



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

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OPINION – Rakesh Sood

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NPT’s Midlife Crisis

In March 2020, the NPT turned fifty. The 10th RevCon, originally scheduled for April and May, was postponed to January 2021 and is now tentatively planned for August 2021. The NPT is often described as the cornerstone of the global nuclear order. It is among the most widely adhered to global treaties. All countries except four (India, Israel, and Pakistan never joined, and North Korea withdrew in 2003) are parties to the NPT. Despite its enviable record, a sense of disquiet and uncertainty surrounds RevCon and its future.

Any global order needs two enabling conditions: a convergence of interests among the present major powers to define a shared objective, and an ability to package and present it to the world as a global public good. The conditions for nuclear order and the NPT were no exception.

In 1963, only four countries (the US, France, the Soviet Union, and the UK) had tested a nuclear device when U.S. President John F. Kennedy sounded the alarm that by 1975 there could be as many as 20 countries with nuclear weapons. The Soviet Union shared similar concerns. This convergence of

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CONTENTS

- ☞ **OPINION**
- ☞ **NUCLEAR STRATEGY**
- ☞ **BALLISTIC MISSILE DEFENCE**
- ☞ **EMERGING TECHNOLOGIES AND DETERRENCE**
- ☞ **NUCLEAR ENERGY**
- ☞ **NUCLEAR COOPERATION**
- ☞ **NUCLEAR PROLIFERATION**
- ☞ **NUCLEAR DISARMAMENT**
- ☞ **NUCLEAR TERRORISM**
- ☞ **NUCLEAR SAFETY**
- ☞ **NUCLEAR WASTE MANAGEMENT**

interests between the two Cold War adversaries enabled the NPT negotiations.

To make nuclear order attractive as a global public good, it was packaged as a three-legged stool: non-proliferation, obliging those without nuclear weapons to never acquire them and accept full-scope safeguards; disarmament, requiring the five countries with nuclear weapons (the U.S., China, France, the Soviet Union, and the U.K.) to negotiate the reduction and eventual elimination of their

nuclear weapons; and the peaceful use of nuclear energy, guaranteeing non-nuclear weapons states full access to peaceful applications of nuclear science and technology.

Since the NPT was concluded, only the four countries outside the NPT have acquired nuclear weapons, bringing the total number of nuclear weapons states to nine, far fewer than Kennedy feared in 1963. Among the oft-cited successes of the NPT is the dramatic reduction in the number of nuclear weapons from a peak of over 70,000 warheads in the early 1980s to around 14,000 at present, with the U.S. and Russia accounting for over 12,500 of them. However, these reductions were a result of bilateral negotiations between the U.S. and Russia, reflecting the state of their relations. No negotiations have ever been held within the NPT framework.

In fact, during the first 15 years of the NPT, the U.S. and Soviet arsenals increased from below 40,000 to over 65,000, making it clear that the nuclear disarmament leg of the NPT was being ignored as the U.S. and Soviet Union embarked on a nuclear arms race.

Some claim that the NPT helped strengthen the taboo against nuclear weapons. However, a closer examination of recently declassified papers indicates that since 1970, there have been over a dozen instances where the U.S. and Soviet Union came close to initiating a nuclear exchange, many of which were based on system errors or misperceptions about the intentions of the other.

Today, the nuclear taboo is being challenged as

major nuclear powers undertake R&D for more usable low-yield nuclear weapons. Ballistic missile defense, hypersonic systems that carry both conventional and nuclear payloads, and growing offensive cyber capabilities further blur the line between conventional and nuclear weapons. The NPT has reached the limits of its success as far as

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the proliferation objective is concerned. Further, its packaging as a balanced three-legged stool stands exposed as a wobbly, one-legged stool, for the NPT delegitimized proliferation but not nuclear weapons. The clearest reflection of this growing frustration among the non-nuclear weapons states party to the NPT was the humanitarian initiative spearheaded by a coalition of NGOs and civil society to negotiate a treaty prohibiting nuclear weapons. The Treaty on the Prohibition of Nuclear Weapons (TPNW) was concluded in 2017 and entered into force in January 2021, making it the only multilateral nuclear treaty to emerge since the NPT 50 years ago. Each of the TPNW's 86 signatories and 54

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ratifying states are members of the NPT in good standing. For the first time, an NPT RevCon will take place with a new, un-ignorable divide between states that rely on nuclear weapons (or nuclear-armed allies) for their security and states that believe nuclear weapons are a threat to global security and accept that the NPT cannot be the route to nuclear disarmament. However, the five nuclear weapons states party to the NPT are convinced that the TPNW undermines the NPT even though the TPNW's 140 signatories and ratifiers provide legitimacy. Other divisive political challenges for the RevCon include Iran and the Joint

Comprehensive Plan of Action, which was unilaterally discarded by the Donald Trump administration; a push by non-nuclear weapons states for substantive reductions in nuclear arsenals; lack of progress on the 1995 initiative for the Middle East as a zone free of all weapons of mass destruction; a U.S. push for universal adherence to the IAEA Additional Protocol; and North Korea's nuclear arsenal, among others.

In the run-up to the 26th Conference of Parties (COP-26) in November 2021, when global momentum is building up to achieve net-zero emission goal by 2050, we must appreciate the ecological aspects of nuclear energy and pay serious attention to its positive role in the national energy transition in today's carbon-constrained world.

For the last 50 years, a substantive consensus outcome has been the criteria for a successful RevCon. Yet anticipating the difficulties of a consensus, supporters of the NPT are suggesting that the definition of a successful outcome should be reconsidered. However, such an approach is at best a temporary resolution. Any permanent resolution would lie in accepting the limitations of the NPT and seeking to join the TPNW proponents in a constructive dialogue. This needs imaginative approaches and a shift from the zero-sum model of negotiation to a win-win outcome, preserving the NPT while looking beyond it. A mindset change is necessary for the NPT to overcome its midlife crisis.

A typical 1,000-megawatt nuclear facility needs a little more than 1 square mile to operate whereas wind farms require 360 times more land area to produce the same amount of electricity; and solar photovoltaic plants require 75 times more space.

Source: <https://www.orfonline.org/research/npts-midlife-crisis/>, 17 June 2021. The commentary originally appeared in *The Korean Times*, https://www.koreatimes.co.kr/www/opinion/2021/06/197_310524.html, 16 June 2021.

OPINION – Sitakanta Mishra

Embrace Nuclear Energy for Net-zero Emission Goal

Nuclear energy is often left out of the 'clean energy' debate despite it being the second-largest source of low-carbon electricity in the world, next

only to hydropower. In the run-up to the 26th Conference of Parties (COP-26) in November 2021, when global momentum is building up to achieve net-zero emission goal by 2050, we must appreciate the ecological aspects of nuclear energy and pay serious attention to its positive role in the national energy transition in today's carbon-constrained world.

Nuclear energy is relatively ecological in the sense that producing electricity with nuclear fission emits almost no CO₂ and fine particles, in contrast to coal, oil, or even gas. Globally, the use of nuclear power has reduced CO₂ emissions by about 60 gigatonnes, or nearly two years' worth of emissions over the past 50 years according to the IEA. The ecology of nuclear energy can further be proved when one compares the amount of electricity produced by a reactor vis-à-vis fossil fuels and their land footprint. For example, one gigawatt of electricity produced by a typical nuclear reactor can be matched by almost two coal or nearly three renewable plants. Also, a

typical 1,000-megawatt nuclear facility needs a little more than 1 square mile to operate whereas wind farms require 360 times more land area to produce the same amount of electricity; and solar photovoltaic plants require 75 times more space. Undoubtedly, all sources of energy grapple with the trilemma of carbon emissions, continuity of supply, and cost; but nuclear energy amicably addresses the first two, and with advancement in reactor technologies, it is increasingly becoming cost-competitive. Modular and advanced reactor designs are under development which would reduce the capital costs and gestation period to get the reactor online in a short span. In addition, while other energy sources dispose of wastes to the environment and its expenses are not costed into the product, nuclear energy stands apart.

Nuclear energy projects factor fully the costs of waste management, disposal and decommissioning in the actual cost of electricity produced.

While absorption of the emissions can be increased by creating more carbon sinks such as forests, reduction of emission requires futuristic technologies, and nuclear fits the most without compromising desired economic growth. It is projected that to reach net-zero emissions by 2050, annual clean energy investment worldwide will need to triple by 2030 to

around \$4 trillion. If a fraction of this is devoted to the nuclear sector, and national energy transition plans are crafted keeping in mind the promise of nuclear technology, achieving net-zero emission goal by 2050 would not be difficult. It is reassuring to see that nuclear power is given relative importance today in the energy baskets of all major economies. China, EU, Japan, Russia, USA, South Korea, Canada, etc.

have chosen to retain a much higher share of nuclear power in their energy mix. Though India pursues an ambitious nuclear energy expansion plan, its capacity addition has been decelerating. Unless scaled up soon the nuclear component in its energy mix, no other carbon sinks option or decarbonisation plan can effectively compensate, for its emissions likely to grow exponentially in subsequent years as India presses for a higher growth trajectory.

Even if India is not able to meet its climate mandate within the set timeframe, the prevailing conducive global nuclear trade atmosphere, and its trusted civil nuclear cooperation with Russia, should be utilized to ensure long-term energy security and carbon neutrality simultaneously. The

Russian-built Kudankulam reactors are still the cheapest of all foreign-built nuclear plants in India. Today, such reactors can be built within five to six years based on current capabilities. "According to NPCIL, the land footprint of nuclear power is at least 20 times smaller than that for solar energy. The lifecycle greenhouse gas emissions from solar are 50 grams/kWh compared to 14 g/kWh for nuclear power."

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But nuclear projects never received the quantum of generous subsidy the fossil fuel received in the past, and renewable projects are receiving today. Sporadic nuclear disasters have caused small fatalities during the last seven decades leading to a negative perception of nuclear technology. But everyone forgets that man-made disasters take place in coal, gas, oil industries; people have died, and pollution has spread, but the world has not abandoned any of them yet. Rather, all study what went wrong, try to fix it and move on. Surprisingly, contrast is the case in the nuclear sector which get a lot of negative attention.

If global energy transition in a carbon-constrained world has to be smoothed, and the Net-Zero Emission target has to be achieved within the stipulated timeframe, nuclear energy needs to be embraced wholeheartedly. Else, we will miss the only bogie that could ensure energy sustainability and climate conservation simultaneously. The current pandemic experience should be an eye-opener for all to realise that if nature beckons belligerently, humans become mere dolls.

Source: <https://timesofindia.indiatimes.com/readersblog/nuclear-energy/embrace-nuclear-energy-for-net-zero-emission-goal-33883/>, 19 June 2021.

OPINION – Punch Moulton, Francis Mahon

Robust, Credible and Layered Missile Defense is the Foundation of Deterrence

In 2005, an anticipated missile threat to the homeland prompted the expeditious fielding of a missile defense capability to defend the US. Today, that threat is real, expanding, and most likely nuclear. Our defense needs to also be real and effective for today and into the future.

A recent report by the think tank Rand estimates North Korea has 50 nuclear weapons in its arsenal and, by 2027, will have in excess of 200 and several dozen intercontinental ballistic missiles to complement its several hundred theatre ballistic missiles. The director of national intelligence's 2021 Annual Threat Assessment clearly states: "North Korea will be a [weapons of mass destruction] threat for the foreseeable future, [and] the country is actively engaged in ballistic missile research and development."

While we must not cast diplomacy aside, we should recognize deterrence is an essential element in any strategy for dealing with the North Korean nuclear missile threat. Deterrence matters, and Adm. Charles Richard, commander of U.S. Strategic Command, framed the point well when he said: "A robust and credible layered missile defense system paired with our conventional and nuclear force capabilities provide the ability to deter strategic attacks, deny benefits, and impose costs against any potential adversary." Deterrence discourages an adversary by instilling doubt and anxiety in their decision calculus. Our BMD System "denies benefit" by planting that seed of doubt in North Korea's decision calculus; the doubt that an attack on the US will succeed. Today, our defense rests on the Ground-based Midcourse Defense system, or GMD, and its 44 interceptors. But that alone is not going to be adequate to deal with the threats of 2027. Defending our homeland is vital. Looking

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to the next decade, we need to stay ahead of our threats. Our concerns are four-fold: technology, numbers, layers and sensors.

Technology: Advancing the effectiveness of our missile defense capabilities is extremely important. The Missile Defense Agency recently awarded two contracts, to two teams, to competitively develop a Next Generation Interceptor, or NGI, to overcome the shortcomings in the current interceptor fleet and provide a path to outpace future threats. This competitive development cycle will add up to 20 new interceptors to the inventory. As long as the program enjoys support and an adequate budget from the Department of Defense and Congress, we are on solid ground for the technology.

Numbers: A point of concern, though, is the math: 20 new intercepts plus the current 44 will give us 64. If Rand is anywhere close, we could be outnumbered by the end of the decade. More important,

we certainly cannot accept a 1-to-1 exchange ratio when we are dealing with nuclear missiles coming toward the homeland.

Layers: No single defensive system is successful 100 percent of the time, and we cannot base the defense of America solely on the hope of success for every GMD intercept. We need the opportunity for a second engagement in the event GMD's interceptors do not destroy the in-bound threat. Developing a layered defense is a vital strategy for our nation. We have the technology. MDA recently demonstrated the SM-3 Block 2A missile could intercept an ICBM. All we need now is an aggressive plan to truly build our layered approach for homeland missile defense.

Sensors: Lastly, our future missile defense architecture needs to have the right capabilities to "see the threat" and enable successful defenses. As Gen. John Hyten, vice chairman of the Joint Chiefs of Staff, has stated: "If you can't see it, you can't shoot it. And if you can't see it, you can't deter it either." Today's sensor suite — a handful of terrestrial sensors — needs to

advance to the next generation: space-based sensors. Our defenses need to be able to pick out the lethal objects in a cluster of countermeasures. Further, our sensors need to provide “fire control quality” information to the defensive interceptors. While a space-based sensor architecture will be expensive, it will cost far less — in both dollars and operational risk — than relying solely on a terrestrial network.

We cannot take our foot off the pedal. While it will likely take six to seven years to field our NGI, rest assured our adversaries are not standing still. The threat is real: in North Korea today, and potentially Iran tomorrow. NGI funding and robust competition within the program to limit technical risk and accelerate deployment are essential to stay on plan. The DoD needs to initiate a real commitment to developing the homeland’s layered defense and creating a robust, space-based missile defense sensor architecture. Development of an Aegis- and Terminal High Altitude Area Defense-based homeland defense architecture, which could be rapidly fielded, would provide the homeland an initial layered defense. Development of a space-based, discriminating sensor would enhance GMD’s and an underlayer’s performance, as well as contribute to improved theater missile defense operations. With the upcoming debates on budget, there are sure to be opponents who will challenge the investment in our missile defenses. The issue is not how much the defense costs; the question is how much risk are you willing to buy as nuclear weapons fly toward America. Deterrence is clearly the best approach. America needs a robust and credible layered missile defense system to deter and, if necessary, defeat a North Korean missile attack on our homeland.

Source: <https://www.defensenews.com/opinion/commentary/2021/06/16/robust-credible-and-layered-missile-defense-is-the-foundation-of-deterrence/>, 14 June 2021.

OPINION – Richard Hass

Taming the New Wild West

Traditionally, the US has favoured a largely unstructured internet in order to promote the free flow of ideas and information. But US enthusiasm for such an internet is waning as foes exploit this openness to undermine its democracy and steal intellectual property important to the functioning and comparative advantage of its economy.

During the Cold War, summit meetings between the US and the Soviet Union were often dominated by agreements to set limits on nuclear weapons and the systems built to deliver them. The US and

Russia still discuss these topics, but at their recent meeting in Geneva, US President Joe Biden and Russian President Vladimir Putin focused in no small part on how to regulate behaviour in a different realm: cyberspace. The stakes are every bit as great. It’s not hard to see why. Cyberspace and the internet are central to the workings

of modern economies, societies, political systems, militaries, and just about everything else, which makes digital infrastructure a tempting target for those seeking to cause extraordinary disruption and damage at minimal cost.

Moreover, states and nonstate actors can carry out cyberattacks with a high degree of deniability, which adds to the temptation to develop and use these capabilities. We know when and from where a missile is launched, but it can take a long time to discover that a cyberattack has occurred, and figuring out who is responsible can take even longer. Such a slow and uncertain attribution process can render the threat of retaliation, which is at the heart of deterrence, beyond reach. What put this issue squarely on the agenda of the Biden-Putin meeting is that Russia has grown increasingly aggressive in cyberspace, whether by creating false accounts on social media to influence American politics or by gaining access

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to critical infrastructure, such as power plants. Reinforcing the issue's salience is the reality that Russia is not alone: China reportedly gained access in 2015 to 22 million US government personnel files – which include information that could help determine who was or is working for the US intelligence community. Likewise, North Korea attacked Sony (and compromised all sorts of private communications) in an effort to block distribution of a satirical film that depicted the assassination of the country's leader. This all adds up to a latter-day Wild West, with many armed people operating in a space governed by few laws or sheriffs to enforce them.

Traditionally, the US has favoured a largely unstructured internet – “open, interoperable, secure, and reliable,” according to a policy set a decade ago – in order to promote the free flow of ideas and information. But US enthusiasm for such an internet is waning as foes exploit this openness to undermine its democracy and steal intellectual property important to the functioning and comparative advantage of its economy. The question – easier to pose than to answer – is where to draw lines and how to get others to accept them. For one thing, the US is not without its contradictions, as it, too, carries out espionage in cyberspace (think of it as the modern equivalent of steaming open envelopes to read someone else's mail) and reportedly, along with Israel, installed malware to sabotage Iran's nuclear weapons program. So, any ban on activities in cyberspace would presumably be partial.

One promising idea would be to follow up on what Biden and Putin discussed, namely, to ban the targeting of critical infrastructure, including but not limited to dams, oil and gas production facilities, electrical grids, health-care facilities,

nuclear power plants and nuclear weapon command and control systems, airports, and major factories. Cyber capability can become a weapon of mass destruction when such important sites are compromised. Even with such an agreement, verifying compliance could prove impossible, so the US would also want to introduce a degree of deterrence to ensure that parties to such a pledge honour it.

Deterrence could involve the declared willingness to carry out symmetrical responses: if you target or attack our critical infrastructure, we will do the same to yours. Deterrence could also be asymmetrical: if you target or attack our facilities, we will sanction you or target your interests elsewhere.

Any such agreement would also need to be buttressed by unilateral action, given the stakes and the reality that other agreements (such as China's 2015 pledge not to steal intellectual property) have been violated. For example, the US would want to take steps to reduce the vulnerability of its high-value systems. It would also be necessary to declare or negotiate that claims of ignorance or denials of government involvement in aggressive cyber activity, such as when Putin said his government had nothing to

do with Russian ransomware attacks, will not be accepted. The analogy here is to terrorism: in the wake of the September 11, 2001, attacks, the US made clear that it would not distinguish between terrorist groups or governments that provided them support or sanctuary. Russia would therefore be held accountable for the actions of groups acting from its territory. Insisting on accountability should increase Russia's incentive to rein in such behaviour. Over time, a US-Russia pact could serve as a model that could be joined by China, Europe, and others. If it were extended to China,

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Over time, a US-Russia pact could serve as a model that could be joined by China, Europe, and others. If it were extended to China, prohibitions on the theft of intellectual property (and penalties for violating the ban) could be added. None of this adds up to disarmament, but it is the cyber equivalent of arms control, which is as good a place to start as any.

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Source: <https://www.project-syndicate.org/commentary/biden-putin-meeting-cyber-security-will-depend-on-deterrence-by-richard-haass-2021-06>, 23 June 2021.

OPINION – Walter Pincus

Where Biden Stands on Nuclear Weapons

Back in 1964, Chairman J. W. Fulbright of the Senate Foreign Relations Committee gave a long speech he entitled “Old Myths and New Realities.” Fulbright began by saying, “There is an inevitable diversion, attributable to the imperfections of the human mind, between the world as it is and the world as men perceive it.

As long as our perceptions are reasonably close to objective reality, it is possible for us to act upon our problems in a rational and appropriate manner. But when our perceptions fail to keep pace with events, when we refuse to believe something

because it displeases or frightens us, or because it is simply startlingly unfamiliar, then the gap between fact and perception becomes a chasm, and action becomes irrelevant and irrational.”

Fulbright’s speech came to my mind last week after I listened to two hearings that dealt with nuclear weapons. One was from June 10, when a House Armed Services subcommittee heard from four current administration officials on the fiscal 2022 budget request for “Nuclear Forces and Atomic Energy Defense Activities.” The other was a session on 16 June, of the Senate Armed Services Subcommittee on Strategic Forces where four former government officials discussed “United States Nuclear Deterrence Policy and Strategy.” During the first hearing, Acting Assistant Secretary of Defense for Strategy, Plans, and Capabilities Melissa Dalton disclosed that

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the Biden administration Nuclear Posture Review (NPR) is just starting and will not be finished until January 2022. Its impact will appear in the fiscal 2023 Biden budget. Dalton said the NPR will cover such practical things as current modernization efforts; Defense Department delivery systems and platforms; the nuclear weapons required for those systems; and the National Nuclear Security Administration (NNSA) infrastructure necessary to produce and maintain those weapons. The NPR will also deal with U.S. declaratory policy, which essentially is a statement or set of statements describing the circumstances under which the President would consider using nuclear weapons. Dalton said that of course would be a Biden decision but that the options for the President would be discussed and explored during NPR inter-agency discussions.

The 2010 Obama NPR said the US “will not use or threaten to use nuclear weapons against non-nuclear weapons states that are party to the NPT... and in compliance with their nuclear non-proliferation obligations.” Against states that possess nuclear weapons and states not in compliance with their nuclear non-proliferation obligations, the Obama NPR kept open retaliatory use of nuclear weapons against nuclear, CBW [chemical or biological weapons) or in “extreme circumstances to defend the vital interests of the US or its allies and partners.”

The Trump NPR Of 2018 expanded the “extreme circumstances,” to include not only nuclear attacks but “attacks on the U.S., allied, or partner civilian population or infrastructure, and attacks on U.S. or allied nuclear forces, their command and control, or warning and attack assessment capabilities.” The Trump NPR also contained the threat: “Our adversaries must understand that a terrorist nuclear attack against the US or its allies and partners would qualify as an ‘extreme circumstance’ under which the US could consider the ultimate form of retaliation.”

Biden's past statements indicate that the Trump declaratory policy will change. In a January 2017 speech while he was Vice President, Biden said, "The President and I strongly believe we have made enough progress that deterring—and if necessary, retaliating against—a nuclear attack should be the sole purpose of the US nuclear arsenal." He reiterated that idea in a March 2020 "Foreign Affairs" article in which he wrote: "I believe that the sole purpose of the US nuclear arsenal should be deterring—and, if necessary, retaliating against—a nuclear attack. As President, I will work to put that belief into practice, in consultation with the US military and US allies." The Biden strategic guidance given to the NPR team, also includes that "this administration will take steps to reduce the role of nuclear weapons in our national nuclear strategy." While that guidance implied the Biden administration may eventually change the current nuclear program, the Biden budget now before Congress carries forward aggressive plans that were proposed during the Trump administration. These include initial funds for a new, low-yield, warhead for a submarine-launched cruise missile and a new warhead for ICBMs, the W-93. It also has increased funds for producing future plutonium pits, the triggers of thermonuclear weapons, for a controversial multi-billion-dollar facility at Savannah River, South Carolina. Also disclosed at the House hearing was that the original goal for producing 80 plutonium pits by 2030 at Savannah River and Los Alamos National Laboratory has been pushed back to 2032-to-2035 because of delays in getting necessary equipment.

Dalton did note one fact that fit into the Biden guidance, that current US investment in a new hypersonic missile "at present" is only for a "conventional capability," despite Russian statements that Moscow's hypersonic missiles will

be nuclear capable. While the earlier House hearing focused on current and future nuclear weaponry, 16 June Senate session, chaired by Sen. Angus King (I-Maine), went over the policy and strategy issues that are to be part of the NPR. In doing so, the witnesses and Senators raised old issues and arguments long part of the nuclear weapons debate.

For example, Dr. Matthew Kroenig, a senior policy advisor to the Pentagon during the Trump administration and currently Deputy Director of the Atlantic Council's Scowcroft Center for Strategy and Security, described the differences between U.S. and Chinese nuclear targeting in a manner that needed further explanation. He said the U.S. practices so-called "counterforce nuclear targeting," which means its nuclear weapons would be used "only against legitimate military targets, such as: enemy nuclear forces and bases, command and control nodes, and leadership sites." He said such US targeting "potentially allows the US to destroy enemy nuclear weapons before they can be used against the US or its allies, limiting damage and potentially saving millions of lives."

When it came to the Chinese, Kroenig said they practice "counter value targeting," which meant they would use their "nuclear weapons against US population centres with the goal of slaughtering as many innocent civilians as possible." Here's a historic note: The original atomic bomb target of Hiroshima was chosen because it could be claimed as a military objective because Hiroshima served as the headquarters for Japan's 2nd Army, which defended the southern part of the country. However, the real reason for the choice was that a large civilian population lived around the area and the targeting committee wanted to destroy a city with one bomb for psychological

Believe that the sole purpose of the US nuclear arsenal should be deterring—and, if necessary, retaliating against—a nuclear attack. As President, I will work to put that belief into practice, in consultation with the US military and US allies.

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effect to end World War II. In short, the US' first use of a nuclear weapon demonstrated, by Kroenig's terms, counter value targeting. Kroenig said targeting "has important implications for nuclear force sizing."

He explained, "If the US pursued a counter value policy designed to kill large numbers of innocent civilians in Beijing and Moscow, then a small nuclear arsenal might suffice. A counterforce policy, however, requires the US to possess sufficient numbers of nuclear weapons to cover the nuclear-related targets (missile silos, naval bases, air bases, command and control nodes, leadership sites etc.) in Russia, China, and North Korea." In short, Kroenig used the targeting strategy to explain why the US today has over 1,500 deployed strategic nuclear warheads, and over 2,000 more not deployed, while the Chinese for years have had fewer than 300. Even the current threat that in the coming decade Beijing may double or even triple that number, China still would not get close to the US-sized nuclear stockpile.

The claim that US counterforce targeting potentially saves lives, while counter value targeting kills large numbers of innocent civilians would just not be true. Counterforce nuclear weapons would be used against ground-based or silo-based weapons creating radioactive fallout, and in the numbers planned – two warheads for each enemy weapon – even with China – we are talking currently about using 600 or more 100 kiloton-or-higher US warheads. In the case of Russia, it would be in the thousands. The numbers of prospective people killed and wounded plus square miles of unliveable cities, towns and areas created because of residual radioactivity cannot be estimated. No one talks about that any more, although it makes use of nuclear weapons more unlikely to be employed, particularly because cyber has provided US Presidents with a new and much more usable class of strategic weaponry that does not have the same devastating and potential world-ending consequences.

An interesting fact about Presidential nuclear

hesitancy came up during the Senate hearing testimony of Prof. Sharon K. Weiner of American University, who has worked at Los Alamos National Laboratory, the Joint Staff's Strategic Plans and Policy Directorate, and the National Security Division of the White House Office of Management and Budget. She told the panel, "Only one President of the United States ever actually participated in these [nuclear weapon] drills when they were asked to. Everybody else sent a delegate – somebody else. And so you may

have the President of the US in this crisis, the clock is ticking, trying to figure out what to do. Keep in mind there is a huge amount of uncertainty, right. You don't have perfect intel at that point and so the President is trying to make a decision, and they may never have practiced what it's been like to be in a nuclear crisis."

The legal opinion also finds that the UK's change in stance on the use of nuclear weapons is in breach of international law. Any use of nuclear weapons would violate international humanitarian law and a whole raft of legal obligations relating to the environment, proportionality, distinction and other matters enshrined in law.

Subcommittee Chairman King responded, "I find it shocking that only one President in the nuclear age has physically participated in one of these exercises. I participated in one in the NAOC [National Airborne Operations Centres, planes that allow leaders to issue commands from the sky] four or five years ago and it was a stunning experience. I would think you would want to have some experience in what that situation would be like." That one President that did participate was Jimmy Carter, according to Weiner, who as a Navy officer had dealt with nuclear submarines. Given what's at stake, it may be time to make room on the calendar.

Source: https://www.thecipherbrief.com/column_article/where-biden-stands-on-nuclear-weapons, 22 June 2021.

OPINION – Henrik Stålhane Hiim, Magnus Langset Trøan

China's Atomic Pessimism and The Future of Arms Control

Marshall Billingslea, the Trump administration's arms control envoy, argued in 2020 that the US knew how to win arms races and "spend the adversary into oblivion." It was a strange comment

coming from a diplomat — especially one charged with reducing nuclear dangers — but it was revealing. Billingslea’s observation was meant to grab China’s attention and lay out the consequences for Beijing if it did not, as Washington hoped, participate in nuclear arms control talks with the US and Russia.

While adopting a less strident tone, the Biden administration also sees Chinese participation in arms control as essential. U.S. Secretary of State Antony Blinken recently stated that the Biden administration will “pursue arms control to reduce the dangers from China’s modern and growing nuclear arsenal.” Scholars and analysts have supported the administration’s arguments, claiming that Beijing should join future negotiations, as both its nuclear and conventional capabilities are on an upward trajectory. Missing from these debates is analysis of Chinese perspectives. For any effort to engage China to be successful, it is vital to understand how Chinese strategists and experts regard nuclear arms control. In a recent article published in the *Journal of Contemporary China*, we map the evolution of Chinese assessments during the last decade. Unfortunately, the views of the Chinese strategic community provide little ground for optimism.

Chinese strategists generally view arms control through a strongly realpolitik prism. Many do not view U.S. calls for arms control as an effort to improve strategic stability and limit the risk of nuclear war. Rather, they see a trap designed by the US to lock in its nuclear superiority, undermine China’s nuclear deterrent, and try to win the moral high ground. In recent years, this skepticism has

only hardened. Chinese analysts see the arms control agenda as an arena in the intensifying political and military struggle between the US and China. Including China in arms control will therefore be severely challenging. U.S. efforts will most likely fail unless they address nonnuclear strategic capabilities such as missile defense.

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The Arms Control

“Struggle”: China’s suspicious attitude towards nuclear arms control is not new. Even during the first period of Barack Obama’s Presidency — when the prospects for the international arms control seemed much more promising — Chinese experts were highly skeptical. While China’s leaders paid lip service to Obama’s disarmament visions, Chinese observers dismissed it as “hollow talk.” In the 2013 edition of the authoritative text *Science of Military Strategy (Zhanlüe xue)*, the authors described arms control as a “struggle” where great powers were trying to protect their advantages.

While recognizing that arms control between the US and Russia could serve China’s interests by reducing the risk of nuclear war and limiting military spending, strategists worried that a reinvigorated arms control agenda could increase pressure for China to join. Chinese analysts were

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also concerned about calls for greater transparency — which they feared would undermine Chinese deterrence — and claimed U.S. political domination could produce an “unbalanced” agenda designed to serve U.S. interests. Chinese analysts further saw the nuclear modernization efforts of United States as evidence that its nuclear thinking had not changed, and that the vision of a nuclear weapons-free world was “a myth.”

Skepticism of arms control hardened under President Trump. Many Chinese analysts believe U.S. calls for China to join trilateral talks with the US and Russia was little more than an attempt to blame the collapse of New START on China. Officials in Beijing further claimed U.S. allegations of Russian cheating was a pretext to withdraw from the INF Treaty, and that the real motive was to have a free hand to deploy new capabilities in both Europe and the Asia-Pacific. As Ling Shengli from China Foreign Affairs University argued in PLA Daily, the withdrawal was “entirely logical,” given that the US only adheres to treaties that serve its interests, and abandons those that do not.

In addition, Chinese strategists were highly skeptical about the direction of U.S. nuclear policy, and regarded the 2018 *Nuclear Posture Review* a confirmation that the US was pursuing a “hegemonic” nuclear policy. They further claimed the review signalled that the US lowered the threshold for employing nuclear weapons, and saw the reintroduction of low-yield nuclear weapons on U.S. ballistic missile submarines part of an effort to address growing Chinese conventional military might.

The 2019 U.S. *Missile Defense Review* further confirmed these suspicions, with observers in China seeing yet another sign of the U.S. desire for “absolute security.” The strategic community in China has long regarded U.S. missile defense as the biggest threat to their retaliatory capability, fearing that such defenses could intercept any surviving Chinese missiles after a U.S. first strike.

There is little to suggest that the shift in U.S. leadership has dampened suspicions about U.S. intentions. Chinese analysts are skeptical of the Biden administration’s signals that it will reduce the importance of nuclear weapons in its security strategy, and point to its embrace of great-power rivalry and its support for nuclear modernization

efforts. The administration’s efforts to secure robust funding for modernization of all three legs of the nuclear triad, along with a focus

on bolstering deterrence of China, will do little to dampen these concerns. Moreover, while they welcomed the Biden administration’s decision to extend New START, Chinese observers argue that it is likely to use calls

for arms control to promote its “moral supremacy,” but simultaneously continue to pursue superiority. Observers in China continue to regard arms control as an arena of political competition, where each party attempts to push its narrative and to portray its policies favourably — at the expense of its rivals.

What China Wants: China’s deep mistrust makes it difficult to be optimistic that U.S. arms control efforts will succeed, at least in the near term. So far, the dialogue has not even started, with China

reportedly unwilling to hold bilateral talks on this topic with the United States. However, while overly cynical, Chinese skepticism is not completely unwarranted. So far, there have been few specific proposals from U.S. officials about efforts that could suit China’s interests. If the Biden administration

really wants to include China, it needs to demonstrate to skeptical Chinese strategists how arms control can improve China’s national security.

An agreement that limits only nuclear weapons is likely to be almost impossible to achieve. Chinese officials and analysts frequently point to the major gap between the arsenals of the US and Russia, on the one hand, and China on the other. China’s nuclear stockpile is currently estimated to be in the “low 200s,” compared to approximately 3,800 warheads in America’s arsenal and nearly 4,500 warheads in Russia’s stockpile. Even if China’s stockpile doubles in the next decade, as the U.S. Department of Defense claims it might, a major discrepancy will

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remain. Unless the threshold is set very high, China is unlikely to accept a deal that would cap its arsenal in exchange for U.S. reductions. To entice China, the US may instead need to go beyond nuclear weapons and include the non-nuclear strategic capabilities Chinese strategists care most deeply about in talks. As other analysts have argued with regard to Russia, compromise on missile defense may be a prerequisite for serious progress. In addition to missile defense, Chinese observers are concerned about U.S. conventional precision-strike capabilities — including the prospect of U.S. ground-launched missiles being deployed in East Asia — as well as U.S. military superiority in space. While challenging, it may be necessary to address nuclear and advanced non-nuclear capabilities simultaneously.

The US may need to consider forums beyond bilateral or trilateral talks. Given China's deep skepticism of U.S. motives, pressure from the US to join such talks may backfire, as it is politically difficult for Chinese leaders to cave in. However, it is harder for China to disregard broader initiatives, such as discussions of arms control among the five permanent members of the Security Council Chinese strategists have long expressed concerns about being internationally isolated in arms control and disarmament processes, as it may harm China's international image. Moreover, continued efforts to engage Chinese experts and analysts are important, as they could help blunt at least some of the most extreme cynicism of U.S. intentions.

In an era of intensifying great-power rivalry, reinvigorating the arms control agenda is crucial. Arms control could not only dampen the emerging arms race between the United States, Russia, and China, but also serve as a tool to build trust and ease broader political tensions. Unfortunately, thus far, Chinese observers see arms control as an arena for mutual accusations and blame-shifting, and a tool the US uses to cement its nuclear hegemony.

Source: <https://warontherocks.com/2021/06/>

chinas-atomic-pessimism-and-the-future-of-arms-control/, 21 June 2021.

NUCLEAR STRATEGY

INDIA

India Successfully Test-Fires Agni Prime Missile

India successfully test-fired the nuclear-capable Agni Prime ballistic missile - a more advanced version of the Agni class of missiles - from a location off the Odisha coast on 28 June morning. A statement by the Defence Research and Development Organisation, or DRDO, said the successful test - which began at 10.55 am - was a "textbook launch", and took place at a testing facility on Dr APJ Abdul Kalam island, which located is around 150 km east of Bhubaneswar.

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"Various telemetry and radar stations positioned along the eastern coast tracked and monitored the missile. It followed textbook trajectory... meeting all mission objectives with a high level of accuracy," the DRDO statement said.

The Agni Prime missile is a next-generation, nuclear-capable weapon made fully of a composite material, sources added. It is a canisterised missile with range of 1,000-2,000 kilometres, they said. Two days ago the DRDO also successfully test fired an extended range version of the indigenously developed 'Pinaka' rocket from the Integrated Test Range in Odisha's Chandipur.

A total of 25 'enhanced pinaka' rockets - launched from a Multi-Barrel Rocket Launcher (MBRL) - were fired in quick succession at targets at different ranges. An official quoted by news agency PTI said all mission objectives had been met and that the enhanced range version could destroy targets at distances up to 45 kilometres. ...

Source: <https://www.ndtv.com/india-news/agni-prime-test-fired-india-successfully-test-fires-agni-prime-new-missile-in-agni-series-2474102>, 28 June 2021.

USA

Testimony as Delivered by Secretary of Energy
Jennifer M. Granholm

U.S. Senate Committee on Armed Services

Thank you so much, Chairman Reed and Ranking Member Inhofe, and members of the Committee. It is a privilege to be before you on behalf of the Department of Energy as the nation's 16th Energy Secretary. I'm unspeakably honoured to be entrusted with the responsibility of enhancing America's security through nuclear defense, non-proliferation, and environmental efforts, in addition to leading the Department's efforts to support the breakthrough scientific discoveries at our 17 National Labs, and to deploy those breakthroughs at scale to create jobs for the American people. As we endeavour to build America's clean energy future, we know the Department's nuclear security mission is essential to ensuring that future is safe and secure. It is a core focus of our daily work. And I recognize that the Senate Armed Services Committee has always demonstrated bipartisan commitment to this mission.

I applaud your ability to consistently work together on such serious matters, and your continued support for the Department's efforts around deterrence, and non-proliferation, and environmental management—which of course, together, make up nearly three quarters of the Department of Energy's budget. We know full well that as long as nuclear weapons exist, the United States must maintain the safety, security, and effectiveness of our nation's nuclear stockpile. We have to make sure that the U.S. Navy has the nuclear propulsion that they need to carry out their important operations. And we must also advance nuclear non-proliferation intentionally, and we have to do it internationally. We have to address the threat of nuclear terrorism, we have to mitigate the environmental harm from our nuclear program.

The budget proposal before you would allow us to make substantial progress in five areas: One, it would sustain funding for NNSA in support of the agency's longstanding nuclear modernization efforts. Second, it would support our Weapons Activities account, and that means allowing us to keep the nation's stockpile and infrastructure in line with DOD requirements.

And to those ends, I am pleased to report that since I have taken office, the Department and the NNSA have reinforced a strong working relationship, prioritizing collaboration and communication while respecting NNSA's semi-autonomous status. Here, I do want to thank our colleagues at the NNSA—in particular, Acting Under Secretary Dr. Charlie Verdon who is here, and whose incredible, vast experience and expertise has been invaluable to our nuclear security mission. And I want to thank this Committee for having advanced Dr. Jill Hruby and Frank Rose to the next level—and hopefully the

Senate can follow your lead, given the importance of this mission. Working together with NNSA and DOE, we have reached several notable milestones over the last five months. And that includes our support for diplomatic efforts to successfully extend the New START nuclear arms control treaty with Russia, and our progress around the Los

Alamos Plutonium Pit Production Project—which is now underway and which will produce 30 war reserve plutonium pits per year to meet our national security needs.

We've also moved forward on a series of upgrades that are essential to the Nation's nuclear deterrent. And our work is further facilitated by our exceptional partnership with the Department of Defense. You'll be glad to know, I hope, that DOE, and NNSA, and DOD are engaging in high-level coordination, and we are in lockstep around our mutual goal of ensuring that the U.S. nuclear deterrent is fully funded and properly managed. I'll note also that we are fully aligned with the Department of Defense regarding the budget for this next fiscal year, which meets DOD requirements. I'm fully committed to working in close cooperation and coordination with the Defense Department on the future budget requirements.

The budget proposal before you would allow us to make substantial progress in five areas: One, it would sustain funding for NNSA in support of the agency's longstanding nuclear modernization

efforts. Second, it would support our Weapons Activities account, and that means allowing us to keep the nation's stockpile and infrastructure in line with DOD requirements. Third, it will enhance our Office of Defense Nuclear Non-proliferation, so that we can ramp up our work to prevent state and non-state actors from achieving their ambitions around nuclear weapons. Fourth, it provides the resources needed to support the U.S. Navy with militarily-effective nuclear propulsion plants and ensures their safe and reliable and long-lived operation. And fifth, importantly, it would allow our Office of Environmental Management to advance our commitments to the communities that have supported national defense programs and nuclear research, and facilitating continued progress along all 16 of our clean-up sites.

Before I close, I do want to acknowledge that we know, following the attacks on the grid and the pipeline with SolarWinds and the Colonial Pipeline, that we face this national security imperative to harden our critical infrastructure against these evolving cyber threats as well. So I'm humbled by the opportunity to lead the Department of Energy in this moment, and happy to discuss our priorities and our goals with this Committee, and answer any questions that you may have.

Source: <https://www.energy.gov/articles/testimony-delivered-secretary-granholm-senate-armed-services-committee>, 24 June 2021.

BALLISTIC MISSILE DEFENCE

RUSSIA

This Russian Missile Submarine is the Size of an Aircraft Carrier

The Russian Typhoon-class submarine is massive. According to Russian sources, a submerged Typhoon-class displaces 48,000 tons. For a sense of size, the largest submarines in the US arsenal, the much-vaunted Ohio-class, displace just shy of 19,000 tons, making the Typhoons two-and-a-half times as large by displacement. Like the Ohio-class, the Soviet Union built the Typhoons to conduct nuclear deterrence patrols, lying quietly undetected

in remote locations underwater and awaiting the command to launch their whopping twenty R-39 Rif intercontinental ballistic missiles at targets in the US. The Soviet Union's R-39 Rif missile was the largest intercontinental ballistic missile ever created, and the Typhoons were built around the missiles. The massive size of the Typhoon-class is due to its correspondingly large ballistic missiles. The U.S. Naval Institute explains just how large these missiles are:

The R-39 (NATO SS-N-20) missile on board a Typhoon weighs 90 tons at launch, including a massive collar from which the missile hangs (for shock isolation). The collar also seals the tube so that the gas generator inside can pop the missile out. The collar is discarded as the missile flies out above the launch tube. By way of contrast, the R-29RM (NATO SSN-23) on a Delta IV, which has much the same performance as an R-39, weighs only 40.3 tons, and is only 1.9 meters (rather than 2.4 meters) in diameter. It has no shock collar. The equivalent U.S. missile, the solid-fuel Trident D-5, weighs about 59 tons and is 2.11 meters in diameter."

According to the U.S. Naval Institute, this massive disparity in size between the American and Soviet/Russian missiles is due to the differences in plastics industry maturity, which in the US, was able to create both plastic children's toys, as well as important binders for solid-fuel missile components. Due to their massive size, the Typhoon-class has many amenities onboard that would be unheard of in any other submarine class — some bordering on the ridiculous. There is apparently a pool, a sauna, a waterfall, and even a bird aviary onboard. The Typhoon submarines were able to carry a full crew of 160 seamen and supplies to last for a single 4-month deployment. There were also some creature comforts on board like the pool, sauna, and gym.

Source: https://www.defenceaviationpost.com/2021/06/this-russian-missile-submarine-is-the-size-of-an-aircraft-carrier/?utm_source=rss &

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utm_medium=rss&utm_campaign=this-russian-missile-submarine-is-the-size-of-an-aircraft-carrier, 26 June 2021.

USA

Official Details DOD Missile Defense Strategy

Missile defense plays a key role in U.S. national security. However, as missile technology matures and proliferates among potential adversaries China, Russia, North Korea and Iran, the threat to the U.S., deployed forces, allies and partners is increasing, the deputy assistant secretary of defense for nuclear and missile defense policy said. Leonor Tomero provided testimony at a House Armed Services Subcommittee on Strategic Forces hearing regarding the fiscal year 2022 budget request for missile defense and missile defeat programs. To address these evolving challenges, the Defense Department will review its missile defense policies, strategies and capabilities to ensure the U.S. has effective missile defenses, Tomero said. The review will contribute to the department's approach on integrated deterrence, she said, noting that the review is expected to be completed in January.

The department recently initiated development of the Next Generation Interceptor, she said, adding that the NGI will increase the reliability and capability of the United States' missile defense. "The department will continue to ensure that we bring a more integrated approach to air and missile defense to address various types of ballistic missile threats and enable defense against cruise missiles and unmanned aerial systems," she said. Additionally, the department will enhance its global network of integrated space-based and land-based sensors used in a variety of capabilities, such as detection, tracking and targeting through all phases of flight for incoming missiles, Tomero said, mentioning that U.S. commercial innovation is already transforming this field.

In fiscal year 2022, the department will continue

to develop the prototype hypersonic and ballistic tracking space sensor that will allow the tracking of hypersonic threats and add resiliency to the sensor architecture, she said. The department's approach for regional hypersonic defense will first focus on defense in the terminal phase, she said, meaning the final phase of a missile's trajectory. Information superiority is critical to future battlefields and is necessary to enable rapid planning and employment in a joint operating environment. To that end, the department is developing multi cyber-hardened, advanced, all-

domain awareness for command and control architecture that will enable timely and accurate decision making to address emerging threats, she said. "The department is engaging and working with our allies and partners to enhance our collective missile defense efforts," she said, mentioning Japan, South Korea, Australia and our NATO allies, along with Israel and Gulf Cooperation Council nations.

Source: David Vergun,

<https://www.defense.gov/Explore/News/Article/Article/2660275/official-details-dod-missile-defense-strategy/>, 16 June 2021.

MDA Unlocks Key Challenge to Advanced Ballistic Missile Tracking

The US is progressing with its HBTSS project, having overcome an important obstacle. The US military has cleared an important technological hurdle in its project to develop a next-generation space-based sensor, by advancing plans for a new constellation to track long-range hypersonic and ballistic missiles from launch to impact and provide fire-control quality data to weapons on the ground to counter these threats. The Missile Defense Agency (MDA) says it has addressed the highest threat risk to its plans for launching a Hypersonic and Ballistic Tracking Space Sensor (HBTSS) by 2023 — the ability for the IR system to distinguish dim targets from the ambient temperatures of the ground and sea when staring down at Earth.

Missile defense plays a key role in U.S. national security. However, as missile technology matures and proliferates among potential adversaries China, Russia, North Korea and Iran, the threat to the U.S., deployed forces, allies and partners is increasing, the deputy assistant secretary of defense for nuclear and missile defense policy said.

'Being able to see down from space, warm tracks going over a warm Earth — that is really tough science,' MDA chief VADM Jon Hill said on 9 June in testimony before the Senate Armed Services Strategic Forces Subcommittee. 'But we've got that licked, we've shown that we can do that on the ground. That sort of capability gives us global coverage.' There is still a challenge: ground-based sensors looking up have the benefit of picking out a warm target against the cold and featureless background of space, but when looking down from an on-orbit position, the background is warm and irregular.

MDA director of space sensors Walter Chai said in June 2020 that 'picking out the dim targets with the cluttered earth background was going to be the highest threat risk'. On the evident strength of improved image processing algorithms to distinguish the threat, the MDA in June proposed spending \$256 million in FY2022 for continued development of HBTSS, building on \$238 million appropriated in FY2020 and FY2021. HBTSS is a planned new constellation of low Earth orbit satellites and aims to leverage advances in the commercial space and satellite sector.

In January, the MDA narrowed the competitive field for HBTSS from 12 companies two years ago by identifying two firms to develop on-orbit prototype demonstrations. The agency awarded Northrop Grumman (\$155 million) and L3Harris (\$121 million) contracts to develop and build satellites for launch in 2023 and early orbit testing. While each company is designing a slightly different HBTSS capability, the satellites will be interoperable. 'The idea is to keep competition in [the programme] early, given the complexity of the mission,' said Hill. 'It is the only

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programme within the space portfolio that provides fire control quality data down to a weapon system like Glide Phase Interceptor,' he added, referring to an MDA project to develop a counter-hypersonic defence capability. 'The key characteristic of HBTSS that sets it apart from other Overhead Persistent Infrared sensors is the requirement to provide fire-control quality tracking data,' according to the MDA FY2022 budget proposal. Tracking information will be handed off to the planned hypersonic defence

weapons systems to allow long-range engagement of the threat. Long-range engagement begins with HBTSS tracking and monitoring an adversary's missile through burnout, followed by accurate impact predictions as well as information that missile defence systems on the ground can use to chase the target.

Source: Jason Sherman, <https://www.shephardmedia.com/news/digital-battlespace/mda-unlocks-key-challenge-advanced-ballistic-missi/>, 18 June 2021.

EMERGING TECHNOLOGIES AND DETERRENCE

GENERAL

Nuclear Batteries Offer a New Approach to Carbon-Free Energy

Much as large, expensive, and centralized computers gave way to the widely distributed PCs of today, a new generation of relatively tiny and inexpensive factory-built reactors, designed for autonomous plug-and-play operation similar to plugging in an oversized battery, is on the horizon, they say.

We may be on the brink of a new paradigm for nuclear power, a group of nuclear specialists suggested recently in the National Academy of Engineering. Much as large, expensive, and centralized computers gave way to the widely distributed PCs of today, a

new generation of relatively tiny and inexpensive factory-built reactors, designed for autonomous plug-and-play operation similar to plugging in an oversized battery, is on the horizon, they say.

These proposed systems could provide heat for industrial processes or electricity for a military base or a neighbourhood, run unattended for five to 10 years, and then be trucked back to the factory for refurbishment. The Professor of Nuclear Science and Engineering; Robert Frida, a founder of GenH; Steven Aumeier of the Idaho National Laboratory; and Kevin Chilton, retired commander of the U.S. Strategic Command—have dubbed these small power plants “nuclear batteries.” Because of their simplicity of operation, they could play a significant role in decarbonizing the world’s electricity systems to avert catastrophic climate change.

The idea of smaller, modular nuclear reactors has been discussed for several years. What makes this proposal for nuclear batteries different? The units we describe take that concept of factory fabrication and modularity to an extreme. Earlier proposals have looked at reactors in the range of 100 to 300 megawatts of electric output, which are a factor of 10 smaller than the traditional big beasts, the big nuclear reactors at the gigawatt scale. These could be assembled from factory-built components, but they still require some assembly at the site and a lot of site preparation work. So, it’s an improvement over the traditional plants, but it’s not a huge improvement.

This nuclear battery concept is really a different thing because of the physical scale of these machines—about 10 megawatts. It’s so small that the whole power plant is actually built in a factory and fits within a standard container. The idea is to fit the whole power plant, which comprises a microreactor and a turbine that converts the heat to electricity, into the container. This provides several benefits from an economic point of view. You are completely decoupling your projects and your technology from the construction site, which has been the source of every possible schedule delay and cost overrun for nuclear projects over the past 20 years. This way it becomes sort of

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energy on demand. If the customer wants either heat or electricity, they can get it within a couple of months, or even weeks, and then it’s plug and play. This **machine** arrives on the site, and just a few days later, you start getting your energy. So, it’s a product, it’s not a project.

Source: <https://www.eletimes.com/nuclear-batteries-offer-a-new-approach-to-carbon-free-energy>, 26 June 2021.

SOUTH KOREA

New Initiatives for Marine Nuclear Propulsion

The Korea Atomic Energy Research Institute (KAERI) and shipbuilder Samsung Heavy Industries have announced plans to work together on the development of a molten salt reactor (MSR) for marine propulsion and floating nuclear power

plants. Samsung Heavy is also carrying out R&D into using ammonia and hydrogen to power ships in efforts to find alternative, low-emission propulsion options. Nuclear power is likely to be a key to producing these. The company’s president said

that the “MSR is a carbon-free energy source that can efficiently respond to climate change issues and is a next-generation technology that meets the vision of Samsung Heavy Industries.” It could put South Korea in a leading position globally for such technology.

Shipping is seen as a ‘hard-to-abate’ sector for decarbonisation. The UN’s International Maritime Organisation aims to halve greenhouse gas emissions from international shipping by 2050 from 2008 level, and eventually to eliminate them completely. IMO already has a code of safety for nuclear-propelled merchant ships and Lloyd’s Register maintains a set of provisional rules for them. Lloyds earlier led a major study on the practical maritime applications of small modular reactors. This resulted in a preliminary concept design study for a 155,000 dwt Suezmax tanker based on a conventional hull with a 70 MWt

nuclear propulsion plant delivering up to 23.5 MW shaft power and average: 9.75 MW.

Since then, modular molten salt reactors of about 100 MWt have been seen as particularly suitable for marine propulsion due to ambient operating pressure and low-enriched fuel. The large shipping company X-Press Feeders is investing in Core Power (UK) Ltd, which is promoting for marine propulsion Southern Company and TerraPower's molten chloride fast reactor as a modular MSR which would never require refuelling during its operational life.

Source: <https://world-nuclear.org/our-association/publications/weekly-digest/latest-world-nuclear-association-weekly-digests.aspx>, 18 June 2021.

UK

UK Proposal to Prioritise High-Temperature Gas-Cooled Reactors

Over 2015 to 2019 a number of well-supported proposals were put forward for small modular reactors in UK and in mid 2020 the government attempted to prioritise some of these. Now the Dalton Nuclear Institute at Manchester University has published a *Strategy for Action* that aims to cut through the confusion. It set out eight actions required to assess objectively the role of nuclear power in achieving the government's aim of net zero CO2 emissions by 2050. These focused on early commissioning of a demonstration high-temperature gas-cooled reactor, with major consideration also paid to demonstrating hydrogen generation using nuclear heat. Then an ongoing review of all kinds of small modular reactors should be maintained and led by a body that is

not conflicted by claims and lobbying by any particular proposer. R&D into closed fuel cycles should continue.

Source: <https://world-nuclear.org/our-association/publications/weekly-digest/latest-world-nuclear-association-weekly-digests.aspx>, 18 June 2021.

NUCLEAR ENERGY

CHINA

Hongyanhe 5 Achieves First Criticality

Unit 5 of the Hongyanhe nuclear power plant in China's Liaoning province has attained a sustained chain reaction for the first time. The 1080 MWe domestically-designed ACPR1000 pressurised water reactor is expected to be connected to the grid later this year, after which it will enter commercial operation.

The first pre-critical control point of Hongyanhe 5 was signed and released at 9.22 on 12 June, the National Nuclear Safety Administration, which oversaw the procedure, announced yesterday. The reactor achieved first criticality the following day. Construction of Phase I (units 1-4) of the Hongyanhe plant, comprising four CPR-1000 pressurised water reactors, began in August 2009. Units 1 and 2 have been in commercial operation since June 2013 and May 2014, respectively, while unit 3 entered commercial operation in August 2015 and unit 4 in September 2016.

Phase II of the Hongyanhe plant - units 5 and 6 - comprises two 1080 MWe CGN-designed ACPR-1000 reactors. Construction of unit 5 began in March 2015 and that of unit 6 started in July the same year. Cold functional

Modular molten salt reactors of about 100 MWt have been seen as particularly suitable for marine propulsion due to ambient operating pressure and low-enriched fuel. The large shipping company X-Press Feeders is investing in Core Power (UK) Ltd, which is promoting for marine propulsion Southern Company and TerraPower's molten chloride fast reactor as a modular MSR which would never require refuelling during its operational life.

Unit 5 of the Hongyanhe nuclear power plant in China's Liaoning province has attained a sustained chain reaction for the first time. The 1080 MWe domestically-designed ACPR1000 pressurised water reactor is expected to be connected to the grid later this year, after which it will enter commercial operation.

testing of unit 5 began on 10 October 2019, marking the start of its commissioning phase. In late December 2019, CGN announced a change in the schedule for starting up units 5 and 6. It said the units were now expected to start operating in the second half of 2021 and the first half of 2022, which is, respectively, one year and six months later than previously scheduled. The Hongyanhe plant is owned and operated by Liaoning Hongyanhe Nuclear Power Company, a joint venture between China General Nuclear (CGN) and State Power Investment Corporation, each holding a 45% stake, with the Dalian Municipal Construction Investment Company holding the remaining 10%.

The ACPR-1000 - a three-loop unit with double containment and core-catcher - was launched by CGN in November 2011. In 2012 central planners in Beijing directed China National Nuclear Corporation (CNNC) and CGN, to 'rationalise' their reactor programmes. This meant CNNC's ACP1000 and CGN's ACPR-1000 were 'merged' into one standardised design - the Hualong One (HPR1000). Yangjiang units 5 and 6 were the first ACPR-1000 units to enter commercial operation, in July 2018 and July 2019, respectively.

Source: <https://world-nuclear-news.org/Articles/Hongyanhe-5-achieves-first-criticality>, 17 June 2021.

GENERAL

G7 Leaders Reaffirm Decarbon Goals

Leaders of the G7 countries meeting in UK have committed to "an overwhelmingly decarbonised power system in the 2030s and to actions to accelerate this." Hence they have pledged to accelerate deployment of 'zero emissions energy' including nuclear power. World Nuclear Association commented that "The G7 nations must turn their ambitions into actions and take

all the steps necessary to maximise the contribution of nuclear power plants in operation today and ensure a rapid and substantial increase in nuclear new build."

Source: <https://world-nuclear.org/our-association/publications/weekly-digest/latest-world-nuclear-association-weekly-digests.aspx>, 18 June 2021.

IAEA and NEA-OECD Discuss Key Nuclear Power Developments During Annual Meeting

Experts from the IAEA and the Nuclear Energy Agency (NEA) of the OECD discussed cooperation on key nuclear power topics including climate change mitigation, the impact of COVID-19, advanced nuclear technologies and gender balance in the nuclear field during their recent annual coordination meeting.

The world is at a turning point when it comes to energy production, climate change and sustainable development. The IAEA, thanks to its global membership, and normative and standard setting competences, has a fundamental role to play as an enabler of international cooperation on nuclear energy.

"The world is at a turning point when it comes to energy production, climate change and sustainable development. The IAEA, thanks to its global membership, and normative and standard setting competences, has a fundamental role to play as an enabler of international

cooperation on nuclear energy" said Mikhail Chudakov, IAEA Deputy Director General and Head of the Department of Nuclear Energy, in his opening remarks. "We cannot succeed in this role without leveraging the power of key partnerships, such as the one we enjoy with OECD/NEA." ...

During this meeting, IAEA and NEA discussed the decarbonization approaches and the need for greater use of low-carbon nuclear power to ensure the global transition to clean energy. Both organizations are looking forward to their participation at the UN COP26 in Glasgow, UK, this November, where they will highlight the critical role of nuclear power, together with hydropower, wind and solar, in meeting the climate change goals. "It is time to act now to achieve the net zero carbon emission goals set for 2030. As the largest source of clean energy in

OECD countries, nuclear energy – together with variable renewables – can accelerate the energy transition towards meeting climate objectives during post-Covid-19 economic recovery,” said William D. Magwood, IV, Director-General of the OECD/NEA). “The NEA looks forward to continue collaborating with the IAEA to advance global nuclear safety and technology. We also look forward to further dialogues as both organizations pursue gender equality in nuclear.”

Senior representatives of the two organizations also discussed opportunities for greater synergies with regard to supporting countries in the development and deployment of advanced nuclear power technologies, such as SMRs. Recognizing the increasing global interest in SMRs, which is expected to become an option for flexible generation for a wide range of users and applications across the world, the IAEA recently established a platform to provide integrated support to Member States on all aspects of SMR development, deployment and oversight. ... Highlighting the need for developing risk communication strategies and engaging with all relevant stakeholders at every stage in the life cycle of nuclear facilities, Evrard mentioned the recent launch of an IAEA project called the Radiation Safety Navigator, a new tool for radiation professionals, regulators and other stakeholders interested in launching or improving communication activities related to radiation safety.

While the COVID-19 pandemic presented both organizations with challenges, new working methods were introduced to provide continuous support to plant operators and policy makers. The IAEA, for example, introduced the COVID-

19 Nuclear Power Plant OPEX Network, to assess measures undertaken by all 32 countries with operating nuclear power plants and to discuss the impact on training activities and human resources policies in nuclear power plants.

The two agencies also touched on another area of common concern: gender balance, both within their organizations and in the wider nuclear field. A

number of practical initiatives implemented by both the IAEA and OECD/NEA have been implemented to raise awareness, mentor and attract more young women to nuclear science and technology. ...

Source: <https://www.iaea.org/newscenter/news/iaea-and-nea-oecd-discuss-key-nuclear-power-developments-during-annual-meeting>, 23 June 2021.

IRAQ

Iraq Looks to Revive its Nuclear Programme

Iraq is working on a plan to build nuclear reactors in face of widespread blackouts that have sparked social unrest, Bloomberg reported on 8 June. Despite being OPEC’s second biggest oil producer, Iraq is suffering from power shortages and insufficient investment in ageing plants, and needs to meet

an expected 50% jump in demand by the end of the decade. Building NPPs could help to close the supply gap.

Iraq is seeking to build eight reactors capable of producing about 11 gigawatts, said Kamal Hussain Latif, chairman of the Iraqi Radioactive Sources Regulatory Authority (IRSRA). It would look for funding from prospective partners for the \$40 billion plan and pay back the costs over 20 years,

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he said. Falling oil prices in 2020 deprived Iraq of funds to maintain and expand its long-neglected electricity system. The resulting outages triggered protests that threatened to topple the government. ... Not only is there the power shortage and surge in demand to deal with, but Iraq is also trying to cut emissions and produce more water via desalination " issues that raise the alarm for me."

Even if Iraq builds the planned number of power stations, that still won't be sufficient to cover future consumption. The country already faces a 10GWe gap between capacity and demand and expects to need an additional 14GWe this decade.

Latif said the Iraqi cabinet is reviewing an agreement with Russia's Rosatom to cooperate in building reactors. South Korean officials this year said they wanted to help build the plants and offered the Iraqis a tour of reactors in the United Arab Emirates run by Korea Electric Power Company (Kepco). Latif said the nuclear authority has also spoken with French and US officials about the plan.

Bloomberg cited a company official as saying Kepco was not aware of Iraq's nuclear plans and has not been in touch with Iraqi officials or been asked to work on any projects there. Rosatom declined to comment when asked about an agreement with Iraq. Even if Iraq builds the planned number of power stations, that still won't be sufficient to cover future consumption. The country already faces a 10GWe gap between capacity and demand and expects to need an additional 14GWe this decade, Latif said. Iraq, therefore, plans to build enough solar plants to generate a similar amount of power to the nuclear programme by the end of the decade.

Iraq currently has access to 18.4GWe of electricity, including 1.2GWe imported from Iran. Capacity additions mean generation will rise to around 22GWe by August, still short of notional demand that stands at almost 28GWe under normal conditions. Peak usage during the hot months of July and August exceeds 30GWe, according to the

Electricity Ministry. Demand will hit 42GWe by 2030, Latif said. The nuclear authority has selected 20 potential sites for the reactors and Latif suggested that the first contracts could be signed in the coming year. ...

Source: <https://www.neimagazine.com/news/newsiraq-looks-to-revive-its-nuclear-programme-8822664>, 15 June 2021.

KENYA

Kenya Makes Nuclear Infrastructure Progress

The IAEA has provided an update on Kenya's progress since its 2015 Integrated Nuclear Infrastructure Review (INIR) mission. INIR missions enable IAEA member states to have in-depth discussions with international experts about the conditions and best international practices in the development of a nuclear power programme.

Areas for further action included establishing the key goals and requirements to guide the nuclear power programme, and setting up the necessary legal and regulatory framework.

Kenya - which has Africa's seventh-largest economy and a population of 52 million people - is considering the introduction of nuclear power to help meet its growing energy demand. The 2015

INIR mission to Kenya made 15 recommendations and eight suggestions. Areas for further action included establishing the key goals and requirements to guide the nuclear power programme, and setting up the necessary legal and regulatory framework. A follow-up INIR mission on 8-11 June assessed Kenya's progress and had a hybrid format, with two IAEA experts travelling to Kenya and two international experts from Ireland and Spain participating virtually.

The follow-up INIR team said that Kenya had completed 10 of the recommendations and four of the suggestions from the 2015 review. Progress included: development of the National Nuclear Policy and the National Policy and

Strategy for Safety to enable the government to make an informed decision on whether to introduce nuclear power; enactment of a national nuclear law and establishment of a regulatory body with clear responsibilities for safety, security and safeguards; completion of an assessment of the national legal framework and identification of other laws needing review; and enhanced coordination among key stakeholders in the development of a nuclear power programme.

They will support the accelerating wave of innovation in clean nuclear energy and innovative international activity among their respective memberships. CNA and JAIF will also share information on technology development initiatives, including small modular and advanced reactors, decommissioning technologies, and applications in other key industrial sectors.

Source: <https://www.world-nuclear-news.org/Articles/Kenya-progresses-with-nuclear-infrastructure-devel>, 14 June 2021.

NUCLEAR COOPERATION

JAPAN–CANADA

Canadian, Japanese Industry Groups Enhance Cooperation

The Canadian Nuclear Association (CNA) and the Japan Atomic Industrial Forum (JAIF) have signed a Memorandum of Understanding to strengthen their collaboration in advancing nuclear energy's development, application and deployment to meet climate change goals. The MoU was signed yesterday by CNA President and CEO John Gorman and JAIF President Shiro Arai. Through the MoU, the two organisations will support, coordinate, and champion the continued safe and reliable use of nuclear power for clean energy generation. They will encourage their respective governments and international agencies to include nuclear as a clean energy technology to meet climate change objectives and net-zero emissions plans by 2050 through events such as COP, Clean Energy Ministerial and IAEA initiatives. CNA and JAIF will also enhance public awareness and understanding regarding the advantages of nuclear power to meet climate change goals.

The two parties will also share information about the restart of Japan's fleet of nuclear power

reactors and the Canadian refurbishment programmes. They will support the accelerating wave of innovation in clean nuclear energy and innovative international activity among their

respective memberships. CNA and JAIF will also share information on technology development initiatives, including small modular and advanced reactors, decommissioning technologies, and applications in other key industrial sectors. The MoU also calls for the promotion of human resources

development through industry-level exchange activities and collaboration on international work such as Nuclear for Climate, Young Generation Network, World Nuclear University, IAEA Nuclear Energy Management School and other youth-focused initiatives.

In addition, CNA and JAIF will facilitate meetings between Canada and Japan's nuclear industries via reciprocal conference invitations and periodic meetings or workshops. They will also share information and promote opportunities associated with the decommissioning of nuclear facilities and nuclear waste management as well as the recycling of nuclear materials. Gorman said: "This presents both of our organisations with a great opportunity for collaborating and exchanging information to meet our common goals that include addressing the climate crisis. Nuclear technologies will play an important role here and partnerships like these align our collective efforts." ...

Source: <https://www.world-nuclear-news.org/Articles/Canadian,-Japanese-industry-groups-enhance-coopera>, 25 June 2021.

RUSSIA–IRAQ

Rosatom Discussing Nuclear Industry Cooperation with Iraq

Rosatom is discussing an opportunity for cooperation in the nuclear power sphere with partners from Iraq, the Russian state-run

corporation told reporters. "The entire agenda of potential cooperation is discussed as part of the dialog with Iraqi partners - both energy and non-energy applications of nuclear technologies for peaceful purposes. Development of the regulatory base for such interaction is underway in parallel," Rosatom said. Mass media reported earlier that Iraq planned to build eight units of nuclear power plants by 2030 to meet the country's demand for electricity. It was noted that Rosatom could implement this project.

Source: <https://tass.com/economy/1302755>, 15 June 2021.

RUSSIA-NORWAY

Nuclear Safety is Still a High Priority in Norway's Cooperation with Russia

On 16 June, the 24th joint Norwegian-Russian commission meeting on nuclear and radiation was held. It is one of the few Western-Russian contact points that are still active and working. This year, the collaboration celebrates its 25th anniversary. The agenda for the meeting included the handling of spent nuclear fuel and radioactive waste in north-western Russia, cooperation on warning and nuclear preparedness, environmental monitoring, and safety at Russian nuclear power plants.

Decrease in Radioactive Waste: "Today we can state the fact that there has been a serious decrease in the volumes of radioactive waste in most facilities in North-West Russia", said Oleg Kryukov, Director for the State Policy in the Field of RW and SNF Management and Nuclear Decommissioning, ROSATOM. In 2019, Norway provided funding for the extraction and transport of spent nuclear fuel from Andreyev Bay for the first time. "Safe handling and removal of spent nuclear fuel and radioactive waste from Andreyev Bay is still among Norway's most important priorities in nuclear safety cooperation. It is, of course, a Russian responsibility to carry out this work in accordance with international standards,

but we are happy to be able to contribute to the process and follow it", said State Secretary Audun Halvorsen.

Improved Dialogue: The dialogue and contact between the Norwegian Radiation Protection Authority (DSA) and Rosatom State Atomic Energy Corporation have improved during the pandemic. "Although we have had a pandemic for a little over a year now, we have had a very good dialogue with ROSATOM during this time. In fact, we have had more frequent contact and dialogue than we are used to. We have agreed to continue this virtual contact even after the pandemic is over. We see a more continuous dialogue as very positive", said Per Strand, General Director, DSA.

Preparedness: At the end of the meeting, a question and answer session was held with Russian and Norwegian non-governmental organizations and media. Kjersti Album, a project manager at the Norwegian Society for the Conservation of Nature, asked if there are sufficient plans and preparedness from the authorities when it comes to transportation of radioactive materials along the Russian and Norwegian coast. ...

Source: Peter B Danilov, <https://www.highnorthnews.com/en/nuclear-safety-still-high-priority-norways-cooperation-russia>, 16 June 2021.

USA-ROMANIA

Romania Ratifies \$8bn Nuclear Power Deal with US

Romania's Senate has ratified an intergovernmental agreement signed in 2020 with the US which aims to expand and modernise the country's nuclear power industry. The \$8bn deal may lead to the completion of two reactors at Cernavoda, Romania's only nuclear power plant, and the refurbishment of one of its two existing reactors. Cosmin Ghita, the chief executive of nuclear operator Nuclearelectrica, commented in a press statement that the ratification of the draft

legislation meant that Romania was in a position to achieve its aim of connecting unit 3 to the grid in 2030 and unit 4 in 2031. He added that the refurbishment of Cernavoda's Candiru-6 reactor offered the lowest cost way of generating electricity, so "nuclear projects come with a double advantage: competitive costs and zero carbon emissions".

...In July 2020, Romania launched a tender for a new feasibility study to complete units 3 and 4. The European Commission approved the plan to enlist US aid in completing work on the two reactors in November, ending long standing plans to enlist Chinese aid in the project....

In 2013, Romania and China signed two agreements that assigned China General Nuclear (CGN) a leading role in building and financing the reactors. This was followed by a deal in May 2019 between Romania's state nuclear company Nuclearelectrica and CGN to build two 700MW reactors. Romania changed course at the start of 2020 as the Trump administration intensified its criticisms of China. According to Nuclearelectrica, the projects will contribute to the development of the country's nuclear industry, and will create up to 9,000 jobs, as well as stimulating "research, innovation and development in the nuclear industry". The draft law will now go to President Klaus Iohannis for approval.

Source: <https://www.globalconstructionreview.com/news/romania-ratifies-8bn-nuclear-power-deal-us/>, 25 June 2021.

NUCLEAR PROLIFERATION

IRAN

G7 Leaders, NATO Members Vow to Prevent Iran from Getting Nuclear Weapons

Leaders of the Group of Seven wealthy nations and members of NATO reaffirmed a commitment to stop Iran from making nuclear weapons, as diplomats from outside the European Union cautioned that negotiations with the Islamic

Republic to salvage the 2015 nuclear deal still need more time.

Iranian envoys held another round of negotiations with international delegations in Vienna a day after EU coordinators suggested that differences over the accord limiting Iran's nuclear activities had narrowed further. But Iranian Deputy Foreign Minister Abbas Araghchi told Iranian state media he thought a deal was unlikely to emerge in the coming week. A diplomat from Russia also said more time was needed to work out details.

The Vienna meetings are aimed at rebuilding the nuclear containment agreement between Iran and major world powers that the Trump administration withdrew the United States from in 2018. US President Joe Biden and other G7 leaders

expressed support for the Vienna process after a three-day summit in southwest England that ended. The G7 nations are Canada, France, Germany, Italy, Japan, the United Kingdom and the US.

NATO members also welcomed the discussions with world powers, urged Tehran to avoid "any further escalation," and backed the UN's atomic watchdog, which has been documenting Iranian violations of the nuclear deal.

"We are committed to ensuring that Iran will never develop a nuclear weapon," the leaders said in a joint statement. "A restored and fully-implemented [nuclear deal] could also pave the way to further address regional and security concerns," the statement said. A statement echoing the same sentiment and using the same wording was issued by the 30-nation NATO following a summit in Brussels, Belgium.

NATO members also welcomed the discussions with world powers, urged Tehran to avoid "any further escalation," and backed the UN's atomic watchdog, which has been documenting Iranian violations of the nuclear deal. The NATO statement also slammed the Islamic Republic for supporting proxy terror groups and over its ballistic missile program.

"We condemn Iran's support to proxy forces and non-state armed actors, including through financing, training, and the proliferation of missile technology and weapons," the statement said. "We call on Iran to stop all ballistic missile activities inconsistent with UNSCR 2231, refrain

from destabilising actions, and play a constructive role in fostering regional stability and peace." A resolution would see Iran return to commitments made in 2015, aimed at making the development of a nuclear weapon impossible, in exchange for lighter US sanctions. ...

Source: <https://www.timesofisrael.com/g7-leaders-nato-members-vow-to-prevent-iran-from-getting-nuclear-weapons/>, 15 June 2021.

US: Election of Raisi Unlikely to Change Dynamics of Nukes Talks

Iran's supreme leader determines Tehran's policy on important issues, US State Department Spokesperson Ned Price said, signaling that the election to the presidency of hardliner Ebrahim Raisi won't change the dynamics of the talks on the nuclear issues between Iran and the world powers in Vienna. ...Price's remarks came as IDF Chief of Staff Lt.-Gen. Aviv Kohavi is in Washington to warn American officials against rejoining the deal and to discuss the threat posed by Tehran's nuclear program.

"The chief of staff emphasized the shortcomings of the current nuclear agreement, which will allow Iran to make significant progress related to centrifuges as well as to substantially enhance the amount and quality of enriched matter over the next few years, also emphasizing the lack of supervision in terms of nuclear proliferation," the IDF Spokesperson's Unit said in a statement.

... Prime Minister Naftali Bennett said at cabinet meeting that "Raisi's election is, I would say, the last chance for world powers to wake up before returning to the nuclear agreement, and understand who they are doing business with." "Both former-prime minister [Benjamin] Netanyahu and Prime Minister Bennett have been quite clear in saying they think this is a bad move and that Israel will act as it sees necessary," said Rafati. "But it's quite possible that the Israeli government would underscore to Washington that if the JCPOA really is the way they want to proceed, then it should be done in a way as to maximize the non-proliferation restrictions on Iran and minimize the sanctions relief it gets in return.

Source: Omri Nahmias, <https://www.jpost.com/middle-east/iran-news/us-election-of-raisi-unlikely-to-change-dynamics-of-nukes-talks-671771>, 22 June 2021.

NUCLEAR DISARMAMENT

CHILE

Chile Approves Nuclear Weapons Ban Treaty

The Chilean Chamber of Deputies unanimously approved the Draft Agreement ratifying the Treaty on the Prohibition of Nuclear Weapons, adopted in New York in 2017, which was approved by 122 out of 124 States of the UN.

... In this context, according to the report of the Foreign Affairs Committee of the Lower House, it is "a disarmament treaty, highlighting the explicit mention of the catastrophic humanitarian and environmental consequences that the deliberate or accidental use of this type of weapon would provoke. It also enshrines dimensions such as the specific role of women in nuclear disarmament, and the need for equal participation for the promotion and achievement of sustainable peace and security", adding that "the parties give an account of the purposes for concluding it and 20 articles in which the norms are set out". The Chilean MP for Acción Humanista, Tomás Hirsch, welcomed the decision, assuring that "this is an important and profound sign to advance towards a nuclear-free world, where these weapons are not manufactured, transported, tested or used. Of course, our country does not have nuclear weapons thanks to the 'Treaty of Tlatelolco', which was a pioneer in the world and signed by the Latin American region". ...

Source: <https://www.pressenza.com/2021/06/chile-approves-nuclear-weapons-ban-treaty/>, 26 June 2021.

USA

Russia Raises Concerns Over US Compliance with Nuclear Treaty

Just three and a half months after the US and Russia agreed to extend a bilateral treaty limiting their nuclear arsenals, Moscow has voiced

concerns over Washington's compliance. On June 24, Russia's foreign ministry claimed that the number of US launchers and bombers exceeded the limit outlined by the New START'. The ministry conveyed that it was unable to confirm that 56 launchers and 41 heavy bombers were no longer nuclear-capable', as Washington had declared, nor could it verify the removal of four underground missile silos. The US has insisted that it is meeting the treaty's requirements.

New START first entered into force in 2011 and has since marked a cornerstone of global nuclear arms control. In February 2020, the treaty was just two days from expiring before President Putin and President Biden extended it until 2026. The treaty's extension prompted sighs of relief worldwide amid tensions between the two countries over hacking attempts and human rights abuses. However, Moscow's allegations this week cast some doubt on what had looked like progress in repairing relations between the two nuclear superpowers. According to a report from Reuters, Russia has raised similar concerns in the past. "The US has explained many times why US conversion procedures are in full compliance with its treaty obligations...and is prepared to do so again," said a State Department spokesperson.

Verifying Moscow's accusations', or Washington's compliance', is no simple task. The SIPRI, which produces annual reports on the global state of nuclear armaments, has cited a lack of transparency from most nations regarding their nuclear stockpiles. Even so, its 2019 report confirmed that the United States is continuing a nuclear modernization program started by the Obama administration.

During Trump's presidency, the program's focus shifted towards expanding the capabilities of its nonstrategic nuclear weapons, which it claimed was necessary without offering evidence that the existing arsenal was insufficient, says Defense News. While the modernization program does not violate New START's terms, it paints an ominous picture of the path that nuclear armament may take without such a treaty. In the 2019 report, SIPRI noted that the actions of the US may prompt other nations to follow suit. The same report warned that Russia appears to be shifting its nuclear efforts in the same direction, which may trigger

China to do the same.

Establishing lasting nuclear arms agreements with Russia has been a delicate process since the 1970s. The outlook for preserving any sort of bilateral treaty looked especially bleak just before Biden took office last year, as diplomatic relations with Russia had become increasingly strained. After efforts to secure a stricter arms control treaty ended in stalemate in 2019, Donald Trump became the first American president in 50 years to reach no agreement on nuclear weapons, according to the Brookings Institution. Worse still, the United States formally withdrew from the Intermediate-Range Nuclear Forces Treaty during the Trump administration, which had been responsible for the successful destruction of 2,692 missiles. New START is now the only bilateral agreement between Russia and the U.S. limiting nuclear weapons, while a new ban on intermediate-range missiles remains non-existent.

Moscow's accusations are a reminder that cooperation on matters of nuclear disarmament between Russia and the U.S. are by no means a foregone conclusion, the extension of New START

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Moscow's accusations are a reminder that cooperation on matters of nuclear disarmament between Russia and the U.S. are by no means a foregone conclusion, the extension of New START merely offers some breathing room.

merely offers some breathing room. Yet before it can even hope to make further advances, the U.S. must ensure that its current agreement with Russia is stable. As President Putin remarked in June 2019, without New START, “there will be no instruments left to curb the arms race.” Although President Biden is taking a tougher stance toward Russia than his predecessor, nuclear disarmament is an area where delicate diplomacy is an unconditional necessity. Whatever the Biden administration’s goals, the risk of unconstrained nuclear competition puts them in jeopardy. If Biden hopes to build momentum off of the treaty’s five-year extension, he must prioritize cordiality and transparency in Washington’s dealings with Moscow over the implementation of the only remaining nuclear treaty.

Source: Caleb Loughrin, <https://theowp.org/russia-raises-concerns-over-u-s-compliance-with-nuclear-treaty/>, 18 June 2021.

USA–RUSSIA

Biden-Putin Summit an Opportunity to Ban Nuclear Weapons?

As Putin and Biden meet in beautiful Geneva, they should remember the destruction and horror in Hiroshima and Nagasaki over 75 years ago, and commit to working to ban and eliminate nuclear weapons before such a tragedy happens again.

Presidents Joe Biden and Vladimir Putin meet on 23 June for a summit that will discuss strategic stability, which includes nuclear weapons. The summit takes place in Geneva, the international city renowned for advancing peace and disarmament, and will be held between two individuals who control 90% of the world’s nuclear arsenals. Right now, the risk of nuclear war is unacceptably high, according to experts such as the Bulletin of Atomic Scientists, the International Committee of the Red Cross, and UN Secretary

General António Guterres. Recently, a paper from Stanford University concluded that a child born today has a greater chance of experiencing nuclear war during their lifetime than not.

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modernization programs, emerging technologies in the military, and increasing hostile rhetoric between nuclear armed states slowly ups the risk of nuclear use, by intent or accident. Even with the world’s overall stockpile of nuclear weapons decreasing since 2020, the amount of operationally deployable weapons is growing, according to a new report from the SIPRI. In 2020, the nine nuclear-armed states spent more money

In 2020, the nine nuclear-armed states spent more money than ever on their nuclear arsenals, totalling \$73.6 billion. We have been lucky for 75 years, but eventually our luck might run out. The catastrophic consequences of the COVID-19 pandemic should make us take scientists, doctors, and experts seriously—before the worst happens.

We must act urgently like our world depends on it, because it does. The only way to eliminate the risk of nuclear use is to eliminate nuclear weapons. The ongoing nuclear modernization programs, emerging technologies in the military, and increasing hostile rhetoric between nuclear armed states slowly ups the risk of nuclear use, by intent or accident. Even with the world’s overall stockpile of nuclear weapons decreasing since 2020, the amount of operationally deployable weapons is growing, according to a new report from the SIPRI. In 2020, the nine nuclear-armed states spent more money than ever on their nuclear arsenals, totalling \$73.6 billion. We have been lucky for 75 years, but eventually our luck might run out. The catastrophic consequences of the COVID-19 pandemic should make us take scientists, doctors, and experts seriously—before the worst happens. No

country or group of countries possess any ability to mount an effective humanitarian response to any use of nuclear weapons. Health care systems and infrastructure would collapse. No help would come.

We must act urgently like our world depends on it, because it does. The only way to eliminate the risk of nuclear use is to eliminate nuclear weapons. This will be the first time the two Presidents meet since Biden took office, and it’s being compared to the historic U.S.-Soviet meeting in Geneva that Presidents Reagan and Gorbachev had nearly 40 years ago in November of 1985. That meeting was an important step in the rapprochement of the two countries and was considered a turning point in the Cold War

between the Soviet Union and the U.S., leading to a huge reduction of over 80% of global nuclear arsenals.

Nuclear weapons are a considerable problem that requires substantial action. But massive progress is not unprecedented. This week, both countries have the opportunity to make history. The U.S. and Russia must act in accordance with the ever-growing risk of nuclear annihilation and in recognition of the humanitarian consequences of nuclear use to significantly reduce their nuclear arsenals on the road to a world free of nuclear weapons. They can accomplish this by agreeing to sign the Treaty on the Prohibition of Nuclear Weapons, which bans nuclear weapons under international law. ...

Source: Beatrice Fihn, <https://www.laprogressive.com/biden-putin-summit-2/>, 18 June 2021.

NUCLEAR TERRORISM

GENERAL

Tomography Technique could Help in the Fight against Nuclear Terrorism

Physicists at the Royal Institute of Technology in Stockholm, Sweden, have developed a new technique to rapidly detect and characterize so-called special nuclear materials like plutonium and enriched uranium. The technique, dubbed neutron-gamma emission tomography, works by measuring the “coincidences” of particles emitted in nuclear fission.

Special nuclear materials are a double-edged sword. As fuel for power stations and reactors, they have enabled great technological advances, but they can damage cities and even threaten human civilization if employed as weapons of mass destruction. They also pose a long-term contamination hazard, from accidents and from potential acts of nuclear terrorism using radiotoxic dispersion devices. Being able to identify, localize and characterize such materials quickly is

therefore critical for national security, as well as for detecting radiation leaks and mapping radioactive contamination.

The problem is that the radiation portal monitors commonly used in settings such as airports and seaports are unable to do these things. Instead, they are simply designed to measure the radiation flux as people, vehicles, parcels and other objects pass through them, and set off an alarm if the flux exceeds predefined thresholds. The radiation flux they measure consists primarily of neutrons and gamma photons, both of which are produced during nuclear fission – the decay process by which the nucleus of an atom splits into two or more smaller, lighter “daughter” nuclei.

“Coincidences” of Neutron and Gamma-Ray Emissions: In contrast, the new neutron-gamma emission tomography (NGET) technique developed by Bo Cederwall and colleagues can determine the location of special nuclear materials with high precision. It works by measuring the time of arrival of neutrons and gamma photons at specially-designed detector assemblies. The system then looks for “coincidences” – that is, events in which neutrons and gamma rays are detected one after the other – and uses the time-of-arrival information to pinpoint the particles’ source in real time.

“In physics, fast coincidences mean that particles have arrived within a very short time interval, in this case within a couple of 100 nanoseconds or so,” Cederwall explains. “These particles are, in the majority of cases, correlated from the same fission event, or from other types of reactions like alpha-particle induced reactions in the material.”

Test Source: The team members demonstrated their new technique using a prototype radiation portal monitor they developed in their laboratory. This system consists of an array of eight 127-mm-diameter by 127-mm-length cylindrical liquid organic scintillator cells arranged in two detector

assemblies 1 metre apart. The researchers carried out their tests using a radioactive source of californium-252 (Cf-252) with a mass of 3.2×10^{-9} g, encapsulated in a 4.6-mm \times 6-mm cylindrical ceramic casing.

Cf-252 undergoes spontaneous fission, producing an average of 3.76 neutrons per fission event. The source's total fission rate of roughly 1900 events per second is thus equivalent to that produced by around 100 g of weapons-grade plutonium (7% plutonium-240 and 93% plutonium-241), which would correspond to an object about 1 cm in size.

Not Yet Optimized:

Although Cederwall and colleagues stress that they have not yet optimized their detector for efficiency, nor designed it for imaging, they were nevertheless able to identify the position of their relatively weak test source within an uncertainty of just 4.2 cm. Using a set of more uniformly distributed detectors or smaller detector cells would, they say, substantially improve the detector's spatial resolution. What is more, while the current study focused on measuring coincidences from a stationary source, the researchers say the method could readily be adapted to moving objects with the aid of an optical tracking system.

The researchers, who report their work in *Science Advances*, say they now plan to try out the NGET technique on different configurations and geometries of portal monitors, including some that might be used for vehicles and freight containers rather than pedestrians. They have also begun a project to analyse the contents of radioactive waste containers. "There is a large global stockpile of temporarily stored radioactive waste – for example, from civil and military nuclear research – which is quite often of unknown detailed composition and origin," Cederwall tells *Physics World*. "Such materials need careful characterization before they are disposed of to ensure public safety".

Source: <https://physicsworld.com/a/tomography>

- *technique-could-help-in-the-fight-against-nuclear-terrorism/*, 15 June 2021.

IRAN

'Sabotage Attack' on Iranian Nuclear Building Foiled

A sabotage attempt against a building belonging to the Iranian Atomic Energy Organization has been foiled, Iranian media reported. An Iranian news site close to security services said authorities thwarted a "sabotage attack" on the country's civilian nuclear programme, without providing further information. Social media channels linked to the Islamic Revolutionary Guard Corps (IRGC) said a drone tried to attack the building. Another report said no "loss of life or property damage" was inflicted.

Nournews, a website believed to be close to Iran's Supreme National Security Council, reported the attack was halted "before causing any damage to the building". "Investigations are ongoing to identify the perpetrators and determine the facts surrounding the incident," said Nournews. When asked for comment, an Iranian official referred to the Nournews report. The official spoke on condition of anonymity as they did not have authorisation to discuss the matter with the media. No further details on the nature of the sabotage attempt or how it was averted were given.

Iran's English-Language Press TV reported "the hostile attempt occurred, but did not result in any casualties or damage owing to tight security precautions adopted following similar acts of sabotage against Iranian nuclear sites and scientists". Iran has accused Israel of several attacks on facilities linked to its nuclear program and killing its nuclear scientists over the past years. Israel has neither denied nor confirmed the allegations.

Iran's semi-official ISNA news agency said the building under attack was located near Karaj City,

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40km (25 miles) west of the capital Tehran. The website of state-owned IRAN newspaper published the same report without offering the location or other details. Iran's Atomic Energy Organization describes the Karaj city facility as a centre founded in 1974 that deals with the improvement of the "quality of soil, water, agricultural and livestock production using nuclear technology". ...

Source: <https://www.aljazeera.com/news/2021/6/23/sabotage-attack-on-nuclear-building-foiled-iranian-media>, 23 June 2021.

NUCLEAR SAFETY

GENERAL

IAEA Nuclear Verification Continued During the COVID-19 Pandemic – Safeguards Statement 2020

"Despite the COVID-19 pandemic, the Agency performed all of its most time-critical in-field nuclear verification work," said IAEA Director General Rafael Mariano Grossi. "Safeguards implementation did not stop for a single minute." The Safeguards Statement for 2020, published this week, presents the IAEA's findings and safeguards conclusions for all States for which the IAEA implemented safeguards during the year. IAEA safeguards are technical measures embedded in safeguards agreements, which are implemented by the IAEA to provide the international community with confidence that nuclear material remains in peaceful use.

"The global pandemic presented unprecedented and challenging conditions, which the IAEA managed to overcome to carry out its nuclear verification work worldwide," said Massimo Aparo, IAEA Deputy Director General and Head of the Department of Safeguards. "By adjusting to the circumstances, and implementing specific solutions

to address particular situations, the IAEA retained its ability to draw independent and soundly based safeguards conclusions." As in previous years, the amount of nuclear material under safeguards increased globally – by 2.3% in 2020 – resulting in a growing demand for verification. One of the novel solutions to meet the particular challenges posed by restrictions in air travel involved chartering aircraft for the first time in the history of the IAEA to transport inspectors around the world. Inspectors in many cases were required to spend extended periods travelling, in addition to over 2,300 days under quarantine at their destinations.

In 2020, the IAEA was able to draw safeguards conclusions for 183 of the 184 States with safeguards agreements in force. The one State without a safeguards conclusion is the Democratic People's Republic of Korea, where the Agency did not implement safeguards and, therefore, could not draw any conclusion. Of the 176 States with

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a comprehensive safeguards agreement in force in 2020, 131 also had an additional protocol in force or being provisionally implemented. By providing access to additional information, sites and locations, the additional protocol significantly increases the IAEA's ability to verify the peaceful use of all nuclear material in a State with a comprehensive safeguards agreement. For 72 States with a

comprehensive safeguards agreement and an additional protocol in force, the IAEA was able to conclude that "all nuclear material remained in peaceful activities," and for the other 103 States with comprehensive safeguards agreements, 59 of which also have additional protocols in force, that "declared nuclear material remained in peaceful activities."

For the three countries with item-specific safeguards agreements in force (India, Israel and Pakistan), the IAEA concluded that "nuclear

material, facilities or other items to which safeguards had been applied remained in peaceful activities.” For the five countries with voluntary offer agreements in force (China, France, Russia, the UK and the US), the IAEA concluded that “nuclear material in selected facilities to which safeguards had been applied remained in peaceful activities or had been withdrawn from safeguards as provided for in the agreements.” During the year, a new safeguards agreement and additional protocol between the United Kingdom and the IAEA entered into force, ensuring continuing safeguards implementation following the country’s departure from the European Union.

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During 2020, the IAEA conducted over 2,800 verification activities and implemented safeguards at over 1,300 nuclear facilities and locations outside of facilities across the globe.

In September 2020, Director General Grossi wrote to 31 States with original small quantities protocols (SQPs) calling upon them to amend or rescind their SQPs. Recognized as a weakness by the IAEA Board of Governors more than 15 years ago, the original SQP text is inadequate to meet today’s verification challenges. In 2020, Haiti amended its original SQP. ...

Source: Adem Mutluer, <https://www.iaea.org/newscenter/news/iaea-nuclear-verification-continued-during-the-covid-19-pandemic-safeguards-statement-2020>, 21 June 2021.

NUCLEAR WASTE MANAGEMENT

GENERAL

NEA Proposes New Approach to Back-End Funding

The current approaches to assessing financial adequacy for decommissioning and radioactive waste management - which are based on the linear discounting of estimated future costs -

should be complemented with a broader “circular” approach, a new OECD Nuclear Energy Agency (NEA) report proposes. This approach, it says, reflects that changes of different kinds will play out between today’s decisions and future funding needs.

The study - *Ensuring the Adequacy of Funding Arrangements for Decommissioning and Radioactive Waste Management* - consists of a conceptual framework, 12 country case studies on funding arrangements prepared in collaboration with NEA countries, and some best policy guidelines. It focuses on

the interdependency of costs and funding requirements on the one hand and changes in nuclear policy, such as long-term operation or premature shutdowns, as well as technological progress, on the other. ...

Four Reasons: The NEA says now is a good time to discuss the adequacy of funding for decommissioning and radioactive waste for at least four reasons: as the nuclear power fleet ages, many units will approach the end of their original operating licences in the coming years, with prospects for long-term operation varying widely across NEA countries; changes in the macroeconomic environment are questioning many of the assumptions on which, until recently, discussions about funding were predicated; changes in funding arrangements are already under way in a number of NEA countries; and decommissioning and, in particular, radioactive waste management remain highly sensitive issues in policy debates.

In the current linear approach, all elements of the system are based on the discounted value of the estimated future costs of a specific technical solution. “While the linear framework with its unidirectional causality from estimated costs to current assets is too simple, it remains, as long as stakeholders are aware of its limitations, a useful starting point,” according to the study. “The

challenge is to maintain the robustness of funding systems at a moment where a number of framework conditions are changing significantly, including macroeconomic framework conditions, energy policy making, societal preferences or the structure of electricity markets."

The NEA says current funding systems in NEA countries are adequate. "Nevertheless, there are challenges as decommissioning and radioactive waste management programmes move to implementation and societal preferences evolve over time. The very long-term nature of the solutions, in particular for radioactive waste disposal can also create challenges."

Circular Approach: The report proposes a circular decision-making framework, in which all elements of the system can vary, while continuing to feed into each other. The adequacy of funding is assessed by considering whether decision-making processes are capable of taking into account changes in key parameters in a manner that is sufficiently robust and sophisticated to align and realign them in different constellations. Such key parameters will include the envisioned technical solution and its costs, constituted assets and rates of return, as well as the lifetimes of nuclear power plants and evolving societal preferences. The essence of the circular approach is that a necessary evolution of the system can be triggered by any given element of the system. This could be a change in economic framework conditions, a political decision to shorten or extend the operating lifetimes of nuclear power plants, a new technological or legal option for radioactive waste management or new societal pressures to accelerate or delay the implementation of waste management solutions.

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By its very nature the circular approach is adaptive and iterative." The study explores the theme of incentive compatibility in the sense that funding arrangements should be cost-effective in the long term to make them more politically and socially sustainable in different OECD countries. "Clearly, there is a wide range of solutions as national circumstances differ greatly both in economic and technical terms with respect to the historical allocation of responsibilities and social preferences," it says.

Law and Economics: The NEA says the report has drawn inspiration from a branch of economics referred to as Law and Economics, which links general economic notions of efficiency and cost minimisation in a flexible and non-dogmatic manner to the working of institutions and the allocation of legal responsibilities. It is often concerned with the optimal allocation of responsibilities, the alignment of incentives and risk management.

This approach suggests that financially, socially and politically sustainable funding arrangements will need to be built on two fundamental guiding thoughts. First, the parties that are best capable of managing the costs and risks related to decommissioning and radioactive waste management should also ultimately be the ones responsible for funding. Secondly, decommissioning and even more so waste management concern commitments that stretch out far into the future for decades, possibly centuries. "It is obvious that economic, political and technical framework conditions both on the asset and on the cost side will change over these periods," the study says. "As long as commitments for disbursement are far away, maintaining a narrative of stable parameters can be a useful

intermediate step to set up funding systems.

However, as soon as real disbursements loom, the accuracy of estimates can

no longer be taken for granted. In other words, funding frameworks will increasingly need to integrate the conscious and explicit management of change in a sustainable rhythm." The NEA notes that funding systems are already regularly reviewed to check whether they satisfy particular financial requirements. However, it

says long-term sustainability also demands periodic reviews of the technical options and their likely costs, liability allocation and institutional arrangements. Many existing frameworks in NEA countries already respect these two guiding principles to varying degrees, the study says. "The adequacy of financing for decommissioning and radioactive waste management is a major issue that receives significant policy attention. The case studies show that sophisticated and by and large well-funded systems are in place and that much good work is being accomplished, although frequently in an ad hoc and implicit manner, rather than in a systematic and explicit one."

Source: <https://www.world-nuclear-news.org/Articles/NEA-proposes-new-approach-for-assessing-back-end-f>, 18 June 2021.

JAPAN

IAEA Commends JAEA's Back-End Programme

The 70-year decommissioning programme of the Japan Atomic Energy Agency (JAEA), including long-term management of residual waste, provides a good basis for future effective implementation, an IAEA team of experts has concluded. The team made several

recommendations to support JAEA in increasing the effectiveness of its decommissioning activities, including in the area of waste disposal.

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The current programme of decommissioning is concentrated on three main facilities: the Tokai reprocessing plant, the Monju prototype fast breeder reactor and the Fugen advanced thermal reactor. The Roadmap does not cover Japan's fleet of commercial nuclear power plants or facilities in other research institutes or in universities.

The Japanese government requested the mission to review JAEA's so-called "Back-end Roadmap", a long-term programme for decommissioning 79 nuclear research and development facilities over a period of 70 years. These facilities include prototype power reactors and research reactors, reprocessing and other fuel

cycle facilities, and waste management facilities, and the associated radioactive waste processing and disposal facilities. The current programme of decommissioning is concentrated on three main facilities: the Tokai reprocessing plant, the Monju prototype fast breeder reactor and the Fugen advanced thermal reactor. The Roadmap does not cover Japan's fleet of commercial nuclear power plants or facilities in other research institutes or in universities.

Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and

Remediation (ARTEMIS) reviews provide independent expert opinion and advice, drawn from an international team of specialists convened by the IAEA. Reviews are based on the IAEA safety standards and technical guidance, as well as international good practices. This service is intended for facility operators and organisations responsible for radioactive waste management, as well as for regulators, national policy makers and other decision makers.

The IAEA team on 22 June released the final report from an ARTEMIS review which took place on 12-22 April. Due to travel restrictions related to the COVID-19 pandemic, the review was held in a hybrid fashion. The review team - comprising

eight experts from Belgium, France, Hungary, Italy, Sweden, the UK and the USA, as well as three IAEA staff members - met in Vienna or participated from their home locations. They held virtual meetings with counterparts in Japan from the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and JAEA.

The ARTEMIS mission reviewed the overall adequacy of JAEA's programme of decommissioning and waste management, the associated cost estimation methodologies, and approaches to ensuring effective programme implementation. The team said JAEA is in a good position to continue meeting high standards of safe and responsible management of decommissioning, radioactive waste and used fuel. The team highlighted the professionalism involved in the design and implementation of the Roadmap, and the commitment to safety in all aspects. The team observed that JAEA's technology development achievements can benefit the future programme for decommissioning and waste treatment and welcomed the establishment of a centralised management structure in JAEA. ...

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The team provided recommendations and suggestions to support JAEA in increasing the effectiveness of the Roadmap. These include: reviewing a range of options to more clearly separate its organisational and resourcing responsibilities for research and development and decommissioning to strengthen the focus on each mission; developing an integrated schedule for the entire decommissioning and waste management programme, identifying major risks and opportunities, and enhancing the methodology for decommissioning cost assessments; preparing for delays in the development of disposal facilities and provide appropriate waste storage capacity for the interim period; and, promoting an expansion of the range of industrial supplier organisations with appropriate skills to implement decommissioning work, taking a long-term perspective, and implementing a framework for ensuring its own personnel have the appropriate skills required to implement the Roadmap. ...

Source: <https://world-nuclear-news.org/Articles/IAEA-commends-JAEAs-back-end-programme>, 22 June 2021.



Centre for Air Power Studies

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Centre for Air Power Studies

P-284

Arjan Path, Subroto Park,

New Delhi - 110010

Tel.: +91 - 11 - 25699131/32

Fax: +91 - 11 - 25682533

Email: capsnetdroff@gmail.com

Website: www.capsindia.org

Edited by: Director General, CAPS

Editorial Team: Dr. Sitakanta Mishra, Dr. Hina Pandey, Dr. Poonam Mann, Zoya Akhter, Nasima Khatoon, Rushali Saha, Silky Kaur

Composed by: CAPS

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