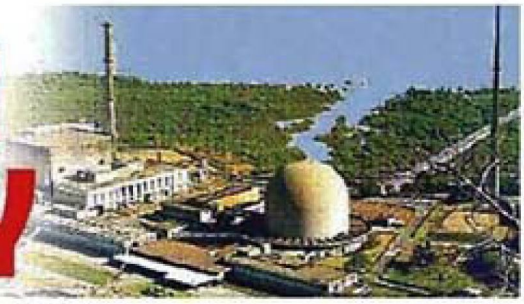
NUCLEAR SECURITY



A FORTNIGHTLY NEWSLETTER ON NUCLEAR DEFENCE, ENERGY AND PROLIFERATION FROM CENTRE FOR AIR POWER STUDIES

Vol 14, No. 22, 15 SEPTEMBER 2020

CONTENTS

OPINION - Manpreet Sethi

India's Options When Faced with a Collusive Two-Front Threat

The China-India military stand-off continues and is likely to be a long haul. Meanwhile, there is contemplation that China and Pakistan could pose a collusive two-front threat to India. The strategic nexus between the "iron brothers" is old, deep and broad-based. Both symbiotically support each other to complicate India's security. Pakistan is assured of Chinese weaponry, economic assistance for infrastructure development, intelligence inputs, diplomatic support and psychological backing. China can bank on Pakistan for tactical actions to impose pressure on India by opening new fronts using its regular army or terrorist infrastructure.

Placed in the middle, India faces China, which enjoys numerical conventional superiority, and Pakistan whose nuclear weapons negate India's conventional edge. To address them individually or jointly, some opine that India should adopt a more offensive nuclear posture by projecting first use of nuclear weapons, building "tactical" nuclear weapons (TNWs) and threatening their use with impunity, a la Pakistan.

Pakistan is assured of Chinese weaponry, economic assistance for infrastructure development, intelligence inputs, diplomatic support and psychological backing. China can bank on Pakistan for tactical actions to impose pressure on India by opening new fronts using its regular army or terrorist infrastructure.

Before India rushes to this conclusion, some questions should be answered. Pakistan may project use of nuclear weapons, but can it really use them in a manner that brings benefits? Does India believe Pakistan's nuclear use threat? Has that stopped a resolute India from undertaking conventional punitive actions? Notwithstanding all the nuclear noise, Pakistan understands that unless its first use is able to disarm India's nuclear arsenal, it is sure to suffer nuclear retaliation, worsening its situation. How, then, is the threat of first use credible?

India will face the same credibility issues when it signals the first use of nuclear weapons. In fact, laying down artificial redlines for nuclear use in conventional scenarios is not helpful. It

can place national leaderships in a commitment trap or a credibility crisis. India has wisely circumvented this problem by adopting the no-first-use doctrine. The only redline here is nuclear use by the adversary. Short of that, there should be little reason for India to use nuclear weapons. Meanwhile, the assumptions that use of low-yield TNWs is more credible, or that their controlled use would be condoned for fear of nuclear escalation, are both questionable. A 75-year old taboo against nuclear use makes any decision to use them, even the low-yield variety, extremely difficult and not easily condoned. Also, no such use can guarantee a controlled conflict since the response from the other side will always be unknown. India, for instance, promises massive retaliation against any use of nuclear weapons. Pakistan can never safely presume that India would act otherwise. The assuredness of retaliation ensured by secure second-strike capabilities makes the weapon non-usable. The Superpowers could not use them despite building thousands of TNWs. Neither has Pakistan been able to do so despite professedly deploying such weapons. India will not be able to do so either.

India will face the same credibility issues when it signals the first use of nuclear weapons. In fact, laying down artificial redlines for nuclear use in conventional scenarios is not helpful. It can place national leaderships in a commitment trap or a credibility crisis. India has wisely circumvented this problem by adopting the no-first-use doctrine. The only redline here is nuclear use by the adversary. Short of that, there should be little reason for India to use nuclear weapons.

The answer to dealing with a collusive two-front situation lies not in projection of first nuclear use, but in exploiting arrows in the diplomatic, information, military and economic (DIME) quiver.

In the diplomatic domain, India's stature as a responsible country that respects international rules and values is far ahead of China and Pakistan. Individually and jointly, their disruptive behaviour is well recognised. India has the opportunity to team up with like-minded nations to pose credible dilemmas to both. For example, India's efforts at engaging West Asia or exposing state support to terrorism have been fruitful against Pakistan. China's non-transparency on the pandemic, debt diplomacy, expansionist behaviour has already created an anti-China sentiment that India can exploit to great effect.

Utilisation of the information spectrum is critical for this. India's success at blocking Pakistan's ability to play a victim of terrorism is one illustration of effective use of this sphere. In case of China too, India needs to amplify Beijing's aggressive tendencies and duplicity, facts that already have a resonance. Further, India can find and fuel fissures in the collusion. Beijing and Islamabad have no civilisational, ideological, socio-cultural, or religious affinities. China is apprehensive of Pakistan's radical Islam and its appeal with the Uighurs; this could be exploited. China should also be reminded that any Pakistani nuclear use would result in socio-environmental consequences that it will not be able to escape either. Other points of friction can be found and exploited.

On the military front, the answer lies in building usable capability in the conventional realm. Chief of Defence Staff has expectedly underscored India's ability to take on a collusive threat. More thoughtful build-up and use of numerous rungs on the conventional spectrum, including newer realms of space and cyber, can provide important leverages. Indeed, conventional capability is the only instrument that can credibly deter and punish.

Lastly, India's trade, markets and resources are its strength. Denial of these allows India to wage "economic warfare". This has persisted with Pakistan for some years now. India has also managed further economic heat from the Financial Action Task Force. China, meanwhile, has squandered a good economic relationship worth $100 billion owing to the current crisis. Some steps taken by India have also reverberated with other countries and the collective impact on China will

be felt if these policies are sustained.

India's security challenges are complex. But a change in nuclear doctrine to deal with tactical, sub-conventional or even conventional concerns would be meaningless. A shift to nuclear pre-emption would only heighten risks of inadvertent nuclear escalation. As instruments of deterrence, nuclear weapons are most credible when threatened against an existential crisis. India's DIME actions can ensure that China and Pakistan, individually or collusively, cannot pose such a risk to the country. India must focus on options that lie between fisticuffs and nuclear use.

India's security challenges are complex. But a change in nuclear doctrine to deal with tactical, sub-conventional or even conventional concerns would be meaningless. A shift to nuclear pre-emption would only heighten risks of inadvertent nuclear escalation.

Source: https://www.sundayguardianlive.com/, 05 September 2020.

OPINION - Abhijnan Rej

Triangles of Instability: Nuclear Dilemmas and how they Feed into Each Other

The Pentagon's recently published report on China's military capabilities highlights American concerns about the country's growing nuclear arsenal and delivery systems, at a time when key nuclear dyads are adopting increasingly competitive postures. That there has been considerable churn in the India-China relationship over the past few months is evident. The Trump Administration has also insisted that Beijing participate in a three-way New START arms control talks along with Moscow — the U.S.-Russia New START Treaty is set to expire early next year — though it appears to have eased back on that demand more recently. Along with growing speculation about India's nuclear capabilities and strategic intent vis-à-vis Pakistan, these independent developments highlight the complex interlocking problems linking five out of the nine (*de jure* or *de facto*) nuclear powers.

Some have claimed that China tested a nuclear weapon on Pakistan's behalf in 1990, a full eight years before Pakistan (and India) openly declared themselves nuclear powers by carrying out tests in 1998. But at the very least, China has consistently provided technical help for Pakistan's nuclear program.

At hand is what is emerging to be two overlapping triangular relationships, with China as the common node: India-Pakistan-China and China-U.S.-Russia. To be sure, Robert Einhorn and W.P.S. Sidhu have argued in the past that when it came to nuclear risks, India, Pakistan, China, and the United States formed a single "strategic chain," with the posture of each affecting the others and with few restraint measures between them in place. But the recent spike in strategic competition within the two triangular relationships — including at the levels of conventional weapons and emerging technologies — add an additional layer of complications.

The India-Pakistan-China nuclear dynamics are old, so much so that scholars speak of a "Southern Asia" strategic space involving all three powers' geopolitical preferences, nuclear postures and capabilities. China's support for Pakistan's nuclear weapons program has a long history. Some have claimed that China tested a nuclear weapon on Pakistan's behalf in 1990, a full eight years before Pakistan (and India) openly declared themselves nuclear powers by carrying out tests in 1998. But at the very least, China has consistently provided technical help for Pakistan's nuclear program.

For its own part, India's nuclear-weapons capabilities increasingly emphasize contingencies with regard to both. The country's Agni V ICBM is reported to be capable of holding all of China's eastern coast at risk. As Hans Kristensen and Matt Korda noted in their most recent update on India's nuclear forces, "[w]hile India's primary deterrence relationship is with Pakistan, its nuclear modernization indicates that

it is putting increased emphasis on its future strategic relationship with China." India's dogged though somewhat haphazard pursuit of a sea-based nuclear deterrent shows a keen awareness in ensuring a credible second-strike option when it comes to China.

But as Yogesh Joshi has argued, India's quest for deterrence stability with China — the ability to have a secure second-strike option against that country — has created crisis instability with Pakistan, where Islamabad/Rawalpindi worries that the INS Arihant, India's sole nuclear ballistic missile submarine (SSBN), will be used for a first strike against Pakistan's nuclear weapons in a crisis. Such a belief is likely to generate a "use it or lose it" pressure for Pakistan in a contingency involving India. Repeated Indian statements chipping away at India's official NFU policy haven't helped matters.

The question here is the extent to which either nuclear threats from India or an Indian tactical nuclear-weapons capability can forestall that possibility or, in the event of a conventional deterrence failure, generate favorable outcomes.

Add to this already complex three-way dynamic the possibility that India may face a two-front conventional military threat from China and Pakistan — either with both colluding, or with one taking advantage of the other's military action to open a new front against India. The question here is the extent to which either nuclear threats from India or an Indian tactical nuclear-weapons capability can forestall that possibility or, in the event of a conventional deterrence failure, generate favorable outcomes. Analysts have argued that the India-China conventional balance across the LAC between the two countries is not unfavorable to India and therefore, the country should take a lead in promoting nuclear restraint globally.

India is unlikely to take part in any such initiative as long as China seeks to augment its nuclear capabilities, if not in the number of warheads per se, then through pursuit of technologies such as MIRVs or even conventional Hypersonic Glide Vehicles (HGV). China is currently pursuing both as countermeasures for Washington's BMD plans.

India is unlikely to take part in any such initiative as long as China seeks to augment its nuclear capabilities, if not in the number of warheads per se, then through pursuit of technologies such as MIRVs or even conventional Hypersonic Glide Vehicles (HGV). China is currently pursuing both as countermeasures for Washington's BMD plans. (While not originally intended as such, MIRVs are considered "effective countermeasures" for BMD systems.) But China's pursuit of such technologies also stands to complicate India's belief in the survivability of its own second-strike ability — especially if it fails to increase the size of its SSBN fleet in the near future.

One recurring theme in the debate around the future of India's nuclear weapons has been the extent to which it may move — or already has — from the official NFU posture to one in which it decides to use nuclear (or even conventional) missiles to attack the adversary's nuclear weapons first. Some analysts have argued — though not all are convinced — that India is already contemplating such a shift, and that, as part of a "counterforce" strategy, India might use the Russian defensive S-400 system to pick off "residual" incoming Pakistani nuclear missiles following a first Indian strike that takes out most (though not all) of them. India has decided to go ahead with the purchase of the S-400 system despite repeated U.S. statements noting that the purchase could attract sanctions or, at the very least, limit further U.S.-India defense cooperation. Notably, Russia has also sold the S-400 system to China, though it reportedly halted important related deliveries and installation last month, which would render the system inoperable for China.

But it is the Russian deployment of a ground-

launched cruise missile that sealed the fate of the INF. The Trump administration formally announced its withdrawal from the INF in August last year. That, in turn, paves the way for the American deployment of ground-launched intermediate range missiles in Asia. This is a worry for Beijing notwithstanding the fact that South Korea and Japan — the farthest the missiles can be stationed by the U.S. to target China — are both likely to be unwilling to host these systems. But Beijing's reaction to this development may lead it to consider countermeasures to enhance the survivability of its nuclear assets. This in turn could lead India to push for new capabilities of its own. (On September 7, India tested a "Hypersonic Technology Demonstrator Vehicle," the fourth country to successfully do so.) At the very least, China may think India's pursuit of certain nuclear capabilities is action taken in tandem with the U.S. You get the picture.

Source: The Diplomat, https://thediplomat.com/2020/09/triangles-of-instability-nuclear-dilemmas-and-how-they-feed-into-each-other/, 08 September 2020.

OPINION - Roderick Lee

China's Air Force Might be Back in the Nuclear Business

Circumstantial evidence suggests that China now possesses a full nuclear triad. The Department of Defense's recent 2020 China Military Power Report reiterated an assessment first made in the 2018 China Military Power Report: that the Chinese PLA has re-assigned the PLA Air Force (PLAAF) with a nuclear counterattack mission after a several-decade-long hiatus. (The PLAAF conducted most of the PLA's early nuclear testing, but the PLA then-Second Artillery, now Rocket Force, later took on the role as China's primary nuclear force.) This assessment is based on the fact that the new H-6N bomber is capable of carrying a new air-launched ballistic missile, currently in development, that may be nuclear-capable.

Unlike platforms that the PLA explicitly associates with nuclear missions, such as intercontinental ballistic missiles and ballistic missile submarines, it is harder to positively demonstrate China's intent to use long-range bombers as part of a nuclear triad just because they are technically capable of delivering a nuclear payload. However, there is now a growing body of evidence to suggest that China has created an operational bomber unit tasked with conducting nuclear strikes, alongside the acquisition of weapon systems needed to conduct air-launched nuclear strikes.

Unlike platforms that the PLA explicitly associates with nuclear missions, such as intercontinental ballistic missiles and ballistic missile submarines, it is harder to positively demonstrate China's intent to use long-range bombers as part of a nuclear triad just because they are technically capable of delivering a nuclear payload.

Where Did the H-6Ns Go?

The first piece of evidence suggesting that the PLA has elevated a new bomber unit is the disappearance of China's new H-6N bombers. The PLA finally unveiled the new H-6 variant, capable of aerial refueling, at its 70th National Anniversary military parade in 2019. Although the refueling probe and semi-recessed underside fuselage, capable of mounting an air-launched ballistic missile, attracted the most attention, the numbers painted on the side of the aircraft merit equal scrutiny. The three H-6Ns featured in the parade had "55301," "55302" and "55034" painted onto their fuselages. The PLAAF uses these numbers, called "bort numbers," to identify the unit to which a particular aircraft belongs. But the 553XX numbering scheme does not conform to any known PLAAF bomber unit.

To further complicate issues, these aircraft cannot be found at any known PLA H-6 base on publicly available overhead imagery dating from after the parade, nor in any handheld photographs released by PLA official press sources. However, it is possible that the PLAAF may have stationed this aircraft at an airfield not previously associated with an active H-6 unit.

Facility Built for Nuclear War: Enter Neixiang Airfield. Although historical Google Earth imagery shows that this airfield only saw periodic use hosting transport aircraft from 2010 to 2015, it now appears to be a facility built with nuclear operations in mind.

In July 2017, the PLAAF initiated a major renovation of the airfield to include larger aprons, large aircraft shelters capable of accommodating aircraft up to 36 meters in wingspan, and adjacent garrison facilities for aircrew and other personnel. By April 2019, it had completed the large aircraft shelters. While no publicly available imagery shows any aircraft in open areas since the PLA completed the airfield renovations, the latest imagery from May 2020 shows runway skid marks consistent with those found exclusively at other H-6 bases. This suggests that the missing H-6Ns may in fact be stationed at Neixiang.

The other more telling feature of Neixiang Airfield that is suggestive of a nuclear mission is the adjacent underground facility (UGF). This facility has been in place since at least 2009, and has allowed the PLA to store aircraft stationed at the airfield in relative safety while not in use.

The other more telling feature of Neixiang Airfield that is suggestive of a nuclear mission is the adjacent underground facility (UGF). This facility has been in place since at least 2009, and has allowed the PLA to store aircraft stationed at the airfield in relative safety while not in use. The original configuration features two portals that are both roughly 36 meters wide. Both portals lead to the flight line. Although the original portals are barely wide enough to accommodate an H-6, a ground crew would likely have to carefully tow the aircraft in and out of this facility to prevent any damage to the aircraft. However, recent enhancements to the UGF make this a unique facility compared to other H-6 bases.

The latest imagery from May 2020 reveals that the PLA constructed two additional portals on the western reverse-slope side of the UGF that are around 61 meters in width (an H-6 has a wingspan of roughly 33 meters). Furthermore, the PLA expanded the width of the taxiway to which these portals lead. This suggests that an aircraft as large as an H-6 can now comfortably taxi out of the UGF under its own power and reach the runway in about 12 minutes – a number not dissimilar to the United States Air Force's (USAF's) 15-minute minimum interval takeoff time for B-52s.

The Neixiang Airfield UGF is also built with survivability in mind. The UGF lies under roughly 220 meters of limestone overburden. Assuming that the PLA installed rock supports and tunnel lining commensurate with what is has previously installed at PLA Rocket Force UGFs, the Neixiang Airfield UGF may be able to withstand a 300-400 kiloton surface burst – roughly equivalent to a U.S. B61 nuclear weapon. The two large portals are also on a reverse slope and dug into the middle of the mountain to mitigate cruise missile and low-altitude air attacks.

A Mystery Unit at Neixiang: In addition to the circumstantial evidence suggesting that the PLA could be stationing nuclear-capable bombers at Neixiang and reinforcing the infrastructure with an eye toward nuclear missions, the PLAAF also reactivated what is likely an old bomber unit – publicly known as 93671 Unit.

The PLA could be stationing nuclear-capable bombers at Neixiang and reinforcing the infrastructure with an eye toward nuclear missions, the PLAAF also reactivated what is likely an old bomber unit – publicly known as 93671 Unit.

An academic article published in mid-2018 is the first known reference to 93671 Unit. The article identifies it as an "aviation unit" located in Wugong county. However, by late 2019, the unit appears to have relocated to Nanyang in Henan province – the prefecture in which Neixiang county is located. Subsequent local Dengzhou government press from 2019 suggests that a radar

station located 5 miles east of Neixiang provides flight training support for a "106th Brigade." There is no other known PLAAF unit with this true unit designator and Neixiang is the closest airfield to the radar station in question. 93671 Unit being a brigade-level unit is corroborated by photography of the unit's political commissar, Sun Jun, showing that he is a brigade-level officer. This all suggests that 93671 Unit is in fact the 106th Brigade.

...Within the PLA, a unit's political commissar and commander usually match the unit's assigned grade. Overhead imagery also offers some clues regarding what type of aircraft are located at Neixiang. Although publicly available imagery does not show any aircraft stored in the open at Neixiang, the skid mark patterns found on the runway are consistent with the skid marks found exclusively at other H-6 air bases.

While PLA Rocket Force ICBMs and PLA Navy SSBNs can range parts of the continental United States (CONUS) from relatively safe launch locations near or within China, H-6Js equipped with even long-range standoff munitions face a challenging geography should they wish to target CONUS.

Circumstantial Nuclear Ties: The two academic articles published by this unit also suggest that 93671 Unit may be involved in nuclear activities. The first article is titled "Development of the First-Generation Associated Particle Tube" and is co-authored by individuals from the PLA Rocket Force Engineering University's School of Nuclear Engineering, the Chinese Academy of Atomic Energy's Institute of Nuclear Physics and the Chinese Academy of Engineering Physics. Particle detectors are used to detect, track and identify ionizing particles associated with nuclear decay.

The second article is titled "Molecular Dynamics Study on Effects of Doping Defects on Properties of PBXs" and is co-authored by individuals from the Rocket Force Engineering University and the PLA Navy's 91515 Unit – a unit likely associated with the Navy's nuclear submarines at Hainan. Doping of explosives is commonly used to improve detonation performance, and PBX is a common material used for explosive lenses found in fission weapons.

A Lopsided Triad?: Although the PLA has long discussed the potential role of PLAAF bombers in nuclear counterstrike missions, this part of the triad has received the least amount of attention. Assuming that 93671 Unit is indeed a new PLAAF bomber brigade with a nuclear mission, the implication for the U.S. government is that China now possesses a full nuclear triad, albeit somewhat lopsided. In addition to the air-launched component of the PLA's nuclear triad being relatively small as of 2020, its potential range is also limited. While PLA Rocket Force ICBMs and PLA Navy SSBNs can range parts of the continental United States (CONUS) from relatively safe launch locations near or within China, H-6Js equipped with even long-range standoff munitions face a challenging geography should they wish to target CONUS.

In order to range CONUS targets, an H-6J and accompanying tankers would have to either fly over Russian airspace, or take a vulnerable 8,000 km route across the Pacific. Neither of these options seems optimal. This begs the question of why the PLA is pursuing an air-launched nuclear capability in the first place. There are at least three non-mutually exclusive plausible explanations for why the PLA is pursuing a nuclear-armed bomber force:

Other Nuclear Neighbors: The U.S. is obviously not the only power with which the PLA must contend. China shares land borders with four nuclear states (Russia, India, Pakistan and North Korea) and has an active border dispute with one (India). Nuclear armed H-6s may be intended to deter and retaliate against one or more of China's nuclear neighbors.

Tactical Use: Discussions in the "Science of Second Artillery Campaigns" suggests that military bases are acceptable targets during a nuclear counterattack. H-6s equipped with nuclear-armed standoff munitions may be intended to deter U.S. regional allies from getting involved in a conflict

and to retaliate against U.S. bases if necessary.

A Safer Pacific in the Future: The PLA might see the Western and Central Pacific as being a "safer operating area" in the next few decades, although there is no PLA discourse discussing such a future. If the PLA is able to push most U.S. forces beyond the second island chain in the coming decades, long-range bomber flights supported by tankers could range CONUS targets with greater confidence than they can at present. In the meantime, the PLA wishes to establish nuclear mission competencies within the PLAAF.

The PLA typically shrouds the activities of its nuclear units in secrecy, but cannot totally eliminate all public traces. Knowing that 93671 Unit may be called to participate in nuclear counterstrikes will help guide further research into how the PLA views nuclear war.

At this point, one might expect a cursory list of "big things to do" to respond to the new development. However, the U.S. is already doing many of these things. Instead, the possible emergence of a PLAAF bomber unit with a nuclear mission suggests two "small things to do" for the U.S.

First, this unit can serve as a starting point or supplementary information when discussing Chinese theater nuclear weapons policy. Just as the emergence of the nuclear DF-26 intermediate range ballistic missile prompted discussions of risk and ambiguity, the possibility of nuclear-armed H-6Js should add to that discussion. Second, observers can now use the activities at Neixiang and of the 93671 Unit as an additional data point when trying to better understand overall Chinese nuclear policy. The PLA typically shrouds the activities of its nuclear units in secrecy, but cannot totally eliminate all public traces. Knowing that 93671 Unit may be called to participate in nuclear counterstrikes will help guide further research into how the PLA views nuclear war.

Source: Roderick Lee is the director of research at the Air University's China Aerospace Studies Institute (CASI), 09 September 2020.

OPINION - Joseph Trevithick

How China's Ballistic Missile and Nuclear Arsenal is Ballooning According to the Pentagon

A new report from the Pentagon offers an updated public assessment of China's ballistic missile arsenal, which shows a notable increase in its size and the scope of its capabilities. The annual review of the Chinese military also indicates that these developments are, at least in part, tied to important developments in the country's nuclear posture and the doctrine and policies surrounding it.

The Pentagon released the latest iteration of its report on the Chinese military and its capabilities, an updated version of which it is required to send to Congress every year, by law, on 02 September 2020. It warned that the PLA is continuing to make strides in a variety of important and advanced technologies, including, but certainly not limited to hypersonic weapons, artificial intelligence, cyber warfare, counter-space systems, air defenses, and the construction of large capital ships and advanced submarines. The review's discussion about ballistic missiles and nuclear capabilities, including a first-ever public estimate from the Department of Defense about the size of the Chinese nuclear arsenal, was especially significant.

PLA is continuing to make strides in a variety of important and advanced technologies, including, but certainly not limited to hypersonic weapons, artificial intelligence, cyber warfare, counter-space systems, air defenses, and the construction of large capital ships and advanced submarines.

"The PLARF [People's Liberation Army Rocket Force] develops and fields a wide variety of conventional mobile ground-launched ballistic missiles and cruise missiles," the report said. "The PRC [People's Republic of China] is developing new ICBMs that

will significantly improve its nuclear-capable missile forces."

The Pentagon estimates that China has added 10 new ICBMs to its arsenal since its 2019 report, as well as 10 more launchers, including silos and road-mobile transporter-erector-launchers, to fire them. This brings to the estimated size of the country's total operational IBCM force from 90 to 100.

The most dramatic change in the Pentagon's assessment of the PLARF's ballistic missile inventory between 2019 and 2020 was with regards to IRBM, which have ranges between 3,000 kilometers (1,864 miles) and 5,500 kilometers (3,417 miles).

The most notable addition are examples of the new DF-41 ICBM, also known to the U.S. intelligence community as the CSS-X-20, which reportedly has the ability to deploy MIRVs, allowing a single missile to strike multiple targets...There is no year-over-year change in the number of SRBM and MRBM launchers, though the number of total missiles in both cases have been revised. In 2019, the Pentagon said that China had between 750 and 1,500 SRBMs and between 150 and 450 MRBMs, while it simply said that the country had more than 600 SRBMs and more than 150 MRBMs in 2020. SRBMs are defined as ballistic missiles with ranges between 300 kilometers (186 miles) and 1,000 kilometers (621 miles), while MRBMs can reach distances of between 1,000 kilometers (621 miles) and 3,000 kilometers (1,864 miles).

The new report says that the total number of DF-26 road-mobile transporter-erector-launchers has surged from 80 to 200, while the total number of actual missiles has risen from between 80 and 160 to over 200.

The most dramatic change in the Pentagon's assessment of the PLARF's ballistic missile inventory between 2019 and 2020 was with regards to IRBM, which have ranges between 3,000 kilometers (1,864 miles) and 5,500 kilometers (3,417 miles). At present, China's sole operational IRBM is understood to be the DF-26, "which is capable of conducting both conventional and nuclear precision strikes against ground targets, as well as conventional strikes against naval targets," according to the Pentagon. The Chinese military highlighted its long-range anti-ship ballistic missile capabilities in a recent major exercise in the South China Sea.

The new report says that the total number of DF-26 road-mobile transporter-erector-launchers has surged from 80 to 200, while the total number of actual missiles has risen from between 80 and 160 to over 200. The DF-26 is rapidly becoming one of the most important missiles in China's arsenal, but there does not appear to have been any public discussion from Chinese authorities about such a significant expansion of this part of the PLARF. The Pentagon offers no context for how it arrived at this estimate.

The DOD's estimates of the size of China's ground-based ballistic missile and ground-launched cruise missile (GLCM) arsenals as of 2020. Those same estimates as of 2019. Adding 120 new TELs would very likely reflect a notable increase in the overall DF-26 force, as well as supporting elements and infrastructure. Experts have openly questioned whether this might be a typo, with the launcher figure being an accidental copy-paste of the missile figure, or some kind of other error. There is at least one clear quantitative error elsewhere in the new Pentagon report, with another section of the text saying the PLARF only has 200 SRBM launchers, instead of 250, as found in tables in both the 2020 and 2019 editions.

In addition to the ground-based ballistic missiles, the Pentagon report also notes that the People's Liberation Army has six Type 094 Jin class ballistic missile submarines, "four operational and two outfitting at Huludao Shipyard," each of which can carry up to 12 nuclear-tipped JL-2 submarine-launched ballistic missiles. The combination of the Type 094s and the JL-2s, which China also paraded publicly last year, represent "the country's first viable sea-based nuclear deterrent." The Chinese

are also working to develop a follow-on ballistic missile submarine, known as the Type 096, as well as an improved submarine-launched ballistic missile, the JL-3.

...The DOD report also raises the possibility that the People's Liberation Army Navy's Type 055 warships, which it classifies as cruisers, rather than destroyers, may be able to carry anti-ship ballistic missiles of some kind in the future. It has been previously reported that the CM-401 short-range anti-ship ballistic missile, which the China Aerospace Science and Industry Corporation unveiled in 2018, might be a future armament for the Type 055. The assessment does not appear to be talking about the integration of larger ballistic missiles, such as anti-ship variants of the DF-21 or DF-26, onto these ships.

...The Pentagon says that these developments are, at least in part, a component of broader efforts to expand the size and scope of the PLA's nuclear capabilities. The 2020 assessment includes, for the first time ever, an estimate of how many nuclear warheads China has – "in the low-200s" – with the possibility of that stockpile doubling in the coming years. As many as 200 warheads may be capable of threatening the United States within the next five years, according to the review.

...Another map showing the range of China's various SRBMs, as well as the DF-26, in comparison to other conventional strike capabilities, including ground and air-launched land-attack and anti-ship cruise missiles. The DF-17, a ballistic missile-type rocket booster armed with hypersonic boost-glide vehicle is notably included in the "land attack missile" ring.

The report offers limited detail about how the Pentagon arrived at this assessment, saying that it is due in part to the expected introduction of more MIRVed DF-41s. However, it also says "China probably has enough nuclear materials to at least double its warhead stockpile without new fissile material production," but that it "will require increased nuclear warhead production" in order to make this a reality. The "low-200s" warhead estimate is also notably lower than past Defense Intelligence Agency assessments, as well as those from experts outside of the U.S. government, and may only reflect deployed weapons and not those held in reserve.

This assessment itself is based in part in the Pentagon's belief that China is looking to reorganize and improve its nuclear forces to better withstand a potential first strike. It says specifically:

"The PRC's nuclear weapons policy prioritizes the maintenance of a nuclear force able to survive a first strike and respond with sufficient strength to inflict unacceptable damage on an enemy. China is enhancing peacetime readiness levels for these nuclear forces to ensure their responsiveness. In addition, China insists its new generation of mobile missiles, with warheads consisting of MIRVs and penetration aids, are intended to ensure the viability of its strategic nuclear forces in the face of continued advances in U.S. and, to a lesser extent, Russian strategic ISR [intelligence, surveillance, and reconnaissance], precision strike, and missile defense capabilities. India also plays a factor in China's nuclear threat perceptions." Part of this increased peacetime readiness could include the expansion of the PLARF's silo-based ICBM force, according to the Pentagon. With regards to this development, it says:

India also plays a factor in China's nuclear threat perceptions." Part of this increased peacetime readiness could include the expansion of the PLARF's silo-based ICBM force, according to the Pentagon.

"Commercial imagery from 2019 has revealed that China has constructed an ICBM silo at one of the PLARF's Western training ranges that is smaller than China's existing CSS-4 (DF-5) silos. According to state media, the CSS-X-20 (DF-41) ICBM can be launched from silos; this site is probably being used to at least develop a concept of operations for silo basing this system. There are also some indications that China may be building new CSS-4 (DF-5) ICBM silos."

..."Their size precludes use by the DF-5 and may support concept development for a silo-based DF-41 or one of China's smaller ICBMs. When taken with China's past concerns about silo survivability and ongoing strategic early warning developments, these new silos provide further evidence China is moving to a LOW [launch-on-warning] posture."

However, at present, there does not appear to be any further public evidence of new Chinese silo construction for the DF-41 to further support the Pentagon's assessment. There is also mention of possible rail-mobile DF-41s, something China reportedly tested in 2015, but it is unclear how seriously the PLARF is exploring this capability.

Launch-on-warning refers to a nuclear deterrent policy to launch a massive counterstrike upon detecting incoming nuclear threats. This helps ensure that a retaliatory strike can be successfully initiated before the hostile weapons reach their targets...The Federation of American Scientists (FAS) was the first to spot the silo at the PLARF's nuclear missile training site near Jilantai in the Gobi Desert and released its own assessment in September 2019. FAS said that it was possible that this silo, which is a distinctly different design from the ones China uses for the DF-5, could be part of the development of an alternate basing option for the DF-41 or for some other future solid-fuel ballistic missile.

However, at present, there does not appear to be any further public evidence of new Chinese silo construction for the DF-41 to further support the Pentagon's assessment. There is also mention of possible rail-mobile DF-41s, something China reportedly tested in 2015, but it is unclear how seriously the PLARF is exploring this capability. The Soviet Union notably did deploy a similar system during the Cold War, the RT-23 Molodets, and Russia more recently looking into bringing that capability back before shelving those plans in favor of missiles armed with nuclear-armed hypersonic boost-glide vehicles, known as Avangard.

The Pentagon also separately said that China's nuclear arsenal could grow to include new warheads, including a potential lower-yield warhead for the DF-26, and new delivery systems. A lower yield nuclear weapon could indicate that the Chinese military may be looking at a so-called escalate-to-deescalate policy, in which a limited nuclear strike could be used to bring a quick end to a conflict before outside powers might be able to intervene or to otherwise dissuade them from doing so. The U.S. government says that Russia has such a policy in its nuclear doctrine, but experts dispute that it exists.

...All of this comes as the United States is engaged in negotiations with Russia about extending the New START, which limits the number of nuclear warheads and various strategic delivery systems that each country can have, and is otherwise set to sunset next year. The U.S. government has been campaigning to bring China into the discussions and potentially expand the deal into a trilateral arrangement.

The Pentagon also separately said that China's nuclear arsenal could grow to include new warheads, including a potential lower-yield warhead for the DF-26, and new delivery systems. A lower yield nuclear weapon could indicate that the Chinese military may be looking at a so-called escalate-to-deescalate policy.

China has expressed virtually no interest in doing so. Beyond a spike in geopolitical friction with Washington over a host of different issues, Beijing is unlikely to see any benefit in making itself a party to such an agreement in the near future given that its existing nuclear arsenal is so small compared to that of the U.S. and Russian militaries. The Pentagon looks to be making a case in its latest China assessment for getting them to accept limits now before they can expand the size of their stockpile. Chinese officials have already countered these calls by saying it would be willing to talk nuclear arms control with the United States if it agreed to reduce its arsenal to China's level first.

Whether or not the Chinese grow their ballistic missile and nuclear forces in the ways that the Pentagon expects, it is clear that the People's Liberation Army is working to significantly expand its capabilities in both regards to better challenge the United States, as well as other potential adversaries.

Source: https://www.thedrive.com/the-war-zone/36149/how-chinas-ballistic-missile-and-nuclear-arsenal-is-ballooning-according-to-the-pentagon, 03 September 2020.

OPINION - Maxim Schoofs, Francesco Pezzarossi

Covid-19 is Affecting Nuclear Disarmament

The Covid-19 pandemic is having a significant impact on all areas of international politics, disarmament being one of them. Disarmament is undoubtedly a multifaceted field. While on one side some of its aspects have to do with advocacy and information sharing, on the other side a key part is strictly related to policy-making and treaty negotiation. In the year 2010, the new strategic arms reduction treaty or 'New Start' was created. In this bilateral agreement, the US and Russia had agreed to reduce their strategic nuclear warheads and delivery systems significantly. Both parties would "only" be allowed to possess 1550 long-range nuclear warheads and 700 deployed delivery systems.

Due to the COVID-19 pandemic, the inspections have been postponed and it is unclear if the remaining 32 inspections will be conducted or not. It is in the interest of both parties to conduct at least one more inspection of both types before the end of the year. As the treaty expires on the 5th of February 2021, both the US and Russia will likely want a final assessment of the other party's adherence to the treaty.

To verify each state is abiding by the agreed-upon terms, a series of on-site inspections would occur each year, 18 to be precise. The treaty makes a distinction between two types of inspection. A Type 1 inspection entails the inspection of military sites with deployed and non-deployed strategic systems. A Type 2 inspection only entails the inspection of those sites with non-deployed strategic systems. The inspections provide both parties with insight into the amount of strategic nuclear weapons and the missiles capable of delivering them. Every year each side can conduct ten type 1 inspections and eight type 2 inspections. So far, both sides have performed all inspections for each year. However, in 2020 the US has only conducted two Type 1 inspections and Russia has only conducted two Type 2 inspections.

Due to the COVID-19 pandemic, the inspections have been postponed and it is unclear if the remaining 32 inspections will be conducted or not. It is in the interest of both parties to conduct at least one more inspection of both types before the end of the year. As the treaty expires on the 5th of February 2021, both the US and Russia will likely want a final assessment of the other party's adherence to the treaty. This is the last remaining bilateral nuclear arms control treaty between the US and Russia, its existence is an important part of global disarmament.

When the treaty expires in February, three things can happen. The first option is that the treaty is extended until 2026. A second option is that the US and Russia replace the 'New Start' with a different disarmament treaty. From an international security point of view, both of these options are desirable yet unlikely.

The third and most likely option is that both parties cannot come to an agreement and abandon the treaty, which would mean that for the first time in almost 50 years, there would be no disarmament treaty between the US and Russia regarding their nuclear arsenals.

No less evident are the repercussions of the Covid-19 pandemic on the review conference of the NPT which is regarded as the cornerstone of the global nuclear non-proliferation regime. The quasi-universal scope of the Treaty – 191 States have joined it – explains the fundamental role of

the NPT in the global pursuit of nuclear disarmament.

After the success of the 2010 Review Conference, the 2015 Review Conference ended without reaching consensus on a substantive outcome document. The 2020 Review Conference, which has now been postponed to 2021 due to the ongoing pandemic, may turn into a great occasion for the international community to reaffirm the multilateral commitment to preserve and strengthen the global non-proliferation regime.

Unfortunately, the path towards the 2021 Conference has plenty of hurdles. As it clearly emerged from the past Review Conferences, one of the most problematic issues relates to the recurrent dissatisfactions among many of its parties.

Unfortunately, the path towards the 2021 Conference has plenty of hurdles. As it clearly emerged from the past Review Conferences, one of the most problematic issues relates to the recurrent dissatisfactions among many of its parties. As the former UN High Representative for Disarmament Affairs Sergio Duarte recently explained, "An exacerbation of this pattern could lead to any or some of them to exercise the right ensured by article X.1 and leave the Treaty. This would create a major crisis and must be prevented."

Indeed, while the asymmetry of the parties' rights and duties initially found its justification in the logic of bargain – non-proliferation was bargained for the progressive disarmament of the major nuclear powers – frustration has increased over time as nuclear weapon States have consistently modernized their arsenals despite their disarmament commitment under Article VI.

The dynamic negotiating processes behind the scenes of the 2021 NPT Review Conferences are not isolated from the other aspects of nuclear disarmament. As Ambassador Duarte pointed out "early agreement on the extension of the 'New Start' beyond its expiration in February next year – that is, before the Review Conference – would be a welcome signal of the will of the two largest possessors of nuclear weapons to further reduce existing arsenals," thus helping prevent a failure of the conference.

Aside from the political dynamics closely underpinning NPT negotiations, it is worth recalling that the frustration of a significant portion of States parties has already emerged. Such irritation contributed to the conclusion of the Treaty on the Prohibition of Nuclear Weapons (TPNW), signed in New York in 2017.

Some States and many civil society organizations, including the Nobel prize-winner ICAN, are striving to increase the number of ratifications. Having Ireland, Niue, Nigeria, Saint Kitts and Nevis deposit their instruments of ratification on the occasion of the 75th anniversary of Hiroshima and Nagasaki nuclear bombings, the number of States parties has now increased to 44.

In this way, only six ratifications are missing to the TPNW's entry into force. There is never an ideal time for a global health crisis but when it comes to nuclear disarmament it could not have come at a worse time.

In this way, only six ratifications are missing to the TPNW's entry into force. There is never an ideal time for a global health crisis but when it comes to nuclear disarmament it could not have come at a worse time. Hopefully, inspections can be resumed so that transparency can be restored between the US and Russia before the expiration of the 'New Start'.

Perhaps even more important is that dialogue on the matter can be resumed as well. Zoom calls and other kinds of digital solutions might be effective tools for small groups, but when it comes to discussions where delegates from all around the world need to participate, a zoom call will never have the same impact as the practice of in-person diplomacy. One thing is for sure, the coming months will be crucial for the future of nuclear disarmament.

Source: The Brussels Times, 19 August 2020.

JOINT STATEMENT: IAEA-IRAN

Joint Statement by the Director General of the IAEA and the Vice-President of the Islamic Republic of Iran and Head of the AEOI

The IAEA and the Islamic Republic of Iran agreed to further reinforce their cooperation and enhance mutual trust to facilitate the full implementation of Iran's Comprehensive Safeguards Agreement (CSA) and the Additional Protocol (AP) thereto, which is provisionally applied by Iran since 16 January 2016.

After intensive bilateral consultations, Iran and the IAEA reached an agreement on the resolution of the safeguards implementation issues specified by the IAEA, in good faith. In this regard, Iran is voluntarily providing the IAEA with access to the two locations specified by the IAEA and facilitating the IAEA verification activities to resolve these issues. Dates for the IAEA access and the verification activities have been agreed. The IAEA verification activities will proceed in accordance with the CSA and the AP, and the IAEA's standard verification practice as implemented for all States with CSAs and APs on equal basis and without discrimination.

Iran and the IAEA reached an agreement on the resolution of the safeguards implementation issues specified by the IAEA, in good faith. In this regard, Iran is voluntarily providing the IAEA with access to the two locations specified by the IAEA and facilitating the IAEA verification activities to resolve these issues. Dates for the IAEA access and the verification activities have been agreed.

In the context of resolution GOV/2015/72 adopted by the Board of Governors on 15 December 2015, the IAEA and Iran recognize that these safeguards implementation issues are exclusively related to nuclear material and activities subject to safeguards under the CSA and the AP. In this present context, based on analysis of available information to the IAEA, the IAEA does not have further questions to Iran and further requests for access to locations other than those declared by Iran under its CSA and AP.

Both sides recognize the independence, impartiality and professionalism of the IAEA continue to be essential in the fulfilment of its verification activities. The IAEA will continue to take into consideration Iran's security concerns, by protecting all safeguards confidential information in accordance with the IAEA's Statute, the relevant provisions of the CSA and the AP, and the established IAEA confidentiality regime, standards and procedures.

Source: https://www.iaea.org/, 26 August 2020.

NUCLEAR STRATEGY

USA

Northrop Grumman Wins $13 Billion Contract to Replace U.S. Ballistic Missiles

The U.S. Air Force has awarded Falls Church-based defense manufacturer Northrop Grumman a $13.3 billion contract to replace America's aging stock of intercontinental ballistic missiles, marking a major step forward for an ambitious plan to modernize the nation's crumbling nuclear missile infrastructure. While a nonproliferation treaty caps the Defense Department's stock of nuclear warheads, top defense officials have said updating the missile infrastructure that would be used to deliver those warheads is essential for deterring aggression from countries such as Russia and China.

"Modernizing the nuclear strategic triad is a top priority of our military," Defense Secretary Mark T. Esper said in a statement. "It's key to our nation's defense. It provides that strategic nuclear deterrent that we depend on day after day — that we've depended on decade after decade."

The award sweeps aside an earlier attempt to challenge the terms of the competition by Boeing, which has led the Pentagon's ballistic missile work since the Eisenhower administration. And it gives Northrop the lead on a long-term program,

estimated to be worth $85 billion or more over the next several decades, that includes almost every major defense manufacturer except Boeing.

The U.S. military operates 400 nuclear intercontinental ballistic missiles out of 450 silos across three Air Force bases: Minot Air Force Base in North Dakota, Malmstrom Air Force Base in Montana and F.E. Warren Air Force Base in Wyoming. Air Force officers man the silos around-the-clock in underground capsules with equipment that dates to the Cold War, waiting for an order from the commander in chief to launch the nation's most dangerous weapons if necessary. Because the silos are scattered across farmland in remote areas of multiple states, they ensure that the U.S. nuclear deterrent would survive in the event of an attack and be able to respond. The contract calls for Northrop to develop and manufacture missiles that can be operational by 2029.

...The award of the contract to Northrop Grumman comes in the middle of a vast, three-decade-long modernization of the U.S. nuclear arsenal that President Barack Obama approved in 2010 in exchange for the Republican-led Senate's ratification of the New START Treaty with Russia. In addition to replacing the ICBM fleet, the modernization will see the Pentagon introduce a new submarine and bomber, a long-range standoff cruise missile for the bomber, and new command and control technology.

In addition to replacing the ICBM fleet, the modernization will see the Pentagon introduce a new submarine and bomber, a long-range standoff cruise missile for the bomber, and new command and control technology.

In 2017, the Congressional Budget Office estimated that the overhaul would cost $1.2 trillion over 30 years, including the operation and maintenance of the existing nuclear arsenal while the new technology is introduced. In 2019, the CBO estimated that the Pentagon would spend $61 billion over the subsequent 10 years on modernization of the ICBM fleet alone.

The Defense Department has regularly underscored that the expenditure on the nuclear modernization is only a small percentage of the total defense budget and the country's gross domestic product each year, and that it is necessary to keep the country's nuclear deterrent safe and up to date. But the cost of the project has led to calls for it to be rolled back, particularly from House Armed Services Committee Chairman Adam Smith (D-Wash.), who has called the plan unaffordable. Some congressional Democrats have also opposed the cruise missile, saying its introduction will cause instability among nuclear powers.

This is the first time that the United States is trying to simultaneously modernize the nuclear enterprise while also modernizing an aging conventional fleet of aircraft and other equipment, Gen. David Goldfein, then the top officer in the Air Force, said during an appearance at the Brookings Institution in July 2020.

Goldfein said, "There are either going to be some significant trades made, or we're going to have to find a fund for strategic nuclear deterrence," or a separate account to bankroll the nuclear modernization outside the Air Force budget.... Others say the push to modernize nuclear missiles is not only expensive but could be overtly counterproductive. Congressional Democrats have expressed opposition to developing new cruise missiles, warning that that could spur Russia and other nations to be more aggressive in their weapons programs. Some argue sea- and air-launched nuclear missiles are sufficient.

"Our nation faces major security challenges, including a global pandemic that has killed almost 200,000 Americans, and we shouldn't spend our limited resources on new nuclear weapons that we don't need and make us less safe," said William J. Perry, who served as defense secretary during Bill Clinton's administration. Perry has also argued that ground-based ballistic missiles are a danger because they cannot be recalled if launched by mistake. Perry has proposed scrapping the ICBM fleet altogether.

The decision to give the contract to Northrop Grumman could permanently tip the scales in a U.S. defense industry in which Boeing has been, and remains, a leading supplier. The contract awarded was preceded by a head-to-head competition in which the two companies were separately awarded research and development contracts to build a new ballistic missile.

The decision to give the contract to Northrop Grumman could permanently tip the scales in a U.S. defense industry in which Boeing has been, and remains, a leading supplier. The contract awarded was preceded by a head-to-head competition in which the two companies were separately awarded research and development contracts to build a new ballistic missile.

But Boeing effectively walked away from the table last year, telling top defense officials that it would not submit a bid. Its concerns stemmed from Northrop's 2017 acquisition of a company called Orbital ATK, which builds the solid rocket motors that propel ballistic missiles. Boeing took its case to the Federal Trade Commission and the Pentagon seeking to force Northrop to team up, but no such agreement materialized.

Source: Washington Post, 09 September 2020.

NUCLEAR ENERGY

CHINA

China Grants Approval to Construct Two Nuclear Projects

China's cabinet says it aims to construct six to eight nuclear plants per year up to 2025. The Government of China has reportedly approved the construction of two nuclear power projects in the country. Reuters quoted state radio as saying that China's cabinet approved the Hainan Changjiang nuclear power plant phase 2 project, and the Zhejiang San'ao nuclear power plant phase-I. For these two new nuclear power plants, the country has invested approximately $10.24bn (CNY70bn). Hainan Changjiang nuclear power plant phase 2 will come online in 2026, while the Zhejiang San'ao nuclear power plant phase 1 will begin operations by 2025.

China's cabinet approved the Hainan Changjiang nuclear power plant phase 2 project, and the Zhejiang San'ao nuclear power plant phase-I. For these two new nuclear power plants, the country has invested approximately $10.24bn (CNY70bn). Hainan Changjiang nuclear power plant phase 2 will come online in 2026, while the Zhejiang San'ao nuclear power plant phase 1 will begin operations by 2025.

The two new nuclear power plants will form part of the country's policy to cut pollution levels and boost its economy. China's cabinet made the decision in a meeting chaired by Premier Li Keqiang. In the meeting, the cabinet announced it would focus on maintaining a flexible monetary policy to support its economy affected by the pandemic.

In an official statement, the cabinet said: "Pushing forward the construction of nuclear power projects actively and steadily is an important measure to expand effective investment, enhance energy support, and reduce greenhouse gas emissions."

Last year, China launched three new nuclear power plants in the provinces of Shandong, Fujian and Guangdong, which marked the end of a moratorium on new projects. China's nuclear association said that six to eight nuclear reactors a year will be built in the country between 2020 and 2025. These will raise the country's total capacity to 70GW, up 43.5% from May-end, according to the official *China Daily* in July. The association also said that the total installed nuclear capacity in China is expected to stand at 52GW by the end of this year.

Source: https://www.power-technology.com/, 03 September 2020.

New Chinese Reactor Starts Construction

Construction has started of the second Hualong One reactor at Zhangzhou nuclear power plant in Fujian province, eleven months after the first 1212

MWe unit. The two are expected in operation in 2024 and 2025, and will be followed by four more units there. The plant is being built by CNNC-Guodian Zhangzhou Energy Company, which is 49% owned by China Guodian Corporation, one of the four large power companies unable to build nuclear plants on their own.

There are now seven Hualong One reactors under construction in China and two in Pakistan. Two are planned for Bradwell in UK. Fuel loading has commenced at the first of the Chinese units - Fuqing 5. State Council has approved construction start on four more Hualong One reactors, at Cangnan/ San'ao in Zhejiang and Changjiang in Hainan.

Source: World Nuclear News, 04 September 2020.

POLAND

Poland Firms Up Nuclear Power Plans to Diminish Coal

In a new draft energy policy to 2040, coal will be phased out more rapidly than earlier intended. The policy is expected to be adopted later this year (2020). Today coal provides three quarters of the country's electricity. The plan envisages 23% from renewables, mainly wind, but identifies the need for zero-emission power that is not weather-dependent as fundamental. The government aims to commission the country's first nuclear power unit in 2033, with more reactors joining it every 2-3 years, up to six units in total. This would be 6 to 9 GWe, capable of supplying one quarter to one third of the country's electricity. Offshore wind energy capacity is to increase to 8-11 GWe by 2040, at much lower capacity factors.

The government aims to commission the country's first nuclear power unit in 2033, with more reactors joining it every 2-3 years, up to six units in total. This would be 6 to 9 GWe, capable of supplying one quarter to one third of the country's electricity. Offshore wind energy capacity is to increase to 8-11 GWe by 2040, at much lower capacity factors.

The Climate Minister said that the transformation of the Polish energy sector would be fair and that European funds of €13.49 billion would help finance this transition.... Five western and South Korean reactor vendors have expressed interest in Polish plans. Russian technology is not under consideration. Construction of the first large nuclear power reactor is envisaged from 2026. Meanwhile there is close cooperation with the Japan Atomic Energy Agency on high-temperature gas-cooled reactors with a view to hydrogen production.

Source: World Nuclear News, 09 September 2020.

RUSSIA

New Large Russian Reactor Starts Up

The second new-generation large reactor at Leningrad power plant has started up. This is a VVER-1200 and will replace unit 2 of the old plant after 45 years' service. It is an RBMK type made infamous at Chernobyl (but since much modified). The first of the two new units was grid connected in March 2018. These are 1085 MWe net, and represent the main current Russian export offerings, and are being built now in Belarus, Turkey and Bangladesh, and soon in China, Finland, Egypt, Hungary and Uzbekistan.

The second new-generation large reactor at Leningrad power plant has started up. This is a VVER-1200 and will replace unit 2 of the old plant after 45 years' service. It is an RBMK type made infamous at Chernobyl (but since much modified).

Source: World Nuclear News, 01 September 2020.

Russia to Produce New Recycled Nuclear Fuel

Rosatom is setting up a new small-scale production line at the Siberian Chemical Plant for an innovative way of recycling used fuel from nuclear power reactors. Instead of the MOX fuel used for several decades, which combines recycled plutonium with depleted uranium, the new REMIX fuel comprises recycled uranium and plutonium together mixed with fresh low-enriched uranium. This gives fuel with about 1% Pu-239

and 4% U-235 which can sustain burn-up of 50 GWd/t over four years and has similar characteristics to normal reactor fuel. Pilot REMIX fuel rods have been tested in Balakovo unit 3 over four years.

Source: World Nuclear News, 27 August 2020.

USA

Bill Gates' Nuclear Venture Plans Reactor to Complement Solar, Wind Power Boom

A nuclear energy venture founded by Bill Gates said...it hopes to build small advanced nuclear power stations that can store electricity to supplement grids increasingly supplied by intermittent sources like solar and wind power. The effort is part of the billionaire philanthropist's push to help fight climate change, and is targeted at helping utilities slash their emissions of planet-warming gases without undermining grid reliability.

A nuclear energy venture founded by Bill Gates said...it hopes to build small advanced nuclear power stations that can store electricity to supplement grids increasingly supplied by intermittent sources like solar and wind power. The effort is part of the billionaire philanthropist's push to help fight climate change, and is targeted at helping utilities slash their emissions of planet-warming gases without undermining grid reliability.

TerraPower LLC, which Gates founded 14 years ago, and its partner GE Hitachi Nuclear Energy, plan to commercialize stations called Natrium in the United States later this decade, TerraPower's President and Chief Executive Chris Levesque said.

Levesque said the companies are seeking additional funding from private partners and the U.S. Energy Department, and that the project has the support of PacifiCorp, owned by billionaire Warren Buffett's Berkshire Hathaway, along with Energy Northwest and Duke Energy. If successful, the plan is to build the plants in the United States and abroad, Levesque said.

By 2050 "we would see hundreds of these reactors around the world, solving multiple different energy needs," Levesque said. The 345-megawatt plants would be cooled by liquid sodium and cost about $1 billion each. Nuclear power is a top source of virtually emissions-free electricity, but many plants are shutting in the United States because of high costs and competition from solar and wind. Critics of advanced nuclear have also warned that smaller nuclear is even more expensive than conventional. The new plants, however, are designed to complement a renewable power because they will store the reactor power in tanks of molten salt during days when the grid is well supplied. The nuclear power could be used later when solar and wind power are low due to weather conditions.

Molten salt power storage has been used at thermal solar plants in the past, but leaks have plagued some of the projects. Levesque said the Natrium design would provide more consistent temperatures than a solar plant, resulting in less wear and tear. Gates, chairman of TerraPower's board, said in a statement that Natrium innovation was "extremely difficult" but its team had "the expertise, commercial experience, and the resources necessary" to develop viable reactors. Levesque said Natrium plants would first be built in the United States and other developed countries, but could later spread to countries that do not have yet have nuclear power. Nonproliferation experts have warned that advanced nuclear projects could become targets for attack because their uranium fuel would be more highly enriched and more easily converted to fissile material than conventional fuel.

Levesque said the plants would reduce proliferation risks because they reduce overall nuclear waste. Gates had initially hoped to build an experimental nuclear plant near Beijing with state-owned China National Nuclear Corp. But last year, TerraPower was forced to seek new partners after the Trump administration restricted nuclear deals with China.

Source: Reporting by Timothy Gardner; Editing by Bernadette Baum, Reuters, 28 August 2020.

NUCLEAR COOPERATION

HUNGARY-BANGLADESH

Hungary, Bangladesh Agree to Enhance Cooperation in Nuclear Energy Sector

Hungary has agreed to expand its cooperation in the nuclear energy and a few other sectors in Bangladesh in a bid to enhance bilateral ties. Foreign Minister AK Abdul Momen announced the development after a meeting with his Hungarian counterpart Péter Szijjártó at the state guest house Padma in Dhaka....

On Budapest's assistance to increase Bangladesh's nuclear energy capacity, Szijjártó pointed out that his country has been generating electricity from nuclear power since the 1980s while the South Asian country only recently took the initiative to build a nuclear power plant. "We have agreed to cooperate in various sectors, including the training of nuclear engineers and specialists. As part of this process, 130 students from Bangladesh will be given scholarships to study in Hungary instead of the current 100. The 30 additional students will get scholarships to study nuclear energy." Highlighting his country's experience with nuclear power, Szijjártó said, "Russia's Rosatom is the main constructor of nuclear power plants in Bangladesh. We have also built reactors using similar structures in Hungary."

We have agreed to cooperate in various sectors, including the training of nuclear engineers and specialists. As part of this process, 130 students from Bangladesh will be given scholarships to study in Hungary instead of the current 100. The 30 additional students will get scholarships to study nuclear energy.

The new Hungarian consulate will have a consul as well as a diplomat to look after economic affairs. It will be run in collaboration with the Hungarian embassy in New Delhi. The consulate could open in January 2021, according to Momen. Addressing the Rohingya crisis, Szijjártó said Hungary is closely following the matter.

...Highlighting Hungary's investments abroad, Momen said, "Hungary has earmarked about $115 billion for foreign investment. They have invested more than $50 billion in some countries."Szijjártó arrived in Dhaka on a one-day official visit. He also met with Commerce Minister Tipu Munshi before departing the country in the evening.

Source: https://bdnews24.com/bangladesh/2020/09/10/hungary-bangladesh-agree-to-enhance-cooperation-in-nuclear-energy-sector, 10 September 2020.

IRAN-RUSSIA

Officials Discuss Iran-Russia Nuclear Cooperation

Iran's ambassador to Russia and deputy head of Russian nuclear energy company Rosatom weighed plans for closer nuclear cooperation between the two countries. In the meeting in Moscow, Kazem Jalali and Rosatom Deputy Director General for International Relations Nikolay Spassky stressed the need to promote cooperation between Iran and Russia in the peaceful nuclear industry. They also called for continued meetings and cooperation between the two countries against the US' irresponsible pressures on the 2015 nuclear deal. In February 2020, Russian Deputy Foreign Minister Sergei Ryabkov said Tehran and Moscow continue their consultations on their nuclear cooperation.

"We are conducting consultations on various aspects of our nuclear cooperation. Rosatom and the Atomic Energy Organization of Iran are coordinating their schedules directly. We are not dragging this on, while it is clear that the situation has not improved, compared to the moment when the project (at Iran's Fordow nuclear facility) was suspended. But we will hold consultations," Ryabkov said after Rosatom suspended work on revamping a factory at Fordow due to an issue with uranium compatibility.

Source: https://www.tasnimnews.com/en/news/2020/09/05/2342233/officials-discuss-iran-russia-nuclear-cooperation, 05 September 2020.

NUCLEAR NON-PROLIFERATION

IRAN

Intel: Iran Claims it Found Agents Behind Natanz Nuclear Explosion

Saboteurs responsible for the 02 July 2020 explosion at Iran's Natanz nuclear facility have been identified, said a senior Iranian energy official as reported by the country's semi-official state media outlet, Fars News Agency.

...Atomic Energy Organization of Iran (AEOI) spokesperson Behrouz Kamalvandi told state media that the government had discovered those responsible for the blast. Kamalvandi declined to provide further details as he said the investigation is ongoing.... The Natanz incident was first announced by AEOI in early July 2020 and later verified as an explosion. No casualties were reported.

Although the blast impacted capabilities of the energy facility and caused serious damage, the regime later backtracked and said the destruction was not significant and production was able to compensate for the loss... Israel was widely reported to have been behind the blast, stemming from an April 2020 report by the Washington Post that hackers linked to Iran has targeted important Israeli water systems. There is also speculation the Natanz blast was a cyberattack.

Although the blast impacted capabilities of the energy facility and caused serious damage, the regime later backtracked and said the destruction was not significant and production was able to compensate for the loss... Israel was widely reported to have been behind the blast.

Natanz is one of several Iranian facilities monitored by the IAEA. In a joint press conference after the 25 August 2020 meeting, both sides expressed hope that there would be strengthened Iran-IAEA cooperation in the future. An agreement formed after the meeting allows IAEA to continue their inspection work, said IAEA Director General Rafael Mariano Grossi.

...The IAEA's vist to Tehran arrived on the heels of the United States demanding the UN Security Council to reimpose sanctions against Iran. US President Donald Trump withdrew from Iran's 2015 nuclear deal. But an August vote by the UN Security Council halted a call to snapback sanctions against the regime.

Source: https://www.al-monitor.com/, 09 September 2020.

NUCLEAR PROLIFERATION

NORTH KOREA

Images Suggest North Korea May be Preparing Launch of Submarine Missile, Think Tank Says

The CSIS said the images showed several vessels within a secure boat basin, one of which resembled vessels previously used to tow a submersible test stand barge out to sea. It said the activity was "suggestive, but not conclusive, of preparations for an upcoming test of a Pukguksong-3 submarine launched ballistic missile from the submersible test stand barge."

Satellite imagery of a North Korean shipyard... shows activity suggestive of preparations for a test of a medium-range submarine-launched ballistic missile, a U.S. think tank reported....The Center for Strategic and International Studies said the images it published on its website of North Korea's Sinpo shipyard showed several vessels within a secure boat basin, one of which resembled vessels previously used to tow a submersible test stand barge out to sea.

It said the activity was "suggestive, but not conclusive, of preparations for an upcoming test of a Pukguksong-3 submarine launched ballistic

missile from the submersible test stand barge." North Korea said last October (2019) it had successfully test-fired a Pukguksong-3, a new SLBM, from the sea as part of efforts to contain external threats and bolster self-defense. That launch was seen by analysts as the most provocative by North Korea since it entered dialogue with the United States over its nuclear weapons and missile programs in 2018.

...There was no immediate comment from the State Department or the Pentagon on the CSIS report. At news conference earlier....Trump hailed his relationship with North Korea, saying that when he was elected people had predicted he would be at war with the country within a week....

Trump has held up the absence of intercontinental ballistic missile and nuclear tests by North Korea since 2017 as a success from his diplomacy and has sought to play down numerous shorter-range tests in the period...."North Korea already tested a PKS-3 SLBM last October. And it didn't cross Trump's redline then, and is unlikely to this time. ... News of the activity at Sinpo comes amid signs that North Korea may be preparing for a major military parade in October, which some analysts believe could be used to show off new missiles as the country has done at such events in the past.

Source: CNBC, 05 September 2020.

NUCLEAR SAFETY

USA

NuScale's Small Nuclear Reactor is First to Get US Safety Approval

...The first small modular reactor received a design certification from the US Nuclear Regulatory Commission, meaning that it meets safety requirements and could be chosen by future projects seeking licensing and approval. The design comes from NuScale, a company birthed from research at Oregon State University that has received some substantial Department of Energy funding. It's a 76-foot-tall, 15-foot-wide steel cylinder (23 meters by 5 meters) capable of producing 50 megawatts of electricity. (The company also has a 60-megawatt iteration teed up.) They envision a plant employing up to 12 of these reactors in a large pool like those used in current nuclear plants.

The first small modular reactor received a design certification from the US Nuclear Regulatory Commission, meaning that it meets safety requirements and could be chosen by future projects seeking licensing and approval.

The basic design is conventional, using uranium fuel rods to heat water in an internal, pressurized loop. That water hands off its high temperature to an external steam loop through a heat exchange coil. Inside the plant, the resulting steam would run to a generating turbine, cool off, and circulate back to the reactors. The design also uses a passive cooling system, so no pumps or moving parts are required to keep the reactor operating safely. The pressurized internal loop is arranged so that it allows hot water to rise through the heat exchange coils and sink back down toward the fuel rods after it cools.

NuScale's Illustration of its Reactor Design: In the case of a problem, the reactor is similarly designed to manage its heat automatically. The control rods—which can encase the fuel rods, blocking neutrons and halting the fission chain reaction—are actively held in place above the fuel rods by a motor. In the event of a power outage or kill switch, it will drop down on the fuel rods due to gravity. Valves inside also allow the pressurized water loop to vent into the vacuum within the reactor's thermos-like double-wall design, dumping heat through the steel exterior, which is submerged in the cooling pool. One advantage of the small modular design is that each unit holds a smaller amount of radioactive fuel, and so it has a smaller amount of heat to get rid of in a situation like this.

NuScale submitted its design at the end of 2016, and approval of a new type of reactor was no small task. The company says it submitted over two million pages of requested information

throughout the process. But at the end, the agency signed off: "The NRC concludes the design's passive features will ensure the nuclear power plant would shut down safely and remain safe under emergency conditions, if necessary."

A couple of additional modular light water reactors are about to start the certification process. Separately, a handful of companies have plans to submit very different designs, like molten salt reactors. But these are even farther out. NuScale, on the other hand, says it aims to have its first reactors deployed "by the mid-2020s."

Source: Scott K. Johnson, https://arstechnica.com/science/2020/09/first-modular-nuclear-reactor-design-certified-in-the-us/, 01 September 2020.

NUCLEAR WASTE MANAGEMENT

GENERAL

The iPhone 16 Could Be Powered by Nuclear Waste Diamond Batteries

Every year, smartphones become increasingly intelligent, thanks to shiny new components and the latest chipsets. But while they're getting more powerful, our devices are still hindered by one piece of technology that ultimately curtails their power. Batteries.

As we all crave longer lasting batteries in the hope that one day we can ditch our cables, companies everywhere are racing to develop the latest breakthrough in battery technology. From solid-state batteries to graphene batteries to souped up lithium, the race is on to find the Duracell equivalent of the next Tetra Pak, and with it untold riches. The flavour of the month this time? Batteries made from nuclear waste.

A number of companies are working on developing nuclear waste-powered batteries that could last for years upon years. Arkenlight, a company formed out of the University of Bristol, is one of them. Unlike traditional lithium-ion batteries, which rely on chemical reactions to power your devices, Arkenlight's nuclear waste-powered batteries use graphite from decommissioned nuclear plants. This graphite is then harvested for radioactive carbon-14 and turned into man-made diamonds. As the carbon-14 naturally decays, the beta particles knock electrons in the diamond loose to generate an electrical current. What's more, this self-powering process can last between 12 and 5,000 years. Theoretically, this means if such a battery could be commercialised sufficiently, you'd never have to charge your phone... ever again. It would continually recharge itself.

A number of companies are working on developing nuclear waste-powered batteries that could last for years upon years. Arkenlight, a company formed out of the University of Bristol, is one of them. Unlike traditional lithium-ion batteries, which rely on chemical reactions to power your devices, Arkenlight's nuclear waste-powered batteries use graphite from decommissioned nuclear plants. This graphite is then harvested for radioactive carbon-14 and turned into man-made diamonds.

The concept of turning nuclear waste into energy isn't entirely new. Researchers have been working on turning radioactive material into electrical current since the early 1900s. And in the 1970s, betavoltaic batteries, which use radioactive isotopes to create tiny electric currents, were already being used in pacemakers. These were eventually replaced with traditional lithium-ion batteries. One of the main reasons why they were used in devices like pacemakers was because they could last a long time, but they were never used in anything more intensive because of their small power output.

...Arkenlight says that it has been able to develop a more efficient and power dense nuclear battery than the ones created in the past. The researchers from the University of Bristol found that if they placed the radioisotope inside a diamond material then they would be able to increase the power output. "The diamond lattice matrix is so tight that the beta particles aren't going to escape," explains

Morgan Boardman, Arkenlight's CEO. "So, boom, now we have the magic answer – the underlying magic is we have something so tightly bound, it's safe for humans to use, and the energy density is actually relevant to commercial applications."

Those commercial applications include everything from actuators and sensors on factory floors to security tags for shipping containers and space components. Generally, any device which is currently using micro batteries to power them. But smartphones and electric cars? Probably not. "We could power your phone now," says Boardman, "if you are willing to have a battery the size of a tub of vegetable spread."

The problem with betavoltaic batteries is that they provide far less power – we're talking tens of microwatts – for the trade-off that they'll last a whole lot longer. ...To power a device such as a warehouse sensor for a thousand years, Boardman says it would cost manufacturers around £50. A smartphone with a diamond-material the size of a tub of margarine, however, would cost "back of the napkin, in excess of £200,000." The energy required to power a smartphone, for instance, is significantly more than the energy required to power a microwatt pacemaker.

The State Nuclear Regulatory Inspectorate of Ukraine (SNRIU) has issued a permit to SSE Chernobyl Nuclear Power Plant (ChNPP) to start commissioning work at the Chernobyl Interim Spent Nuclear Fuel Storage Facility (ISF-2), which upon loading will be the world's largest dry storage installation.

A prototype of Arkenlight's gammavoltaic battery that will convert gamma rays from nuclear waste repositories into electricity. But California-based NDB says that it has found the solution to the meagre power output of betavoltaic batteries, claiming that it will be able to upscale radioactive waste so that it can be used to drive high-power devices like iPhones and even electric cars.

The company has been developing nano-diamond batteries that it says use not just the beta decay of radioisotopes but also the alpha decay as well. With NDB's technology, CEO Nima Golsharifi claims that it could power a whole range of devices. Starting from low-voltage space electronic sensors to consumer electronics, like your phone and your laptop, and even on to high power devices like electric vehicles or planes. "Anything that the current lithium-ion batteries could run, we can do the same," Golsharifi claims.

While Golsharifi doesn't go into many specifics, making his claims difficult to verify, he says that (depending on the radioisotope) the battery's power output could go up to 50 milliwatts per gram. He explains that the batteries won't last as long as the ones using solely beta decay, but your phone power could still last nine years, while your electric car could last as long as 90 years.

The company is currently working on a prototype for a few different applications, which it says will be finished in eight to 12 months. If it does manage to make the technology work, Golsharifi says it could be ready for use in consumer electronics in just three years. In the meantime, we'll have to wait and see if this is just another bold vision which never comes to fruition - and keep plugging in our phones every day.

Source: Alex Lee is a writer for WIRED, https://www.wired.co.uk/article/nuclear-batteries, 12 September 2020.

UKRAINE

Chernobyl Used Fuel Store Gains Permit for Commissioning

The State Nuclear Regulatory Inspectorate of Ukraine (SNRIU) has issued a permit to SSE Chernobyl Nuclear Power Plant (ChNPP) to start commissioning work at the Chernobyl Interim Spent Nuclear Fuel Storage Facility (ISF-2), which upon loading will be the world's largest dry storage installation.

Announcing the milestone in separate statements, ChNPP and Holtec International of the USA said the permit initiates the campaign to disassemble each of Chernobyl's more than 21,000 fuel

assemblies into three parts - two fuel bundles and an activated connecting rod - in a purpose-built 'hot cell', packaging them in double-walled transportable canisters and placing them into dry storage.

Holtec had handed over the complex to the owner, ChNPP, in December 2019. The permit was issued once the owner had completed the last round of confirmatory component and integral effects tests. Presenting the permit took place in a small ceremony on 7 September led by the SNRIU Chairman Grigoriy Plachkov and attended by Bogdan Borukhovskiy, deputy minister of the Ministry of Ecology and Natural Resources of Ukraine, Sergiy Kalashnik, head of the State Agency of Ukraine on Exclusion Zone Management, as well as representatives of the European Bank for Reconstruction and Development (EBRD), ChNPP and Holtec.

Speaking at the ceremony, Plachkov said: "This is an important and long-awaited event. The transfer of ChNPP Spent Nuclear Fuel to a long-term safe dry storage at ISF-2 over the next 10 years is one of [the] key milestones in the transformation of the Chernobyl NPP into an ecologically safe system."

Balthasar Lindauer, director of the EBRD's Nuclear Safety Department, added: "Providing safe and secure storage for spent fuel is one of the most pressing nuclear safety challenges at the Chernobyl site. The start of hot testing at the new storage facility is therefore a major milestone. It is credit to the hard work of ChNPP and Holtec in overcoming many technical challenges as well as to the support of the donors to the Nuclear Safety Account. It is now critically important that this nuclear legacy is addressed in a timely and safe manner."

...ChNPP thanked the Assembly of Donors, consisting of the governments of Belgium, Canada, Denmark, the European Union, Finland, France, Germany, Italy, Japan, the Netherlands, Norway, Russia, Sweden, Switzerland, Ukraine, the UK and the USA, who provided the financial support, and the Fund Administrator, the EBRD, for its "steadfast support to bring this important and critical project to this final stage"....

Source: World Nuclear News, 09 September 2020.

Centre for Air Power Studies

The Centre for Air Power Studies (CAPS) is an independent, non-profit think tank that undertakes and promotes policy-related research, study and discussion on defence and military issues, trends and developments in air power and space for civil and military purposes, as also related issues of national security. The Centre is headed by Air Marshal K.K Nohwar, PVSM VM (Retd).

Centre for Air Power Studies
P-284
Arjan Path, Subroto Park,
New Delhi - 110010
Tel.: +91 - 11 - 25699131/32
Fax: +91 - 11 - 25682533
Email: capsnetdroff@gmail.com
Website: www.capsindia.org

Edited by: Director General, CAPS

Editorial Team: Dr. Sitakanta Mishra, Hina Pandey, Dr. Poonam Mann, Sreoshi Sinha, Zoya Akhter, Carl Jaison, Nasima Khatoon, Sanjana Gogna

Composed by: CAPS