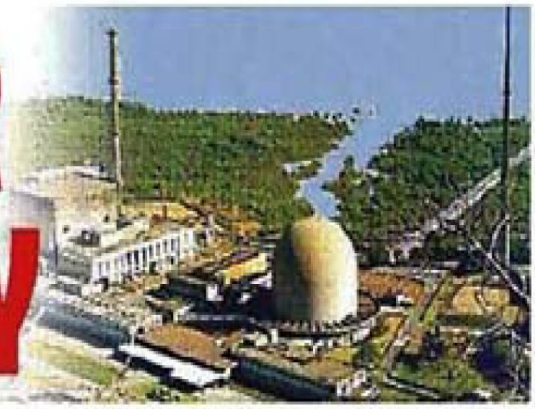
NUCLEAR SECURITY



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

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OPINION – Harsh V. Pant, Kartik Bommakanti

Keeping an Eye on China's Expanding Nuclear Stack

CONTENTS

More evidence emerged recently that the People's Republic of China is expanding the size of its nuclear arsenal by building more missile silos. The debate, though, surrounding China's nuclear build-up is mired in considerable dispute. The source of contention is over the scope and prospective size of the PRC's nuclear capabilities. The construction of the nuclear missile silo field in Xinjiang region in western China indicates the PRC is fielding a larger nuclear force based on fixed land-based capabilities. The site is believed to host 110 silos. This development comes against the backdrop of evidence that China had built a site with 120 silos in the arid region of Yumen, in the Gansu province.

The most likely reason behind the current expansion of China's nuclear arsenal is: increase the survivability of its arsenal against a first strike from their nuclear adversaries, most prominently the United States. Washington, which possesses a larger arsenal, stands at 3,800 warheads, and paired with its growing missile defence capabilities poses a threat to Chinese retaliatory nuclear forces. However, other countries too loom large in China's nuclear expansion such as Russia and India, even if Russia is not an overriding concern presently.

The most likely reason behind the current expansion of China's nuclear arsenal is: increase the survivability of its arsenal against a first strike from their nuclear adversaries, most prominently the United States. Washington, which possesses a larger arsenal, stands at 3,800 warheads, and paired with its growing missile defence capabilities poses a threat to Chinese retaliatory nuclear forces.

Rate and Extent is Key: The key question is not so much why or whether the PRC is expanding its arsenal, but rather the rate and extent of the production. Does China want a usable and deployable atomic stockpile

running into thousands of warheads, or does Beijing want an arsenal in the middle to high hundreds? Making a precise estimate of the PRC's nuclear strength is not easy. However, Chinese nuclear forces stand at roughly anywhere between 250 to 350 nuclear warheads according to the SIPRI as well as the Federation of American Scientists (FAS).

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Last year, the USTRATCOM chief Admiral Charles Richard stated that the PRC could double its current operational stockpile which is still in the "low 200s" over the next decade. However, the current silo-based missile expansion being undertaken by the PRC can be misleading, because the PRC's quest might be as much to conceal the number of missiles tipped with nuclear warheads in its possession as it is to disassemble and deceive by building a large number of decoy missile silos.

A First Strike Strategy: Land-based nuclear capabilities also enable the Chinese to present a nuclear adversary with a larger menu of targets to strike, exhausting a large number of the enemy's missiles in a first strike. Indeed, some of the decoy silos are meant to absorb and exhaust a part of the enemy' first strike nuclear forces. Thus, the larger the target list for any potential opponent, the greater the chances of China's arsenal surviving a first strike thereby boosting the credibility of China's nuclear deterrent. In all probability, the PRC is expanding its nuclear forces if not to match the larger nuclear forces fielded by the Americans and the Russians, but sufficient to withstand a first strike and then execute a retaliatory attack that would defeat U.S. missile defences.

The growth in China's nuclear arsenal might not have an immediate impact on India, but its development of land-based nuclear silos in the Xinjiang province should worry decision-makers and strategic elites in New Delhi given the region's proximity to India. More importantly, it is likely to have an impact on the ongoing boundary stand-off between the two countries in Eastern Ladakh.

China's nuclear tipped ballistic missiles forces, whether land-based or sea-based, have certainly improved in quantity and quality. The PRC's ICBM capabilities and IRBM capabilities in the form of the DF-41 and the DF-26, respectively, are its most potent land-based missile systems. At least 16 launchers of the DF-26 are known to be deployed in the Xinjiang region close to the Sino-Indian border.

In the case of the first, the silos being built in Xinjiang and Gansu could house DF-41 ICBMs that are capable of carrying multiple warheads much like their road mobile counterparts. In addition, the decoy silos can launch conventional armed ballistic missiles, and since they are likely to be interspersed with nuclear-tipped missiles, they create inadvertent escalation risks.

What New Delhi should Track: Consequently, the latest development of silos presents a grim and disturbing set of consequences for the world and India. The PRC has refused to enter any tripartite arms control negotiations with Americans and Russians that could forestall the deployment of a more numerically robust nuclear arsenal, and possibly sees its current build-up as a necessity to bridge the nuclear asymmetries it faces vis-à-vis Washington and Moscow.

The growth in China's nuclear arsenal might not have an immediate impact on India, but its development of land-based nuclear silos in the Xinjiang province should worry decision-makers and strategic elites in New Delhi given the region's proximity to India. More importantly, it is likely to have an impact on the ongoing boundary stand-off between the two countries in Eastern Ladakh. The issue is not so much actual nuclear use by the PRC against India, but the coercive leverage fixed land-based nuclear capabilities give the Chinese

in consolidating their territorial gains in Depsang, Demchok and Gogra-Hotsprings. If anything, it is likely to produce a suppressive effect against any conventional military escalation. The more extreme and adverse outcome for India is that New Delhi is left with no choice but to accept China's fait accompli.

The strategic balance between China and India is unlikely to be altered because of the Chinese nuclear expansion, but New Delhi would be wise to keep a close eye on its neighbour and work on enhancing its own strategic capabilities. Amidst an all-round sharpening of great power contestation, the nuclear issue will continue to challenge policymakers.

Source: https://www.thehindu.com/opinion/op-ed/keeping-an-eye-on-chinas-expanding-nuclear-stack/article35987126.ece, 19 August 2021.

OPINION – Tobias Bunde

Germany and the Future of NATO Nuclear Sharing

Nuclear weapons have made a return to the top of the agenda of world politics. All major nuclear powers have begun to invest in new capabilities or to modernize their arsenals. At the same time, attempts to curb nuclear proliferation have had, at best, a limited effect, while new technologies may undermine the assumptions on which traditional nuclear strategies have been based. With old rules eroding and new challenges emerging, a "second nuclear age," marked by more actors and likely less stability, is taking shape.

Nevertheless, critics of nuclear deterrence are gaining ground in Western societies. The abolitionist movement, spearheaded by the International Campaign to Abolish Nuclear Weapons, has stressed the humanitarian and environmental consequences of nuclear weapon use and has attempted to outlaw nuclear weapons. On Jan. 22, 2021, the Treaty on the Prohibition of Nuclear Weapons entered into force. It is unclear what its consequences will be, as all existing nuclear-weapon states have rejected the treaty and most of the 50 participants are smaller countries. However, the treaty has already changed the debate in Western societies, particularly in Europe. What the late Michael Howard described in the early 1980s has become an even greater challenge today. The fact that engaging in deterrence is now seen by many as more dangerous than deterrence failure may result, as Howard wrote almost 40 years ago, from the degree to which we Europeans have abandoned the primary responsibility for our defense to the United States; have come to take the deterrence provided by others for granted; and now assume that the dangers against which we once demanded reassurance only now exist in the fevered imagination of our protectors.

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Extended deterrence has become too successful, undermining its very foundations — the perceived need of protection. Together, this twin challenge puts NATO leaders in a tough spot. They not only have to respond to new nuclear challenges posed by adversaries, but they need to deal with domestic constituencies that are skeptical of nuclear deterrence.

In other words, extended deterrence has become too successful, undermining its very foundations — the perceived need of protection. Together, this twin challenge puts NATO leaders in a tough spot. They not only have to respond to new nuclear challenges posed by adversaries, but they need to deal with domestic constituencies that are skeptical of nuclear deterrence. While it was far from easy to shore up domestic support for nuclear deterrence during the Cold War, as the

Euromissiles crisis in the early 1980s demonstrated, it will likely be even more difficult to do so today. The transatlantic alliance is more heterogeneous than in the past, with some allies promoting a strengthening of NATO's nuclear posture and others flirting with supporters of the Treaty on the Prohibition of Nuclear Weapons. The ongoing debate about the future of NATO's nuclear sharing arrangement suggests that NATO policy rests on shakier grounds than often assumed. There is thus a real risk of a new nuclear crisis that could severely hamper NATO's ability to deter or even endanger the long-term health of the alliance.

Unfortunately, NATO leaders are woefully unprepared for such a crisis. For a long time, many of them have preferred not to talk too much about nuclear deterrence. Apart from the general nod to the existence of nuclear weapons and NATO's self-understanding as a "nuclear alliance" in official documents or summit declarations, nuclear weapons have hardly been discussed publicly. For many, nuclear deterrence seemed to be a relic of the Cold War. And those who believed it was important not to scrap it often preferred not to discuss it, thinking it would be better to let sleeping dogs lie. The deterioration of NATO's security environment, as well as the rise of the abolitionist movement in Western societies, have arguably made this strategy unsustainable.

Officially, of course, NATO member states have repeatedly underlined their commitment to nuclear deterrence. Most allies hosting U.S. non-strategic nuclear weapons have decided to invest in new dual-capable aircraft. Yet, both public opinion and significant portions of the elites in several NATO member states have become skeptical of NATO's reliance on nuclear deterrence. According to a 2019 survey for the International Campaign to Abolish Nuclear Weapons, public opinion in the four E.U. states that host U.S. nuclear weapons tends to support the removal of these weapons and is highly critical of the idea of equipping new fighter jets with a nuclear capacity.

The Risks of a German Exit: This view is particularly pronounced in Germany. A 2020 public opinion poll for the Munich Security Conference found that two-thirds (66 percent) of Germans supported the position that Germany should completely abandon nuclear deterrence. While the German government's 2016 white paper on security policy — the Weißbuch, which is similar to America's national security strategy — stresses the continued necessity of nuclear deterrence as long as nuclear weapons exist, it maintains that "the strategic nuclear capabilities of NATO, and in particular those of the United States, are the ultimate guarantee of the security of its members," and underlines that "Germany continues to be an integral part of NATO's nuclear policy and planning" through nuclear sharing, several prominent politicians have recently questioned the acquisition of new dual-capable aircraft needed to replace the ageing Tornados.

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The junior partner in the current coalition, the Social Democratic Party, has repeatedly delayed a decision on a Tornado replacement, leading German Defence Minister Annegret Kramp-Karrenbauer to announce her plan to buy American F-18s without being sure whether the Bundestag would support it. The Green Party, which has surpassed the Social Democrats in the polls, has its roots in the peace movement and calls for "a Germany free of nuclear weapons" and "a broad public debate about outdated deterrence doctrines of the Cold War" in its most recent party manifesto (although influential parts of the party argue for some flexibility). As a parliamentary majority without the Greens or the Social Democrats is highly unlikely, this issue will almost certainly be a stumbling block in coalition negotiations after the elections for the Bundestag in September 2021.

Proponents of a withdrawal of U.S. non-strategic nuclear weapons from German soil argue that it would make Germany and Europe more secure and downplay the potential risks of such a decision. For them, Berlin's refusal to continually host U.S. nuclear weapons and invest in the next generation of dual-capable aircraft would neither mean the end of nuclear sharing nor undermine NATO cohesion. They often try to distinguish between the so-called technical and political elements of nuclear sharing, arguing that ending the former would not necessarily affect the latter. Pointing to states such as Canada or Greece that once hosted U.S. nuclear weapons but got rid of them a long time ago and still participate in NATO's Nuclear Planning Group, they argue that Germany would still be able to influence NATO nuclear strategy, that the United States would still be willing to protect NATO, and that NATO and the nuclear sharing arrangement as such would continue to exist and function well.

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These arguments are based on rather heroic assumptions. First, they assume that it does not matter what you bring to the table. According to Rolf Mützenich, chairman of the Social Democrats in the Bundestag, a withdrawal of non-strategic nuclear weapons from Germany "would not result in the end of the American nuclear guarantee nor of Germany's say in nuclear matters ... as it would still be guaranteed through its membership in the Nuclear Planning Group." Yet, it would be very surprising if those states that actively contributed to NATO's nuclear sharing mission didn't have more influence than other member states. After all, it is well known that those NATO members that provide troops to allied operations (in particular those that carry special risks) have more influence on NATO strategy for a given operation than other member states.

The German proponents of a withdrawal of U.S. nuclear weapons underestimate the role of their own country. Germany, after all, is not just another member state. To begin with, the country's role in NATO was a major reason for the very creation of this special arrangement.

Second, they implicitly or explicitly argue that it would not make much of a difference for the security provider, the United States, whether their protégés participate in the arrangement or not. After all, they argue, the United States does not need the few non-strategic nuclear weapons on European soil to provide effective deterrence for the whole of NATO. According to the critics, these weapons are militarily useless, because there is no realistic scenario for their use. Yet, many military experts disagree. They maintain that even the current generation of jet fighters could successfully carry out their mission. Moreover, from this perspective, jet fighters carrying gravity bombs provide a lot of operational flexibility and are valuable tools for strategic communication.

It could also be argued that these non-strategic nuclear weapons never really had much military use in a narrow sense. Rather, they have always been political symbols, linking European security to American security. It is important to recognize, though, that "symbolic" does not mean politically unimportant. In contrast, nuclear sharing has also meant reassurance and risk sharing. However, as former U.S. ambassador to NATO, Ivo Daalder, notes, reassurance works both ways: "it's a two-way street." For the United States, it will thus make a huge political difference whether U.S. allies are willing to continue to share the risks associated with the nuclear umbrella. In an article for Der Spiegel, two experienced Europe hands, former Deputy Secretary of Defense Michèle Flournoy and former Deputy Assistant Secretary of Defense for Policy Jim Townsend, warned in no uncertain terms that "Germany walking away from this vow to share the nuclear burden, this expression of solidarity and risk sharing, strikes at the heart of the trans-Atlantic bargain."

Third, the German proponents of a withdrawal of U.S. nuclear weapons underestimate the role of their own country. Germany, after all, is not just another member state. To begin with, the

country's role in NATO was a major reason for the very creation of this special arrangement. Its departure from NATO's technical nuclear sharing arrangement would very likely trigger other "exits" and lead to transatlantic disruption. While the nuclear sharing arrangement may survive a Belgian or Dutch exit, it is hard to imagine that a German withdrawal would not bring about a general crisis of nuclear sharing. According to Flournoy and Townsend, "the bargain sustaining U.S. extended nuclear deterrence to Europe would collapse and the U.S. umbrella would essentially be decoupled from Europe." At a time of upheaval for the transatlantic alliance and ongoing discussions about a potential "decoupling," this promises to be a dangerous strategy with potentially far-reaching consequences.

The Road Ahead: How can We Avoid Transatlantic Nuclear Disruption? As the past few years have shown, a reactive communication strategy that tries to protect a very fragile elite consensus without rocking the boat is apparently not enough. Those in the strategic community who still believe that nuclear deterrence remains indispensable will have to make the case for it and be ready to engage in moral and ethical discussions. They should not be afraid of a debate with those who think that unilateral disarmament is the safer strategy. After all, the case can be made that supporting NATO cohesion and limited nuclear deterrence is the more promising path toward risk reduction, disarmament, and peaceful relations in the long run.

They need to be clear in communicating the risks of a unilateral end to nuclear sharing. They should also highlight the meager benefits of unilateral disarmament when other states are investing in new nuclear capabilities and doctrinal developments.

Most importantly, they need to be clear in communicating the risks of a unilateral end to nuclear sharing. They should also highlight the meager benefits of unilateral disarmament when other states are investing in new nuclear capabilities and doctrinal developments. In particular, Berlin's allies need to pay attention to the German debate and stress the potential damage of Germany pushing for the withdrawal of U.S. non-strategic weapons. Germans may be less receptive to arguments about nuclear strategy, but they may listen to warnings that the end of nuclear sharing would present a major threat to multilateralism and could pave the way for a renationalization of security policy.

At the same time, proponents of NATO's nuclear sharing arrangement will also have to make clear that they take seriously the valid points made by those concerned with the very real risks that come with nuclear weapons. For large parts of the Western public, it is far from self-evident today that relying on nuclear deterrence is indeed the best strategy to deal with a deteriorating security environment. Consequently, NATO leaders should engage with critics' concerns that the alliance is just sticking with a dangerous relic from the Cold War because it does not know what else to do. They should also be open to thinking through potential alternatives to the current arrangement (which dates back to the 1960s) that would be able to fulfill the same role (i.e., serving as a link between U.S. and European security). And they need to find ways to combine efforts to maintain a necessary level of deterrence with a sincere commitment to nuclear risk reduction, arms control, and disarmament.

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For instance, NATO leaders should be open to discussing proposals such as a five-year moratorium, during which neither Russia nor NATO would deploy new "destabilizing weapons to Europe until 2025," giving NATO time to reassess the nuclear status quo and test Russia's willingness to seriously consider mutual arms reductions. Likewise, following in the footsteps of NATO's traditional dual-track strategy, they should also be open to adapting their capabilities if the security environment continues to erode further. Germany, in any case, would do well to

discuss the difficult questions relating to the future of nuclear security within NATO, instead of incrementally phasing out its participation in the nuclear sharing arrangement.

After all, without NATO cohesion, neither deterrence nor security will be achieved. Alliance management and balancing different assurance and deterrence needs within NATO will be major challenges for the coming years. Given the very heterogeneous threat perceptions and policy preferences within the alliance, discussions on the nuclear components of NATO's next strategic concept and on a potential update of the Deterrence and Defense Posture Review of 2012 will be difficult. For a complete denial of deterrence, however, the transatlantic alliance will very likely be punished. A metaphor the late Justice Ruth Bader Ginsburg once used in a completely different case may also apply to the nuclear umbrella: "throwing out [something] when it has worked and is continuing to work ... is like throwing away your umbrella in a rainstorm because you are not getting wet."

The Biden administration has a unique opportunity to reset the discussion on how the US government addresses adversaries seeking to use unconventional weapons against US national security interests.

But the biggest issue right now is that the US government does not have a strategy for countering China's or Russia's use of WMD on the battlefield, in regional conflicts, or in crises that fall below the threshold of conflict.

Source: https://warontherocks.com/2021/08/the-risks-of-an-incremental-german-exit-from-natos-nuclear-sharing-arrangement/, 25 August 2021.

OPINION – Al Mauroni

How to Build a Better Policy for Countering WMD Threats

In 2002, the Bush administration released a National Strategy to Combat WMD. This strategy took a military counterproliferation concept and turned it into a vehicle for guiding the federal government toward protecting the United States from nation-states and sub-state groups with WMD programs. A lot has changed over twenty years, including the fact that the number of countries seeking to develop nuclear, biological, or chemical weapons has dropped from an estimated 25 countries in 2001 to less than 10 today. Meanwhile, the national security community remains split as to the actual purpose of counter-WMD strategy — is it as an adjunct to arms control activities, an aspect of deterrence operations, or to guide crisis response drills?

Yet the US has still held closely to the 2002 policy, even as the challenges have mutated. It's well past time for the strategy to be replaced with something ready to face the realities of modern WMD concerns. The Biden administration has a unique opportunity to reset the discussion on how the US government addresses adversaries seeking to use unconventional weapons against US national security interests.

A first necessary step is having the White House define what a WMD is, given advances in technology and warfighting. Some US defense analysts seek to add high-yield explosives, pharmaceutical drugs, natural diseases, and cyber weapons to the WMD family in an effort to remain relevant to contemporary national security operations. These attempts would, however, dilute rather than reinvigorate defense policies addressing adversaries seeking WMD capabilities. In the wake of the pandemic, a significant number of people are suggesting that COVD-19 may be a catalyst for bioterrorism incidents, and that a general biodefense concept — addressing natural disease outbreaks, deliberate biological incidents, and accidental biological releases — is the only answer. If the US military is to develop discrete capabilities to counter nation-states armed with nuclear, biological, and chemical weapons, it must start with a national strategy that clarifies terms of reference and discrete responsibilities for federal government agencies.

But the biggest issue right now is that the US government does not have a strategy for countering China's or Russia's use of WMD on the

battlefield, in regional conflicts, or in crises that fall below the threshold of conflict. These are two nuclear-weapon states that have been accused of falling short on their obligations as signatories to the Chemical Weapons Convention and Biological Weapons Convention. If these major powers have active WMD programs, does the 2002 National Strategy to Combat WMD and the 2014 DoD Strategy to Counter WMD provide the guidance to counter these states? The answer is simply, no.

The existing strategies were only intended for small nation-states and violent extremist groups that sought WMD capabilities, adversaries that could be easily overcome with the US superiority of its conventional weapons. Given that, most defense analysts have studiously ignored the possibility that China and Russia might use WMD in confrontation with the United States and its partners, perhaps hoping that those states would only respond to future crises with lesser quantities of conventional weapons. Sure, the US government can continue to focus on the arms control aspects of these powers, but the US military does not have a concept of victory in facing China or Russia in a future conflict that includes WMD use. The next military strategy to counter WMD must focus on these strategic competitors and abandon its current threat-agnostic approach.

There is no single agency responsible for overseeing and directing WMD policy in the US government, allowing State, Defense, Energy, Justice, Homeland Security, and Health and Human Services to all independently decide on what they think is a WMD and how they should align their resources against national policy objectives.

Now, who should take the lead on this issue? In the wake of COVID-19, many public health advocates and some defense analysts want to develop a new biological defense construct that directs the medical community to manage deliberate biological threats (meaning bioterrorism cases) as well as natural disease outbreaks. In all national preparedness discussions, we talk about who is responsible for prevention, protection, response, and recovery.

While it is true that, in the response phase to any biological crisis, the medical community is doing nearly all of the work, it would be a mistake to believe that this community should manage all biological threats under a single construct. The medical community is not the right agent to develop prevention or protection concepts for bioterrorism, biological weapons use, or laboratory biosecurity. The other option, putting natural disease outbreaks in a counter-WMD strategy, is just as bad, if not worse. These threats require different but coordinated approaches.

Talking about WMD issues today is challenging for two significant reasons — first, it's a very technical discussion that has atrophied since the Cold War ended, given the lack of any WMD attacks against US military forces or the homeland. Few see it as a vital mission today. Second, there is no single agency responsible for overseeing and directing WMD policy in the US government, allowing State, Defense, Energy, Justice, Homeland Security, and Health and Human Services to all independently decide on what they think is a WMD and how they should align their resources against national policy objectives. As there has been no significant national review of WMD threats and policy development since 2002, the US government's capability to address WMD crises has been reduced to ad hoc actions with no institutionalism of what worked.

We need to start with a clean sheet of paper to define what a WMD is today, address strategic competitors who may use WMD, and untangle the military's biodefense program from public health efforts. Making this happen will require a top-level working group with representatives from across the government — never easy, but vital to avoid having each agency making up its own definition of WMD and acting accordingly. If the proliferation of WMD is still considered a national security challenge, then this administration should provide clear terms of reference as to what WMD are, how it conceptualizes the contributions of federal executive agencies, and measures of effectiveness to assess whether the executive agencies have

developed the right capabilities. Only then should the Department of Defense develop its military concept to execute its unique responsibilities to protect US forces in future operating environments involving nuclear, biological, and chemical weapons.

Source: https://breakingdefense.com/2021/08/how-to-build-a-better-policy-for-countering-wmd-threats/, 16 August 2021.

OPINION – Kali Robinson

What is the Iran Nuclear Deal?

The fate of the arms control agreement is in doubt following the United States' withdrawal and Iran's noncompliance, but newly elected leaders in both countries in 2021 have signalled a willingness to mend the deal. The Iran nuclear agreement, formally known as the JCPOA, is a landmark accord reached between Iran and several world powers, including the United States, in July 2015. Under its terms, Iran agreed to dismantle much of its nuclear program and open its facilities to more extensive international inspections in exchange for billions of dollars' worth of sanctions relief. Proponents of the deal said that it would help prevent a revival of Iran's nuclear weapons program and thereby reduce the prospects for conflict between Iran and its regional rivals, including Israel and Saudi Arabia. However, the deal has been in jeopardy since President Donald Trump withdrew the United States from it in 2018. In retaliation for the U.S. departure and for deadly attacks on prominent Iranians in 2020, including one by the United States, Iran has resumed some of its nuclear activities.

The fate of the arms control agreement is in doubt following the United States' withdrawal and Iran's noncompliance, but newly elected leaders in both countries in 2021 have signalled a willingness to mend the deal.

The JCPOA, which went into effect in January 2016, imposes restrictions on Iran's civilian nuclear enrichment program. At the heart of negotiations with Iran were the five permanent members of the UN Security Council (China, France, Russia, the United Kingdom, and the United States) and Germany—collectively known as the P5+1. The European Union also took part.

In 2021, President Joe Biden said the United States will return to the deal if Iran comes back into compliance, though Iran's leaders have insisted that Washington lift sanctions first. Ebrahim Raisi, a conservative cleric elected as Iran's president in June, has indicated that he will take a harder line than his predecessor in nuclear negotiations. The JCPOA, which went into effect in January 2016, imposes restrictions on Iran's civilian nuclear enrichment program. At the heart of negotiations with Iran were the five permanent members of the UN Security Council (China, France, Russia, the United Kingdom, and the United States) and Germany—collectively known as the P5+1. The European Union also took part.

Some Middle Eastern powers, such as Saudi Arabia, said they should have been consulted or included in the talks because they would be most affected by a nuclear-armed Iran. Israel explicitly opposed the agreement, calling it too lenient.

What were the Goals? The P5+1 wanted to unwind Iran's nuclear program to the point that if Tehran decided to pursue a nuclear weapon, it would take at least one year, giving world powers time to respond. Heading into the JCPOA negotiations, U.S. intelligence officials estimated that, in the absence of an agreement, Iran could produce enough nuclear material for a weapon in a few months. Negotiating nations feared that Iran's moves to become a nuclear weapons state risked thrusting the region into a new crisis. Israel had taken pre-emptive military action against suspected nuclear facilities in Iraq and Syria and could do the same against Iran, perhaps triggering reprisals by Lebanon-based Hezbollah or disruptions to the transport of oil in the Persian Gulf. Additionally, Saudi Arabia has since signaled

a willingness to obtain a nuclear weapon if Iran successfully detonates one.

Iran had previously agreed to forgo the development of nuclear weapons as a signatory to the Nuclear Nonproliferation Treaty, which has been in force since 1970. However, after the overthrow of the Pahlavi dynasty in 1979, Iranian leaders secretly pursued this technology. (In 2007, U.S. intelligence analysts concluded that Iran halted its work on nuclear weapons in 2003 but continued to acquire nuclear technology and expertise.) Prior to the JCPOA, the P5+1 had been negotiating with Iran for years, offering its government various incentives to halt uranium enrichment. After the 2013 election of President Hassan Rouhani, who was viewed as a reformer, the parties came to a preliminary agreement to guide negotiations for a comprehensive deal. For its part, Iran sought the JCPOA for relief from international sanctions, which starved its economy of more than $100 billion in revenues in 2012–2014 alone.

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Does it Prevent Iran from Getting Nuclear Weapons? Many experts say that if all parties adhered to their pledges, the deal almost certainly could have achieved that goal for longer than a decade. Many of the JCPOA's restrictions on Iran's nuclear program have expiration dates. For example, after ten years (from January 2016), centrifuge restrictions will be lifted, and after fifteen years, so too will limits on the amount of low-enriched uranium Iran can possess. Some of the deal's opponents faulted these so-called sunset provisions, saying they would only delay Iran building a bomb while sanctions relief would allow it to underwrite terrorism in the region.

What did Iran Agree to? *Nuclear restrictions.* Iran agreed not to produce either the highly enriched uranium or the plutonium that could be used in a nuclear weapon. It also took steps to ensure that its Fordow, Natanz, and Arak facilities pursued only civilian work, including medical and industrial research. The accord limits the numbers and types of centrifuges Iran can operate, the level of its enrichment, as well as the size of its stockpile of enriched uranium. (Mined uranium has less than 1 percent of the uranium-235 isotope used in fission reactions, and centrifuges increase that isotope's concentration. Uranium enriched to 5 percent is used in nuclear power plants, and at 20 percent it can be used in research reactors or for medical purposes. High-enriched uranium, at some 90 percent, is used in nuclear weapons.)

Monitoring and Verification*:* Iran agreed to eventually implement a protocol that would allow inspectors from the IAEA, the United Nations' nuclear watchdog, unfettered access to its nuclear facilities and potentially to undeclared sites. Inspections are intended to guard against the possibility that Iran could develop nuclear arms in secret, as it has allegedly attempted before. The IAEA has issued quarterly reports to its board of governors and the UN Security Council on Iran's implementation of its nuclear commitments. A body known as the Joint Commission, which includes representatives of all the negotiating parties, monitors implementation of the agreement and resolves disputes that may arise. A majority vote by its members can gain IAEA inspectors access to suspicious, undeclared sites. The body also oversees the transfer of nuclear-related or dual-use materials.

What did the other Signatories Agree to? Sanctions Relief: The EU, United Nations, and United States all committed to lifting their nuclear-related sanctions on Iran. However, many other U.S. sanctions on Iran, some dating back to the 1979 hostage crisis, remained in effect. They cover matters such as Iran's ballistic missile program, support for terrorist groups, and human rights abuses. Though the United States committed to lifting its sanctions on oil exports, it kept restrictions on financial transactions, which have deterred international trade with Iran.

Weapons Embargo: The parties agreed to lift an existing UN ban on Iran's transfer of conventional weapons and ballistic missiles after five years if the IAEA certifies that Iran is only engaged in

civilian nuclear activity.

How is the Iran Deal Enforced? If any signatory suspects Iran is violating the deal, the UN Security Council may vote on whether to continue sanctions relief. This "snapback" mechanism remains in effect for ten years, after which the UN sanctions are set to be permanently removed. In April 2020, the United States announced its intention to snap back sanctions. The other P5 members objected to the move, saying the United States could not unilaterally implement the mechanism because it left the nuclear deal in 2018.

Did Iran Comply Initially? The agreement got off to a fairly smooth start. The IAEA certified in early 2016 that Iran had met its preliminary pledges; and the United States, EU, and United Nations responded by repealing or suspending their sanctions. Most significantly, U.S. President Barack Obama's administration dropped secondary sanctions on the oil sector, which allowed Iran to ramp up its oil exports to nearly the level it was prior to sanctions. The United States and many European nations also unfroze about $100 billion worth of frozen Iranian assets. However, the deal has been near collapse since President Trump withdrew the United States from it in 2018 and reinstated devastating banking and oil sanctions. Trump said the agreement failed to address Iran's ballistic missile program and its proxy warfare in the region, and he claimed that the sunset provisions would enable Iran to pursue nuclear weapons in the future.

With the sanctions lifted, inflation slowed, exchange rates stabilized, and exports—especially of oil, agricultural goods, and luxury items-—skyrocketed as Iran regained trading partners, particularly in the EU.

Iran accused the United States of reneging on its commitments, and faulted Europe for submitting to U.S. unilateralism. In a bid to keep the agreement alive, France, Germany, and the United Kingdom launched a barter system, known as INSTEX, to facilitate transactions with Iran outside of the U.S. banking system. However, the system is only meant for food and medicine, which are already exempt from U.S. sanctions. Following the U.S. withdrawal, several countries—U.S. allies among them—continued to import Iranian oil under waivers granted by the Trump administration, and Iran continued to abide by its commitments. But a year later, the United States ended the waivers with the aim of halting Iran's oil exports completely.

What is Iran's Current Nuclear Activity? In response to the other parties' actions, which Tehran claimed amounted to breaches of the deal, Iran started exceeding agreed-upon limits to its stockpile of low-enriched uranium in 2019, and began enriching uranium to higher concentrations (though still far short of the purity required for weapons). It also began developing new centrifuges to accelerate uranium enrichment; resuming heavy water production at its Arak facility; and enriching uranium at Fordow, which rendered the isotopes produced there unusable for medical purposes. In 2020, Iran took more steps away from its nuclear pledges, following a series of attacks on its interests. In January, after the U.S. targeted killing of a top Iranian general, Qasem Soleimani, Iran announced that it would no longer limit its uranium enrichment. In October, it began constructing a centrifuge production center at Natanz to replace one that was destroyed months earlier in an attack it blamed on Israel. And in November, in response to the assassination of a prominent nuclear scientist, which it also attributed to Israel, Iran's parliament passed a law that led to a substantial boost in uranium enrichment at Fordow. The following year, Iran announced new restrictions on the IAEA's ability to inspect its facilities, and soon after ended its monitoring agreement with the agency completely.

How has the Deal Affected Iran's Economy? Prior to the JCPOA, Iran's economy suffered years of recession, currency depreciation, and inflation, largely because of sanctions on its energy sector. With the sanctions lifted, inflation slowed, exchange rates stabilized, and exports—especially of oil, agricultural goods, and luxury items-—skyrocketed as Iran regained trading partners, particularly in the EU. After the JCPOA took effect,

Iran began exporting more than 2.1 million barrels per day (approaching pre-2012 levels, when the oil sanctions were originally put in place). However, these improvements did not translate to a significant increase in the average Iranian household's budget.

The end of sanctions waivers on oil exports and the restoration of U.S. sanctions in 2018 has once again cut deeply into a vital source of national revenue: oil and petroleum products account for 80 percent of Iran's exports. By mid-2020, oil exports had plummeted to below three hundred thousand barrels per day. Additionally, in October of that year, the United States imposed sanctions on eighteen major Iranian banks, causing the Iranian rial to fall further against the U.S. dollar. Meanwhile, the wide range of U.S. sanctions unrelated to the nuclear program have added to the damage. Multinational firms fear being punished by the United States for transacting with sanctioned Iranian entities associated with, for example, the Islamic Revolutionary Guard Corps (IRGC) which holds sway over many industries. With sanctions deterring international trade, black markets have boomed, enriching the IRGC at the expense of the regular economy.

Looking over the horizon, many analysts say Raisi is on a path to succeed Ayatollah Ali Khamenei as Iran's supreme leader. "The regime seems to have perceived that he needs some managerial experience before ascending to the highest office.

What is the Outlook for the Agreement? The fate of the Iran nuclear deal remains uncertain. Biden has said the United States will rejoin the agreement if Iran returns to compliance, but has also said he wants to negotiate a broader agreement that addresses Iran's other activities, such as its missile program. Meanwhile, Raisi has said Washington has to return to the original deal. "Regional and missile issues are nonnegotiable," Raisi said shortly after being elected as president in June 2021. In April, JCPOA signatories began talks in Vienna to bring Washington and Tehran back into the deal, but the negotiations stalled after Raisi's election. That August, Raisi nominated hard-line diplomat Hossein Amirabdollahian to replace Zarif as foreign minister. Some analysts say Amirabdollahian's close connections to the IRGC could boost his political influence and thus enable him to bring Iran back to the negotiating table. Looking over the horizon, many analysts say Raisi is on a path to succeed Ayatollah Ali Khamenei as Iran's supreme leader. "The regime seems to have perceived that he needs some managerial experience before ascending to the highest office," CFR's Ray Takeyh writes.

Source: https://www.cfr.org/backgrounder/what-iran-nuclear-deal, 18 August 2021.

NUCLEAR STRATEGY

CHINA

Beijing Likely to Expand its N-Capabilities: US Report

China may expand its nuclear arsenal, while the nuclear missile capabilities of the PLA represent one strongest investment in warfare, says a report of the US Army. Titled "Chinese tactics" dated August 2021, it is part of the "Army Techniques Publication" of the US Army and it has been put online in public. The US report said China's nuclear strategy could be described as a minimal deterrence approach, possessing only the nuclear capability necessary to deter a nuclear attack. "Future modernisation accompanied by an expansion of the nuclear force, however, is a clear possibility"....

The US report said China's nuclear strategy could be described as a minimal deterrence approach, possessing only the nuclear capability necessary to deter a nuclear attack. "Future modernisation accompanied by an expansion of the nuclear force, however, is a clear possibility.

China is not a signatory to the Intermediate-Range Nuclear Forces Treaty, and thus it is free to develop short and medium range missiles of all

types. The PLA employs several types of missiles as its primary precision deep-strike capability to target high-value assets, including air and seaports, supply depots, and command and communication nodes. These missiles represent a significant element of the Chinese strategy of denying access. More-advanced missiles are designed specifically to engage hardened or mobile high-value assets, such as aircraft carriers and missile systems of other countries. Chinese capabilities represent one of the PLA's strongest investments in system warfare, as nuclear missiles asymmetrically destroy or neutralise assets that traditionally required force-on-force methods to effectively attack....

With China's substantial investment in nuclear missile capabilities, it is unlikely that China will ever voluntarily downgrade its conventional missile-strike capability. "The PLARF's conventional missile force is the world's largest and among the world's most technologically advanced and most capable.

The People's Liberation Army Rocket Force (PLARF) operates most of China's nuclear arsenal through a fleet of 60-70 ICBMs – meaning with ranges in excess of 5,500 km. China at present does not possess an immediate second-strike nuclear capability.... In nuclear strategy 'second strike capability' is an assured capability of an armed force to respond to a nuclear attack with its own nuclear weapons. And a submarine launched nuclear weapons is considered the most reliable and potent form of second strike.

The US report argues that with China's substantial investment in nuclear missile capabilities, it is unlikely that China will ever voluntarily downgrade its conventional missile-strike capability. "The PLARF's conventional missile force is the world's largest and among the world's most technologically advanced and most capable"....

Source: https://www.tribuneindia.com/news/world/beijing-likely-to-expand-its-n-capabilities-us-report-303710, 29 August 2021.

UK

UK Sees Role for Nuclear in Hydrogen Economy

The UK government says nuclear will play a significant role in developing a thriving low-carbon hydrogen sector to meet the country's ambition for 5GW of low-carbon hydrogen production capacity by 2030. Releasing its Hydrogen Strategy today, the Department for Business, Energy & Industrial Strategy said a hydrogen economy could support over 9000 UK jobs and unlock GBP4 billion (USD5.5 billion) in investment by 2030, potentially rising to 100,000 jobs and worth up to GBP13 billion by 2050. The UK's first-ever Hydrogen Strategy drives forward the commitments laid out in Prime Minister Boris Johnson's ambitious 10 Point Plan - announced in November 2020 - for a green industrial revolution by setting the foundation for how the UK government will work with industry to meet its ambition for 5GW of low-carbon hydrogen production capacity by 2030. This level of hydrogen production could be equivalent to the amount of gas consumed by over 3 million households in the UK each year.

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By 2030, the government says, hydrogen could play an important role in decarbonising polluting, energy-intensive industries like chemicals, oil refineries, power and heavy transport like shipping, trucks and trains, by helping these sectors move away from fossil fuels. By 2050, 20-35% of the UK's energy consumption could be hydrogen-based. It says hydrogen could be critical in meeting the UK's targets of a 78% reduction in emissions by 2035 and net zero emissions by 2050.The Hydrogen Strategy outlines how the UK will rapidly and significantly scale up production and lay the foundations for a low-carbon hydrogen economy by 2030, as well as how government will

support innovation and stimulate investment in the 2020s to scale up low-carbon hydrogen.

It outlines a "twin track" approach, supporting both "green" electrolytic and "blue" carbon capture-enabled hydrogen production, and commits to providing further detail in 2022 on the government's production strategy. The government says it will collaborate with industry to develop a UK standard for low-carbon hydrogen giving certainty to producers and users that the hydrogen the UK produces is consistent with net zero while supporting the deployment of hydrogen across the country. The government will also undertake a review to support the development of the necessary network and storage infrastructure to underpin a thriving hydrogen sector. It says it will work with industry to assess the safety, technical feasibility and cost effectiveness of mixing 20% hydrogen into the existing gas supply. This, it says, could deliver a 7% emissions reduction on natural gas. The government will also launch a hydrogen sector development action plan in early-2022 setting out how it will support companies to secure supply chain opportunities, skills and jobs in hydrogen. The Hydrogen Strategy also contains details on different ways to produce hydrogen and the government's technical cost projections of each technology up to 2050.

From the 2030s onwards, we may see a wider range of production technologies coming to the market including more hydrogen from nuclear, using low-carbon heat and power from small modular and advanced modular reactors, as well as bio-hydrogen with carbon capture, utilisation and storage that can deliver negative emissions.

Role for Nuclear: The Energy White Paper, published in December 2020, sets out how the UK will expand renewable generation while decarbonising power sector emissions further, including through its ambition to quadruple offshore wind capacity to 40GW by 2030 and pursue new large-scale nuclear while investing in small-scale nuclear technologies. "This low-carbon electricity will be the primary route to decarbonisation for many parts the energy system, and will also support electrolytic production of hydrogen," the Hydrogen Strategy says. "From the 2030s onwards, we may see a wider range of production technologies coming to the market including more hydrogen from nuclear, using low-carbon heat and power from small modular and advanced modular reactors, as well as bio-hydrogen with carbon capture, utilisation and storage that can deliver negative emissions," it adds. "A dynamic market will include multiple sources and end uses for hydrogen."

The UK government has also today launched a public consultation on a preferred hydrogen business model which - built on a similar premise to the offshore wind Contracts for Difference - is designed to overcome the cost gap between low-carbon hydrogen and fossil fuels, helping the costs of low-carbon alternatives to fall quickly. In addition, the government is consulting on the design of the GBP240 million Net Zero Hydrogen Fund, which aims to support the commercial deployment of new low carbon hydrogen production plants across the UK. ...

The German Navy plans to equip its F124 frigates with new radars that expand the vessels' capabilities into the field of ballistic missile defense, the German military acquisition branch announced on 24 August 2021. To that end, the Bundeswehr awarded a €220 million (U.S. $258 million) contract to German sensor specialist Hensoldt in conjunction with Israel Aerospace Industries' Elta Systems.

Source: https://world-nuclear-news.org/Articles/UK-sees-role-for-nuclear-in-hydrogen-economy, 17 August 2021.

BALLISTIC MISSILE DEFENCE

GERMANY

Germany Readies Frigates for Ballistic Missile Defense Missions

The German Navy plans to equip its F124 frigates with new radars that expand the vessels' capabilities into the field of ballistic missile defense, the German military acquisition branch announced on 24 August 2021. To that end, the

Bundeswehr awarded a €220 million (U.S. $258 million) contract to German sensor specialist Hensoldt in conjunction with Israel Aerospace Industries' Elta Systems. The two companies will enter into a "strategic cooperation," as Hensoldt calls it, to deliver four radar sets based on Germany's TRS-4D product and beefed up with Elta's long-range capabilities.

Officials plan to install the new equipment on three air defense frigates of the Sachsen class between 2024 and 2028, according to a statement from the military acquisition office. A fourth system will be set up on land to help the German Navy train its sailors. The new radars would elevate the ships' surveillance and target-tracking capabilities for various aerial threats, including ballistic missiles, the office said.

Berlin has pledged missile defense contributions to NATO as the alliance assembles a network of sensors and interceptors in Europe meant to one day protect the entire continent from such attacks.

The Navy's foray into ballistic missile defense follows the government's strategy of inserting requisite sensor capabilities into its arsenal whenever substantial weapon upgrades are on the books anyway. Berlin has pledged missile defense contributions to NATO as the alliance assembles a network of sensors and interceptors in Europe meant to one day protect the entire continent from such attacks. Naval vessels are considered especially desirable in that equation because they can be moved around and seek the most advantageous positions when it comes to detecting and intercepting missiles.

Hensoldt and Elta are already teamed up on an upgrade for the land-based Hughes Air Defense Radars, which marks another step in Berlin's quest for greater ballistic missile defense capabilities. For years, Germany's missile defense ambitions rested on a replacement of its Patriot fleet with the TLVS weapon, short for Taktisches Luftverteidigungs system. Officials shelved that program earlier this year to free up money for drone defense, though it's unclear what the Defence Ministry intends to field to that end.

Source: https://www.defensenews.com/global/europe/2021/08/24/germany-readies-frigates-for-ballistic-missile-defense-missions/, 24 August 2021.

RUSSIA

Unstoppable! Russia Signs Contract to Induct Deadly Hypersonic Missile that No Air Defense System can Intercept

The Russian Defense Ministry has announced that it signed a contract for the delivery of a batch of Kinzhal hypersonic nuclear-capable air-launched ballistic missiles with the KB Mashinostroyeniya (Machine-Building Design Bureau, part of the Rostec corporation). "A state contract for production and delivery of Kinzhal missiles was signed at the international defense forum Army-2021," the Russian Defense Ministry told reporters. Earlier, as *EurAsian Times* reported, Russia is developing the latest Kh-95 long-range hypersonic airborne missile for its armed forces. The Russian military believes that dominance in airspace and outer space is vital to maintain an edge over adversaries.

"It is for this purpose that such new and modernized models of weapons, military and special equipment, such as the Tu-160M strategic missile carrier-bomber; the Kinzhal ["dagger"] hypersonic airborne missile system; high-precision long-range airborne weapons, in particular the Kh-95 hypersonic missile, are being developed and introduced into service for the Russian Aerospace Forces," Colonel-General Vladimir Zarudnitskyaid wrote in an article. Russian Defense Minister Sergei Shoigu said back in February that hypersonic weapons would be the main component of the

Russia is developing the latest Kh-95 long-range hypersonic airborne missile for its armed forces. The Russian military believes that dominance in airspace and outer space is vital to maintain an edge over adversaries.

country's conventional deterrence forces. There are also reports that Russia's fifth-generation Su-57 fighters may be equipped with the prospective Kinzhal missiles after 2030, a representative of the Russian Aerospace Forces told President Vladimir Putin according to Sputnik News Agency.

There are plans to equip the Su-57 fighter jet with an advanced Okhotnik combat drone, the representative recalled in his conversation with Putin at an exhibition in the National Defense Management Center. Earlier, two MiG-31K aircraft loaded with carrying Kinzhal hypersonic missiles were deployed to Syria for the first time as part of joint military drills, the Russian defense ministry had stated. "A pair of MiG-31K aircraft, which are able to use the newest Kinzhal hypersonic missiles, flew for the exercise to Russia's Khmeimim Air Base in the Syrian Arab Republic," the statement said. The aircraft will carry out "learning tasks" in Syria, one of the crews said.

Russian Defense Minister Sergei Shoigu said back in February that hypersonic weapons would be the main component of the country's conventional deterrence forces. There are also reports that Russia's fifth-generation Su-57 fighters may be equipped with the prospective Kinzhal missiles after 2030.

Challenging the West: Western hypersonic missiles pose no threat to Russia, as Russian missile defense systems are capable of shooting them down, Pavel Sozinov, general designer at the Almaz-Antey defense concern said in an interview with Sputnik in August 2021. In July 2020, the US revealed its plan to develop hypersonic missiles capable of flying at velocities of 17 times the speed of sound and labeled by then-President Donald Trump as "super-duper." "We can deal with any hypersonic missile, either existing or that can be created in the near future," Sozinov stated. The high speed of missiles itself entails no repercussions since any hypersonic missile can develop a maximum speed only at high altitude, and while approaching the target and entering the atmosphere, it loses speed, the general designer elaborated.

"These 'super missiles' developed abroad pose no tangible threat to us, and we know how to develop further in this sphere," Sozinov added. The Almaz-Antey defense concern has long been living in a "hypersonic reality," as almost all the ballistic missiles, its defense systems are aimed at intercepting, are hypersonic, and Almaz-Antey's defense missiles themselves are capable of developing hypersonic speeds. ...

Source: https://eurasiantimes.com/unstoppable-russia-signs-contract-to-induct-deadly-hypersonic-missile-that-no-air-defense-system-can-intercept/ , 24 August 2021.

EMERGING TECHNOLOGIES AND DETERRENCE

GENERAL

Extending Nuclear Power Accident Code for Advanced Reactor Designs

Nuclear power is a significant source of steady carbon-neutral electricity, making the design and construction of new and next-generation nuclear reactors critical for achieving the U.S.'s green energy goals. A number of new nuclear reactor designs, such as small modular reactors and non-light water reactors, have been developed over the past 10 to 15 years. In order to help the Nuclear Regulatory Commission evaluate the safety of the next generation of reactors, fuel cycle facilities and fuel technologies, researchers at Sandia National Laboratories have been expanding their severe accident modeling computer code, called Melcor, to work with different reactor geometries, fuel types and coolant systems.

These advancements have been demonstrated at several virtual public meetings this summer. The purpose of these meetings is to show U.S. policymakers, members of the nuclear energy industry, international nuclear energy regulators and members of public interest groups that the NRC has the tools needed to evaluate the safety of new and advanced nuclear reactor designs. "This computer code really is the Swiss Army knife of nuclear system safety," said David Luxat, manager for Sandia's nuclear reactor severe accident modeling group. "It is a flexible toolbox of physics and chemistry that allows us to

simulate how a nuclear power plant or another nuclear facility reacts during an accident that could potentially lead to the release of radioactive material into the environment. In my view, the code is central to enabling the innovation of nuclear energy in the U.S. and thus mitigating the worst outcomes from climate change."

Advancing the Safety Code for the Next Generation: Sandia and the NRC have worked together for decades to advance the understanding of system performance under accident conditions. This research covered areas such as accident progression, combustible gas generation and transport, molten core concrete interaction, fuel coolant interactions and many others. Starting in the 1980s, the NRC directed Sandia to consolidate these capabilities into one software package.

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The Melcor code can model a wide array of phenomena including severe accidents that can occur at a nuclear power plant, then estimate the extent of radioactive material release possible due to the accident. Work on the code began after the Three Mile Island accident in 1979. Currently, the computer code is used to inform the NRC's regulatory decision-making activities, including licensing reviews for new reactors, regarding the risks from very low-likelihood but high-impact accidents. In fact, Sandia's code was used to study the Fukushima accident and evaluate the risk-reduction potential of several safety improvements to U.S. nuclear reactors for the NRC, Luxat said.

There are many different types of next-generation nuclear reactors, each with their own performance attributes. Small modular reactors take up one-tenth of the area or less of current reactors, with lower initial investments, and could possibly be manufactured at one central location and moved to remote locations. As the industry develops new methods and technologies, however, existing capabilities must also advance, based on decades of foundational work. Some advanced designs, such as helium-cooled high-temperature reactors, can use more robust, graphite-pebble-based nuclear fuel. This approach requires adjustments to Melcor for modeling reactor geometry and the physics of the coolant.

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Since 2018, Luxat's team has expanded the severe accident code to tackle these differences, and more, to enable the evaluation of the risks of next-generation reactors and impacts to the fuel cycle in general. To expand the code capabilities, Larry Humphries, the lead code developer, has been working with experts at other Department of Energy labs to determine the critical phenomena for the reactor types. He then works to fit those phenomena into the existing physics-based code, determine what physical parameters are missing and fill in those knowledge gaps. ...

Demonstrating Risk-Assessment Readiness: To demonstrate that Melcor is ready to assist the NRC in reviewing new reactor designs, the team developed models of three published nuclear reactor designs. The three reactor designs were chosen to represent the diversity of next-generation reactors, including a microreactor

originally designed by Los Alamos National Laboratory, a high-temperature helium-cooled reactor, and a high-temperature molten-fluoride-cooled reactor, said K.C. Wagner, a Sandia nuclear engineer who has been leading the demonstration calculations.

The reactor models include everything from the radionuclides expected to be in the reactor vessel and the building that surrounds it to the coolant pipes and the physical properties of the fluid within, Wagner said. Then the team simulated a wide range of potential accidents. They analyzed what happens as time progressed to see how much, if any, fission products are released. The results of these simulations were presented at the public meetings to highlight the code's capabilities as the NRC works to establish its readiness to evaluate next-generation reactors.

This missile with nuclear warheads is claimed to be able to circle the Earth for months in patrol mode. On August 19, 2021, CNN reported that Russia might be preparing to test its latest nuclear-powered cruise missile Burevestnik, dubbed 'Skyfall' by the Americans.

However, it's not just the U.S. that will benefit from the extension of the nuclear safety code. "This best-estimate, severe-accident analysis code is used by maybe 1,000 people around the globe in about 30 countries," Wagner said. "Through the Cooperative Severe Accident Research Program, we are giving these folks access to a tool that they can also use to improve nuclear power plant safety world-wide."

Since the early 2000s, Melcor has been expanded and updated to support safety assessments for other kinds of nuclear facilities — including research reactors, reactors that produce medical isotopes and DOE facilities that work with radioactive material — and even fusion reactors, Luxat and Humphries said. ...The team is also working to restructure the safety code so that it will be easier to model new reactor designs and answer new safety questions, Humphries said. ...

Source: https://www.newswise.com/articles/extending-nuclear-power-accident-code-for-advanced-reactor-designs, 24 August 2021.

RUSSIA

Everything we Know about Russia's 'Skyfall' Missile

This missile with nuclear warheads is claimed to be able to circle the Earth for months in patrol mode. On August 19, 2021, CNN reported that Russia might be preparing to test its latest nuclear-powered cruise missile Burevestnik, dubbed 'Skyfall' by the Americans. Here's what we know about the project. 'Burevestnik' is a cruise missile powered by an integrated nuclear engine that was unveiled in 2018. "It has an atomic reactor that allows it to remain in the skies for months and even for years until time comes to change nuclear components. Its unpredictable flight routes make this missile an [extremely] effective weapon, because no foreign military will be able to predict the time it switches from patrolling to attacking," says Ivan Konovalov, military expert and the development director of the Foundation for the Promotion of Technologies of the 21st Century.

At the moment, there are no direct analogues of the weapon, but, in the foreseeable future, the Americans will create something similar, thinks Dmitry Safonov, the editor-in-chief of *Independent Military Review* magazine. The U.S. Government adopted the new $1.2 trillion nuclear arms modernisation program to catch up with Russia in nuclear weapon development.

The missile is capable of flying around the North Atlantic Ocean, around the Arctic or across Russia and back as long as needed. After getting the target's coordinates from the military command, the missile will fly there at hypersonic speed of 2,500 km/h. According to Konovalov, "Skyfall's firepower can be compared to the nuclear bombs that were dropped on Hiroshima and Nagasaki. "I don't think the missile will be patrolling over the Russian territories all the time, but it will be taken to the skies on alert and used as a means of nuclear deterrence," adds

Konovalov. According to him, 'Skyfall' will have an atomic warhead and will be used alongside other nuclear triad weapons.

Foreign Analogues: At the moment, there are no direct analogues of the weapon, but, in the foreseeable future, the Americans will create something similar, thinks Dmitry Safonov, the editor-in-chief of *Independent Military Review* magazine. The U.S. Government adopted the new $1.2 trillion nuclear arms modernisation program to catch up with Russia in nuclear weapon development. According to him, Russia began modernising its nuclear arsenals ten years ago and, therefore, is already reaping the fruit from this work.

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"We invested $150 billion (ten times less than the new U.S. program) into the development of new era nuclear means of deterrence. The Americans didn't take our plans and scientists seriously ten years ago and now they have to catch up with us in these technologies. By the time [they come up with their analogues], we will already finish testing the weapons and will adopt them to the military," says Safonov. Currently, Russia has a range of modernized nuclear weapon systems: an unmanned underwater nuclear drone Poseidon that can "sleep" at the bottom of an ocean, new 'Sarmat' and 'Avangard' intercontinental ballistic missiles, together with the 'Burevestnik' (or 'Skyfall') nuclear-powered cruise missile. "Russian military command expects that the Americans will present their analogues of our technologies in the coming years. We don't underestimate their scientists, technologies and military potential. They will very soon catch up with us and show what their military industrial complex is capable of," suggests Safonov. Among the latest American technologies he named the orbital project X-37 - a plane that will be able to conduct operations in near space.

Currently, Russia has a range of modernized nuclear weapon systems: an unmanned underwater nuclear drone Poseidon that can "sleep" at the bottom of an ocean, new 'Sarmat' and 'Avangard' intercontinental ballistic missiles, together with the 'Burevestnik' (or 'Skyfall') nuclear-powered cruise missile.

Source: https://www.rbth.com/science-and-tech/334123-everything-known-about-skyfall, 21 August 2021.

USA

Pentagon Poised to Unveil, Demonstrate Classified Space Weapon

For months, top officials at the Defense Department have been working toward declassifying the existence of a secret space weapon program and providing a real-world demonstration of its capabilities, Breaking Defense has learned. The effort — which sources say is being championed by Gen. John Hyten, the vice-chairman of the joint chiefs of staff — is close enough to completion that there was a belief the anti-satellite technology might have been revealed at this year's National Space Symposium, which kicks off last week of August 2021. However, the crisis in Afghanistan appears to have put that on hold for now. Pulling the trigger on declassifying such a sensitive technology requires concurrence of the Director of National Intelligence, Avril Haines, and a thumbs up from President Joe Biden, sources explain; with all arms of the national security apparatus pointed towards Kabul, that is almost certainly not going to happen next week. And until POTUS says yes, nothing is for certain, of course.

The system in question long has been cloaked in the blackest of black secrecy veils — developed as a so-called Special Access Program known only to a very few, very senior US government leaders.

While exactly what capability could be unveiled is unclear, insiders say the reveal is likely to include a real-world demonstration of an active defense capability to degrade or destroy a target satellite and/or spacecraft. At least, that is what has been on the table since last year — when officials in the Trump administration viewed revealing the technology as a capstone to the creation of Space Command and Space Force. The plan apparently had been to announce it at the 2020 Space Symposium, which was cancelled due to the COVID-19 pandemic; the arrival of the Biden administration also led to a reevaluation of moving forward with the reveal.

Expert speculation on what could be used for the demonstration ranges from a terrestrially-based mobile laser used for blinding adversary reconnaissance sats to on-board, proximity triggered radio-frequency jammers on certain military satellites, to a high-powered microwave system that can zap electronics carried on maneuverable bodyguard satellites. However, experts and former officials interviewed by Breaking Defense say it probably does not involve a ground-based kinetic interceptor, a capability the US already demonstrated in the 2008 Burnt Frost satellite shoot-down.

Many military space leaders believe that Space Force and Space Command must publicly demonstrate to Moscow and Beijing not just an ability to take out any space-based counterspace systems they may be developing or deploying, but also to attack the satellites they, like the US, rely upon for communications, positioning, navigation and timing (PNT), and ISR.

Requests for comment to the offices of Hyten, Haines, and SPACECOM were not returned by deadline. Many military space leaders believe that Space Force and Space Command must publicly demonstrate to Moscow and Beijing not just an ability to take out any space-based counterspace systems they may be developing or deploying, but also to attack the satellites they, like the US, rely upon for communications, positioning, navigation and timing (PNT), and ISR.

Notably, the second-in-command of the Space Force recently foreshadowed movement in the long-running debate about declassification of all things related to national security space — a multifaceted and complex debate which has pitted advocates against upholders of the traditional culture of secrecy within DoD and the Intelligence Community. "It is absolutely a true problem," Gen. DT Thompson, deputy Space Force commander, responded to a question about over-classification during a July 28 Mitchell Institute event. ...

The Transparency Dilemma: In fact, Thompson's comments represented only one of several comments, quietly dropped in speeches or interviews, from top military space officials pushing for declassification of high-end systems, following several years of a steadily intensifying drumbeat on the issue. A who's-who list of top officers, DoD civilian leaders, and key members of Congress have for years been arguing that over-classification is harming the ability to convey the growing threat of foreign counterspace to lawmakers, the public and allied/partner nations — as well as the ability to cooperate with industry and foreign partners to mitigate those threats.

Sources say that Hyten remains the biggest proponent of a new, declassified demonstration of counterspace capabilities. (And for this reason, there is some rationale to speculate that any announcement would come before he retires in November.) For years, Hyten has argued that it is impossible to deter adversaries with invisible weapons, and he has taken the lead in calling for space systems to be declassified at a more rapid pace than some traditionalists find comfortable. "In space, we over-classify everything," Hyten told the National Security Space Association (NSSA) on Jan. 22. "Deterrence does not happen in the classified world. Deterrence does not happen in the black; deterrence happens in the white." Further, Hyten, Chief of Space Operations Gen. Jay Raymond, and Space Command Commander Gen. Jim Dickinson all have asserted that offensive space weapons are a necessary part of that deterrent.

There is also precedent for using conferences to unveil black programs. In 2014, Gen. William Shelton, the then-head of Air Force Space Command, casually unveiled the existence of the Geosynchronous Space Situational Awareness Program (GSSAP) satellites in the middle of a presentation. But while there is broad consensus among DoD space leadership on the need for declassification, there is fierce debate about what actually should be brought out from behind the onyx curtain of mega-secrecy (in Air Force slang, often called "The Green Door".)" The National Reconnaissance Office, for example, has long been loath to reveal much of anything about its spy satellites — with officials even attempting to slow-roll a 2018 Hyten policy lifting restrictions on access to basic orbital data about national security satellites.

Strategists and policy-makers must be careful in attempting to map space deterrence to traditional Cold War nuclear deterrence. While there are some similarities — and importantly some strong linkages between nuclear stability and the use of space — there are too many differences, not the least of which is the fact that losing a few satellites is not parallel to losing a few cities.

The central dilemma isn't hard to understand, but the devil is in the details of solving it. ... There are also a number of experts who believe that whatever decisions are made, the march of technology guarantees there soon will be no possible way to keep US satellites, or actions on the ground, secret. ...

Deterrence — It's Complicated: To be fair to decision-makers, there have been countless studies, essays and books written about deterrence theory, including about space deterrence, and there are just as many opinions as there are authors. There is a general consensus among Western experts that strategists and policy-makers must be careful in attempting to map space deterrence to traditional Cold War nuclear deterrence. While there are some similarities — and importantly some strong linkages between nuclear stability and the use of space — there are too many differences, not the least of which is the fact that losing a few satellites is not parallel to losing a few cities.

The second area of general consensus is that deterring adversaries from attacking US space systems (military and commercial) will depend on the adversary. China is not Russia, or even the Soviet Union. Furthermore, because of economic entanglements, US relations with China are way more complicated than they ever were with the USSR.

A third and final point of agreement: space deterrence in particular is hard, and will require an entire tool box ranging from multi-domain military capabilities, to diplomatic actions such as signaling and building international consensus about threatening activities, to economic levers such as punitive sanctions. Choosing what tools to use when, however, is where agreement breaks down.

Space deterrence in particular is hard, and will require an entire tool box ranging from multi-domain military capabilities, to diplomatic actions such as signaling and building international consensus about threatening activities, to economic levers such as punitive sanctions. Choosing what tools to use when, however, is where agreement breaks down.

This is particularly true with regard to China, which up to now has not had as great a military reliance on space as the US — and more importantly does not have a strategic view shaped by Cold War superpower nuclear deterrence theory (i.e. "mutually assured destruction.") Following Beijing's 2007 ASAT test, there have been oodles of studies inside and outside DoD specifically on deterring China in space, many of which come to the same conclusion, if not always the same solutions: it's hard.

For example, RAND's recent "Tailoring Deterrence for China in Space" has snagged a lot of DoD

eyeballs. It highlights the obstacles to success, and argues that DoD might need a "demonstration of capabilities (emphasis ours) that would compromise the PLA's space systems, perhaps through enhanced U.S. cyber hacking, spoofing, jamming or other dazzling capabilities against China, but could also include kinetic options as well." But, it warns, any such Space Force activities must be "carefully calibrated."

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A 2008 Council on Foreign Relations report, "China, Space Weapons and U.S. Security," based on meetings of an advisory board that included active and former DoD and IC officials plus think tank experts (including this author), came to essentially the same conclusions as RAND regarding the difficulties involved. It, too, recommended deployment of offensive ASAT weapons, but limited to non-kinetic systems with reversible effects — and coupling this with robust diplomatic initiatives to set norms and/or establish a treaty to ban debris-creating ASATs.

In Burnt Frost, DoD took down a failed satellite that was tumbling back to Earth, using a modified Standard Missile-3 interceptor. The George W. Bush administration argued at the time that the move was necessary to avoid the potential spread of toxic rocket fuel, convincing almost no one.

The USS Lake Erie (CG 70) launches a Standard Missile-3 at a non-functioning National Reconnaissance Office satellite as it traveled in space at more than 17,000 mph over the Pacific Ocean on Feb. 20, 2008. The objective was to rupture the satellite's fuel tank to dissipate the approximately 1,000 pounds (453 kg) of hydrazine, a hazardous material which could pose a danger to people on earth, before it entered into earth's atmosphere. The USS Lake Erie is an Aegis guided missile cruiser. USS Decatur (DDG 73) and USS Russell (DDG 59) were also part of the task force. DoD photo by U.S. Navy. (Released) The USS Lake Erie (CG 70) launches a Standard Missile-3 at a non-functioning National Reconnaissance Office satellite as it traveled in space at more than 17,000 mph over the Pacific Ocean on Feb. 20, 2008.

Active Messaging: The US military tends to focus on two distinct types of deterrence, including in the space domain: reducing the vulnerability of US capabilities (i.e. building resilience/ reconstitution/passive protections) and punitive military responses via offensive strikes. In the blurry middle between those two is "active defense." The key Joint Publication outlining milspace operations, JP 3-14 Space Operations (updated in October 2020), defines active and passive "space defense" (not to be confused with plain old active and passive defense as elsewhere, and differently, defined in the "DoD Dictionary of Military and Associated Terms".) It says: Active space defense consists of actions taken to neutralize imminent space control threats to friendly space forces and space capabilities. ...

And the terminology used by the US in declassifying a weapon will matter, because it affects the messaging, and how that message is received by the US public, allies/partners, and the broader international community. Indeed, these distinctions are often deliberately muddied by space weapons advocates out of concerns about US public perception, which to this day remains largely leery of space weaponization. For example, one expert worried about the declassification plan's potential negative ramifications for US efforts to set global norms of behavior for space — especially if there is an accompanying demonstration of capability akin to 2008's Burnt Frost. (Ironically, DoD just last month issued its first-ever policy on space norms.)

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of toxic rocket fuel, convincing almost no one. Instead, the shoot-down spurred criticism inside and outside the US, including in allied nations, with observers perceiving it as a direct response to China's ASAT test the year before. Critics argued that it was at best was an unnecessary demonstration US ASAT capability that until then was known but implicit; and at worst provocative, confirming long-standing allegations by Beijing (and Moscow) that US missile defenses were also designed as ASATs. ...

Source: https://breaking defense.com/2021/08/ pentagon-posed-to-unveil-classified-space-weapon/, 20 August 2021.

NUCLEAR ENERGY

CANADA

Nuclear Energy/ is what/ Canada Needs/ to Win the/ Energy Transition

In the fight against climate change, all Canadians will benefit from the increasing global recognition that nuclear power generation is key to achieving net-zero carbon emission goals. As a proven, reliable source of electricity generation that is carbon-free, nuclear energy is a game-changer in the fight against climate change. And, nuclear energy could play an important role in Canada's post-Covid economic recovery. Meeting Canadian and international emissions targets will require a diverse portfolio of solutions. Critically, nuclear energy must be in the decarbonization mix. The OECD International Energy Agency estimates in its Net Zero by 2050 report that nuclear power output will need to increase 40 per cent by 2030 and double by mid-century.

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There has been no new nuclear power plant construction in Canada since the 1990s, and, since then, innovation has transformed the technology. New nuclear reactor designs are smaller and modular, lowering capital costs and speeding up installation. The latest SMRs can provide grid-scale power generation, replace diesel as a distributed power source in remote communities or be used in industry. As much as Canadians want their electricity to be carbon-free, they want it to be safe and reliable. Today, nuclear plants have automatic shut-off safety features, and they are protected by multiple backup safety systems. Generations of Canadians have come to safely rely on nuclear energy, the only source of carbon-free electricity generation that is available 24/7, 365 days a year.

SMR technology has the potential to deliver energy across Canada with that same level of certainty. Companies like GE Hitachi Nuclear Energy (GEH) are already through the steep learning curve associated with designing, licensing and deploying nuclear reactor technologies. GEH has decades of experience and more than 90 per cent of its SMR design components have been tested and proven in operating nuclear reactors. Because SMRs are designed to produce reliable, carbon-free electricity 24/7, they can complement intermittent or variable sources of electricity, such as solar and wind technologies. Together, nuclear energy alongside wind, solar, and other sources of electricity generation form a balanced mix that can move Canada toward a carbon-free energy future.

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Canada has the building blocks to develop a world-class supply chain for SMR technology: multi-level government support, world-class universities, an established nuclear power industry and a skilled workforce. Canada is leading on SMR development. The federal government has released a roadmap and action plan for SMR technology development, and the provinces of

Ontario, New Brunswick, Saskatchewan and Alberta recently committed to work together on SMR deployment. Canada's first grid-scale SMR—among the first in the world—is slated to be in operation at the Ontario Power Generation (OPG) Darlington site as early as 2028. Ontario Power Generation (OPG), Bruce Power (BP), and New Brunswick Power (NB Power) have decades of experience operating nuclear reactors. Ontario-based engineering, procurement, and construction firms such as Aecon and Hatch have robust capabilities to design and build nuclear power plants. Ontario Tech, Durham College, McMaster University, the University of Saskatchewan and more are helping develop the nuclear workforce of the future.

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In addition to helping achieve energy reliability and carbon-free emissions goals, the deployment of SMRs can act as an engine for job creation and economic growth in Canada. In an independent report (commissioned by GEH), PwC estimates that the deployment of a single SMR at OPG's Darlington site could create more than 1,700 highly skilled jobs during seven years of manufacturing and construction, nearly 200 jobs sustained over a 60-year period of operation, and $2.3 billion in total GDP. Each subsequent SMR deployed in Canada – whether it be in Ontario or another province – is expected to create more than $1.1 billion in GDP.

The federal government, in its SMR Action Plan, estimates the global SMR market will be worth $150 billion per year by 2040. PwC estimates each SMR deployed globally will generate approximately $98 million in GDP for Canada and more than $45 million in total tax revenue through the purchase of nuclear fuel, machinery, and equipment.

While Ontario and Canada are poised to support the development and deployment of SMRs on a provincial and national level, the bigger opportunity is for Canada to support the energy transition to safe, reliable, carbon-free nuclear power generation around the world. With Canada's world-class nuclear operating expertise and infrastructure project experience, Canada is well-positioned to become a global leader in the deployment of carbon-free energy technology. The federal government, in its SMR Action Plan, estimates the global SMR market will be worth $150 billion per year by 2040. PwC estimates each SMR deployed globally will generate approximately $98 million in GDP for Canada and more than $45 million in total tax revenue through the purchase of nuclear fuel, machinery, and equipment.

Canada can seize this global SMR opportunity by working together with companies like GE that know how to scale energy technology innovation for deployment globally: GE technology generates 30 per cent of the world's power. As just one example, our LM Wind facility in Gaspe, Quebec exports wind turbine components around the world. If Canada seizes this opportunity, SMRs could play a key role in reinvigorating Canada's post-Covid manufacturing economy as the world works toward meeting its goal of zero-carbon emission electricity. Climate change is an urgent global priority, and nuclear energy will play a major role in helping Canada—and the rest of the world—reach its net-zero carbon emissions goals. Provincial and federal stakeholders are working to harness Canada's capabilities to deploy SMRs at home and deliver jobs and economic benefits for generations of Canadians. Canada is on the brink of becoming a global leader in the energy transition.

Source: https://www. qpbriefing. com/2021/08/25/sc-nuclear-energy% E2%80%AFis-what%E2%80%AFcanada-needs%E2%80%AFto-win-the%E2%80%AFenergy-transition/, 25 August 2021.

USA

US Lab Stands on Threshold of Key Nuclear Fusion Goal

A US science institute is on the verge of achieving a longstanding goal in nuclear fusion research.

The National Ignition Facility uses a powerful laser to heat and compress hydrogen fuel, initiating fusion. An experiment suggests the goal of "ignition", where the energy released by fusion exceeds that delivered by the laser, is now within touching distance. Harnessing fusion, the process that powers the Sun, could provide a limitless, clean energy source. In a process called inertial confinement fusion, 192 beams from NIF's laser - the highest-energy example in the world - are directed towards a peppercorn-sized capsule containing deuterium and tritium, which are different forms of the element hydrogen. This compresses the fuel to 100 times the density of lead and heats it to 100 million degrees Celsius - hotter than the centre of the Sun. These conditions help kickstart thermonuclear fusion.

NIF scientists also believe they have now achieved something called "burning plasma", where the fusion reactions themselves provide the heat for more fusion. This is vital for making the process self-sustaining.

An experiment carried out on 8 August yielded 1.35 megajoules (MJ) of energy - around 70% of the laser energy delivered to the fuel capsule. Reaching ignition means getting a fusion yield that's greater than the 1.9 MJ put in by the laser. "This is a huge advance for fusion and for the entire fusion community," Debbie Callahan, a physicist at the Lawrence Livermore National Laboratory, which hosts NIF, told BBC News.

NIF is one of several projects around the world geared towards advancing fusion research. They include the multi-billion-euro Iter facility, currently under construction in Cadarache, France. Iter will take a different approach to the laser-driven fusion at NIF; the facility in southern France will use magnetic fields to contain hot plasma - electrically-charged gas. This concept is known as magnetic confinement fusion (MCF).

As a measure of progress, the yield from this month's experiment is eight times NIF's previous record, established in Spring 2021, and 25 times the yield from experiments carried out in 2018. "The pace of improvement in energy output has been rapid, suggesting we may soon reach more energy milestones, such as exceeding the energy input from the lasers used to kick-start the process," said Prof Jeremy Chittenden, co-director of the Centre for Inertial Fusion Studies at Imperial College London.

NIF scientists also believe they have now achieved something called "burning plasma", where the fusion reactions themselves provide the heat for more fusion. This is vital for making the process self-sustaining. "Self-sustaining burn is essential to getting high yield," Dr Callahan explained. "The burn wave has to propagate into the high density fuel in order to get a lot of fusion energy out. "We believe this experiment is in this regime, although we are still doing analysis and simulations to be sure that we understand the result." As a next step, Dr Callahan said the experiments would be repeated. ...Existing nuclear energy relies on a process called fission, where a heavy chemical element is split to produce lighter ones. Fusion works by combining two light elements to make a heavier one.

Construction on the National Ignition Facility began in 1997 and was complete by 2009. The first experiments to test the laser's power began in October 2010. NIF's other function is to help ensure the safety and reliability of America's nuclear weapons stockpile. At times, scientists who want to use the huge laser for fusion have had their time squeezed by experiments geared towards national security.

But in 2013, the BBC reported that during experiments at NIF, the amount of energy released through fusion had exceeded the amount of energy absorbed by the fuel - a breakthrough and a first for any fusion facility in the world. Results from these tests were later published in the journal Nature. NIF is one of several projects around the world geared towards advancing fusion research. They include the multi-billion-euro Iter facility, currently under construction in Cadarache, France. Iter will take a different approach to the laser-driven fusion at NIF; the facility in southern France will use

magnetic fields to contain hot plasma - electrically-charged gas. This concept is known as magnetic confinement fusion (MCF). But building commercially viable fusion facilities that can provide energy to the grid will require another giant leap. ...

Source: https://www.bbc. com/news/science-environment-58252784, 18 August 2021.

Biden Urged to Take 'Emergency' Measures to Save Nuclear Plants

Illinois congressman Adam Kinzinger has called on President Joe Biden to consider the use of emergency powers to keep the Byron and Dresden nuclear power plants in operation, at least until the enactment of new state or federal laws to ensure a "level playing field" for such plants. Separately, Exelon said its Illinois nuclear fleet, including Byron and Dresden, operated at full power levels during the hottest July on record.

Exelon's Illinois nuclear fleet operated at full power levels during the hottest July in at least 142 years, the company said yesterday. Illinois grid operators issued several hot weather alerts calling for maximum electricity generation during the period.

I write to you with an urgent request to take extraordinary measures - to maintain the continuity of operations for these plants," Kinzinger said in a 23 August letter to the president which was also copied to top administration officials. He goes on to urge the President "or your delegates" to cite "new or existing emergencies" through which statutory authorities may be used to compel the continued operation of the two plants. The Defense Production Act and the Federal Power Act both provide emergency powers to compel certain actions of energy providers, he said, and the administration could use either of these statutes.

In a statement released after the letter was sent, Kinzinger said an "astonishing" failure of leadership at the state level had made the closures of Byron and Dresden imminent. Despite the fact that Congress is "poised to pass" bipartisan legislation - the Preserving Existing Nuclear Energy Generation Act - which would provide a financial credit programme, such legislation would be unlikely to be able to help Byron or Dresden as they are slated to close in the coming weeks, he added.

"As laid out in my letter to the President, there are existing legal authorities for the Biden Administration to save these plants from closure. Therefore, I'm making an urgent plea that they employ these powers to keep our plants online. There are plenty of reasons why this is beneficial: for energy independence and resilience, preservation of sufficient non-emitting baseload power, climate preservation, public health, national defence and security, etc. We cannot turn a blind eye to this problem any longer; we have to save our nuclear plants," Kinzinger said. "If Springfield lacks the will to save these plants, and if Congress cannot act quickly enough, then it's time for the President to step in and consider every possible action to support nuclear power in favour of our collective security - including the security of energy resources, the climate, the economy, and the nation."

Exelon in 2019 said it would retire the two-unit Byron and Dresden plants this year due to low energy prices and market policies giving fossil fuel plants an unfair competitive advantage, unless state policy reforms to support their continued operation were passed. A package of clean energy legislation that would have achieved this stalled in the last session of the Illinois legislature due to contentions over measures unrelated to the preservation of the nuclear plants. Byron is currently scheduled to shut down in September and Dresden in November. A group of Illinois lawmakers earlier this month called for the state's General Assembly to return as soon as possible to pass the legislation that would keep the nuclear plants online. The Assembly is now set to return for a special session on 31 August, although according to Senator Sue Rezin - one of those campaigning for a vote - energy legislation is not on the agenda.

Reliability: Exelon's Illinois nuclear fleet operated at full power levels during the hottest July in at

least 142 years, the company said yesterday. Illinois grid operators issued several hot weather alerts calling for maximum electricity generation during the period. ...Illinois' nuclear fleet produces more than half of the state's electricity and includes the Braidwood, Byron, Clinton, Dresden, LaSalle and Quad Cities plants. Exelon has previously said the Braidwood and LaSalle nuclear plants are also at high risk of premature retirement in the near term.

for yet another year, global primary production is expected to be over 5,000 tU lower than was previously anticipated." "However, in a world that is expanding its use of nuclear power, we would much rather be seeing a market that is demanding more uranium supply.

Source: https://world-nuclear-news.org/Articles/Biden-urged-to-take-emergency-measures-to-save-nuc, 25 August 2021.

URANIUM PRODUCTION

GENERAL

Global Uranium Production to Remain Constrained, Kazatomprom Says

Even though the world is expanding nuclear power use, global uranium supply will continue to be lower than expected as NAC Kazatomprom JSC recently extended production cuts for an additional year, to 2023. Here's what the world's largest uranium producer, which reported first half results, had to say:

Companies, including Kazatomprom, are now moving to do more in publicizing and reiterating the opportunity for nuclear energy to play a role in addressing climate change, managing pollution and waste in the atmosphere, on land and in waterways, and improving and deploying clean technology.

On Uranium Market: "The impact of COVID continued to be felt across the industry, and though near term supply continued to decrease, market sentiment has remained cautious." Accordingly, after the end of the second quarter, we announced that we are extending the 20% reduction of our production against subsoil use agreements for an additional year, through 2023. This means that for yet another year, global primary production is expected to be over 5,000 tU lower than was previously anticipated." "However, in a world that is expanding its use of nuclear power, we would much rather be seeing a market that is demanding more uranium supply."

On Nuclear Power Generation: "Thankfully, we are starting to hear more thoughtful conversations about nuclear power, with knowledgeable experts being given a voice to increase both formal and informal public discussions about nuclear's role in addressing the climate challenges." "Kazatomprom is working to support broader acceptance of nuclear power as a key component of greener international strategies, and while doing so, we remain committed to prioritizing long-term value and continuing to exercise discipline in our market activities." "Companies, including Kazatomprom, are now moving to do more in publicizing and reiterating the opportunity for nuclear energy to play a role in addressing climate change, managing pollution and waste in the atmosphere, on land and in waterways, and improving and deploying clean technology."

Source: https://www.marketwatch. com/story/global-uranium-production-to-remain-constrained-kazatomprom-says-commodity-comment-271629966172, 26 August 2021.

NIGER

Niger Government Expresses Support for Uranium Project

Toronto-based Global Atomic is to set up a 90%-owned Niger mining subsidiary after the Government of Niger formally confirmed it will not increase its ownership stake in the Dasa project beyond the legally mandated 10% minimum. The company plans to bring the project into full production by the end of 2024. Niger's Minister of Mines Hadizatou Ousseini Yacouba expressed

the government's confidence in the company to bring the mine into production and to deliver direct benefits to the country, through taxes, royalties and the government's 10% ownership interest and indirect benefits through employment and in-country procurement of mine supplies and services. She also noted the company's "exemplary" record on environmental, social and governance issues and pledged the government's full support for the Dasa project, Global Atomic said.

The Dasa project is a high-grade uranium deposit that lies within the Adrar Emoles III licence area, 105 km south of the established uranium mining town of Arlit, in Niger. It has indicated resources of 101.6 million pounds U3O8 (39,080 tU) at a 1752 ppm cut-off and inferred resources at 87.6 million pounds U3O8 at 1781 ppm, according to an NI 43-101 technical report published in July 2019. The project is fully permitted for commercial production.

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A preliminary economic assessment issued in April 2020 envisages the development of an underground mine and a mill with a 360,000 tonnes per year capacity to produce 4-5 million pounds U3O8 per year. Lower grade resources would be extracted in subsequent phases. In June, Global Atomic said it is advancing negotiations with Orano Mining relating to direct shipments of ore from Dasa to Orano's Somaïr uranium processing plant following successful testing of Dasa ore to confirm blending characteristics. A drilling programme planned to begin in September 2021 will focus on upgrading indicated and inferred mineral resources to measured and indicated categories. Groundbreaking for the box cut and mine portal is to begin in the first quarter of 2022. "We plan to bring the 12-year Phase I of the Dasa Project into full production by the end of 2024 and add subsequent phases to extend the life of the mine for many decades," Roman said.

Source: https://www.world-nuclear-news.org/Articles/Niger-government-expresses-support-for-uranium-pro, 26 August 2021.

NUCLEAR COOPERATION

CANADA–INDIA

The Need for a Canada-India Energy Pact

The decision by newly-elected US President Biden to cancel the Keystone XL pipeline was still a shock when it was finally announced. An election promise for months, it is now finally reality. As sure as the US is our next-door neighbour, so too we face a familiar problem—how to get Canadian oil to the world market. The US administration's focus on environment and climate change is unlikely to mellow down or deviate over the next four years. It is, therefore, time Canada shifts its focus from our largest trading partner to partnering with the largest democracy.

Canada has the third-largest reserves of uranium and oil in the world. India is the world's third-largest energy consumer, and its need for energy continues to climb. The International Energy Agency (IEA) in its latest outlook for India states that it will account for a quarter of global energy demand by 2040, and will overtake the EU as the world's third-biggest energy consumer by 2030.

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biggest energy consumer by 2030. This growth in demand will consist mainly of fossil fuels with India's reliance on overseas oil increasing to 92 per cent by 2040. India is well aware of the need for increased energy sources and the impact of climate change. That is why India is building infrastructure to boost use of LNG and is aiming to generate more than half of its electricity consumption using solar energy. India is on the hunt for strong, stable, energy supplies while Canada needs a reliable consumer. Whether oil or uranium, or both, India has plenty of hunger for energy. The world's two largest democracies have what the other needs. Despite being a fellow democracy with shared characteristics, it is not our top market. Why?

Canada and India started cooperating on energy, especially nuclear, soon after the end of the Second World War. India bought the CANDU reactor from Canada and started building nuclear reactors to generate electricity. Facing two hostile nuclear weapons-armed neighbours, India used plutonium produced in the Canadian reactor for a nuclear test in 1974. The Canadian foreign establishment is still sore about it, even though the agreement did not forbid the nuclear test that India carried out. Nuclear cooperation picked up only after a bilateral agreement in 2013.

Coal and petroleum supply nearly three-quarters of India's total energy consumption, with the rest supplied by traditional biomass and waste. With 300 million Indians living without access to power and energy consumption projected to double over the long term, the transformative impacts are huge. Indian Prime Minister Modi has committed to continue "efforts to fight climate change" even though India with 18 percent of the world's population uses only 6 percent of the world's primary energy. Two key drivers of India's energy map are an acceleration to "move towards a gas-based economy" and a push for cleaner use of fossil fuels. Simply put, India presents a clear and continuing opportunity for Canada when it comes to energy—an immediate friend, and a long-term partner.

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As a uranium producer and exporter, Canada has much to gain by exporting to India. India has demonstrated responsibility and maturity given its geo-political situation and security concerns when it comes to nuclear power. With a huge swath of the rural population to be connected to the electricity grid, India represents a huge market for Small Modular Reactors (SMRs), an area where Ontario, New Brunswick, Saskatchewan, and Alberta are collaborating. India is going to take decades to transition to green energy. Canada can easily step in and provide the crude oil and natural gas that it is going to need until then. With nearly half of India's energy consumption coming from coal, there is a strong environmental case to be made for India and the world. India is already a leader in solar energy generation and has focused on renewables, another area for collaboration.

Canada exports only 0.2 percent of its oil to India. Alberta—home to Canada's oil patch—is not sitting idle. Since 2018, Alberta Premier Jason Kenney has been pushing for the Canada-India oil trade. Alberta's Canadian Energy Centre noted that India will import two million barrels per month from Canada to replace supplies from Venezuela. India plans to increase the share of natural gas in its total energy mix from the current six percent to 15 percent by 2030. As the world's fifth-largest producer of natural gas, Canada cannot afford to ignore this key market. Note that the Climate Action Tracker rates India as a "global leader" on climate change, while Canada's climate commitments are rated as "insufficient". India is the founder of the International Solar Alliance (ISA), which aims to mobilise investments of US $1 trillion by 2030. Canada aims for clean

technology to be one of Canada's top five exporting industries, with CAD 20 billion annually in exports by 2025. All those exports have to go somewhere! India is a large enough market that can absorb virtually all of Canada's exports.

An aggressive energy pact with India will create new jobs in Canada and secure markets for Canadian resources for decades. It will show that Canada stands up for democracy, and that democracy and markets can and do go hand-in-hand. If Canada and the US can be great trade partners, there is no reasonable excuse for why a similar relationship cannot exist between Canada and India.

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The oil and natural gas sector directly and indirectly supported over half a million jobs across Canada (2017). Supporting the creation or continuation of more than 500,000 jobs for decades to come is going to have strong ripple effects even electorally. In fact, it could help current Prime Minister Justin Trudeau win votes in ridings that have not been traditionally Liberal, and also in the broader Indo-Canadian community. Sounds glib, but in the end, everyone wins—the environment, Canada, India, the market, and democracy. Coming back to where we began, US President Biden is clear about what he intends to do over the next four years. We can continue waiting and hoping that the US grants permission to the pipeline, or we can start working on building a relationship with a reliable trading partner and market.

Source: https://www.orfonline.org/expert-speak/the-need-for-a-canada-india-energy-pact/, 18 August 2021.

NUCLEAR PROLIFERATION

GENERAL

Pandemic Progress Proves the World can Stop Nuclear Proliferation

As the world begins its gradual recovery from the coronavirus pandemic, we are reminded what humanity can accomplish when motivated by a common purpose—and extreme circumstances. Through the tireless efforts of scientists, health professionals, policymakers, and countless more, we will turn the tide of the pandemic.

Thirty years ago, the world faced another existential threat: the collapse of the Soviet Union and the fate of its many thousands of nuclear weapons. Just one of these devices—if it ever fell into the wrong hands—could decimate an entire city. As each of the former Soviet republics charted its own path to independence, questions emerged over the security of the USSR nuclear stockpile. Together, world leaders, non-proliferation experts, international bodies, and old adversaries joined hands to secure or dismantle the orphaned arsenal. To the surprise of many, the collapse of the Soviet Union was relatively bloodless, and to the relief of all, no nuclear weapons were detonated or fell into wrong hands.

The people of Kazakhstan deserve credit for their role in post-Soviet nuclear disarmament, as well as their current efforts in non-proliferation. Our first step towards this goal was the closure of the infamous Semipalatinsk nuclear test site in 1991. It was here that the Soviet Union had conducted 456 nuclear tests for more than four decades, which exposed up to 1.5 million people living around the site to nuclear fallout and caused huge damage to the environment.

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456 nuclear tests for more than four decades, which exposed up to 1.5 million people living around the site to nuclear fallout and caused huge damage to the environment.

Just four years later in 1995, Kazakhstan completed its voluntary renunciation of the world's fourth most powerful nuclear missile arsenal, which it had inherited after the USSR's breakup. This deadly legacy then surpassed the nuclear forces of France, Great Britain, and China combined. Indeed, we decided to rid the country of these weapons, believing that the world would be a safer place without them. In cooperation with Russia and the United States, we removed all the warheads and dismantled their infrastructure.

Kazakhstan sees the imperative of promoting confidence-building measures between nation-states—especially vis-à-vis nuclear weapons—as it did in using its non-permanent seat on the UN Security Council in 2017-2018. We appeal to reinvigorate political dialogue and negotiations on nuclear weapons.

Yet the specter of nuclear destruction persists—Pandora's box opened in 1945. The present expansion of nuclear weapons is alarming in both size and diversity. New technologies—from warhead miniaturization to hypersonic missiles—are changing the way states think about nuclear war. Once a tool for global deterrence between superpowers, nuclear weapons are now viewed as tactical or regional assets. This is a dangerous mindset that is unfortunately shared by part of the world's military planners. Thus, Kazakhstan sees the imperative of promoting confidence-building measures between nation-states—especially vis-à-vis nuclear weapons—as it did in using its non-permanent seat on the UN Security Council in 2017-2018. We appeal to reinvigorate political dialogue and negotiations on nuclear weapons.

As the global energy transition unfolds, demand for clean and affordable baseload power is increasing. A significant recent achievement on this path was the establishment of the IAEA's Low-Enriched Uranium Bank in Kazakhstan. Its main purpose is to provide countries with a secured stockpile of nuclear fuel in case of disruption of commercial supplies.

On August 29, the thirtieth anniversary of the closure of the Semipalatinsk nuclear test site, the world marks the International Day Against Nuclear Tests, designated by the UN General Assembly in December 2009 at our initiative. It is an occasion to remind the world that we need to consider concrete steps to advance global nuclear disarmament and non-proliferation efforts. First, it is necessary to establish and expand nuclear-weapon-free zones in as many regions as possible. In 2009, Kazakhstan, together with its neighbors, created a nuclear-weapon-free zone in Central Asia, the first located entirely in the northern hemisphere. In this context, it is of the utmost importance for the international community to explore all the opportunities to preserve the nuclear deal with Iran, reached in 2015 with the modest contribution of Kazakhstan, which hosted two rounds of talks.

Second, the Treaty on the Prohibition of Nuclear Weapons, the first multilateral and legally binding agreement to ban their development, stockpiling and use, entered into force earlier this year. The treaty, supported by 122 states, strengthens collective hope for a world free of nuclear weapons by the UN's Centennial in 2045.

Third, we must also end nuclear weapons testing once and for all. This can only happen through signature, full ratification, and compliance of the CTBT by the remaining eight states on whose action its entry into force depends. Without their unanimous support, the treaty is totally undermined.

Finally, the world should continue to advance the peaceful use of nuclear energy. As the global energy transition unfolds, demand for clean and affordable baseload power is increasing. A significant recent achievement on this path was

the establishment of the IAEA's Low-Enriched Uranium Bank in Kazakhstan. Its main purpose is to provide countries with a secured stockpile of nuclear fuel in case of disruption of commercial supplies.

We in Kazakhstan are under no illusion that it is unrealistic to call upon nuclear powers to give up all their weapons immediately due to the Mutually Assured Destruction thinking. Nevertheless, as a starting point, all efforts should be made to substantially reduce the still massive global stockpile. The recent decision by the United States and Russian Federation to extend the New START Treaty, which augurs well for future agreements, is welcome. The U.S.-Russia Presidential Joint Statement on Strategic Stability, following the presidential summit in Geneva, unequivocally reaffirmed that "a nuclear war cannot be won and must never be fought."

Obviously, critics might say that the aspiration of a nuclear-weapons-free world is wishful thinking. The case of Kazakhstan proves otherwise. Our country pursued its independence without relying on nuclear weapons for its security, though we are flanked by two nuclear powers.

Obviously, critics might say that the aspiration of a nuclear-weapons-free world is wishful thinking. The case of Kazakhstan proves otherwise. Our country pursued its independence without relying on nuclear weapons for its security, though we are flanked by two nuclear powers. We advocate a responsible foreign policy and equitable and sustainable economic development. We strive for mutual trust within the world community. Today, this policy is continued by President Kassym-Jomart Tokayev, who previously contributed to the cause of a future world free of nuclear weapons as our foreign minister and as the secretary-general of the UN Conference for Disarmament.

During the Cold War, despite the prevailing mistrust, the United States and the Soviet Union resolved to vastly reduce their nuclear stockpiles. Thanks to the determination of their leaders, nuclear catastrophe was averted, and the threat of nuclear war receded. The statesmen of today should emulate their sterling example. Today, we need determination and wisdom to place the common interests of humankind above short-term political considerations. Together, there is no challenge too large for us to overcome.

Source: https://nationalinterest.org/feature/pandemic-progress-proves-world-can-stop-nuclear-proliferation-191718, 24 August 2021.

IRAN

UN Nuclear Watchdog: Iran Producing More Uranium Metal

Iran continues to produce uranium metal, which can be used in the production of a nuclear bomb, the United Nation's atomic watchdog confirmed, in a move that further complicates the possibility of reviving a landmark 2015 deal with world powers on the Iranian nuclear program. In a report issued by the IAEA in Vienna to member nations, Director General Rafael Mariano Grossi said that his inspectors had confirmed that Iran had now produced 200 grams of uranium metal enriched up to 20%.

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Grossi had previously reported in February that his inspectors had confirmed that a small amount of uranium metal, 3.6 grams, had been produced at Iran's Isfahan plant. The production of uranium metal is prohibited by the 2015 nuclear deal known as the Joint Comprehensive Plan of Action, or JCPOA, which promises Iran economic incentives in exchange for limits on its nuclear program, and is meant to prevent Tehran from developing a nuclear bomb. Iran insists it is not interested in developing a bomb, and that the uranium metal is for its civilian nuclear program.

The European members of the JCPOA earlier this year voiced "grave concern" over the production of uranium metal, however, saying Iran has no credible civilian need for it and that it is a "key step in the development of a nuclear weapon." The U.S. unilaterally pulled out of the nuclear deal in 2018, with then-President Donald Trump saying it needed to be renegotiated. Since then, Tehran has been steadily increasing its violations of the deal to put pressure on the other signatories to provide more incentives to Iran to offset crippling American sanctions re-imposed after the U.S. pullout. The western Europeans, as well as Russia and China, have been working to try to preserve the accord.

U.S. State Department spokesman Ned Price said the move was "unconstructive and inconsistent with a return to mutual compliance." "Iran has no credible need to produce uranium metal, which has direct relevance to nuclear weapons development," he said in a statement. "Such escalations will not provide Iran negotiating leverage in any renewed talks on a mutual return to JCPOA compliance and will only lead to Iran's further isolation.

President Joe Biden has said he is open to rejoining the pact, but that Iran needs to return to its restrictions, while Iran has insisted that the U.S. must drop all sanctions. Months of talks have been held in Vienna with the remaining parties of the JCPOA shuttling between delegations from Iran and the U.S. The last round of talks ended in June with no date set for their resumption. Following the latest IAEA report on the increase in uranium metal production, U.S. State Department spokesman Ned Price said the move was "unconstructive and inconsistent with a return to mutual compliance." "Iran has no credible need to produce uranium metal, which has direct relevance to nuclear weapons development," he said in a statement. "Such escalations will not provide Iran negotiating leverage in any renewed talks on a mutual return to JCPOA compliance and will only lead to Iran's further isolation." He said further that "Iran's nuclear advances have a bearing on our view of returning to the JCPOA," and suggested that the U.S. was slowly running out of patience. "We are not imposing a deadline for negotiations, but this window will not remain open indefinitely," he said.

Source: https://apnews.com/article/joe-biden-middle-east-business-europe-iran-nuclear-468969423ed42240a0cb647ad59876 17, 17 August 2021.

Israel had made "significant headway" in equipping its military and had also made progress on its bid for visa-free entry for its citizens to the U.S. Following the meeting, Biden said with regard to Iran that the U.S. is "putting diplomacy first and seeing where that takes us." He added that if talks fail, the U.S. is ready to turn to other options.

Israel, US to Pursue Joint Strategy on Iran Program

Israel and the U.S. have agreed to pursue a joint strategy to halt Iran's nuclear program, Prime Minister Naftali Bennett said, without providing further details. "We achieved all the goals that we set for this visit, and even more," Bennett said before boarding a flight to Israel from the U.S. Bennett, who met with President Joe Biden on 27 August 2021, said Israel had made "significant headway" in equipping its military and had also made progress on its bid for visa-free entry for its citizens to the U.S. Following the meeting, Biden said with regard to Iran that the U.S. is "putting diplomacy first and seeing where that takes us." He added that if talks fail, the U.S. is ready to turn to other options. U.S. officials are mulling their options after months of talks with Iran failed to produce an agreement that will allow a return to the 2015 accord that limited Iran's nuclear program in exchange for U.S. sanctions relief. Israel has a long-standing opposition to the pact, and Bennett has said that the deal with Tehran is no longer relevant.

Source: https://www.bloombergquint.com/onweb/israel-u-s-to-pursue-joint-strategy-on-iran-nuclear-program, 29 August 2021.

NUCLEAR DISARMAMENT

CHINA

China Rejects Calls to Join Nuclear Disarmament Talks

China has always been committed to a national defence policy that is defensive in nature and a nuclear strategy of self-defence, and honoured its commitment that it will neither be the first to use nuclear weapons, nor use or threaten to use nuclear weapons against non-nuclear weapon states or nuclear weapon-free zones. Its nuclear capabilities are kept at the minimum level required for national security. Committed to the path of peaceful development, China has never participated and will never participate in any nuclear arms race.

As the two countries with the largest and most advanced nuclear arsenals in the world, the US and Russia bear primary responsibility for nuclear disarmament, and should earnestly implement existing treaties and further drastically and substantively reduce their nuclear stockpile, so as to enable other nuclear states to join multilateral negotiations towards the goal of complete nuclear disarmament.

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However, recent years have seen the US investing heavily in upgrading its "nuclear triad", developing low-yield nuclear weapons, lowering the threshold for using nuclear weapons and advancing the deployment of missile defence systems. These actions have severely undermined global strategic stability. Furthermore, some people in the US have been playing up "China's military and nuclear threat" and a "nuclear arms race between the US, Russia and China", hyping the so-called "trilateral arms control negotiation" to divert attention, shirk its own responsibility for nuclear disarmament and seek military supremacy. China is firmly against this. Given the huge gap between the nuclear arsenals of China and those of the US and Russia, it is unfair, unreasonable and impractical to ask China to join any trilateral arms control negotiation. China will not participate in such negotiation and will never accept any coercion or blackmail.

Source: https: //www. ft.com/ content/ 634220f9-0d34-4e85-9290- 698 b333852e2, 25 August 2021.

CUBA

Cuba Reaffirms Commitment to Nuclear Disarmament and Non-proliferation

Cuba today reaffirmed its commitment to nuclear disarmament and non-proliferation as it addressed a virtual session of the UN in Vienna. We require the maintenance of a balanced approach between the three main programmes of the verification regime: the international monitoring system, the international data centre and on-site inspection, said the third secretary of the Caribbean nation's mission to UN bodies here, Marlen Redondo. Speaking at the 57th working group of the CTBT, Redondo urged to take into account in the budgets for next year and 2023 the training and delivery of resources to signatory countries, especially developing ones. He also expressed concern about the limitations on several states to participate in virtual rounds on substantive issues.

We reaffirm the need for continued cooperation and support, including the provision of technical assistance to ensure that all members have the capacity to participate effectively in the Treaty's verification regime, he said. In this regard, he remarked, we appreciate the support provided by the Secretariat for the establishment of the National Data Centre in Cuba.

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assistance to ensure that all members have the capacity to participate effectively in the Treaty's verification regime, he said. In this regard, he remarked, we appreciate the support provided by the Secretariat for the establishment of the National Data Centre in Cuba. He also drew attention to the difficulties faced in the establishment of the institution as a result of the US blockade and the restrictions on the import of equipment resulting from the implementation of that policy.

Source: https://www.pressenza.com/2021/08/cuba-reaffirms-commitment-to-nuclear-disarmament-and-non-proliferation/, 24 August 2021.

GENERAL

The Role of Citizen and Science Diplomacy Interactions in Nuclear Disarmament

The year 2021 marks the 30th anniversary of the closure of the Semey test site, the 76th anniversary of the United Nations, Hiroshima and Nagasaki bombings, of the first atomic testing Trinity, 51 years of the NPT, 25 years of the CTBT which is not entered into force, collapse of the INF and extension of New START Strategic Arms Reduction Treaty (New START) until February 2026. Marzhan Nurzhan, a UNODA/OSCE Scholar for Peace and Security, has availed of the opportunity to write a two-part series of articles in 'Atomic Reporters', titled "Roles of key civil society actors in nuclear disarmament—Epistemic communities in multi-track diplomacy fora". Nurzhan showcases some of the instances of track 2 diplomacy activities through citizen and science diplomacy interactions.

"These occasions," says Nurzhan, "serve as a reminder to further continue pursuit of global nuclear disarmament in retaining negative peace implications and reinforce the need for more engagement on the topic of nuclear arms and international security through civil society empowerment, disarmament education, peacebuilding activities and mediation via multi-track diplomacy channels". She was Fellow at the Nuclear Nonproliferation Education and Research Center at the KAIST. She was also the Education/Outreach Coordinator for the CTBTO Youth Group in 2019-2020. In 2017, Nurzhan was chosen by the President of the UN General Assembly as the youth speaker for the United Nations High Level Meeting on Nuclear Disarmament that was held that year.

Guided by the principle of social responsibility to the dual nature of science, the roles and actions of the scientists to be a part of the discussions laid the foundation of the term "citizen scientist", states Nurzhan. One of the most prominent examples of the actions of citizen scientists was the collaboration on a manifesto issued jointly by Albert Einstein and Bertrand Russel in 1955, which emphasized the dangers of nuclear arms and called for peaceful resolution of international conflict caused by the Cold War.

One of the most prominent examples of the actions of citizen scientists was the collaboration on a manifesto issued jointly by Albert Einstein and Bertrand Russel in 1955, which emphasized the dangers of nuclear arms and called for peaceful resolution of international conflict caused by the Cold War.

The manifesto was launched under the chairmanship of Joseph Rotblat, a nuclear physicist, who worked to develop the first atomic bomb in the framework of the Manhattan project. With a strong belief that science and research should purport peace, Rotblat assembled a group of scientists and others from the east and west blocks under the auspices of the Pugwash Conferences on Science and World Affairs, that he established to provide platform for dialogue on the issues of disarmament and global security.

He was also recognized as a citizen scientist while being awarded a Nobel Peace Prize (1995) shared with the Pugwash movement for "their efforts to diminish the part played by nuclear arms in international politics and, in the longer run, to eliminate such arms". Although an American epistemic community pioneered the foundation of the internationally common knowledge and system of nuclear arms control, collaboration with the Soviets to avert nuclear war and retain strategic stability strengthened security regime

between the opposing sides, continues Nurzhan. Thanks to the establishment of an international negotiation agenda based on the epistemic community engagement, policy proposals were taken into consideration and implemented in various ways.

Track two diplomacy was practiced not only within scientific circles, but also encouraged citizen diplomats, among the ordinary public, to join the efforts to promote peace and preserve humankind from the catastrophe of nuclear conflict. One of the instances was connected with the American girl Samantha Smith, who wrote a letter to then Soviet leader, Yuri Andropov, to convey her concern regarding the possible nuclear exchange between two superpowers in 1982. She was invited to visit the Soviet Union which displayed the peacebuilding initiative that resulted in the establishment of cultural exchange programs with the United States fostering further growth of citizen diplomacy.

Another example of the citizen diplomacy is the American-Soviet peace walks comprised of a five-week long trip from Leningrad to Moscow that took place in 1987 and brought together 230 Americans and 200 Soviets impacting the way of their interaction and creating better understanding between the people from two axis of powers.

Another example of the citizen diplomacy is the American-Soviet peace walks comprised of a five-week long trip from Leningrad to Moscow that took place in 1987 and brought together 230 Americans and 200 Soviets impacting the way of their interaction and creating better understanding between the people from two axis of powers. Amid these citizen diplomacy initiatives, the doctors from the USA and the USSR founded an organisation called International Physicians for the Prevention of the Nuclear War (IPPNW) in 1980, which was awarded a Nobel Peace Prize in 1985. Despite the ideological divide, they demonstrated a common interest in preserving humankind from atomic warfare. They organised anti-nuclear protests to stop worldwide testing and to raise awareness of the public regarding the health, humanitarian and environmental consequences of the use of nuclear weapons.

Another fact of citizen diplomacy was depicted by the decision of Soviet officer, Stanislav Petrov, to save the world from the nuclear conflict whereas his duty was to register external missile attack, when in one of the days in 1983 the Soviet Union early-warning systems elicited an incoming nuclear strike which must had been reported and he instead chose to dismiss it as a false notification. All these examples of citizen diplomacy actions along with science diplomacy and track two diplomacy interactions led to more appearance and diversity of informed civil society actors, resulting in the rise of non-governmental organisations to participate in international deliberations and demanding nuclear disarmament, notes Nurzhan. For instance, the NPT Preparatory Committee meetings and Review Conferences serve as a main forum for civil society actors and NGOs to officially take part in public meetings, deliver speeches and statements, organise side-events since 1994.

In 1995 at the Review Conference of the NPT, 195 NGOs attended as observers, where the indefinite extension of the Treaty was made. United in the pursuit of nuclear disarmament and abolition of the nuclear arms, representatives of the NGOs jointly prepared a statement consisting of 11 points which called for a nuclear weapons convention that takes into account a verification aspect, the illegality of the use and threat to use nuclear arms, the completion of a truly comprehensive test ban treaty, a start of negotiations on a treaty to eliminate nuclear weapons within a specific timeframe and etc.

"Since then, civil society actors actively participate in every NPT meetings at the United Nations and have the opportunity to address the delegations within given time, to make interventions at the official meetings, to organise briefings, to engage in a dialogue with the representatives of the governments and voice their issues," states Nurzhan. However, there are also some limitations related to the participation of the NGOs in the closed meetings between the States Parties due

to security concerns given the confidential nature of arms control negotiations and mechanism of the NPT process.

Nevertheless, there is a recent practice of including civil society actors, scientific or political researchers in most of the cases, members of the parliament into the States delegations at the table of negotiations to influence policy field to function as advisors, which is in line with the recommendation based on the UN Study on Disarmament and Non-proliferation Education (2002). Thus, throughout time, activities of civil society in the nuclear field transformed from being seen as activists or protesters to becoming more professional as epistemic community representatives, and their role in multilateral negotiations was decisive in exerting pressure and influence by campaign work, advocacy initiatives and lobbying to adopt several agreements such as the CTBT in 1996, advisory opinion on the legality of threat or use of nuclear weapons by the ICJ issued in 1996.

Thus, throughout time, activities of civil society in the nuclear field transformed from being seen as activists or protesters to becoming more professional as epistemic community representatives, and their role in multilateral negotiations was decisive in exerting pressure and influence by campaign work, advocacy initiatives and lobbying to adopt several agreements such as the CTBT in 1996, advisory opinion on the legality of threat or use of nuclear weapons by the ICJ issued in 1996.

After a political stalemate at the NPT and absence of significant progress for years to fulfil the Article Six obligation by the States Parties, effective and democratic participation of the nuclear disarmament epistemic community at the multilateral forum of the United Nations OEWG (Open-ended working group) taking forward multilateral nuclear disarmament negotiations in 2016 under imperative of the "catastrophic humanitarian consequences of any use of nuclear weapon", which subsequently led to the adoption of the Treaty on the Prohibition of Nuclear Weapons (TPNW) in 2017 and entry into force in January 2021.

Source: https://www.indepthnews.net/index.php/armaments/nuclear-weapons/4660-the-role-of-citizen-and-science-diplomacy-interactions-in-nuclear-disarmament, 18 August 2021.

RUSSIA

Russia-led Bloc Members Reaffirm Commitment to Nuclear Disarmament

The member states highlight Kazakhstan's contribution to strengthening nuclear non-proliferation and preserving global security and stability by abandoning nuclear weapon. Members of the Collective Security Treaty Organization (CSTO) are committed to nuclear disarmament and non-proliferation of weapons of mass destruction, the foreign ministers of CSTO member nations announced in a statement dedicated to the 30th anniversary of the shutdown of the Semipalatinsk nuclear test site in Kazakhstan. "CSTO member states are firmly committed to nuclear disarmament and non-proliferation of weapons of mass destruction based on strict compliance with international law," the Kazakh Foreign Ministry quoted the statement as saying.

Members of the Collective Security Treaty Organization (CSTO) are committed to nuclear disarmament and non-proliferation of weapons of mass destruction, the foreign ministers of CSTO member nations announced in a statement dedicated to the 30th anniversary of the shutdown of the Semipalatinsk nuclear test site in Kazakhstan.

According to the document, CSTO countries reaffirm their commitment to maintaining peace and security, and highlight Kazakhstan's contribution to strengthening nuclear non-proliferation and preserving global security and stability by abandoning nuclear weapons. In addition, the member states recognize that the CTBT is an integral part of nuclear non-proliferation efforts, while nuclear powers' moratoriums on nuclear testing are vital for international efforts aimed at preventing the resumption of nuclear tests. "That said, CSTO

member states call for the treaty's early entry into force, which requires the remaining eight countries to join the accord," the statement reads.

The Semipalatinsk test site, the world's largest nuclear testing venue, was shut down on August 29, 1991. A total of 458 atmospheric and underground tests were conducted at the site between 1949 and 1989, which affected over 300,000 square meters of land. More than one mln people were recognized as victims of nuclear testing activities. Kazakhstan, supported by the international community, including the United Nations and donor countries, has been combating negative effects for nearly 30 years. "Since 2004, Russia, the United States and Kazakhstan have implemented a number of joint projects at the test site, making a significant contribution to averting the nuclear proliferation threat and enhancing physical security," the statement added.

Source: https://tass.com/defense/1330503, 26 August 2021.

NUCLEAR WASTE MANAGEMENT

JAPAN

Unclear if Fukushima Clean Up can Finish by 2051: IAEA

Christophe Xerri urges Japan to speed up studies of the reactors to achieve a better long-term understanding of the decommissioning process. Too little is known about melted fuel inside damaged reactors at the wrecked Fukushima nuclear power plant, even a decade after the disaster, to be able to tell if its decommissioning can be finished by 2051 as planned, a U.N. nuclear agency official said on August 27, 2021. ... He urged Japan to speed up studies of the reactors to achieve a better long-term understanding of the decommissioning process.

...Japanese government and utility officials say they hope to finish its decommissioning within 30 years, though some experts say that's overly optimistic, even if a full decommissioning is possible at all. The biggest challenge is removing and managing highly radioactive fuel debris from the three damaged reactors, said Xerri, the director of IAEA's Division of Nuclear Fuel Cycle and Waste Technology. ...

Japan announced it will start releasing into the sea large amounts of treated but still radioactive water that has accumulated at the plant since the accident. TEPCO announced a plan to release the water offshore via an underground tunnel after further treating it to reduce rsdioactive materials to allowable levels. IAEA has agreed to help facilitate the decommissioning and cooperate in the monitoring and implementation of the water disposal.

Fifth Review: The IAEA team's review, the fifth since the disaster, was mostly conducted online due to the coronavirus pandemic. Only Xerri and another team member visited the plant before compiling and submitting a report to Japan's government. In the report, the team noted progress in a number of areas since its last review in 2018, including the removal of spent fuel from a storage pool at one of the damaged reactors, as well as a decision to start discharging massive amounts of treated but still radioactive water stored at the plant into the ocean in 2023.

Although there now is a better understanding of the melted fuel inside the reactors, details are still lacking and further research should be expedited, the report said. The team encouraged Japan to allocate sufficient resources to prepare for measures beyond the next decade through the end of the decommissioning. Research and development of new technologies needed for the cleanup will take one or two decades, Xerri said, urging Japan to apply additional resources as early as possible. The report advised Japan to prepare full plans not only for the cleanup of the melted reactors but also for the entire decommissioning, and a clearer end-state picture. ... Government officials and the plant operator, Tokyo Electric Power Company Holdings, have not provided a clear picture of how the plant will look when the cleanup ends.

In April, Japan announced it will start releasing into the sea large amounts of treated but still radioactive water that has accumulated at the plant since the accident. TEPCO announced a plan

to release the water offshore via an underground tunnel after further treating it to reduce rsdioactive materials to allowable levels. IAEA has agreed to help facilitate the decommissioning and cooperate in the monitoring and implementation of the water disposal. A first IAEA mission on the water disposal is expected to visit Japan in September.

The decommissioning environment remains complex and challenging, the team added. The latest review took place just a few months after Japan decided in April how to dispose of large amounts of treated water that has accumulated at the site since the accident.

Source: https://www.thehindu.com/news/international/unclear-if-fukushima-cleanup-can-finish-by-2051-iaea/article36159726.ece, 29 August 2021.

IAEA Sees Continued Progress at Fukushima Daiichi

Conditions at the Fukushima Daiichi nuclear power plant site have improved since a review in 2018, the IAEA has concluded following its fifth review of Japan's plans and activities to decommission the plant. The IAEA team of experts reviewed the current situation at the site and future plans in areas such as the removal of used fuel and the retrieval of fuel debris, radioactive waste, water and site management. The 12-member team - comprising nine from the IAEA and one each from Indonesia, the UK and the USA - conducted a two-month review mission from 30 June to 27 August. The mission, which followed two previous reviews in 2013, one in 2015 and one in 2018, was conducted at the request of the Japanese government. The review comprised a combination of online discussions, face-to-face meetings in Vienna and Tokyo and a visit to the Fukushima Daiichi site. The team said Japan had made significant progress since the accident in moving from an emergency to a stable situation, managing daily activities at the site, reducing risks to the workforce and the environment, and planning for decommissioning with a systematic industrial approach.

The review team encouraged Japan to continue carrying out and enhancing its strategy for safe and effective decommissioning. Further development of human resources in areas such as project management will be vital in this respect.

Site conditions have improved further since the previous IAEA review in 2018, with a decline in the generation of contaminated water, the safe emptying of a used fuel pool, better understanding of the reactor fuel debris, new waste management facilities, and measures against extreme tsunamis and earthquakes. However, the decommissioning environment remains complex and challenging, the team added. The latest review took place just a few months after Japan decided in April how to dispose of large amounts of treated water that has accumulated at the site since the accident. The 2018 mission had advised Japan to urgently decide on the issue, and this year's mission welcomed that a decision had now been taken, saying it will facilitate the whole decommissioning plan. To help address future challenges for a decommissioning project expected to last several decades, the review team encouraged Japan to start allocating sufficient resources to plan and prepare for activities beyond the next 10 years until the end of the work.

Recommendations: In its report delivered to Japanese authorities today, the team acknowledged a number of accomplishments since the 2018 mission, including: strengthening of project management; risk reduction measures, such as completing the emptying of the used fuel pool of reactor unit 3 in February; and, better understanding of the presence of fuel debris in units 1-3 and the development, with UK support, of a one-of-a-kind robotic arm for a trial fuel debris retrieval from unit 2 in 2022.

The review team encouraged Japan to continue carrying out and enhancing its strategy for safe and effective decommissioning. Further development of human resources in areas such as project management will be vital in this respect, it said. The team of experts also suggested the application of circular economy principles to

maximise efficiency and reduce waste. The team noted that information currently being gathered on the fuel debris, as well as the experience that will be gained from its retrieval from unit 2, will be used in the development of options for the next steps, in particular regarding units 1 and 3.

In addition, the team provided advice on more specific organisational and technical areas, including: the development of planning scenarios for the entire decommissioning programme, including all reactor units and ageing management for recently built supporting facilities at the site; comprehensive characterisation of the fuel debris to identify key parameters that will enable the design of future strategies, including potential treatment and conditioning, to manage this material from initial storage to disposition; further management development to optimise utilisation of site space and workforce logistics; conducting surveys to assess how the public outreach programme contributes to enhancing public confidence in the decommissioning activities; and, strengthening of international cooperation to ensure both that Japan benefits from external solutions and experience for safe and effective decommissioning and that it makes the knowledge and expertise it gained as a result of the accident available internationally. ...

Source: https://www.world-nuclear-news.org/Articles/IAEA-sees-continued-progress-at-Fukushima-Daii-(1), 27 August 2021.

SWEDEN

Sweden's Nuclear Waste Storage Problem may Provoke National Power Crisis

Sweden finds itself in a bind as its intermediate spent fuel storage site is expected to reach full capacity volume by 2024. An application for the building of what would be the country's first nuclear fuel repository was initially submitted by radioactive waste management company Svensk Kärnbränslehantering AB (SKB) as far back as March 2011. In October 2021, the company stated that it had received the necessary approval from the necessary courts as well as that of the individual municipality (Östhammar) where the repository would be built. Yet the Swedish government continues to stall. Having announced a public consultation round on the matter, the authorities decided to make plans for the expansion of the existing interim nuclear waste storage site, wanting to consider the repository building application as a separate instance.

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As the judiciary process lengthens and the permit for the country's interim storage solution is set to run out, the country is increasingly at risk of experiencing a national electricity crisis. Nuclear operator Vattenfall AB has warned that they may have to shut down plants in just about three years. The delayed decision-making process has been criticised by both the Swedish Radiation Safety Authority as well as the Swedish Energy Agency. The government's inaction does not only handicap 30% of the country's electricity generation but also threatens to derail Sweden's net zero carbon emissions goals, objectives to be achieved by 2045.

According to Torbjorn Walborg, the head of generation at Vatenfall, the replacement of nuclear output at such short notice is not feasible, especially given the demand in power. Nuclear storage is a contentious issue in many European countries. Just recently, Germany came under the spotlight over the return of processed high-level nuclear waste from France. The return and transport are a matter of consequence in so far

as Germany does not have a final storage solution set in place for radioactive waste. Earlier this year, Japan shocked the international community over its plans to dump 1 million cubic metres of treated radioactive water from the wrecked Fukushima Dai-Ichi nuclear plant into the Pacific Ocean.

Source: https://waste-management-world.com/a/sweden-s-nuclear-waste-storage-problem-may-provoke-national-power-crisis, 26 August 2021.

UK

Nuclear Storage Plans for North of England Stir Up Local Opposition

The long-running battle to build an underground nuclear waste facility in the north of England has run into fresh problems, as communities reacted with shock to the news that they were being considered as locations. The north-east port town of Hartlepool is one of the sites in the frame as a potential site for a geological disposal facility (GDF), while a former gas terminal point at Theddlethorpe, near the Lincolnshire coast, is another. Cumbria, where much of the waste is stored above ground, is also being considered. Victoria Atkins, a government minister and the MP for Louth and Horncastle, said she was "stunned" by the prospect that her constituency could host a GDF, claiming that the Conservative-controlled Lincolnshire county council's engagement with the government's radioactive waste management group had been kept hidden from her.

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The facility is intended to deal with the long-running problem of nuclear waste storage by providing a safe deposit for approximately 750,000 cubic metres of high-activity waste hundreds of metres underground in areas thought to have suitable geology to securely isolate the radioactive material. The waste would be solidified, packaged and placed into deep subterranean vaults. The vaults would then be backfilled and the surrounding network of tunnels and chambers sealed. The UK would be following the example of Finland, where a geological repository for high-level spent nuclear fuel is under construction at Olkiluoto. A handful of other countries are considering similar schemes in an attempt to tackle the long-term dilemma of radioactive waste management.

Between 70% and 75% of the UK's high-activity radioactive waste, which would be designated for the GDF, is stored at the Sellafield facility in west Cumbria. The sources of the waste include power generation, military, medical and civil uses. Existing international treaties prohibit countries from exporting the waste overseas, leading some scientists to argue for underground burial that, they say, would require no further human intervention once storage is complete.

Politicians first started talking about a GDF in the 1980s. This latest attempt would need a public consultation plus varying levels of approval, and would mean that, at the earliest, waste could be deposited there in the 2040s. It would resolve the long-term dilemma of radioactive waste storage "for a generation", according to Prof Geraldine Thomas, a molecular pathologist at Imperial College London who also sits on the government's radioactive waste management committee (RWM). ... Alongside job creation and investment promises, financial incentives worth £1m and £2.5m are on offer for communities that sign up to the engagement process, which has already led to nominations for two Cumbrian boroughs. Drop-in sessions are being held across Copeland and Allerdale by area-specific working groups that would help deliver the GDF.

However, the proposals have stirred up strong local feeling among both community leaders and

residents, and accusations of secrecy have been levelled at councils and the RWM in recent weeks. In north-east England, the political fallout generated by news of the GDF "early stage" discussions triggered the resignation of Hartlepool council's deputy leader, Mike Young.... There is already considerable opposition from local groups. ...

Source: https://www. theguardian.com/ environment /2021/aug/23/nuclear-storage-plans-for-north-of-england-stir-up-local-opposition, 23 August 2021.

Centre for Air Power Studies

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

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