined, as below:

Post-Cold War: 1990s

- Experience with Iraq's clandestine weapons programme hardened the NSG which insisted on adherence to comprehensive IAEA safeguards (INFCIRC 153) as a condition of supply of even natural uranium. This severely impaired fuel supplies for Indian power reactors.
- The collapse of the Soviet Union in 1991 left India virtually friendless among the UN Security Council permanent members whose pressure mounted on India to sign the NPT and to accept partial and regional restraints. The US, as the sole superpower, was seen favouring Pakistan for the latter's Cold War role and did not seem to realise what a rising China meant for the region and the world.
- India's economy went through a serious crisis, and embraced reforms and broad-based liberalisation under the International Monetary Fund (IMF) conditions that did not support state enterprise. Globally, cheap oil and gas ruled out nuclear power.
- Encouraged by the US and China, the Pakistani military indulged in unrestrained cross-border terrorism under a nuclear umbrella. In 1995, the NPT was indefinitely extended, thus, perpetuating the iniquitous nuclear order. Nuclear disarmament was all but shelved by the Permanent Five (P-5) and their allies

who forced the rest to accept a Comprehensive Test Ban Treaty (CTBT). The CTBT was concluded, rejecting India's demand for commensurate obligations on the part of the P-5 for nuclear disarmament and elimination of nuclear weapons. India, on its part, refused to sign the CTBT.

- Clandestine proliferation linkage between China and Pakistan continued alongside the Pakistani clamour about a nuclear flashpoint in South Asia. The combined impact of these developments led India to the testing of nuclear weapons in May 1998 (Shakti tests) and proclamation of its nuclear weapon status.
- Post 1998, developments were rapid in that there was initially a strong international uproar against the tests but when the sanctions failed to impact India, the US reviewed its stance and engaged India in a dialogue at a high level. The essential elements of India's security and development concerns were well presented by Foreign Minister Jaswant Singh to his interlocutor, Strobe Talbot, deputy secretary of state and a confidante of the US president. This dialogue was extensive and covered diverse aspects of India's security and approach to its neighbours. It was explained that the US sanctions were borne out of insensitivity to India's security environment, aggravated by the China-Pakistan nuclear and missile linkages. India's avowal of the doctrine of No First Use (NFU) demonstrated its responsible attitude, nonetheless, which was supported by its record of controls on export of sensitive equipment, material and technology. These export controls were further enhanced in 2000.
- The efforts made by the Vajpayee government to engage Pakistan and the historic visit by Prime Minister Vajpayee to Lahore in February 1999 were seen in stark contrast with Pakistan's Kargil misadventure and proved to be a turning point. It led to a change in the US' perceptions about India. The highly successful visit of President Clinton to India in March 2000 then concluded with a landmark vision statement laying out vistas for bilateral cooperation in the 21st century. However, pressure persisted in the final year of the Clinton presidency about capping and

roll back of the nuclear programme, signing of the CTBT and accepting negotiations of a Fissile Materials Cut-off Treaty (FMCT).

- The relationship went through even closer understanding and rapid improvement with the Administration of George W. Bush after 2001. George Bush and his team had a different world view in which they saw India as a partner of strategic nature. Post 9/11, this world view became progressively clearer as India took steps comprising: exhaustive export controls adopted in the full 2005 Weapons of Mass Destruction (WMD) Act, active bilateral approaches with US friends and allies as well as Russia and China through sustained dialogues, and a concerted diplomatic offensive in general to demonstrate India's prowess and responsible behaviour. The New Steps in Strategic Partnership (NSSP) were announced by India and the US in January 2004. These were carried further after the new United Progressive Alliance (UPA) government assumed office in May 2004 and culminated in the US-India July 2005 Statement. The statement was followed by the separation of strategic and civilian facilities in India, an active outreach with the NSG in a general ambience of nuclear renaissance which prepared the way for NSG exemption for India for its energy needs and conclusion of the India-US Nuclear Cooperation Agreement in 2008.

The India-US cooperation mainstreamed India into the global nuclear community and was followed in rapid steps by cooperation agreements with France, the UK, South Korea, Australia, Canada as well as uranium producing states such as Kazakhstan and Namibia. India's status is widely accepted as a country with advanced capability in the nuclear realm. The stage has since been set for major expansion of nuclear power in India. Two visits of the US President Obama to India, in 2010 and 2015, have taken India-US cooperation to new heights, embracing a comprehensive agenda. Similar ties are also in progress with major economies and long standing strategic partners such as Russia, supported by regular summits. It is verily up to India to make the most of this propitious state of its diplomatic successes.

The past several decades have also seen the institutions in India evolve, expand and multiply with meritorious achievements to their credit. It is true that these have not yet reached the scale and heights planned. Examples of thinking big in the past decades have been in numbers smaller than desirable and even these examples, as in nuclear, space, Information Technology (IT) and biotechnology have to grapple with grudging or self-serving – and often ineffective – support from the polity. At the same time, in order to expand and attain heights, the endeavour of science, particularly nuclear S&T, has to emerge out of the sheltered environment bequeathed by the institution builders and to connect and synergise with the larger society.

However, in this process, the unrelenting pursuit of perfection and excellence gets subordinated to compulsions of socio-economic development. The forces unleashed in the evolution of the polity have long outstripped a scientific temper that Nehru may have visualised. The non-science bent still tends to dominate the scientists, overrules them and, at the first opportunity, would appropriate the surplus generated by their smart enterprise and dedicated endeavours. Challenges, thus, never cease for a developing society and economy for its scientific institutions and enterprise. The generation that steered the early nuclear S&T in quite difficult conditions, looks today for successors whose numbers and capabilities will be challenged by the demand imperative and competition in the coming decades. As things stand today, while China speaks in terms of tens and even hundreds of thousands of personnel in industry, academia and skill development, in India, the struggle remains to keep up the figures to a high number in tens of thousands – and this despite the head start that we had.

Additional pressures of public perceptions inspired by international campaigns for the security and safety of nuclear installations pose new challenges and compel the human resource pool and research institutions to have greater transparency and public acceptability. India's defensive nuclear doctrine comes in for increasing public scrutiny. A nuclear deterrent is commonly understood in narrow terms of the demonstrable possession, deployment and readiness to use nuclear weapons for security. However, such an understanding fails to apply strictly in the case of

nations, other than the erstwhile superpowers, that came to acquire nuclear weapons much later in the course of the past century. India is an exception as it realises the destruction inherent to actual nuclear use in the perilous event of deterrence failure. Therefore, its policy and posture is driven by the pursuit of a credible and effective deterrent at a minimum level even as it progresses to maintaining a nuclear triad to ensure survivability.

It would be useful to conclude this discussion of present-day challenges by a brief epilogue on nuclear safety and security.

NUCLEAR SAFETY, SECURITY AND LIABILITY

Since the first full-scale nuclear power plants went into operation in the 1950s, nuclear energy has come to supply almost 14 percent of global electricity needs by 438 reactors worldwide; and 69 under construction. At the same time, roughly 1,440 metric tonnes of Highly Enriched Uranium (HEU) and 500 metric tonnes of plutonium have been produced globally – enough fissile materials to build more than 100,000 nuclear warheads. The global expansion of the nuclear fuel cycle has been accompanied not only by a rise in cross-border transfers of civilian nuclear materials but also the availability of materials for nuclear weapons. Nuclear security is a series of measures to prevent direct or indirect threat of unauthorised access to nuclear materials, radioactive substances, their facilities or other related activities for a malevolent purpose. These measures differ from nuclear safety which focusses on proper operating conditions, radiation protection, accident prevention, emergency preparedness and response and radioactive waste management. The two concepts do overlap, but there is a distinction: nuclear safety addresses the protection of the workers, public and environment from the potential risks of exposure to nuclear radiation, whereas nuclear security focusses on the safe custody and physical protection of the nuclear material itself. The US president has convened in this regard four Nuclear Security Summits since 2010; an unprecedented initiative to focus a global leader's attention. His avowed aim is to highlight the acute dangers that lurk behind inadequate attention to nuclear security globally and the urgent need to systematically enhance it to rule out nuclear terrorism. India has been an active summiteer

in this process and made a further pledge at the fourth summit in Washington last March of a million dollar contribution to support the IAEA for the latter's nuclear security action plan.

In India, concerns for safety and security have been compounded by a national approach to nuclear liability defined by the law on nuclear liability enacted by the Parliament in 2010. This law, at some variance from international conventions, affixes liability for damage in the event of an accident to the supplier. This has made the multinational supplier companies in nuclear technology as well as domestic suppliers circumspect but systematic efforts have been under way to reassure the concerned partners about the compatibility of Indian law with established international practices and norms. The challenges coming from economic factors, public perceptions and competition with other new age technologies for energy are inevitable in the coming decades, especially given the extraordinary leaps in S&T transformation that lie in store. India's nuclear enterprise is better placed today than at any time in the past, to look to the future with confidence and a fair measure of self-assurance. It continues to strive with progressive augmentation in capacity, capability and reach.

OVERVIEW OF NUCLEAR NON-PROLIFERATION, MAY 2015-MAY 2016

MANPREET SETHI

The Bulletin of the Atomic Scientists, an American publication, maintains a Doomsday Clock that indicates the nearness of mankind to the probability of catastrophe. The closer the hand of the minutes to 12'o clock, the greater is the likelihood of Armageddon. In 2012, the hand of the clock was moved up by two minutes from five to three minutes to midnight. Four years from then, we are still at the same point. This gives a fair indication of the lack of meaningful movement by the international community on non-proliferation.

This article examines the nuclear highs and lows of the period May 2015-May 2016. By flagging five major developments over the last 12 months, it provides an overview that can help identify some trends for the future, and nudge course correction where necessary. The specific events that are briefly examined are the nuclear Non-Proliferation Treaty Review Conference (NPT RevCon) of May 2015, the US-Iran deal of July 2015, the North Korean nuclear test of January 2016, the Nuclear Security Summit in March 2016, and the visit of President Obama to Hiroshima in May 2016.

Dr. **Manpreet Sethi** is a Senior Fellow at the Centre for Air Power Studies, New Delhi.

NPT REVCON, MAY 2015

On May 22, 2015, the quinquennial NPT RevCon came to an end after a month-long session. There was little excitement in the run-up to the conference and the expectations were low too. The previous RevCon in 2010 had been hailed as a success since it could bring out a consensus final document besides a comprehensive Action Plan identifying 64 actions for countries to take across three domains that the NPT governs: peaceful use of nuclear energy; non-proliferation; and disarmament. However, not much progress took place on the implementation of the Action Plan between 2012-14. And since there was nothing much to show, nations avoided discussing this document in 2015. Rather, the main sticking point at the RevCon 2015 proved to be the issue pertaining to the creation of a Weapons of Mass Destruction Free Zone in the Middle East (MEWMDFZ).

Finding a solution to the Middle Eastern nuclear issue has long been on the agenda of the NPT. In 1995, in fact, support for the indefinite and unconditional extension of the NPT was clinched on this issue. However, nothing happened for a decade and a half. At the 2010 RevCon, a commitment was again made to hold a conference of all relevant players by 2012. A facilitator was appointed in Ambassador Lavajaa of Finland. He held as many as 70 meetings with stakeholders of the region, urging all to "adopt an open and forward looking approach" and "engage with each other in constructive dialogue and spirit". Nevertheless, the intentions were not translated into action and as a result of developments such as the Arab Spring in Egypt, wars in Libya and Syria, and general tension in the region, the conference was not held. In fact, there never was any clarity about when the conference would take place, for what duration, and with what agenda and level of participation. Most of all, the participating states were not known either! There was a total lack of leadership on the issue from the USA, owing perhaps to the criticism that it had suffered from Israel in 2010 for having agreed to the idea of a conference in the first place.

At the 2015 RevCon, the exasperation of the Arab states was evident. They insisted on holding the conference before 2016 was over, even if it had to be held without the participation of some states such as Israel. But the US dismissed this proposition as setting

"unrealistic and unworkable conditions". Owing to the differences of opinion on this issue, no consensus final document could be reached. Rather, a number of fissures amongst nations was evident. The Nuclear Weapon States (NWS) and the Non-Nuclear Weapon States (NNWS) were divided over the lack of progress on disarmament by the NWS even as the stringency of non-proliferation measures being applied to them was increasing. Meanwhile, within the NWS too, tensions between the US/NATO (North Atlantic Treaty Organisation) and Russia, and the US and China were palpable. While 2015 will ultimately be only one episode in the life of the NPT, conferences ending in such a manner leave a bitter aftertaste that can magnify frustration and discontentment.

IRAN-US NUCLEAR AGREEMENT

Two months after the despondent close of the NPT RevCon, non-proliferation watchers had something to cheer about in the successful conclusion of the Joint Comprehensive Plan of Action (JCPOA) between the EU-3+3 and Iran. Nearly a decade after serious negotiations were started by three European countries – France, Germany and the UK – in the mid-2000s, and which were eventually joined in by the USA, Russia and China, the JCPOA was finally announced on July 14, 2015. It marked the success of patient, persistent multilateral diplomacy.

The JCPOA, a unique agreement, has been subject to many interpretations by different sides. One Western analyst aptly describes the value of the deal for the US and Iran in these words, "For the US and its partners, the JCPOA was a tool to remove the risk of near-term Iranian nuclear weapons break-out and to make it harder thereafter. For Iran, the JCPOA was a tool to remove much of the sanctions pressure that had badly savaged the Iranian economy for the previous five years."[1] Despite its technical nature, the JCPOA is a political solution to a political problem. A study of Iran's nuclear programme, especially the enrichment component, shows that it had become strongly intertwined with its sense of identity and sovereignty. Therefore, a solution had to be found that could address the politico-

1. Richard Nephew, "What the Nuclear Deal Means for Moderates in Iranian Politics", *Markaz- Middle East Politics and Policy*, Brookings Institute, February 16, 2016, available at http://brookings.org. Accessed on May 18, 2016.

psychological dimension. Indeed, the ruling powers in Iran have used the deal to showcase the country as a powerful and technically advanced one that stood up for its rights in difficult negotiations with the major powers of the world. In the Iranian perception, retention of the right to enrichment, even if to low levels, is a vindication of their sense of pride in the country's nuclear achievements.

The basic purpose of the JCPOA is to allow Iran to pursue an "exclusively peaceful nuclear programme" by removing elements of technology or material that could lead to nuclear weapons. So, both routes to the bomb – through Highly Enriched Uranium (HEU) or Plutonium (Pu) – have been sought to be blocked. Accordingly, Iran has agreed to reduce its first generation installed centrifuges from 19,000 to only 5,060 for 10 years. It will also not enrich uranium over 3.67 percent for at least 15 years. It will reduce its current stockpile of 10,000 kg of Low Enriched Uranium (LEU) to 300 kg and ship the rest to another state in exchange for natural uranium. This arrangement has been worked out with Russia and Kazakhstan. On December 28, 2015, Iran shipped LEU enriched to 20 percent in excess of the 300 kg to Russia.[2] In exchange, it is to get natural uranium from Kazakhstan paid for by Norway for now and which will be repaid by Iran over time as commercial arrangements for this are finalised.[3] Iran will also place all excess centrifuges and enrichment infrastructure, including the 1,000 second generation centrifuges, in an International Atomic Energy Agency (IAEA) monitored storage site, to be used only as replacements for operating centrifuges and equipment, and will not build any new enrichment facilities for 15 years.

On plutonium, Iran will redesign and rebuild a heavy water Research Reactor (RR) in Arak, based on a design agreed to by the P-5 plus 1. This would be for nuclear research and radioisotope production and not produce plutonium. The original core of the reactor (which could have enabled production of weapons grade Pu) would be destroyed or removed from the country and no new heavy water reactor would be built for the next 15 years. All spent fuel from

2. "Iran Ships Off Uranium as Part of Nuclear Agreement", *Wall Street Journal*, December 28, 2015.
3. Ibid.

the reactor is to be transported outside the country for the reactor's lifetime so as to rule out any reprocessing.

The JCPOA provides for a well devised IAEA monitoring system using modern technologies such as electronic seals and online enrichment measurements to ensure compliance of all commitments. Described as an "extraordinary and robust monitoring, verification and inspections mechanism", it would allow inspectors access to every element of Iran's nuclear related activities. Even more importantly, the deal sets up a "dedicated procurement channel for Iran's nuclear programme established to monitor and approve, on a case by case basis, the supply, sale, or transfer to Iran of certain nuclear related and dual use materials and technology".[4]

In exchange for these commitments, the sanctions imposed on Iran under the UN Security Council Resolutions (UNSCRs) are to be lifted. Restrictions on its oil, natural gas, petrochemicals, metals, banking, and port sectors as well as access to cash accumulated overseas during the sanctions have been removed since the deal began to be implemented in January 2016. Since then, Iran has claimed a perking up of its economy. The most immediate benefits have been in the upsurge in its oil exports. By April 2016, just four months after the Implementation Day of the deal, Iran was exporting oil to the tune of 1.7 million barrels per day (mbpd), up from 700,000 mbpd during the period of the sanctions.[5]

However, the critics persist. The Iranian Revolutionary Guards Council (IRGC), which has described the deal as "nuclear sedition", lost no time in taking provocative steps such as conducting missile launches in March to derail the agreement. But the Western countries chose to ignore these and Rouhani has for now managed to keep his focus on fulfilling commitments under the JCPOA.

Meanwhile, there are chances of things going wrong at the US end, particularly as the domestic political situation heats up in the run-up to the presidential elections later this year. A Gallup Poll in mid-February 2016 showed 57 percent of Americans as being opposed to

4. Office of the Spokesperson, "Parameters for a Joint Comprehensive Action Plan Regarding the Islamic Republic of Iran's Nuclear Programme", Media Note, Department of State, Washington DC, April 2, 2015.
5. "Crude Awakening: Iran's Oil Revenue Jumps 90% after Lifting of Sanctions", http://sputniknews.com, April 11, 2016. Accessed on May 19, 2016.

the agreement and only 30 percent approving it.[6] In order to keep the deal on track, the European Union (EU), China and Russia will have to remain constructively engaged with the implementation process and watch out for any drastic action by either Iran or the US that could rock the JCPOA. Slowly, as all sides build confidence in each other and as benefits flow into Iran, starting to make a difference, the deal would acquire surer footing.

Overall then, the JCPOA provides a constructive framework. It has pushed back the break-out time for Iran and many of the prohibitions and implementation commitments are looking at a timeline of 10-15 years. It remains to be seen whether the US and Iran will ultimately use it as a tactical arrangement for narrow immediate gains (such as stopping proliferation for the US and gaining sanctions relief for Iran) or whether they can use it as a strategic game changer with long-term implications.

DPRK NUCLEAR TEST

The new year 2016 literally started with a bang. The Democratic People's Republic of Korea (DPRK) chose to greet the world with the conduct of its fourth nuclear test on January 6, 2016. The country claimed that it had detonated its first hydrogen bomb, which was a "complete success"[7]. A rocket launch was undertaken in February and on March 9, the country claimed that it had mastered miniaturisation capability too and could launch 1,000 kg payload on the Unha 3 missile, to reach Alaska. Such claims obviously rattled the world, especially the US, Japan and South Korea. Ballistic Missile Defence (BMD) deployments are already continuing in these nations, and in recent years, an incipient internal debate in Tokyo and Seoul on having nuclear deterrents of their own has also been heard.

The international community has responded to the developments in the DPRK with the usual criticism and another round of 'most stringent sanctions'. These include inspection of all cargo in and out of the country, a ban on all weapons trade and an expansion of the list of prohibited individuals. However, there is no evidence of serious

6. Bradford Richardson, "Poll: Americans Oppose Iran Deal 2-1", *The Hill*, February 17, 2016, http://thehill.com. Accessed on May 17, 2016.
7. "North Korea Claims to have Tested Hydrogen Bomb", *The Hindu*, January 7, 2016.

attention from the US to resolve the issue. It wants to outsource the solution to China. But the problem is China's own bonafides on wanting to resolve the issue. China is North Korea's largest trading partner, accounting for more than 74 percent of its trade.[8] To the extent that the problem keeps the US unsettled, why should China want to remove the cause of discomfort to its rival? China only desires to keep North Korea on a leash that gives it the control. However, there is no guarantee that the DPRK might not want to run away with it, or that it already might have done so. China would then have created another nuclear delinquent, like Pakistan, adding to the non-proliferation concerns of the world.

Given the bitter hostility between the US and North Korea, there is little chance that a political solution could be found unless the two find a way of bilateral negotiations. This is a major lesson from Iran. The moment Washington and Tehran began talking to each other directly, a resolution became possible. So, while a broad-based consensus amongst the major powers to achieve a peaceful solution could provide a platform, Washington and Pyongyang will have to find the desire within themselves to engage each other. For now, both do not seem to have found any meeting ground, nor wish to do so. North Korea remains low on the American foreign policy priority list even as young Kim Jong-un undertakes provocative actions, hankering for attention. This is not conducive for nuclear non-proliferation and international security.

THE FINAL NUCLEAR SECURITY SUMMIT

In March 2016, the successful conduct of the last Nuclear Security Summit marked a happy development of sorts. President Obama had started this initiative from the US capital in 2010 with an aspiration to secure all nuclear material on national territories over the next four years. That was an under-estimation of the task, and even six years later, the Security Summit signed off without being able to claim that all had been well secured. However, what the summits have achieved is the accordance of the highest level of attention across the world to the issue of nuclear security in order to minimise, if not obviate,

8. "How Impoverished but Nuclear Armed North Korea Earns its Millions", *The Indian Express*, January 15, 2016.

chances of nuclear terrorism. The summit process has inspired nations into action since they came with report cards to showcase the highlights of all they had done at the national and regional levels towards nuclear security – creation of national legislation to handle unauthorised access to nuclear and radiological materials, strengthening of the national nuclear security culture, tightening of export controls, outreach to national industry, regional efforts, or the signing/ratifying of nuclear security specific treaties.

Indeed, over the last few years, adherence to such international treaties has increased. Ten additional countries, for instance, ratified the International Convention on Suppression of Acts of Terrorism (ICSANT) since the last summit in 2014, leading the total ratifications to about 100. Similarly, some of the major nations that had accepted Amendment 2005 of the Convention on Physical Protection of Nuclear Materials (CPPNM) in the last two years include major holdouts such as the US, South Korea, Turkey, Japan and Singapore and Pakistan.

In another task undertaken under the aegis of the NSS, progress has been made in ensuring the security of HEU through either the conversion of research reactors running on them to LEU, or its repatriation and elimination. Given that HEU is relatively easier to smuggle out of facilities and also somewhat more amenable to being used by terrorists, the summits focussed on getting nations to give up its use for civilian purposes such as in research reactors. So it is that if 50 countries had an HEU stockpile of more than 1 kg in 1992, these are now down to half the number. Since 2010, when the first Nuclear Security Summit was held, HEU has been removed from 13 countries.

With the curtain coming down on the summit process in April 2016, what will keep the focus and momentum on nuclear security alive? Several think-tanks across the world have thrown up ideas on this.[9] These range from holding ministerial level summits every two years (with the heads of governments convening only every four years) to holding periodic nuclear security issue specific conferences. However, the most popular and likely to be accepted idea is that of the IAEA taking a lead on this.

9. See, for instance, "How can Countries Ensure that the Nuclear Security Summit Does not Lose Momentum and, Hence, Become Another Gathering?", Global Forum, *The Bulletin of the Atomic Scientists*, vol. 68, no.2, 2012, pp. 81-83.

Traditionally, with its primary focus on promotion of peaceful uses of nuclear energy and safeguards, nuclear safety and security have largely been the peripheral and not the primary responsibilities of the IAEA. But given the large membership of the organisation, its experience in the nuclear domain since 1957 and a deep expertise built over years, the IAEA seems best equipped to carry the mantle of the summits into the future. In any case, the IAEA has periodically issued guidelines, albeit of an advisory nature, on aspects of nuclear security. For instance, in 2003 the IAEA brought out a Code of Conduct on Safety and Security of Radiological Material in 2009, in an initiative to support efforts at nuclear security, and it issued INFCIRC/225/Rev 5 that provided implementation guidance on Amendment 2005 of the CPPNM with respect to the security of domestic transportation of nuclear materials. In July 2013, the IAEA organised an international conference on nuclear security that was attended by 125 states and 21 organisations. It comparison, the NSS have been attended by only 50 odd countries and 4 organisations. This provides a sense of the reach and influence of the IAEA.

For the moment, the IAEA does suffer from the limitation of availability of monetary sources for the tasks of nuclear security. There is no regular nuclear security budget that can allow the agency to undertake long-term activity planning on nuclear security. Ad hoc contributions like the one of $1 million that India announced at Washington in April 2016 have been made.[10] Another limitation it faces is that of enforcement since it has an advisory role, by way of offering guidance that is non-binding and only for voluntary acceptance. It can levy no penalties for non-compliance and nor does its diktat extend over the military related nuclear programmes. However, if nations agree to provide the mandate of nuclear security to the IAEA, then some of these limitations can be overcome.

It is imperative that the momentum achieved on nuclear security outlasts the summit process. Nuclear security is a global concern. It is the responsibility of each nation to ensure that no terrorist organisation is able to find a weak link within its territory. Nations will have to persist with their efforts and hope to stay ahead of the non-state

10. Lalit K Jha, "Modi Announces Key Nuclear Security Measures", *Indian Express*, April 3, 2016.

actors. While the NSS ensured a high level of national commitment, time-bound follow-up, targeted focus areas and inclusion of new countries and constituencies, it is signing off on a note of political discordance between the US and Russia. This is unfortunate since continued political consensus on the subject is critical. It is in India's interest to find ways of keeping interest and actions on the issue active and alive.

PRESIDENT OBAMA'S VISIT TO HIROSHIMA

On May 27, 2016, President Obama made a historic visit to Hiroshima – the first ever by a sitting US president. It was an evocative moment and it goes to his credit that he took this step. Obama's personal commitment to the concept of a nuclear weapons free world had been evident from his Prague speech in 2009. Unfortunately though, boxed in by a strong weapons lobby and a conservative bureaucracy, he could not travel any distance on this road. Ironically enough, his Administration will be remembered for having approved the spending of as much as a trillion dollars on nuclear weapons modernisation in the coming three decades.

In fact, a look at the nuclear weapons related developments as have been mapped across all the NWS over the last year, presents a pretty dismal picture. The US is committed to maintaining, upgradation and replacement of its entire nuclear arsenal over the next 30 years.[11] It has also announced with much fanfare, the development of a new nuclear tipped air launched cruise missile and to do so after the amount of headway it has made on BMD has acted like applying salt on the Russian and Chinese wounds.

In any case, Russia is well on its way to its own nuclear modernisation. Alleging NATO plans of its encirclement through BMD deployments in countries like Bulgaria and Romania that it once considered its area of influence, Russia has only increased its reliance on nuclear weapons. According to reports, Moscow is to receive 40 ICBMs in the coming months. No further arms control measures between the US and Russia are on the table as both move towards honing their nuclear capabilities. The Russian focus is particularly on its delivery systems.

11. "Cruise Control", *Economist*, as reproduced in *Indian Express,* January 28, 2016.

China too appears to be following a similar trajectory. It is improving the accuracy of its missiles besides equipping them with MIRV (Multiple Independent Reentry Vehicle) and MARV (Manoeuvrable Reentry Vehicle) capabilities. The sea-based leg of its nuclear deterrent has become operational with the new Jin class SSBNs (nuclear-powered ballistic submarines) equipped with the 7,000-km range Julang-2 missiles conducting sea patrols. Arms control is certainly not on its agenda for the time being as a more assertive China projects new found power. Meanwhile, the UK and France are in no mood to give up their nuclear arsenals either. India and Pakistan, as also North Korea, continue to build their versions of credible deterrence. The Conference on Disarmament remains stalemated by Pakistan on the issue of the Fissile Material Cut-off Treaty (FMCT) and no other serious forum for discussing disarmament issues has yet been found.

The overall trend then seems to point towards an increasing salience of nuclear weapons. Nuclear deterrence remains the central feature of national security strategies. In such a situation, nuclear proliferation will remain an issue of concern for many years to come.

PAKISTAN'S NUCLEAR BEHAVIOUR

SHALINI CHAWLA

In March 2016, Sartaj Aziz, Pakistan's Prime Minister Nawaz Sharif's Adviser on Foreign Affairs, said that "national security was top priority of Islamabad and there would be no compromise on the country's nuclear programme."[1] Pakistan has been very proud of its nuclear weapon programme and its dependence on the weapons has enhanced tremendously with the continuing instability within the country and rising Islamic extremism in the region. Islamabad has long tried to balance its domestic vulnerabilities with the nuclear weapons which it treats as the ultimate guarantor of its survivability and security.

Pakistan has been an overt nuclear state for eighteen years now and its arsenal has grown considerably in size. Pakistan's expansion of its nuclear arsenal, development of the delivery systems, and adoption of "full spectrum deterrence" does indicate its rather *excessive reliance* on nuclear weapons for its security. Pakistan's nuclear programme is on its way to become the third largest arsenal after those of the US and Russia. Pakistan's induction of Tactical Nuclear Weapons (TNWs) (Hatf-9) does signal a dangerous

Dr. **Shalini Chawla** is a Senior Fellow at the Centre for Air Power Studies, New Delhi.

1. "There will be no Compromise on Pakistan's Nuclear Programme: Sartaj Aziz", *Firstpost,* March 9, 2016, http://www.firstpost.com/world/there-will-be-no-compromise-on-pakistans-nuclear-programme-sartaj-aziz-2664970.html. Accessed on March 12, 2016.

strategy. The presence of TNWs not only injects complexities into the existing instability in South Asia, but also, by their nature, tactical nuclear weapons exacerbate enormous command and control challenges. The weapons are vulnerable to falling into the hands of non-state actors after they are deployed, or even while they are being transported to the battlefield. Pakistan has been very proud of making 'tiny bombs' not realising that these weapons could actually backfire on Pakistan, given the nature of the volatility of the state and rising extremism in the Pakistani society. There have been numerous attacks in the past on nuclear installations/air bases in Pakistan. The leadership in Pakistan very proudly announces the progress of TNWs with great confidence. TNWs, according to the Pakistani leadership, comprise the biggest deterrent they have against the Indian military forces. Talking about Pakistan's sense of accomplishments in the nuclear programme, Gen Khalid Kidwai said:

> It's a comprehensive satisfaction of having taken the Pakistani capability which has been proven by scientists, at a scientific level, ……and having taken these devices, which were scientific experiments, into an area of complete operationalization, into a vision which has consolidated Pakistan's nuclear capability in a manner that it today possesses a variety of nuclear weapons. In different categories. At the strategic level, at the operational level, and the tactical level."[2]

It would be useful to study and analyse the evolution of Pakistan's nuclear doctrine and nuclear behaviour over the past three decades.

PAKISTAN'S THREAT PERCEPTIONS AND OBJECTIVES OF NUCLEAR WEAPONS

Pakistan started to think about nuclear weapons seriously after its defeat in the 1971 War. Nuclear weapons were perhaps seen as the sole guarantor of Pakistan's security against the (perceived!)

2. A Conversation with Gen Khalid Kidwai, Pakistan's Nuclear Command Authority, Peter Lavoy, Monitor 360, Carnegie International Nuclear Policy Conference 2015, March 23, 2015, p.6. Accessed on January 1, 2016.

hegemonic India, which remains Pakistan's enemy number one till date! India and Pakistan have fought four wars, and for the last 70 years, the security dynamics of South Asia continues to be dominated by Indo-Pak hostility. Pakistan has been perpetually insecure about its neighbour and has consistently tried to neutralise India's conventional superiority.

Pakistan's strategic aims, as brought out in the Pakistani writings, are: "to strengthen national power; to prevent open aggression by India; to induce India to modify its goals, strategies, tactics and operations; to attain a position of security or, if possible, dominance, which would enhance the role of other (non-military) means of conflict; to promote and capitalise on advances in technology in order to reach parity or superiority in military power."[3]

The central assumption on which Pakistan has progressed and built up its nuclear arsenal is that a credible nuclear deterrent would compensate for the inferiority of its defence forces. Pakistan received direct support from Beijing for its nuclear programme, and in its pursuit of nuclear power status, it received financial support from Saudi Arabia and Libya and eventually, it shared nuclear data and expertise with Iran, Libya and Iraq.

For over more than six decades, Pakistan's foreign and security policies have revolved around balancing and countering the Indian "threat". The military leadership in Pakistan has attempted to counter the Indian threat by primarily four means:

- Alliance with major powers (the US and China) for defence modernisation.
- Efforts to acquire high technology weapons to seek competitive military advantage.
- Covert war to compensate for imbalance in conventional superiority.
- Expansion and modernisation of the nuclear arsenal to enhance deterrence in order to offset India's conventional superiority.

3. Ross Masood Hussain, "Threat Perception and Military Planning in Pakistan: The Impact of Technology, Doctrine and Arms Control," in Eric Arnett, ed., *Threat Perception in Pakistan* (Oxford: Oxford University Press, 1997), p.130.

PAKISTAN'S NUCLEAR DOCTRINE

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 perceptions. 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 policy-makers in Pakistan have clearly outlined basic elements in its nuclear doctrine. There is an unofficial code adopted by the Pakistani leadership, based on *Indo-centricity, credible minimum deterrence (now full spectrum deterrence), strategic restraint* and *first use.* Very interestingly and rather ironically, the code asserts on the principles of a peaceful programme revolving more 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. Pakistan has been talking rather often about TNWs which it is confident would deter India from a conventional military response.

Minimum Nuclear Deterrence

The concept of credible minimum deterrence is not based specifically on numbers but the weapon arsenal, including the nuclear weapons, delivery systems, command and control and the doctrine and strategy, is based on the perceived threat from India. A credible minimum deterrent 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."[4]

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

Pakistani Foreign Minister Abdul Sattar repeated the doctrine in November 1999: "Minimum nuclear deterrence will remain the guiding principle of our nuclear strategy." [5]

President General Pervez Musharraf also reasserted the concept when he said in May 2000:

> We refuse to enter a nuclear arms race and instead seek stability in the region. Pakistan, unlike India, does not have any pretensions to regional and global power status. We are committed to a policy of responsibility and restraint by maintaining a credible minimum deterrent. [6]

In May 2016, Sartaj Aziz said:

> As we seek to ensure our security, credible minimum deterrence remains our guiding principle and our conduct will continue to be defined by restraint and responsibility. [7]

The initial reasons for Pakistan's adoption of credible minimum deterrence were 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 states. It is unclear that Pakistan has actually quantified deterrence, and minimum for Pakistan would be based on the calculation of threat, owing to the numbers of the nuclear weapons and missile systems with India. Sartaj Aziz made a statement that "despite limited resources, Pakistan has developed a robust nuclear

5. Address to the "Pakistan Response to the Indian Nuclear Doctrine" Seminar, Foreign Minister Abdul Sattar, November 25, 1999, in "Pakistan Responds to India's Nuclear Doctrine", *Disarmament Diplomacy*, issue no.14, November 1999.
6. Talk by Scott D. Sagan, "The Evolution of Indian and Pakistani Nuclear Doctrine," May 7, 2008, http://belfercenter.ksg.harvard.edu/files/uploads/Sagan_MTA_Talk_050708.pdf. Accessed on March 10, 2011.
7. "Pak to Maintain Minimum Nuclear Deterrence: Sartaj Aziz," *Deccan Chronicle*, May 3, 2016 http://www.deccanchronicle.com/world/neighbours/030516/pak-to-maintain-minimum-nuclear-deterrence-sartaj-aziz.html. Accessed on May 4, 2016.

deterrent system whose safety and security is acknowledged."[8] Pakistan's minimum deterrence appears to be based on the robust capability to inflict unacceptable damage. Pakistan started with credible minimum deterrence but the interpretation of the concept has evolved over the years. The concept seems to have changed as Pakistan has been focussed on building the nuclear arsenal. According to a 2013 State Department Report:

> The increasing scale of Pakistan's fissile material production enhances its means to expand the size of its nuclear arsenal at a faster rate than any other state possessing nuclear weapons. Pakistan has not established a ceiling for the size of its arsenal, which has increased to an estimated 90-110 warheads.[9]

The credible minimum deterrence for Pakistan is not defined by numbers and remains dynamic. Pakistan is building a large number of delivery systems creating an option for *flexible response*.

First Use Doctrine

Pakistan has long held the belief that being the weaker state, it can compensate for 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 strategy that it followed in all the wars it waged against India, including the last one which was a regular war in Kargil in 1999 and, more important, the war through terrorism across the border for a quarter century. The specific concentration of terrorism in the border districts in Punjab, west of the river Beas, was clearly aimed at similar goals. 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 a war with India if the Indian military even crossed the international border.

8. "Pakistan has Developed a Robust Nuclear Deterrent System: Sartaj Aziz," *The Nation,* June 7, 2016, http://nation.com.pk/national/07-Jun-2016/pakistan-has-developed-a-robust-nuclear-deterrent-system-sartaj-aziz. Accessed on June 8, 2016.
9. "Assessing Progress on Nuclear Nonproliferation and Disarmament," UPDATED Report Card 2010-2013, An Arms Control Association Report, April 2013, at https://www.armscontrol.org/files/ACA_2013_Nuclear_Report_Card.pdf. Accessed on March 20, 2014.

Pakistan's first use doctrine has been clearly stated in Lt Gen (Retd) Sardar F.S Lodhi's writing in the *Pakistan Defence Journal*:

> The political will to use nuclear weapons is essential to prevent a conventional armed conflict, which would later on escalate into a nuclear war…….Pakistan's Nuclear Doctrine would, therefore, essentially revolve around the first-strike option. In other words, we will use nuclear weapons if attacked by India even if the attack is with conventional weapons. With his American experience of a graduated nuclear response Professor Stephen P. Cohen feels that Pakistan would use what he calls an 'option-enhancing policy' for a possible use of nuclear weapons. This would entail a stage-by-stage approach in which the nuclear threat is increased at each step to deter India from an attack. The first step could be a public or private warning, the second, a demonstration explosion of a small nuclear weapon on its own soil, the third step would be the use of a few nuclear weapons on its own soil against Indian attacking forces. The fourth stage would be used against critical but purely military targets in India across the border from Pakistan. Probably in thinly populated areas in the desert or semi-desert, causing least collateral damage. This may prevent Indian retaliation against cities in Pakistan. Some weapon systems would be in reserve for the counter-value role.[10]

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

The same logic for first use was used by the North Atlantic Treaty Organisation (NATO) during the Cold War when it suggested

10. Lt Gen Lodhi , "Pakistan's Nuclear Doctrine", *Pakistan Defence Journal*, at http://www.fdefencejournal.com/apr99/pak-nuclear-doctrine.htm. Accessed on December 10, 2011

that it would be the first one to use nuclear weapons in a conflict, as it perceived that a hostile Soviet Union had an overwhelming advantage in conventional forces. The Pakistani leadership claimed that given their limited resources and India's superior conventional capability, it was not possible for them to have a no first use doctrine. Also, the prime objective of nuclear weapons for Pakistan has been to deter India from a conventional aggression /response and, thus, first use was an undisputed option. Pakistan's assertion and belief in first use has been further intensified with India's positioning that a conventional war is possible even in the nuclear environment. This possibility was proved during the Kargil War, which was the first conventional war between India and Pakistan since the two went nuclear in May 1998. The Kargil War demonstrated the strong possibility of a limited war under the nuclear overhang, which has been discomfiting for Pakistan. Islamabad talked much more openly about its first use in the initial phase of nuclearisation. Even before the Pokhran tests in 1987, A Q Khan, in an interview to Kuldip Nayyar, said:

> Mr Nayar, if you ever drive us to the wall, we will use the bomb. You did it to us in East Bengal. We won't waste time with conventional weapons. We will come straight out with it.[11]

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 "preemptive nuclear strikes" against India and it is convinced that its preemptive strikes would lead to the destruction of India's retaliatory capabilities and/or paralyse the Indian political decision-making. Secondly, Pakistan has 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. An assumption related to India's strategic culture could be one of the pressing reasons for the Pakistani assumption which seems to be intensified with India's non-reactive approach (with conventional means) towards Pakistan-sponsored terrorist attacks.

11. *The Telegraph*, November 4, 2007, http://www.telegraphindia.com/1071104/asp/7days/story_8508991.asp. Accessed on December 10, 2007.

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.

In 2002, Lt Gen. Khalid Kidwai, the head of the Strategic Planning Division in Pakistan's nuclear command and control system, in an interview to Italian journalists, painted the scenarios in which Pakistan would opt for nuclear weapons. He talked about the controversial four scenarios: space threshold, military threshold, economic strangling and domestic destabilisation. [12] The thresholds drew vast parameters giving Pakistan choices in every possible (tense) scenario to react with nuclear weapons.

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 unpredictability and irrationality. The Pakistani leadership is convinced that they have managed to deter India with their posture of irrationality and uncertainty, more than once in the past. [13]

Weapon of Last Resort

Most of the Pakistani writings pre-1998 pointed towards the build-up of nuclear capability against Indian conventional forces and, thus, implied its first use. There was a shift in the Pakistani thinking regarding the use of nuclear weapons and adoption of a relatively moderate stance, by claiming nuclear weapons as the "weapon of last resort". Abdul Sattar (former Pakistani foreign minister), Agha Shahi and Zulfiqar Ali Khan jointly authored an article in *The News* on October 5, 1999, which stated:

> The exigency under which the 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

12. As cited in Paolo Cotta-Ramusino and Maurizio Martellini, *Nuclear Safety, Nuclear Stability and Nuclear Strategy in Pakistan* (Landau Network – Centro Volta Report).
13. For details, see Dr Shalini Chawla, *Nuclear Pakistan* (New Delhi: Knowledge World, 2012).

> 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.[14]

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.[15]

Although, the weapon of last resort option stands in contradiction to Pakistan's earlier statements, and appears moderate, on the other hand, it also projects 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 last few years, Pakistan's endeavour has been to project itself as a *responsible* nuclear power. The need to do so was exacerbated with 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.

Full Spectrum Deterrence

Islamabad started with a nuclear programme with credible minimum deterrence but the programme and the doctrine evolved into *full*

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

15. Cited in Rory McCarthy and John Hooper, "Musharraf ready to use nuclear arms", *theguardian,* April 6, 2002, https://www.theguardian.com/world/2002/apr/06/pakistan.rorymccarthy. Accessed on April 15, 2010

spectrum deterrence. According to the Pakistani leadership, the need for full spectrum deterrence was felt strongly after India talked about the possibility of a limited conventional war under the nuclear overhang. Gen Khalid Kidwai talked about Pakistan's movement from minimum deterrence to full spectrum deterrence:

> What they (India) were finding attractive, and what was probably encouraging them to find the space for conventional war, below this gap, was the absence of a complete spectrum of deterrence...That is what we have been calling the full spectrum deterrence.[16]

On April 19, 2011, Pakistan tested its short-range surface-to-surface multi-tube ballistic missile, the 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.[17]

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. NASR falls under the category of TNWs, and has generated ample debate in the Indian defence and strategic community. Pakistan claims that it has opted for TNWs in response to possible Indian retaliation/aggression and India's Cold Start Doctrine. Gen Kidwai argues:

> By introducing the variety of tactical nuclear weapons in Pakistan's inventory , and in the strategic security debate, we have blocked the avenues for serious military operations by the other side.[18]

16. A Conversation with Gen Khalid Kadwai, n. 2, p. 8.
17. Rodney W Jones, "Pakistan's Answer to Cold Start?", *The Friday Times,* at http://www.thefridaytimes.com/13052011/page7.shtml. Accessed on October 13, 2011.
18. A Conversation with Gen Khalid Kadwai, n. 2, p. 5.

Unofficial reports indicate Pakistan's plans to acquire a sea-based second nuclear strike capability. Pakistan's Naval Strategic Force Command was announced in 2012, and the leadership indicated that it possessed sea-based second strike nuclear capability. Islamabad's full spectrum deterrence has achieved 95 percent completion.[19] Kidwai was asked a direct question as to whether the remaining 5 percent would be done through submarines? He responded by saying, "If you're talking of the possibility of Pakistan developing a second strike capability, which is a larger definition, a submarine is just a platform, but beyond the submarine, you'd need a number of other things. Communications with the weapon itself, and so on and so forth."[20]

NUCLEAR BEHAVIOUR

Pakistan has consistently claimed that its nuclear weapons have been in response to India's peaceful test in Pokhran in 1974. Bhutto clearly announced Pakistan's conviction to acquire the bomb back in 1972. The nuclear weapons were meant to neutralise India's conventional superiority and to deter it from a conventional response in any form. The weapons are seen as the ultimate guarantee for Pakistan's security. Pakistan has tried to project its nuclear assets as an instrument of blackmail. The acquisition of the nuclear capability (in 1987) enhanced Pakistan's capability to wage and escalate the covert war in Kashmir. Pakistan's non-adherence to no first use was believed to serve the objective to deter India from responding with conventional military retaliation. Policy-makers in Pakistan seem to be convinced that they will be able to carry on, or rather accelerate, their activities in Kashmir under the broader threat, using nuclear weapons, if required, and this would constrain India's strategic moves. Although, this has been the Pakistani thinking for long, it has been reinforced with Pakistan's acquisition of nuclear weapons and announcement of the first use policy.

Pakistan claimed that it had the capability to build a nuclear bomb in 1987, and in 1989, the then Army Chief, Gen Aslam Beg announced the famous "offensive defence doctrine". It is noteworthy that during the late 1980s, the activities in the Valley witnessed a shift and the

19. Ibid., p. 6.
20. Ibid., pp.14-15.

terrorist acts increased significantly in numbers and were planned in a more organised manner.

In 1999, the JIC (Joint Intelligence Committee – India) emphasised how Pakistan might use its nuclear capability to advance its objectives in Kashmir:[21] Pakistan's nuclear capability would allow Pakistan to continue its Low Intensity Conflict (LIC) in Jammu and Kashmir and Punjab under the cover of a nuclear threat, which, in their perception, would limit India's retaliatory options of threatening escalation to a conventional war.

Pakistan used nuclear weapons to blackmail not only India but also to send a message to the international community, which, it felt, could potentially pressurise India not to retaliate militarily in stressed situations and help Pakistan to attain its diplomatic and political objectives.

Pakistan's belief that India would be deterred by Pakistan's stated 'first use' doctrine formed one of the most critical bases for the Kargil intrusions. The Kargil Review Committee Report stated the assumptions of Pakistan's aggression in Kargil:

> Its nuclear capability would forestall any major Indian move, particularly across the international border, involving use of India's larger conventional capabilities. It appears to have persuaded itself that nuclear deterrence had worked in its favour from the mid-1980s.

During the Kargil War, Pakistan did threaten the use of nuclear weapons in case of escalation of the conflict from the Indian side. Post Kargil, in 2001, following the attack on the Indian Parliament on December 13, 2001, India mobilised its forces and Operation Parakaram was conducted. Pakistan once again used the nuclear card in its efforts to build international pressure on India as the 2001-02 military stand-off between the two nuclear power states was, indeed, alarming. President Musharraf, in his speech, on March 23, 2002, said:

21. *From Surprise to Reckoning: The Kargil Review Committee Report* (New Delhi: Sage, 1999), p. 197.

> With the blessings of Allah, Pakistan has the full capability to defend itself and is in a position to thwart any aggression against it. If anyone tries to challenge its power, they would be taught a lesson, which would be remembered.[22]

In a subsequent address to the nation on May 27, 2002, President Musharraf announced:

> We do not want war. But if war is thrust upon us, we would respond with full might, and give a befitting reply.[23]

Although the term nuclear has been deliberately avoided, the military leadership did threaten the use of nuclear weapons which would inflict "unforgettable damage". The Pakistani leadership has been consistent in using the nuclear threat to counter Indian conventional retaliation, directly and indirectly, by building international pressure on India to refrain from military moves.

Although the build-up of Pakistan's nuclear arsenal was to counter-balance India's conventional superiority, Pakistan has used its nuclear capability to fulfill its political and diplomatic objectives. It managed to get US military aid and support for sixteen years, starting in 2001. The flow of US assistance continued despite Washington's apparent displeasure with the Pakistan military, following Osama bin Laden's killing in Pakistan. It will not be incorrect to say that Pakistan's nuclear weapons and the threat of these weapons falling into the hands of non-state actors, did place Washington in a rather vulnerable position. American aid and assistance continued (although at a lower pace!) despite Washington giving clear indications of its dissatisfaction with the Pakistan military's performance in the war on terror.

Pakistan has been focussed on strengthening its conventional military capabilities to deal with a limited war below the nuclear

22. President Gen Pervez Musharraf's Address to the Nation, March 23, 2002, at http://presidentmusharraf.wordpress.com/2006/07/17/musharraf-address-23-march-2002/. Accessed on March 12 , 2010
23. President Gen Pervez Musharraf's Address to the Nation, May 27, 2002, at http://presidentmusharraf.wordpress.com/2006/07/20/musharraf-address-27-may-2002/. Accessed on December 10, 2009.

threshold, and to be able to have greater freedom/confidence to continue covert war through terrorism. A strong conventional military base definitely provides confidence to carry on terrorism, as the nation feels strong enough to face Indian retaliation.

The central strategic assumption of the Pakistani nuclear strategy has been that India cannot impose a conventional war on Pakistan, leave alone achieve a decisive victory without the risk of catastrophic consequences of a Pakistani nuclear attack. The Pakistani leadership believes that Pakistan's possession of the nuclear arsenal and its first use policy, and, now, full spectrum deterrence, would be sufficient to deter war. This logic in Pakistan has been reinforced by the common Pakistani perception that it was able to deter Indian military action on various occasions even after highly provocative terrorist attacks.

Looking into Pakistan's posture on nuclear weapons, some distinct contradictions can be seen. It talks about the use of nuclear weapons as a last resort, with restraint and responsibility. But on the other hand, it boasts about TNWs projecting an extremely low threshold. Obviously, last resort has not been defined by Pakistan, which adds to uncertainty and enhances deterrence. It would not be incorrect to state that Pakistan has very rationally adopted the posture of irrationality.

The following conclusions can be drawn regarding Pakistan's nuclear behaviour in the last three decades:

- The objectives of the nuclear weapons have not changed, and for Islamabad, nuclear weapons serve primarily three objectives: to avoid conventional war; to support non-state actors conducting terrorism against India; to be the ultimate guarantor of its security against India and the major powers (the US).
- Pakistan believes in ambiguity, as it enhances deterrence and it would maintain a posture of ambiguity in the future. It claims to be extremely transparent on the safety and security of its nuclear arsenal, but has maintained silence on the other aspects of its nuclear programme.
- Pakistan's believes in expansion of its arsenal which is expected to continue to expand due to the increasing number of its insecurities.

- The Pakistani leadership is extremely confident of its doctrine – full spectrum deterrence – and believes it would deter India from any conventional response.
- Despite claiming to be a responsible nuclear power, Islamabad continues to threaten India with a nuclear attack.
- Pakistan's reliance on nuclear deterrence would intensify with the constantly growing asymmetries between India and Pakistan.

GLOBAL CENTRE OF NUCLEAR EXCELLENCE: INDIA'S NUCLEAR SECURITY PROVIDER

RESHMI KAZI

The practice of strengthening nuclear security is an imperative task. In the 21st century, nuclear security is daunted with increasing challenges that make the process of securing weapons-usable nuclear and radiological materials and their associated facilities a complex job. New terrorists groups like the Islamic State of Iraq and the Levant (ISIL), also commonly known as the Islamic State in Syria (ISIS), seeking nuclear and radiological materials, expanding stockpiles of nuclear materials, insider threats and inadvertent human errors convolute the job of thwarting potential risks to nuclear security. The complexities involved in improving nuclear security primarily arise from the fact that the process has to be ever continuous and ongoing. The defences against all potential threats to nuclear security have to be constantly upgraded to prevent any misappropriation of weapons-usable nuclear or radiological materials falling into the wrong hands. This is the primary objective of India's nuclear security policy.

The essence of India's nuclear security policy is to prevent, detect and effectively respond to any unauthorised removal,

Dr. **Reshmi Kazi** is an Associate Fellow at the Institute of Defence Studies and Analyses, New Delhi.

access to, or sabotage of, nuclear weapons, materials or their associated facilities. In consonance with India's nuclear security objective, the foundation of a centre of excellence – Global Centre for Nuclear Energy Partnership (GCNEP) – was announced during the Washington Nuclear Security Summit (NSS) in 2010. This paper attempts to explore the emerging challenges to global nuclear security and studies the role of centres of excellence in countering them. Further, the paper seeks to examine India's contribution in sharing nuclear security best practices with several countries through education, training and enhancing awareness. Finally, the paper examines India's role in strengthening its national nuclear security that will contribute in embedding a robust nuclear security architecture at the global level.

NUCLEAR SECURITY SUMMIT PROCESS: OUTCOME AND PROGRESS

The existing and emerging nuclear threats continue even as the world has successfully concluded four NSS beginning from 2010 to 2016. The NSS process was critical in minimising and securing weapons-usable nuclear materials in several countries and has pioneered several meaningful and tangible developments for strengthening nuclear security. The summit process has underscored the importance of ratification and implementation of principle international legal instruments for preventing and combating acts of nuclear terrorism. The world leaders, during the summits, emphasised upon the importance of universalisation of the Convention on Physical Protection of Nuclear Material (CPPNM) and its 2005 Amendment and the International Convention on the Suppression of Acts of Nuclear Terrorism (ICSANT). The NSS process has underscored the importance of these legal instruments in detecting and recovering illicitly trafficked nuclear material and helped in reducing any radiological consequences or sabotage related offences involving weapons grade nuclear and radiological materials. The summits have successfully facilitated the recovery or elimination of more than 1,500 kg of Highly Enriched Uranium (HEU) and separated plutonium, achieved success in making

twelve countries become HEU-free[1], established a network of new training and support centres, and secured reports specifying the status of national laws on nuclear safety and security by most participant states. The summit process has also underlined the effectiveness of international diplomacy for an integrated approach to combat the danger of nuclear terrorism, which is a threat to global security. An equally important accomplishment of the NSS process is the fact that more than 90 percent of the summiteer countries, including India, have voluntarily provided detailed national progress reports specifying the ways and means on how they are upholding their national commitments and responsibilities in building a robust nuclear security architecture.[2] This is an important step towards sharing information about how nations are performing in developing a more comprehensive, sustainable and robust global nuclear security architecture that assures the security of all. The national reports play a commendable role in assuring the international community about the national commitments towards protective efforts against the threat of nuclear terrorism. The NSS played a monumental role in drawing high-level political attention to the potential threat of terrorists resorting to the most brutal atrocities with the help of nuclear and radiological materials. During these six years, the various commitments made by political leaders or senior representatives underscore the political importance of the pledges. It can be inferred that even though the commitments lack legal sanctity, they are, nonetheless, politically binding.

EMERGING THREATS TO NUCLEAR SECURITY

Despite the accomplishments achieved by the summits, the threat of nuclear and radiological terrorism remains far from being dissipated.

1. These countries include Chile, Czech Republic, Denmark, Georgia, Hungary, Mexico, Republic of Korea, Romania, Sweden, Turkey, Ukraine, and Vietnam. See "Joint Statement on Countries Free of Highly Enriched Uranium (HEU)," The White House, March 24, 2014, https://www.whitehouse.gov/the-press-office/2014/03/24/joint-statement-countries-free-highly-enriched-uranium-heu. Accessed on May 3, 2016.
2. Of the 53 participating states in the Fourth Nuclear Security Summit in Washington in 2016, every state has made at least one national commitment to strengthen nuclear security and some countries have been prolific in their pledges, particularly Canada, Japan, Kazakhstan, Netherlands, Norway, Philippines, Republic of Korea, Spain, United Kingdom, and United States. See "Nuclear Security Cooperation after the Summits at Risk," *Partnership for Global Nuclear Security*, March 23, 2016, https://pgstest.files.wordpress.com/2016/03/aca-pgs-press-release-dc-3-11-2016.pdf. Accessed on May 3, 2016.

An array of new threats has emerged since the gruesome September 11, 2001 attacks. As opined by President Barack Obama in his 2009 Prague speech, "The threat of global nuclear war has gone down, but the risk of a nuclear attack has gone up."[3] Obama's observation is a critical pointer that nuclear and radiological terrorism continues to remain a real possibility. With the death of Osama bin Laden, the leader of the dreaded terrorist organisation, Al Qaeda, many presumed that the danger of nuclear and radiological threats had significantly reduced. However, such conjectures have little credibility with the emergence of new terrorist organisations like the ISIS. There already exists compelling evidence to indicate that the ISIS militants are likely to have used mustard agent against Kurdish forces in Iraq. Growing evidence indicates that the ISIS is likely to have obtained the mustard agent from Syria or Iraq.[4] It is also suspected to have used the mustard agent against Kurdish forces in Iraq in August 2015.[5] If this reported intelligence is believed to be correct, then the ISIS holds the culpability of using weapons of mass destruction since the twin nuclear bombings of Hiroshima and Nagasaki in 1945 by the US. Additionally, several sources have claimed that the ISIS could pose a potential Chemical, Biological, Radiological and Nuclear (CBRN) threat. Mainstream media reports have raised the alarm about the ISIS seizing chemical weapons and materials for its nefarious activities. That the alarm was not just a figment of the imagination or merely hypothetical was clear when British Home Secretary Theresa May, warned that the ISIS "will acquire chemical, biological, or even nuclear weapons to attack us."[6]

With ISIS terrorists gaining ground, the CBRN threat is becoming less hypothetical and more real. Having large swathes of land under

3. "Remarks By President Barack Obama In Prague", The White House, April 5, 2009, https://www.whitehouse.gov/the-press-office/remarks-president-barack-obama-prague-delivered. Accessed on May 3, 2016.
4. Adam Entous, "Islamic State Suspected of Using Chemical Weapon, U.S. Says," *Wall Street Journal*, August 13, 2015, http://www.wsj.com/articles/islamic-state-suspected-of-using-chemical-weapon-u-s-says-1439499549. Accessed on May 3, 2016.
5. "IS Suspected of Chemical Arms Attack on Kurds in Iraq," *BBC News*, August 14, 2015, http://www.bbc.com/news/world-middle-east-33922493. Accessed on May 3, 2016.
6. Joseph Cirincione, "ISIS Will be in Position to get Nuclear Weapons if Allowed to Consolidate Power, Resources, Says Expert," *Daily News*, September 30, 2014, http://www.nydailynews.com/news/national/isis-nukes-allowed-consolidate-expert-article-1.1958855. Accessed on May 3, 2016.

a unified command will enable the ISIS to fulfill its goals of not only establishing the Islamic State but also exploit them as fitting safe havens for laboratories and other facilities to build and assemble dangerous CBRN weapons. According to US intelligence sources, the ISIS militants are incessantly working towards developing more sophisticated CBRN weapons.[7] For this purpose, the terrorist group is recruiting "highly trained professionals" to make chemical weapons.[8] These facts indicate that the Islamic militants are undertaking "serious efforts" to manufacture their chemical weapons stockpiles. According to the Australian Foreign Minister, Julie Bishop, "Da'esh [ISIS] is likely to have amongst its tens of thousands of recruits, the technical expertise necessary to further refine precursor materials and build chemical weapons."[9]

The ISIS' attempts to acquire weapons of mass destruction including nuclear weapons, has been emphasised upon by India. India has warned that the ISIS may acquire a nuclear bomb from Pakistan. Interestingly, India's concerns echo claims made by the ISIS terrorists that they are "infinitely" closer to getting hold of a nuclear weapon, emphasising that they could buy it via corrupt Pakistani officials.[10] Recognising the emerging threat from the ISIS, Home Minister Rajnath Singh "admitted that online recruitment by the Islamic State (IS) had become a major security challenge for India."[11] In their official English-language propaganda magazine, *Dabiq*, the ISIS militants have drawn a hypothetical operation wherein the Islamic State [with]

7. Desmond Butler and Vadim Ghirda, "AP INVESTIGATION: Nuclear Black Market Seeks IS Extremists," *The Independent*, October 7, 2015, http://bigstory.ap.org/article/6fd1d202f40c4bb4939bd99c3f80ac2b/ap-investigation-nuclear-smugglers-sought-terrorist-buyers. Accessed on May 3, 2016.
8. Alexander Ward, "ISIS Recruiting 'Highly Trained Foreigners' to Produce Chemical Weapons," *The Independent*, June 7, 2015, http://www.independent.co.uk/news/world/middle-east/isis-is-recruiting-highly-trained-professionals-in-a-bid-to-develop-chemical-weapons-10303031.html. Accessed on May 3, 2016.
9. Ibid.
10. John Hall and Jenny Stanton, "ISIS Could Get Their Hands on a Nuclear Weapon from Pakistan, Warns Indian Minister of Defence," *Indian Defense News*, June 2, 2015, http://www.indiandefensenews.in/2015/06/isis-could-get-their-hands-on-nuclear.html. Accessed on May 3, 2016.
11. Milind Ghatwai, "Online Recruitment by Islamic State Major Security Challenge: Rajnath Singh," *The Indian Express*, September 13, 2015, http://indianexpress.com/article/india/india-others/online-recruitment-by-is-major-security-challenge-rajnath-singh/. Accessed on May 3, 2016.

billions of dollars in the bank, [will] call on their *wilāyah* in Pakistan to purchase a nuclear device through weapons dealers with links to corrupt officials in the region.[12] The article further suggests that such an illicitly diverted weapon could be smuggled into the US homeland either over land from Mexico or Canada, or by boat.

The risk of the ISIS acquiring radiological weapons is not negligible. According to the Australian intelligence sources, the ISIS has seized enough radioactive material from government facilities to suggest it has the capacity to build a large and devastating "dirty" bomb. [13] In 2010, WikiLeaks cables revealed that poor security at Yemen's[14] National Atomic Energy Commission (NAEC) facility, housing radioactive materials, makes these dangerous materials vulnerable to terrorist access. Georgia has become a transit point for illicit trafficking of unsecured nuclear/radiological materials.[15] It has struggled to combat the illicit trafficking of nuclear/radiological materials, with 13 criminal cases brought against suspected smugglers of radioactive materials between 2002 and 2010 alone.[16] According to the Incident and Trafficking Database (ITDB), from January 1993 to December

12. John Cantlie, "The Perfect Storm," *Dabiq*, Issue 9, 1436 SHA'BAN, p.77, http://www.joshualandis.com/blog/wp-content/uploads/Dabiq-9-They-Plot-and-Allah-Plots-compressed.pdf. Accessed on May 3, 2016.
13. Adam Withnall, "ISIS' Dirty Bomb: Jihadists Have Seized 'Enough Radioactive Material to Build their First WMD' " *The Independent*, June 10, 2015, http://www.independent.co.uk/news/world/middle-east/isiss-dirty-bomb-jihadists-have-seized-enough-radioactive-material-to-build-their-first-wmd-10309220.html. Accessed on May 3, 2016.
14. The location in Yemen is obviously of particular concern since AQ in the Arab Peninsula has an active base there. A senior government official in Yemen said that the lone guard standing watch at Yemen's National Atomic Energy Commission (NAEC) facility, had been removed from his post and that its only closed circuit TV security camera had broken down six months previously and was never fixed. See Karen McVeigh, "WikiLeaks Cables: Yemen Radioactive Stocks 'Were Easy Al-Qaida Target," *The Guardian*, December 19, 2010, http://www.theguardian.com/world/2010/dec/19/wikileaks-cables-yemen-al-qaida. Accessed on May 3, 2016 and "US Embassy Cables: Yemen Sounds Alarm Over Radioactive Materials," *The Guardian*, December 19, 2010, http://www.theguardian.com/world/us-embassy-cables-documents/242991. Accessed on May 3, 2016.
15. Georgia's proximity to Russia, unsecured borders alongside South Ossetia and Abkhazia, political instability, abject poverty, corruption, existing trade routes opening into Asia and Europe, make it a thriving black market hub for illicit trafficking of either unknown or suspected to be diverted nuclear and radioactive materials from Moscow via Tbilisi. See Alexander Kupatadze, "Organized Crime and the Trafficking of Radiological Materials: The Case of Georgia," *The Nonproliferation Review*, vol. 17, July 2010, p. 220.
16. Ibid., p. 222.

2014, out of the 2,734 reported incidents, 442 incidents involved illegal possession and movement of nuclear material or radioactive sources and attempts to sell, purchase or otherwise use such material for illegal purposes.[17] Twenty-one incidents in this category involved HEU, plutonium and plutonium beryllium neutron sources.[18] The above statistics indicate that there is a perceived demand for nuclear and radioactive material and an'illicit nuclear market' is effectively catering to these illicits requirements.

It is noteworthy that there has been no recorded incident of a dirty bomb being used anywhere in the world, including India. However, Dr KS Pradeepkumar, head of emergency preparedness for India's main nuclear laboratory, the Bhabha Atomic Research Centre in Mumbai, warns that there have been attempts where people have tried to make dirty bombs using radioactive Cesium-137 and explosives like RDX. He expresses concern over the increasing "use of radioactive sources and radioisotopes in a very significant way the world over."[19] As the security of sites housing radioactive sources varies, with some being poorly protected, there have been cases of lost sources, misplaced sources, etc. "These orphan sources can get into the hands of the bad boys. It is believed that they can integrate these with explosives, and they can use it."[20]

Prolonged political instability exacerbated with domestic conflicts and civil strife in countries possessing nuclear/radiological materials can be a dangerous catalyst to heighten risks to nuclear security. Countries with poor nuclear security provide a potential pathway for terrorists' acquisition of nuclear/radiological materials. This is the current situation in Pakistan. Islamabad's nuclear security is severly challenged by incessant terrorist attacks and political instability. Several attacks perpetrated by terrorists operating from the Pakistani soil indicate that their intention is to sabotage vital installations,

17. "Incident and Trafficking Database (ITDB)," International Atomic Energy Agency, 2015 Fact Sheet, http://www-ns.iaea.org/downloads/security/itdb-fact-sheet.pdf , p.2. Accessed on May 3, 2016.
18. Ibid.
19. "Top Indian Nuke Scientist Busts Myths Surrounding 'Dirty Bomb'," *The Economic Times*, May 10, 2016, http://economictimes.indiatimes.com/opinion/interviews/top-indian-nuke-scientist-busts-myths-surrounding-dirty-bomb/articleshow/52201378.cms. Accessed on May 10, 2016.
20. Ibid.

including the nuclear facilities of the country.[21] The Tehreek-e-Taliban Pakistan's (TTP's) June 2014 attacks on Karachi's Jinnah International Airport further reignited security concerns about Pakistan's sensitive installations.[22] The TTP's repeated attacks on airports and naval bases have successfully exposed the capacity gaps in Pakistan's security apparatus. It cannot be ignored that TTP militants might next be emboldened to target Pakistan's nuclear weapons installations.[23]

CENTRE OF EXCELLENCE: MEETING THE CHALLENGES TO NUCLEAR SECURITY

Nuclear security will face vulnerabilities as long as there are terrorists seeking nuclear materials. By that argument, they will look for nuclear and radiological materials wherever they exist and are poorly guarded. To safeguard against such complications in a timely manner, it is essential to develop an effective nuclear culture among all the agencies/departments governing nuclear security. This can be expected to produce sustainable and constant improvement in nuclear security. To implement higher security standards, an effective mechanism in the form of Centres of Excellence (CoEs) has been adopted by several countries. Since the 2010 and 2014 Nuclear Security Summits (NSS), 33 countries have either announced or established CoEs or training programmes related to nuclear security.[24]

A CoE is an efficient mechanism for promoting nuclear security through regional and national mechanisms. These are an integral aspect of the global nuclear security architecture for disseminating awareness about the importance of strengthening nuclear security. A CoE can be defined as a dedicated insitution that imparts training

21. The attacks on the Kamra military air base in August 2012 renewed concerns about the threat that terrorists could pose to the security of the Pakistani nuclear arsenal.
22. On earlier occasions, the TTP has attacked several heavily guarded state installations — the Mehran naval base in 2011, the Minhas air base (possibly a nuclear weapons storage base) and the Peshawar airport in 2012.
23. Reshmi Kazi, "Pakistan's Nuclear Security Faces Insider Threat," *Hindustan Times*, June 19, 2014, http://www.hindustantimes.com/comment/analysis/pakistan-s-nuclear-security-faces-insider-threat/article1-1231378.aspx. Accessed on May 5, 2016.
24. Algeria, Abu Dhabi, Australia, Brazil, Canada, Chile, China, Czech Republic, European Union France, Germany, Hungary, Indonesia, India, Italy, Japan, Jordan, Kazakhstan, Lithuania, Malaysia, Mexico, Morocco, Netherlands, Pakistan, Philippines, Republic of Korea (ROK), Saudi Arabia, Singapore, South Africa, Ukraine, United Arab Emirates, the United Kingdom and the United States.

on various aspects of nuclear security at both national and regional levels. These aspects may include physical protection, material accountancy, export controls, nuclear forensics and emergency response mechanisms. The underlying purpose is to develop human capacity building, achieve technological progress, and share best practices on nuclear security. The significant rise of participant states from 47 in the 2010 NSS to 52 in the 2016 NSS has provided the necessary stimulus to the International Atomic Energy Agency (IAEA) to further strengthen the network of CoEs.

INDIA'S APPROACH TO NUCLEAR SECURITY

India views nuclear security as an integral aspect of its security policy that needs to be continously strengthened. The continous process of strengthening not only improves and upgrades the nuclear security system but also lays the foundation of a strong culture of nuclear security. An improved nuclear security system built within the framework of a progressive nuclear security culture holds the potential to transform India's nuclear establishment into a robust security architecture. To achieve this objective, an institutionalised framework in the form of a CoE for nuclear security requires to be established, dedicated to "enhanced nuclear safeguards to effectively and efficiently monitor nuclear materials and facilities."[25] This objective shaped the basic foundation of India's centre of excellence, the Global Centre of Nuclear Energy Partnership (GCNEP). In January 2014, Prime Minister Manmohan Singh laid the foundation of the centre in the Jasaur-Kheri village of Haryana announcing that the GCNEP "aims to continue strengthening the security of its nuclear power plants and nuclear materials…together with the development of human resources in the field of nuclear energy."[26] The **primary missions** of the GCNEP are to:

- "conduct research, design and development of nuclear systems that are intrinsically safe, secure, proliferation resistant and sustainable" with the aim of strengthening nuclear security in the future;

25. GCNEP, http://www.gcnep.gov.in/about/about.html
26. "Indian Research Centre Takes Shape," *World Nuclear News*, January 3, 2014, http://www.world-nuclear-news.org/NN-Indian-research-centre-takes-shape-0301144.html. Accessed on May 10, 2016.

- "to organise training, seminars, lectures and workshops" on critical issues by Indian and international experts and build a group of trained human resource; and
- "to promote global nuclear energy partnership through collaborative research and training programs." [27]

The GCNEP is designed to be a state-of-the-art CoE principled upon international collaboration with the IAEA and other interested foreign partners. The centre symbolises India's "commitment to the national and international fraternity to forge global partnerships for development of technologies and processes which will promote large-scale yet sustainable, safe and secure exploitation of nuclear energy."[28] The GCNEP related Memorandum of Understanding (MoU) and other cooperation arrangements have been signed with France, Russia, the US and the IAEA.[29] The centre houses five schools to conduct research into advanced nuclear energy systems, nuclear security, radiological safety, as well as applications for radioisotopes and radiation technologies. These schools include:

- Advanced Nuclear Energy System Studies.
- Nuclear Security Studies.
- Nuclear Material Characterisation Studies.
- Radiological Safety Studies.
- Studies on Applications of Radioisotopes and Radiation Technologies.

The GCNEP is expected to become an international platform for India to interact with the global stakeholders associated with all aspects of peaceful uses concerning nuclear energy, including nuclear security, safety and non-proliferation.[30] It will support international cooperation in nuclear energy applications and facilitate

27. "Global Centre for Nuclear Energy Partnership," Government of India, Department of Atomic Energy, http://www.gcnep.gov.in/about/about.html. Accessed on May 10, 2016.
28. See, "Message by Chairman AEC and Secretary DAE," Global Centre for Nuclear Energy Partnership, Annual Report 2013 -14.
29. "Nuclear Security Summit 2014: National Progress Report India," Nuclear Security Summit 2014, p.2, https://www.nss2014.com/sites/default/files/documents/india.pdf. Accessed on May 10, 2016.
30. R.B. Grover, "The Technological Dimension of Nuclear Security," *Strategic Analysis*, vol. 38, no. 2, 2014, p.155, http://www.tandfonline.com/doi/pdf/10.1080/09700161.2014.884434. Accessed on May 10, 2016.

the establishment of "extensive facilities" related to advanced education, research and training in the field of proliferation resistant nuclear system designing in nuclear power plants, nuclear security, radiological safety, nuclear material characterisation and applications of radiation technologies and radioisotopes.[31] The centre also seeks to pursue advancement in improved technologies for cutting-edge nuclear energy systems, advanced nuclear forensic and establishment of accreditation facilities for radiation monitoring.

GCNEP: A SECURITY PROVIDER

The GCNEP is a dedicated Reseach and Development (R&D) component under the aegis of the Department of Atomic Energy (DAE). Being a CoE, the primary aim of the GCNEP is to be an operative forum focussing India's advancement in the field of nuclear safety, security, and improved nuclear and radiation technologies. The GCNEP has shouldered the responsibility to develop capacity building in technology training and human resource for robust nuclear security. The mandate of the GCNEP will include research by Indian and visiting international scientists; training of Indian and international participants; and hosting international conferences, workshops and group discussions by experts on topical issues. The mandate further includes design and conduct of nuclear security courses in collaboration with like-minded countries and the IAEA.[32] The centre will be boosted by bringing together Indian and international scientists for their research and training programmes.[33] Training facilities are to include virtual reality laboratories and a radiation monitoring, calibration and accreditation laboratory.[34] The GCNEP is a signature of India's commitment to be a "responsible state with advanced nuclear technology"[35] by exploring methods to establish and share nuclear best practices at national and international levels.

31. "Global Centre for Nuclear Energy Partnership," Government of India Department of Atomic Energy Rajya Sabha, Unstarred Question no. 3724, p.1, http://dae.nic.in/writereaddata/rsus3724.pdf. Accessed on May 10, 2016.
32. Ibid.
33. Ibid.
34. Ibid.
35. "Joint Statement between President George W. Bush and Prime Minister Manmohan Singh," Department of Atomic Energy, Government of India, July 18, 2005, http://dae.nic.in/?q=node/61. Accessed on May 10, 2016.

A qualifying edge to the GCNEP is visible in the form of its dedicated outreach programme cell that actively showcases India's technological advancement in several areas like physical protection of nuclear material and nuclear facilities, prevention and response to radiological threats, nuclear material control and accounting practices, protective measures against insider threats, radiochemistry and application of radioisotopes, applications of radioisotopes in agriculture and radiation processing of food, and public awareness programme on DAE technologies for rural India. Under the guidance of the DAE, the outreach cell has been regularly conducting courses, symposiums, and workshops on issues related to nuclear security. These courses benefit the participants from various security establishments by assisting in capacity building through the relevant training.

The GCNEP has broadened its horizon by developing nuclear security practices, nuclear safety and nuclear non-proliferation at the international level. The GCNEP has undertaken collaborative research and detailed studies from time to time. During October 4-12, 2004, India and the IAEA held a regional training course on "Physical Protection of Nuclear Installations", in Mumbai.[36] The course was arranged with 16 lecture sessions, two workgroup sessions, one workgroup presentation session by the course participants, a plenary session and a field visit to the Kakrapar Atomic Power Station.[37] There were 25 participants in the course, including 13 foreign participants (from Bangladesh, China, Indonesia, Malaysia, Philippines and Thailand) and 12 Indians.[38] The course covered wide-ranging topics under nuclear security like physical protection concerns, nuclear fuel cycle activities, safety-design and evaluation of physical protection systems, International Physical Protection Regime, IAEA activities in nuclear security, security technologies, design basis threats, security and control of radioactive materials, safety-security interface, nuclear

36. A total of four foreign faculty members was arranged by IAEA, two were IAEA staff members, one was from Sandia National Laboratory, USA, and one from ARPANSA (Australian Radiation Protection and Nuclear Safety Agency), Australia. 10 faculty members from India took part in this training course. "Regional Training Course on 'Physical Protection of Nuclear Installations'," http://www.barc.gov.in/publications/nl/2005/200503-8.pdf p.1. Accessed on May 10, 2016.
37. Ibid.
38. Ibid.

material control and security, security culture, etc.[39] From October 17-19, 2012, India, in collaboration with the IAEA, conducted an international workshop on "Safety of Multi-Unit Nuclear Power Plant Sites Against External Natural Hazards" at Mumbai. The agenda of the workshop included courses on emergency response methods related to safety evaluation of a multi-unit site with respect to multiple hazards, such as earthquakes, tsunamis and fire. The workshop was attended by experts from regulatory authorities and plant operators from different countries as well as the IAEA.[40]

In an attempt towards building an international partnership for strengthening nuclear security, India "called on the nuclear agency to recognise centres of excellence for human resources development under the Technical Cooperation for Developing Countries (TCDC) programme and offered training facilities to scientists and engineers from developing countries."[41] In 2000, the DAE signed an MoU with the IAEA for cooperation in connection with the agency's regional and inter-regional training events, and individual and group fellowships training programmes carried out as part of the technical cooperation activities of the IAEA.[42] The MoU is an important milestone in India-IAEA cooperation and formalises New Delhi's long standing offer to make the Bhabha Atomic Research Centre (BARC) a "centre of excellence/Regional Resource Unit (RRU)" under the Agency's Technical Cooperation for Developing Countries (TCDC) programme.[43]

Even as the GCNEP remains a site under construction, it started conducting an "off-campus" regional training course on "Physical Protection of Nuclear Facilities Against Sabotage, Assessing Vulnerabilities and Identification of Vital Areas" for 25 participants, including 17 foreign nationals and 8 Indian participants from

39. Ibid.
40. "Statement by Dr. Ratan Kumar Sinha, Chairman of the Atomic Energy Commission and Leader of the Indian Delegation," International Atomic Energy Agency 57th General Conference, Vienna, September 18, 2013, p.2, http://dae.nic.in/writereaddata/gc2013_stmt.pdf. Accessed on May 10, 2016.
41. "Nuclear India," Department of Atomic Energy, Government of India, vol. 34 no. 5-6, (Nov-Dec 2000), http://dae.nic.in/?q=node/168. Accessed on May 10, 2016.
42. Ibid.
43. Ibid.

November 14–18, 2011 at New Delhi.[44] India has undertaken six courses on topics related to physical protection of nuclear material and facilities, prevention and response to radiological threats, nuclear material accounting, and computer security controls, etc.[45] This was followed up with an additional National Training Course (NTC) on Physical Protection of Nuclear Material and Nuclear Facilities jointly organised by GCNEP and BARC from March 24-28, 2014, in Mumbai.[46] The course included 14 lecture sessions, five special lectures, three quiz and video sessions, one workgroup exercise and a field visit for security gadgets demonstration. The objective of the NTC was to sensitise participants to develop a general understanding of the physical protection of nuclear materials and nuclear facilities against theft and sabotage. The lecture sessions focussed on disseminating information on state-of-the-art in electronic security systems and their applications for nuclear security. It also highlighted critical issues like prevention, preparedness and responses involving malicious acts with radioactive materials, medical management, safeguard practices, etc.

India has supported the IAEA's goal in assisting national efforts to strengthen nuclear security and dynamically promoted effective international cooperation. As a partner in the IAEA-US Regional Radiological Security Partnership (RRSP), India has pioneered

44. See "Report on Regional Training Course on Physical Protection of Nuclear Facilities against Sabotage, Assessing Vulnerabilities and Identification of Vital Areas," International Atomic Energy Agency (IAEA) and Global Centre for Nuclear Energy Partnership (GCNEP), India, November 14-18, 2011, p.3, http://www.gcnep.gov.in/programs/details/ReportRTConPPS2011.pdf. Accessed on May 10, 2016.
45. The course was attended by 17 foreign participants and 8 Indian participants. Amongst the foreign participants, five were from Indonesia, three from the United Arab Emirates, two each from Thailand, Bangladesh and USA, one each from Malaysia, Philippines and Korea. Among the Indian participants, three were from BARC, two from the Nuclear Power Corporation of India Ltd. (NPCIL), each from the Atomic Energy Regulatory Board (AERB), Bharatiya Nabhikiya Vidyut Nigam Ltd. (BHAVINI), Heavy Water Plant, Kota, Rajasthan. There were two observers from the USA. See "Report on Regional Training Course on Physical Protection of Nuclear Facilities against Sabotage, Assessing Vulnerabilities and Identification of Vital Areas," International Atomic Energy Agency (IAEA) and Global Centre for Nuclear Energy Partnershipc(GCNEP), India, November 14-18, 2011, p.3, http://www.gcnep.gov.in/programs/details/ReportRTConPPS2011.pdf. Accessed on May 10, 2016.
46. Report on the "2nd National Training Course on "Physical Protection of Nuclear Material and Nuclear Facilities", Global Centre for Nuclear Energy Partnership, March 24- 28, 2014, Mumbai, p. 1.

several international training courses in India in collaboration with the IAEA.[47] Through the IAEA-US conducted RRSP, India extended help and cooperation for the "search and recovery of orphan radioactive sources in countries which were unable to effectively deal with them and had sought such assistance."[48] In the trilateral meeting held in February 2005 in New Delhi, "the US and the IAEA representatives welcomed India's participation in the RRSP programme as a Regional Partner and discussions were held to work out the modalities of this cooperation."[49] New Delhi has proposed "providing infrastructure and expertise on a regular basis for conducting international training courses in India under the aegis of the IAEA on issues related to the security of radiological sources and materials as also for locating orphan radioactive sources in countries which are unable to effectively deal with them and which seek assistance from the IAEA."[50] The three sides expressed consensus in holding further deliberations on the subject. India is also on record for conducting nine regional training seminars on nuclear security in cooperation with the IAEA. During August 26-30, 2013, the GCNEP organised a national programme on prevention and response to radiological threats. Two other programmes, one on nuclear material control and accounting practices, and the other on insider threats, were also organised in the same year. There are expectations that the conclusion of Practical Arrangements between the GCNEP and the IAEA would further strengthen India's collaboration with the IAEA in the future.[51] India, thus, has been part of several training activities "including participation in the

47. "Nuclear Security Summit Seoul 26-27 March 2012," *National Progress Report India*, p.1, http://nuclearsecuritymatters.belfercenter.org/files/nuclearmatters/files/india_-_national_report.pdf. Accessed on May 10, 2016.
48. "Nuclear Security Summit National Progress Report India," Press Information Bureau, Government of India, Prime Minister's Office, March 27, 2012, http://pib.nic.in/newsite/PrintRelease.aspx?relid=81755. Accessed on May 10, 2016.
49. "Statement by MEA Official Spokesperson on India-US-IAEA meeting on Regional Radiological Security Partnership," Embassy of India, February 9, 2005, https://www.indianembassy.org/archives_details.php?nid=602 . Accessed on May 10, 2016.
50. "Statement by Official Spokesperson on India-US-IAEA Meeting on Regional Radiological Security Partnership," Media Centre, Ministry of External Affairs, Government of India, February 09, 2005, http://www.mea.gov.in/press- releases.htm?dtl/5833/Statement+by+Official+Spokesperson+on+IndiaUSIAEA+meeting+on+Regional+Radiological+Security+Partnership. Accessed on May 10, 2016.
51. n. 48.

IAEA effort to take nuclear security training to different member states and to make it really global."[52]

SCHOOL OF RADIOLOGICAL SAFETY STUDIES (SRSS)

Unlike nuclear terrorism, a dirty bomb attack or Radiological Dispersal Device (RDD), made by combining radioactive material with conventional explosives to spread it is considered to be a more plausible threat worldwide. Interestingly, there is a fair degree of consensus among experts on this threat unlike on the possibility of an act of nuclear terrorism. Though an act of radiological terrorism cannot cause mass destruction, it can, nevertheless, wreak mass disruption. The chaos, panic, psychological terror and radiation effects unleashed by the detonation of a dirty bomb can leave an indelible scar on the populace and destroy the economy of the land. Perhaps the most vulnerable aspect about radiological terrorism is the extensive use of radioactive sources in a large number of applications in industry, healthcare and research. The wide applications of radioactive sources make them easily available. Though these sources are used and transported under stringent regulatory control, there is a possibility of their deliberate diversion for malicious purposes by terrorists. To safeguard radiation source security, the School of Radiological Safety Studies (SRSS) under the GCNEP is designed to carry out R&D on radiation detection systems and dosimetry.[53] In collaboration with BARC, significant work has been undertaken to improve radiological safety. This includes "...assessment of radioactivity releases integrated with geographical information systems with nationwide radius and background mapping; ensure the safety of radioactive nuclear material; address emergency preparedness and response, medical management of radiation emergencies, and conduct fixed field exercises on radiological safety and emergency response."[54] BARC also conducts radiation safety training courses from time to time.[55]

52. "India-United States Cooperation on Global Security: Summary of a Workshop on Technical Aspects of Civilian Nuclear Materials Security," National Academy of Sciences, 2013, p.90.
53. Ibid., p.94.
54. Ibid.
55. Ibid., p.95. Some of the training courses conducted in radiological safety are for the National Disaster Response Force, state police, fire-fighters, civil defence, Department of Atomic Energy (DAE) Emergency Response Team, and medical professionals.

The SRSS is expected to man an emergency response centre. There are currently 23 emergency response centres across India, and they are monitored by the emergency response monitoring network, and have all the modules for mobile and aerial searches, monitoring at ports, and a facility for air monitoring of stand-alone detectors, which communicate using the Global System for Mobile Communications (GSM) or Code Division Multiple Access (CDMA) networks.[56] India also houses a National Disaster Response Force (NDRF) that could be called at the request of the state authorities or of the Indian national government.[57] The NDRF is tasked with the job to examine the traces of RDD sources at the explosion site.

In a recent workshop on "Nuclear Forensics: Fundamentals an Applications," organised by the School of Nuclear Material Characterisation and School of Radiological Safety Studies from May 4–7, 2016, in Mumbai, four lectures were conducted on radiological threats. A demonstration session was also held on various gadgets for radiation detection systems. The objective of the workshop was to develop an understanding about the effects of radiation hazards and the need to have effective detection mechanisms to prevent, detect, and respond to, any radiological disaster.

The GCNEP is seeking to achieve excellence in several other areas like nuclear forensics, cyber and insider threats through several courses, training programmes and discussions at both national and international levels. With an aim to protect these critical digital assets and the information they contain against sabotage or malicious use, the IAEA, in cooperation with the BARC, held a technical meeting on the "Guiding Principles on Applying Computer Security Controls to Instrumentation and Control Systems at Nuclear Facilities" under the aegis of the GCNEP from September 23-27, 2013.[58] The objective of this meeting was to review and update a draft document entitled

56. Ibid. There are more than a few hundred: Kumar estimated that around 500 such detectors have been deployed all across the country.
57. Ibid.
58. "Technical Meeting on Guiding Principles for Applying Computer Security Controls to Instrumentation and Control Systems at Nuclear Facilities," Office of Nuclear Security, Department of Nuclear Safety and Security, International Atomic Energy Agency, September 23–27, 2013, http://www.ujd.gov.sk/ujd/web.nsf/0/a311e8a825a3217ac1257bcf0030a73f/$FILE/viesm0021.pdf p.2. Accessed on May 12, 2016.

"Applying Computer Security Controls to Instrumentation and Control Systems at Nuclear Facilities" (to be issued as a technical guidance publication within the IAEA Nuclear Security Series), and provide technical comments.[59] The document focusses on cyber-security matters that are crucial in the "lifecycle of digital I&C security associated with nuclear power facilities systems applied at nuclear facilities."

Nuclear forensics is a critical aspect of nuclear security and in tandem with that requirement, the GCNEP has held several courses. The May 4–7, 2016 course held in Mumbai, included 12 lectures, one demonstration session and a table-top exercise to impart basic knowledge on nuclear forensics fundamentals and applications in combating the threats to nuclear safety and security. It is, however, recommended that the GCNEP undertake appropriate measures to enhance the effectiveness of nuclear forensics to respond to incidents of illicit nuclear trade and transportation risks. The Directorate of Forensic Science Laboratories (DFSL) in Bangalore has drawn up a comprehensive perspective plan, including the aim to take forensic sciences to a global level with the establishment of a centre for nuclear forensic science. The plan is expected to take off by 2018-19, but the proposal is still pending with the state government.[60] The Home Department has said that Karnataka, with its vast potential for academic avenues in both science and technology, can lead the way in nuclear forensic sciences expertise in the country as well as to meet global demands in the field.[61] It remains the prime responsibility of the CoE to coordinate and expedite the DFSL plan to implement a dedicated nuclear forensic science centre in India.

CONCLUSION

The GCNEP recognises the critical importance of strengthening nuclear security at both national and international levels. Despite being an under construction site,[62] the series of measures undertaken by the GCNEP are expected to enhance coordination of efforts at

59. Ibid.
60. Ibid.
61. n.48.
62. One school is expected to be set up by the end of 2016.

the national, sub-regional, regional and international levels. These measures are expected to develop a robust response to the serious challenge of proliferation of nuclear weapons and materials threating international security. However, the GCNEP must also make efforts to meet certain challenges closer home. Though India has so far displayed commendable efforts towards nuclear security, there still remains the challenge to negotiate a similar outreach programme with Pakistan for facing acute nuclear security challenges. Possibilities may be explored for developing collaborative programmes between the Indian and Pakistani CoEs to bolster nuclear security, not only in the region. The two nuclear-capable neighbours could potentially explore the options for both countries to combine their nuclear expertise and excellence in combating the problem of terrorism bedevilling both nations.

THE WISDOM OF INDIA'S NO FIRST USE POLICY

HINA PANDEY

Ever since Pakistan's induction of 'battlefield' tactical nuclear weapons into its nuclear posture, the debate on the rationale of India's No First Use (NFU) policy has gained attention. In 2013, after a flight test of the Nasr (Hatf-9), it was declared as ready to use. This development of the Nasr, a 60-km, short range ballistic missile, had raised some concerns among the Indian strategic experts. In this context, some defence intellectuals have loosely argued that India should reverse its NFU in order to respond to the aforementioned development. In a recent report, a panel of Indian experts had asked Prime Minister Modi to review India's nuclear doctrine.[1]

Indeed, the evolving nuclear strategy of Pakistan that comprises short range ballistic missiles to target Indian armoured formations in the battlefield is worthy of a strategic analysis from an Indian perspective. The necessity is heightened especially because Pakistan's nuclear use doctrine is unmistakably India-centric which is placed under the broad rubric of its strategic culture – which does not give much space for transparency in security matters. Additionally, the need for such an assessment arises as Pakistan's strategic culture has

Hina Pandey is an Associate Fellow at the Centre for Air Power Studies, New Delhi.

1. Iftikhar Gilani ,"Time to Review and Articulate India's Nuclear Doctrine, Experts Tell PM", *DNA*, April, 30, 2016, available at http://www.dnaindia.com/india/report-time-to-review-and-articulate-india-s-nuclear-doctrine-experts-tell-pm-2207513. Accessed on May 8, 2016.

remained an academically esoteric subject. However, to have one of the salient features of India's nuclear doctrine reversed in order to counter the evolving nuclear posture of Pakistan does not seem a wise option. In this context, this article presents arguments in favour of India's NFU policy and demonstrates as to why it is a viable deterrence policy.

PAKISTAN'S EVOLVING NUCLEAR POSTURE

Three years ago (2012), *The Bulletin of the Atomic Scientists Nuclear Notebook* published a report that identified the role for Pakistan's Nasr missile as "*intended to be used against invading Indian troop formations...*"[2] According to these estimates, Islamabad had deployed two new nuclear-capable Short Range Ballistic Missiles (SRBMs) and a new Medium Range Ballistic Missile (MRBM) to counter India.

In 2015, the former head of Pakistan's Strategic Planning Division (SDP), Gen. Kidwai attributed the rationale for development of Tactical Nuclear Weapons (TNWs) to the alleged Indian Cold Start Doctrine. According to him, this was a "*...Pakistani defensive, deterrence response to an offensive doctrine...*"[3] Some Pakistani scholars have claimed that six war exercises conducted annually from the year 2004 to 2011 were actually designed trial runs for Cold Start style operations.[4] From a Pakistani perspective, the role of battlefield nuclear weapons was envisaged in response to counter the power asymmetry that prevails between India and Pakistan. The Nasr, thus, consolidates Pakistan's deterrence at the levels of the threat spectrum. In the words of Maleeha Lodhi, "...Nasr's purpose is to plug the tactical gap evident to Indian planners and achieve full spectrum deterrence..."[5]

A similar reinforcement of the rationale was expressed by Pakistan's current Foreign Secretary Aizaz Chaudhary last year

2. Hans M. Kristensen and Robert S. Norris, "Pakistani Nuclear Forces, 2015", *The Bulletin of the Atomic Scientists*, vol. 71, no.6, 2015, pp. 59-66.
3. "A Conversation with Gen. Khalid Kidwai", of Pakistan's National Command Authority, Peter Lavoy, *Monitor 360, Carnegie International Nuclear Policy Conference*, March 23, 2015, available at http://carnegieendowment.org/files/03-230315carnegieKIDWAI.pdf. Accessed on April 28, 2016.
4. Jaganath Sankaran, "Pakistan's Battlefield Nuclear Policy", *International Security*, vol. 39, no.3, 2015, pp. 118-151.
5. Maleeha Lodhi, "Pakistan's Nuclear Compulsions," *News* (Pakistan), November 6, 2012, available at http://defence.pk/threads/pakistans-nuclear-compulsions.217465/. Accessed on May 13, 2016.

(2015) while addressing a press brief during his US visit. This was the first ever concrete explanation from a senior Pakistani official.[6] During the same visit, the Sharif-Obama meeting also confirmed that Pakistan would not accept any limits on its tactical nuclear arms.[7] It is, thus, clear that the discourse getting shaped in Pakistan points to the Nasr's utility in being able to close the tactical gap and achieve full spectrum deterrence vis-a-vis India. Furthermore, this evolving nuclear narrative in Pakistan has been received by the sceptics as "... practising for nuclear war on the battlefield..."[8] Pakistani scholars such as Zia Mia and Pervez Hoodboy recently argued for a likelihood of nuclear weapons use in South Asia. According to them, "...Pakistan's planners may intend this first use of nuclear weapons as a warning shot, hoping to cause the Indians to stop and withdraw rather than risk worse..." All this had already amounted to much speculation about the feasibility of the NFU policy that India is committed to. However, the usefulness of the NFU policy that lies in it being a viable deterrent can be further explained through the presentation of the following arguments:

PERILS OF FIRST USE POLICY

In nuclear matters, the strategy of offence is to be viewed as the last resort. The evolution of nuclear strategy in all these years has conveyed well the utility of nuclear weapons as strictly political. It is now established and accepted by almost all nuclear weapons states that nuclear weapons are not meant for war-fighting as they behave differently from the conventional weapons. Today, the heart of a nuclear strategy rests on the premise that nuclear weapons exist to serve a political purpose. They are meant to *deter the use* or the *threat of use* of nuclear weapons. It has also been understood that no nuclear war can be truly limited in nature. Thus, in the realm of

6. Anwar Iqbal, "Pakistan Has Built Low-Yield Nuclear Weapons To Counter Indian Aggression", *Dawn*, October, 20, 2015, available at http://www.dawn.com/. Accessed on April 28, 2016.
7. Mehreen Zahara Malik and David Brunnstrom, "Pakistan to Tell US it Won't Accept Limits on Tactical Nuclear Arms", *Reuters*, October 21, 2015, http:// http://www.reuters.com/article/us-nuclear-pakistan-idUSKCN0SF2A120151022. Accessed on October 25, 2015.
8. Pervez Hoodboy and Zian Mia, "Nuclear Battles in South Asia", *The Bulletin of The Atomic Scientists*, May 4, 2016, http://thebulletin.org/nuclear-battles-south-asia9415?platform=hootsuite. Accessed on May 2, 2016.

nuclear strategy, 'deterrence' is the best form of defence. It is because of the annihilating nature of nuclear weapons that there has existed a nuclear taboo. Post the atomic bombings of the Japanese cities, no nuclear strike had occurred. States with the most powerful nuclear capabilities have refrained from using the nuclear option even in the direst circumstances. Thus, in the nuclear realm, deterrence is the only defence. Since the purpose of nuclear weapons is to deter a nuclear war, the first use of nuclear weapons to break the deterrence is viewed as not benefiting. In the India-Pakistan dyad, the scenario can be further elaborated.

Both India and Pakistan possess secured counter-strike capabilities. In such a situation, a tactical first use of nuclear weapons (a low yield weapon) cannot guarantee defence from the adversary's counter-strike capability. It can be further argued that after absorbing the first strike, the adversary's likely counter-strike response would be to ensure massive material damage.[9] In the case of the India-Pakistan deterrence scenario, this must be understood in the context of the nuclear doctrine that India has carved out for itself. The 2003 note of the Cabinet Committee on Security (CCS) on India's draft nuclear doctrine has clearly stated India's response to a nuclear first strike. The CCS' review on the operationalisation of the draft nuclear doctrine states, "*...nuclear retaliation to a first strike will be massive and designed to inflict unacceptable damage.*"[10]

Thus, in this scenario, it can be argued that an Indian response to a nuclear first strike from Pakistan, howsoever limited, is likely to be massive retaliation, promising unacceptable damage to Pakistan. In this context, striking first would invite self-inflicted damage of a greater degree on the geography, economy and society of that country. Adopting this nuclear strategy would not only invite a possible unlimited escalation, it would also make the situation much worse, as the consequences would not be limited to just material damage but also diplomatic. Since the country

9. Manpreet Sethi, "Counterstrike: The Philosophy Underlying India's Nuclear Doctrine", in Manpreet Sethi and Shalini Chawla, eds., *India's Sentinel: Select Writings of Air Commodore Jasjit Singh* (New Delhi: KW Publishers, 2014), pp. 137-162.
10. Press Release, "Cabinet Committee On Security Reviews Progress In Operationalizing India's Nuclear Doctrine", *PMO*, January 4, 2003, http://pib.nic.in/archieve/lreleng/lyr2003/rjan2003/04012003/r040120033.html. Accessed on May 9, 2016.

striking first would also be breaking a nuclear use taboo, it would invite vehement international opprobrium. This is likely to further put the political leadership of the country striking under immense psychological pressure of inviting mass destruction on itself. Therefore, an offensive nuclear strategy in this context neither assures victory nor promises protection from nuclear damage to self.[11] Thus, a nuclear first use option by Pakistan would leave it more hurt (physically, economically, socially and politically), it would question its future survival, aggravate the domestic situation due to an illegitimate attack and would probably leave it internationally isolated.

THE FIRST USE DILEMMA

(a) A Triumph of a Nuclear Holocaust!

As mentioned above, the first use of nuclear weapons by Pakistan would most likely invite a counter-strike by India as it legitimately activates the Indian nuclear doctrine. The decision to launch Nasr would mean the use of battlefield weapons in the heavily populated India-Pakistan international border region, amounting to civilian casualties for Pakistan in thousands or tens of thousands. The argument can be elaborated further and a calculation of the qualitative assessment of potential civilian casualties from using the Nasr has been observed as follows: The employment of a battlefield nuclear weapon of 30 kilo tonne (kt) or 5 kt against Indian armoured troops in Lahore, Sialkot, Rahim Yar Khan (previous war theatres) reveals the following figures. A rough death toll ranging from 9,000 to somewhere between 30,000/50,000 deaths in the Lahore theatre. The use of a 5-kt battlefield nuclear weapon does not change the estimates of civilian casualties very much. If the same weapon was detonated over the city of Lahore, the number of the dead could reach 122,000. Similarly, a nuclear offensive at Sialkot would likely result in fatalities numbering between 8,600-30,000. The number of fatalities could go even higher to 54,000 in the case of multiple explosions. Lastly, at the Rahim Yar Khan theatre, the number of fatalities is assessed as

11. Sethi, n. 8, p. 142.

approximately 42,000 deaths for a 30-kt weapon. The number of casualties does not decrease significantly when a 5-kt weapon is used.[12]

The aforementioned figures concerning the fatalities, thus, establish that the possibility of a nuclear strike in the region portends great damage. This scenario must be understood in the light of the reality that states are ill equipped for containing the after effects of a nuclear attack. Decades of research and study have suggested that there are no feasible means to protect societies from a nuclear attack.

In 2004, a similar assessment of the effect of a single nuclear weapon explosion of 10-20 kt in South Asia was conducted by scholars from India and Pakistan. However, the accuracy of the consequences of a nuclear attack depends upon various attributes such as the nature of changing geography, atmospheric conditions and the time of the day, the demography of the city attacked and the design and construction of buildings, etc. Some estimates on the blast and shock wave, thermal radiation and nuclear radiation have been conducted. According to a study by Prof. Raja Ramanna and Zia Mia, the impact on most of the population in Delhi, Mumbai and Islamabad would be grave. Millions of people would be affected in a nuclear attack.

The study confirms that within the South Asian region, the preparations of civil defence in the case of such an event would also present its own unique challenges. In 2004, there were no ongoing plans for the widespread provision of fallout shelters in many major

12. Jaganath Sankaran, "Pakistan's Battlefield Nuclear Policy", *International Security*, vol. 39, no. 3, pp118-151. Jagannathan Sankaran used the NUKEMAP application, an online application developed by Alex Wellerstien, to estimate the effects of the detonation of a nuclear weapons. All civilian fatalities and injuries were calculated with data available from the population database (Global Population 2011) ingrained in NUKEMAP. Open source data on the physical effects of the overpressure, heat, and radiation emerging from a nuclear bomb explosion is used. The 30 kt weapon is optimised to explode at an altitude of 0.56 km in order to maximise the distance to which the 20 psi (pounds per square inch) overpressure blast wave is effective. The 5 kt weapon is optimised to explode at an altitude of 0.31 km in order to maximise the distance to which the 20 psi overpressure blast wave is effective. The application is available at http://nuclearsecrecy.com/nukemap/. Responsibility for generating and interpreting the data, however, lies with the author (Jaganathan Sankaran). The figures mentioned in the article are indicative and only taken for reference.

Indian and Pakistani cities. The study revealed that in a radius of 1.5 km for a 10-20 kt weapon explosion, there is no defence.[13] And no accurate assessment is possible that can determine the nature of the nuclear response by any country, i.e. flexible or massive. In either case, the two case studies confirm the consequences of a nuclear attack as severe. Clearly the first use policy also poses a dilemma within. While it is easier adopting the policy of first use, its translation into practice poses a huge dilemma for Pakistan.

(b) Pakistan's Underlying Nuclear Philosophy is Survival

It is significant to recognise what lies beneath the declared policy of first use. It is clear that the TNWs have come to occupy an increased salience in Pakistan's nuclear strategy. They have been viewed as the defenders of the nation in the light of India's increasing conventional superiority. The reason Pakistan has opted for the employment of battlefield nuclear weapons in the first place is because they are being viewed as the final defence against an Indian conventional superiority. The very idea that TNWs are necessary to deter Indian advancement inside Pakistan conveys an ambiguous yearning for security and survival. There remains an implicit hope that these battlefield weapons might deter India from overpowering Pakistan. Its overall nuclear strategy is to sustain deterrence in the face of an Indian military attack. Contrary to what it claims, "Pakistan is not seeking to redress the conventional balance in a tactical situation...but seeking to deter a conventional operation through the threat of use of battlefield weapons..."[14] Pakistan believes it is facing an enemy six times larger and the only way to deal with such a great threat is to acquire an equalizer. It sees the nuclear weapons as a defender's (conventially weak) dream weapon which can be utilized, implicitly and explicitly to influence the adversary's decision-making through an appropriate signaling mechanism."[15]

13. R Rajaraman, Zian Mian, A. H. Nayyar, "Nuclear Civil Defence in South Asia: Is it Feasible?", *Economic and Political Weekly,* vol. 39, issue no. 46-47, November 2004.
14. Manpreet Sethi, "India's Response Options", in Gurmeet Kanwal and Monika Chansoria, eds., *Pakistan's Tactical Nuclear Weapons: Conflict Redux* (New Delhi: KW Publishers Pvt Ltd, 2014), p.231.
15. Arun Sahgal, "Logic and Options For Use", in Kanwal and Chansoria, Ibid., pp.85-113.

The argument in favour of the philosophy of survival can be further bolstered by an observation on Pakistan's grand strategy. Its nuclear strategy cannot be viewed in isolation. The nuclear strategy of Pakistan is a reflection of a security policy that is aimed at achieving strategic aims. Despite a lack in transparency, the availability of information and deduced analysis from circumstantial evidence points to Pakistani strategic aims as: (a) strengthening of its national power; (b) prevention of open aggression/war with India; (c) attainment of a position of security to enhance other means of conflict. Pakistan's progression of its nuclear arsenal should be seen as a compensation for its inferior defence forces. Nuclear weapons in this manner also accentuate a sense of national pride, and guarantee security. Furthermore, the Pakistani consciousness has long held the belief that being a weaker state, a bold initiative is necessary, thus, a first use doctrine.[16]

Additionally, while analysing Pakistan's first use strategy, it merits taking note of how serious is the intention of engaging in an all out total nuclear war. It is imperative to ask the question: "Under what circumstances is Pakistan likely to introduce nuclear weapons in a conventional scenario?" Bharat Karnad argues for a zero possibility of actual use of tactical nuclear weapons by Pakistan. The Pakistan Army according to him, "is extremely mindful of the consequences of an Indian response, (which) would mean a nuclear holocaust". Moreover, Islamabad's nuclear threat could be viewed as hollow, as there remains a gap in the capability of its nuclear arsenal vis-a-vis what is required to successfully deliver on the threat. In 2010, the country's nuclear arsenal wasn't large enough to expend battlefield nuclear weapons at the rate of the Indian advancing capability on the ground. According to an estimate by Pakistani scholars, to effectively stop an Indian armoured division, as many as 436 low yield nuclear weapons would be required. The gap in Pakistan's inventory of nuclear weapons vis-à-vis its rate of delivery at the time of conflict further casts doubts upon Pakistan's nuclear threat from the TNWs.[17]

16. Jasjit Singh, "Pakistan' Nuclear Deterrent: An Introductory Essay" and Shalini Chawla, "Nuclear Doctrine and Strategy", in Shalini Chawla, *Nuclear Pakistan* (New Delhi: KW Publishers, 2012), pp.xvi, 130-141.
17. Bharat Karnad, "Scaring Up Scenarios: An Introduction", in Kanwal and Chansoria, eds., n.14, pp. 10-14.

In short, the threat of use of TNWs and their actual use could be viewed as separate issues.

NFU: SILENT STRENGTH FOR STRATEGIC STABILITY

The first use policy is loud and weak, making the strategic space more risk-prone, while the no first use policy comprises silent strength for strategic stability. It is imperative to understand India's NFU in the context of its operation. The NFU operates with the doctrinal principle of "Credible Minimum Deterrence" (CMD). Because the purpose of nuclear weapons is identified as 'deterrence', a credible (assured) response can be delivered through the 'minimum' nuclear arsenal. The concept of CMD rests on the credibility of the counter-strike that can inflict unacceptable damage on the adversary after absorbing the first strike. This implies a powerful counter-strike capability that negates the need for a first use. The confidence in a nation's CMD is actually a posturing of strength. Additionally, it adds to stability as there remains no necessity for matching the nuclear arsenal with that of the adversary. Through the NFU, defence is ensured through the survivability of the nuclear arsenal. The balance of nuclear weapons in this manner doesn't really matter as "*sufficient, survivable and operationally ready*" remain the prerequisites for CMD.[18]

In the South Asian context, this adds to strategic stability as the current security environment that comprises nuclear armed neighbours with contested claims on borders reflects a fragile nuclear reality. By incorporating the principle of NFU, the Indian nuclear doctrine has effectively handled the challenge of maintaining stability. Because the region is nuclear risk-prone, the chances of conflict escalation under a nuclear overhang seem higher. The NFU helps mitigate the risks emanating from this setting, as it takes away the temptation of launching a disarming first strike from Pakistan. It takes away the constant fear of Pakistan concerning an Indian first strike, thereby preventing miscalculation at some level. Refusing a first use automatically detaches a country from the necessity of possessing nuclear forces an alert status. If nuclear forces are retained on hair-trigger alert, the possibility of an accidental nuclear war, based on gross

18. Manpreet Sethi, "Trumpet of the Elephant", in Manpreet Sethi, *Nuclear Strategy: India's March Towards Credible Deterrence* (New Delhi: Knowledge World Publishers, 2009).

miscalculation, becomes a plausible scenario. With first use, this risk is inherent. NFU, on the other hand, ensures stability in this scenario.[19]

NFU JUSTIFIES THE DEFENSIVE POSTURE OF THE INDIAN NUCLEAR DOCTRINE

The wisdom of India's NFU policy also lies in the manner in which it is situated in the Indian nuclear doctrine. The NFU actually justifies the doctrine's defensive nature. The Indian nuclear doctrine is centred on the philosophy of defence. The official nuclear doctrine elucidates the purpose of nuclear weapons for India's security. It rejects nuclear war-fighting and lays out the purpose of nuclear weapons for India as, "...to deter the use and threat of use of nuclear weapons by any State or entity against India and its forces..." The Preamble of the Indian nuclear doctrine is set under the tone of a defensive nuclear posture. Paragraph-1 highlights a broad perspective that "...use of nuclear weapons… constitutes the gravest threat to humanity... to peace and stability in the international system..." Paragraph-5 views the the "first use of nuclear weapons" as *"offensive"*.

Since a nation's nuclear doctrine is a reflection of its strategic thought and culture, the traces of India's strategic thought too are present in its nuclear doctrine. A brief discussion on India's defensive strategic thought/culture is imperative for elucidation here. There are certain core traits of the Indian strategic culture/ thought that have persisted since independence despite shifts in India's changing foreign and security policies. It is established that India's overall strategic approach is rooted in the philosophy of "*defensive –defence*".[20] Throughout most of its history, India has been on the strategic defensive. India has seldom attempted a forward strategy and has fought defensive wars. It has maintained a history of non-aggression and non-expansion outside of the subcontinent. The independent India has also seen itself as continuing the tradition of non-aggression.[21] In the realm of nuclear strategy, the policy of no first use actually operationalises the principle of non-aggression,

19. Ibid.
20. Gurmeet Kanwal, "Nuclear Doctrine and Policy" in *Nuclear Defence: Shaping the Arsenal* (New Delhi: Knowledge World, 2001), p 50.
21. George Tanham, "Indian Strategic Thought: An Interpretive Essay", R-4207-USDP *RAND Report,* National Defence Institute, 1992, pp. 1-92.

thereby, legitimising the idea of nuclear weapons for defence.

The Indian strategic-nuclear narrative is embedded in the idea that nuclear weapons are 'political weapons'. They serve a political utility and are meant to defend the country against nuclear coercion. The purpose of India's nuclear doctrine is to defend against aggression, not participate in 'nuclear aggression'. The defensive nature of its nuclear doctrine could be viewed as a reflection of a *deeply ingrained cultural belief that use of force to resolve inter-state disputes is a repugnant concept.*[22]

Ever since its independence, India has recognised the principle of peaceful coexistence as a guiding direction for its foreign policy. The subsequent years in India's foreign policy-making too have demonstrated the application of nuclear restraint. India had acquired the potential to develop nuclear weapons since the first Peaceful Nuclear Explosion (PNE) in 1974, yet it chose to work towards global nuclear disarmament. Similarly, post the 1998 PNE, the *suo moto* parliamentary statement by Prime Minister Atal Bihari Vajpayee too clarified the defensive nature of the tests by stating that "... we do not intend to use the nuclear weapons for aggression or for mounting threats against any country; these are weapons of self-defence, to ensure that India is not subjected to nuclear threats or coercion..." Furthermore, even 18 years after the second nuclear tests, India has maintained a self-moratorium on its weapons testing. The Indian government formally granted the official status to India's draft doctrine on January 4, 2003, five years after it conducted the PNE in 1998. There remains a generic agreement on the defensive thrust of the nature of nuclear doctrine. The NFU policy provides credence to this overall defensive nature. In a convincing manner, the NFU completes the defensive posture that India's strategic culture resonates. The NFU caters to a unique nuclear conundrum that India has been facing since the time of its PNE.

22. Kanwal, n. 20, p. 50.

LESSONS FROM THE IRAN NUCLEAR DEAL: MOVING BEYOND THE NPT IN STRENGTHENING THE NUCLEAR NON-PROLIFERATION ARCHITECTURE

ARKA BISWAS

The terms of the Joint Comprehensive Plan of Action (JCPOA) were agreed upon on July 14, 2015, after about 20 months of intense negotiations between the P5+1 (China, France, Russia, United Kingdom, United States and Germany) and Iran.[1] The deal that called

Arka Biswas is a Junior Fellow at the Observer Research Foundation, New Delhi.

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1. "Joint statement by EU High Representative Federica Mogherini and Iranian Foreign Minister Javad Zarif Vienna, 14 July 2015," *European Union External Action*, July 14, 2015, http://eeas.europa.eu/statements-eeas/2015/150714_01_en.htm. Accessed on April 29, 2016.

for blocking all pathways for Iran to acquire nuclear weapons, has been termed a historical feat for the global nuclear non-proliferation architecture. While it is certainly in the interest of countries from the region and the global nuclear non-proliferation architecture to not have a nuclear Iran, the deal and the negotiations leading upto it capture the shortcomings of the architecture.

Many technical challenges were identified and addressed during the course of the negotiations until January 16, 2016, when all the terms of the JCPOA were implemented by Iran and the P5+1. However, there were basic issues such as Iran's right to uranium enrichment and appropriate mechanisms for monitoring and verification, which were difficult to resolve.

An assessment of the negotiations on these issues captures the gap that exists between the provisions of the nuclear Non-Proliferation Treaty (NPT) and the contemporary understanding of the norms of nuclear non-proliferation. It is this gap which made the mentioned issues sticky and their resolution difficult. Furthermore, agreements reached under the deal on these issues reflect the deal to be an attempt at bridging that gap.

Building upon lessons that the Iran deal has to offer, this paper argues that the global non-proliferation community must reduce reliance on the NPT when it comes to addressing the challenges of nuclear proliferation in the 21st century. While the NPT continues to hold the global nuclear non-proliferation community in a formal structure, there is a need to continue the expansion and strengthening of other formal and informal mechanisms that address the shortcomings of the NPT and help spread the norms of nuclear non-proliferation, as interpreted currently.

This paper is an attempt to understand the lessons that the Iran deal has to offer. It attempts to argue that there is a need to look beyond the NPT in expanding and strengthening other (in) formal mechanisms of nuclear non-proliferation. The debate on India's prospective entry into the Nuclear Suppliers Group (NSG) is taken up to elucidate this argument.

IRAN NUCLEAR DEAL: AN OVERVIEW

On November 24, 2013, Iran and P5+1 agreed on an interim deal –

officially called the Joint Plan of Action – which set the course for negotiations for a comprehensive deal that would resolve all issues pertaining to Iran's nuclear programme.[2] The interim deal was the first phase of reciprocal compromises, wherein Iran agreed to halt the construction of the heavy water reactor at Arak and discontinue the plans for building a reprocessing facility, in return for slight relief from the economic sanctions imposed on it by the US and European Union (EU).[3] The interim deal was implemented on January 20, 2014.[4] For the next 20 months thereon, the negotiators met several times to resolve various issues and assess the progress both sides were making in the implementation of the solutions agreed.

The terms agreed under the JCPOA block the pathways for Iran to acquire nuclear weapons.[5] Firstly, the deal restricts Tehran's access to Highly Enriched Uranium (HEU). Under the deal, Iran has reduced its uranium stockpiles from an estimated 10,000 kg to 300 kg. Furthermore, the enrichment level of the remaining uranium stockpile has been reduced to 3.67 percent. The enrichment capacity of Iran too has been reduced significantly under the deal. From about 20,000 centrifuges that Iran had installed at Natanz and Fordow, only 6,104 have been retained. Moreover, the Fordow facility will only be used for research purposes, under the direct watch of the International Atomic Energy Agency (IAEA). Meanwhile, the centrifuges being operated at Natanz will be only the least efficient and oldest models (IR-1s).

The second pathway to nuclear weapons could be through the acquisition of weapons grade plutonium. Towards blocking that pathway, the deal restricts Iran from constructing new heavy water reactors for the next 15 years. Iran has also redesigned the core of the

2. For the text of the Joint Plan of Action, see "Joint Plan of Action," *European External Action Service*, November 24, 2013, http://eeas.europa.eu/statements/docs/2013/131124_03_en.pdf. Accessed on April 29, 2016.
3. Ibid.
4. "Implementation of the Joint Plan of Action from November 24, 2013, in Geneva Between the P5+1 and The Islamic Republic of Iran and Provision of Limited, Temporary, and Targeted Sanctions Relief," US Department of State, January 20, 2014, http://www.state.gov/r/pa/prs/ps/2014/01/220054.htm. Accessed on April 29, 2016.
5. For the text of the JCPOA, see "Joint Comprehensive Plan of Action," US Department of State, July 14, 2015, http://www.state.gov/e/eb/tfs/spi/iran/jcpoa/. Accessed on April 29, 2016.

Arak heavy water reactor that decreases the production of plutonium in spent fuel to one-sixth. The spent fuel rods from the Arak reactor will be shipped out of Iran as long as the reactor stays active. Iran will also not construct any reprocessing facility – without which it cannot extract weapons grade plutonium from the spent fuel.

As a result of these two sets of measures implemented under the deal, the break-out time – the time needed to acquire sufficient fissile material to build a nuclear weapon – has increased from what was previously two to three months to about one year.[6] Finally, in order to ensure early detection of any break-out from the terms of the deal, an "extraordinary and robust monitoring, verification and inspection" mechanism has been agreed upon and implemented.[7] Under the deal, IAEA inspectors will continuously monitor every element of Iran's nuclear-related activities. The Additional Protocol to Iran's Safeguards Agreement with the IAEA allows the IAEA inspectors to access, and inspect, any site they deem suspicious. Suspicion will be triggered by factors including, but not limited to, "holes in the ground (suspected uranium mines), intelligence reports, unexplained purchases, and isotope alarms."[8] Inspectors will continue to verify that no fissile material has been covertly transferred to a secret location. Furthermore, a dedicated procurement channel has been established to monitor and approve, on a case-by-case basis, the supply, sale and transfer to, and from, Iran of nuclear and related dual-use materials and technology.

The deal, if implemented rigorously, will ensure that Iran does not acquire nuclear weapons. Critics of the deal, however, have raised certain shortcomings, two of which are pertinent to this paper. The first is on the scope of Iran's enrichment capacity. While the deal limits Iran's enrichment capacity to insignificant levels for the next 10 to 15 years, it nonetheless allows Iran to retain the capacity, and Tehran could expand its uranium enrichment programme once the

6. "An Update on Progress Toward Implementation Day of the JCPOA – Press Statement by John Kerry, Secretary of State," US Department of State, December 28, 2015, http://www.state.gov/secretary/remarks/2015/12/250876.htm. Accessed on April 29, 2016.
7. "The Historic Deal that Will Prevent Iran from Acquiring a Nuclear Weapon," The White House, January 16, 2016, https://www.whitehouse.gov/issues/foreign-policy/iran-deal. Accessed on April 29, 2016.
8. Ibid.

deal expires.[9] This relates directly to the debate on whether Non-Nuclear Weapon States (NNWS) under the NPT have the right to enrich uranium or not. The following section examines this debate further and assesses if it is in the interest of the global nuclear non-proliferation architecture to have more nations acquire uranium enrichment capabilities.

The second shortcoming noted is with respect to the scope of monitoring and verification. Though the US government has claimed that the deal provides "extraordinary and robust monitoring, verification and inspection", the deal, for instance, does not provide for inspections "anywhere, anytime" – a demand which was discussed during the negotiations.[10]

Though Iran has agreed to stringent monitoring and verification measures under the deal, it has never been under any international legal obligation to do so. In the past as well, while there were demands for Iran to ratify the Additional Protocol to its Safeguards Agreement with the IAEA that would allow verification of Iran's compliance with the NPT, Tehran's decision to not ratify the Additional Protocol could not be called a violation of the treaty. Therefore, there is a need to examine whether the NPT is sufficient in addressing contemporary concerns on verification of treaty compliance by its signatories.

The deal has been implemented and Iran has received relief from all economic sanctions, having fulfilled the commitments it made under the JCPOA. If all the parties continue to adhere to the terms of the deal, it will ensure that Iran does not get nuclear weapons. This has been the sole objective of the global nuclear non-proliferation community as well, and from that perspective, the Iran deal is certainly a success. But the deal also captures certain flaws of the existing NPT framework, which have been examined in the following section.

9. See Michaela Dodge, Steven Groves and James Phillips, "Senate's Iran Nuclear Bill Misses the Point," *The Heritage Foundation Issue Brief, No.4387* (Washington D.C.: The Heritage Foundation, 2015), p. 1.
10. David Welna, "Critics Say US Officials Promised 'Anytime, Anywhere' Inspections In Iran Nuclear Deal," *NPR*, August 11, 2015, http://www.npr.org/2015/08/11/431672987/critics-say-u-s-officials-promised-anytime-anywhere-inspections-in-iran-nuclear-. Accessed on April 29, 2016.

SHORTCOMINGS OF THE NPT

There are specific Articles of the NPT pertaining to both debates on Iran's right to uranium enrichment and on appropriate monitoring and verification mechanisms. Iran has defended its position on each of these debates by highlighting its compliance with NPT obligations. This section examines these NPT Articles against the backdrop of Iran's nuclear programme and assesses their relevance and significance in addressing contemporary nuclear proliferation threats.

Right to Uranium Enrichment – Article IV

Article IV of the treaty captures the right of all states to peaceful uses of nuclear energy. Article IV.1 reads:

> Nothing in this Treaty shall be interpreted as affecting the inalienable right of all Parties to the Treaty to develop research, production and use of nuclear energy for peaceful purposes without discrimination and in conformity with Articles I and II of this Treaty.[11]

This Article does not specifically mention the right of all parties to uranium enrichment. But as experts of international law have noted, it refers to the "inalienable right" to pursue all steps of nuclear fuel production – including uranium enrichment – as that forms a critical part of "peaceful uses of nuclear energy."

Since the time when concerns over Iran's nuclear programme were raised, Tehran has reiterated its position that the NPT bestows on it the inalienable right to pursue uranium enrichment. While officials from the US government in recent years have argued that Washington does not see the NPT giving that right,[12] as William O. Beeman notes, this was not the case, especially in the mid-2000s.[13]

11. "The Treaty on the Non-Proliferation of Nuclear Weapons (NPT)," United Nations, http://www.un.org/en/conf/npt/2005/npttreaty.html. Accessed on April 29, 2016.
12. The position of Japan and Germany was acknowledged by the US Under-Secretary of State for Political Affairs, Wendy Sherman. See "Written Statement: Wendy Sherman, Under Secretary of State for Political Affairs, U.S. Department of State, Senate Foreign Relations Committee on 'Reversing Iran's Nuclear Program'," United States Senate Committee on Foreign Relations, October 03, 2013, http://www.foreign.senate.gov/imo/media/doc/Sherman_Testimony1.pdf. Accessed on April 29, 2016.
13. William O. Beeman, "Does Iran Have the Right to Enrich Uranium? The Answer Is Yes," *The Huffington Post*, December 31, 2013, http://www.huffingtonpost.com/entry/does-iran-have-the-right-_b_4181347.html?section=india. Accessed on April 29, 2016.

Moreover, even as the US government does not interpret Article IV to be giving the right to pursue uranium enrichment to its members, countries such as Japan and Germany take uranium enrichment to be a right.[14] Thus, until there is a greater clarification and an agreement among all signatories to the NPT on the right to uranium enrichment under the treaty, each of the NPT signatories may interpret Article IV of the NPT as it deems fit for its interests.

Also, irrespective of whether the US government considers uranium enrichment a right given under the NPT, considering its past engagements with NNWS that have active uranium enrichment programmes, like Japan and Germany, Washington cannot label pursuance of uranium enrichment by other NNWS as violation of their obligations under the treaty. That Iran has been allowed to retain enrichment capacity under the deal is an acknowledgement of the fact that having an active uranium enrichment programme does not violate the NPT.

Therefore, there is a possibility of more NNWS seeking uranium enrichment capacity, calling it their inalienable right under the NPT. Though it will not be a violation of their treaty obligations *per se*, having more nuclear threshold states – that have the requisites to build a nuclear weapon – will not be in the interest of the global nuclear non-proliferation community. Examination of Article IV of the treaty in the context of the Iran nuclear deal, thus, captures a gap between the provisions of the treaty and the interests of the global nuclear non-proliferation community.

The Iran deal on this debate appears to be an attempt at bridging the gap between the NPT provisions and the current understanding of acceptable non-proliferation practices. On the one hand, the deal reflects the acceptance of Iran's right to uranium enrichment under the NPT. On the other, it reduces Iran's enrichment capacity to levels that would make it difficult to even consider acquiring enough fissile material to build a nuclear weapon.

Monitoring and Verification – Article III

Assessment of Article III of the NPT is done in the context of not just the Iran nuclear deal but the larger issue of Iran's nuclear

14. n.12.

programme and its compliance with the NPT. Article III.1 of the treaty states:

> Each non-nuclear-weapon State Party to the Treaty undertakes to accept safeguards, as set forth in an agreement to be negotiated and concluded with the International Atomic Energy Agency in accordance with the Statute of the International Atomic Energy Agency and the Agency's safeguards system, for the exclusive purpose of verification of the fulfilment of its obligations assumed under this Treaty with a view to preventing diversion of nuclear energy from peaceful uses to nuclear weapons or other nuclear explosive devices.[15]

Article III, thus, provides the legal mandate for the monitoring of nuclear activities in each NNWS and for the verification of their compliance with the NPT obligations. Fulfilling its treaty obligations as a NNWS, Iran signed the Safeguards Agreement with the IAEA, which entered into force on May 15, 1974.[16] Interestingly, to date, there remain 12 NNWS, party to the NPT, which have not yet brought into force a Safeguards Agreement with the IAEA.[17] Thus, as far as ratification of the Safeguards Agreement pursuant to Article III of the NPT is concerned, Iran has a better record than some of the other NNWS.

The shortcomings of the Safeguards Agreement in verifying treaty compliance by the NNWS, however, were realised in the early 1990s, when Iraq's clandestine nuclear activities were reported.[18] INFCIRC/153 which defined the comprehensive Safeguards Agreement, for instance, includes routine inspections, but they

15. n.11.
16. "INFCIRC/214 - The Text of the Agreement Between Iran and the Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons," International Atomic Energy Agency, December 13, 1974, https://www.iaea.org/sites/default/files/publications/documents/infcircs/1974/infcirc214.pdf. Accessed on April 29, 2016.
17. "Key Facts and Figures – Basics of IAEA Safeguards," International Atomic Energy Agency, April 21, 2016, https://www.iaea.org/safeguards/basics-of-iaea-safeguards/safeguards-facts-and-figures. Accessed on April 29, 2016.
18. John Carlson, "IAEA Safeguards Additional Protocol," Department of Foreign Affairs and Trade, Australian Government, January 20, 2009, http://dfat.gov.au/about-us/publications/Pages/iaea-safeguards-additional-protocol.aspx. Accessed on April 29, 2016.

are limited to agreed "strategic points" in declared facilities.[19] Furthermore, while the right of *special inspection* – "anywhere to investigate circumstances giving rise to suspicion" – is given to IAEA inspectors, it has never been used except in 1993 in the Democratic People's Republic of Korea (DPRK).[20] Considering that a majority of Iraq's clandestine nuclear activities were being conducted away from its declared nuclear facilities, the mandate given to the IAEA under the Safeguards Agreement was found to be insufficient in detecting such activities. Even the undeclared activities undertaken at the declared facilities could not be detected due to the fact that routine inspections were allowed only on agreed "strategic points".

Having recognised the shortcomings of the Safeguards Agreement, the IAEA Board of Governors agreed in 1995 to expand the scope of the agreement. The expansion, however, was limited as that would have required renegotiation of the agreement with the respective countries. Instead, the IAEA developed the Additional Protocol which would include additional measures complementary to the safeguards in force under the existing agreements. The Additional Protocol is, thus, a tool to assist the IAEA in verifying the compliance of the NNWS to their NPT commitments. It is important to note here that signing and ratifying the Additional Protocol, however, is not a treaty obligation in itself. At present, only 146 states have signed the Additional Protocol and it is in force in 127 states, including India.[21] A significant number of NNWS of the NPT have not signed and ratified the Additional Protocol but they cannot be accused of violating their treaty obligations.

In Iran's case as well, it cannot be concluded that Tehran has violated the NPT. The UN Security Council, for instance, has never declared that Iran is violating its obligations under the NPT. Paul K. Kerr, while examining "Tehran's Compliance with International Obligations", assesses multiple reports that claimed Iran to be in

19. "INFCIRC/153 (Corrected) – The Structure and Content of Agreements between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons," International Atomic Energy Agency, June 1972, https://www.iaea.org/sites/default/files/publications/documents/infcircs/1972/infcirc153.pdf. Accessed on April 29, 2016.
20. Carlson, n.18.
21. n.17.

violation of Articles II and III of the NPT.[22] The November 2007 National Intelligence Estimate (NIE), for instance, states that "until fall 2003, Iranian military entities were working under government direction to develop nuclear weapons."[23] However, as Kerr notes, "The estimate does not provide any detail about the program."[24] The IAEA too has never reported that Iran has attempted to develop nuclear weapons in violation of its treaty obligations. As Kerr succinctly highlights, the treaty "does not contain a mechanism for determining that a state-party has violated its obligations."[25]

Even though it cannot be concluded that Iran has violated its treaty obligations, it pursued clandestine nuclear activities which were against the interest of the nuclear non-proliferation architecture. It leads us to the conclusion that non-violation of the NPT cannot be regarded as a reliable and sufficient indicator of a country's commitment and adherence to the principles of nuclear non-proliferation.

LESSONS FOR THE NUCLEAR NON-PROLIFERATION COMMUNITY

Assessment of Articles III and IV of the treaty in the context of Iran's nuclear programme and the deal captures how the NPT by itself fails to serve the interests of the nuclear non-proliferation community at present. As has been argued:

> The Iran nuclear deal succinctly captures how the nuclear non-proliferation community either has already moved beyond the NPT obligations, as with monitoring and verification mechanisms, or does not find the provisions of the NPT in its best interest, with regard to the right to uranium enrichment.[26]

22. Paul K. Kerr, "Iran's Nuclear Program: Tehran's Compliance with International Obligations," *CRS Report*, April 7, 2016, https://www.fas.org/sgp/crs/nuke/R40094.pdf. Accessed on April 29, 2016.
23. "National Intelligence Estimate – Iran: Nuclear Intentions and Capabilities," National Intelligence Council, November 2007, https://www.dni.gov/files/documents/Newsroom/Reports%20and%20Pubs/20071203_release.pdf. Accessed on April 29, 2016.
24. Kerr, n.22, p. 12.
25. Ibid., p. 11.
26. Arka Biswas, "Iran Deal, NPT and the Norms of Nuclear Non-Proliferation," *The Diplomat*, February 18, 2016, http://thediplomat.com/2016/02/iran-deal-npt-and-the-norms-of-nuclear-non-proliferation/. Accessed on April 29, 2016.

There are shortcomings in Articles V, VI and X of the treaty as well. Article V, for instance, talks of NNWS' access to peaceful applications of nuclear explosion – a provision that cannot possibly be viewed as being in the interest of the global nuclear non-proliferation community at present. Similarly, Article VI, which deals with the NPT signatories' commitment to nuclear disarmament, has become a major issue between the Nuclear Weapon States (NWS) and NNWS, resulting in the growing popularity of initiatives such as the Humanitarian Impact of Nuclear Weapons. Meanwhile, debates on Article X, pertaining to the exit clause, remain inconclusive, leaving the window open for other NNWS to pull off a North Korea.

The NPT remains the largest legal framework holding states together in the nuclear non-proliferation architecture. Despite the vital role it has played in curbing the horizontal spread of nuclear weapons, the presence and persistence of the loopholes, as captured in this analysis of the Iran deal, make heavy reliance on the NPT counter-productive.

Attempts have been made to address some of these loopholes of the NPT. However, considering that these attempts have not resulted in any changes in the mandate and provisions of the treaty, its Articles have become potential tools of defence, which future nuclear proliferators could exploit.

Given the geo-political reality of today, the possibility of negotiating an alternative to the NPT of similar scale and nature is bleak. Thus, the NPT should be allowed to continue playing the role it can. However, it is not incorrect to state that as the interests of the global nuclear non-proliferation community evolve, the relevance and significance of a stagnant NPT will reduce. Given the trends, it will be important for the global nuclear non-proliferation community to expand and consolidate the role of other formal and informal mechanisms that address the NPT's shortcomings and secure the evolving interests of the global nuclear non-proliferation community.

Expansion of the Nuclear Suppliers Group (NSG) beyond the NPT, especially with regard to India's inclusion, is a case in point. The NSG was established following the 1974 peaceful nuclear explosion by India, to address one of the shortcomings of the NPT pertaining to the control of exports of sensitive nuclear and related items. Article

III.2 of the treaty establishes its mandate for export controls.[27] The Zangger Committee was established in 1971 to further identify items whose exports were to be controlled and to define guidelines that would govern those controls, to be implemented by the NPT signatories.[28]

A shortcoming of the NPT, right after its entry into force in 1970, was that its membership was limited. One of the first objectives of the US government in setting up the NSG was to include France, which was then not a signatory to the NPT, in order to ensure that none of the exports of nuclear or related items by Paris contributed to proliferation of nuclear weapons.[29] Indeed, prior to joining the NSG, France had negotiated a deal with Pakistan to construct a reprocessing facility. The contract, however, was terminated soon after France joined the group – then called the London Club.

India now seeks to join the NSG as a member, reflecting its willingness to contribute to global nuclear non-proliferation efforts. The NSG too stands to gain credibility by including in India, a major potential supplier of nuclear and related items, whose exports are otherwise not governed by Article III.2 and the Zangger Committee under the NPT.

Yet, some countries continue to hold reservations against India's inclusion into the group as India remains outside the NPT. Examination of the relationship between the NSG and NPT, however, leads to the conclusion that:

> [w]hile nuclear non-proliferation is definitely the point of reference for the NSG, the Group was not meant to remain contained within the framework of the NPT… To the contrary, the NSG was established with the purpose of going beyond the NPT in controlling nuclear exports where the latter could not.[30]

27. n.11.
28. Tadeusz Strulak, "The Nuclear Suppliers Group," *The Nonproliferation Review*, Fall, 1993, p. 2.
29. Ibid.
30. Arka Biswas, "India's NSG Membership: Examining the Relationship between the NPT and the NSG," *ORF Issue Brief No. 88* (New Delhi: Observer Research Foundation, 2015), pp. 6-7.

The case of France discussed above elucidates this conclusion. As an informal mechanism, the NSG could evolve to play a larger role in the nuclear non-proliferation architecture. It will be up to its members and the larger nuclear non-proliferation community to assess the path the NSG takes in the coming years in addressing newer threats of nuclear proliferation. Restricting the group's scope and mandate within the NPT framework and membership would reduce not only its capacity but also its credibility.

CONCLUSION

If Iran abides by the terms of the nuclear deal, it will ensure that Iran's nuclear programme remains peaceful for the period of the deal. From that perspective, the deal has certainly been a success. There, however, are larger questions pertaining to the evolution of the nuclear non-proliferation architecture and the NPT's role in it which the Iran deal raises.

Though the deal restricts Tehran's uranium enrichment capacity, it, nonetheless, concedes the right of enrichment to Iran. While Article IV of the NPT continues to be open to debate, the resultant ambiguity allows Iran to justify its pursuance of uranium enrichment as an inalienable right given to it by the NPT. Other NNWS may also seek enrichment capabilities and call it their inalienable right, quoting the treaty. Managing a larger number of nuclear threshold states could be a challenge which the global nuclear non-proliferation community would arguably prefer to avoid.

Similarly, the NPT by itself fails to enforce appropriate monitoring and verification mechanisms that could ensure compliance by the NNWS with their treaty obligations. Apart from a few additions like environment sampling introduced in 1995 to the existing Safeguards Agreements, all other verification measures have been incorporated into the Additional Protocols. Signing and ratifying these protocols, however, is not a treaty obligation. Consequently, there remain many NNWS that are yet to bring these protocols into force. All that the IAEA and even the UN Security Council (UNSC) could do is to request the NNWS to sign and ratify Additional Protocols when suspicions over the nature of their respective nuclear programmes are raised. Considering

that ratifying the Additional Protocols is not a treaty obligation, future proliferators may not allow the IAEA greater access to their nuclear activities and they cannot be held responsible for violating any international obligations. This would again be a challenge to the nuclear non-proliferation community.

As long as the NPT remains stagnant, proliferators would either continue exploiting the existing shortcomings of the treaty or explore newer loopholes to their advantage. The time, therefore, has come for the global nuclear non-proliferation community to accept the reality and, thus, reduce reliance on the NPT in addressing contemporary threats of nuclear proliferation.

MAKING SENSE OF RUSSIA'S STRATEGIC NUCLEAR MODERNISATION

DEEP JYOTI BARMAN

A cursory glance at newspaper reports indicates that Russia-NATO (North Atlantic Treaty Organisation) relations are at their lowest point after the end of the Cold War: Russian involvement in Georgia in 2008 and now in Ukraine, the expansion of NATO into the former Soviet Union countries, the downing of an Su-24 Fencer attack-bomber by Turkey in the ongoing Syrian crisis, the July 4, 2015 incident, when two Russian Tu-95 Bears flew close to the Alaskan and Californian coasts,[1] the simulated attack carried out by Russian Su-24s against an US Arleigh Burke class destroyer, the USS *Donald Cook*, on April 11-12, 2016 in the Black Sea,[2] etc. These incidents attained further significance when coupled with Russia's decision to expand its arsenal of nuclear weapons, ballistic missile submarine fleet, supersonic bombers, and new class of land and sea-launched ballistic missiles. These developments were interpreted by the US

Deep Jyoti Barman is an Associate Fellow at the Centre for Air Power Studies, New Delhi.

1. Barbara Starr and Sophie Tatum, " US Intercepts Russian Bombers off Coast of Alaska, California", July 10, 2015, http://edition.cnn.com/2015/07/09/politics/russian-bombers-u-s-intercept-july-4/. Accessed on April 27, 2016.
2. Julian Borger, "Russian Attack Jets Buzz US Warship in Riskiest Encounter for Years", April 13, 2016, http://www.theguardian.com/us-news/2016/apr/13/russian-attack-planes-buzz-uss-donald-cook-baltic-sea. Accessed on April 27, 2016.

and its allies as deliberate moves by Russia to alter the strategic balance, which can potentially revive the Cold War.[3] This paper will attempt to understand the logic behind Russia's strategic weapons modernisation programme and the changes made in its nuclear doctrine to answer the question: Is Russia's strategic modernisation programme and nuclear posturing altering the strategic nuclear balance with the US?

THE NEW START FOR OLD FEARS

The United States and Russia signed the New START Treaty on April 8, 2010, which was ratified by the US Senate on December 22, 2010, by a vote of 71-26, and by the Russian Duma and Federation Council on January 26, 2011. The Treaty entered into force on February 5, 2011, after Secretary of State Hillary Clinton and Foreign Minister Sergei Lavrov exchanged the instruments of ratification. The treaty restricts both of its signatories (the United States and Russia) to 1,550 nuclear warheads, a total of 700 deployed nuclear delivery vectors [Intercontinental Ballistic Missiles (ICBMs), Sea-Launched Ballistic Missiles (SLBMs), and heavy bombers], and 800 non-deployed launchers. Under the treaty, the warheads deployed on the ICBMs and SLBMs count toward this limit, while each deployed heavy bomber equipped for nuclear armaments, whether with gravity bombs or Air-Launched Cruise Missiles (ALCMs), counts as one warhead only. The treaty also specifies that the United States and Russia must implement the necessary reductions to reach these limits no later than seven years (2018) after the treaty's entry into force.

According to the data exchange of September 1, 2011, when the first such data exchange between both parties took place, the United States had 822 deployed launchers, 1,790 nuclear warheads, and further 1,043 non-deployed launchers.[4] In contrast, the Russian Federation had 516 deployed launchers, 1,566 nuclear warheads on deployed launchers, and further 871 non-deployed

3. William J. Broad and David E. Sanger, "Race for Latest Class of Nuclear Arms Threatens to Revive Cold War", April 17, 2016, http://www.nytimes.com/2016/04/17/science/atom-bomb-nuclear-weapons-hgv-arms-race-russia-china.html?_r=0. Accessed on April 27, 2016.
4. US Department of State, "New START Treaty Aggregate Numbers of Strategic Offensive Arms", 2012, http://www.state.gov/t/avc/rls/178058.htm. Accessed on April 27, 2016.

launchers.[5]According to the latest New START data exchange of March 1, 2016, Russia has 521 deployed strategic launchers (ICBMs, SLBMs, and heavy bombers) carrying 1,735 nuclear warheads, with further 856 non-deployed launchers, while the United States has 741 deployed strategic launchers carrying 1481 nuclear warheads, with further 878 strategic launchers in a non-deployed state.[6] Russia was able to increase the number of its launchers after the induction of two Borei-class SSBNs (nuclear-powered ballistic submarines) carrying 16 RSM-56 Bulava missiles each, and the RS-24 Yars ICBMs in 2013.

The data show that to meet the requirements of the New START Treaty, while the United States has to drastically reduce its nuclear delivery vectors, the Russian Federation has to build up the numbers instead. However, the New START data belies the actual capability of delivery vectors and deployed nuclear warheads mainly because of two factors. Firstly, the treaty provisions are such that each bomber is counted as carrying only one nuclear warhead, although the heavy bombers of both sides are capable of carrying scores of ALCMs and gravity bombs. Secondly, the treaty counts nuclear missile silos as ICBMs, even if the silo is uninhabited by a missile.[7] For the United States, the 50 silos that held the Peacemaker missiles until 2005 and the 50 silos that held the Minuteman II missiles until 2008, that have not yet been destroyed, continue to be counted under START.[8]

The Stockholm International Peace Research Institute (SIPRI) database states that as of January 2015, the United States had a stockpile of approximately 4,760 nuclear warheads, which included 2,080 deployed warheads of which 1,900 are strategic and 180 non-strategic warheads. In addition to this deployed arsenal, about 2,680 warheads were held in reserve.[9]Another roughly 2,500 retired warheads were scheduled for dismantlement, giving a total inventory of approximately 7,260 warheads.[10] In contrast, the Russian Federation

5. Ibid.
6. Ibid.
7. Amy F. Woolf, "The New START Treaty: Central Limits and Key Provisions," Congressional Research Service, April 13, 2013, https://www.fas.org/sgp/crs/nuke/R41219.pdf. Accessed on May 1, 2016.
8. Ibid
9. SIPRI, "Military Spending and Armaments: United States", http://www.sipri.org/research/armaments/nuclear-forces/the-united-states. Accessed on May 2, 2016.
10. Ibid.

maintains an arsenal of approximately 4,380 nuclear warheads, of which 2,430 are strategic and 1,780 are deployed on ballistic missiles and at bomber bases, 700 additional warheads are held in reserve and there are nearly 2,000 non-strategic nuclear warheads.[11] A further 3,120 warheads were retired or awaiting dismantlement, for a total inventory of roughly 7,500 warheads.[12] The data clearly show that there is near parity in the number of nuclear warheads between the United States and Russia.

Steven Pifer argues that the numerical advantage of the United States in nuclear delivery vectors conceals an additional advantage: the US military has "downloaded" all of its ICBMs and most, if not all, of its SLBMs.[13] The Trident D-5 SLBM can carry eight warheads but under the New START, the Trident D-5s carry an average of only four to five warheads.[14] Moreover, all Minuteman III ICBMs have been downloaded to carry a single warhead, even though two-thirds of them could carry three Multiple Independently Reentry Vehicle (MIRVed) warheads.The US military also maintains a large number of non-deployed nuclear warheads in storage and if the New START were to break down, the United States could add hundreds of nuclear warheads— well over 1,000—to its strategic ballistic missile force; an action that cannot be mirrored by Russia,[15] which operates only about 70 per cent of the number of nuclear delivery vectors and plans to build only 8 Borei-class SSBNs against the US Navy's plan to build 12 replacements for the Ohio-class boats.

SOVIET NUCLEAR POSTURE: CONTINUITY

The earliest Soviet nuclear strategy was somewhat crude and incongruent: while, on the one hand, nuclear weapons were understood as anti-city weapons, on the other, they were envisaged as war-fighting weapons, a replacement for tanks as the central strategic weapon in the European theatre for achieving strategic

11. Ibid.
12. Ibid.
13. Stefen Pifer, "Overblown: Russia's Empty Nuclear Sabre-Rattling", March 17, 2015, http://www.brookings.edu/research/opinions/2015/03/17-russia-nuclear-weapons-modernization-pifer. Accessed on May 2, 2016.
14. Ibid.
15. Ibid.

breakthroughs to be exploited by mobile conventional forces.[16] The beginning of the 1960s saw the maturation of Soviet and American missile technology and preemptive global and theatre nuclear strikes became the centrepiece of the Soviet nuclear strategy.[17] In the mid-1960s, the United States gained counter-force targeting capability with their new highly accurately MIRVed MX missile, making Soviet ICBM bases and control nodes vulnerable to ground bursts.[18] This development marked a departure from the earlier Soviet nuclear strategy of war-fighting to deterrence. However, a Central Intelligence Agency (CIA) report states that "from the Soviet perspective, the concept of deterrence and war-fighting were not mutually exclusive; and, hence, they never built weapons for either escalation dominance or for maintaining a stable strategic balance. They did, however, build weapons that credibly could and would be used in the event of nuclear war. In this sense, the ability to fight a war was an integral part of the Soviet deterrence strategy, despite the fact that the leadership was not sanguine about the possibility of a meaningful victory, not even of the survival of the Soviet state. In a sense, the Soviets relied even more heavily on the logic of pure deterrence than did the US, because they did not seriously explore options for intermediate levels of nuclear warfare outside the theater of strategic military operations and instead relied purely on the threat of massive retaliation."[19] This thinking has remained fundamentally unchanged over the decades, even after the demise of the Soviet Union. To understand this, two developments are crucial: first, the Soviet insistence on nuclear No First Use (NFU); and, second, the Intermediate-Range Nuclear Forces (INF) Treaty of 1987.

The Soviet Union achieved rough parity in nuclear terms with the United States in the 1970s and a slight superiority in the early

16. John Battilega, "Soviet Views of Nuclear Warfare: The Post-Cold War Interviews" in Henry D. Sokolski, ed., *Getting MAD: Nuclear Mutual Assured Destruction, its Origins and Practices* (Washington D.C.: Strategic Studies Institute, 2004), p. 153.
17. Ibid.
18. John G. Hines, *Soviet Intentions 1965-1985 (Vol. 1): An Analytical Comparison of U.S.-Soviet Assessments During the Cold War* (Washington D.C.: OSD-NET Assessment, 1995), p 2.
19. Central Intelligence Agency, "Intelligence Community Experiment in Competitive Analysis: Soviet Strategic Objectives. An Alternate View: Report of Team "B", December 1976, http://nsarchive.gwu.edu/NSAEBB/NSAEBB139/nitze10.pdf. Accessed on April 4, 2016.

1980s, but ever since the end of World War II, it had conventional superiority over NATO in the European theatre. The United States tried to offset the Soviet advantage by introducing tactical nuclear weapons in the region; a step soon followed by the Soviets. This established equilibrium in the European theatre but degraded the overall strategic balance between the two principle adversaries, as deployed tactical nuclear weapons lowered the overall threshold of their use. The Soviet efforts to develop a global consensus on nuclear non-use in the mid-1960s, efforts to extract reciprocal no first-use commitments from the United States throughout the 1970s, bilateral efforts with Britain and France, and, finally, a unilateral commitment on no first use of nuclear weapons by Premier Brezhnev during the UN Special Session on Disarmament on July 15, 1982, were geared towards preserving Soviet conventional superiority in the European theatre by raising the bar for nuclear combat. The Soviet acquiescence for the INF Treaty can be interpreted as an effort in a similar direction; to retain operational space for conventional conflict without fearing escalation to the nuclear level. This demonstrates that the Soviet threshold for a nuclear exchange was far higher than that of the United States; a necessity to compensate for its conventional inferiority.

The Soviet nuclear posture remained defensive throughout its existence, and has continuity in the new Russian Federation. After the collapse of the Soviet Union, it lost 23.9 percent of all nuclear delivery launchers, and almost half its strategic bomber force to the newly independent republics.[20] However, the SSBN fleet remained intact as all of them were based in Russian waters. The collapse of the Soviet Union also adversely impacted the Russian Strategic Command and control system, as Russia no longer had access to many early warning radar stations, creating many blind spots.Although the space-based Oko and Prognoz satellites provided immediate solutions to blind spots, these systems also continued to degrade throughout the 1990s due to lack of funding for replacement satellites and booster rockets.[21]

20. For a detailed analysis of the shifts in the strategic balance, see Steven Zaloga, "Strategic Forces of the SNG," *Jane's Intelligence Review,* February 1992, pp.79-85.
21. Steven J. Zaloga, *The Kremlin's Nuclear Sword: The Rise and Fall of Russia's Strategic Nuclear Forces, 1954-2000* (Washington D.C.: Smithsonian Institution Press, 2002), p. 225.

In June 1994, Russia decided to move away from an outright NFU pledge when Minister of Defence Pavel Grachev announced that "Russia has not reaffirmed the pledge, declared earlier by the Soviet Union, not to be the first to use nuclear weapons."[22] Grachev emphasised that the abandonment of NFU did not signify a shift to the policy of preemption and that "a first, preemptive strike is out of the question".[23] It meant that Russia was maintaining its policy of launch-upon-attack, but reserving the right to nuclear retaliation to a conventional attack. The 1997 Russian National Security Blueprint stepped back even further from the 1993 position, stating: "Russia reserves the right to use all the forces and systems at its disposal, including nuclear weapons, if the unleashing of armed aggression results in a threat to the actual existence of the Russian Federation."[24] Many scholars have interpreted this as a watershed in Russia's nuclear posture, which went from a defensive to an aggressive one. This belief was further strengthened when Russia released its draft military doctrine in 1999, which talked about nuclear use in conventional conflicts. This radical shift from previous nuclear doctrines was termed as "escalate to de-escalate", and was reflected in the 2000 military doctrine, which allowed for nuclear weapon use under conditions of "large-scale aggression by conventional weapons in situations deemed critical to the national security of the Russian Federation."[25] With demonstrated credibility and resolve, Russia used simulated nuclear strikes during its large-scale military exercise, Zapad 1999. This radical shift in the Russian nuclear doctrine reflects the Russians' lack of confidence in their conventional balance and degraded nuclear response capability. While many scholars see the "de-escaate" doctrine as the Russian attempt to lower the nuclear threshold, it would not be incorrect to say that it merely signifies

22. Pavel S. Grachev, "Firsthand: Military Doctrine and Russia's Security- Nuclear Wapons are a Means of Deterring any Aggressor Against the Russian Federation," *CDSP 46*, no. 23, 1994, p 10.
23. Ibid.
24. Government of Russian Federation, "Russian Federation National Security Blueprint", *Rossiiskayagazeta*, December 26, 1997, Section IV, Defence.
25. Security Council of the Russian Federation, "Military Doctrine of the Russian Federation: Approved by Order of the President of the Russian Federation", Order No. 706, April 21, 2000.

an attempt by a militarily insecure Russia to ensure its political survival by engaging in nuclear sabre-rattling, a continuity with its previous doctrines that used nuclear weapons for achieving general deterrence—a different understanding from the American understanding on nuclear deterrence.

However, the first decade of the new millennium saw rapid technological development and induction of Russian missiles, radar systems, fighters, submarines, early warning satellites etc., which bolstered their previously floundering confidence in their ability to deter conventional aggression and in nuclear deterrence, resulting in a reversal of their previous nuclear posture in their 2010 military doctrine which de-coupled nuclear use and conventional conflict. The same point was reiterated in the latest military doctrine of 2015, which states: "The Russian Federation shall reserve the right to use nuclear weapons in response to the use of nuclear and other types of weapons of mass destruction against it and/or its allies, as well as in the event of aggression against the Russian Federation with the use of conventional weapons when the very existence of the state is in jeopardy."[26] Olga Oliker states that this is a relatively high bar in the world of nuclear policies; it's a higher bar than that of the United States, which reserves the right to use nuclear weapons "to defend the vital interests of the United States and its allies and partners." The Russian doctrine might look more aggressive than it actually is because of two reasons: firstly, unlike their American counterparts, who avoid inflammatory rhetoric, the Russian officials want to create an atmosphere of uncertainty regarding their nuclear intentions, stopping short of direct nuclear threats in most cases.[27] This obfuscation restricts NATO intervention in Russia's conflicts, for the fear of escalation, allowing more freedom of action to Russian forces. Secondly, the Russian large-scale military exercises ever since Zapad 1999, had some form of simulated nuclear attack scenario, fostering speculations from Western analysts of possible nuclear strikes during conventional conflicts with Russia. The most troubling exercise for

26. Embassy of the Russian Federation in the United Kingdom, "Military Doctrine of the Russian Federation, December 25, 2014: Section III, Para 27," June 29, 2015, http://rusemb.org.uk/press 2029. Accessed on May 2, 2016.
27. Olga Oliker, *Russia's Nuclear Doctrine: What We Know, What We Don't, and What That Means* (Washington D.C.: Centre for Strategic and International Studies, 2016.), p 5.

the West was the "mock nuclear attack" on Sweden in March 2013 involving dual-capable medium-range Tu-22M3 bombers.[28]

An analysis of Russian nuclear doctrines demonstrates continuity in thought regarding the utility of nuclear weapons; the emphasis on retaliatory strikes or weapons of last resort during an existential threat has been constant since the 1960s. While the stated Russian doctrines belie aggressive intent, the statements made by Russian officials and military exercises espouse a lower nuclear threshold and tactical use of nuclear weapons. However, when it comes to nuclear weapons, the stated doctrine is paramount and any hidden capability injects uncertainty in the equilibrium. Moreover, by lowering the nuclear threshold, Russia invites reciprocal action by the United States, which would restrict Russia's strategic autonomy in its neighbourhood. The disjuncture between the stated doctrine and the posturing can be understood as an attempt by Russia to deter NATO intervention in its local conflicts such as in Georgia, and Ukraine.

STRATEGIC MODERNISATION: SHOULD UNITED STATES MIRROR RUSSIAN MOVES?

The Russian strategic modernisation programme has finally started delivering. It has launched the first three of what are planned to be eight Borei-class SSBNs, which carry the new Bulava SLBMs. Russia is also deploying the SS-27 Topol-M ICBM and its multiple-warhead variant, the RS-24 Yars, and plans to begin deployment of the RS-26 Sarmat ICBM in 2016. The Russian Air Force is developing a new strategic bomber, the PAK-DA, to augment or replace its Tu-160 Blackjack and Tu-95 Bear-H aircraft. How does the induction of these weapon systems impact the strategic balance with the United States? This paper argues that modernisation of Russian strategic weapons is a stabilising factor in the US-Russia strategic balance, as it increases strategic stability. Furthermore, the United States should refrain from an aggressive arms build-up to offset the Russian modernisation programme in the immediate future as it will not only

28. Armin Rosen, "NATO Report: A 2013 Russian Aerial Exercise Was Actually a 'Simulated Nuclear Attack' on Sweden," *Business Insider*, February 3, 2016, http://www.businessinsider.com/nato-report-russia-sweden-nuclear-2016-2. Accessed on May 2, 2016.

force the Russians to enter into a competitive arms race—which will be difficult for Russia which is facing a run on the rouble as oil and gas prices have plummeted—but, unable to match the arms build-up by the United-States, Russia will have to lower its nuclear threshold, degrading the strategic balance.

Although Russia is proceeding steadfastly with its modernising programmes, it is only now catching up with the technological level of the United States. [29] Steven Pifer states that the United States and Russia are on different cycles when it comes to strategic force modernisation. While the Soviet Union deployed significant numbers of the (then) new strategic systems in the late 1970s and early 1980s (which included the SS-18 and SS-19 heavy ICBMs and Blackjack bombers, as well as the Typhoon-class ballistic missile submarine which was armed with the R-39 SLBMs), the US strategic modernisation peaked some years later, with induction of the new Ohio-class ballistic missile submarine, Trident D-5 SLBMs, MX ICBMs and B-1 and B-2 bombers in the 1980s and early 1990s.[30] This means that although it appears that Russia is racing ahead in the development of new weapon systems, in reality, it is only now entering their development cycle that would allow them to match US systems; and when US modernisation kicks in, in a decade, the Russian systems would be easily surpassed. Pifer also points out that there exists an asymmetry in the design philosophy of strategic weapons between Russia and the United States. The Russians, like the Soviets, build their weapon systems for a shorter life than their American counterparts, who extend the life of the system using life extension programmes to ensure their continued longevity as well as to modernise them.[31] It should also be noted that the American systems are understood to have higher reliability than their Russian counterparts.

Although some factors suggest that the Russian modernisation programme is not as aggressive and threatening to the US, it would be incorrect to state that it does not negatively impact the strategic balance between the two states. Russia has a historic tendency to invest heavily in liquid-fuelled and silo-based ICBMs with MIRVed

29. Pifer, n. 13.
30. Ibid.
31. Ibid.

warheads (like the new Sarmat ICBM) rather than SLBMs and more survivable mobile ICBMs. These missiles are unstable as they have low pre-launch survival and are considered as first-strike weapons; thereby, are earmarked for counter-force targeting by the adversary. These silo-based missiles, coupled with the degraded early warning satellites and ground radar network of Russia, greatly degrade the strategic equilibrium. Another factor that impacts the strategic balance between the US and Russia is the large number of non-strategic nuclear weapons that Russia still holds, albeit in a de-mated state, in nuclear storage facilities.[32] Apart from the non-strategic warheads, the Russians have built the Iskander ground-based ballistic missile, with ranges up to 500 km, and the Kalibr sea-based cruise missile, with ranges between 300-2,500 km. These short-range strategic nuclear capable missiles flirt with the minimum ranges pre-set in the INF Treaty.

IS THE RUSSIA-US STRATEGIC BALANCE STABLE?

Albert Wohlstetter, writing in the late 1950s argued that a country's nuclear deterrence is in jeopardy if the adversary has a reasonable expectation of limiting damage from those weapons.[33] To maintain a robust nuclear deterrent, Wohlstetter propounded an assiduous maintenance of the nuclear arsenal; every technological advancement or deployment of strategic nuclear weapons by the adversary should be closely matched by the opponent.[34] Nuclear weapons technology and nuclear deterrence theory have come a long way since the time Wohlstetter was writing. The hardening of missile silos, a permanently deployed SSBN fleet, road/rail mobile ICBMs, and early-warning satellite constellations and ground-based radar networks ensure that any mature nuclear power will be able to absorb a debilitating nuclear first strike and retaliate with a punitive second strike. As long as the second strike capability survives, strategic stability remains constant.

32. Igor Sutyagin, "Atomic Accounting: A New Estimate of Russia's Non-Strategic Nuclear Forces", *Occasional Paper* (London: Royal United Services Institute, November 2012), https://rusi.org/sites/default/files/201211_op_atomic_accounting.pdf. Accessed on April 5, 2016.
33. Albert Wohlstetter, "The Delicate Balance of Terror", November 6, 1958, http://www.rand.org/about/history/wohlstetter/P1472/P1472.html. Accessed on May 2, 2016.
34. Ibid.

This circumvents the need to precisely calibrate one's nuclear arsenal to one's adversary's every year.

Adam Mount maintains that the United States interprets the demands of deterrence with exceptional stringency and this rather luxurious understanding is the result of a favourable strategic situation. Technological sophistication and economic predominance mean that the United States can produce and maintain a larger and more capable force than any other country on the planet.[35] However, with a stagnating economy, manifold military priorities, diplomatic concerns, etc. the perceived gap in capabilities is going to be harder to fill than ever before.[36] He argues that the United States has to learn to live with greater risks; a feat hitherto accomplished by Britain which has based its nuclear deterrent on a monad of just four Vanguard class SSBNs, and Russia during the 1990s decade, when its nuclear arsenal had shrunk, and early warning satellite systems and ground radar networks had degraded.[37] The strategic balance remains robust despite significant advancements in the adversary's strategic arsenal.

In conclusion, it would be erroneous to assume that the United States does not need to worry about the Russian strategic weapons modernisation programme, since the Russian nuclear arsenal poses an existential risk to it. On the other hand, it would be an over-reaction on the part of the United States to mirror every weapon system that Russia introduces in its arsenal, as it would not only put enormous strain on the economy, but might draw both states into an arms race. Unless Russia develops damage limitation capability by deploying ballistic missile defence, etc. or achieves a high confidence counter-force capability, the strategic balance between them will remain robust.

35. Alan Mount, "The Indelicate Balance of Nuclear Modernization," *The Bulletin of the Atomic Scientists*, January 28, 2016, http://thebulletin.org/indelicate-balance-nuclear-modernization9132. Accessed on May 2, 2016.
36. Ibid.
37. Ibid.

CIVIL NUCLEAR ENERGY COOPERATION: STRENGTHENING BILATERAL TIES BETWEEN INDIA AND RUSSIA

CHANDRA REKHA

The exponential growth performance of India in the 21st century has caught the attention of the international community. Today, 'India matters'[1] has become the catchphrase in the foreign policy interests of many leading global players. Due to its economic growth, military modernisation, huge global market potential, infrastructural development and global engagements, India has emerged as one of the epicentres of the "Asian Century"[2] debate. Having said that, like many

Chandra Rekha is an Associate Fellow at the Centre for Air Power Studies, New Delhi.

1. "India Matters", a phrase first used by India's Prime Minister Atal Bihari Vajpayee in his speech, "India, USA and the World", made in New York to the Asia Society in September 1998. Chris Ogden, "International 'Aspirations' of a Rising Power", in David Scott, ed., *Handbook of India's International Relations* (Routledge, 2011), p. 9.
2. Asia is in the middle of a historic transformation: In theory, the concept is of an "Asian Century" — meaning that the world's political and economic centre of gravity is shifting to Asia in the 21st century. The Asian Century is the projected 21st century dominance of Asian politics and culture, assuming certain demographic and economic trends persist. Dan Blumenthal, Alex Coblin, Sadanand Dhume, Nicholas Eberstadt and Derek M. Scissors, "Rethinking the Asian Century", *The Washington Examiner*, August 6, 2015. http://www.washingtonexaminer.com/rethinking-the-asian-century/article/2565662#. Accessed on March 10, 2016.

countries, India too has its share of capabilities and inadequacies. The energy sector remains the primary interest for emerging countries like India as it is hugely an 'export oriented' country in this market. India, is, thus, maintaining a delicate balance in achieving its national goals and interests and overcoming its inadequacies to achieve financial security and infrastructural development in order to sustain its progress in current international relations.

Nevertheless, to overcome its energy deficiency, the Government of India (GoI) has undertaken several initiatives in renewable energy resources such as wind, solar, hydro power and bio-power, for example, the Jawaharlal Nehru National Solar Mission.[3] Ironically, the enormous dependence on fossil fuels such as oil, natural gas and coal has been the key arrangement to enhance energy security. British Petroleum, which released the 2015 edition of *Energy Outlook* has projected India's energy production rise by 117 percent to 2035, with consumption growing by 128 percent. According to the report, the country's energy mix will evolve very slowly over the next 22 years, with fossil fuels accounting for 87 percent of demand in 2035, compared with a global average of 81 percent (down from 92 percent today). Oil remains the dominant fuel (36 percent) followed by gas (30 percent) and coal (21 percent).[4] India has been vigorously foraging for dependable energy supply markets to satiate its growing energy demands. However, the politics surrounding energy diplomacy, fluctuating and unpredictable energy prices in the energy market business, with non-renewable resources speculated to deplete in the coming years, India has tactfully ventured into civil nuclear energy cooperation with several countries, including Russia, which is the key partner in its nuclear power ambitions.

3. The Jawaharlal Nehru National Solar Mission was launched on January 11, 2010, by the Prime Minister. The mission has set the ambitious target of deploying 20,000 MW of grid connected solar power by 2022 and is aimed at reducing the cost of solar power generation in the country through (i) a long-term policy; (ii) large scale deployment goals; (iii) aggressive R&D; and (iv) domestic production of critical raw materials, components and products, as a result to achieve grid tariff parity by 2022. The mission will create an enabling policy framework to achieve this objective and make India a global leader in solar energy. Ministry of New and Renewable Energy, Government of India http://www.mnre.gov.in/solar-mission/jnnsm/introduction-2/. Accessed on March 10, 2016
4. "BP Energy Outlook- Edition 2015", *British Petroleum*, http://www.bp.com/en/global/corporate/energy-economics/energy-outlook-2035.html. Accessed on March 18, 2016.

Before exploring the growing nuclear cooperation between India and Russia which is fast emerging as the plank in the bilateral relations, it would be useful to go through the evolution of India's nuclear power programme and ambition.

EVOLUTION OF INDIA'S NUCLEAR POWER AMBITION

Since its independence, India has strongly endorsed nuclear power for civil use. In 1948, the Atomic Energy Act was passed in the Constituent Assembly, and the Atomic Energy Commission was set up. The Department of Atomic Energy (DAE) was created in 1954 which was under the direct charge of the Prime Minister's Office (PMO). This was established when the country's 3-stage plan for establishing nuclear power was first outlined.[5] In 1969, with the help of the United States, India was able to start its first reactor in Tarapur. The Nuclear Power Corporation of India Limited (NPCIL), a public sector enterprise under the administrative control of the DAE, is the only utility that deals with civilian nuclear power in India. The objective of NPCIL is to monitor the operation of atomic power stations and implement atomic power projects for generation of electricity, in pursuance of the schemes and programmes of the Government of India under the Atomic Energy Act.[6] For many years, as India was isolated from gaining nuclear technology and assistance from foreign players, it was claimed that the nuclear strategy was directed towards complete independence in the nuclear fuel cycle.

Adding further details on the issue of India's isolation in civil nuclear engagement, the real challenge emerged post India's first peaceful nuclear explosion in 1974. As India was not a party to the nuclear Non-Proliferation Treaty (NPT), the test declared India as a nuclear weapons capable state and it was excluded from international trading on nuclear commodities, nuclear technology and assistance by the Western countries, thus, immensely affecting its nuclear programme. Having realised the ascendency of India in

5. "India, China and NPT", *World Nuclear Association,* updated in July 2014. http://www.world-nuclear.org/information-library/safety-and-security/non-proliferation/india,-china-npt.aspx. Accessed on April 1, 2016.
6. "Nuclear Power in India", *Greenpeace India*, March 27, 2011, http://www.greenpeace.org/india/en/What-We-Do/Nuclear-Unsafe/Nuclear-Power-in-India/Q-and-A-Civilian-Nuclear-Sector-in-India/. Accessed on April 12, 2016.

the new world order, the Washington Administration shifted away from its previous stance and made efforts to revive its relations with New Delhi. It is widely accepted that the signing of the first long-term strategic agreement in the field of foreign policy and global partnership on cooperation in civil nuclear energy, the "India–US Agreement for Cooperation Concerning Peaceful Uses of Nuclear Energy" based on the US Atomic Energy Act for nuclear cooperation,[7] led to a breakthrough in the partnership. In fact, the end of the nuclear logjam paved the way for many other foreign players to also penetrate the huge nuclear market in India.

According to the agreement, over the next few decades, India was guaranteed a supply of nuclear fuel for civilian reactors, mainly to be built by the American companies. However, there was stiff opposition and criticism from various countries, some member states of the NPT regime and political parties at the domestic level, as they were unhappy with the agreement as it was (a) being signed with a non-signatory of the NPT (India), and (b) with certain portions of the agreement such as the guarantee of fuel supply to India or allowing it to maintain a strategic reserve of nuclear fuel. Nevertheless, the agreement granted India the 'exceptionalism' status as the international trading ban was lifted by the Nuclear Suppliers' Group (NSG), opening the door for foreign countries that wished to trade in nuclear equipment and fuel with India, fenced for civilian (non-weaponry) purposes. Deals with the US, France and Russia swiftly followed, as well as with Canada, Mongolia, Kazakhstan, Argentina, Namibia, South Korea and the UK.[8] Foreign nuclear corporations were, thus, given a green signal to build reactors in India.

Today, many years after the signing of the agreement and in view of the developments that have taken place in this sector, it merits attention. To being with, "the implementation of the civil nuclear cooperation agreement with the US was put back on course when the Indian Prime Minister hosted US President Obama in New Delhi on

7. "Frequently Asked Questions on the India-US Agreement for Cooperation Concerning Peaceful Uses of Nuclear Energy", Ministry of External Affairs, Government of India, http://www.mea.gov.in/Uploads/PublicationDocs/19149_Frequently_Asked_Questions_01-11-2008.pdf. Accessed on April 9, 2016
8. Lagan Charu, "India-USA: Does 'Strategic Partnership' Have a Future?", *New Eastern Outlook*, 2010-2014, p.3, http://journal-neo.org/wp-content/digests/digest_10.pdf. Accessed on April 9, 2016.

January 25-27, 2015. Commercial negotiations between NPCIL and Westinghouse for the construction of 6 units of the AP-1000 reactor at Mithi Virdi, Gujarat, are on course, for finalisation in 2016. Civil nuclear cooperation with France was also taken forward during the Prime Minister's visit to France in April 2015 during which a Memorandum of Understanding (MoU) was signed between M/s Larsen and Toubro and M/s Areva aimed at cost reduction by increasing localisation for the Jaitapur project in Maharashtra. Following the signing of a contract for long-term supply of uranium during the Prime Minister's visit to Canada in April 2015, the first consignment of uranium reached India in December 2015. Likewise, a long-term contract for the purchase of uranium was signed during the Prime Minister's visit to Kazakhstan in July 2015. In a major development, a civil nuclear cooperation agreement with Australia was brought into force on November 13, 2015, along with the administrative arrangement for implementing the agreement. The fuel supply arrangements with Canada, Kazakhstan and Australia will bolster energy security by supporting the expansion of nuclear power in India.[9] Nuclear energy cooperation has enabled India to meet its energy demands to some extent but the major spin-off of nuclear energy has been the development of industries and revolutionising its energy security.

As India is moving in the direction of expanding its nuclear power sector, the GoI intends to draw 25 percent of its energy from nuclear power by 2050. This plan includes '20,000 MW (Mega Watt) of installed capacity from nuclear energy by 2020, and 63,000 MW by 2032.[10] India also has a well established nuclear power programme and policies to achieve a target of nearly 15,000 MWe (Mega Watt electric) of nuclear capacity on line by 2020'.[11] Currently, India has 21 operational nuclear power reactors across six states**.** Table 1

9. "Civil Nuclear Cooperation – A Year of Solid Achievements", Department of Atomic Energy, *Press Information Bureau*, Government of India, December 30, 2015. http://pib.nic.in/newsite/printrelease.aspx?relid=134030. Accessed on April 9, 2016.
10. "India's Nuclear Ambitions", *Greenpeace India*, http://www.greenpeace.org/india/en/What-We-Do/Nuclear-Unsafe/Nuclear-Power-in-India/. Accessed on April 9, 2016.
11. "Nuclear Power in India", *World Nuclear Association*, updated in April 2016. http://www.world-nuclear.org/information-library/country-profiles/countries-g-n/india.aspx#ECSArticleLink1. Accessed on March 9, 2016.

provides details of the nuclear power plants in India. But with the abovementioned targets, demands and nuclear power ambitions, these power reactors contribute less than 3 per cent of the country's total energy generation.[12] Given below is the list of nuclear power plants in India alongside details of the capacity of each nuclear power plant.

Table 1: Nuclear Power Plants in India

Plant	Unit	Type	Capacity (MWe)	Date of Commercial Operation
Tarapur Atomic Power Station (TAPS), Maharashtra	1	BWR	160	October 28, 1969
Tarapur Atomic Power Station (TAPS), Maharashtra	2	BWR	160	October 28, 1969
Tarapur Atomic Power Station (TAPS), Maharashtra	3	PHWR	540	August 18, 2006
Tarapur Atomic Power Station (TAPS), Maharashtra	4	PHWR	540	September 12, 2005
Rajasthan Atomic Power Station (RAPS), Rajasthan	1	PHWR	100	December 16,1973
Rajasthan Atomic Power Station (RAPS), Rajasthan	2	PHWR	200	April 1,1981
Rajasthan Atomic Power Station (RAPS), Rajasthan	3	PHWR	220	June 1, 2000
Rajasthan Atomic Power Station (RAPS), Rajasthan	4	PHWR	220	December 23, 2000
Rajasthan Atomic Power Station (RAPS), Rajasthan	5	PHWR	220	February 4, 2010
Rajasthan Atomic Power Station (RAPS), Rajasthan	6	PHWR	220	March 31, 2010
Madras Atomic Power Station (MAPS), Tamil Nadu	1	PHWR	220	January 27,1984
Madras Atomic Power Station (MAPS), Tamil Nadu	2	PHWR	220	March 21,1986
Kaiga Generating Station (KGS), Karnataka	1	PHWR	220	November 16, 2000

12. n.10.

Kaiga Generating Station (KGS), Karnataka	2	PHWR	220	March 16, 2000
Kaiga Generating Station (KGS), Karnataka	3	PHWR	220	May 6, 2007
Kaiga Generating Station (KGS), Karnataka	4	PHWR	220	January 20, 2011
Kudankulam Atomic Power Project, Tamil Nadu	1	VVER -1000 (PWR)	1000	December 31, 2014
Narora Atomic Power Station (NAPS), Uttar Pradesh	1	PHWR	220	January 1,1991
Narora Atomic Power Station (NAPS), Uttar Pradesh	2	PHWR	220	July 1,1992
Kakrapar Atomic Power Station (KAPS), Gujarat	1	PHWR	220	May 6, 1993
Kakrapar Atomic Power Station (KAPS), Gujarat	2	PHWR	220	September 1,1995
Total Nuclear Power Plant Capacity: 5,780 MWe				

Source: Nuclear Power Corporation of India Limited, Department of Atomic Energy, Government of India. http://www.npcil.nic.in/main/AllProjectOperationDisplay.aspx

NUCLEAR COOPERATION BETWEEN INDIA AND RUSSIA

Throughout the Cold War period, India and Russia maintained a quintessential partnership as the two countries developed a robust alliance despite non-conformity in terms of ideology and world view. Geo-political dimensions and strategic congruence helped mature the collaboration between the two countries into a full-blooded partnership during this period. However, after the dissolution of the Communist bloc, the two countries began to pursue different paths in order to achieve national rejuvenation through economic progress, stabilisation of their internal affairs and enhancement of their international profiles. Simultaneously, these aspirations required diversification of their respective foreign policy relations with other global players. Consequently, Russia, in the early 1990s, began to drift away from India which had been a key player for the Soviet interests in the Asian region. India, on the other hand, had to deal with a new

Russia which was Euro-centric; economically dependent on the West; and which did not have either interest in, nor the resources for, Third World regimes.[13] India and Russia have emerged as potential global players in international affairs in the post-Cold War era. India, in particular, regained its affinity and position in the Kremlin's national interests. The bilateral interaction between the two countries began to transform towards a broader engagement since the late 1990s. Within a decade of the Soviet collapse, both Moscow and New Delhi, therefore, began formulating policies that would assist in revamping the relations between the two countries. One such endeavour has been in the energy sector, especially in nuclear energy cooperation.

The case of India-Russia energy cooperation, including nuclear energy, is an elaborate saga. Russia is a significant contributor to India's energy mix and the potential of cooperation is definitely huge. The negotiations for building nuclear reactors had started during the Soviet era in 1988. However, the Soviet disintegration challenged the very nature of the bilateral relations between India and Russia in 1990s. One such concern for India during this period was when the Russian government urged India to join the NPT and in March 1992, applied 'full-scope safeguards', as a pre-condition to future nuclear supply agreements with India. This constrained the latter's use of its civilian nuclear power programme to produce fissile material for nuclear weapons.[14] Nevertheless, the Soviet collapse brought a pause to the negotiations due to external pressure, and as mentioned above, the initial fragility in the post-Cold War relations contributed to the slow pace. The NSG pact in 1992 had further complicated the scenario but the relations revived soon thereafter.

Russia's foreign policy towards India revived since 1996, as Yevgeny Primakov replaced the pro-Western Andrei Kozyrev as Russia's foreign minister. In order to reinforce the relations with India, Primakov visited India in 1998 and an agreement for the construction of two 1,000 MW light water nuclear reactors at Kudankalam in Tamil Nadu was reached between Moscow and New Delhi.[15] The Russian

13. Gulshan Sachdeva, "India's Relations with Russia", in Scott, ed., n.1, p. 214.
14. Ramesh Thakur, "The Impact of the Soviet Collapse on Military Relations with India", *Europe-Asia Studies,* vol. 45, no. 5, 1993, p. 5.
15. Jerome M. Conley, "Indo-Russian Military and Nuclear Cooperation: Implications for US Security Interests", *INSS Occasional Paper 31*, Proliferation Series, USAF Institute for National Security Studies, Colorado, February 2000.

Minister for atomic energy signed a deal in New Delhi in 1998 to build two nuclear reactors at Kudankulam.[16] Following the Pokhran II nuclear tests in May 1998, the US, in 1999, warned India against moving in the direction of developing a nuclear deterrent, but the Russian response did not decry India's decision to become a nuclear power state. The support extended by Russia during India's crisis situation is viewed by many scholars as the first step to regaining the warmth and enthusiasm in the partnership.

Parallel to these aspects, both India and Russia also share the objective of preventing proliferation of weapons of mass destruction and their means of delivery, including preventing their possible acquisition by terrorist groups. Both countries maintain the view that all states possessing nuclear weapons should accelerate concrete progress on the steps leading to global nuclear disarmament in a way that promotes international stability, peace and undiminished and increased security for all. Both countries had signed the "Moscow Declaration on a Non-Nuclear and Non-Violent World' as early as in 1986. The two countries have been keen to strengthen the multilateral export control regimes as an important component of the global non-proliferation regime. In this regard, Russia has expressed readiness to assist and facilitate India's membership in the NSG, Missile Technology Control Regime (MTCR) and the Wassenaar Arrangement.[17]

The relationship between India and Russia gained further momentum during President Vladimir Putin's visit in 2000 which held out an opportunity to create a special bilateral economic relationship with the signing of the "Strategic Partnership between India and Russia". Realising the potential areas of trade growth that include defence, energy, nuclear, diamonds, pharmacy and science and technology, the two countries established annual summit meetings which fostered extensive collaboration and dynamism for economic development. Since then, in the field of nuclear cooperation, several agreements, MoUs to establish nuclear reactors, nuclear technological

16. Debidatta Aurobinda Mahapatra, "India-Russia Nuclear Ties on an Upswing", *Russia and India Report*, March 12, 2015. http://in.rbth.com/economics/2015/03/12/india-russia_nuclear_ties_on_an_upswing_41935.html. Accessed on February 27, 2015
17. Arun Mohanty, "Indo-Russian Strategic Partnership: A Reality Check", *Mainstream Weekly*, vol XLIX, no 16, April 9, 2011

assistance, joint collaborations and various other aspects have been addressed on a timely basis.

Aware of India's energy demand to meet the growing expectation of its increasing population and industrial and infrastructural development, Russia is a steady partner in India's peaceful exploration of nuclear energy. In India's nuclear odyssey, it recognises Russia as a country with advanced nuclear technology and an impeccable non-proliferation record. The nuclear component of this relationship, which traverses the entire range of activities from fuel fabrication to plant decommissioning, is remarkable. The "Treaty of Friendship and Cooperation between the Russian Federation and the Republic of India," signed on January 28, 1993, established a strong and long-term basis for cooperation between the two countries. Besides, it also actively developed mutually beneficial cooperation in the peaceful uses of atomic energy. Towards this, the two countries recognised the relevance of the following documents signed between the two governments: the agreement between the Government of the Russian Federation and the Government of the Republic of India on cooperation in the construction of additional nuclear power plant units at the Kudankulam site as well as in the construction of Russian designed nuclear power plants at new sites in the Republic of India, signed on December 5, 2008 (hereinafter referred to as the "Agreement of 2008"); and Agreement the between the Government of the Russian Federation and the Government of the Republic of India on cooperation in the uses of atomic energy for peaceful purposes, signed on March 12, 2010 (hereinafter referred to as the "Agreement of 2010").[18]

India and Russia have, thus, sealed a breakthrough long-term pact for expanding civil nuclear cooperation that has assured freedom from any restrictions or curbs on India in the future. Under the agreement signed during Prime Minister Manmohan Singh's visit to Moscow in 2011, Russia agreed to set up more nuclear reactors in India, transfer the full range of nuclear energy technologies and ensure uninterrupted supply of fuel. As

18. "Strategic Vision for Strengthening Cooperation in Peaceful Uses of Atomic Energy between the Republic of India and the Russian Federation", Ministry of External Affairs, Government of India, *Press Information Bureau*, December 11, 2014. http://pib.nic.in/newsite/PrintRelease.aspx?relid=113165. Accessed on April 15, 2016.

specialists began to analyse and compare the all-out support by Russia and the US Administration's engagement in India's nuclear energy ambitions, many argued that the nuclear pact with Russia goes far beyond the bounds of the 123 Pact with the US, as, despite the hype surrounding the 'exceptionalism' granted to India, some of the conditions of the agreement call for the termination of ongoing nuclear cooperation and for the return to the US of equipment and fuel already supplied to India in the event of the nuclear agreement being terminated. Russian President Dmitry Medvedev, on the other hand, made it clear that Russia will not accept any foreign-imposed restrictions on its nuclear cooperation with India. [19] In fact, the positive outcome of the civil nuclear cooperation has been Kudankulam (KK) 1, India's first Russian reactor, which became fully operational in 2014, and KK 2 is nearly ready too. There are also plans for the construction of KK 3 and 4 at the same site as per the General Framework Agreement signed in April 2014.[20]

Construction of the Kudankulam Nuclear Power Plant (KKNPP) Units 1 & 2 (VVER 1,000 MW units) is an example of fruitful cooperation between India and Russia. The KKNPP Unit 1 became operational in July 2013, and attained full generation capacity on June 7, 2014, while its Unit 2 is at an advanced stage of construction.[21] Table 2 provides information of the KKNPP Unit 1 which is currently operational. In January 2014, the testing programme was successfully completed at a power setting of 50 percent, and in June 2014, at 75 percent and 100 percent. Electricity from the Kudankulam NPP is provided to the states of Tamil Nadu, Kerala, Andhra Pradesh, Karnataka, and Union Territory of Puducherry. Since its first synchronisation with the network, the energy unit has worked a total of 4,700 hours. During this time, India received

19. Vladimir Radyuhin and Sandeep Dikshit, "India and Russia Sign Civil Nuclear Agreement", *The Hindu*, December 7, 2011. http://www.thehindu.com/news/national/india-and-russia-sign-civil-nuclear-agreement/article61503.ece. Accessed on January 2, 2012.
20. Manpreet Sethi, "India-Russia Nuclear Vision Statement: See that it Delivers", *Institute for Peace and Conflict Studies*, December 15, 2014. http://www.ipcs.org/article/india/india-russia-nuclear-vision-statement-see-that-it-delivers-4775.html
21. Embassy of India, Moscow, "Bilateral Relations: India-Russia Relations", 2014. http://indianembassy.ru/index.php/bilateral-relations/bilateral-relations-india-russia. Accessed on January 10, 2015.

more than 2.8 billion kWh (kilo watt hours) of electricity.[22] It has added 20 per cent to the existing nuclear generation of electricity in India. Table 3 explains the capacity of Unit 2 of the Kudankulam NPP which is in its advanced stage and is set to be commissioned shortly. There are plans to establish two more units in the plant. During President Putin's visit to India for the 15th Annual Summit in 2014, he expressed satisfaction at the level of nuclear cooperation,[23] and agreed to expand it further with the construction of 12 more nuclear plants in India. The two countries also agreed on exploring the necessary steps in the development of the nuclear fuel cycle, including the exploration for, and production of, uranium, nuclear fuel, radioactive waste and spent nuclear fuel. In addition, Russia and India signed a contract for the supply of the main equipment for the third and fourth reactors of the Kudankulam NPP.[24]

During Prime Minister Modi's visit to Moscow on December 25, 2015, for the 16th Annual Summit between the two countries, a plethora of agreements was signed between Moscow and New Delhi. Among the 16 agreements signed, the two countries, while pursuing the commitment in the nuclear energy sector made in the previous summit, announced the construction of 12 more nuclear reactors in India, with Andhra Pradesh most likely to be the second site apart from Kudankulam where a total of six reactors will be set up. The Russian company Atomstroyexport, a government subsidiary, has also reached a deal to build 16 nuclear reactors in India.[25] The two sides also agreed that some of the components of the Russian made reactors will be manufactured in India. Under the aegis of the 'Make in India' initiative, the leaders of both countries welcomed the finalisation of the Programme of Action for localisation between RosAtom of Russia and the Department of Atomic Energy of India.[26] Based on

22. Andrei Retinger, "Why Electricity from Russian Nuclear Power Plants is Cheaper?" *Russia and India Report*, February 27, 2015. http://in.rbth.com/economics/2015/02/27/why_electricity_from_russian_nuclear_power_plants_is_cheaper_41689.html. Accessed on November 4, 2014
23. Mahapatra, n. 16.
24. Retinger, n.22.
25. n.10.
26. Dipanjan Roy Chaudhury, "India and Russia Sign 16 Agreements, Russia to Help Build 12 Nuclear Reactors", *The Economic Times*, December 25, 2015. http://articles.economictimes.indiatimes.com/2015-12-25/news/69300307_1_india-and-russia-permanent-seat-russian-plane. Accessed on May 5, 2016 .

this initiative, in consultation with Russian technology providers and Indian private and public sector manufacturers, all major equipment and spares, as well as nuclear fuel assemblies, which are currently being manufactured in Russia, are to be manufactured in India for the future Russian designed reactors in India.[27]

Table 2: Kudankulam Atomic Power Project

Unit	Reactor Type	Capacity(MWe)	Date of Commercial Operation
1	V V E R -1000 (PWR)	1000	December 31, 2014

Source: Nuclear Power Corporation of India Limited, Department of Atomic Energy, Government of India, May 8, 2016, http://www.npcil.nic.in/main/ProjectOperationDisplay.aspx?ReactorID=77

Table 3: Kudankulam Atomic Power Project 2

Unit Number	Reactor Type	Capacity (MWe)	Scheduled Date of Commercial Operation	Expected Date of Commercial Operation	Physical Progress
2	V V E R -1000 (PWR)	1000	December 2008	June 2016 (First Criticality)	98.82 % as on April 2016

Source: Nuclear Power Corporation of India Limited, Department of Atomic Energy, Government of India, May 8, 2016, http://www.npcil.nic.in/main/ConstructionDetail.aspx?ReactorID=77

THE ROAD AHEAD

The current geo-political system post-Soviet disintegration has undeniably been a litmus test for the bilateral relations between India and Russia. In the contemporary geo-political scenario, the strategic community has predicted that the vigour in the bilateral engagement between the two countries could diminish in the

27. Press Release by Government of India, Department of Atomic Energy, December 24, 2015. http://dae.nic.in/writereaddata/moscow24122015.pdf. Accessed on May 10, 2016.

coming years. However, the way nuclear cooperation between the two countries has progressed and the prospects it holds for the future owing to the fact that nuclear power currently has high potential for a country like India to sustain its economic growth, industrial and infrastructural development, the nuclear sector has only reassured the strengthening of ties between the two traditional partners. However, this sphere of cooperation is not without impediments and some of the factors identified in this regard are the high capital cost of the construction and maintenance of nuclear power plants. Additionally, limited availability of raw material is another cause of concern as India would continue to depend on the availability of uranium for its operational and planned reactors despite the uranium available in India, as it is of very poor quality. In fact, Dr Kakodkar, former Chairman DAE, once stated that the quality of Indian uranium is so poor that it is akin to the tailings that are thrown away by the Australian mining industry. Therefore, it is widely accepted that the input of high quality fuel soon from Australia, besides Canada, Mongolia, France and Kazakhstan, would expectedly enhance the capacity factors of Indian reactors.[28]

Although India under the leadership of Narendra Modi initiated the 'Make in India' programme, similar to the defence sector, India would continue to source spare parts from other countries. While Russia and India have undertaken programmes to manufacture nuclear fuel assemblies in India for Russian reactors, similar efforts should be initiated with other countries involved in this sector. There is also the fear and danger of radioactive pollution which needs to be addressed at the earliest. There are other major factors, including the allotment of sites for future reactors, as identified by Dr. Manpreet Sethi which may in the future pose a major hurdle in realising the prospects of the vision and compulsion of addressing the growing demand for energy in India's developmental path. Another factor identified by Dr. Sethi is the issue of public acceptance that is an added dimension in the post-Fukushima environment. Hence,

28. Manpreet Sethi, "Uranium and Nuclear Power: Three Indian Stories", *Institute for Peace and Conflict Studies*, September 14, 2014. http://www.ipcs.org/article/india/uranium-and-nuclear-power-three-indian-stories-4660.html

according to Dr. Sethi, the acquisition of the necessary land will call for much greater investment, and not just monetary, by the nuclear establishment to reach out to the constituencies to inform and educate them with the objective of winning them over.[29]

As mentioned earlier, the civil nuclear cooperation between India and Russia has been one of the major factors in revitalising the bilateral partnership. Russia has often been the pillar in assisting India in making its vision a reality—nuclear cooperation is an area that has time and again been proof of the unconditional support extended to India by its traditional partner, Russia. Hence, India and Russia should overcome the impediments that may pose a threat to the progress of the partnership in this sector. As there are plans to construct nearly 12 more nuclear reactors, the partnership will be further strengthened as it is not only a long-term process but also a long-term vision towards energy security that the two countries have together taken up to make it a reality.

29. Sethi, n.20.

INDIA-FRANCE CIVILIAN NUCLEAR COOPERATION: DYNAMICS AND CHALLENGES

MANISHA CHAURASIYA

The 67th Indian Republic Day brought with it several reasons for the India-France relationship to be termed as one of the most flourishing bilateral relationships of the century. Both states reaffirmed their existing multifaceted relationship stretching across the economic, counter-terrorism, defence, space, nuclear, cultural and strategic sectors. The Indian diplomatic fraternity has directed attention to fostering bilateral cooperation on civilian nuclear energy in the 21st century. This area holds unique importance, especially because of the optimism and enthusiasm attached to nuclear energy and its vital role in the Indian roadmap to greater diversify its sources of clean energy generation in the face of the rapidly growing energy demand. The Indo-US Civilian Nuclear Cooperation Agreement signed in 2005 marked the beginning of a meaningful engagement between India and the world in civilian nuclear commerce. It was followed by nuclear cooperation agreements with France, Russia, Canada, Argentina, Kazakhstan, Republic of Korea, Australia, and the UK[1] in nuclear reactors, nuclear fuel, technology, goods, etc. The India-France

Manisha Chaurasiya is a Research Associate at the Centre for Air Power Studies, New Delhi.

1. Department of Atomic Energy (DAE), Government of India, "Important Agreements", http://dae.nic.in/?q=node/75. Accessed on February 5, 2016.

relationship has been emerging as an important bilateral dimension in this regard. It will be useful to identify the dynamics of the nuclear diplomatic cooperation, as well as the emerging challenges

INDIA-FRANCE RELATIONS: COOPERATION AND CONVERGENCE

France was the first country with which India entered into an agreement on civil nuclear cooperation following the waiver given by the Nuclear Suppliers' Group (NSG) which enabled India to resume full civil nuclear cooperation with the international community.[2] France too regards India as a trusted partner with which it signed a strategic partnership back in 1998. In the present international scenario, the strategic convergence of India and France can be identified in three main areas: defence cooperation, counter-terrorism, and civil nuclear cooperation. The triad of these issues was, no doubt, the nucleus of French President François Hollande's recent visit to India in January, 2016. This was not the maiden visit of President Hollande to India and his earlier state visit in 2013 had already set the stage for a meaningful, multi-sectoral and productive bilateral relationship for both states. In defence cooperation, the Rafale fighter jets deal, after several hiccups, is finally happening. On counter-terrorism, both states have realised the need for synergic cooperation in fighting terrorism. France, in the last year, has been the target of global terrorist outfits as was witnessed in the Charlie Hebdo shooting and the Paris terror attacks. France and India both demand global attention and prioritisation of dealing with terrorism, condemning states that distinguish between good terrorism and bad terrorism, along with their active funding to the former for selfish interests.

On civilian nuclear cooperation, it appears to be a two-way road for both India and France. France has extended its hand towards India in civilian nuclear technology, nuclear fuel, components and now construction of civilian nuclear reactors too. France and India envision a multipolar world order based on coexistence and cooperation. Post Indian nuclear 'exceptionalism,' France has welcomed the Indian

2. Ministry of External Affairs (MEA), "India France Relations", 2014, http://mea.gov.in/portal/foreignrelation/france_february_2014.pdf. Accessed on January 25, 2016.

commitments of separation of civilian and military nuclear fuel cycles, safeguards agreement with the International Atomic Energy Agency (IAEA), Additional Protocol, harmonising with the multilateral export control regime norms and the continued moratorium on nuclear testing. France accepts that "these commitments help to bring India into the current non-proliferation regime without forcing the country to join the NPT, which would require the abandonment of all military nuclear programs."[3] Free from the threats of nuclear non-proliferation, France has identified in India a responsible and trusted partner.

A Snapshot of the French Civilian Nuclear Capabilities

Why civilian nuclear cooperation has become a niche area of the bilateral relationship between India and France is an interesting question. "France derives about 75 percent of its electricity from nuclear energy (out of which) about 17 percent is from recycled nuclear fuel."[4] France has taken energy security far more seriously than many and has dedicatedly worked to attain it. As Manpreet Sethi believes, "A major reason for France to embark on an ambitious nuclear power programme was the oil crisis in the early 1970s when it realised the salience of reducing its dependence on imported energy sources substantially."[5] For self-sufficiency in matters of energy through the nuclear wand, France is progressively involved in exporting its nuclear expertise and goods all across the globe, with deals with the UK, Finland, Poland and India in swing.

AREVA, the civilian nuclear giant was established in 2001 and it emerged as the only company to have a presence in every part of the nuclear fuel cycle. In 2010, France was also urged by the IAEA[6] to don a strategic role as a provider of low-cost, low-carbon base-load

3. French Committee on Foreign Affairs, "The Bill Authorizing the Approval of the Agreement between France and India Concerning the Allocation of Intellectual Property Rights in Developing Agreements on the Peaceful Uses of Nuclear Energy", 2013, http://www.senat.fr/rap/l12-466/l12-466.html. Accessed on January 27, 2016.
4. "Nuclear Power in France", *World Nuclear Association*, 2012, http://www.world-nuclear.org/information-library/country-profiles/countries-a-f/france.aspx. Accessed on February 27, 2016.
5. Manpreet Sethi, "The French Nuclear Energy Experiences: Lessons for India", 2011, http://www.ifre.fr/c/490. Accessed on February 12, 2016.
6. *World Nuclear Association*, 2012, n.4.

power for other countries. Its performance and record as a leading civilian nuclear power producer and exporter was acknowledged by New Delhi. India has emerged as a preferred destination for all the major international civilian nuclear goods and technology exporters due to the exponentially rising civilian nuclear requirements. Trust is further strengthened through not just the remarkable French civilian nuclear story but also due to the healthy relations the European giant has had with India historically.

A Brief Analysis of the Dynamics of Nuclear Cooperation

The agreement between the Governments of the French Republic and the Republic of India in 2008 set the stage for a meaningful relationship in the civilian nuclear sector. On the menu were issues not just on the development of nuclear energy but also the related broad array of Research and Development (R&D), nuclear safety, and education/training related issues. French President Sarkozy's visit to India in 2010 had seen several cooperation agreements on the nuclear front: (a) two European Pressurised Reactors (EPRs) and the related fuel supply; (b) nuclear science and technology for peaceful uses of nuclear energy;[7] (c) protection of confidentiality of technical data and information relating to cooperation in the peaceful uses of nuclear energy; (d) Intellectual Property Rights (IPR) relating to the development of peaceful uses of nuclear energy;[8] (e) exchange of technical information and cooperation in the regulation of nuclear safety and radiation protection,[9] and nuclear reactor safety;[10] and

7. The agreement was signed between the Commissariat à l'Energie Atomique et aux Energies Alternatives and the Department of Atomic Energy of the Government of India which aimed at covering the entire scope of cooperation on civil nuclear energy research and development, http://www.ambafrance-in.org/Bilateral-Civilian-Nuclear,7474. Accessed on February 5, 2016.
8. Ibid. The agreement was between the Government of the French Republic and the Government of the Republic of India aiming at the protection of classified information and material through framing the distribution of IPR in cooperation agreements or contracts on the peaceful uses of nuclear energy.
9. The agreement was signed between Autorité de Sûreté Nucléaire française (ASN) and the Atomic Energy Regulatory Board (AERB) of the Government of India for furthering cooperation on *nuclear safety regulations.* Available at: http://www.ambafrance-in.org/Bilateral-Civilian-Nuclear,7474. Accessed on February 5, 2016.
10. The agreement was signed between the Institut de Radioprotection et de Sûreté nucléaire (IRSN) and the Atomic Energy Regulatory Board (AERB)

(f) radioactive waste management.[11] The commercial contract between AREVA and the Nuclear Power Corporation of India Limited (NPCIL) for EPRs can be called the nucleus of this bilateral endeavour. It was elaborated in the 2009 Memorandum of Understanding (MoU) regarding setting up of 6 x 1,650 MWe (Mega Watt Electric) EPR units at Jaitapur. On the industrial front, AREVA was already in possession of experience of providing the NPCIL with 300 tonnes of nuclear fuel for the public electricity utility in 2008.[12] The giant firm got the responsibility for two EPR reactors (2 x 1,650 MWe capacity) for the Jaitapur site, along with fuel supply.[13] The deal between AREVA and NPCIL comprises one of the biggest techno-commercial cooperation agreements.

The Prime Minister's "Make in India" initiative has led to elevation of the Indo-French collaboration to higher levels, including of transfer of technology and cost-effective localised manufacturing of civilian nuclear energy related components on the Indian soil. Indo-French civilian nuclear cooperation is the element of synergic gain and strategic convergence. France needs markets for its civilian nuclear technology, goods, nuclear reactors and fuel. India, on the other hand, is in need of clean, reliable and economically viable sources of energy generation. It has realised the potential of nuclear energy as a viable option and accepts it as a salient lynchpin in the overall equation. All this gives rise to greater emphasis on maintaining the techno-commercial bond. France has interest in assuring that no hurdles and challenges pull the deal backwards. As the reports reveal, "The ink had yet to dry on two separate agreements signed by France's AREVA with Larsen & Toubro and the NPCIL for the French-designed 1,650 MWe EPR reactor in Jaitapur, Maharashtra, when the French nuclear giant went into meltdown."[14] Apprehensions and fears on the future of AREVA and the deal, thus, were bound to emerge.

11. On nuclear waste management, a Memorandum of Understanding (MoU) was signed between Agence Française Nationale Pour La Gestion Des Déchets Radioactifs (ANDRA) and Bhabha Atomic Research Centre (BARC), http://www.ambafrance-in.org/Bilateral-Civilian-Nuclear,7474. Accessed on February 5, 2016.
12. French Embassy in New Delhi, "Bilateral Civilian Nuclear Cooperation", http://www.ambafrance-in.org/Bilateral-Civilian-Nuclear,7474. Accessed on January 25, 2016.
13. Ibid.
14. Vaiju Naravane, "Modi Shouldn't Have Rushed Deal with Ailing French Company and Its Problem Reactor", 2015, http://thewire.in/2015/07/20/as-areva-goes-belly-up-modis-french-nuclear-plans-may-start-unravelling-6854/. Accessed on February 2, 2016.

Challenges Confronting Nuclear Cooperation

Challenges to the Indo-French civil nuclear commerce emerge from several pressing issues and freshly emerged uncertainties. A detailed analysis suggests that there seem to be some fresh challenges in the successful fruition of the commercial deal. The "EPR Jaitapur-General Framework Agreement" attempts to cover the entire scope of cooperation on civil nuclear energy research and development with details of the two EPRs, the supply of fuel in addition to the price, general terms and conditions of the deal. Still, the recent developments and experiences of AREVA raise concerns in New Delhi:

1. **The Mounting Cost of the EPRs**

   There are apprehensions that the costs of the EPRs, as and when delivered, would far exceed those anticipated and pledged. The experience of AREVA with Finland has been upsetting where the cost of two EPR reactors has tripled since the agreement on purchase was made, reaching an unacceptable Euro 9 billion. The reactors were to be commissioned by 2009, but they were not ready, which doubled the costs. These developments had led to a churning in India too. Many wonder whether the Olkiluoto reactor would be ready even by the revised deadline of 2018. Finland, on the other hand, has denied paying the additional costs. The slowdown caused by the 2011 Fukushima nuclear meltdown has affected the nuclear fuel producers, including AREVA, adversely, as the production remained suspended because the reactors remained shut since the accident. Reports note that "this fuel export shortfall adds to the worsening finances of AREVA."[15]

2. **Slippages in Estimated Time of Delivery**

   If one misses the right time to acquire a technology, one loses winning the anticipated edge. Certainly, in the international system, especially in the game of technology, nothing is more

15. "Nuclear Company Areva Really in a State of Bankruptcy but Tax Payers Will Bail It Out", *Nuclear News*, 2015, http://nuclear-news.net/2015/01/05/nuclear-company-areva-really-in-a-state-of-bankruptcy-but-tax-payers-will-bail-it-out/. Accessed on February 5, 2016.

expensive than a missed opportunity. In the case of the timely delivery of the EPR reactors, the concerns are similar. The delivery of the six EPRs was designed in a phased manner with the delivery of two EPRs of 1,650 MWe each in 2016. R. Rajaraman notes that in the French company's previous and recent assignments, the "construction of the Finnish reactor being built at Olkiluoto since 2005 has repeatedly suffered from serious delays and cost overruns."[16] The other side of the story is the one explained by AREVA. No doubt, slippages have occurred but AREVA has explained the delay as having been caused by the reactor Instrumentation and Control (I&C) system, which gained approval from Säteilyturvakeskus (STUK), the Finnish Radiation and Nuclear Safety Authority in April 2014, four years after what AREVA described as "exchanges" between the constructor and Teollisuuden Voima Oy (TVO).[17] Now the completion of construction and commissioning is expected in mid-2016.

"AREVA is committed to bringing India long-term fuel security and certainty of supply."[18] India's history and experience with nuclear technology is different and much more mature than Finland's, making India better equipped to understand the estimated time and requirements with nuclear projects.

3. Future of AREVA

Prime Minister Modi's April 2015 visit to France inked the final agreement with the French company. The very next month, AREVA announced enormous losses amounting to Euro 4.8 billion, exceeding its very capital base. It would not be an exaggeration to say that the firm was nearly bankrupt when the French government bailed it out. The state presently holds 86

16. R. Rajaraman, "India Should Renegotiate Terms with French Giant Areva for its EVR Nuclear Reactors", http://articles.economictimes.indiatimes.com/2014-12-31/news/57558348_1_areva-reactor-flamanville. Accessed on January 27, 2016.
17. "Nuclear Power in Finland", *World Nuclear Organisation*, http://www.world-nuclear.org/information-library/country-profiles/countries-a-f/finland.aspx. Accessed on February 15, 2016.
18. AREVA India, "Fact Pack: AREVA EPR Nuclear Reactor", http://india.areva.com/home/liblocal/docs/India%20Offer/Nuclear%20Activities/Fact%20Pack%20_%20EPR%20and%20AREVA%20_%20FULL%20DOCUMENT.pdf, p. 28. Accessed on February 5, 2016.

percent of the capital of AREVA, making it a direct responsibility of the French government to sustain it and ensure that it lives up to its promises worldwide. Media reports highlight the unusualness of AREVA in not being able to deliver even a single reactor for the past seven years. The French nuclear industry's reputation is at stake and there are fears of losing the international nuclear market share to competitors like South Korea and Russia. Indeed, the future of AREVA would have a direct impact on the Indian energy plans.

4. Lack of Trust and Acceptability of Nuclear Energy in India

On the Indian front, public acceptance of nuclear energy has emerged as a challenge post Fukushima. The disaster's psychological impact on the Indian public, ill-informed on nuclear energy matters, poses a challenge to investments in civilian nuclear plant establishments, further multiplying the apprehensions on the safety and viability of the nuclear plants. Lack of trust in, and acceptability of, nuclear energy is high, with unwarranted and ill-informed fears of nuclear radiation and technology. For instance, the Kundakulam nuclear plant in the state of Tamil Nadu was a target of the anti-nuclear groups and civil society organisations just before its completion. Nuclear safety regulations have been a priority for both India and France, without any compromise on the issue. The joint agreement of 2008 also emphasised on the aspects of "nuclear safety, radiation and environment protection."[19] NPCIL has also published a dedicated report titled "Misconceptions and Facts about Jaitapur Nuclear Power Project (JPPP)"[20] to allay misperceptions on the safety of the plant, in particular, and the viability and safety of nuclear energy, in general. India has prolonged experience of civilian nuclear technology. The

19. Department of Atomic Energy, "Cooperation Agreement between the Republic of India and the Government of the French Republic on the Development of Peaceful Uses of Nuclear Energy", 2008, http://dae.nic.in/writereaddata/ncpw/IGA_france_2008_1.pdf. Accessed on February 7, 2016.
20. *NPCIL*, "Misconceptions and Facts about Jaitapur Nuclear Power Project (JNPP)", http://www.npcil.nic.in/main/Misconceptions_combine_final.pdf. Accessed on January 26, 2016

Bhabha Atomic Research Centre (BARC) was well in place even before India's independence. India, being a founder member of the IAEA, has adhered to its principles and guidelines. The Nuclear Security Summit (NSS) catalysed the already ongoing Indian efforts and seriousness on nuclear security. The Global Centre for Nuclear Energy Partnership (GCNEP) initiative further established leadership in the field of nuclear energy through partnership in research, scientific interactions and training by Indian and international experts from the IAEA and interested countries on the issues.

5. Civilian Liability for Nuclear Damage

The Civilian Liability for Nuclear Damage Bill was elevated to a law in 2010. It provided "civil liability for nuclear damage and prompt compensation to the victims of a nuclear incident through a no-fault liability regime channelling liability to the operator, appointment of a Claims Commissioner and establishment of a Nuclear Damage Claims Commission."[21] In January 2016, India also progressed multilaterally in this direction by ratifying the Convention of Supplementary Compensation for Nuclear Damage.

Unfortunately, since its inception, it has come under criticism for making it unviable for foreign suppliers to conduct nuclear business in India with the risk of that kind of liability being "channelled" to the suppliers.[22] This led to a slowdown in foreign investments for some time, dominated by confusion and misinterpretation rather than substantial hurdles. India plans to construct about 60 new nuclear reactors and has been in talks with giants like AREVA, Westinghouse Electric Co LLC, GE, etc. in this regard. Russia is separately building six reactors in southern India and is aiming for more. Any lack of clarity

21. The Ministry of Law and Justice, Government of India, "The Civil Liability for Nuclear Damage Act", 2010, http://lawmin.nic.in/ld/regionallanguages/THE%20CIVIL%20LIABILITY%20OF%20NUCLEAR%20DAMAGE%20ACT,2010.%20%2838%20OF2010%29.pdf. Accessed on February 13, 2016.
22. Suhasini Haider, "No Change in Nuclear Liability Law: MEA", *The Hindu*, 2015, http://www.thehindu.com/news/national/mea-on-indous-negotiations-no-changes-to-the-law/article6871193.ece. Accessed on February 15, 2016.

or confusion over the Indian liability law can become a hurdle in the enthusiasm of foreign players to freely participate in techno-commercial cooperation with India. According to French Ambassador François Richier, "We will abide by the Indian law. The Indo-French dialogue on the nuclear liability issue has been transparent."[23] However, the issue of liability can act as a hurdle if not tackled appropriately. The President of AREVA India Pvt. Ltd. said in an interview in Mumbai last year that the Indian government has "taken some measures to address the concerns of suppliers, however, details are yet to come out. We don't have clarity on how these concerns will be addressed and how it will translate into economic and legal impact."[24]

AN ASSESSMENT

India wants to increase its nuclear capacity to 63,000 Mega Watts (MW) by 2032, from the existing 5,780 MW. The project is indeed ambitious and its fruition depends on several factors. Indo-French nuclear cooperation is an important part of this ambition to move away from fossil fuels for energy generation and sustainably proceed to fulfil India's growth and development needs without affecting the environment. AREVA, the French-based nuclear power giant has been contracted to construct the reactors at Jaitapur in Maharashtra. There are expectations from it to fulfil the promised construction within the estimated time, quality and costs. The recent days have certainly communicated distress signals from AREVA and its performance globally. India has stood firmly with France in this deal though the fact cannot be discounted that India is presently concerned about the future of the deal and the delivery of the nuclear reactors on time. It will be India's maiden journey to try the European Pressurised Reactors (EPRs), a new evolutionary design which has been untested in the country so

23. "Nuclear Liability Law No Hurdle for France: François Richier, French Ambassador", *Economic Times Bureau*, October 10, 2013, http://articles.economictimes.indiatimes.com/2013-10-10/news/42903063_1_areva-safety-review-jaitapur-project. Accessed on February 13, 2016.
24. Rajesh Kumar Singh, "Areva's India Nuclear Plans Await More Clarity on Liability Laws", *Bloomberg*, October 28, 2015, http://www.bloomberg.com/news/articles/2015-10-28/areva-s-india-nuclear-plans-await-more-clarity-on-liability-laws. Accessed on February 14, 2016.

far. For the success of this techno-commercial cooperation, it is imperative for France to remain dedicated to the fulfilment of the committed quality. India needs to keep a close eye on developments at AREVA. The three chief critical area of Indian concerns are: (a) the expected delivery of two reactors in 2016; (b) the quality of the EPRs; and (c) the costs. The Indian Prime Minister has expressed his faith in his French counterpart and is proceeding on his quest for energy security and elimination of the energy deficit through clean, economic and reliable sources like nuclear energy, solar energy and wind energy. Nuclear energy has been the top priority in moving towards the 'renewable sources' due to the unavoidable limitations of immediate rapid expansion and investment in the latter two and the benefits, scope and potential of nuclear energy for India.

IMPACT OF NUCLEAR WEAPONS ON THE EXPECTED NATURE OF WAR: AN INDIAN PERSPECTIVE

VIVEK KAPUR

The presence of nuclear weapons cannot be wished away and these weapons do impact the utilisation of conventional military forces. It is indeed necessary, while examining the external security environment, to understand the impact of nuclear weapons on the employment of conventional military forces, in the process providing some clarity and removing a few common misconceptions about the security provided by nuclear weapons and the likelihood of war under the nuclear overhang.

NUCLEAR WEAPONS DEVELOPMENT AND PROLIFERATION

Nuclear weapons have been sought by states since the invention of these devastating weapons in the 1930s to mid-1940s[1] for the immense power that these weapons possess. The effect of nuclear weapons on security is complex, especially as these weapons can increase and, paradoxically, even reduce a nation's security. Some aspects of

Group Captain **Vivek Kapur** is a Senior Fellow at the Centre for Air Power Studies, New Delhi.

1. "Invention and Discovery: Atomic Bombs and Fission", http://nuclearweaponarchive.org/Usa/Med/Discfiss.html. Accessed on March 17, 2016.

nuclear weapons as tools of security are analysed, leading on to India specific aspects.

Nuclear weapons remain a currency of power today and are expected to continue to be so in the future, the number of nuclear capable states in existence being the current nine (the USA, Russia, China, France, the UK, India, Israel, Pakistan and North Korea)[2] with the possible addition of one more Asian country (Iran or Japan) in the foreseeable future.

Over the years, since their advent in the 1940s, it has come to be recognised that nuclear weapons are not actually usable in war due to their devastating effects. Till date, as far as is known, no viable method of fighting a nuclear war, in a situation of near nuclear symmetry / parity, without causing long-term damage to both opponents in the conflict, has been found.

Nuclear weapons, with the possible exception of low yield "tactical" nuclear weapons, are most likely to be used in situations of nuclear asymmetry, where one side possesses these and the other side does not, as the fear of similar retaliation is absent in such a case. This is the only situation in which nuclear weapons have actually ever been used in war, in the horrific US attacks on Hiroshima and Nagasaki on August 6, 1945, and August 9, 1945, respectively.[3] However, the prospect of widespread environmental radioactive contamination for decades post use of nuclear weapons, which is expected to make vast areas on a continental scale unfit for human habitation, with trans-national adverse effects caused by the spread of radioactive contamination on a near global scale due to the prevailing global wind patterns, is a powerful restraining factor against the use of nuclear weapons today.

The nuclear weapons doctrine places emphasis on deterrence of war that is "conflict avoidance rather than victory in conflict". Keeping in mind that a nuclear doctrine is essentially a "mind

2. Amanda Macias, "Nine Nations Have Nukes: Here's How Many Each Country Has", http://www.businessinsider.in/Nine-Nations-Have-Nukes-Heres-How-Many-Each-Country-has/articleshow/36724379.cms. Accessed on April 8, 2016.
3. "Atomic Bombings of Hiroshima and Nagasaki," Wikipedia search, Atomic Bombings of Hiroshima and Nagasaki. http://en.wikipedia.org/wiki/Atomic_bombings_of_Hiroshima_and_Nagasaki. Accessed on March 25, 2016.

game",[4] militarily weaker nuclear capable nations could be expected to express a 'first use' doctrine in order to deter the more powerful conventional forces of likely adversaries, while militarily more capable nations with a viable second strike capability would proclaim a 'no first use' doctrine. India is likely to fall into the latter category, primarily due to its historical focus on Pakistan (a militarily and economically weaker country in comparison to India). Though India has professed a 'no first use' doctrine, a credible second strike capability is still several years from realisation. It is expected that India's nuclear weapons, after development of a credible second strike capability, would be used primarily to prevent coercion by more powerful nuclear nations such as China, Russia and possibly the US. Of these three nuclear powers, India should be able, in a few years, when the 3,500-km to 5,000-6,000-km range Agni-III, Agni-IV, and Agni-V missiles respectively are finally inducted into service, to strike deep into China, at Beijing, northeast China and Shanghai.[5] The ability to deter Russia and the US will have to wait for several years till India is able to induct Intercontinental Ballistic Missiles (ICBMs), Submarine Launched Ballistic Missiles (SLBMs) and / or hypersonic aerospace craft that by their nature confer rapid global reach and, if inducted into Indian Air Force (IAF), could give the capability to deliver payloads anywhere on Earth extremely rapidly.

EFFECT OF NUCLEAR WEAPONS ON INTER-STATE CONFLICT

Nuclear weapons provide deterrence against open classical conventional war between states possessing these – which states number would include today's nine nuclear powers or possibly ten states after the addition of another Asian state.[6] All out conventional

4. Brig Gurmeet Kanwal (Retd), "Pakistan's Nuclear Posture", talk during Nuclear Strategy Capsule at the Centre for Air Power Studies, New Delhi, India, June 19-23, 2006 and November 24-28, 2008.
5. Y. Mallikarjun, "Agni-III Test-Fired Successfully", *The Hindu*, April 13, 2007, http://www.hinduonnet.com/2007/04/13/stories/2007041304010100.htm. Accessed on March 15, 2016; Namrata Tripathi, "India's Agni-V Missile: Five Things You Need to Know", http://www.dnaindia.com/india/report-india-s-agni-v-missile-five-things-you-need-to-know-205706. Accessed on March 26, 2016.
6. Both Japan and South Korea are likely to possess the technological and technical capability to weaponise their nuclear capability, while Iran could, at a later date, do likewise. There are no firm indications regarding these three Asian countries weaponising but the possibility exists and, hence, it cannot be ruled out at a later date.

war may be less likely in the Indo-Pakistan and Sino-Indian scenarios due to the presence of nuclear weapons, but limited conventional operations (such as the Kargil operations), limited (in geographical extent, in objectives or in the forces used) wars and sub-conventional war would persist as would border clashes below the conventional war threshold. The flip side is that the presence of nuclear weapons increases insecurity, especially of a population forced to live in fear of a nuclear attack. Proliferation of nuclear weapons and nuclear facilities leads to fears of non-state actors being able to obtain actual nuclear weapons on the arms black market (ex-Soviet or ex-US nuclear artillery shells / tactical nuclear weapons: a danger that has exercised the minds of security experts the world over since the end of the Cold War and break-up of the erstwhile Soviet Union in the early 1990s);[7] or obtaining radioactive material to field a dirty bomb that aims to cause radioactive contamination in populated areas through dispersal of radioactive material propelled outwards over large areas by means of a conventional explosives bomb. Living in fear of a nuclear attack, being targeted by other nuclear weapon states as a contingency, fear of a nuclear attack by non-state actors all combine to result in nuclear weapons reducing and not enhancing the security of a country's population at large.

India's future nuclear deterrence is expected to be based on the traditional triad with SSBNs (Ship Submersible Ballistic missile carrying Nuclear), a small complement of nuclear armed bombers and land-based mobile Intermediate Range Ballistic Missiles (IRBMs) / Medium Range Ballistic Missiles (MRBMs) / ICBMs. Of these weapon systems, the MRBMs and IRBMs, in the form of the Agni-II and Agni-III missiles are nearing full operationalisation but the ICBMs are yet to be fully developed. The indigenous programme to develop an SLBM (codenamed the K-15 missile and longer range K-4 missile)[8] is underway and, as per reports in the press, the Indian designed and built nuclear powered submarine, the Advanced Technology Vessel (ATV) INS *Arihant*, is expected to become ready for induction into the

7. "Loose Nukes", January 1, 2006 http://www.cfr.org/weapons-of-mass-destruction/loose-nukes/p9549. Accessed on March 28, 2016.
8. Aditya Bhat, "DRDO Secretly Tests Nuclear-Capable K-4 Underwater Missile: Report", http://www.ibtimes.co.in/drdo-secretly-tests-nuclear-capable-k-4-underwater-missile-report-669985. Accessed on March 29, 2016.

combat fleet in the near future.[9] In order to train its submarine crews for the operation of a nuclear powered submarine, India has obtained a Russian Akula-II Project 971 nuclear powered attack submarine on a ten-year lease from Russia, and there are stray reports of the Indian desire to obtain another similar vessel on lease from Russia.[10] India, even after induction of these advanced weapon systems would (most likely) retain its "no first use" doctrine, possibly reiterating that these weapons would not be used against states that do not themselves possess or use Weapons of Mass Destruction (WMDs) (which definition is likely to be logically expanded to cover not just nuclear, but chemical and biological weapons also). India has professed a "no first use doctrine" with regard to nuclear weapons. China has also announced a "no first use" doctrine but the Chinese position is rather ambigious. What China says and does are often quite different things. The Chinese behaviour at the Nuclear Suppliers Group (NSG) meetings in 2008 where it tried to scuttle the Indo-US nuclear deal through attempts to delay the decision on grant of a waiver to India after publicly assuring New Delhi and Washington that it would not come in the way of the NSG waiver, and the publicly proclaimed Chinese policy of being against all forms of terrorism but in action thrice vetoing the placement of terrorist organisations such as the Lashkar-e-Tayyeba (LeT) and its front organisations on the UN's list of terrorist groups show that what China says cannot be trusted to be what it finally does. Recently, China blocked the placing of Masood Azhar on the UN sanctions list on a technicality.[11] These instances lead to a total disbelief in the publicly stated Chinese desire for a "peaceful rise". Hence, it follows that China is likely to abandon its "no first use" policy if it finds that this suits it at any time in the future,

9. Manu Pubby, "India's First Nuclear Submarine INS *Arihant* Ready for Operations, Passes Deep Sea Tests", *The Economic Times*, February 23, 2016, http://economictimes.indiatimes.com/articleshow/51098650.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst. Accessed on April 1, 2016.
10. Ankit Panda, "Will India Lease Another Russian Nuclear Submarine?", *The Diplomat*, March 2015, http://thediplomat.com/2015/03/will-india-lease-another-russian-nuclear-submarine/. Accessed on April 1, 2016.
11. "Masood Azhar Doesn't Meet UN Criteria to be Banned as Terrorist: China", http://indianexpress.com/article/india/india-news-india/chinas-pro-pakistan-stance-becomes-clearer-says-masood-azhar-doesnt-meet-un-criteria-to-be-banned-as-terrorist/#sthash.bkSdfL26.dpuf. Accessed on April 2, 2016.

possibly without publicly announcing the shift in policy. Moreover, in the process of its rise to great power status, it is likely to be less than peaceful in dealing with India which is expected to be close at its heels and poised to speed ahead of China towards the latter half of this century. Pakistan has as yet not made any official declaration regarding its nuclear doctrine. However, a fairly good picture of Pakistan's ambiguous nuclear doctrine emerges from an interview of Gen Khalid Kidwai who was in charge of Pakistan's nuclear arsenal in 2004. According to Gen Kidwai, a nuclear attack by Pakistan is possible under the following conditions: If India,

- Annexes Pakistan's territory.
- Destroys a large part of its land forces.
- Tries to impose a naval blockade.
- Coerces Pakistan into political destabilisation or creates large-scale internal subversion in Pakistan.[12]

It could be argued that overt nuclearisation has effectively blunted India's advantage in conventional forces over Pakistan as Pakistan professes a first use nuclear doctrine. In other words, Pakistan will use nuclear weapons if attacked by India even if the attack is with conventional weapons, if the four red lines stated above are reached or breached. Professor Stephen P. Cohen feels that Pakistan would use what he calls an "option-enhancing policy" for a possible use of nuclear weapons. This would entail a stage-by-stage approach in which the nuclear threat is increased at each step to deter India from an attack or an unconditional victory post attack.

- The first step could be a public or private warning.
- The second step may be a demonstration explosion of a small nuclear weapon on its own soil.
- The third step would be the use of a few nuclear weapons on its own soil against Indian attacking forces.
- The fourth stage would be a nuclear weapon used against critical but purely military targets in India across the border with Pakistan. Probably in thinly populated areas in the desert or semi-desert, causing least collateral damage.

12. Rai Singh, "Auditory Challenge", http://www.southasianmedia.net/index_opinion4.cfm?id=34731. Accessed on April 1, 2016.

This gradual escalation as listed above, may, in Professor Cohen's opinion, prevent Indian retaliation against cities in Pakistan. [13]

The presence of nuclear weapons in India's neighbourhood cannot be wished away. Here it is relevant to understand that the mere presence of nuclear weapons does not deter war completely. The presence of nuclear weapons does, however, make the conduct of conventional warfare somewhat different. However, it needs to be clearly understood that there is considerable room for the conduct of conventional military operations, albeit of a somewhat different kind.

The kind of conventional military operations that may be feasible is a subject of study at various levels of several military forces all over the world. Very simplistically, the use of conventional military forces, under a nuclear overhang, should be possible as long as the objectives and long-term implications of the use of such conventional forces are not too drastic for the other party involved in the conflict. Some degree of restraint, however, could be expected in the utilisation of conventional military forces when operating under the nuclear overhang. Restrictions and restraint in utilisation of conventional military forces could be in terms of time, impact, duration, intensity and depth of attack, and kinds of targets addressed, etc. For almost all countries, nuclear weapons are weapons of last resort. This means that the likelihood of use of nuclear weapons is stronger when the political, diplomatic, economic , and military means of ensuring the continuity of the nation have failed and only nuclear weapons remain unused and available. A country's leadership could justify the use of nuclear weapons in such a situation through arguing that there is no choice as all other means have failed to deliver and the responsibility of ensuring the survival of the country and its inhabitants requires the use of the nuclear option. As an extension of this line of thought, it can be argued that, given the widespread international opinion against the use of nuclear weapons, in circumstances where other tools, diplomatic, political, and military means, are available to a country to ensure its survival and the safety and prosperity of its population, the use of nuclear weapons would be very unlikely

13. Lt Gen (Retd) Sardar FS Lodi "Pakistan's Nuclear Doctrine", *Defence Journal*, April 1999, http://www.defencejournal.com/apr99/pak-nuclear-doctrine.htm. Accessed on April 1, 2016.

in a situation of rational leaders being in power in the national government and military spheres. Hence, as long as the utilisation of conventional military forces does not threaten the existence of the opposing country and does not cause such destruction that the livelihoods of the opponent's population are threatened to the extent of death becoming a viable alternative for them, conventional military forces should be fully usable despite the presence of nuclear weapons. Thus, it is argued that conventional military forces are very usable in a war between states that possess nuclear weapons and there is sufficient scope for a conventional war under a nuclear overhang. There are a few differences from the manner of conduct of conventional war that should be considered. The earlier utilisation of very powerful armoured forces in terms of armour heavy formations like the erstwhile USSR's Operational Manoeuvre Groups (OMGs),[14] that combined massed Main Battle Tanks (MBTs) with integrated artillery, and aviation assets in terms of attack helicopters and Surface-to-Air Missiles (SAMs) may be unusable. OMGs were designed and deployed to exploit their inherent high manoeuvrability to cut through enemy defences and to penetrate very deep behind enemy lines to cause widespread destruction of opposing military forces and political / economic centres.

In the Indian context along the western borders, the utilisation of powerful and near unstoppable heavily armoured strike formations designed to almost cut the western opponent in half through a deep penetration east to west may not be feasible when operating under the nuclear overhang. Such an operation, if successfully executed, could threaten the existence of the opponent and push the opponent's leadership to opt for the weapon of last resort. Therefore, ground operations across the western border may require being relatively shallow and aimed at gaining advantages that can be capitalised on for political objectives well short of the destruction of the opposing country. Even air operations may require a recalibration through careful vetting of the target lists to remove targets that could push the opponent towards his destruction. There is still adequate scope to

14. "1971-1985 - Operational Maneuver Groups", *Globalsecurity.org*, http://www.globalsecurity.org/military/world/russia/army-cccp-omg.htm. Accessed on May 26, 2016.

inflict appreciable punishment on the opposing state through careful execution of attacks, both on the ground and from the air. The targets addressed and the weight of attacks, though, could be controlled in order for the attacks to send the required message without being more destructive than planned.

The definition of what situation will comprise victory and the achievement of planned objectives would also require a revisit. Wars of earlier times were usually aimed at the full and unconditional surrender of the opponent, leading to major changes in the structure of the loser's governance, structure of the state, etc. These objective may be readjusted to suit the prevailing situation of presence of nuclear weapons. Here it is important to point out that air forces, due to the very nature of air power, are likely to be the most effective and capable of grading the punishment meted out to the opposing country without crossing the threshold that could trigger a nuclear response. Hence, more effort should be devoted towards strengthening the nation's air power capabilities.

The development of Ballistic Missile Defence (BMD) systems has often been termed as destabilising. This is because the presence of a BMD system with one party provides it with some level of assurance of safety from an enemy nuclear attack. This perceived safety could lower this side's threshold to use its own nuclear armed ballistic missiles on the assumption that the other side will be unable to retaliate effectively enough to be a real danger. India's Defence Research and Development Organisation (DRDO) is developing the Advanced Air Defence (ADD) system [An Anti-Ballistic Missile (ABM) system]. Once it is operationalised, it may give protection against ballistic missile attacks to critical parts of the country such as the most vital political, financial and economic / industrial nodes. Defending the entire Indian landmass is likely to be too exorbitantly expensive even in the future. There is a necessity to defend carefully chosen locations in the country such that the enemy feels that any nuclear strike by him is unlikely to have the desired effect on India and so, hopefully, leading him to desist from a nuclear attack.

Conventional war between India and China could be expected to be generally avoided due to the potential risks of miscalculation and nuclear escalation quite apart from the economic development

imperative in India and China for the next few decades. This situation is expected to lead to primacy of Low Itensity Conflict (LIC) and sub-conventional warfare as the main means of conflict for nuclear states (India-Pakistan, China-India) as also for relatively weaker states against more powerful states [Syria / Iran vs Israel, Afghanistan (Taliban) / other Islamic radicals (Iraq, Islamic State-IS, Palestinians, etc.) vs US and its allies]. However, limited conventional war with modifications to reduce the risks of going nuclear, as discussed earlier, could still be possible.

In today's world wherein non-state actors are willing to undermine states from within and states are indulging in proxy wars through terrorist / separatist groups, the relevance of a state's nuclear deterrence capabilities is in doubt. Such weapons and their doctrines seem more suited to the second half of the 20th century predominated by conventional war between nation-states than the 21st century where non-state actors are emerging as the main threat to countries across the globe. While a state's nuclear deterrent posture may deter nuclear or conventional attacks by other states, it is unlikely to work against highly motivated non-state actors willing to die for their cause. Possession of nuclear weapons by Russia, India and Israel or even the US and UK has not deterred insurgencies and terrorism on their soil. Here the theory of Unrestricted War (UW) may be relevant.[15] However, despite the apparent uselessness of nuclear weapons in countering the new threats to national security, as no nuclear weapon state is willing to give up nuclear weapons, possession of such weapons by India continues to be a requirement to hedge against a future conflict situation with such a nuclear armed state and to avoid nuclear blackmail.

As a result of the increase in the number of nuclear states, the nature of the threat to national security is expected to change further from the hostile conventional military forces to be more from Non-State Actors (NSAs)/ deniably supported proxies (like the Pakistan supported Jammu and Kashmir militants) and Pakistani attempts to deny the complicity of the LeT and Pakistani citizens who are caught perpetrating terrorist activities in various parts of the world, from the UK, Europe, Africa and the US to South Asia.

15. Martin Van Creveld, *On Future War* (UK: Maxmillan Group, 1991), p. 42.

However, conventional wars, though less likely, will remain a possibility, forcing retention of conventional forces, especially in view of the fact that conventional military forces cannot be built up overnight if their requirement arises. A consequence of this is that conventional military forces will increasingly require adapting to be able to contribute more effectively to anti-NSA / LIC operations in addition to their present ability to engage in conventional inter-state warfare. This situation increases the challenges manifold for military forces the world over and is especially applicable to India, given the nature of the threats it faces along its land borders and coastlines.

In sum, the effect of nuclear weapons is that their presence with belligerent nations has overall reduced, but not eliminated, the probability of open conventional war between countries that possess these weapons while making LIC, sub-conventional and 4th Generation Warfare [such as Unrestricted Warfare (UW)] more likely.

Over time, it is likely that new areas of war may emerge, ranging from economic warfare, cyber warfare, ecological warfare, etc. Such developments could force a major revamp of nation-states' armed forces and other organs of national security.

CONCLUSION

The spread of nuclear weapons has provoked a high level of intellectual debate on their utility. It has been deduced that nuclear weapons have reduced inter-state warfare between nuclear armed states. It is also recognised that nuclear weapons are more of deterrent value than actual war-fighting weapons. In certain situations, nuclear weapons are seen to reduce rather than increase a country's security. In the Indian context, the possession of nuclear weapons by India, China and Pakistan has reduced the probability of conventional war in the region. On the other hand, the presence of nuclear weapons has given an impetus to LIC and terrorist operations, especially in the Indo-Pakistan context. It is clear that there is adequate space for conventional war under the nuclear overhang. Such conventional war against the nuclear backdrop is likely to be limited in objectives, geographical spread and duration. These changes, spurred by nuclear weapons, have made the task of military forces far more complex and demanding. Modern military forces, especially in India's case,

require the ability to engage in traditional conventional warfare while also putting in place robust capabilities to engage, and win, in unconventional operations. It appears certain that the armed forces will require to be reorganised in major ways to cope with the myriad demands being placed on them today, with such demands only increasing in scope and intensity over the following decades.

CHALLENGES OF CYBER SECURITY TO NUCLEAR INFRASTRUCTURE

E DILIPRAJ

The cyber domain, widely claimed as the fifth domain of warfare, has revolutionised the way the world functions within a short span of two-three decades since its emergence in the late 20th century. The dependency on this domain for everyday life has grown to such an extent that any disruption to this service would cause heavy damage to people's lives. Moreover, in the current networked scenario, all the other four domains of warfare, namely, land, sea, air and space are also dependent on the cyber domain, owing to its ability of interconnectivity. This dependency on the cyber domain makes the aspect of cyber security an important phenomenon in all walks of life.

Since cyber technology has penetrated every possible field in the world for various reasons, nuclear technology is no exception. All forms of nuclear infrastructure like civilian nuclear power plants, nuclear research facilities and military nuclear installations use cyber technology for day-to-day operations. The sensitivity of security to nuclear infrastructure is a well known fact. Moreover, the nuclear infrastructure of a country is part of the state's critical information infrastructure. A 'critical information infrastructure'

E Dilipraj is an Associate Fellow at the Centre for Air Power Studies, New Delhi.

is defined by Section 70 of the Indian IT Amendment Act, 2008, as "the computer resource, the incapacitation or destruction of which, shall have debilitating impact on national security, economy, public health or safety."[1] Therefore, any disruption or destruction of the cyber resources in the nuclear infrastructure could be devastating for a country. Hence, providing effective cyber security to nuclear infrastructure is not only important for securing a country's nuclear programme but also safeguarding its national interest.

CYBER THREATS TO NUCLEAR INFRASTRUCTURE

High technology cyber resources are employed in the nuclear infrastructure like nuclear power plants to operate equipment, to obtain and store vital and sensitive data/information, to link networks across the plant, to monitor and control equipment health and to operate emergency functions. Hence, several key systems like monitoring and Process Control Systems (PCS), Supervisory Control and Data Acquisition (SCADA), Distributed Control Systems (DCS) and Physical Protection Systems (PPS) that function on cyber resources are vulnerable to cyber threats. In the current global scenario, malicious cyber activity is growing at an unprecedented scale, with extraordinary sophistication of attacks, and is likely to continue to do so in the foreseeable future.[2]

Considering the sensitivity of, and the level of security to, any nuclear infrastructure, a cyber attack on such installations would be a customised attack, precisely targeting the infrastructure, which needs meticulous planning and execution after undergoing a thorough study of the existing security mechanisms and the plants' networks. The possible methods of a cyber attack on a nuclear infrastructure may include methods like:

- Exploiting an insider (insider threat);
- Social engineering method; and
- Supply chain contamination method.

These methods can be effectively used to conduct a number of cyber attacks like Denial of Service/Distributed Denial of Service

1. Information Technology (Amendment) Act 2008, No.10 of 2009, February 5, 2009.
2. Robert Anderson, et al, "Cyber Threats to Nuclear Infrastructures", *Idaho National Laboratory*, INL/CON-10-17777, July 2010.

(DoS/DDS) attacks, Botnet attacks, SQL injection, viruses, worms, Trojans, ransomware attacks, etc. Such cyber attacks on nuclear infrastructure, when successful might result in disruption and destruction of data/ information and service of the plant which might in turn create a sort of chaos and panic among the society.

Additionally, it is a widely held belief that the computer resources in critical infrastructure like nuclear power plants would be isolated from the other networks even within the campus and they may not be accessible through the internet, therefore, cyber attacks on these air-gapped systems are impossible. While the aspect of isolation is true for certain highly sensitive computer resources, probably inside the plant, the fact remains that precisely targeted attacks are specifically customised in order to overcome this aspect of isolation. Moreover, with the current sophistication in hacking techniques, isolating a system or a network alone is not enough for securing the same as many new methods are emerging now, especially for hacking into isolated/ air-gapped systems. The following are a few methods to hack into isolated/ air-gapped computers:

- Airhopper – Hacking into an isolated computer using FM signals.[3]
- Bitwhisper – Hacking air-gapped computers using heat.[4]
- Side-channel attack – To extract secret decryption keys from air-gapped computers.[5]
- Extracting data using electromagnetic waves with the help of a mobile phone and malware installed on the targeted system.[6]

Also, some networks like office networks in the same infrastructure which are connected to the internet can also be compromised, irrespective of the level of security architecture in place, to gather

3. Mohit Kumar, "Airhopper – Hacking into an Isolated Computer Using FM Radio Signals", *The Hacker News,* October 31, 2014, http://thehackernews.com/2014/10/airhopper-hacking-into-isolated.html. Accessed on May 5, 2016.
4. Swati Khandelwal, "Hacking Air-Gapped Computers Using Heat", *The Hacker News*, March 24, 2015, http://thehackernews.com/2015/03/hacking-air-gapped-computer.html. Accessed on May 5, 2016.
5. Swati Khandelwal, "How to – Stealing Decryption Key from Air-Gapped Computer in Another Room", *The Hacker News,* February 15, 2016, http://thehackernews.com/2016/02/hacking-air-gapped-computer.html. Accessed on May 5, 2016.
6. Mohit Kumar, "Hacking Air-Gapped Computer using A Simple Cell Phone", *The Hacker News*, July 27, 2015, http://thehackernews.com/2015/07/hacking-air-gapped-computer.html. Accessed on May 5, 2016.

sensitive information or to interrupt the operations of the plant. Such an attack on the office networks of a nuclear infrastructure might disturb the smooth operations of the nuclear infrastructure. Also, if the office networks are connected to the plant control network for data collection, monitoring and control, then that link becomes the vulnerable path for the hackers or the malware to access the plant network directly.

In order to understand the kind of danger that cyber threats pose to nuclear infrastructure, a few real world incidents are examined below.

Davis-Besse v/s Slammer: On January 25, 2003, a computer malware known as 'Slammer' started exploiting the zero-day vulnerability in the Microsoft SQL Server. Within a short period, the malware had infected thousands of servers across the world and the numbers kept increasing every moment. Although Slammer did not carry any malicious payload that would delete or modify any files from the infected systems, the malware copied itself at a rapid rate which resulted in a huge volume of spurious traffic that consumed bandwidth and clogged several networks. The worm resulted in disabling data-entry terminals at a 911 call centre in Washington, shutting down of 13,000 Bank of America ATMs, cancellation of several flights by Continental Airlines due to the failure in their online ticketing system and kiosks, and a nationwide internet outage lasting half a day in South Korea.[7]

To top all these infections, the Slammer malware was also successful in entering the computer systems at the Davis-Besse nuclear power plant in Ohio. Although firewalls existed between the corporate network and the plant network in the infrastructure, a consultant working for the corporate network of First Energy Nuclear, the licensee for Davis-Besse, had created a connection behind the existing firewall to the consultancy's office network. Thus, the worm travelled from the consultant's network to the corporate network, finally, reaching the plant control network and generated huge traffic which clogged the corporate and control networks. As a result, for more than four hours and fifty minutes, the Safety Parameter Display System (SPDS) of the plant became inaccessible which caused a huge hindrance in the smooth functioning of the plant.[8]

7. Brent Kesler, "The Vulnerability of Nuclear Facilities to Cyber Attack", *Strategic Insights*, vol 10, issue 1, Spring 2011, pp. 15-25.
8. Ibid.

Although there was no serious damage to the nuclear power plant, it was only because of the fact that the worm 'Slammer' did not carry any malicious payload, but the alarming fact remains that the malware was successful in reaching and infecting the nuclear power plant system.

South Korean Nuclear Plant Hack: In mid-December 2014, a twitter account handle named *president of anti-nuclear reactor group* was found to be uploading sensitive files related to blueprints and manuals of nuclear reactors, air conditioning and cooling systems, a radiation exposure report, and personal data of employees of the nuclear power plant on the social networking platform.[9] The hacker (it is unclear if it was an individual or a group) had managed to hack and collect internal data of the Korea Hydro & Nuclear Power Co (KHNP), the government company that operates all the 23 nuclear power plants in the country, which was leaked through the social network in stages.

The perpetrator/s further went to the extent of demanding that the authorities shut down three nuclear reactors, namely, Gori-1, Gori-3 and Wolsong-3, starting Christmas Day, warning that *residents near the reactors should stay away for the next few months* if the demand is ignored.[10] However, the authorities conducted a two-day cyber security drill on December 22-23, 2014, across the country on all the nuclear power plants to ensure no further leak of information took place and they did not comply with the demands of the perpetrator/s for shutting down the reactors. Later, in March 2015, after a thorough investigation, the South Korean authorities claimed that the perpetrator/s had collected all the information through cyber attacks which were made between December 9 and 12, by sending 5,986 phishing emails containing malicious codes to 3,571 employees of the nuclear plant operator.[11] Thus, once again, the global nuclear community understood the importance of cyber security through the South Korean nuclear power plant hack episode.

9. "S Korea Nuclear Firm to Hold Cyber-Attack Drills After Hack", *BBC*, December 22, 2015, http://www.bbc.com/news/world-asia-30572575. Accessed on May 8, 2016.
10. "S. Korea Nuclear Plant Hack: 3 Reactors Demanded Closed by Christmas", *RT*, December 22, 2014, https://www.rt.com/news/216599-korea-nuclear-plant-hacked/. Accessed on May 8, 201
11. Ju-Min Park and Meeyoung Cho, "South Korea Blames North Korea for December Hack on Nuclear Operator", *Reuters*, March 17, 2015, http://www.reuters.com/article/us-nuclear-southkorea-northkorea-idUSKBN0MD0GR20150317. Accessed on May 8, 2016.

Although both the abovementioned episodes of cyber attacks on nuclear infrastructure prove the point that nuclear installations are vulnerable to sophisticated cyber attacks, these attacks did not cause much damage. However, the following case study of Iran v/s Stuxnet would help understand the gravity of the danger that a precisely targeted sophisticated cyber attack can create not only for a nuclear infrastructure but also for a country's national interest.

CASE STUDY: IRAN V/S STUXNET

A suitable example to understand the intensity of damage a successful cyber operation against a nuclear infrastructure can cause would be the series of events which unfolded in Iran in the recent past that changed the fate of the country's ambitious nuclear programme. Iran had started its ambitious nuclear programme with aid from the US in the 1950s under the then "Atoms for Peace" policy of the US. As the years passed, due to regime change in Iran, the country which was once an ally of the US, became a foe and was put under economic sanctions. The drift between the two countries also affected Iran's nuclear programme. However, with help from Russia and other countries, and through the nuclear black market, Iran sustained and enhanced its nuclear programme. Later, in 2005, when Ahmadinejad became the President of Iran, the nuclear programme gained momentum and Iran began its work towards enrichment of weapons grade uranium. Due to the failure in the talks between the US and Iran, in December 2006, sanctions were imposed by the United Nations, initiated by the US, on Iran, to curb its nuclear programme. However, these sanctions were not successful in getting the desired results and Iran managed to move forward in its nuclear programme.[12]

Nevertheless, in 2008, the centrifuges in the Natanz nuclear facility in Iran began to face unprecedented crashes. These breakdowns, which seemed to be like small random accidents, continued till Spring 2010 and the engineers in the facility were clueless about the reason for those crashes. In Spring 2010, the situation in the Natanz facility began to deteriorate further when the centrifuges in the facility started to function in a haphazard manner which was followed by more frequent

12. "Timeline on Iran's Nuclear Programme", *New York Times*, November 24, 2014, in http://www.nytimes.com/interactive/2014/11/20/world/middleeast/iran-nuclear-timeline.html?_r=2#/#time243_7215. Accessed on December 10, 2014.

and high intensity breakdowns, thus, affecting the whole nuclear programme of Iran. During this period, the engineers struggled to decipher the reasons behind the disruptions in the Natanz nuclear facility. It was later discovered by Symantec, a cyber security products manufacturing company, that a highly sophisticated computer worm had affected the controller systems or Supervisory Control and Data Acquisition (SCADA) systems in the facility.[13] This computer worm was named Stuxnet, thus, becoming the first computer programme to be used as a cyber weapon. Additionally, technical papers started coming out related to its functioning.

Later, Stuxnet started getting media attention and slowly media reports emerged about the origin of this computer worm. It was generally reported across all media that Stuxnet was the result of a joint effort by the US and Israeli intelligence agencies, National Security Agency (NSA) and Unit 8200 respectively. It was reported that way back in 2006 after the negotiations between Iran and the West floundered, the US, during the Bush Administration, started with a covert cyber programme codenamed Olympic Games in order to sabotage Iran's nuclear programme. The engineers at the NSA and Israeli Unit 8200 initially wrote a 'beacon' computer programme that could map the functioning of the Natanz facility and introduced it into the facility, possibly with the aid of an unsuspecting insider. The 'beacon' programme collected and transmitted information related to the facility's computer configurations and more such sensitive information to the agencies. Using the collected data, the engineers again wrote another complex 'worm' programme with the ability to disrupt the facility and, thus, introduced this programme into the computers of the facility through various unknown methods. The worm programme took control of many centrifuges in the facility which made them run either too fast or too slow and, at times, the centrifuges even exploded, thereby the worm succeeded in disrupting the nuclear programme of Iran. Surprisingly, in Summer 2010, the worm programme, due to some programming error, copied itself into the laptop of an Iranian scientist who worked in the facility. When the scientist connected the same laptop to the internet, the worm spread itself to other parts of the

13. "How a Secret Cyber War Program Worked", *New York Times*, June 1, 2012, http://www.nytimes.com/interactive/2012/06/01/world/middleeast/how-a-secret-cyberwar-program-worked.html?ref=middleeast. Accessed on December 11, 2014.

world through the internet and this was when the world community took notice of such a malicious programme. It was later revealed by the cyber research community that the Stuxnet programme that had spread through the internet, was only one version of the various programmes written under the Olympic Games project and many such variants were utilised on the facility in order to disrupt and sabotage Iran's nuclear programme. The Stuxnet had ably used some 'zero-day' vulnerability in the Siemens Step 7 software, which was widely used in the facility, to cause disruption. It was also reported that when Obama became the US President in 2009, his predecessor, President Bush successfully persuaded him to continue with the Olympic Games project by highlighting its importance.[14]

In 2013, Symantec came up with a research paper exclusively on Stuxnet, describing its evolution and different variants (Table 1). This report ascertained that Stuxnet 0.5 was the oldest known Stuxnet version which was in the process of development as early as 2005 and it was in the wild since November 2007. Stuxnet 0.5 was less aggressive than its later versions, especially than Stuxnet 1.x.[15] Some highlighting dates and their relevance about different versions of Stuxnet are mentioned in Table 1.

Table 1: Evolution of Stuxnet Versions

Version	Date	Description
0.500	November 3, 2005	C&C server registration
0.500	November 15, 2007	Submit date to a public scanning service
0.500	July 4, 2009	Infection stop date
1.001	June 22, 2009	Main binary compile timestamp
1.100	March 1, 2010	Main binary compile timestamp
1.101	April 14, 2010	Main binary compile timestamp
1.x	June 24, 2012	Infection stop date

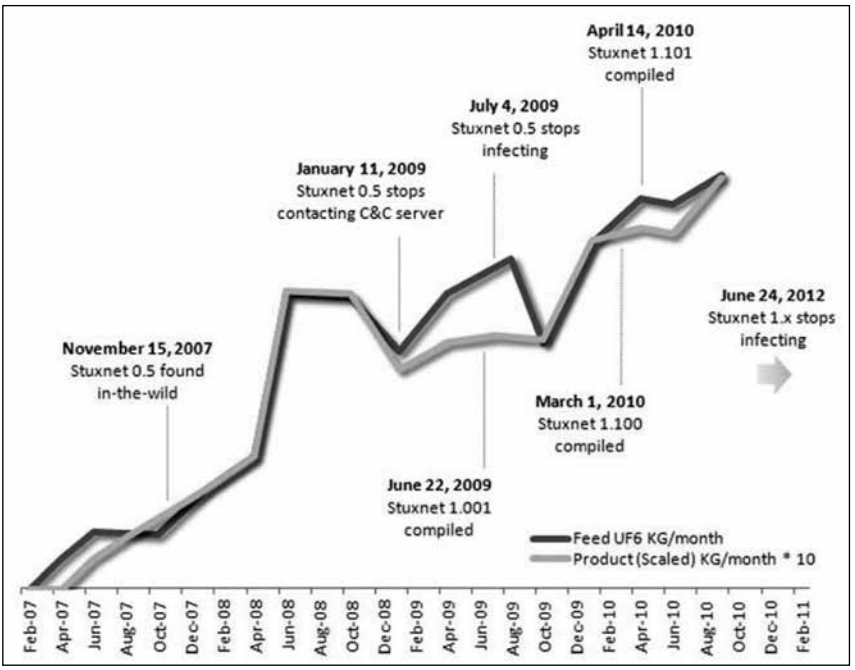
Source: Geoff Mcdonald, Liam O Murchu, Stephen Doherty and Eric Chien. "Stuxnet 0.5 – The Missing Link", *Symantec*, version 1.0, February 26, 2013.

Fig 1 refers to the uranium enrichment production at Natanz and key milestones of Stuxnet, development. Interestingly, the

14. Ibid.
15. Geoff Mcdonald, Liam O Murchu, Stephen Doherty and Eric Chien. "Stuxnet 0.5 – The Missing Link", *Symantec*, version 1.0, February 26, 2013.

highlighting dates in Stuxnet's life cycle coincide with the dips in feed or production amounts and lower levels of production given the same or greater feed amounts (shown as gaps between the two lines).

Fig 1: Low Enriched Uranium Production and Milestones in Stuxnet Coincidences



Source: Geoff Mcdonald, Liam O Murchu, Stephen Doherty and Eric Chien. "Stuxnet 0.5 – The Missing Link", *Symantec*, version 1.0, February 26, 2013.

Although the operational success of different variants of the Stuxnet worm remains unclear, it has succeeded in achieving various other aspects. These are:

- This computer programme has succeeded in making cyber weapon a reality.
- Different variants of Stuxnet together succeeded in delaying Iran's nuclear programme by one and a half to two years.
- The Stuxnet episode that disrupted Iran's nuclear programme has instilled fear about the prospective danger of cyber weapons in the mindset/ psyche of the world community.

- Most importantly, the Stuxnet episode might have been one of the highlighting reasons which changed the mindset of the Iranian political circles and persuaded them to return to the diplomatic table and discuss Iran's nuclear programme with the West.

Therefore, this episode of the Iranian nuclear programme v/s Stuxnet cyber weapon is a clear example of what precisely targeted sophisticated cyber operations are capable of in causing destruction to a nuclear infrastructure/ programme and in general to a country's national interest and security or even in creating a change of balance in international politics.

PREPAREDNESS INITIATIVES

It is clear from the case study and the other two episodes that cyber threats to nuclear infrastructure around the world are imminent and there is a pressing need for high level cyber security. Realising this fact, countries around the world have taken individual and collective initiatives in this regard to secure and safeguard their critical information infrastructure.

On the part of global organisations, the International Atomic Energy Agency (IAEA), an international organisation that seeks to promote the peaceful use of nuclear energy and functions under the United Nations, has formulated both legal and technical guidelines. A technical guidance reference manual was released in 2011 by the IAEA titled *Computer Security at Nuclear Facilities* which has brought together the knowledge and experience of specialists, who have applied, tested and reviewed computer security guidance and standards within nuclear facilities. Since the safety and security of nuclear infrastructure are sole responsibilities of sovereign nations, the IAEA and other multilateral initiatives extend only advisory help.[16]

India, on its part, has taken serious steps towards the cyber security of its national critical information infrastructure in general and its nuclear infrastructure in particular. The National Critical Information Infrastructure Protection Centre (NCIIPC) was set up under Section 70A of the IT Act, NCIIPC, under the National Technical

16. Sitakanta Mishra, "Cyber Threat to Nuclear Installations", *Scholar Warrior*, Autumn 2012, pp. 110-113.

Research Organisation (NTRO), and was declared as the nodal agency for the protection of critical information infrastructure of the country. NCIIPC under NTRO came up with a detailed policy document in June 2013 titled *Guidelines for Protection of National Critical Information Infrastructure*, especially focussing on the cyber security aspect for the country's critical facilities. This policy document called for appointing a Chief Information Security Officer (CISO) in all critical information infrastructure who would be assisted by a group of individuals and this group would be collectively responsible for the information security of that particular facility. It also called for framing strict cyber security architecture in every critical infrastructure under the supervision of the CISO and his team.

India's concern for cyber security of nuclear infrastructure was also evident from the country's National Progress Report, presented in the Nuclear Security Summit 2016 where it was stated, "Addressing the growing challenges of threats to computer, network and information systems is a national priority. Utilising the extensive expertise available in the country, a hierarchy of on-site cyber security architecture has been deployed and also a number of sophisticated products and services like Secure Network Access System (SNAS) have been developed and deployed for protection of the cyber security in the country."[17]

SNAS is a cyber security service developed by the Bhabha Atomic Research Centre (BARC) and is extensively – but not limited to – utilised in the nuclear infrastructure of the country for ensuring cyber security. It has several modules, one of which is the network admission control which detects, identifies, and authenticates the end-system and end-network. Unless a system is supposed to be in the network, SNAS will not allow it to be integrated into the network. The network behaviour and anomaly module continuously monitors the network to detect any malicious behaviour in terms of network traffic. If there is a certain increase in the network traffic from a particular node or if certain applications are being spawned by a particular system or even if there is a denial of service, then SNAS would isolate the whole

17. "India's National Progress Report, Nuclear Security Summit 2016", Ministry of External Affairs, Government of India, April 2, 2016, http://www.mea.gov.in/bilateral-documents.htm?dtl/26590/Indias_National_Progress_Report_Nuclear_Security_Summit_2016. Accessed on May 10, 2016.

system. Another most important aspect of SNAS is the firewalls that create barriers between zones. SNAS dynamically changes the rules of the firewalls, depending on the end-system security stage. The moment SNAS detects a change in the security state, it changes the firewall and isolates the system from that particular zone.[18]

CONCLUSION

In the current scenario, India's critical information infrastructure, including nuclear facilities are well protected from cyber threats, both legally and technically. However, the cyber security community of the country has to be vigilant even in the future as the cyber threat vector is a highly unpredictable zone and the effect of one deadly cyber attack on a critical infrastructure is enough to change the scenario from secure to chaos.

In conclusion, it can be said that despite the advancements, cyber technology in its current form is still in a toddler's stage as its full potentials are yet to be discovered and utilised. Therefore, as a fast evolving technology, increasingly, issues and challenges related to its security would emerge in the future, to tackle which, the security community needs to become competent enough. The need to effectively tackle these cyber security challenges to the critical infrastructure sector is essential as there is too much at stake, including a country's pride and national interest. Ironically, it would be such critical information infrastructure that would become the primary target for an adversary in future wars which would be mostly fought through networks and the electromagnetic spectrum. Hence, cyber security and cyber security personnel would become the first line of defence not only for the critical information infrastructure, including the nuclear infrastructure, but also for the whole country.

18. Rita Guenther, Micah Lowenthal, Rajaram Nagappa and Nabeel Mancheri, *India-United States Cooperation on Global Security: Summary of a Workshop on Technical Aspects of Civilian Nuclear Materials Security* (Washington D.C.: The National Academies Press, 2013).

DF-41 ICBM: A SHORT IMAGERY AND OPEN-SOURCE DATA ANALYSIS TO STUDY THE FUTURE NUCLEAR ICBM CAPABILITY OF THE PLA ROCKET FORCE

ARJUN SUBRAMANIAN P

INTRODUCTION

The Second Artillery Force has now been established as the People's Liberation Army Rocket Force (PLARF) as an independent arm of the People's Liberation Army (PLA). On December 31, 2015, Chinese President Xi Jinping conferred military flags to the new wing of the armed forces.[1] Like the former Second Artillery Force was, the PLA Rocket Force will be responsible for all missiles, both nuclear and conventional, including Land Attack Cruise Missiles (LACMs). Wei Fenghe and Wang Jiasheng were made the commander and political commissar respectively.[2] China has made tremendous advances in

Arjun Subramanian P is an Associate Fellow at the Centre for Air Power Studies, New Delhi.

1. "China Establishes Rocket Force and Strategic Support Force", http://eng.mod.gov.cn/ArmedForces/second.htm , January 1, 2016. Accessed on April 15, 2016.
2. Ibid.

missile technology, particularly in developing conventional precision strike capability using ballistic and cruise missiles. The PLARF now operates a wide variety of highly accurate conventional ballistic missiles and is on the verge of completely modernising its nuclear Intercontinental Ballistic Missile (ICBM) force.

Unlike earlier times, when the People's of Republic of China (PRC) had to focus on two nuclear adversaries—the United States and Soviet Union – it now focusses primarily on maintaining nuclear deterrence against the United States and, hence, the increasing emphasis on nuclear ICBMs. The only concern presently regarding the survivability of its nuclear ICBMs is the increasing conventional precision strike capability of the United States. Hence, the PLARF's focus is on having an ICBM force which has better survivability and thereby offers credible nuclear deterrence capability against the United States.

ANALYSIS: DATA AND IMAGERY

From the recent activities of the newly instituted PLA Rocket Force it can be inferred that the focus of China's future nuclear deterrence is mostly on the ICBM force, particularly the new Multiple Independently Reentry Vehicle (MIRV) DF-41 ballistic missile. After several tests, Chinese media reports stated that the missile would become operational by the end of this year after some more testing.[3] Considering the entry of the new missile, which is the third ICBM and the second most important development in the ICBM force of the PRC, it is pertinent to look at the future shape of the Chinese nuclear ICBM force.

Before the DF-41, the DF-31 and DF-31A were the only solid fuelled and road mobile ICBMs. However, the range restriction of 8,000-km will allow the missile to reach only Alaska. If the missile was fired from the extreme northeastern part of China, i.e. Heilongjiang province or the northeastern part of inner Mongolia, the missile could cover most parts of the northwestern state of Washington. The DF-41 on the other hand, can strike any part of continental US. A couple of years ago, there were some reports claiming that the new DF-31 version, the DF-

3. "东风41今年服役　透露最先部署省份", March 29, 2016, http://www.cn1n.com/mil/sw/20160329/174387988.htm. Accessed on April 18, 2016.

31A, might be MIRVed and the estimate was put at three warheads per missile.[4] However, logically speaking, given the abovementioned restriction, it would make no sense to MIRV the missile.

The DF-41, on the other hand, more or less matches the range of the DF-5 series and is road-mobile, making it more survivable. In addition, the missile has been incorporated with most of the technological advancements made so far in ballistic missile development in China. The missile is MIRVed and is estimated by various sources that it could carry a maximum of 10 nuclear warheads[5] (which, however, cannot be verified as no actual imagery of the missile without the canister or of the size of the warhead is available in the open domain). However, China, for a long time, has had the technological capability to MIRV its ICBMs, though it did not do so until recently.

MIRV technology is to a great extent similar to the bus design that places multiple satellites in orbit. It may be noted that China, in 2015, placed 20 small satellites in orbit in a single launch with the new Long March 6 launcher.[6] The video of the launch in the CCTV showed the graphical bus design of the launcher with the 20 satellites, which in assembly differs a lot from a nuclear bus. However, the point here is the precise insertion of the payload in its orbit. A nuclear bus is usually built on a flat bed where nuclear Reentry Vehicles (RVs) are placed tangentially to the bus bed. Here the only requirement is for the individual warhead base to be small enough to be accommodated in the payload area and to conform to the payload capacity. In this regard, it is to be remembered that in the early 1990s, China allegedly obtained the US W-88 500 kt (kilo tonne) two-stage thermo-nuclear warhead design information clandestinely, as confirmed by the US' Cox Report.[7]

4. "Does Chinese Land Based Nuclear Force Have a Clear Advantage over US?", *blog.ifeng.com*, April 02, 2016, http://blog.ifeng.com/article/44409323.html. Accessed on April 28, 2016.
5. "Chinese Military Confirms DF-41 Light Test", December 26, 2015, http://freebeacon.com/national-security/chinese-military-confirms-df-41-flight-test/. Accessed on April 30, 2016.
6. "Debut Launch of Long March 6 Deploys 20 Satellites", *SPACEFLIGHT NOW*, September 20, 2015, https://spaceflightnow.com/2015/09/20/debut-launch-of-long-march-6-deploys-20-satellites/. Accessed on May 1, 2016.
7. Shirley A. Kan, "China: Suspected Acquisition of U.S Nuclear Weapon Secrets", *CRS Report for Congress*, February 1, 2006, https://www.fas.org/sgp/crs/nuke/RL30143.pdf. Accessed on April 29, 2016.

The Chinese might have acquired sufficient information which could have helped them to MIRV the DF-41 with at least 5-6 warheads. This estimation is based on rough measurements of the canister diameter of the missile in Fig 1 and the assumption that the warhead base would be similar to the base diameter of the W-88 warhead, which is 22 inches.[8]

Fig 1: DF-41

Source: http://bbmxsm.blog.163.com/blog/static/232465272012723103912264/. Accessed on April 20, 2016.

Based on approximate measurements, the diameter of the canister is estimated to be a little above 2 metres (m) and, hence, the diameter of the missile booster could most probably be 2 m. However, without an actual picture of the missile nose cone design, the exact warhead capacity cannot be estimated accurately.

The length of the missile ought to be approximately 20 to 21 m; again, the estimation is based on rough imagery measurements. The DF-41 is based on a 16 wheeled Transporter Erector Launcher (TEL) and the extending front portion of the canister is tucked in a wedge-like carving in the driver cabin, just like the Soviet S-24 TEL. It is a three-stage missile, all solid fuelled. The payload capacity of the ICBM is unknown.

8. "The W88 Warhead: Intermediate Yield Strategic SLBM MIRV Warhead", October 1, 1997, http://nuclearweaponarchive.org/Usa/Weapons/W88.html. Accessed on May 1, 2016.

The missile system appears to have very good mobility on the road as is evident from Fig 2 projecting the missile with its TEL making a sharp turn supported by a banked corner.

Fig 2: DF-41 Making a Sharp Banking Turn

Source: http://military.china.com/important/11132797/20140806/18687656_2.html. Accessed on April 20, 2016.

Deployment

There are speculations that the missile will enter service this year and that the first unit will be deployed in Xinyang, Henan province.[9] This means that the missile unit will come under Base 54. Although, traditionally, Base 55 is the division that is known to handle ICBMs, it has been operating only the DF-5 and DF-5A, and now the DF-5B, which is a liquid fuelled, silo-based missile. On the other hand, Base 54 has good experience in handling solid fuelled, road mobile ICBMs – the DF-31 and DF-31A – and has the requisite infrastructure. Hence, this might be one reason why the DF-41 would be operated by Base 54.

Analysts also speculate that the missile would be deployed with Unit 96267 in Xinyang in Henan.[10] Xinyang might have been chosen because it is located on the route of the Shijiazhuang-Wuhan high speed rail line and also the area is well connected by the regular rail line. China is also deploying the missile as a rail mobile missile and,

9. "漢和：東風41飛彈進行最後測試", March 27, 2016, http://dailynews.sina.com/bg/chn/chnoverseamedia/cna/20160327/20147250607.html. Accessed on May 2, 2016.
10. Ibid.

hence, this location might act as a transfer point. The Shijiazhuang-Wuhan rail line passes through several tunnels south of Xinyang and, hence, it is also possible that the tunnels might be used to base some of the systems in the future, as this is a well known practice (Fig 3).

Fig 3: Mountain Tunnel South of Xinyang

Source: Google Earth

However, there are obviously some drawbacks when it comes to basing the DF-41 in the Shijiazhuang-Wuhan line as the movement of the train can be restricted as most of the line passes over an elevated corridor. One other argument against this speculation would be the electric power feed lines for the high speed trains that run overhead and which would be a hurdle for the launch of a missile as the canister would need to be erected vertically to fire the missile.

However, in addition to the high-speed rail connection, Xinyang is well connected with the regular rail line as well which is well connected to the north, south and east. In addition, there are two rail repair/maintenance/parking garages in Xinyang (Figs 4 and 5). In fact, the regular rail line is in totality, longer than the high-speed rail and has greater traffic density than the high-speed rail lines. Hence, most likely, the PLARF would deploy its rail-mobile units along with the regular rail-traffic rather than the high speed rail.

Fig 4: Rail Parking/ Maintenance Garage, Xinyang

Source: Google Earth

Fig 5: Rail Parking/ Maintenance Garage, Xinyang

Source: Google Earth

Deployment Method

For its road mobile systems, China had opted for the garrison deployment despite not having an early warning system like those available with Russia or the United States. As with its future rail mobile systems, it is to be seen what kind of deployment China is likely to adopt. Since China to some extent follows the Russian deployment methods, it can be expected to go for either garrison-based rail-mobile missile deployment or it might opt for random deployment. Random deployment is more secure as it would be hard to detect or even

know the exact location of a nuclear armed train. China would, by logic, be expected to adopt the random deployment method as, unlike Russia, China has a limited nuclear arsenal governed by the minimum deterrence requirement and, hence, survivability should naturally receive high priority. However, due to considerations of complexity of command and control, as had been done with the road-mobile systems, China might opt for the garrison-based deployment as well.

US defence analyst Phillip A. Karber, who heads the Potomac Foundation, claims to have seen imagery of huge tunnel complexes capable of hosting three missile trains side by side.[11] If Karber's claim is correct, then China has opted for garrison-based deployment and as per Chinese media claims, each train could carry four missiles.[12] Some analysts claim that the increase in the number of MIRVed DF-41 would lead to an increase in the Chinese nuclear arsenal. However, their nuclear deterrence posture would not change from the current minimum deterrence and the No First Use (NFU) doctrine.

WHY DOES CHINA WANT TO MIRV IT?

MIRVed ballistic missiles are considered as a first strike weapon since the Cold War because MIRVs were intended to be used as counter-force weapons. However, in the case of China, the argument is flawed. China follows an NFU and credible minimum deterrence policy. Hence, MIRVs are to ensure credible minimum deterrence. With a limited force structure which depends to a great extent on survivability of the arsenal, MIRVs would ensure that in case of an enemy first strike, the surviving couple of missile systems would pack enough punch to cause unacceptable damage to the enemy in terms of lives and property. Hence, as far as the PRC is concerned, MIRVing of the ICBM is to ensure credible minimum deterrence.

Another pointer towards this is the fact that China has made a complete U-turn in the arena of nuclear signalling. More of its

11. "China Tests New ICBM from Railroad Car: Rail Mobile Launcher Used in DF-41 Ejection Test", *The Washington Free Beacon*, December 21, 2015, http://freebeacon.com/national-security/china-tests-new-icbm-from-railroad-car/. Accessed on May 2, 2016.
12. "深度：东风41洲际导弹将用北斗导航 可达到米级精度", March 31, 2016, http://mil.news.sina.com.cn/jssd/2016-03-31/doc-ifxqxcnr5059447.shtml?cre=milpagepc&mod=f&loc=5&r=9&doct=0&rfunc=92. Accessed on May 2, 2016.

systems are appearing on TV and in the internet media which clearly conveys the intent to signal its capability to strengthen deterrence, though subtly, as official statements are rare. In a press conference last December, the spokesperson of China's Ministry of Defence, Col Yang Yujun, while not denying the testing of the rail-mobile DF-41, stated that "scientific experiments and research are being carried out as planned".[13] For example, Fig 1 and Fig 6 released in the Chinese internet media provide sufficient details to enable measurement of the system and evaluate the capability of the system to a good extent. Particularly, Fig 1 provides deliberate references for the task with several measurable features.

Fig 6: DF-41

Source: http://hk.on.cc/cn/bkn/cnt/commentary/20140807/bkn cn-20140807000314002-0807_05411_001.html. Accessed on May 1, 2016

This level of nuclear signalling was unimaginable two decades ago. Clearly, China has learnt to extract maximum deterrence value with its nuclear weapons via signalling.

PENETRATING DEFENCES

China, possibly, is not too concerned about the US Ballistic Missile Defence (BMD) capability, given the nascent status of the US Ground-based Mid-course Defence (GMD) system. A couple of

13. "Chinese Ministry of Defence Confirmed Rail Launch Version of DF-41 Missile", *news.hexun.com*, December 31, 2015, http://news.hexun.com/2015- 12-31/181538554.html. Accessed on May 3, 2016.

years ago, the test data chart (GMD) was put up on the website of the US Missile Defence Agency (MDA). However, later, probably because of the increasing test failures, the chart was removed. Such a low test record was despite reports of several of the tests being scripted and mostly involving unitary warhead missiles. This might have been the reason for the US missile defence system lobby to have made up a new threat perspective which portrays an ICBM threat from countries like North Korea in the future. So, at present, the GMD is being projected as a system to meet limited threats like a lone ICBM launch from rogue regimes like North Korea. For example, several articles can be found in the American press which lobby for more funding for the GMD system. An article in the *US News* written by retired US Air Force personnel, which is as recent as March 24, 2016, lobbies for funding for ballistic missile defence. The article hypes the Iranian ballistic missile threat.[14] Ironically, Iran is too far away to even think of building an ICBM capable of delivering a nuclear warhead on the US mainland.

The new Chinese ICBM could also be carrying some counter-measures against the GMD sensors or might employ some counter-BMD tactics. The Chinese ICBM (DF-41) is MIRVed and, hence, in the present scenario, guarantees a strike on the US mainland. Although the US has sufficient sensors, like the four-phased array radar all looking up over the North Pole and also the sea-mobile long range BMD radar to track and get sufficient early warning, yet, the probability of intercept is extremely low for the system to be effective.

LESSONS FOR INDIA

China's ICBM capability doesn't appear to be even slightly directed at India. However, there are other nuclear capable missiles like the DF-31 and DF-21 which could be deployed against India. Hence, India ought to have the capability to deter any nuclear aggression or coercion. So far, India did not have the capability to hit high value cities (counter-value targets), all of which lie in the eastern and southeastern parts of China.

14. "Fully Fund Our Best Defence Against Iran", *U.S. News*, March 24, 2016, http://www.usnews.com/opinion/blogs/letters-to-the-editor/articles/2016-03-24/iran-missile-test-shows-need-to-fully-fund-gmd-ballistic-missile-defense. Accessed on April 27, 2016.

India's only long range missile capable of reaching high value targets like Shanghai and Beijing is still in the testing stage. India had tested the Agni-V ballistic missile a couple of times now and the development work is probably still on. The Defence Research and Development Organisation (DRDO) had claimed that the Agni-V will be MIRVed in future, but there is no information on the number of warheads it will be capable of carrying. Since India too has a no first use and credible minimum deterrence doctrine, the MIRVing of the Agni-V would enhance nuclear deterrence against China in the scenario of a counter-force first strike by China.

DRDO had already successfully test-fired the missile from a hermetically sealed canister which enhances the mobility and improves ease of handling of the system. However, it is to be noted that after the first test firing of the Agni-V missile, there were statements from China that India does not have proper infrastructure like roads and bridges to support the load of this 50-tonne missile which would put restrictions on its mobility.[15] Nevertheless, India is a vast country and the range of the missile permits launching it from most parts of the country while still being capable of reaching vital counter-value targets in the eastern and northeastern parts of China.

CONCLUSION

From the events taking place related to the DF-41, it is obvious that the missile will be the mainstay of the Chinese nuclear ICBM force for several decades to come. The pointers are:

- The missile is MIRVed, possibly above 5 warheads (based on the assumptions and inferences as explained above).
- It is being deployed as a road mobile as well as rail mobile ICBM.
- The unprecedented amount of information (compared to the past Chinese trend) revealed about this missile appears to be a clear intention to signal deterrence.

The missile would most probably be deployed under units operating under the Base 54 as it enters service in 2016. Before it

15. "Agni-V: China Says India Underplaying Agni, It Can Hit Europe", *The Times of India*, April 20, 2012, http://timesofindia.indiatimes.com/india/Agni-V-China-says-India-underplaying-Agni-it-can-hit-Europe/articleshow/12752380.cms. Accessed on May 6, 2016.

becomes operational, we could expect some more testing of the missile. Eventually, the missile would be deployed as a rail mobile missile most likely on the regular rail and less likely on the high-speed rail. The MIRVed DF-5B is likely to continue in service for a couple of decades more. The overall assessment is that China will maintain a credible nuclear arsenal against its adversaries, particularly against the United States and that the present NFU and CMD policy would continue unaltered.

Meanwhile, India would certainly have its own credible minimum deterrent in the form of the Agni-V, which is presently undergoing testing, and an operational sea-based nuclear deterrent in the future. The sea-based nuclear deterrent is presently in the testing and experimental stage. The present missile, the K-15, lacks the range to enable the submersible to fire it from a safe distance and also it does not bring some of the potential counter-value targets within its reach. Once the K-4 Sea-Launched Ballistic Missile (SLBM) is inducted into service, India will have a real third leg of its nuclear deterrent which will be capable of targeting the northeastern part of China while sailing in the Bay of Bengal. But in the near future, the land-based Agni-V would provide deterrence after induction into service.

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