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OPINION – Walter Pincus

A Glimpse of the US’ New Nuclear Posture

The Biden Administration will begin its own Nuclear Posture Review (NPR) in the coming weeks to determine what the U.S. needs in order “to sustain deterrence and defense,” and “how we can continue to reduce reliance on the role of nuclear weapons in our strategy,” according to Secretary of State Antony Blinken in comments made to Nikkei Asia and other Japanese reporters during a virtual press conference in Tokyo.

Cyber creates opportunities to reduce dependence on nuclear weapons, and the team putting together the Biden NPR study should explore making advanced cyber capabilities part of the U.S. deterrence package. One idea already in the works is “Pathfinder,” a new approach to all-domain awareness using AI being promoted by Northern Command’s boss, Air Force Gen. Glenn D. VanHerck.

“Harnessing the capability of distributed multi-domain sensors, machine learning, and artificial intelligence will provide military leaders, the intelligence community, and senior civilian officials with the information necessary to anticipate, rather than react to, competitors’ actions,” VanHerck told the Senate Armed Services Committee.

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He has described that as getting “left of launch,” i.e. being able “to posture [US] forces and message to create doubt in their [adversaries] minds about utilizing these capabilities [their ICBMs] to attack the [US] homeland to achieve their objectives.” VanHerck added, “That’s what I mean by deterrence by denial. It’s about [creating] doubt about the success that they can actually achieve.”

Dr. James Andrew Lewis, Senior Vice President and Director of the Strategic Technologies Program at the Center for Strategic and International Studies (and a Cipher Brief Expert), recently recalled to me conversations he had with Russian experts two

years ago, saying they already feared a combination of US technologies and advanced conventional weapons that "circumvented nuclear deterrence."

"They [the Russians] said that the combination of UAVs, cyber, stealth, hypersonics, and PGMs, gave the U.S. the ability to achieve strategic effect without using nuclear weapons, by crippling command and control and Russian nuclear weapons," Lewis said. Another task for the Biden NPR would be to

question the need for several proposals contained in the Trump administration's 100-page, 2018 NPR. It led to several proposed and actual increases in U.S. nuclear weaponry starting with the January 2020 deployment of the new, low-yield W-76-2 warheads on several strategic Trident sub-launched ballistic missiles now on patrol.

It also called for research on a new, sea-launched, nuclear cruise missile (SLCM-N) and stepped-up production of a new, bomber-carried, long-range, stand-off, air-launched, nuclear cruise missile (LRSO). Both drew Democratic opposition in Congress, but the LRSO is in development while the SLCM-N has remained a paper study. On March 2, Sen. Edward Markey (D-Mass.) and Rep. Ro Khanna (D-Calif.) sent a letter to President Biden calling on him "to withdraw the low-yield W76-2 warhead from deployment and cancel the SLCM-N."

The Trump NPR also reversed an Obama Administration plan to retire the B83-1, the most powerful bomb in the U.S. arsenal with a top yield of 1.2 megatons (equivalent to 1.2 million tons of TNT). The stated rationale for keeping this 40-

year-old weapon in the active stockpile was that it holds "at risk a variety of protected targets," which means those underground inside mountains.

The current B-61 tactical nuclear bomb, some 200 of which are deployed in NATO countries, can handle the job so there is no need for the B-83-1.

The Trump NPR also called for a new facility with the "enduring capability and capacity to produce plutonium pits at a rate of no fewer than 80 pits per year by 2030." Plutonium

pits are located at the core of thermonuclear weapons and serve as the trigger for the devices.

A pit production facility at Los Alamos National Laboratory currently produces 11 a year and could do 20. A new facility to meet the proposed goal of

80 pits yearly could cost upwards of \$2 billion and has been the subject of congressional hearings over the years. The proposed new pit facility at Savannah River, S.C., remains under study.

Biden's quick agreement with Russian President Vladimir Putin to extend for five years, the 2010 New START could provide the

Biden NPR team with a basis for formulating future nuclear arms control efforts, not only with Russia but also with China and other nuclear armed nations.

A British announcement that it planned to "move to an overall nuclear weapon stockpile of no more than 260 warheads" from a previous ceiling of 225, raised a complaint from Moscow. "This decision harms international stability and strategic security," Kremlin press spokesman Dmitry Peskov told reporters.

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The need for some new multilateral approaches to nuclear arms control is growing. Russia and China are creating new, hypersonic, nuclear cruise weapons and even nuclear submersible arms. Britain and France as well as India and Pakistan are modernizing their stockpiles. Israel is constructing a new underground facility at its undeclared nuclear weapons complex and North Korea has become a nuclear power.

Source: *The Cipher Brief*, https://www.thecipherbrief.com/column_article/a-glimpse-of-the-u-s-new-nuclear-posture, 23 March 2021.

OPINION – Evans J.R. Revere

North Korea’s New Nuclear Gambit and the Fate of Denuclearization

In March 2012, North Korean Foreign Minister Ri Yong-ho told a group of U.S. experts and former officials that North Korea would not denuclearize until the United States removed its “threat.” He defined this as the U.S.-South Korea alliance, the presence of U.S. troops in South Korea, and the U.S. nuclear umbrella defending South Korea and Japan.

“If you remove the threat,” Ri said, “we will feel more secure, and in 10 or 20 years we will be able to consider denuclearization.” “In the meantime,” he declared, “we can sit down and engage in arms control talks as one nuclear power with another.” Faced with a new U.S. president whose North Korea policy remains unclear, Kim Jong Un has decided to pre-empt the outcome of the ongoing U.S. policy review by ending all prospects of

Faced with a new U.S. president whose North Korea policy remains unclear, Kim Jong Un has decided to pre-empt the outcome of the ongoing U.S. policy review by ending all prospects of denuclearization and expanding his nuclear and missile capabilities instead. In doing so, Kim hopes to compel Washington to engage in “arms control talks” if it hopes to slow the North’s nuclear program.

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Kim’s gambit to change the main topic of U.S.-North Korea dialogue from denuclearization to arms control was hiding in plain sight in his January 2021 address to the Korean Workers Party Congress. He described North Korea’s nuclear weapons development as the nation’s “strategic and predominant goal” and an “exploit of greatest significance in the history of the Korean nation.” Declaring North Korea a “responsible nuclear weapons state,” Kim’s message was that the regime is now a permanent nuclear power and Washington must deal with it as such. No less important was Kim’s announcement of a plan to enhance his nuclear and missile arsenals by developing “ultramodern tactical nuclear weapons,” multiple-warhead missiles, and solid-fuel intercontinental ballistic missiles.

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Kim’s remarks signaled his determination to make a dangerous threat even more potent. Much has been said about the Biden administration’s ongoing North Korea policy review. But Kim Jong Un’s remarks to the Party Congress suggest Pyongyang has conducted its own review, the result of which will be a major challenge for a new U.S. administration still

finding its feet.

Kim Jong Un’s costly move to modernize weapons of mass destruction comes as North Korea is in the grip of an economic crisis. The COVID-19 pandemic has decimated trade with China — the

regime's economic lifeline. The state planning system is broken, foreign exchange holdings are down, state revenue is shrinking, growth is declining, and international sanctions and bad weather are taking a toll on the economy. Despite this, Kim Jong Un is forging ahead, apparently convinced that the benefits will outweigh the economic risks.

One benefit would be sanctions relief — if he can convince the United States this is the price it must pay to limit Pyongyang's nuclear program. Kim failed to do this at his February 2019 summit with former U.S. president Donald Trump in Hanoi. But increasing Washington's sense of nuclear threat might yield a more favorable result.

North Korea's new approach, rooted in an old strategy, shifts the focus of dialogue with Washington from denuclearization to a new question: how can North Korea and the United States manage their relations in light of Pyongyang's new status as a de facto nuclear weapons state?

In pursuing this approach, North Korea hopes to exploit the view held by many U.S. experts and officials that denuclearization is no longer achievable. Instead, Washington should focus on "managing" North Korea's nuclear threat and constraining the growth of its arsenal. This view is surely music to Pyongyang's ears, since it would draw Washington into a dialogue not about whether North Korea should have nuclear weapons, but about how many it should possess.

It remains to be seen whether the Biden administration will take the bait and pursue an arms control approach with Pyongyang. If it does, President Joe Biden will no doubt assure us that he does not "accept" North Korea's nuclear program, but rather wants to limit it quantitatively and qualitatively. Such an argument ignores the fact that denuclearization agreements in 1994, 2005, and 2007 failed to freeze the nuclear

program because of Pyongyang's evasiveness about monitoring and verification. As a fully-fledged nuclear power, North Korea will probably be even more reluctant to accept intrusive inspections today.

With the door to North Korea's denuclearization closing, Kim Jong Un believes he can shut it forever and open a new one that will lead the country to become a permanently nuclear-armed state. If the Biden administration decides to take the slippery slope leading to arms control talks with Pyongyang, it will find an eager "partner" in Kim Jong Un.

Source: Brookings Institution, <https://www.brookings.edu/blog/order-from-chaos/2021/03/26/north-koreas-new-nuclear-gambit-and-the-fate-of-denuclearization/>, 26 March 2021.

OPINION – Serhii Plokhyy

Boris Johnson is Playing a Dangerous Nuclear Game

Boris Johnson's decision to increase the cap on British nuclear stockpiles by more than 40%, from 180 to 260 Trident nuclear warheads, might easily be interpreted as a manoeuvre inspired by domestic politics, rooted in the Conservative Party's longstanding love affair with nuclear power and the recent politics of Brexit. But the decision has broader significance. It reflects the rapidly changing international nuclear environment, and will make it significantly worse.

The world entered a new and dangerous era on 2 August 2019. On that day, the planet's strongest nuclear powers, the US and Russia, declared their withdrawal from the INF treaty signed by Ronald Reagan and Mikhail Gorbachev in 1987. The treaty was the last cold war-era arms control agreement remaining in force. We are now officially at the start of an uncontrolled nuclear arms race.

What this meant became clear on 8 August, less

than a week after the Reagan-Gorbachev agreement was abandoned. The reactor of a nuclear-powered and nuclear-armed Russian cruise missile, codenamed Skyfall, exploded in the Barents Sea, killing five Russian scientists and naval officers and contaminating the atmosphere and waters in the Arkhangelsk region of Russia. The ultimate target of Skyfall, as President Putin demonstrated in a public video a year earlier, is the US.

Today, we are back to a situation that resembles the period preceding the Cuban missile crisis, when there were no mutually binding arms control agreements and various countries, the UK among them, were competing to outspend one another in building nuclear arsenals. In October 1962, only luck and the fear of nuclear confrontation shared by John Kennedy and Nikita Khrushchev saved the world from nuclear war. The shock of the crisis led the two superpowers to negotiate a number of arms control deals, ranging from the Partial Nuclear Test Ban treaty to arms control and limitation agreements. MAD, or mutually assured destruction, a concept strongly associated in the public imagination with Dr Strangelove's "Doomsday Machine", miraculously kept the nuclear powers at bay, maintaining what Churchill called the "balance of terror".

But attempts to change that balance, such as Ronald Reagan's "Star Wars" initiative, which threatened to make the US safer than its Soviet opponent, brought the world back to the brink of nuclear confrontation. We are now learning more about that period. There was a close call in September 1983, when the Soviet early warning missile attack system malfunctioned, sounding a nuclear alarm. It turned out that sunlight passing through high-altitude clouds over

North Dakota made the Soviet space-based system malfunction. It is believed that Lieutenant Colonel Stanislav Petrov, who was on duty that day, all but saved the world from nuclear catastrophe. He happened to know that the early warning system was not reliable and refused to pass on the news about a US "nuclear attack" to his commanders, who believed in the system.

What we are witnessing today has been characterised by some authors as the advent of a "second nuclear age". But we are in a more dangerous and unpredictable world than we were during the cold war. There has been an unprecedented proliferation of nuclear weapons, with more states capable of building a bomb than at any point since the end of the cold war. Even extremely poor but determined regimes, such as the one that rules North Korea, can threaten a superpower with nuclear war. Two rivals, India and Pakistan, both have nuclear capabilities, and Iran's acquisition of nuclear technology causes grave concern, not only in the undeclared nuclear state of Israel but also in the non-nuclear regional hegemon, Saudi Arabia. Cyberwarfare also makes the current situation more dangerous than that of the early 1960s, as it allows one power to seize control of another's nuclear arsenal without firing a shot.

While we face new challenges, we lack the fear of nuclear war developed by previous generations of political leaders and societies. Kennedy and Khrushchev considered nuclear war unwinnable. This is now changing with the scrapping of the old arms control treaties, the renewal of the nuclear arms race, and the development of new technologies making possible the execution of extremely accurate nuclear strikes. These factors have

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lowered the psychological barrier for using nuclear arms and brought back the illusion of the pre-hydrogen bomb age that wars conducted with limited use of nuclear weapons can be fought and won. That in turn feeds the new nuclear arms race, which the US and Russia have already started by abandoning cold war-era limitations.

Hence the true importance of Johnson's announcement, which opens the door for the UK and other countries to join the race. Even if the government decides not to limit itself to lifting the cap on Trident nuclear warheads and in fact acquires all 80 warheads over a short period of time, the world nuclear balance will hardly change. Despite all the changes around the globe since the end of the cold war, there are still two nuclear superpowers: Russia, with approximately 4,300 warheads, and the US, with an estimated 3,800 warheads. Eighty additional Trident warheads will not make much of a difference, nor will they make the UK safer if it comes to the worst.

But by deciding to increase the cap, the UK – the world's third country to develop its own nuclear capability – is sending the wrong signal: rearm. Instead, the world should be heading to the negotiating table to breathe new life into the arms control talks that all but ceased with the end of the cold war. That is no easy task, as negotiations will now have to go beyond the two nuclear superpowers and include the rest of the nuclear "haves" – first and foremost, China. The UK could play an important role in stopping the new nuclear arms race, instead of restarting it.

Source: *The guardian*, <https://www.theguardian.com/commentisfree/2021/mar/19/boris-johnson-nuclear-cold-war-arms-race>, 19 March 2021.

NUCLEAR STRATEGY

INDIA

For Navy, 6 Nuclear-Powered Submarines Take Priority Over 3rd Aircraft Carrier

The Indian Navy has informed the Narendra Modi government that the induction of six nuclear-powered submarines would take priority over a third heavy aircraft carrier discussed earlier to counter the rapid expansion of the PLAN and dominate the Indian Ocean, people familiar with the matter said.

According to South Block officials, the Indian Navy told the country's national security planners at the Combined Commanders Conference this month that the plan to build the nuclear-powered attack submarines or SSNs should take priority over the project to build a third

aircraft carrier (also called indigenous aircraft carrier 2). It is understood that the Navy will seek "acceptance of necessity" or AON approval from the government on the submarine project soon as China has developed the capacity to produce 12,000-tonne Renhai class destroyers in just five years.

While even Pakistan's Agosta 90B submarine, the only one of the five that are operational, can make its way to the Bay of Bengal with an intrepid crew, the SSN class of submarines, carrying a conventional missile and weapon systems, is only limited in range by food supplies.

The nuclear-powered submarines can patrol the entire Indo-Pacific without even surfacing once and remain detected on high seas and equatorial waters. China has nearly a dozen such submarines in operation. Its latest, the Type 095 attack

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submarine has a reduced acoustic signature as compared to the Han class of submarines.

While India has a number of options to jointly design and develop the submarines with countries such as Russia, France and the US under the Atma Nirbhar Bharat rubric, India's preferred partner appears to be Paris as it is already designed Kalvari class of diesel attack submarines for Indian Navy and is currently jointly developing a nuclear attack submarine (named Alvaro Alberto) for Brazil under a strategic partnership.

Apart from being India's closest allies in defence technology, joint development of submarines with France is free from any regulatory regimes such as the ITAR with the US or any future sanctions in case of Russia. India already operates one Akula class SSN from Russia on lease with an agreement to get another one when the lease on the first expires.

The government's emphasis on upgrading naval assets is an attempt to counter China's navy in the Indian Ocean and beyond. The PLA's navy is larger than the US navy in terms of the number of ships, although the US is still ahead in terms of tonnage and capability. It is in this context that the Navy is also seriously thinking of reviving its heavy-destroyer project to counter the 12,000-tonne cruisers being built by China. The first of India's 7,500 tonne INS Visakhapatnam class of guided-missile destroyers is expected to be commissioned within a year.

Indian national security planners believe that the next threat from China will come on Indo-Pacific, particularly in the Indian Ocean with the US Navy continuously deployed in the South China Sea and ensuring that the PLAN ballistic missile

submarines do not cross the first island chain. This means that PLAN will have to take a circuitous route to deploy its nuclear submarines in the Indian Ocean as it is mandatory for sub-surface vessels to surface when they cross Malacca Straits, Sunda or Lombok straits.

As part of India's effort to match China, India will commission its second aircraft carrier INS Vikrant - it is New Delhi's first indigenously-built aircraft carrier - later this year. It will

be home-based on the eastern seaboard while INS Vikramaditya, the other carrier built by Russia, will be on the western seaboard of India. INS Arighat, the second nuclear-powered SSBN will also be commissioned this year.

Source: Shishir Gupta, <https://www.hindustantimes.com/india-news/for-navy-6-nuclear-powered-submarines-take-priority-over-3rd-aircraft-carrier-101616564522467.html>, 24 March 2021.

India Commissions 15,000-tonne Ocean Surveillance Ship INS Dhruv Amid Face Off with China

In an attempt to pushback the Chinese Navy's rapidly-expanding PLAN, the Indian Navy is all set to commission INS Druv (codenamed VC 1118) ship, which is capable of tracking nuclear missiles and satellites from a distance. This ocean surveillance ship is also equipped with game changer active electronically scanned array (AESA) radars that can help India collect accurate data, not just about an enemy nation's missile range and capabilities, but will also track India's own strategic missiles that are in the trial stage.

Indian Navy to Induct INS Dhruv: According to sources aware of the development, the

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sophisticated surveillance system needs 14MW power to fire up and this power will be generated by INS Dhruv itself. This highly classified project is currently being given the final touches in Vizag before the commissioning. The sources further informed that that INS Dhruv has gone through a series of tests and sea trials starting 2018 and now after being delayed by months due to the pandemic, it is now ready to be commissioned.

Considering the aggression India is facing with China, which is not just in eastern Ladakh, but in the Indian Ocean region too, the timing for the induction of this ship could not be better. INS Dhruv is being seen as a force multiplier that will give the Indian Navy a 360-degree view of the Indo-Pacific and help plan offensive operations with a high degree of accuracy.

INS Dhruv has been jointly developed by the DRDO, NTRO and Indian Navy. The indigenously-developed surveillance ship has been built at Hindustan Ship Yard Ltd in Vishakhapatnam under the Make in India initiative. This 15,000-tonne ship, which is also one of the largest warships built at an Indian shipyard, has cost nearly Rs 725 crore.

During the initial days of its construction, the ship was kept under wraps in a covered dry dock to keep it away from the prying eyes of enemy satellites and spying missions. So far, only four other countries — China, France, Russia and the US — have the capabilities that INS Dhruv carries.

Source: Gargi Rohatgi, <https://www.republicworld.com/india-news/general-news/india-commissions-15000-tonne-ocean->

[surveillance-ship-ins-dhruv-amid-face-off-with-china.html](#), 17 March 2021.

UK

Britain Changes Policy So it can Use Nuclear Weapons in Response to 'Emerging Technologies'

The U.K. has changed its defense policy which may enable it to use nuclear weapons in response to "emerging technologies." The country's 111-page Integrated Defense Review included a subtle line on when the U.K. "reserves the right" to use nuclear

weapons.

It says the UK could use nuclear weapons if other countries use "weapons of mass destruction" against it. Such weapons include "emerging technologies that could have a comparable impact" to chemical, biological weapons or other nuclear weapons. Some British newspapers report that "emerging technologies" include cyberattacks, citing defense insiders, but the report doesn't explicitly say that. The UK government did not immediately respond to a CNBC request for comment. Tom Plant, a director at the Royal United Services Institute think tank, told CNBC: "I would not interpret it to include cyber-attacks in isolation, no."

He added that the "understanding of what constitutes emerging tech in government is not evenly distributed — cyber is definitely not 'emerging,' it's pretty substantially emerged." Either way, Plant believes that the change in language is significant. "I think it is a marker that there is the potential in the future for combinations of technologies and behaviors to come together that create emergent risks – which perhaps would not arise through the developments

South Korean suppliers provided key components to the only traditional nuclear power plant currently under construction in the United States—which will soon begin operations in Georgia—and U.S. suppliers have historically provided components and services for South Korean reactors, though future prospects may not be as strong.

South Korean suppliers have provided financial and technical support for U.S. advanced reactor developers in exchange for supply commitments, helping them make progress toward commercialization. Such opportunities could be expanded if restrictions on foreign ownership for nuclear power companies are modernized, as is contemplated in the proposed American Nuclear Infrastructure Act.

of any one technology in isolation – that are incredibly hard to predict and that there is at least the possibility that one or more of these as-yet-unknown emergent challenges might rival WMD in the threat they pose,” he said.

Trident Tactics: The UK’s nuclear program, known as Trident, was established in 1980 and it now costs the UK around £2 billion (\$2.8 billion) a year to operate. The Integrated Defense Review confirmed that the UK is allowing a self-imposed cap on its nuclear weapon stockpile to rise to 260, abandoning the previous cap of 225 warheads as well as the current reduction target of 180 by the mid-2020s. “This reverses the UK’s course of consistent post-Cold War nuclear reductions and runs counter to previous assurances that the program to replace the UK’s existing nuclear deterrent would not add to the number of nuclear warheads in service,” Plant wrote in a blog post.

He added that the changes are presented as a reaction to a changed international security environment. “The government paints a picture of a world with growing international competition and increasing threats from Russia, China, North Korea and Iran,” said Plant. “In its judgment, UK adversaries are increasing the variety and quantities of their nuclear capabilities, and see nuclear weapons as a means of coercion, deterrence and even warfighting.”

While the UK appears to be broadening the scenarios where it could feasibly use nuclear weapons, U.S. President Joe Biden said in his election campaign that the “sole purpose” of nuclear weapons should be to deter or retaliate against another nuclear attack. Indo-Pacific tilt: The Integrated Defense Review also outlined a new “tilt” toward the Indo-Pacific region. “By 2030, we

will be deeply engaged in the Indo-Pacific as the European partner with the broadest, most integrated presence in support of mutually-beneficial trade, shared security and values,” the document reads.

It says the UK will push into the Indo-Pacific region partly in response to “geopolitical and geo-economic shifts” including China’s global “power and assertiveness,” as well as the growing importance of the region to “global prosperity and security.” The report references partnerships with countries including India, Indonesia, Japan, South Korea, Malaysia, the Philippines, Singapore, Thailand, and Vietnam.

Source: Sam Shead, CNBC, [## USA](https://www.cnn.com/2021/03/17/uk-changes-policy-so-it-can-use-nukes-in-response-to-emerging-tech.html?mk_tok=MDk1LVBQVi04MTMAAAAF75ib7_-UQ8q-NO nHaeZN-5jHfloydAnT6ZQN-P_Iv1ecnzcx11m76EcMQ3RRMyZGhu9 urWwg25yTEEhvHERyJxW98oY8E2XJ 1COluq HDBEp TfPTg, 17 March 2021.</p></div><div data-bbox=)

Admiral Nominated to Lead Indo-Pacific Forces Contradicts Current Commander on Chinese Nuclear Stockpile

Adm. John Aquilino, the nominee to be the next commander of American forces in the Pacific, said that even if China were to quadruple its nuclear stockpile within the next decade, the United States would still have more warheads deployed than Beijing. The comment from Aquilino, who is expected to be confirmed later, contradicts how Adm. Phil Davidson, the Indo-Pacific commander now, described the size of China’s nuclear arsenal to the Senate Armed Services Committee earlier

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in March. Davidson agreed at the hearing that the Chinese could surpass the US nuclear stockpile by 2030 if they can quadruple their number of warheads.

Aquilino has served as the commander of the Pacific Fleet since May 2018. He was tapped weeks ago by President Joe Biden's administration to be the next commander of all U.S. forces in the Indo-Pacific region. As a follow up from Davidson's hearing, Sen. Elizabeth Warren, D-Mass., asked Aquilino at his confirmation hearing that even if China quadrupled their stockpile in ten years, "China would still have fewer warheads than the U.S. [has] currently deployed, is that right?" "If it were to quadruple today, that would be accurate," Aquilino responded.

However, at a budget hearing March 9, Sen. Tom Cotton, R-Ark., asked Davidson that if China were to triple or quadruple their stockpile, the adversary "could possibly have nuclear overmatch against the United States before the end of this decade." Davidson agreed with Cotton's assessment.

The hearings this month come as the U.S. focuses on deterring China and lawmakers consider a \$4.7 billion funding request to build up the U.S. military in the Indo-Pacific region. Davidson warned at the hearing earlier this month that the United States needs a larger budget to protect the country from an increasingly aggressive China by investing in troops, missile detection systems and weapons in the Indo-Pacific region.

Aquilino largely agreed with the assessment that the U.S. must bolster its funding, including for the Pacific Deterrence Initiative, to counter Chinese influence in the region and increase cooperation with Pacific allies and partners. The Pacific Deterrence Initiative was established in the 2021 National Defense Authorization Act, annual

legislation that sets funding for the Defense Department, and is designed to enhance budget oversight and funnel resources to key military capabilities to deter China.

Congress funded \$2.2 billion for the PDI in fiscal year 2021, which ends Sept. 30, and Aquilino said he also supports additional funding for the initiative in fiscal year 2022, which is slated to reach \$4.6 billion. "The Pacific Deterrence Initiative is a strong example of the effort required to compete and win," Aquilino said in his opening statement. The

PDI is "kind of the poster child for what the capabilities and things look like in prioritized order," he added later. Force protection, the ability to command and control and communicate in a mission-partner environment, and the ability to train with allies and partners are all key capabilities that are supported by the initiative.

Aquilino warned China's nuclear stockpile is "increasing at a rate that is faster than anyone previously believed," but he downplayed the concern over the number of warheads that the Chinese possess. China's warhead stockpile is "currently estimated to be in the low-200s," according to the Defense Department's most recent report on the Chinese military. The U.S. inventory of nuclear warheads is 5,800.

Aquilino agreed with Warren in response to a question from the lawmaker that "credible conventional deterrence are still the best way of protecting U.S. interests in the Indo-Pacific region and avoiding a conflict with China." "Conventional deterrence to avoid crisis or conflict is certainly the main effort as I would see it, if confirmed," he said. However, Aquilino told Sen. Josh Hawley, R-Mo., later in the hearing that nuclear deterrence remains a "critical backstop."

Davidson warned at the hearing earlier this month that the United States needs a larger budget to protect the country from an increasingly aggressive China by investing in troops, missile detection systems and weapons in the Indo-Pacific region.

Congress funded \$2.2 billion for the PDI in fiscal year 2021, which ends Sept. 30, and Aquilino said he also supports additional funding for the initiative in fiscal year 2022, which is slated to reach \$4.6 billion.

Source: Sarah Cammarata, Stars and Stripes, https://www.stripes.com/news/pacific/admiral-nominated-to-lead-indo-pacific-forces-contradicts-current-commander-on-chinese-nuclear-stockpile-1.667015?mkt_tok=MDk1LVBQVi04MTMAAAF8Cio4ulukc_ZKOPXz33ENL1JyUA8kPMR_xXEM08-rBhiQZSJDpZdSTP6ZnMq1clmrkPFmeZr3WvcXz76sST2cy3heCH9BFFe8JjZZ-CG8FIEPA, 24 March 2021.

BALLISTIC MISSILE DEFENCE

PAKISTAN

Pakistan Successfully Test Fires Nuclear-Capable Ballistic Missile Shaheen 1-A

Pakistan on 26 March successfully test-fired a nuclear-capable surface-to-surface ballistic missile with a range of 900 kilometres, the Army said. The test of Shaheen-1A surface to surface ballistic missile, was aimed at re-validating various design and technical parameters of the weapon system including advanced navigation system, the media wing of the Pakistani army – the ISPR, said in a statement.

The Army's media wing said that the missile has a range of 900 kilometers. Shaheen 1-A with its sophisticated and advanced guidance system is a highly accurate missile system. The launch was witnessed by senior officials from SPD, strategic forces, scientists and engineers of strategic organisations.

Director General SPD, Lieutenant General Nadeem Zaki Manj, congratulated scientists and engineers on the conduct of this successful test. He appreciated the technical prowess, dedication and commitment of scientists and engineers, who contributed whole-heartedly in making the missile

launch successful. President Arif Alvi, Prime Minister of Pakistan Imran Khan, Chairman Joint Chiefs of Staff Committee and Services Chiefs have congratulated the scientists and engineers on successful conduct of the missile test, according to the army. ...

Source: Sajjad Hussain, <https://theprint.in/defence/pakistan-successfully-test-fires-nuclear-capable-ballistic-missile-shaheen-1-a/629379/>, 26 March 2021.

UK

UK Nuclear Warhead Increase Prompted by Russia's Missile Defence Capability

Britain's controversial move to raise the cap on its nuclear warhead stockpile was motivated by the need to maintain a "credible" deterrent to counter Russia's improved ballistic missile defences, the UK defence secretary has said.

Government ministers have so far been reluctant to explain the decision, announced last week as part of its defence, security and foreign policy review. But when challenged on the issue Ben Wallace, defence

secretary, told the BBC that his job in maintaining a credible deterrent was to "reflect and review what the Russians and others have been up to". ... Downing Street's move to increase the ceiling on its stockpile by more than 40 per cent to

260 warheads prompted criticism from nuclear experts, who warned this would damage the UK's consistent emphasis on disarmament since the end of the cold war.

Wallace insisted that despite the increase the UK would still have the "lowest" number of warheads among nuclear powers, pointing out that France has closer to 300. Whitehall officials said privately

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that the decision reflected wider concerns about nuclear proliferation by China and North Korea. Speaking ahead of the announcement of restructuring of the UK armed forces, Wallace did not deny the review would involve a cut in army personnel numbers from a notional force of 82,000. "I'm going to make a decision to have the right armed forces to match our ambition, and to meet the threat," he said.

Military officials have said the army would make greater use of its reserves to compensate for cuts to full-time soldiers, although these would take several months to deploy in the event of a serious conflict. Officials have also been clear that the army is evolving to prioritise "lethality" over size, using new technologies such as swarms of drones and situational awareness systems.

Cuts to equipment are expected to include the retirement of the Hercules transport aircraft, often used by special forces, and known as the workhorses of the Royal Air Force. The UK has operated earlier variants of the US-built aircraft since the mid-1950s and the 14 remaining aircraft had been due to keep flying until the mid-2030s. Their missions will be picked up by the RAF's fleet of 20 larger A400M Atlas transport aircraft, according to people familiar with the plan. ...

Source: <https://www.ft.com/content/a86e8ca8-365e-4774-b22c-fbdf12237935>, 21 March 2021.

NUCLEAR ENERGY

GENERAL

UAE and Belarus Introduced Nuclear Power Last Year. Who is Next?

With nuclear energy increasingly recognized as vital to supporting sustainable development and climate change mitigation, nations from Africa to Asia are eyeing its use. The IAEA is providing them with comprehensive support as they consider

adding nuclear power to their energy mix.

After a landmark year in which Belarus and the United Arab Emirates began using nuclear power for the first time after a decade of working with the IAEA, the Agency is kicking off a new slate of activities to support so-called nuclear newcomers. Earlier this month almost 100 participants from some 30 newcomer countries gathered online for the IAEA's main annual meeting on nuclear power infrastructure development.

After a landmark year in which Belarus and the United Arab Emirates began using nuclear power for the first time after a decade of working with the IAEA, the Agency is kicking off a new slate of activities to support so-called nuclear newcomers. Earlier this month almost 100 participants from some 30 newcomer countries gathered online for the IAEA's main annual meeting on nuclear power infrastructure development.

"Sri Lanka is looking to reduce its dependence on fossil fuel imports and drive sustainable development—and nuclear power is an intriguing option," said Malinda Ranaweera, a Scientific Officer on Sri Lanka's Atomic Energy Board who took part in the weeklong Technical Meeting on Topical Issues in the Development of Nuclear Power Infrastructure.

Access to affordable, reliable and clean energy is crucial for achieving sustainable development goals, from eradicating poverty to advancing health and education, facilitating industrial development and reducing greenhouse gas emissions. Nuclear power can help provide the energy to achieve high living standards, good health, a clean environment and a sustainable economy. Some 30 countries are working with the IAEA as they consider or embark on nuclear power including Bangladesh and Turkey, which are building their first reactors.

The IAEA's work with newcomers looks set to intensify next month when it is scheduled to conduct an Integrated Nuclear Infrastructure Review (INIR) mission to Uzbekistan, the first of four INIR missions planned for 2021. The others are to Sri Lanka, Kenya and Uganda—developing countries all exploring nuclear energy for sustainable development. (Decisions on whether the missions will proceed amid the global pandemic are pending.)

Conducted upon request, INIR missions are holistic peer reviews that assess the status of national infrastructure for the introduction of nuclear power. They provide a chance for countries to engage with international experts about experiences and best practices, and to update their national plans in response to recommendations and suggestions. Belarus and the UAE both used INIR missions for each phase of their programme as well as many other IAEA services such as nuclear safety peer reviews and advisory services on their road to successfully developing a nuclear power programme.

Uzbekistan, a Central Asian country of 33 million people and a top global uranium supplier, is looking to nuclear power to enhance energy efficiency and boost generating capacity, including with low carbon sources. Negotiations with Russia's Rosatom to construct a nuclear power plant are well underway, with an eye to deploying two units by 2029.

"The pre-INIR mission allowed in-depth discussions with international experts on experiences and best practices in nuclear power infrastructure development," said Aleksandra Khidirnazarova of Uzbekistan's Agency for the Development of Nuclear Energy. "The recommendations and proposals of the INIR team made it possible to update the national action plan and ensure increased safety, reliability and sustainability of the national nuclear power program."

Besides INIR missions and other IAEA peer review services, the IAEA's tailored support to newcomers included technical advice,

publications, trainings, webinars and the formulation of an Integrated Work Plan (IWP), which is the strategic framework for planning the IAEA's integrated assistance for a country's nuclear infrastructure development. The Agency's assistance is based on the Milestones Approach, a three-phased method that covers 19 infrastructure issues such as the legal and regulatory framework, safeguards, human resources development, procurement and financing and radioactive waste management.

Kenya, which relies mainly on hydro and fossil fuels for electricity, aims to add nuclear power to sustainably address increasing demand for electricity, which it estimates will grow by 7% annually through 2030. SMRs, which are well suited for Kenya's relatively limited grid capacity, are under consideration as a cost-effective complement to Kenya's growing base of renewable energy sources.

In Sri Lanka the government is looking at nuclear power to provide about 11% of the country's electricity after 2030. The IAEA has conducted 11 national and regional workshops on nuclear infrastructure issues in Sri Lanka. "To achieve an operational nuclear power plant by 2030, Sri Lanka must address several infrastructure areas including human resource development and energy policy, and IAEA support will be crucial to our efforts," said Ranaweera of the Atomic Energy Board.

Uganda is also considering nuclear power as part of plans to increase electricity generating capacity to meet rising demand. The country has identified five potential sites and signed agreements on nuclear energy with Russia and China.

Jordan, a Middle Eastern country of 10 million people, is considering nuclear power to increase

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its energy security and address its water scarcity via nuclear desalination. "Jordan has spent years developing the infrastructure necessary to implement a nuclear power programme, including the preparation of our Bid Invitation Specification (BIS) documents where programme requirements and project needs are described," said Shirin Altaher of the Jordan Atomic Energy Commission (JAEC). "JAEC's technical and economic experts have referred to IAEA publications and guidelines during the BIS preparation, which has also been supported by an IAEA expert review of the working documents."

Jordan is currently assessing various nuclear power technologies. The country plans to commission an SMR plant after 2030 and a large nuclear power plant thereafter, according to the IAEA's Nuclear Technology Review.

Source: Matt Fisher, <https://www.iaea.org/newscenter/news/uae-and-belarus-introduced-nuclear-power-last-year-who-is-next>, 23 March 2021.

INDIA

BHEL Surges Over 7% on Emerging as Lowest Bidder for Nuclear Power Project

BHEL shares soared more than 7 per cent in early trading after the state-owned engineering firm emerged as lowest bidder for the supply of equipment for 6x700 MW nuclear power projects of NPCIL. At 10:45 am, the shares of BHEL were trading at ₹ 52.15, up 4 per cent, on the BSE.

"In an open competitive bidding process, BHEL has emerged as the lowest bidder (Rs 10,800 crore) for the fleet mode tender floated by NPCIL for the 6x700 MW nuclear power projects of NPCIL," BHEL said in a regulatory filing to the

stock exchanges. BHEL has thus retained its market leadership position of being the sole Indian supplier of nuclear steam turbines. The BSE Sensex was trading at 50,067.75, higher by 257.35 points or 0.52 per cent and the NSE Nifty was at 14,803.20, up 81.90 points or 0.56 per cent at the time.

Source: <https://www.ndtv.com/business/bhel-surges-over-7-on-emerging-as-lowest-bidder-for-nuclear-power-project-2393319>, 18 March 2021.

USA

Portable Nuclear Reactor Project Moves Forward at Pentagon

The Pentagon has selected two companies to move forward with developing small, portable nuclear reactors for military use in the field. BWXT Advanced Technologies and X-energy were chosen by the department's Strategic Capabilities Office to continue on with Project Pele, which seeks to develop a reactor of 1- to 5-megawatt output that can last at least three years at full power. In addition, the reactors must be designed to operate within three days of delivery and be safely removed in as few as seven days if needed.

The two companies, along with Westinghouse Government Services, were each given preliminary contracts of less than \$15 million in March 2020 to begin design work. The final design is due to the Strategic Capabilities Office in 2022, at which point the Defense Department will make a decision on whether to move forward with testing the systems.

"We are thrilled with the progress our industrial partners have made on their designs," Jeff Waksman, Project Pele's program manager, said in a statement. "We are confident that by early 2022 we will have two engineering designs

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matured to a sufficient state that we will be able to determine suitability for possible construction and testing.”

The Pentagon has long eyed nuclear power as a potential way to reduce both its energy cost and its vulnerability in its dependence on local energy grids. According to a news release, the Defense Department uses “approximately 30 Terawatt-hours of electricity per year and more than 10 million gallons of fuel per day.” According to an October 2018 technical report by the Nuclear Energy Institute, 90 percent of military installations have “an average annual energy use that can be met by an installed capacity of nuclear power” of 40 MWe or less.

The Biden administration is expected to pursue alternative energy options across the Pentagon, with Defense Secretary Lloyd Austin pledging to lower the department’s carbon footprint and to consider climate impact in strategic decisions. Whether nuclear energy will prove a way forward or not may depend on whether the taboo around nuclear power can be assuaged for local defense communities and members of Congress.

Project Pele is not the only attempt at introducing small nuclear reactors to the Pentagon’s inventory; a second effort is being run through the Office of the Under Secretary of Defense for Acquisition and Sustainment. That effort, ordered in the 2019 National Defense Authorization Act, involves a pilot program aimed at demonstrating the efficacy of a small nuclear reactor in the 2- to 10-MWe range, with initial testing at a Department of Energy site around 2023. While Project Pele is focused on the potential for deployable nuclear reactors, the acquisition and sustainment effort is focused on domestic military installations, with the goal of being operational by 2027.

Source: Aaron Mehta, Defence News, <https://>

www.defensenews.com/smr/energy-and-environment/2021/03/23/portable-nuclear-reactor-project-moves-forward-at-pentagon/?mkt_tok=MDk1LVBQVi04MTMAAAF8Cio4upfEQmvmaYcWtqr0SfVwYKDFllIRPs8dwKT4oV6gRiFThOyzlAdpzfUOLJSQtURhYU7kAMfIVyOBtyzDVDXNpLGcJXqplImFPy5e22UEUw, 24 March 2021.

NUCLEAR COOPERATION

INDIA–BANGLADESH

India’s Credit Line for Bangladesh Covers Nuclear Projects, Rooppur Nuclear Power Plant: Foreign Secretary

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Foreign Secretary Harsh Vardhan Shringla said on 27 March that New Delhi would be involved in the development of the transmission lines for the Rooppur Nuclear Power Plant in Bangladesh as part of its credit line for the neighbouring country. “A significant part of our third line of credit will go

to civil nuclear cooperation. Transmission lines of Rooppur Nuclear Power Plant will be developed by Indian companies under the line of credit. Value of these transmission lines will be worth over USD 1 billion,” Mr Shringla said at a briefing following talks between Prime Minister Narendra Modi and his Bangladeshi counterpart, Sheikh Hasina. ...

Source: <https://www.ndtv.com/india-news/indias-credit-line-for-bangladesh-covers-nuclear-projects-rooppur-nuclear-power-plant-foreign-secretary-2400332>, 28 March 2021.

NUCLEAR PROLIFERATION

IRAN

UN Atomic Watchdog Confirms Details of New Iran Centrifuges

The United Nations’ nuclear watchdog said it has confirmed that Iran has begun operating a

cascade of advanced centrifuges at an underground site. IAEA Director General Rafael Grossi told member delegations that Iran has “begun feeding a newly installed cascade of 174 IR-4 centrifuges” to enrich uranium hexafluoride gas up to 5% U-235 uranium, the Vienna-based organization said.

The use of the advanced centrifuges in the Natanz facility is another violation of the nuclear deal Iran signed with world powers in 2015, which allows it only to enrich with first-generation IR-1 centrifuges. The deal was meant to prevent Iran from building a nuclear weapon, which the country insists it does not intend to do. Tehran has said its nuclear program is only for peaceful purposes.

In his report to member nations, Grossi said an additional cascade of IR4 centrifuges has been installed in the Pilot Fuel Enrichment Plant near Natanz. Tehran also has indicated it plans to install a second cascade in the Natanz facility, although installation has yet to begin, Grossi said. After an explosion at the Natanz nuclear site in July which Iran said resulted from sabotage, Tehran said it would build a more secure, structure in the mountains around the area and has been moving its centrifuges below ground.

Grossi confirmed in November that Iran had began enriching with IR-2m type centrifuges at the Natanz site. Iran announced last month that it had installed two cascades of IR-4 centrifuges, but it did not say where. Since the United States unilaterally withdrew in 2018 from the nuclear deal, Iran has steadily violated the restrictions set out in the agreement to put pressure on the remaining signatories - China, Russia, Germany, France and Britain — to provide economic incentives to offset new U.S. sanctions.

As part of the ongoing violations, Iran last month began restricting IAEA inspections of its nuclear

facilities. Under a last-minute deal worked out during a trip by Grossi to Tehran, some access was preserved. President Joe Biden has indicated that the U.S. is interested in rejoining the accord, known as JCPOA, but the Iranian breaches of the deal complicate the matter. Tehran has insisted that American sanctions be dropped before it rolls back its violations.

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Source: David Rising, AP News, <https://apnews.com/article/tehran-iran->

[united-nations-nuclear-weapons-d56d90b97833cfbc](https://apnews.com/article/tehran-iran-) 2053c 73162791f2c, 17 March 2021.

Israel-US to Set Up Joint Team to Share Intel on Iran's Nuclear Program

Israeli and US officials agreed to set up a joint team for sharing intelligence about Iran's nuclear program during recent strategic talks, according to a report. Last week's talks were the first held by a bilateral group for cooperating in the effort to prevent Iran from acquiring nuclear arms. The meeting was led by US National Security Adviser

Jake Sullivan and his Israeli counterpart Meir Ben-Shabbat.

Citing three senior Israeli officials, the Axios news site reported that Israel's initial objective was to get on the same page with the Biden administration concerning intelligence on

The Israeli officials also said they hoped Iran would continue to rebuff US entreaties and that the pain of American sanctions would lead the Iranians to first offer concessions. A second meeting dealing with Iran's regional activities and missile program will be held in the coming weeks.

Iran. The officials said they were satisfied by the first round of discussions. ... Sullivan pledged to the Israelis the US would be transparent about any decisions regarding Iran and said he expects transparency in return, according to the officials, who also said the American national security adviser was upfront about the difficulties of engaging in diplomacy with Iran.

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meeting dealing with Iran's regional activities and missile program will be held in the coming weeks, the officials added.

A similar working group convened during former US president Barack Obama's first term in office. Its existence was not public, and the sides used the meetings to share intelligence on Iran. However, the group ceased meeting as the Obama administration ramped up efforts to reach an agreement with Iran to curb its nuclear program in exchange for sanctions relief.

... Seeking to avoid public spats this time around, Washington offered to reestablish the working group with Israel, which, after deliberation by Netanyahu with other senior officials, agreed to it, an official familiar with the matter told *The Times of Israel*. Israeli officials, including Netanyahu, have already begun voicing opposition to the Biden administration's desire to rejoin the deal, putting Jerusalem and Washington at odds on the issue. Some leading Israeli officials in recent months have warned of military action to halt Iran's nuclear program.

Source: *The Times of Israel*, https://www.timesofisrael.com/israeli-officials-said-pleased-with-talks-with-us-on-iran-nuclear-program/?mkt_tok=MDk1LVBQVi04_MTMAAAF75ib7_2clizrwVA12vD246R5TLEUo_1fzJiCb5d-hodlu-xhEOY_BJeRAIL-bZ8jRNrMCTGAvSW_tvS4gEIUATLsSciph_QZEWVHQ8onqQ8MHAZSg, 17 March 2021.

Iran Must Come Clean about Hidden Uranium to Revive Nuclear Deal, IAEA Chief Warns

Iran must come clean about recent findings of undeclared uranium to revive the 2015 nuclear agreement, the director general of the UN nuclear watchdog has told *Newsweek*. In an interview, IAEA chief Rafael Grossi said "detailed and technical discussions" are needed to ascertain the location of Iran's undeclared uranium and that this issue is "totally connected" to the future of the deal.

He said there were a number of points that were "still unclear" relating to traces of uranium that were found but had not been declared in the past by Tehran. "We need to know what was going on there, we need to know exactly what kind of activities were taking place there, and we need to know if there was material, where is this material now?" Grossi said. "Because it hasn't been declared. This necessitates a very detailed and technical discussion, which was not taking place." Last month, a Reuters report revealed that the IAEA found uranium particles in two Iranian sites it inspected last August and September, after months of stonewalling by Tehran.

... Grossi broached the topic of undeclared uranium with top Iranian officials in Tehran shortly after the announcement that traces were found. He raised the issue with Iranian Foreign Minister Javad Zarif and Vice President Ali Akbar Salehi, who heads the

The IAEA will be holding talks in Tehran in early April to address this issue. ... Asked when he is hoping to draw a conclusion on Iran's undeclared nuclear capabilities, Grossi demurred. "It's difficult to say I want to clarify this by 'X' date.

Atomic Energy Organization of Iran. The IAEA head said he re-iterated to them that "in the absence of clarifications" the "whole thing would suffer because at this point, frankly, everything is interconnected."

The IAEA will be holding talks in Tehran in early April to address this issue. ... Asked when he is hoping to draw a conclusion on Iran's undeclared nuclear capabilities, Grossi demurred. "It's difficult to say I want to clarify this by 'X' date. But my intention would be to try to at least have some credible elements within the next few months, by the summer, if possible," he said.

...In mid-February Iran threatened to stop implementing the "voluntary transparency measures" in the JCPOA, along with other arrangements in Iran's Safeguards Agreement. Tehran had previously set a deadline of February 21, vowing that if oil and banking sanctions were not lifted by the U.S. by then it will expel the U.N.'s nuclear inspectors from the country, ending outside access to its facilities.

However, that day, Grossi announced the IAEA had struck a deal with Iran to cushion the blow of the steps Tehran took to end snap inspections, with both sides agreeing to keep “necessary” monitoring for up to three months. The IAEA chief warned that the three-month bridge was “quite fragile” and if there is no tangible progress by mid-May when this temporary agreement runs out Washington-Tehran relations will likely enter “a very turbulent period”. ...But he said there was some “guarded optimism” on both sides. ...

Source: Jack Dutton, Newsweek, https://www.newsweek.com/iran-must-come-clean-about-hidden-uranium-nuclear-deal-iaea-chief-1578158?mkt_tok=MDk1LVBQV i04MTMAAA F8Cio4uh CV29Xk3PRr BOblKQKRg kfwawUFVJJHR-TTRJ5GZbL5iP1sNMPDeBs55dUFVI2TP_VMEN2EzXumWTbgA-gB_QafP8fk6gt QdZ8pdMXBEA, 23 March 2021.

NORTH KOREA

Inter-Korean Missile Race may Leave North Korea with TNWs

North Korea has surged ahead during recent years in an inter-Korean arms race that has led to a proliferation of short-range missiles on the peninsula and left Pyongyang closer than ever to deploying tactical nuclear weapons. North Korea's years-long quest to develop precision missiles capable of evading detection and striking targets in South Korea has accelerated in the wake of the country's 2018 self-imposed moratorium on testing its larger ICBMs.

Meanwhile, a 2017 agreement between Washington and Seoul lifted bilateral limits on South Korean missile payloads, leading to the development of at least one heavier weapon that could play a key role in strategies aimed at preempting North Korean attacks or “decapitating” its leadership.

The new missiles tested by North Korea [recently] appear aimed at matching or surpassing South

Korea's quietly expanding arsenal, and are the first such tests since leader Kim Jong Un declared in January that the country could miniaturise nuclear warheads to fit on tactical weapons, underscoring the high stakes for the Biden administration as it mulls options for reducing tensions. South Korean officials see bigger and better SRBMs as a way to reduce their dependence on the United States, which stations around 28,500 troops in South Korea.

North Korea says its missiles are for self defence, and has accused South Korea and the United States of threatening its safety with joint military drills, arms purchases, and other hostile policies.

In a speech last year, South Korean Defence Minister Jeong Kyeong-doo boasted that the country had developed a missile with “sufficient range and the world's largest warhead weight to protect peace on the Korean Peninsula,” referring to the new Hyunmoo-4's 800-kilometre range and 2-ton payload. It was likely no coincidence, analysts noted, that North Korea said its newest SRBM could carry a 2.5-ton warhead. In a statement, Kim Yo Jong, the leader's sister and a powerful politician in North Korea, cited Jeong's speech in defending the North's right to develop its own missiles. ...

Tactical Nuclear Weapons? North Korea says its missiles are for self defence, and has accused South Korea and the United States of threatening its safety with joint military drills, arms purchases, and other hostile policies. At January's ruling party congress, Kim announced that North Korea had accumulated technology to “miniaturise, lighten and standardise” nuclear weapons. The South's spy agency concluded the latest missiles could carry nuclear warheads, though it was unclear whether they had ever been installed, a lawmaker briefed by intelligence officials said.

The South's spy agency concluded the latest missiles could carry nuclear warheads, though it was unclear whether they had ever been installed, a lawmaker briefed by intelligence officials said. ... On 26 March, 38 North, a U.S.-based think tank, reported that satellite imagery showed activity at a shipyard suggesting the North's new ballistic missile submarine, under construction for several years, may be nearing completion.

Rocket Rivalry: In a speech where he discussed North Korea's tests, South Korean President Moon Jae-in described his country's missile capability as "world class." After last year's test of the Hyunmoo-4, South Korea announced it would also mass produce another type of ground-based missile designed to destroy underground artillery bases. "These most recent (North Korean) tests do appear to be communicating to the South Koreans that they have capability on par or superseding that of the Hyunmoo-4," said Melissa Hanham, deputy director of the Open Nuclear Network.

As soon as this year, Seoul may conduct an underwater test of its first SLBM, based on the 500 kilometre-range Hyunmoo-2B, armed with a conventional warhead, and potentially carried by its new 3,000-ton KSS III submarines, South Korean media reported. South Korea's defence ministry declined to confirm the status of specific weapons citing security concerns but said "our military has built the capability to counter North Korea's short range missiles by modernising our forces, and we plan to develop it even further."

Such missiles could bolster two key South Korean strategies: "Overwhelming Response", which aims to detect planned attacks by North Korea and preemptively destroy its nuclear facilities, missiles, and long-range artillery; and "Strategic Target Strike," a counterattack that includes eliminating North Korean leadership. ...

Source: <https://economictimes.in/diatimes.com/news/defence/inter-korean-missile-race-may-leave-north-korea-with-tactical-nuclear-weapons/articleshow/81759683.cms>, 30 March 2021.

Ballistic Missile Launch Near Japan Pushes Tensions with North Korea

North Korea launched two ballistic missiles into the Sea of Japan, in its first provocation of the Biden White House. The missiles fell into the waters that lie between North Korea and Japan, and avoided the latter's economic zone, Japanese Prime Minister Yoshihide Suga said in a statement. Suga condemned Pyongyang's actions and

said it "threatens the peace and security of Japan and the region." He noted that North Korea's actions violate U.N. Security Council resolutions. Thursday's (24 March) launch was the first ballistic missile test since March 2020, and Suga said officials need to be "more vigilant and watchful than ever before."

...The Biden administration is still formulating its foreign policy approach to Pyongyang. Officials have refrained from taking any big steps - in any direction - toward North Korea. It will likely be a different approach to former President Donald Trump's attempts at diplomacy with the North Korean leader Kim Jong Un. While their talks

marked the first in-person meetings between leaders of the two states, the two summits led to no advancement in denuclearization on the Korean peninsula.

North Korea has made it clear it intends to continue building up its military capabilities while waiting

for the U.S. to offer concessions. In a military parade in October, the North displayed what is believed to be its biggest strategic missile so far. Hong Min said it's unclear whether Thursday's (24 March) launch tested a new weapon or an existing one. If it's indeed new, state media will likely report on it, he said, so that "it can send an internal

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message that North Korea is responding strongly against the external pressures from the U.S.”

Source: Anthony Kuhn, Jaclyn Diaz, NPR, https://www.npr.org/2021/03/25/981080005/ballistic-missile-launch-near-japan-pushes-tensions-with-north-korea?mkt_tok=MDk1LVBQVi04MTMAAAAF8Cio4uqJxgNfaoluUhRUjCQsK9uH6GClx6MVDPVK5WUZC7BqgSCYYsktYtN16GdrG_zGXaret4n7p4Kr-yWGqheqlrtTypJ70LOEHx6CpUcKkXQ, 25 March 2021.

A group of mainly survivors of the 1945 atomic bombings of Hiroshima and Nagasaki was awarded the prestigious 2020 Sean MacBride Peace Prize for its petition campaign urging all nations to sign the U.N. treaty banning nuclear weapons. More than 13 million people signed the petition during the campaign, which ran from April 2016 to December 2020.

Terumi Tanaka, co-chairperson of Nihon Hidankyo (Japan Confederation of A- and H-Bomb Sufferers Organizations), during his speech accepting the prize. “We would like to pass the hibakusha movement and its passions down to the younger generation we campaigned with to create the petition,” he added.

The IPB selected the Appeal of the Hibakusha for the award last August for “being one of the largest

signature campaigns ever carried out in the world and a powerful popular force manifesting global demands for the complete elimination of nuclear weapons.”

Source: The Asahi Shimbun, http://www.asahi.com/ajw/articles/14279688?mkt_tok=MDk1LVBQVi04MTMAAAAF75ib7__B4cMfCGFctE8VmRe98r2m-pHh-WVgoBJgRNacE BbZ Ywt4g47pHOJEA Z x 2 7 j M g V N Q D T W E 0 m o c 0 s - 0Kfhwfpr1KiSPZHL3BE0UqreVLLg, 18 March 2021.

NUCLEAR NON-PROLIFERATION

JAPAN

Hibakusha Group Awarded Prize for Work to Ban Nuclear Weapons

A group of mainly survivors of the 1945 atomic bombings of Hiroshima and Nagasaki was awarded the prestigious 2020 Sean MacBride Peace Prize for its petition campaign urging all nations to sign the U.N. treaty banning nuclear weapons. More than 13 million people signed the petition during the campaign, which ran from April 2016 to December 2020.

The Appeal of the Hibakusha received the international prize on March 17 at an online awards ceremony. The International Peace Bureau (IPB) awards the prize to individuals or organizations that have done outstanding work for peace, disarmament or human rights.

The Black Lives Matter movement, which protests racism and police brutality, was a co-recipient of the 2020 prize. “The Treaty on the Prohibition of Nuclear Weapons went into effect, but we might need to try harder than ever to terminate nuclear weapons,” said

NUCLEAR SAFETY

CHINA

China Sets Up Nuclear Safety Committee to Boost 2060 Carbon Neutral Efforts

China has set up a national nuclear safety standardisation technical committee, as it aims to increase use of nuclear power under its efforts to be carbon neutral by 2060. The government last year set a target that China’s carbon dioxide emissions should peak by 2030, with nuclear energy expected to play a significant role in reaching

this as well as the 2060 goal.

In the country’s latest five-year plan – which set out China’s economic and development goals for the five years from 2021 – Beijing said it aimed

In the country’s latest five-year plan – which set out China’s economic and development goals for the five years from 2021 – Beijing said it aimed before 2025 to raise nuclear power generation capacity to 70 gigawatts, which would be an increase of 27 per cent from last year’s 51GW. China failed to meet its nuclear energy targets under the previous five-year plan covering 2016 to 2020.

before 2025 to raise nuclear power generation capacity to 70 gigawatts, which would be an increase of 27 per cent from last year's 51GW. China failed to meet its nuclear energy targets under the previous five-year plan covering 2016 to 2020. It had suspended approvals for new nuclear power stations in 2011 after the Fukushima Daiichi nuclear disaster in Japan.

The committee will establish "a strict and high nuclear safety standard" and "further improve the level of legalisation of nuclear safety", according to a government press release. Set up by the ecology and environment ministry, the new body will be responsible for the formulation of national standards in fields including nuclear power plant safety, nuclear fuel cycle facilities safety, nuclear material safety and radioactive waste safety.

The national nuclear safety standardisation technical committee will have 42 members, who will include representatives drawn from the nuclear safety supervision department, the nuclear energy industry's authority department, nuclear power enterprises, research institutes and universities. Guo Chengzhan, the deputy administrator of the National Nuclear Safety Administration, has been named as the director of the committee. Ye Qizhen and Du Xiangwan, respectively an academic from and the former vice-president of the Chinese Academy of Engineering, will serve as deputy directors. The committee's secretariat will become a department of the ministry.

As China continues planting trees, 23% of the country is now covered in forest. According to the ministry's press release, establishing the committee is "a significant move to boost China's standardisation strategy and deepen the reform of efforts for standardisation". "Strengthening nuclear safety standardisation is of great

importance to the active and orderly development of nuclear power and achievement of 'hitting carbon peak' and 'carbon neutrality' on the premise of ensuring safety," it said.

The China Nuclear Energy Association has anticipated that the country's nuclear power capacity will reach 130GW by 2030 and 340GW before 2050. By the middle of the century, atomic fuel is expected to account for about 20 per cent of China's electricity. As China speeds up development of the nuclear industry to help it to fulfil its commitments on climate change, it also plans to build more facilities in the next five years to manage the waste generated by nuclear power plants, including contaminated gear and used components.

Source: Rachel Zhang, South China Morning Post, <https://www.scmp.com/news/china/politics/article/3126984/china-sets-nuclear-safety-committee-boost-2060-carbon-neutral>, 25 March 2021.

China-Russia Joint Nuclear Power Plant Sees Second Operation Incident in 10 Months

The Tianwan Nuclear Power Plant, the largest technical and economic cooperation project between China and Russia at the moment, reported in March another operation incident within 10 months. On March 9, the temperature difference between No. 1 and No. 2 steam generators resulted in the closure of the main steam isolation valve of No. 2 steam generator. The incident happened during a refueling overhaul of reactor at the Tianwan Nuclear Plant, in East China's Jiangsu Province, the NNSA announced.

The No.2 reactor, which used the Russian-designed VVER-1000 reactor devices, was built

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under a 1992 cooperation agreement between China and Russia. Its construction started in October 1999 and was commissioned in September 2007. After the incident, the faulty regulating valve was replaced and the overhaul proceeded as planned, the NNSA said.

In May 2020, during the refueling overhaul of Unit 1, a defect on nine welding lines on pipes in the low-pressure injection system was found. Both incidents were classified as 0 level according to international standards, indicating that there is a deviation in the operation, but without any breaches of safety. This level of events do not have any impact on nuclear safety, the health of employees, the public and the environment in the vicinity.

The NNSA said that during the March 9 incident, the reactor protection system responded normally, the safety barriers remained intact, and there were no radioactive consequences, no human exposure, and no environmental pollution. The China National Nuclear Corp (CNNC) holds 50 percent of the shares of the Tianwan Nuclear Plant.

The Tianwan and the Xudapu nuclear plants, in Northeast China's Liaoning Province, are part of a 20 billion yuan (\$2.9 billion) nuclear deal signed in June 2018 between the CNNC and Rosatom State Corp Engineering Division, the Russian state nuclear company. The deal is currently the biggest bilateral cooperation project on nuclear energy.

The Tianwan Nuclear Power Plant is planned to have eight units, which will generate about 70 billion kilowatt hours annually. The first four reactors used the Russian-designed VVER-1000 reactor device. Reactors No. 7 and No. 8 will use Russia's

third-generation VVER-1200 model. Alexei Likhachev, Director General of Rosatom, announced on March 11 that the construction of the No. 7 reactor at Tianwan Nuclear Power Plant will start in 2021.

Source: <https://www.globaltimes.cn/page/202103/1219680.shtml>, 29 March 2021.

JAPAN

During the March 9 incident, the reactor protection system responded normally, the safety barriers remained intact, and there were no radioactive consequences, no human exposure, and no environmental pollution.

New Type of Fallout from Fukushima Daiichi Found a Decade after Nuclear Disaster

New, large and highly radioactive particles have been identified from among

the fallout of the 2011 Fukushima Daiichi nuclear disaster in Japan. An international team of researchers has characterized the particles using nuclear forensic techniques and their results shine further light on the nature of the accident while helping to inform clean-up and decommissioning efforts.

This year marks the tenth anniversary of the Fukushima Daiichi disaster, which occurred as a result of a powerful earthquake that struck off of Japan's east coast, generating a tsunami that reached some 14 m high when it reached the nearby shoreline. Breaching sea defences, the water from the wave shut down emergency generators that were cooling the reactor cores. The result was a series of nuclear meltdowns and hydrogen explosions that released a large amount of radioactive material into the surrounding environment — including microparticles rich in radioactive caesium that reached as far Tokyo, 225 km away.

Recent studies have revealed that the fall-out from reactor unit 1 also included larger caesium-bearing particles, each greater than 300 micron in diameter, which have higher levels of activity in the order of 105 Bq per particle. These particles were found to have been deposited in a narrow zone stretching around 8 km north-northwest from the reactor site.

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higher levels of activity in the order of 105 Bq per particle. These particles were found to have been deposited in a narrow zone stretching around 8 km north-northwest from the reactor site.

Surface Soil Samples: In their study, chemist and environmental scientist Satoshi Utsunomiya of Japan's Kyushu University and colleagues have analyzed 31 of these particles, which were collected from surface soil taken from roadsides in radiation hotspots. "[We] discovered a new type of radioactive particle 3.9 km north northwest of the Fukushima Daiichi Nuclear Power Plant, which has the highest caesium-134 and caesium-137 activity yet documented in Fukushima, 105–106 Bq per particle," Utsunomiya says.

Alongside the record-breaking radioactivity seen in two of the particles (6.1×10^5 and 2.5×10^6 Bq, after correction to the date of the accident) the team also found that they had characteristic compositions and textures that differed from those previously seen in the reactor unit 1 fall-out.

Reactor Building Materials: A combination of techniques including synchrotron-based nanofocus X-ray analysis and transmission electron microscopy indicated that one of the particles was found to be an aggregate of smaller silicate nanoparticles each with a glass-like structure. This is thought to be the remnants of reactor building materials that were first damaged in the explosion and then picked up caesium that had been volatilized from the reactor fuel.

The other particle had a glassy carbon core and a surface peppered with other microparticles of various compositions, which are thought to reflect a forensic snapshot of the particles that were airborne within the reactor unit 1 building at the moment of the hydrogen explosion and the physiochemical phenomena they were subjected to.

"Owing to their large size, the health effects of the new particles are likely limited to external

radiation hazards during static contact with skin," explained Utsunomiya — with the two record-breaking particles thought too large to be inhaled into the respiratory tract.

Impact on Wildlife: However, the researchers note that further work is needed to determine the impact on the wildlife living around the Fukushima Daiichi facility — such as, for example, filter feeding marine molluscs which have previously been found susceptible to DNA damage and necrosis on exposure to radioactive particles.

"The half-life of caesium-137 is around 30 years," Utsunomiya continued, adding: "So, the activity in the newly found highly radioactive particles has not yet decayed significantly. As such, they will

remain [radioactive] in the environment for many decades to come, and this type of particle could occasionally still be found in radiation hot spots."

Nuclear material corrosion expert Claire Corkhill of the University of Sheffield — who was not involved in

the study — says that the team have offered new insights into the events that unfurled during the accident. "Although the two particles selected [for analysis] were small, a mighty amount of chemical information was yielded," she said, noting that some of the boron isotopes the researchers identified could only have come from the nuclear control rods damaged in the accident.

Ongoing Clean-up: "This work is important to the ongoing clean-up at Fukushima, not only to the decontamination of the local area, but in defining a baseline understanding of radioactive contamination surrounding the power plant, to ensure that any materials accidentally released during the fuel retrieval operations can be quickly identified and removed," she adds.

With this study complete, the researchers are now using the particles to better understand the conditions involved in the reactor meltdown, alongside looking quantify the distribution of this

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fallout across Fukushima, with a focus on identifying resulting radiation hot spots. "If we can find and remove these particles, we can efficiently lower the radiation dose in the local environment," Utsunomiya concluded.

Source: <https://physicsworld.com/a/new-type-of-fallout-from-fukushima-daiichi-found-a-decade-after-nuclear-disaster/>, 15 March 2021.

USA

Advanced Nuclear Reactors No Safer than Conventional Nuclear Plants, Says Science Group

A new generation of so-called "advanced" nuclear power reactors that Washington believes could help fight climate change often present greater proliferation risks than conventional nuclear power, a science advocacy group said. President Joe Biden, a Democrat, has made curbing climate change a priority and has supported research and development for advanced nuclear technologies.

The reactors are also popular with many Republicans. Last October, the month before Biden was elected, the U.S. Department of Energy, awarded \$80 million each to TerraPower LLC and X-energy to build reactors it said would be operational in seven years. Advanced reactors are generally far smaller than conventional reactors and are cooled with materials such as molten salt instead of with water. Backers say they are safer and some can use nuclear waste as fuel.

"The technologies are certainly different from current reactors, but it is not at all clear they are better," said Edwin Lyman, director of nuclear power safety at the Union of Concerned Scientists. "In many cases, they are worse with regard to...safety, and the potential for severe accidents and potential nuclear proliferation," said Lyman, author of the report UCS released called "'Advanced' Isn't Always Better".

Nuclear reactors generate virtually emissions-free power which means conventional ones, at least, will play a role in efforts to decarbonize the economy by 2050, a goal of the Biden administration. But several of the 94 U.S. conventional nuclear plants are shutting due to high safety costs and competition from natural gas and wind and solar energy.

That has helped spark initial funding for a new generation of reactors. But fuel for many of those reactors would have to be enriched at a much higher rate than conventional fuel, meaning the fuel supply chain could be an attractive target for militants looking to create a crude nuclear

weapon, the report here said. Also, nuclear waste from today's reactors would have to be reprocessed to make fuel. That technique has not been practiced in the United States for decades because of proliferation and cost concerns. Other advanced reactors emit large amounts of radioactive gases, a potentially problematic waste stream.

Lyman said advanced nuclear development funds would be better spent on bolstering conventional nuclear plants from the risks of earthquakes and climate change, such as flooding. The report recommended that the Department of Energy suspend its advanced reactor demonstration program until the NRC requires prototype testing before reactors can be licensed for commercial use.

The DOE did not immediately respond to a request for comment. Brett Rampal, director of nuclear innovation at Clean Air Task Force, a nonprofit that supports advanced nuclear to fight climate change and cut harmful emissions, said the report's conclusions were not based on rigorous assessment of the industry. Rampal said if the DOE acted on the recommendation it would "essentially cease innovation in nuclear energy today."

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Source: Timothy Gardner, Reuters, https://www.reuters.com/article/us-usa-nuclearpower/advanced-nuclear-reactors-no-safer-than-conventional-nuclear-plants-says-science-group-idUSKBN2BA0CP?mkt_tok=MDk1LVBQVi04MTMAAAF75ib7_18u69CXaGzfHwCrA4JheQHlrMhgnd6dpnyjf-IDHABd6qRvfSIRvBoQ8PMS60M3IZdx5w7xAmY7DQMOAUtp9Cud8q59HNult-v407b5Lg, 18 March 2021.

People Downwind of Atomic Blasts Renew Push for US Payout

In the desert northeast of Las Vegas, residents living along the Nevada-Arizona border would gather on their front porches for bomb parties or ride horses into the fields to watch as the US government conducted atomic tests during a Cold War-era race to build up the nation's nuclear arsenal. About 100 of those tests were aboveground, and US Rep. Greg Stanton of Arizona testified during a congressional subcommittee hearing that residents at the time marveled at the massive orange mushroom clouds billowing in the distance.

"They had no idea. They were never told that they were being exposed to dangerous cancer-causing radiation," Stanton said. "As a direct result of the radiation exposure from these tests, thousands of Arizonans have suffered from cancer, entire families have suffered from cancer and far too many have died."

He and others testified as part of a renewed push for compensation from the U.S. government following uranium mining and nuclear testing carried out during the Cold War. Lawmakers from several Western states, advocacy groups and residents have been urging Congress to expand a payout program for years, and advocates say the

latest push takes on added weight because the Radiation Exposure Compensation Act is set to expire next year. Wednesday's (24 March) hearing was the first on the issue since 2018, advocates said.

In New Mexico, about 40,000 people lived within a 50-mile (80-kilometer) radius of a military range where the world's first atomic bomb was detonated as part of World War II's top-secret Manhattan Project, said Tina Cordova, co-founder of the Tularosa Basin Downwinders Consortium.

The advocacy group has been trying for years to bring awareness to the lingering effects of nuclear fallout surrounding the Trinity Site. She told the committee that the bomb, being the first, was inefficient and sent a fireball of plutonium into the atmosphere.

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the atmosphere. "For days, radioactive ash fell from the sky and settled on everything — the soil, in the water, in the air, on the plants and on the skin of every living thing. It was a public health disaster of grand proportions," Cordova testified.

A multibillion-dollar defense spending package approved last year included an apology to New Mexico, Nevada, Utah and other states affected by radiation from nuclear testing over the decades, but no action was taken on legislation that sought to change and broaden the compensation program.

Navajo Nation President Jonathan Nez testified about the environmental and health effects of decades of uranium mining on tribal land. He said more than 30 million tons of ore were extracted from Navajo lands to support U.S. nuclear activities, with many Navajos working in

the mines without knowledge of the dangers. He also pointed to a massive spill in 1979 that spewed radioactive tailings and wastewater onto tribal lands in the Church Rock area in western New Mexico.

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US Sen. Ben Ray Luján of New Mexico, who sponsored the bill to expand the program when he was in the House, recalled how a Navajo woman previously asked lawmakers whether they were waiting for the people who were exposed to radiation to die so the problem would go away. "It's just not right," Luján said, pointing to those on the Navajo Nation as well as people downwind in New Mexico, Idaho, Colorado, Montana, Nevada, Utah and Guam who are not eligible for payouts. "These people deserve justice."

The compensation program covers workers who became sick as a result of the radiation hazards of their jobs and some of those who lived downwind of the Nevada Test Site, where the federal government conducted several hundred nuclear explosive tests over four decades. Excluded are residents near the Trinity Site in New Mexico, others who were downwind in Nevada and Arizona, miners who worked in the industry after 1971, veterans who cleaned up radioactive waste in the Marshall Islands and others.

Source: Susan Montoya Bryan, AP News, https://apnews.com/article/people-near-atomic-tests-see-us-payout-89290c43c3af08600f34c8914528b029?mkt_tok=MDk1LVBQVi04MTMAAAF8Cio4uix2nZhy7vj9j7wJRiDO-fm1Vt3Bh5KP4865_Ras2ijE8m3BmhHdmAEGtuZME7D4DMe4gypNG1vetURtB lCLR VNs WvAyXzVcgwtjk9ydA, 25 March 2021.

NUCLEAR WASTE MANAGEMENT

GENERAL

Is an End to Nuclear Waste Possible?

The 2011 Fukushima disaster in the wake of a 9.0-magnitude earthquake has been an inflection point for nuclear power in the public mind,

particularly in Europe. The events dealt a blow to the image of nuclear as a safe technology, and a decade on, its reputation is yet to recover – even as nuclear's advantages in the fight against climate change are becoming increasingly obvious.

The European Union's reluctance to include nuclear in its long-anticipated "taxonomy", which determines how much financial support governments are allowed to provide for nuclear projects, is reflective of this. Lawmakers are unsure whether nuclear will be given a lifeline under the EU's green finance regulations by classifying it a "transition fuel", or whether it will be permanently ostracized as a form of energy that causes "significant harm" to the environment because of the radioactive waste it produces.

Nuclear waste is one of the main sticking points in the public discourse about the future of nuclear power. In Germany, for example, it has been a driving force behind the country's nuclear phase-out. "Indeed, the biggest hurdle to public acceptance of nuclear energy is nuclear waste, which is used or spent fuel," Koroush Shirvan, an expert on nuclear fuel cycles and professor at the Department of Nuclear Science and Engineering at the Massachusetts Institute of Technology, tells Sustainability Times.

The international consensus is that highly radioactive waste should be stored in deep geological repositories, safely locking it away for many centuries. In Europe, "One geologic repository is currently under construction in Finland and another is nearing that stage in Sweden", explains Prof. Shirvan. "Similarly in France, high level waste is being set aside for geologic disposal after the usable fuel forms (e.g. uranium and plutonium) are recovered and recycled from used fuel."

Yet technological innovations based on closed fuel cycles mean that the amount and radiotoxicity of

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waste can be greatly reduced, and the current uranium resources be extended by a few thousand years. "A closed fuel cycle can reduce the volume of used fuel significantly, depending on the disposition strategy for heavier isotopes within the nuclear fuel," elaborates Prof. Shirvan, meaning that "cost effective sustainability with nuclear energy can truly only be achieved with closing the fuel cycle."

However, incentivizing the construction of the necessary infrastructure and absorbing additional costs for closing the fuel cycle requires a healthy nuclear industry growing at least 2.5 percent per year operating at scale, and an increase in uranium prices. That's because "the economic benefits from closing the fuel cycle increase as nuclear energy programs expand."

Considering that nuclear power use is expanding globally, with the OECD's International Energy Agency predicting installed nuclear capacity to grow by over 15% between 2019 and 2040, demand for technologies to reduce nuclear waste will likely rise accordingly. A critical technology for doing so are fast neutron reactors (FNRs) designed to use fuel that consists of conventional fuel mixed with reprocessed spent fuel, called MOX.

"The spent fuel comes from water-cooled reactors that are the dominant technology across the world", clarifies Prof. Shirvan. "By using spent fuel discharged from existing reactors, MOX fuel is able to reduce the needed mass of fuel and extend the current uranium reserves. As such, only countries with a significant number of NPPs would pursue a closed fuel cycle and MOX fuel fabrication."

For example, France is a major MOX producer, and uses it in its water-cooled reactors, while China and Japan are working towards MOX

commercialisation. Russia's Rosatom, the world's biggest nuclear vendor, is currently the only company operating several FNRs commercially (the BN-600 and BN-800), and preparing construction of another one, the BN-1200M. These FNRs are sodium-cooled, where MOX is considered as a fuel.

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Meanwhile, R&D on FNRs and their use in achieving closed fuel cycles is progressing rapidly. Rosatom is also currently building a fast reactor prototype for a closed fuel cycle at the Pilot Demonstration Energy Complex (PDEC) in Seversk. The Brest-OD-300 power unit recently received a construction license, making it the world's first experimental demonstration power unit employing a lead-cooled fast neutron reactor, with fuel loading scheduled for 2023.

While various sodium-cooled fast reactors have been developed by the US, France Japan and the USSR-Russia, Prof. Shirvan points out that the use of liquid lead as a coolant has several advantages: "Lead has been mastered by Russia, originally for their nuclear submarines and chosen for the Brest demo. The main advantages of lead over sodium are its high boiling point which allows it to operate at higher temperatures, and chemical inertness in interacting with air or water, which means there's no chance of fire."

Another example is the EU-sponsored MYRRHA facility to be built in Belgium. It will include both an accelerator driven system and a lead-cooled test FNR, enabling research on high-level nuclear waste treatment. Its commissioning is scheduled for 2034.

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According to the MIT professor, fast reactor technology "lends itself well to both burning the geologically unattractive radioactive material for eventual disposal, and breeding new useful nuclear fuel." Both are functions that represent

milestones for the nuclear industry and are game changers for development and deployment. As was noted by Stefano Monti of the IAEA's Fast Reactor Technology Development Section back in 2013, FNR technology can help in "reducing the amount and toxicity of radioactive waste, as well as the heat emanating from the waste, and also shortening the waste's hazardous lifetime span."

This makes a compelling case for nuclear's future use by effectively addressing one of the most enduring arguments put forward by nuclear skeptics. And the fact that FNRs can create more fissile material than they consume makes them not only highly efficient but promises to make nuclear energy production truly sustainable once commercial operations begin at scale.

In light of the benefits, these technological advancements could trigger a rethinking about nuclear power in Europe down the line, especially as pressure rises on the EU to deliver results on its promises to become climate-neutral by 2050. This view is broadly shared by Prof. Shirvan, who is confident that nuclear power will be regarded a renewable energy source in the nearer future: "With access to more information and with the wrong connotation of nuclear energy and nuclear weapons fading away, it's reasonable to forecast that by 2050, nuclear energy – alongside other renewable energy sources – will be gaining public support in the USA."...

Source: <https://www.sustainability-times.com/low-carbon-energy/is-an-end-to-nuclear-waste-possible/>, 24 March 2021.

This Autonomous Robot Can Clean Underwater Nuclear Waste

Today's autonomous robots serve as anything from warfighters to fruit pickers. Now, there's a new autonomous robot in town and its aim is a very useful one: to clean underwater nuclear waste.

Called the Autonomous Aquatic Inspection and Intervention (A2I2), the robot is the result of a

wide-ranging UK collaboration led by Rovco that includes Forth Engineering, D-RisQ, the National Oceanography Centre (NOC), Thales UK, and Manchester University. And this week, A2I2 showcased its capabilities in hazardous environments in Forth's 1.2 million liter tank facility in Maryport.

"The whole challenge of this particular project was removing people from hazardous and dangerous environments," Gary Cross, a senior robotics engineer at Rovco, told The Engineer. "One of the key things is increasing the distance between the operators and the environment they're working in. And the easiest way to do that is to make the vehicle remote, remotely controlled, and remotely operated."

A2I2 uses a system known as SubSlam in order to live-stream 3D images of matter within a spent fuel pond. Onshore pilots can then make quick decisions on what to do with the substances. The robot becomes especially handy in situations where nuclear materials are in danger of colliding with one another.

The project was not without its fair share of challenges; particularly the latency. As the distance between the operator and the tools they're using increases, so does the latency in communication, making it very difficult to operate. "So, technology such as the advanced perception system and mapping capabilities enables us to use the autonomy to provide the appropriate systems to the pilots who can still be in control in a safe and meaningful way within the pond," added Cross. A2I2 also has collision avoidance systems built in to tackle whatever comes its way. If all goes well with continued testing, the firm may one day be able to remove all operators from harsh and unforgiving nuclear environments.

Source: Loukia Papadopoulos, <https://interestingengineering.com/autonomous-robot-can-clean-underwater-nuclear-waste>, 28 March 2021.

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IAEA Announces New Collaborating Centre for Radioactive Waste Management

The agreement will facilitate the sharing of good practices and promote the deployment of proven and advanced technologies to implement nuclear decommissioning. It will also contribute to the long-term development of a skilled workforce and transfer of technical knowledge, in particular for VVER reactor decommissioning.

"IAEA Collaborating Centres are one of our key cooperation mechanisms, and I am very happy that JAVYS is now part of this exclusive group of institutions, especially to help the Agency in supporting Member States' efforts in nuclear decommissioning and associated waste management," said Mikhail Chudakov, IAEA Deputy Director General and Head of the Department of Nuclear Energy. "Access to JAVYS's infrastructure and expertise will be an invaluable opportunity to share good practices and support the development and implementation of education and training courses in Member States, as well as learning and training materials on nuclear decommissioning."

The IAEA sees increasing work over the coming decades for decommissioning and associated waste management programmes. Many of the world's 443 nuclear power reactors currently in operation will phase out of service, while new reactors to be commissioned will need plans to fund their decommissioning. A total of 189 power reactors have been shut down for decommissioning, with 17 of them fully decommissioned. In addition, 130 fuel cycle facilities have been decommissioned as well as about 440 research reactors.

JAVYS is located at Jaslovske Bohunice, the closest nuclear power site to the IAEA headquarters in Vienna, Austria. It hosts three nuclear power

plants, with two under decommissioning and one in operation, as well as supporting spent fuel and waste management facilities.

... JAVYS is the fourth IAEA Collaborating Centre in the field of decommissioning, with specific experience in dismantling and other activities related to the final stage of a nuclear facility's lifetime. The others include Italy's Societa Gestione Impianti Nucleari (SOGIN), the Institute for Energy Technology (IFE) in Norway and Électricité de France (EDF). ...

Source: <https://waste-management-world.com/iaea-announces-new-collaborating-centre-for-radioactive-waste-management>, 26 March 2021.

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FINLAND

Project Report: Nuclear Waste Disposal

The Onkalo nuclear waste disposal facility under-construction in Olkiluoto, Finland, will be the world's

first permanent geological repository for spent nuclear fuel and high-level radioactive waste. It is located 500m underground, near Finland's Olkiluoto Nuclear Power Plant, in Eurajoki, on the west coast of the country.

The catalyst for the project came in 1994 when Finland's parliament amended its Nuclear Energy Act to specify that all nuclear waste produced in Finland must also be disposed of in the country.

Solid Surroundings: In 2000, Olkiluoto was identified as the placement site for what would become a very long-term underground storage facility, thanks to the area being formed of granite bedrock. The municipality of Eurajoki then issued a building permit for the facility in August 2003, and excavation work began in 2004.

The facility was named Onkalo, meaning small cave or cavity, in Finnish and being built and is based about 5km from the main nuclear power

plants. Construction specialist Posiva was chosen to carry out the works ahead of the facility becoming operational in 2023, if all goes to plan.

Jarno Säippä is the project manager at Posiva, for the shaft sections of the project, of which there are three: one personnel shaft and two ventilation shafts – one for air coming in and the other for air going out. Säippä's background is in mining, and he has also been certified an official inspector for Radiation (STUK).

As Säippä explains, the shafts and main tunnels of the site were completed in 2012. The officials gave the permit to build nuclear waste disposal facilities in 2015, and the construction works began in 2016, with the excavating and building of the final nuclear waste placement tunnels. ...

Longstanding Containment: When the facilities are complete, the combined length of the tunnels will be about 50km and will have a total volume of approximately 1.5 million cubic metres. According to the plans, 6,500 tonnes of spent nuclear fuel will be held in the main placement tunnels, which required over 3,000 copper containment capsules to be installed. The entire disposal process will take about 100 years, then the premises will be closed.

The four shafts in the facility are almost 0.5km tall, and a range of work needed to be carried out inside those shafts and on the walls of the shafts. Säippä adds, "Building such a facility is a vast project and demands different and specific kinds of tools and equipment."

For the assembly works inside the personnel shaft, Posiva is using a Scanclimber SC2000 hybrid hoist and work platform. The unit was custom built according to Posiva's requirements and provides

both hoisting and mast climbing work platform capabilities. It is being used to assemble the steel frames of the shaft and carry out HVAC works.

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based around the idea of a standard hoist with a sliding door and access in and out on any floor. This section of the platform is being used to provide material transportation as required by the project.

The upper deck provides a platform on which personnel can work and access the shaft walls to attach the shaft fittings and install the air conditioning units. From this position the rail guides for what will become the passenger elevator, once construction is completed, are also being put in place. "Posiva will dismantle the platform at the turn of 2023, and we'll install a standard

c o u n t e r w e i g h t e d passenger lift in the shaft," explains Säippä.

Challenging Elements: A challenge at the start of the project was that the remote control's signal from the platform did not

work in a shaft that is almost 500m deep in bedrock. To solve the problem, the radio control was replaced with a cable. Since then there have been no problems, says Säippä. The work platform's primary task is to provide the base on which workers can install the steel frames inside the shaft. The frames are 10m high, pre-assembled elements that are lowered down into the shaft using cranes at ground level. During the installation, the steel elements will be bolted together and fixed to the shaft wall.

As the work progresses from the bottom up, the mast of the SC2000 is extended upwards. The mast sections are transported up from the floor of the shaft, using the work platform and installed from there, using Scanclimber's standard Mast Assembly Crane Arm. Posiva will then utilise the work platform to install other vital elements in the shaft, like electrical installations, cabling,

lighting, piping, safety and emergency equipment. The guide frames for the personnel elevator that will be installed once the shafts have been completed will also then be fixed.

Source: Euan Youdale, <https://www.khl.com/news/project-report-nuclear-waste-disposal/8011083.article>, 23 March 2021.



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