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STATEMENT – KN Vyas, Chairman, Atomic Energy Commission

President, Excellences, Ladies and Gentlemen,

Good morning to you all. It is my privilege and honour to address this august gathering. I take this opportunity to convey on behalf of the people of India and the Government of India the warmest greetings to the IAEA and the Member States on the occasion of the 63rd General Conference.

I also join my other colleagues to express our deep condolences on the sad demise of DG Amano in July this year. His contribution to IAEA is well known. We in India very fondly remember his visits to our country and his helpful nature. During his tenure, we brought 12 facilities under IAEA safeguards and signed the Additional Protocol to the India-IAEA Agreement for the Applications of Safeguards to Civil Nuclear Facilities. DG Amano's contribution will be remembered forever, especially his vision of "Atoms for Peace and Development" which has global relevance. India whole heartedly supports designating The Flexible Modular Laboratory at Seibersdorf as Yukia Amano Laboratories.

Let me congratulate you Madam President on your election as the President of the 63rd General Conference. I am sure that under your able leadership the current General Conference will accomplish all the tasks

Out of 19 programmes organized at the Global Centre for Nuclear Energy Partnership in India in 2018-19, eight were conducted jointly with the IAEA, thus reinforcing India's collaboration with IAEA in capacity building. I am very pleased to share with you that India's Kaiga Generating Station (KGS-1) has set a new world record of continuous operation for 962 days on 31 December 2018 while working at 99.3% plant load factor.

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laid before it successfully.

As in the previous years, during this year too, India's interaction with IAEA has remained significant. I am happy to share that the 27th IAEA Fusion Energy Conference (FEC-2018), a forum for discussions on key physics and technology issues was held at Gandhinagar, Gujarat, in October 2018. This saw great success as more than 700 experts from 39 countries participated in the Conference. 131 oral & 641 poster presentations and showcasing of products enriched the Conference.

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Centre for Nuclear Energy Partnership in India in 2018-19, eight were conducted jointly with the IAEA, thus reinforcing India's collaboration with IAEA in capacity building. I am very pleased to share with you that India's Kaiga Generating Station (KGS-1) has set a new world record of continuous operation for 962 days on 31 December 2018 while working at 99.3% plant load factor. Tarapur Atomic Power Station Units (TAPS 1 & 2), connected to grid in April and May 1969, have completed 50 years of safe operation. These are currently the oldest operating power reactors in the world, producing nuclear power at less than 3 cents per unit. Such achievements demonstrate India's ability to design, build and reliably operate PHWRs & LWRs.

India has plan for capacity addition in nuclear power generation and presently we have 21 reactors under the stage of construction and planning. This will help in achieving an additional capacity of about 15,000 MWe. Nuclear Fuel Complex, a unit under DAE, has completed the supply of fuel bundles to KAPS-3, the first 700 MWe PHWR, towards initial core requirement. Apsara-U, an upgraded swimming pool type reactor, operational since September 2018, has been operated at 90% of rated power and demonstrated that it can produce carrier free Cu-64 radioisotope, which has potential for usage in PET scans. The U-233 fuelled Kalpakkam Mini Reactor (KAMINI) has continued its successful operation. It is being used for neutron radiography of a large number of pyro-devices from the Indian Space Research Organization, activation analysis, neutron detector

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NCG-Vishwam envisages integration of the hospitals and relevant cancer care institutes in partner countries with the National Cancer Grid (NCG) of India. NCG managed by Tata Memorial Centre (TMC), was established in 2012 with the vision of creating uniform standards of cancer care across India and this has grown to a large network of 183 cancer centres, and hospitals.

testing, etc. Tata Memorial Centre (TMC), a unit under DAE, today has seven hospitals and one research institute catering to the needs of more than half a million patients every year, among which, ~100,000 are new patients.

I am very happy to share with you that on 17 September we have launched a global cancer care network, NCG-Vishwam Cancer Care Connect (NCG-Vishwam 3C) during our side event. NCG-Vishwam envisages integration of the hospitals and relevant cancer care institutes in partner countries with the National

Cancer Grid (NCG) of India. NCG managed by Tata Memorial Centre (TMC), was established in 2012 with the vision of creating uniform standards of cancer care across India and this has grown to a large network of 183 cancer centres, and hospitals. We hope that NCG-Vishwam 3C will bring a

paradigm shift in cancer care in the form of sharing guidelines for management of common cancer, giving second opinion, deciding on treatment, sharing online resources, etc.

India has made huge progress in utilisation of radiation technologies for societal uses. We are willing to share our

knowledge and expertise with our friendly partners. The process has already set in through increased interactions and actual collaborations in all areas of nuclear technologies concerning human life, be it power, health, agriculture or human capital development. We are determined to take this collaboration to a higher level. We also acknowledge the dynamic role played by the IAEA in guiding peaceful uses of nuclear energy,

ensuring safety and security, and look forward to the Agency's continued and vital support for providing a conducive atmosphere for the growth of nuclear science and technology.

I conclude by thanking Government of Austria and its people for hosting the IAEA and the General Conference and wish the 63rd Conference a grand success.

Source: <http://dae.nic.in>, 18 September 2019.

OPINION – RAMESH THAKUR

Nuclear Arms Treaty and Umbrella States

In 1984, US President Ronald Reagan noted the nuclear emperor had no clothes: "The only value in our two nations [US and Soviet Union] possessing nuclear weapons is to make sure they will never be used. But then would it not be better to do away with them entirely"? Indeed it would. The Treaty on the Prohibition of Nuclear Weapons tries to do so through a new normative settling point on the ethics, legality and legitimacy of the bomb. Till 6th September, 70 states had signed and 26 had ratified the treaty, which will enter into force with 50 ratifications. On Sept. 26, a mini-burst of signatures is expected at the United Nations (UN). Japan is unlikely to sign. It should.

The nine countries with nuclear weapons (China, France, India, Israel, North Korea, Pakistan, Russia, the United Kingdom and the US) reject the treaty. Yet since its adoption in 2017, they have done their best to validate the concerns behind it. This poses a particular problem for several US allies — Australia, Canada, Japan,

The nine countries with nuclear weapons (China, France, India, Israel, North Korea, Pakistan, Russia, the United Kingdom and the US) reject the treaty. Yet since its adoption in 2017, they have done their best to validate the concerns behind it. This poses a particular problem for several US allies — Australia, Canada, Japan, Norway, etc. — that had previously positioned themselves as ardent advocates of nuclear disarmament.

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The US administration of President Donald Trump has embarked on an aggressive nuclear modernization program to enlarge its nuclear arsenal, develop new types of "usable" low-yield bombs and lower the threshold for

their use. It scuttled the 2015 Iran nuclear deal that was working well and caused a resulting rise in tensions in the Persian Gulf. It beggars belief that no one in Washington would grasp the impact of this on trying to denuclearize North Korea through negotiations. Why would China, Russia and North Korea hold discussions with an unreliable, perfidious negotiating partner?

In February, Trump suspended US participation in the INF that contributed to the end of the Cold War and underpinned European strategic stability for three decades. It lapsed on Aug. 2. Thus far he has also rebuffed Russian overtures to discuss a

five-year extension of New START beyond 2021. The second summit with North Korean leader Kim Jong Un in Hanoi in February collapsed ignominiously and denuclearization talks are going nowhere fast.

Russia has reacted tit-for-tat to US decisions. In 2018, President Vladimir Putin boasted of a new array of invincible nuclear weapons.

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matched US suspension of the INF and issued a warning that Russia could place hypersonic nuclear weapons on submarines deployed near US waters and is developing the ability to trigger a radioactive tsunami in densely populated coastal areas by a new nuclear-powered underwater drone

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China rejected Germany's request to save the INF by joining it. Its military has called for strengthening China's nuclear deterrence and counterstrike capabilities to match developing US and Russian nuclear strategies. The INF was the first disarmament agreement of the nuclear age. In an unwelcome symmetry, on Feb. 26, we witnessed the first airstrikes by one nuclear-armed state against another, with the air forces of India and Pakistan engaging in a deadly dogfight the next day. Recent developments in Kashmir have provoked a flurry of nuclear cataclysmic warnings by Pakistan. Another India-Pakistan war is a question of when, not if.

All this increases global concerns that the nuclear powers continue to ignore their treaty and moral obligations to eliminate nuclear weapons, and fear of a catastrophic nuclear war if they're not eliminated. The US, described by former Canadian disarmament ambassador Paul Meyer as "the high priest of nuclear orthodoxy," has left its allies looking rather foolish. Washington had led them in dismissing the nuclear weapons ban treaty as impractical virtue-signalling, instead extolling the decades long efforts at step-by-step measures that had seen global stockpiles plummet by over two-thirds from their Cold War peak, as the only credible and practical pathway to nuclear disarmament.

When unkind critics noted that the only steps presently visible were going backward, Washington launched a new initiative in March 2018 on "Creating the Conditions for Nuclear Disarmament." However, a year later Washington suddenly embraced the more nebulous and inherently subjective language of "Creating an

Environment for Nuclear Disarmament." Both statements were delivered by US Assistant Secretary of State for International Security and Non-proliferation Christopher Ford. The absence of the word "disarmament" in his title is noteworthy. The umbrella states have dutifully abandoned their previous insistence on incremental steps as the only credible pathway and embraced the changing US language of conditions followed by environment.

All NATO allies shelter under the nuclear umbrella and nuclear weapons are integrated in NATO defense postures, doctrine and deployment. Three NATO countries possess the bomb: France, the UK and the US. Five allies are NPT non-nuclear weapon states that nevertheless accept the stationing of around 150 US nuclear weapons on their territory: Belgium (10 to 20), Germany (20), Italy (70 to 90), Netherlands (10 to 20) and Turkey (50 to 90). The compatibility of this nuclear sharing practice with the NPT prohibitions was a unilateral NATO interpretation.

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to 20) and Turkey (50 to 90). The compatibility of this nuclear sharing practice with the NPT prohibitions was a unilateral NATO interpretation. In addition, Canada is integrated into US military structures and doctrines through the bilateral North American Aerospace Defense Command. When it was created in 1958, the two countries agreed that its primary function would be early warning and defense for the US Strategic Air Command's retaliatory forces. In the Pacific, US tactical nuclear weapons used to be stationed in South Korea but were withdrawn as part of the denuclearization of the peninsula in 1991-1992. Such stationing is prohibited in Japan and Australia under national and regional nuclear-weapon-free zone laws respectively. But all three subscribe to extended nuclear deterrence whereby they depend on US nuclear weapons for their national security. However, while they lay claims to be defended by US nuclear forces, Washington has been reticent about making

explicit its understandings of its defense obligations and commitments.

Article 1 of the nuclear weapons ban treaty prohibits states parties from assisting, encouraging or inducing anyone to engage in any prohibited activity; to seek or receive any assistance from anyone to engage in a prohibited activity; or to allow any stationing, installation or deployment of any nuclear weapons on its territory.

For Australia, the text of the ANZUS Treaty (anti-Japan in origins) is not in itself incompatible with the obligations of the nuclear weapons ban treaty. But current practices, like naval and intelligence facilities on Australian territory in North West Cape and Pine Gap, and possibly some joint military exercises at sea, would need to be terminated. For Japan, as far as is publicly known, no treaty or existing arrangements constitute insurmountable obstacles to signing the nuclear weapons ban treaty. Doing so would send a powerful message of the priority Tokyo gives to nuclear disarmament.

Source: <https://www.japantimes.co.jp>, 11 September 2019.

OPINION – Katie Tubb

Nuclear could be the Clean Energy Source the World Needs

The challenge to meet the world's energy needs is massive. Demand for electricity continues to grow, with nearly one billion people today still in the dark. Access to affordable, reliable, clean energy has sweeping ramifications for economic

opportunity, education, clean and reliable health care, safe homes, communication — things Americans can happily take for granted. There is a clean option that could meet this challenge:

In 2018, the Clean Energy Ministerial (CEM), an annual gathering of energy ministers from 26 countries and the European Commission, included nuclear energy as a clean energy source for the first time and launched an initiative to encourage others energy organizations to do the same. According to CEM, nuclear can further “economic growth and effective environmental stewardship.”

Nuclear energy. While nuclear energy has met battled persistent PR problems in the past, things seem to be changing — and rightly so.

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Nuclear power is also clean in the sense that it produces a lot of energy for its small physical footprint. A single nuclear reactor uses about 13 acres of land space per megawatt, compared to wind (71 acres), solar (44 acres) and hydro (315 acres). This includes land used for mining, transportation, transmission and storage. Put another way, a solar farm would need roughly 45 square miles of land to produce the same amount of electricity as an average nuclear power plant, and a wind energy farm would need roughly 260 square miles.

stewardship.” CEM is not alone in reconsidering the role nuclear energy could play. In fact, the Massachusetts Institute of Technology, in partnership with Idaho National Lab and the University of Wisconsin, have gone so far as to say nuclear energy is “essential” to expand energy access and reduce greenhouse gas emissions. There are good reasons these organizations have come to see nuclear energy as “clean.”

In the US, 19% of the electricity Americans use comes from 97 nuclear reactors, more than in any other country. There are 444 commercial nuclear power reactors operating globally, with another 54 under construction and 111 planned, most notably in China, India and Russia. The gigawatts of electricity produced for millions of people by these reactors have emitted no air pollutants.

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Wind and solar energy enjoy a much better reputation as clean energy sources and also have benefits like zero emissions energy. However, they both require favourable weather conditions and backup power to be online in case weather doesn't cooperate. Nuclear reactors are online and generating power 93% of the time, compared with wind (37%) and solar (26%). And while most nuclear power plants in the US are licensed to operate for 60 years, the operating life of renewables is roughly half as long.

Like every energy resource, nuclear power does have its trade-offs. But even in those, reality is far better than public perceptions of nuclear energy. Perhaps first among people's concerns are the infamous accidents at Chernobyl, Three Mile Island and Fukushima. It may be hard to believe, but no one has died from radiation exposure from the latter two. In the case of America's worst nuclear accident at Three Mile Island in 1979, actual radiation exposure for the 2 million people living closest to the reactor amounted to less than a dental x-ray. For decades, state and federal agencies and private companies tested agricultural, health and environmental factors, finding nothing of concern. Less a commentary on nuclear technology than on authoritarian government, the accident at Chernobyl in 1986 resulted from an egregious, unethical Soviet experiment. The Chernobyl reactor also lacked important safety features, like containment domes, common to all US reactors.

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So far, the UN has confirmed 43 deaths from radiation at Chernobyl, considered the worst nuclear accident in history.

Radiation itself is another common public concern, but not well understood. Radiation is a part of our everyday lives. Flying in an airplane, eating bananas and carrots, sun bathing, getting medical scans, and simply living on planet Earth all expose a person to more radiation than living within 50 miles of a nuclear power plant. Radiation is an inherent and, to some degree, necessary feature of life.

But fear has caused unnecessary environmental harm and costs. While visiting Fukushima, founder of Environmental Progress, Michael Shellenberger challenged the Japanese government's colossal efforts to remove thousands of tons of "contaminated" topsoil. The response he got was shockingly frank: "Every scientist and radiation expert in the world who comes here says the same thing. We know we don't need to reduce radiation levels...We're doing it because the people want us to."

Among other concerns is nuclear waste. There is 81,500 tons of nuclear waste from commercial power reactors in the US. That represents all the nuclear waste from every commercial reactor in the US since 1957 — no more than a football field 10 yards deep. For reference, the International Renewable Energy Agency estimates the US will have 170,000 to one million tons of waste from solar panels by 2030. While the politics of nuclear waste management have bogged down in the US, it is a technically solvable challenge. The nuclear industry in Finland, for instance, is showing the world how it can be done by building a deep geologic repository to permanently isolate waste from people and the environment.

The point is not that nuclear power is perfect but

that it has a compelling track record despite public perceptions. All energy resources have trade-offs; there is no perfect energy resource. Nuclear power has some unique challenges. But nuclear power also has some incredible benefits that make it a choice well worth considering as a clean energy option to improve our environment and make the world better.

Source: <https://edition.cnn.com>, 16 September 2019.

OPINION – Rafael Loss and Joseph Johnson

Will Artificial Intelligence Imperil Nuclear Deterrence?

Nuclear weapons and artificial intelligence are two technologies that have scared the living daylights out of people for a long time. These fears have been most vividly expressed through imaginative novels, films, and television shows. Nuclear terror gave us Nevil Schute's *On the Beach*, Kurt Vonnegut's *Cat's Cradle*, Judith Merrill's *Shadow on the Hearth*, Nicholas Meyer's *The Day After*, and — more recently — Jeffrey Lewis' 2020 Commission Report. Anxieties about artificial intelligence begat Jack Williamson's "With Folded Hands," William Gibson's *Neuromancer*, Alex Garland's *Ex Machina*, and Jonathan Nolan and Lisa Joy's "Westworld." Combine these fears and you might get something like Sarah Connor's playground dream sequence in *Terminator 2*, resulting in the "desert of the real" that Morpheus presents to Neo in *The Matrix*.

While strategists have generally offered more sober explorations of the future relationship between AI and nuclear weapons, some of the most widely received musings on the issue, including a recent call for an AI-enabled "dead

hand" to update America's aging nuclear command, control, and communications infrastructure, tend to obscure more than they illuminate due to an insufficient understanding of the technologies involved. An appreciation for technical detail, however, is necessary to arrive at realistic assessments of any new technology, and particularly consequential where nuclear weapons are concerned. Some have warned that advances in AI could erode the fundamental logic of nuclear deterrence by enabling counter-force attacks against heretofore concealed and mobile nuclear forces. Such secure second-strike forces are considered the backbone of effective nuclear deterrence by assuring retaliation. Were they to become vulnerable to preemption, nuclear weapons would lose their deterrent value. We, however, view this concern as overstated. Because of AI's inherent limitations, splendid counter-force will remain out of reach. While emerging technologies and nuclear force postures might interact to alter the dynamics of strategic competition, AI in itself will not diminish the deterrent value of today's nuclear forces.

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Understanding the Stability Concern: The exponential growth of sensors and data sources across all warfighting domains has analysts today facing an overabundance of information. The Defense Department's Project Maven was born out of this realization in 2017. With the help of AI, then-Deputy Secretary of Defense Robert Work sought to "reduce the human factors

burden of analysis, increase actionable intelligence, and enhance military decision-making" in support of the counter-ISIL campaign. Hans Vreeland, a former Marine artillery officer involved in the campaign, recently explained the potential of AI in facilitating targeted strikes for counterinsurgency operations, arguing that AI

should be recognized and leveraged as a force multiplier, enabling US forces to do more at higher operational tempo with fewer resources and less uncertainty. Such a “magic bullet” would surely be welcome as a great boon to any commander’s arsenal.

Yet, some strategists warn that the same AI-infused capabilities that allow for more prompt and precise strikes against time-critical conventional targets could also undermine deterrence stability and increase the risk of nuclear use. Specifically, AI-driven improvements to intelligence, surveillance, and reconnaissance would threaten the survivability of heretofore secure second-strike nuclear forces by providing technologically advanced nations with the ability to find, identify, track, and destroy their adversaries’ mobile and concealed launch platforms. Transporter-erector launchers and ballistic missile submarines, traditionally used by nuclear powers to enhance the survivability of their deterrent forces, would be at greater risk. A country that acquired such an exquisite counter-force capability could not only hope to limit damage in case of a spiraling nuclear crisis but also negate its adversaries’ nuclear deterrence “in one swift blow.” Such an ability would undermine the nuclear deterrence calculus whereby the costs of imminent nuclear retaliation far outweigh any conceivable gains from aggression.

These expectations are exaggerated. During the 1991 Gulf War, U.S.-led coalition forces struggled hard to find, fix, and finish Iraqi Scud launchers despite overwhelming air and information superiority. Elusive, time-critical targets still seem to present a problem today. Facing a nuclear-armed adversary, such poor performance would prove disastrous. The prospect of just one enemy warhead surviving would give pause to any decisionmaker contemplating a preemptive counter-force strike. This is why nuclear weapons are such powerful deterrents after all and states who possess them go to great lengths to protect these assets. While some worry that AI could achieve near-perfect performance and thereby enable an effective counter-force capability,

inherent technological limitations will prevent it from doing so for the foreseeable future. AI may bring modest improvements in certain areas, but it cannot fundamentally alter the calculus that underpins deterrence by punishment.

Enduring Obstacles: The limitations AI faces are twofold: poor data and the inability of even state-of-the-art AI to make up for poor data. Misguided beliefs about what AI can and cannot accomplish further impede realistic assessments.

The data used for training and operationalizing automated image-recognition algorithms suffers from multiple shortcomings. Training an AI to recognize objects of interest among other objects requires pre-labeled datasets with both positive and negative examples. While pictures of commercial trucks are abundant, much fewer ground-truth pictures of mobile missile launchers are available. In addition to the ground-truth pictures potentially not representing all launcher models, this data imbalance in itself is consequential. To increase its accuracy with training data that includes fewer launchers than images of other vehicles, the AI would be incentivized to produce false negatives by misclassifying mobile launchers as non-launcher vehicles. Synthetic, e.g., manually warped, variations of missile-launcher images could be included to identify launchers that would otherwise go undetected. This would increase the number of false positives, however, because now trucks that resemble synthetic launchers would be misclassified.

Moreover, images are a poor representation of reality. Whereas humans can infer the function of an object from its external characteristics, AI still struggles to do so. This is not so much an issue where an object’s form is meant to inform about its function, like in handwriting or speech recognition. But a vehicle’s structure does not necessarily inform about its function — a problem for an AI tasked with differentiating between vehicles that carry and launch nuclear-armed ballistic missiles and those that do not. Pixelated, two-dimensional images are not only a poor representation of a vehicle’s function, but also of the three-dimensional object itself. Even though

resolution can be increased and a three-dimensional representation constructed from images taken from different angles, this introduces the “curse of dimensionality.” With greater resolution and dimensional complexity, the number of discernable features increases, thus requiring exponentially more memory and running time for an AI to learn and analyze. AI’s inability to discard unimportant features further makes similar pictures seem increasingly dissimilar and vice versa.

Could clever, high-powered AI compensate for these data deficiencies? Machine-learning theory suggests not. When designing algorithms, AI researchers face trade-offs. Data describing real-world problems, particularly those that pertain to human interactions, are always incomplete and imperfect.

Accordingly, researchers must specify which patterns AI is to learn. Intuitively it might seem reasonable for an algorithm to learn all patterns present in a particular data set, but many of these patterns will represent random events and noise or be the product of selection bias. Such an AI could also fail catastrophically when encountering new data. In turn, if an algorithm learns only the strongest patterns, it may perform poorly — although not catastrophically — on any one image. Consequently, attempts to improve an AI’s performance by reducing bias generally increase variance and vice versa. Additionally, while any tool can serve as a hammer, few will do a very good job at hammering. Likewise, no one algorithm can outperform all others on all possible problem sets. Neural networks are not universally better than decision trees, for example. Because there is an infinite number of design choices, there is no way to identify the best possible algorithm. And with new data, a heretofore near-perfect algorithm might no longer be the best choice. Invariably, some error is irreducible.

The counter-force challenge is anything but. Facing such a complex and dynamic problem set, AI would be constrained to lower levels of confidence. Sensor platforms would provide an abundance of imagery and modern precision-guided munitions could be expected to eliminate designated targets, but automated image recognition could not guarantee the detection of all relevant targets.

Nevertheless, tailoring improves AI performance. Regarding image recognition, intimate knowledge of the object to be detected allows for greater specification, yielding higher accuracy. On the counter-force problem, however, a priori knowledge is not easily obtained; it is likely to be neither clean nor concise. As discussed above, because function cannot be fully represented in an image, it cannot be fully learned by the AI. Moreover, like most military affairs, counter-force

is a contested and dynamic problem. Adversaries will attempt to conceal their mobile-missile launchers or change their design to fool AI-enabled ISR capabilities. They could also try to poison AI training data to induce misclassification. This is particularly problematic because of the one-off nature of a counter-force strike, which prevents validating AI performance with real-world experience.

Simulations can only get AI so far.

When it comes to AI, near-perfect performance is tied inextricably to operating in environments that are predictable, even controlled. The counter-force challenge is anything but. Facing such a complex and dynamic problem set, AI would be constrained to lower levels of confidence. Sensor platforms would provide an abundance of imagery and modern precision-guided munitions could be expected to eliminate designated targets, but automated image recognition could not guarantee the detection of all relevant targets.

The Pitfalls of a Faulty Paradigm: Poor data and technological constraints limit AI’s impact on the fundamental logic of nuclear deterrence, as well as on other problem sets requiring near-perfect levels of confidence. So, why is the fuzzy buzz not making way for a more measured debate on specific merits and limitations?

The military-technological innovations of the past derived their power principally from the largely

familiar and relatively intuitive physical world. Once the mechanics of aviation and satellite communication were understood, they were easily scaled up to enable the awesome capabilities militaries have at their disposal today. What many fail to appreciate, however, is how fundamentally different the world of AI operates and the enduring obstacles it contains. This unfamiliarity with the rules of the computational world sustains the application of an ill-fitting innovation paradigm to AI.

As discussed above, when problems grow more complex, AI's time and resource demands increase exponentially. The traveling salesman problem provides a simple illustration: Given a list of cities and the distances between each pair of cities, what is the shortest possible route a salesman can take that visits each city and returns to the origin city? A desktop computer can answer this question for ten cities (and 3,628,800 possible routes) in mere seconds. With just 60 cities the number of possible routes exceeds the number of atoms in the known universe (roughly 10⁸⁰). Once the list gets up to 120 destinations, a supercomputer with as many processors as there are atoms in the universe — each of them capable of testing a trillion routes per second — would have to run longer than the age of the universe to solve the problem. Thus, in contrast to technological innovations rooted in the physical world, there is often no straight-forward way to scale up AI solutions.

Moreover, machine intelligence is much different from human intelligence. When confronted with impressive AI results, some tend to associate machine performance with human-level intelligence without acknowledging that these results were obtained in narrowly defined problem sets. Unlike humans, AI lacks the capacity for conjecture and criticism to deal flexibly with unfamiliar information. It also remains incapable

of learning rich, higher-level concepts from few reference points, so that it cannot easily transfer knowledge from one area to another. Rather, there is a high likelihood of catastrophic failure when AI is exposed to a new environment.

Understanding AI's Actual Impact on Deterrence and Stability:

What should we make of the real advantages AI promises and the real limitations it will remain constrained by? As Work, Vreeland, and others have persuasively argued, AI could generate significant advantages in a variety of contexts. While the stakes are high in all military operations, nuclear weapons are particularly consequential. But because AI cannot reach near-perfect levels of confidence in dynamic environments, it is unlikely to solve the counter-force problem and imperil nuclear deterrence.

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What is less clear at this time is how AI, specifically automated image recognition, will interact with other emerging technologies, doctrinal innovations, and changes in the international security

environment. AI could arguably enhance nations' confidence in their nuclear early warning systems and lessen pressures for early nuclear use in a conflict, for example, or improve verification for arms control and nonproliferation.

On the other hand, situations might arise in which an imperfect but marginally AI-improved counter-force capability would be considered as good enough to order a strike against an adversary's nuclear forces, especially when paired with overconfidence in homeland missile defense. Particularly states with relatively small and vulnerable arsenals would find it hard to regard assurances that AI would not be used to target their nuclear weapons as credible. Their efforts to hedge against improving counter-force capabilities might include posture adjustments, such as pre-delegating launch authority or co-locating operational warheads with missile units,

which could increase first-strike instability and heighten the risk of deliberate, inadvertent, and accidental nuclear use. Accordingly, future instabilities will be a product less of the independent effects of AI than of the perennial credibility problems associated with deterrence and reassurance in a world of ever-evolving capabilities.

Conclusion: As new technologies bring new forms of strategic competition, the policy debate must become better informed about technical matters. There is no better illustration of this requirement than in the debate about AI, where a fundamental misunderstanding of technical matters underpins a serious misjudgment of the impact of AI on stability. While faulty paradigms sustain misplaced expectations about AI's impact, poor data and technological constraints curtail its effect on the fundamental logic of nuclear deterrence. The high demands of counterforce and the inability of AI to provide optimal solutions for extremely complex problems will remain irreconcilable for the foreseeable future.

Source: <https://warontherocks.com>, 19 September 2019.

OPINION – Prakash Menon

The Hot Risks of 'Cold Start'

Preventing war through deterrence based on military capabilities has historically been the crux of politico-strategic logic for national defence. It's believed that if capabilities to inflict violence are matched, the situation is stable as neither side sees the possibility of achieving political objectives through war. To be effective, capabilities have to be projected in order to create sufficient doubt in the adversary that victory through war may not

be worth the stakes. In practice, deterrence remains a cat-and-mouse game with each side constantly playing up the optics of military capability through acquisition of arms that is also combined with operational doctrines promising victory through military innovations and operational virtuosity. India's Cold Start doctrine belongs to such a genre.

India's Cold Start doctrine was born from India's military mobilisation experience following the Parliament attack by Pakistan-based terrorists in 2001. The mobilisation had taken too long and needed to be shortened. The major switch in political and operational doctrine was the declaration that India could initiate a limited war in retaliation for a terrorist strike.

The adoption of Cold Start in 2004 was followed by the denial of its existence by the COAS in 2011 and also by Jaswant Singh, the former defence minister.

But the denial was accompanied by new terms like 'Pro-active Strategy' and so forth. In January 2017, General Bipin Rawat, the then newly appointed COAS, finally confirmed the existence of Cold Start. It has been followed up by measures to operationalise the doctrine through the creation of IBGs that are suitably sized and equipped to carry out independent ground offensives against Pakistan at the shortest possible notice.

In essence, India seeks to project a capability to launch a limited war before Pakistan is ready and attempts to achieve its military objectives before international intervention. The tactical logic follows the proclivity of all militaries to strike first in the belief that it significantly enhances chances of victory. Historically, though, initial tactical victory has not always delivered ultimate strategic success with Pearl Harbour being a

India seeks to project a capability to launch a limited war before Pakistan is ready and attempts to achieve its military objectives before international intervention. The tactical logic follows the proclivity of all militaries to strike first in the belief that it significantly enhances chances of victory. Historically, though, initial tactical victory has not always delivered ultimate strategic success with Pearl Harbour being a prime example. Cold Start should therefore be evaluated in its ability to deliver political and strategic objectives.

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Politically, Cold Start aims to deter Pakistan from abetting terrorist attacks on India. Of course, it can deter initiation of a conventional war by Pakistan but such an eventuality is unlikely due to the balance of military power and, more importantly, the fact that Pakistan's preferred tool of violence is terror that can also be denied.

Pakistan's tools are in the 'Other than War' category. However, the possibility of Pakistan resorting to a conventional war in concert with China is also a possibility, in which case India would have to prioritise tackling China and be on the strategic defensive against Pakistan. In essence, Cold Start will mostly be confined to action taken after a terrorist strike. The military logic is impeccable but its political outcomes are questionable.

Politically, Cold Start has been leveraged by Pakistan to boost the Indian threat which essentially serves Pakistan's military internally and also allows it to project the Indo-Pak border as a nuclear flashpoint. Pakistan's claims for developing TNWs is supposedly to deter India from executing its Cold Start.

India's reliance on Limited War that is sought to be operationalised through Cold Start suffers from the fallacy that a limited war, even if successfully prosecuted, would force Pakistan to give up utilising terror as a tool of foreign policy. Even if India captured some territory, it would be unlikely that Pakistan would keep to any promise to forsake

terror in exchange for return of the territory.

If India succeeds in weakening Pakistan's military capability, which is unlikely due to the presence of nuclear weapons, Pakistan can rearm and continue to use terror. In fact, a militarily weakened Pakistan could rely more on the terrorist tool. The threat of Limited War does not promise a suitable political solution to the problem.

The question is what would be a successful strategy? Any solution would require acceptance in the politico-military hierarchy of the role of force while dealing with Pakistan's use of terrorism. Limited War under the nuclear shadow is shackled by the risks of escalation. Once launched, military logic could hijack political rationale that is supposed to keep escalation in check.

Worse, escalation is driven by a bilateral dynamic that neither side controls. India may launch its IBGs at the start of a war but its hopes of achieving an element of tactical surprise, capturing territory and wreaking destruction on Pakistan's armed forces may prove false if such military action follows a terrorist attack, as Pakistan could be prepared, through already pre-positioned forces meant to counter India's publicised forward-deployed IBGs. Another issue is the role of air power.

The start of the IBGs ground offensive has to be simultaneous with an Indian air power offensive aimed at neutralising Pakistan's Air Force capability to interfere with the IBGs. This would require hitting targets in an expanded geographical space. Air power-induced escalation in this setting has greater salience. Combined

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with alerted nuclear weapons on either sides and nuclear threats being hurled, the operational situation is pregnant with unacceptable risks. Political prudence demands such a situation is avoided and therefore it would be better not to ride the tiger in the first place. Cold Start had better remain cold and underplayed, but preserved for contingencies where the risks are worth the stakes.

In the context of dealing with Pakistan's terrorist attacks, the utility of force is confined to a certain degree of punitive retaliation that serves to impose some caution, even if temporary. Punitive retaliation can be geographically confined. Admittedly, Pakistan retains its free will to react, as was witnessed after Balakot. The exchange serves to assuage sentiments of revenge on either side but hardly impacts the structural relationship.

India's military should privilege development of a military capability that allows for causing destruction without posturing. Long-range firepower from air, land and sea platforms provide more promise for retribution under the nuclear shadow than IBGs that, at best, could threaten and may mostly even flatter to deceive. Capabilities that support force application in 'Other than War' forms would act as a better deterrence.

Source: <https://www.telegraphindia.com/>, 27 September 2019.

OPINION – Jeff Johnson

Can Nuclear Power Help Save Us from Climate Change?

Globally, nuclear power is on the skids. Its contribution to electricity generation is in a free fall, dropping from a mid-1990s peak of about 18% of worldwide electricity capacity to 10%

today, according to the International Energy Agency (IEA). The agency expects the downward spiral to continue, hitting 5% by 2040 unless governments around the world intervene. The driver for that intervention would be nuclear reactors' ability to generate energy with low greenhouse gas emission. To meet the world's energy needs and avoid the worst effects of climate change, low-carbon electricity generation must increase from providing 36% of the world's energy today to 85% by 2040, the IEA says.

Electricity Sources: The share of electricity generated globally from low-carbon sources has been relatively flat since it peaked in the mid-1990s. "Without an important contribution from nuclear power, the global energy transition will be that much harder," IEA executive director Fatih Birol says in a statement accompanying an IEA nuclear power report. "Alongside renewables, energy efficiency and other innovative technologies, nuclear can make a

significant contribution to achieving sustainable energy goals and enhancing energy security."

But steep barriers to a nuclear energy renaissance exist, among them aging reactors; high costs to build new ones, safety concerns, and questions about how much nuclear is needed in the world's energy mix. Historically, nuclear power has played its biggest role in advanced economies, where it makes up 18% of total electricity generation today. France is the most dependent on nuclear energy, with 70% of its electricity generated from nuclear reactors. By number of operating reactors, the US leads with 98 power plants capable of generating 105 GW; France is second with 58 reactors generating 66 GW of electricity. However, many of those reactors are old. In the US, the EU, and Russia, plants average 35 years or more in age, nearing their designed lifetimes of 40 years.

Building new nuclear power plants based on

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traditional designs will be nearly impossible in developed economies, IEA analysts say. The challenges include high costs and long construction times, as well as time needed to recoup costs once plants start running, plus ongoing issues with radioactive waste disposal. In addition, the competitive electricity marketplace in the US makes it hard to sell nuclear energy against that generated more cheaply through natural gas, wind, or solar. Right now, only 11 nuclear plants are under construction in developed economies—4 in South Korea and 1 each in seven other countries.

There is more potential for nuclear energy expansion in developing nations with state-controlled, centralized economies. China is the world's third-largest nuclear generator, with 45 reactors capable of producing 46 GW of electricity. China also has the biggest plans for new power plants, with 11 at various stages of construction, the IEA says. India is building 7; Russia, 6; and the United Arab Emirates, 4, with a sprinkling of other new plants coming throughout the rest of the world. All will be state owned, the IEA says. The nuclear industry's main hope for future expansion lies in a new generation of small, modular reactors that generate less than 300 MW each and are amenable to assembly-line construction. These are still under development, however, with none licensed or under construction.

A middle path between new plants and no plants is lifetime extensions for existing reactors. The IEA estimates the costs for maintenance and improvements needed to continue operating an existing nuclear reactor for an additional 10–20 years would be \$500 million–\$1.1 billion per gigawatt, an amount the IEA says is comparable to constructing a renewable—solar or wind—system of the same size. The result would be

effectively 1 GW of new, low-carbon electricity without the delays involved in siting and building a new solar field or wind farm. In the US, the Nuclear Regulatory Commission (NRC) has already renewed and extended the operating licenses from 40 to 60 years for 90 of the 98 operating reactors. The industry is now focusing on renewals to operate for up to 80 years. Similarly, other countries are considering extending existing reactor operations but for shorter periods, the IEA reports.

These extensions present what the Union of Concerned Scientists (UCS) terms a “nuclear power dilemma.” The non-profit organization, which advocates scientific solutions to global problems, has been a frequent nuclear industry critic. “We are very cognizant of this climate challenge and the need to act quickly to cut greenhouse gas emissions,” says Rachel Cleetus, the UCS's climate and energy policy director. The UCS's solution for providing energy in a warming world

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is to tax and cap carbon dioxide emissions and introduce a low-carbon electricity standard for all energy sources. Such measures would drive the construction and development of low-carbon energy facilities and technologies, the UCS says. For nuclear energy in particular, the organization endorses temporary financial support for the extension of some plants, conditioned on rate protection for consumers, safety requirements, and greater investments in renewables and energy efficiency. “We can't just give them lots of money and blanket life extensions,” Cleetus says. Scenarios and mathematical models run by the UCS show nuclear is very unlikely to grow beyond providing at most 16% of the world's electricity generation capacity by 2050 even with aid, far short of the 85% or more of the low- or noncarbon generation needed to address global warming.

Underlying the debates about power plant costs and operating lifetimes are questions of safety and risks—real and perceived—of nuclear reactors and radioactivity. These concerns have made nuclear power unpopular in the US, Germany, Japan, and elsewhere. The San Onofre Nuclear Generating Station (SONGS), resting on the US West Coast north of San Diego, provides an example of why. Seven million people live within 80 km of the plant.

A stormy relationship between SONGS and its surrounding community goes back decades. Most recently, the facility was completely shut down in 2013 after two nearly new steam generators failed. The replacements were part of a \$670 million overhaul that was supposed to provide 20 more years of life for the plant. Then, during

d e c o m m i s s i o n i n g operations in 2018, contractor Holtec International mishandled and nearly dropped a 50-metric-ton spent fuel canister. Neither Holtec nor plant owner Southern California Edison reported the incident. Instead, the NRC and the public learned about the slipup from a

whistle-blower speaking at a community meeting. As a result, the NRC froze cleanup operations that are just now restarting. “Repairs and replacements could be done properly at nuclear plants,” says L. R. “Len” Hering Sr., a retired rear admiral of the US Navy who lives near SONGS and is cochair of a task force established by Rep. Mike Levin (D-CA) to address community safety concerns at the facility.

Hering bases that assessment on his navy experience. “Ships are designed to last roughly 30 years, and when the navy goes through a process of life extension, we do extensive testing and evaluation,” he says. “We make certain all components are up to snuff. In the navy, repairs are made by a focused group of individuals separate from the ship’s operators, and it is not about cost.” He has not seen a similar level of attention and rigor at SONGS. Once a nuclear advocate, he has cooled on nuclear power because of concerns over

management and regulation. “I don’t believe the NRC has the capacity to properly inspect and oversee operations or maintenance,” he says. Meanwhile, some of the groups advocating for strong action to address climate change question whether more nuclear energy is necessary. Over the past 20 years, as nuclear power generation has declined, renewable sources have expanded by some 580 GW—more than the output of all the world’s nuclear power plants—to make up the difference. Consequently, the overall share of low-carbon electricity sources—hydropower, nuclear, solar, and wind—has stayed even at about 36%.

The IEA applauds the growth of renewables but says that it is unprecedented and not sustainable. Hence the agency’s support for nuclear power. However, energy researchers at the World Resources Institute and the UCS, speaking at a recent US congressional hearing, say renewable sources will continue to expand, and major increases in energy efficiency are on the

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horizon. In addition, the researchers expect that as more renewable energy facilities come on line, new technologies will be developed to address the challenge of variable output from renewable energy sources, such as with solar on an overcast day.

Overreliance on nuclear might in fact stall development and installation of technologies needed for a transition to a low-carbon future, Cleetus argues. Her modeling shows that capital investment needed for renewable energy development—building high-voltage power lines, advanced batteries and other storage systems, and of course, renewable resources themselves—could be funneled off to build and retrofit more nuclear power plants. And then there are those who question whether nuclear energy can even be called low carbon if greenhouse gas emissions are considered for the

full energy cycle, including plant construction, uranium mining and enrichment, fuel processing, plant decommissioning, and radioactive waste deposition. Ultimately, the future of nuclear power will turn on the world's need for energy security and how it weighs the costs of action and inaction in the face of growing impacts of climate change.

Source: <https://cen.acs.org>, 23 September 2019.

NUCLEAR STRATEGY

INDIA

Navy's 'Second Strike Capability' Most Significant as Nuclear Deterrent: Rajnath Singh

In the backdrop of Pakistan's repeated talk about nuclear war, Defence Minister Rajnath Singh said on 29 Sep that Indian Navy's "second strike capability" as a nuclear deterrent is "most significant". "Second strike capability" is an assured capability of an armed force to respond to a nuclear attack with its own nuclear weapons.

I can say that if there is any "Samundar Ka Sikandar (king of the seas)", it is INS Vikramaditya only." "Keeping in mind our strategic interest and maritime security, Indian government also believes that the country needs three aircraft carriers. Currently, the work on second one is going on. I think it will be over soon.

Addressing the Navy personnel on aircraft carrier INS Vikramaditya, the minister said, "I am aware that after the Pulwama attack, when the country responded effectively through strikes on terror camps in Balakot, the Western Fleet was immediately deployed in a strong posture in the northern Arabian Sea. "This degraded the ability of our adversary to deploy and ensured they did not attempt any misadventure at sea. In this context, the role of Indian Navy to have a credible 'second strike' capability as a nuclear deterrent, is most significant."

The Defence Minister's remarks come just days after Pakistan Prime Minister Imran Khan, in his maiden speech at the UN General Assembly, drummed up hysteria over nuclear war while targeting India over Kashmir. India had hit back saying the "threat of unleashing nuclear devastation qualifies as brinkmanship, not statesmanship".

... Singh said Indian Navy's role is critical in ensuring the energy security and economic growth of the country and noted that about 90 per cent of India's international trade by volume and about 70 per cent by value is carried by sea. "As we move towards our goal of five trillion dollar economy, the volume of maritime trade will only grow in times to come. Thus, I firmly believe that the role of the Indian Navy in general and the Western Fleet in particular is also critical in ensuring the energy security and economic growth of the country," he added.

The minister said that he will write to family members of each personnel, who are working on INS Vikramaditya, talking about their valour. INS Vikramaditya is currently travelling in Arabian sea somewhere near Goa. "I was telling Admiral Karambir Singh (Chief of Naval Staff) that since I have met so many personnel here...I would write a letter to either parents and spouse of each personnel, telling them that I met your son or husband

at INS Vikramaditya." "I will tell them (parents) that your son is full of valour and you have given birth to such a child that the whole country is proud of you and your son. I will go and write to each member of your family," the minister added.

During his overnight stay on the INS Vikramaditya, Singh witnessed various military exercises involving submarines, frigates and the carrier. The minister said that the government would like that Indian Navy to be known across the world as "blue water navy". A blue water navy is capable in operating globally, even in deep ocean waters far away from any coastline. About his overnight stay on the aircraft carrier, the minister said, "I have been with you since last night. And I have got the opportunity for the first time to stay at INS Vikramaditya. I can say that if there is any "Samundar Ka Sikandar (king of the seas)", it is INS Vikramaditya only." "Keeping in mind our strategic interest and maritime security, Indian

government also believes that the country needs three aircraft carriers. Currently, the work on second one is going on. I think it will be over soon," the minister said. The minister's address at INS Vikramaditya was relayed through radio to Navy personnel of 21 ships, which were surrounding the aircraft carrier in Arabian Sea.

Source: <https://www.moneycontrol.com>, 29 September 2019.

RUSSIA

Russian Nuclear Missile with 'Unlimited' Range to be Ready by 2025

Despite a slew of unsuccessful tests, Russia's nuclear-powered missile with so-called unlimited range will be ready for war within the next six years, a slightly accelerated timeline than previously reported, according to a US intelligence assessment. The revelation of the new, more ambitious timeline for the missile comes even though the Kremlin has yet to secure a successful test over multiple attempts, according to sources with knowledge of a US intelligence report. It also comes on the heels of a mysterious explosion off Russia's northern coast that killed five scientists and sparked fears Moscow had tested the missile in question, called Burevestnik. A US intelligence assessment found that the Aug. 8 explosion occurred during a recovery mission to salvage a lost Burevestnik from the ocean floor.

In March 2018, Russian President Putin unveiled several hypersonic weapons, as well as Burevestnik. Putin said it was nuclear powered and had unlimited range. Burevestnik, also known as Skyfall, has been tested once earlier this year and prior to that, the weapon was tested four times between November 2017 and February

2018, each resulting in a crash. The US determined that the longest test flight lasted just more than two minutes, with the missile flying 22 miles before losing control and crashing. The shortest test lasted four seconds and flew for five miles. The tests apparently showed that the nuclear-powered heart of the cruise missile failed to initiate and, therefore, the weapon was unable to achieve the indefinite flight Putin bragged about. Putin had claimed that the "invincible" weapon had a proven capability. However, CNBC reported in March that the Kremlin will only produce a few of these weapons because the

program has yet to complete a successful test and is too expensive to develop.

Despite all the setbacks, though, Putin is determined to invest in weapons of this magnitude, according to national security experts. "Russia is committed to a massive investment in new systems like this to defeat US missile defenses. We are stumbling toward an arms race," Jeffrey Lewis, a nuclear weapons expert at the Middlebury Institute of International Studies at Monterey. "Trump's personal friendship with Putin is no substitute for the treaties that restrained the nuclear superpowers. Whatever the two leaders say, the US and Russian militaries are spending billions on new nuclear weapons targeted at each other," Lewis told CNBC.

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Source: <https://www.cnbc.com>, 11 September 2019.

USA

Stealth F-35: America's Next Nuclear Bomber? Could it Happen?

The Pentagon's accelerated development of a "nuclear-armed" F-35 Joint Strike Fighter attack envelope is of critical importance to a new

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sweeping strategic nuclear weapons modernization and development strategy aimed countering Russia, China and North Korea — and addressing a much more serious global nuclear weapons threat environment. Adding a nuclear-capable F-35 to the air portion of the nuclear triad – to supplement the existing B-2, B-52 and emerging B-21 – will bring a new dimension to US nuclear attack options and potentially place a new level of pressure upon potential adversaries.

Discussion of the F-35's role in nuclear deterrence emerged recently during a House Armed Services Committee hearing on the Pentagon's Nuclear Posture Review. In written testimony, Defense Secretary James Mattis cited the F-35 as an indispensable element of US and NATO nuclear deterrence. "Modernizing our dual-capable fighter bombers with next-generation F-35 fighter aircraft will maintain the strength of NATO's deterrence posture and maintain our ability to forward deploy nuclear weapons, should the security situation demand it," his testimony states. Mattis also cited the emergence of the F-35 as a "nuclear delivery system" in the context of expressing grave concern that US nuclear weapons modernization has not, in recent years, kept pace with a fast-changing global threat environment. "Nuclear delivery system development over the last eight years shows numerous advances by Russia, China, and North Korea versus the near absence of such activity by the United States, with competitors and adversaries' developing 34 new systems as compared to only one for the US —the F-35 aircraft" Mattis said in written statements.

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Officials with the Office of the Secretary of Defense confirmed to Warrior Maven that Mattis here is indeed referring to an emerging "nuclear variant" of the F-35. Multiple news reports, such as Business Insider, cite senior officials saying a nuclear-armed F-35 is slated to emerge in the early 2020s, if not sooner. The F-35 is equipped to carry the B-61 nuclear bomb, according to a report in Air Force Magazine. It makes sense that the F-35 would increasingly be called upon to function as a key element of US nuclear deterrence strategy; in

recent months, F-35s deployed to the Pacific theatre to participate in military exercises over the Korean Peninsula.

The weapons, ISR technology and multi-role functions of the F-35 potentially provide a wide range of attack options

should that be necessary in the region. Utilizing speed, manoeuvrability and lower-altitude flight when compared to how a bomber such as a B-2 would operate, a nuclear-capable F-35 presents new threats to a potential adversary. In a tactical sense, it seems that a high-speed F-35, fortified by long-range sensors and targeting technologies, might be well positioned to identify and destroy mobile

weapons launchers or other vital, yet slightly smaller on-the-move targets. As part of this equation, an F-35 might also be able to respond much more quickly, with low-yield nuclear weapons in the event that new intelligence information locating a

new target emerges.

The F-35 recently completed a series of weapons separation tests and is currently able to be armed with the AIM-9X, AIM-120, AIM-132, GBU-12, JDAM, JSOW, SDB-1 and the

Paveway IV, Lockheed Martin data states. While it is not yet clear exactly how a nuclear weapon might integrate onto the platform, the F-35 is configured to carry more than 3500 pounds of ordnance in stealth mode and over 18-thousand pounds uncontested. While senior Pentagon leaders are understandably hesitant to discuss particular contingencies or attack scenarios, the NPR is quite clear that a more pro-active nuclear weapons posture is aimed at strengthening “deterrence.” After analysing the global threat calculus, the NPR calls for rapid inclusion of two additional nuclear weapons options – to include a sea-launched nuclear armed cruise missile. “A nuclear-armed sea-launched cruise missile and the modification of a small number of existing submarine launched ballistic missile warheads to provide a low-yield option – will enhance deterrence by ensuring no adversary under any circumstances can perceive an advantage through limited nuclear escalation or other strategic attack,” Gen. Paul Selva, Vice Chairman of the Joint Chiefs of Staff, told reporters.

Senior Pentagon leaders stress that neither of these new nuclear weapons recommendations in the NPR require developing new nuclear warheads or will result in increasing the size of the nuclear stockpile. NPR DoD advocates further stress that the addition of these weapons does align with US non-proliferation commitments. Mattis and other senior leaders seem aware that elements of the NPRs strategic approach may reflect a particular irony or paradox; in response to questions from lawmakers about whether adding new low-yield nuclear weapons could “lower the threshold” to nuclear war and therefore introduce new

elements of danger, Mattis told Congress that increasing offensive nuclear-weapons attack capability will have the opposite effect, meaning the added weapons would improve deterrence and therefore enhance prospects for peace. Specifically, Mattis explained that a new, low-yield SLBM could likely provide pressure on Russia to a point where they might be more inclined to negotiate about adhering to the INF treaty they have violated. “We have an ongoing Russian violation of the INF. We want our negotiators to have something to negotiate with because we want Russia back in compliance,” Mattis told lawmakers.

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Alongside this strategic emphasis, Mattis also stressed that the NPR stipulates that nuclear weapons will only be used in the most extreme cases, adding that the “use of any nuclear weapon is a strategic game changer. Nuclear deterrence must be considered carefully.” Citing the rapid technological progress of adversary air-defense

systems, Mattis further elaborated that a sea-launched cruise missile option might be necessary to hold potential enemies at risk in the event that air-dropped low-yield weapons were challenged to operate above necessary targets.

“To drop a gravity bomb that is low-yield means a bomber would have to penetrate air defenses. Air defenses are very different than they were 20 years ago,” Mattis told Congress. This phenomenon also provides indispensable elements to the argument in favor of the Pentagon’s current development of a new nuclear-armed, air launched cruise missile – the Long Range Stand-Off weapon (LRSO). In similar fashion, a nuclear cruise missile could hold

enemy targets at risk in a high-tech threat environment where bombers were less able to operate. Some critics of the LRSO maintain that the introduction of the LRSO brings a “destabilizing” effect to the possible use of nuclear weapons. In a manner quite consistent with the current NPR, senior Air Force weapons developers told Warrior Maven over the course of several interviews that, by strengthening deterrence, the addition of a new LRSO is expected to have the reverse – or “stabilizing” – effect by making it more difficult for a potential adversary to contemplate a first strike.

NPR proponents say a strengthened and more wide-reaching nuclear weapons approach is necessary, given the current threat environment which does, without question, seem to be raising the possibility of nuclear confrontation to a level not seen in years. “We’re concerned about: some of the adjustments in potential adversaries’ thinking about nuclear weapons. With a greater reliance on nuclear weapons, a featuring of them, in some cases — for example, in the Russian nuclear doctrine, called “Escalating to De-escalate”. John Rood, Under Secretary of Defense for Policy told reporters when discussing the NPR.

From the Nuclear Posture Review: Russia’s belief that limited nuclear first use, potentially including low-yield weapons, can provide such an advantage is based, in part, on Moscow’s perception that its greater number and variety of non-strategic nuclear systems provide a coercive advantage in crises and at lower levels of conflict. Recent Russian statements on this evolving nuclear weapons doctrine appear to lower the threshold for Moscow’s first-use of nuclear weapons.

The text of the report specifically cites the importance of dual-capable aircraft (DCA) in Europe and states that the F-35 is fundamental to deterring Russia. “We are committed to upgrading DCA with the nuclear-capable F-35 aircraft. We will work with NATO to best

ensure—and improve where needed—the readiness, survivability, and operational effectiveness of DCA based in Europe,” the Nuclear Posture Review states.

Nuclear Weapons Modernization: New ICBM: The NPR also seeks to accelerate ongoing efforts to modernize the air, sea and ground portions of the nuclear triad. DoD is immersed in current efforts to fast-track development and prototypes of a new Ground Based Strategic Deterrent ICBM, Air Force developers have told Warrior Maven. Early prototyping, including expected prototype “shoot off” testing is slated for 2020, service developers have told Warrior Maven in recent interviews. Northrop Grumman and Boeing are both now under contract to build the new weapon. The Air Force plans to build at least 400 GBSDs, Air Force senior leaders have said. Critical elements of the new ICBM, developed to replace the decades-old Minuteman IIIs, will feature a new engineering method along with advanced command control, circuitry and guidance systems, engineers have said.

New Bomber: Regarding the Air component, the Air Force recently completed a critical design review of its new B-21 Raider nuclear-capable stealth bomber. As is often the case with nuclear weapons, many of the details regarding the development of this platform are not available, but there is widespread discussion among US Air Force leaders that the bomber is expected to usher in a new era of stealth technology; much of the discussion focuses upon the bomber’s ability to operate above advanced enemy air defenses and “hold any target at risk anywhere in the world,” the Air Force Military Deputy for Acquisition Lt. Gen. Arnold Bunch has told Warrior Maven in past interviews.

Early available renderings of the bomber show what appears to be an advanced B-2 like design, yet possibly one with a lower heat signature and improved stealth properties. However, service leaders are quick to point out that, given

advancements in Russian air defenses, stealth will surge forward as “one arrow in a quiver” of nuclear attack possibilities. This is due to the fact that the most modern air defenses, such as S-400 and the emerging S-500s, are built with faster processing speed, improved digital networking connecting firing and radar nodes and longer-range targeting technology, among other things. Concurrently, the Air Force is surging forward with a massive B-2 modernization overhaul, involving new digital nuclear weapons capability and the integration of a developing system called the Defensive Management System. This enables the B-2, which Air Force developers acknowledge may indeed be more vulnerable to advanced air defenses than in earlier years when it was first built, to more quickly recognize locations of enemy air defenses at safer ranges as a means to avoid detection.

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The ISRO, in August, quietly initiated ‘Project NETRA’ – an early warning system in space to detect debris and other hazards to Indian satellites. The project estimated to cost Rs.400 crore, when in place, will give India its own capability in space situational awareness (SSA) like the other space powers — which is used to ‘predict’ threats from debris to Indian satellites.

New Nuclear-Armed

Ballistic Missile Submarine: Finally, shifting to a program widely regarded as among the most significant across the DoD enterprise, the Navy is already underway with early development of the new nuclear-armed Columbia-Class ballistic missile submarines. Several key current efforts with this, including early “tube and hull” forging of missile tubes, work on a US-UK common missile compartment – and little discussed upgrades to the Trident II D5 nuclear missiles. Undersea strategic deterrence, as described by Navy and Pentagon leaders, offers a critical means to ensure a second strike ability in the

event of a catastrophic first-strike nuclear attack impacting or disabling other elements of the triad.

While it may seem obvious, nuclear deterrence hinges upon a recognizable, yet vital contradiction; weapons of seemingly limitless destructive power – are ultimately employed to “keep the peace” – and save lives. Along these lines, Senior Navy and Air Force nuclear weapons developers routinely make the point that – since the advent of nuclear weapons – the world has managed to avoid massive, large-scale major power force on force warfare. While Pentagon leaders rarely, if ever, offer a window into current nuclear-strike capabilities, it is widely discussed that the current North Korean nuclear threat is leading US military planners to envision the full spectrum of nuclear weapons contingencies. Even further, the US did recently send B-2 bombers to the Asian theater – stationing them in Guam

Source: <https://nationalinterest.org>, 20 September 2019.

BALLISTIC MISSILE DEFENCE

INDIA

ISRO Initiates ‘Project NETRA’ to Safeguard Indian Space Assets from Debris and other Harm

In the middle of its two-month Chandrayaan-2 campaign, the ISRO, in August, quietly initiated ‘Project NETRA’ – an early warning system in space to detect debris and other hazards to Indian satellites. The project estimated to cost Rs.400

crore, when in place, will give India its own capability in space situational awareness (SSA) like the other space powers — which is used to ‘predict’ threats from debris to Indian satellites. It also goes so far as to serve as an unstated warning against missile or space attack for the country, experts say. The space agency says our SSA will first be for low-earth orbits or LEO which have remote-sensing spacecraft. Under NETRA, or Network for space object Tracking and Analysis, the ISRO plans to put up many observational facilities: connected radars, telescopes; data processing units and a control centre. They can, among others, spot, track and catalogue objects as small as 10 cm, up to a range of 3,400 km and equal to a space orbit of around 2,000 km. With this the ISRO, which has placed satellites to track the earth from above, will also start training its eyes on space from earth.

Space debris could be floating particles from dead satellites or rocket parts that stay in orbit for many years. Satellite agencies agonise over even a speck of paint or fragment floating towards their spacecraft: it disables on board electronics and cripples the satellite worth several hundred crore rupees besides many services that run on it. Agencies constantly look for debris at the time of a launch and through the life of a satellite.

Global Action: ISRO Chairman K. Sivan had earlier told *The Hindu* that the NETRA effort would make India a part of international efforts towards

tracking, warning about and mitigating space debris. NETRA's eventual goal is to capture the GEO, or geostationary orbit, scene at 36,000 km where communication satellites operate. In the

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Dr. Sivan said, "Even now we do collision avoidance manoeuvres on our satellites. To do that we depend on data from NORAD and others available in the public domain but we don't get accurate [or comprehensive] information. By establishing an observation system of our own, we become part of the global network and can access precise data." NORAD, or the North American Aerospace Defense Command, is an initiative of the US and Canada that shares selective debris data with many

NORAD, or the North American Aerospace Defense Command, is an initiative of the US and Canada that shares selective debris data with many countries. The new SSA centre would consolidate debris tracking activities that are now spread across ISRO centres. Currently there are 15 functional Indian communication satellites in the geostationary orbit of 36,000 km; 13 remote sensing satellites in LEO of up to 2,000 km; and eight navigation satellites in medium earth orbits.

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Security Ring: More importantly, the SSA also

has a military quotient to it and adds a new ring to the country's overall security, as space and defence experts read it. NORAD, too, uses satellites,

ground and air radars to secure its two countries against attacks from air, space or sea. ...

Source: <https://www.thehindu.com>, 24 September 2019.

SAUDI ARABIA

Why Saudi Arabia's Multi-Billion Dollar Anti-missile Defence Came a Cropper on September 14

The attack on the Aramco facility in Saudi Arabia on September 14 marked one of the deadliest acts of destruction of Saudi infrastructure in over two decades. In destroying 50 per cent of the country's crude oil supply, it sent markets into madness, with Brent crude experiencing a global spike. Aramco may recover from this and the oil market may normalise in the next few months but questions around how a country that is the largest arms importer in the world, and the largest global oil-exporter, could not defend against such an attack, continue to linger. According to latest reports, the attack comprised 25 low-flying drones and cruise missiles. Saudi Arabia and the US have blamed Iran for the attack, despite Yemen-based Houthi rebels claiming it as their own shortly after the explosions at the Aramco facility. US Secretary of State Mike Pompeo condemned Iran for the attacks, labelling it an 'act of war'. Saudi military spokesman, Col. Turki al-Malki said the attack "could not have originated from Yemen", contesting the Houthi rebels' narrative.

Blind Spots in Saudi Air Defence: But a closer look at the Saudi missile defence system positioned at the Aramco facilities reveals the existence of grave security vulnerabilities, especially with regard to UAVs. The primary air defence system employed by the Saudi military to protect sensitive facilities is that of the US' long-range Patriot system. The Patriot system has shown past success in intercepting Scud and Tochka missiles fired by Houthi rebels against Saudi locations, and Riyadh specifically. However, defence experts claim that the Patriot system is not equipped to deal with cruise missiles and drones that fly both slower, and lower to the ground. Developed by Lockheed Martin and Raytheon, the

Patriot Missile Defence System is believed to integrate a radar capable of detecting and tracking aerial threats within a 100 km range. Upon confirming a threat, the system can launch a missile in under 9 seconds. Equipped with a transponder, the missile can relay information back to the radar station, and can be guided to intercept its target.

Although the system is listed as capable of intercepting UAVs and cruise missiles along with the high-altitude ballistic missiles, Dave DesRoches, from the National Defense University of Washington... explained, "Most conventional air defence radar is designed for high-altitude threats like missiles. Cruise missiles and drones operate close to the earth, so they aren't seen because of the Earth's curvature. Drones are too small and don't have heat signature for most radar." Other analysts confirm DesRoches' assessment, stating that the Patriot System, in particular, does not have a great record, especially in intercepting threats of this nature. The Patriot system claims to have a detection range of 22 km however, similar to other defence systems also integrated at the facility (German-made Skyguard and French Shahine mobile anti-aircraft system). However, analysts believe that the detection range (on conventional air defence systems) for smaller objects is significantly shorter, translating to smaller warning times as well.

'Poor Readiness': However, the technical inadequacy of the Saudi air defence system may not be the only contributory factor to Saudi's inability to defend the attack. Speaking to CNBC the Royal United Services Institute, Jack Watling, a land and warfare expert, explains that despite the Saudis investing greatly into anti-aircraft defence, the kingdom's forces have "low readiness, low competence, and are largely inattentive".

Russia Chimes In: So what would Saudi Arabia need to do to solve the clear and present threat of low-flying aerial threats? It appears Vladimir Putin has the answer. Speaking from Ankara on 16 September, Putin said, "In order to protect 'our kind', our country, we are ready to provide the

corresponding air to Saudi Arabia, and the political leadership of Saudi Arabia just needs to make a wise state decision." Russia has already struck deals with Iran and Turkey for the sale of the S-300 and S-400 air defence systems, and is currently in high-level talks with India as well.

The failure of US-made air defence systems in Saudi Arabia has provided an opportunity for Moscow to pitch its own equipment, and Putin's statement comes as no surprise at a time when all eyes are on Saudi Arabia.

According to SIPRI, the US and Russia were the largest arms exporters in 2018. Perhaps more tellingly, Saudi Arabia is the largest arms importer, increasing its arms import volume by 192 per cent in 2014-2018 compared to 2009-2013.

As tensions escalate in the Middle-East, there is a growing impetus for Saudi Arabia to implement defence measures capable of countering emerging technological threats. However, as we have witnessed, this may also have a great deal to do with improving its military competencies.

Source: <https://www.timesnownews.com>, 22 September 2019.

US Orders Additional Missile Defence Capabilities to Saudi Arabia

The US will send a "moderate" number of American troops to the Middle East and additional missile defence capabilities to Saudi Arabia in response to attack on oil facilities, top Pentagon officials said. Secretary of Defence Mark Esper said on 20 September that the decision came at the request of Saudi Arabia and the UAE and represented a "first step" in the US response. He

reiterated US statements that evidence collected to date show Iran was responsible for the attacks. The briefing by Esper and General Joseph Dunford,

chairman of the Joint Chiefs of Staff, followed a meeting of national security officials at the White House. "Iran is waging a deliberate campaign to destabilize the Middle East," Esper told reporters at the Pentagon. He added that the US has shown "great restraint" in responding so far, but called the strike on Saudi Aramco facilities... a "dramatic escalation."

Esper and Dunford are still deciding on the specific number of troops and weapons systems but said the personnel deployment will be relatively small, not numbering in the thousands, and that more details would be forthcoming. In

addition to the US missile defense assistance, Esper said "we are calling on many other countries who all have these capabilities to do two things - stand up and condemn these attacks" and also contribute equipment. US and Saudi analyses of the attack have described the strike as complex, involving a mix of

low-flying drones and cruise missiles coming from the north. The attack exposed glaring vulnerabilities in Saudi Arabia's defence capabilities despite having spent hundreds of billions of dollars on weaponry in recent years.

Saudi Arabia has already taken delivery of Patriot-3 hit-to-kill missiles bought years ago and designed to defend against cruise and ballistic missiles. The kingdom earlier this year finalized a long-sought after contract for Lockheed Martin Corp.'s Thaad missile interceptors designed to intercept ballistic missiles at higher altitudes. It's not known whether any Thaad batteries have

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been delivered. "No single system is going to be able to defend against a threat like" the combination of systems launched against Saudi Arabia, Dunford said. "But a layered system of defensive capabilities would mitigate the risk of swarms of drones or other attacks that may come from Iran."

During a news conference earlier on 20 September, President Trump signalled he's trying to avoid a military conflict. Trump campaigned in 2016 on getting the US out of Mideast conflicts and he's repeatedly criticized the second US invasion of Iraq. "I will say I think the sanctions work, and the military would work," Trump told reporters. "But that's a very severe form of winning." After Houthi rebels in Yemen claimed credit for the strike, Saudi and US officials said that the drones and missiles used were made by Iran, had never before been deployed by Iranian proxy groups, and came from a northerly direction, ruling out Yemen as a launch site. Secretary of State Michael Pompeo has repeatedly said Iran was responsible for the attack. As tensions surged, Iranian Foreign Minister Mohammad Javad Zarif warned that any US or Saudi strike on his country in response to the attacks on the kingdom's critical oil facilities would lead to "all-out war." "I know that we didn't do it," he told CNN. He later said in a post on Twitter that it was "curious" the Saudis "retaliated" against Yemen when Iran was blamed for the attacks. "It is clear that even the Saudis themselves don't believe the fiction of Iranian involvement."

Pompeo returned on 20 September from a two-day trip to Saudi Arabia and the UAE, saying he wanted to begin building a coalition that would organize a response to Iran. On the same day

Treasury Department announced it is sanctioning Iran's central bank and sovereign wealth fund, a move aimed at squelching any remaining trade the country conducts with Europe and Asia.

Source: <https://www.arabianbusiness.com>, 21 September 2019.

NUCLEAR ENERGY

INDIA

21 New Nuclear Reactors to Add 15000 MW Capacity: DAE Secy

DAE Secretary KN Vyas on 18 September said nearly 21 nuclear reactors are under various stages of construction and planning which will add around 15000 MW of power generating capacity. "India has a plan for capacity addition in nuclear power generation and presently we have 21 reactors under the stage of construction and planning. This will help in achieving an additional capacity of about 15,000 MW," he said.

21 new nuclear power reactors with a total installed capacity of 15,700 MW are expected to be set up in the country by 2031. It also informed that five sites — which would have total 28 nuclear reactors — have been accorded 'in principle' approval by the central government. At present, there are nine nuclear power reactors at various stages of construction" that are targeted for completion by 2024-25. Vyas, who was in Vienna for the 63rd General Conference of IAEA in Vienna also launched a global cancer care network 'NCG Vishwam Cancer Care Connect', which will enable other countries to access Indian technology to cure the disease.

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Speaking at the event, Vyas said that India has

made huge progress in the utilisation of radiation technologies for societal uses, the knowledge and expertise of which is being shared with friendly partners. "The process has already set in through increased interactions and actual collaborations in all areas of nuclear technologies concerning human life, be it power, health, agriculture or human capital development," he added.

Vyas said through the NCG Vishwam connect India can join hands with all interested partner countries in its fight against cancer. National Cancer Grid (NCG), established and managed by Tata Memorial Centre, is a network of major cancer centers, research institutes, patient groups and charitable institutions across India with the mandate of establishing uniform standards for the treatment of cancer....

Source: <https://energy.economictimes.indiatimes.com>, 19 September 2019.

RUSSIA

Why Russia Built a Floating Nuclear Plant; Why Some are Nervous

On 14 September, a Russian-built floating nuclear power plant completed its 5,000-km journey along the Northern Sea Route, causing excitement in the energy sector, but sparking fears among environmentalists over the safety of the Arctic region. The 'Akademik Lomonosov', is the first such plant to be built in the world.

Russia's Floating N-plant: The Akademik Lomonosov is a first-of-its-kind floating nuclear power station built in St Petersburg, the Russian port city on the Gulf of Finland. Three tugboats pulled it from the northern port of Murmansk for 5,000 kilometres to Chukotka, in Russia's Far East. Named after the 18th-century Russian scientist Mikhail Lomonosov, the 21,000-tonne floating plant is 144 m long and 30 m wide, and contains two nuclear reactors of 35 MW each. It is a small plant compared to conventional land-based nuclear projects. Run by the state-owned nuclear energy corporation Rosatom, the Akademik Lomonosov is expected to have a working life of

40 years.

Why Such a Plant: After it becomes operational in 2020, the plant will supply electricity to the Chukotka region, where important Russian national assets such as oil, gold, and coal reserves are located. Some 50,000 people currently live in the area, and get their electricity from a coal power station and an ageing nuclear power plant. The floating station would become the northernmost nuclear power project in the world.

Electricity supplied by floating power stations, without long-duration contracts or massive investments, is an option that island nations could consider. Power from such small-sized plants can also be supplied to remote regions, as Russia plans to do. Additionally, it is argued that nuclear power plants are a more climate-friendly option than coal-fired plants that emit greenhouse gases.

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Fears and Apprehensions: Environmental groups such as Greenpeace Russia have criticised the project as a "Chernobyl on ice" and a "nuclear Titanic". Activists fear that any accident aboard the plant could cause great damage to the fragile Arctic region. A recent nuclear accident in Russia after which there was a brief spike in radiation levels has added to the fears. The radiation fallout from the Fukushima nuclear disaster in Japan is also cited as a reason to not rush into such projects.

Source: <https://indianexpress.com>, 18 September 2019.

USA

Rebuilding America's Domestic Uranium Industry

The decline of American mining and production of critical minerals in recent decades is a self-inflicted wound that could imperil our economy and national security. Data from the latest federal geological survey showed the US has become 99 percent dependent on imports for at least 20 critical and strategic minerals, not including each

of the rare earth minerals, even though we were No.1 in mining output across the world as recently as 1990.

Uranium is a perfect case in point. In Western states like Arizona, Utah, Colorado, New Mexico, Wyoming, Nebraska and Texas, the US has massive domestic uranium resources and reserves, but, incredibly, more than 90 percent of US uranium requirements are now imported. Although many of the imports come from Canada and Australia, more than 40 percent of the total US uranium imports originate from a potentially adversarial trading bloc — Russia and two of its former satellites, Kazakhstan and Uzbekistan.

This is not a friendly free-market group that America can depend on, especially in an emergency. There is a rapidly rising share of uranium production coming from state-controlled companies not located in Western market-based economies. Worse, the amount of uranium imported to the US from state-owned companies is now close to what is supplied by our allies Canada and Australia combined. The state ownership of Rosatom — Russia's state nuclear energy corporation — is so highly-subsidized at the expense of the Western uranium mining industry that even Canada and Australia are also being undercut by Rosatom's cheap uranium pricing.

The Chinese have also significantly grown their state-owned nuclear enterprises, including acquiring additional uranium from Namibia. While the US does not import significant quantities of

uranium from the Chinese, they have announced their intention to penetrate the US nuclear market. They are also an unreliable trading partner. In addition, several domestic issues contribute to dwindling US production, including some states' environmental laws and regulations that are overtly anti-mining. Also, a parade of never-ending nuisance lawsuits by well-funded nongovernmental organizations aim to force closure of uranium mines currently on standby. Also, the high cost of maintaining non-producing uranium mines, and mothballed processing facilities placed on standby, is also a detriment.

Here are two recent examples of how we have impaired our domestic mining industry. First, Barack Obama shut off some of the highest grades of uranium production in the US in 2012. Second, states like Virginia ban uranium mining and have won a US Supreme Court ruling upholding the bans. A presidential memoranda issued in July ordered the formation

of a cabinet-level working group to find acceptable solutions to the US uranium mining dilemma — what President Trump referred to as a "national security concern." Were the US uranium mining industry to disappear, the prospects of a timely and strategic comeback could be severely impaired — and costs of reviving the industry might be prohibitive. Uranium mining in this country could be "lost" entirely, and the

aging, disappearing workforce makes a comeback more problematic.

Too bad, because so much attention has been appropriately devoted to ensuring the reliability

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and safety of the American electric grid system. Civilian nuclear plants provide critical baseload power that keeps the grid stable. Nuclear energy provides almost 20 percent of that capability, and more than half of the nation's carbon free power. Nuclear power production could even increase modestly because some on the left have suggested that more nuclear power may be a way to further reduce greenhouse gas emissions. President Trump will soon be presented with the working group's recommendations to alleviate America's uranium crisis.

We don't know what the best solution is. We don't support trade protectionism. As The Heritage Foundation's energy analyst Katie Tubb has noted: "Even the Defense Production Act empowers the Pentagon to prevent critical shortages in a way that does not include trade barriers that treat allies the same as unfriendly nations." Imports from Canada are not a problem. The problem is the imports that come from nations that are not allies. Cheap uranium imports from those nations can appear to be a blessing to American nuclear power producers and energy consumers, but we are not talking about toys, tomatoes or household items here. The strategy of benign neglect is not working and must be replaced with a smart strategy that ensures reliable and affordable uranium for years to come.

Source: Stephen Moore and Ned Mamula, <https://www.washingtontimes.com>, 21 September 2019.

NUCLEAR COOPERATION

SAUDI ARABIA-SOUTH KOREA

Saudi Arabia's KACARE, Korea's KAERI to Cooperate on SMART Deployment

A Memorandum of Understanding on comprehensive cooperation in nuclear research and development was signed on 17 September by Mun Miock, first vice minister of South Korea's Ministry of Science and ICT (MSIT), and Khalid bin Saleh Al-Sultan, president of Saudi Arabia's King Abdullah City for Atomic and Renewable Energy (KA-CARE). The agreement was signed on the

sidelines of the IAEA General Conference in Vienna. Under the MoU, Korea and Saudi Arabia will work together to refine the design of the SMART reactor. Korea will also assist in gaining Saudi design approval of the reactor, as well as cooperating in the construction and operation of a SMART reactor in Saudi Arabia. The partners will also promote the SMART design to other Middle Eastern and Southeast Asian countries considering the use of small reactors.

A separate agreement was also signed between MSIT and KA-CARE to establish a joint nuclear energy research centre in Saudi Arabia by the end of 2019. "The MoU and the research centre agreement strengthen the partnership between South Korea and Saudi Arabia as we move to enter the global market for medium-small nuclear reactors," Mun was quoted as saying by the Yonhap news agency.

SMART is a 330 MWt pressurised water reactor with integral steam generators and advanced safety features. The unit is designed for electricity generation (up to 100 MWe) as well as thermal applications, such as seawater desalination, with a 60-year design life and three-year refuelling cycle. While the basic design is complete, development had been stalled by the absence of any orders for an initial reference unit. Developed by the Korea Atomic Energy Research Institute (KAERI), SMART received standard design approval from the Korean regulator in mid-2012. KAERI had planned to build a demonstration plant to operate from 2017. In March 2015, South Korea and Saudi Arabia signed an MoU to jointly promote the SMART reactor in the global market. This followed an inter-governmental agreement the two countries signed in 2011 on the development and implementation of nuclear energy for peaceful purposes. In September 2015, contracts were signed between KA-CARE and KAERI to support their cooperation in developing SMART.

Between late-2015 and November 2018, Korea and Saudi Arabia invested USD130 million to complete their pre-construction design project for

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the reactor. South Korean companies Kepco Engineering & Construction and Korea Hydro & Nuclear Power in December 2018 signed a MoU to jointly develop a project to construct a plant based on SMART in Saudi Arabia.

Source: <https://www.utilities-me.com>, 23 September 2019.

UGANDA–RUSSIA

Uganda Says Russia to Help it Develop Nuclear Energy

Uganda said on 18 September, it had signed an Inter-Governmental Agreement (IGA) with Russia to help the East African country build capacity to exploit nuclear technology for energy, medical and other peaceful purposes. The government of President Yoweri Museveni has previously said it is eager to use the country's uranium deposits to boost energy production capacity.

In May 2018, Uganda also signed a memorandum of understanding with China National Nuclear Corporation (CNNC) to help Uganda build capacity in the use of atomic energy for peaceful purposes. In an emailed statement, Uganda's energy ministry said the IGA with Russia was signed in Vienna on 17

September, 2019 between Energy Minister Irene Muloni and Nikolai Spasskiy, the deputy director general of Russian state corporation ROSATOM. Under the agreement.... Russia will help Uganda with development of nuclear infrastructure and production and application of radioisotopes for industrial, healthcare and agricultural use. "Spasskiy expressed the commitment and readiness of ROSATOM to support Uganda's plans to develop the peaceful use of nuclear energy especially in the nuclear power plant development," the statement said.

Uganda's energy needs are expected to jump in coming years as it prepares to start producing crude oil in 2022 from fields in its west where reserves of 6 billion barrels were discovered in 2006. Uganda's ministry of energy and mineral

development has previously said the country has substantial deposits of uranium but reserve estimates are not known as the mineral has not been commercially explored.

Source: <https://www.reuters.com>, 18 September 2019.

NUCLEAR NON-PROLIFERATION

BENIN

Benin Joins Nuclear Safety, Security and Liability Treaty Instruments

In an unprecedented move by any country, the Government of Benin on 18 September, deposited instruments expressing its consent to be bound by ten international legal instruments under IAEA auspices all at once and brought into force its

Comprehensive Safeguards Agreement and Additional Protocol. "The use of nuclear technologies has already made a major impact in the development of Benin over the last decade," said Benjamin Hounkpatin, Minister of Health. "In order to expand its use, particularly in health care, we need to have a robust legal climate. We now do." In parallel to preparing adherence to the

international treaty instruments, the country also enacted legislation to set up an independent nuclear regulator for the first time. It will be in place in coming weeks, he said.

The IAEA has witnessed many countries deposit legal instruments, but never at this scale, Acting Director General Cornel Feruta said. "I commend Benin for its commitment to the safe and secure use of nuclear technology," he said. "We stand ready to continue our support to Benin as it expands the use of nuclear techniques."

Multilateral treaties under IAEA auspices cover a range of subjects, particularly in strengthening nuclear safety, security and liability globally. These include the Convention on Nuclear Safety, the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive

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Waste Management, the Convention on Early Notification of a Nuclear Accident, the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, the Convention on the Physical Protection of Nuclear Material and its Amendment, the Vienna Convention on Civil Liability for Nuclear Damage and the 1997 Protocol to amend it, the Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention and the Convention on Supplementary Compensation for Nuclear Damage.

At the same time, Mr Hounkpatin handed over a written notification that Benin had passed legislation to bring into force a Comprehensive Safeguards Agreement (with a revised Small Quantities Protocol) and its Additional Protocol. The additional protocol, which is in force with 136 countries, increases the IAEA's ability to verify the peaceful use of nuclear material in a country, and to conclude whether all, and not only declared, nuclear material remains in peaceful use. The Small Quantities Protocol is applicable to countries that have relatively little nuclear material. The IAEA has provided assistance to Benin in preparing domestic legislation related to the safe and secure use of nuclear technology. The assistance involved review and advice on draft legislation, including legislation for the set-up of an independent nuclear regulator and legislation on safety, security and safeguards, which was enacted in 2017. It also provided support through training in nuclear law training and awareness-raising of senior officials. "We are proud to have helped Benin on its journey towards safer and more secure use of nuclear technologies," said Peri Lynne Johnson, the IAEA's Legal Adviser and Director of the Office of Legal Affairs. "We will remain at Benin's disposal as the authorities work towards the implementation of these treaties."

Benin has five ongoing national technical cooperation projects, and its benefits from the use of nuclear technology range from breeding new soya varieties to verifying the level of pesticide residues in pineapple and the monitoring of pollutants in the environment and in food. It is now working on setting up the country's first radiotherapy and nuclear medicine departments in the capital Cotonou, and plans to purchase its

first ever radiotherapy machine, Mr Hounkpatin said.

Source: <https://www.iaea.org>, 19 September 2019.

NUCLEAR PROLIFERATION

PAKISTAN

Pakistan's Dark, Dangerous Nuke Secret

India Today TV's Open-Source Investigation discovers that the heart of Pakistan's nuclear project at Kahuta in Rawalpindi district may have covertly expanded its uranium-enrichment program over the past five years. Sample this from the Pakistan Prime Minister's (PM) mid-September interview to an international media outlet: "So when a nuclear-armed country fights to the end, to the death, it has consequences." And this from his August 30 opinion piece in the New York Times: "If the world does nothing to stop the Indian assault on Kashmir and its people, there will be consequences for the whole world as two nuclear-armed states get ever closer to a direct military confrontation."

Ever since India revoked Jammu and Kashmir's special status on August 5, Imran Khan has issued multiple threats of a devastating nuclear war in the Asian subcontinent. In what could be a disturbing revelation for the international community, an India Today TV Open-Source Investigation has found the Pakistani PM isn't venting empty rhetoric — his intolerable threat to humanity could well be real. Remember, Islamabad is globally notorious as a major proliferant of nuclear materials and expertise. Back in 2004, Pakistan emerged at the centre of an unprecedented nuclear scandal – the father of its atomic bomb, AQ Khan, was exposed as the world's most sophisticated smuggler of nuclear technology to rogue regimes. Fast forward to September, 2019: India Today TV's Open-Source Investigation discovers that the heart of Pakistan's nuclear project at Kahuta in Rawalpindi district, set up by Khan himself in 1976, may have covertly expanded its uranium-enrichment program over the past five years.

The OSINT findings lift the veil of secrecy surrounding the fortified site, officially identified as a global threat. The IAEA has called this lab

“an illicit source of nuclear technology” and “a serious challenge to nuclear-non-proliferation”. High-resolution satellite images, accessed by India Today TV’s OSINT team, confirm the presence of a new facility 800 meters from the old nuclear workshop at Kahuta’s Khan Research Laboratory. When analysed closely, the pictures reveal how a piece of land turned from an empty helipad in 2014 to a possible nuclear centrifuge facility in 2019. The damning new images have a dark backstory. Research by independent global think tanks has earlier pointed to an under-construction structure at the same facility. The Nuclear Threat Initiative, Jane’s and the Institute for Science and International Security agreed that the structure, then being built, resembled a nuclear centrifuge, a facility where uranium is enriched into potent fuel for nuclear bombs.

But foreign watchdogs have remained inconclusive as the construction continued at Kahuta. New satellite images obtained by India Today TV, however, finally confirm that the structure is spread over six hectares and is fully ready. It’s surrounded by a thick two-meter boundary wall and a camouflaged rooftop, the pictures show in what are the telltale signs of a clandestine nuclear program. “Satellite images that I saw very clearly indicate the intent that was from that point onwards. I think it is very surprising that the international community hasn’t made enough noise about it,” noted retired Air Vice-Marshal Sunil Nanodkar, when shown the latest pictures. “The facility is coming up close to the Kahuta facility where there is a lab from which weaponisation of Pakistan’s nuclear capabilities is taking place. I think we need to watch it clearly in terms of what is going to be its capacity. We know it’s a nuclear facility.”

Ravi Kumar Gupta, a former director at the DRDO’s public interface division, echoed similar concerns. “It shows Pakistan is trying to expand its nuclear-enrichment facility. We cannot ignore the fact that it is very close to the Khan Research Laboratory, the very place where it developed its

nuclear bombs and missiles, so it has to be taken very seriously by the world community,” he warned. Pakistan also has a civil-nuclear program assisted by China. But the Khan Research Facility is not under IAEA’s global safeguards. With PM Imran Khan already putting the onus of any future nuclear flashpoint on the international community, experts believe it’s high time the world powers intervened. “These pictures bring you very close to Iranian and North Korean facilities. If today we say it’s only Iran and North Korea – and not Pakistan — then there is something fishy. I think we need to take it up. We need to raise it on all international forums,” said Vice-Marshal (retd.) Nanodkar.

According to the NTI, Pakistan’s stockpiles comprise 90-110 nuclear warheads. These warheads, defence experts caution, would be chiefly for Pakistan’s land-based nuclear delivery systems, including the medium-range Babur cruise missile, the ballistic Shaheen 1A missile and even the tactical short-range Nasr missile – all pointed solely at India.

Source: <https://www.indiatoday.in>, 24 September 2019.

indiatoday.in, 24 September 2019.

IRAN

Iran cannot be Allowed to Develop Nuclear Weapons: Israeli Foreign Minister

Israel Katz called Iran the biggest threat to stability and security in the Middle East and “the biggest sponsor of terror” on the planet. “Iran uses its proxy terror organizations – Hezbollah in Lebanon, Hamas and the Palestinian Islamic Jihad in Gaza, the Houthis in Yemen, and Shiite militias in Syria and Iraq – against Israel and also against other States in the Middle East,” he said.

“I call on the international community to unite in order to stop Iran. The world cannot allow Iran to develop nuclear weapons. The world cannot allow Iran to develop ballistic missiles, and the world must stop Iran from supporting terror organizations in the region.” Mr. Katz described Israel as a “real

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democracy” for all citizens, both Jewish and non-Jewish, which wants peace with all its neighbours. “We call on the Palestinian Authority to stop incitement, to stop encouraging and financing terrorism. And to recognize the right of the Jewish people to its own state,” he said. “We call on the Palestinians to come back to direct negotiations without any pre-conditions.”

Mr. Katz believes there are opportunities for Middle Eastern countries to cooperate to benefit their economies. Israel, he said, has a “clear policy” to advance ties and normalization with the Gulf States. “We have no conflict with the Gulf States, and we have common interests in the field of security against the Iranian threat as well as in developing many joint civilian initiatives,” he stated.

Source: <https://news.un.org/en/story/2019/09/1047812>, 26 September 2019.

NORTH KOREA

North Korea is Still Expanding its Nuclear Weapon Arsenal and could have 40 Warheads by 2020

North Korea is continuing to expand its nuclear arsenal despite ongoing—though currently stalled—discussions with the US on disarmament, according to a global arms watchdog. Dan Smith, the director of the SIPRI, said on 16 September that Kim Jong Un could have between 30 and 40 nuclear weapons by 2020. This represents a significant increase on the country’s 2019 estimated total of between 20 and 30 warheads, made in an SIPRI report in June 2018. Smith made his prediction while speaking with reporters at the residence of the Swedish ambassador to South Korea in Seoul, *The Chosun Ilbo* newspaper reported. The arms expert suggested that the process of denuclearization

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was a complex one, made more so by the political nature of the project.

North Korea has not tested a nuclear weapon or ballistic missile since it began rapprochement with the US in early 2018. A rapid de-escalation in tensions followed, with Kim and President Donald Trump eventually meeting for a historic summit in Singapore in June. At the close of the

meeting, the two leaders signed a vague agreement committing both to denuclearization of the Korean peninsula. The document, though touted by Trump and his supporters as a significant foreign policy achievement, set out no detail as to how or timeline as to when this would be achieved. Progress has been elusive, despite two more meetings between the two leaders. North Korea watchers have suggested that, despite the highly-publicized destruction of the country’s nuclear test site, Kim’s regime has continued nuclear weapon research and production.

Talks are currently once again stalled. According to anonymous reports in South Korean newspapers, Kim has sought to break the deadlock—or simply continue to stroke Trump’s ego—by inviting the President to visit him in Pyongyang. Trump said last month he thinks the two men will meet again, but US officials have not said any third summit is being planned. The vagueness of the denuclearization commitment has both

The eventual definition will greatly influence the chance of success. Experts have warned that Kim is unlikely to ever give up his nuclear weapons, considering the leverage they offer and the time, money and diplomatic capital spent to produce them. Whether this fits with the US concept of denuclearization remains to be seen.

hamstrung the project and allowed it to continue, despite the lack of progress. Smith suggested on 16 September that the term had not even been defined. “The definition of denuclearization is a big thing to be worked out,” he said, adding that the term has both technical and political significance.

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is unlikely to ever give up his nuclear weapons, considering the leverage they offer and the time, money and diplomatic capital spent to produce them. Whether this fits with the US concept of denuclearization remains to be seen. Though South Korean opinion is a key consideration and the country's role as a mediator useful, Smith suggested that the key to progress on denuclearization ultimately lies with Washington. "The definitive key to unlock the problems does not lie in South Korea's hands. It lies much more in American hands," he said.

Source: <https://www.newsweek.com>, 17 September 2019.

NUCLEAR SECURITY

BELARUS –USA

Belarus, USA to Cooperate in Nuclear Security

Belarus and the US will be developing cooperation in nuclear security. The matter was discussed at a meeting of the Belarusian delegation with Administrator of the US National Nuclear Security Administration, Lisa Gordon Hagerty in Vienna on 17 September.... Attending the meeting on Belarus' behalf was head of the Nuclear and Radiation Safety Department of the Belarusian Emergencies Ministry (Gosatomnadzor) Olga Lugovskaya, representatives of the Joint Energy and Nuclear Research Institute Sosny of the National Academy of Sciences of Belarus, and the Ministry of Foreign Affairs.

The parties reaffirmed commitment to joint efforts to secure the global nuclear safety and security regime. Belarus thanked the US for assistance in developing competencies in physical protection, nuclear and radiation security, including a series of training events for healthcare workers, representatives of the regulatory body (Gosatomnadzor) and scientific organizations. The US provides support in strengthening nuclear security and implementing modern approaches to physical protection of the Joint Energy and Nuclear

Research Institute Sosny of the National Academy of Sciences of Belarus. Expert and technical support is also provided to further enhance the nuclear and radiation safety in the country. Belarusian and American scientists have been successfully conducting joint research. Plans are in place to establish a training center at the Sosny Institute with the support of the US....

Source: <https://eng.belta.by>, 18 September 2019.

NUCLEAR SAFETY

CANADA

IAEA Mission Recognizes Canada's Commitment to Safety, Sees Areas for Enhancement

IAEA team of experts said Canada is committed to strengthening its regulatory framework for nuclear and radiation safety. The team also noted areas for further enhancement. The Integrated Regulatory Review Service (IRRS) team... concluded an 11-day mission to review the regulatory safety framework in Canada. The mission was conducted at the request of the Government of Canada and hosted by the Canadian Nuclear Safety Commission (CNSC). The team also met with representatives of Natural Resources Canada and Health Canada. Using IAEA safety standards and international best practices, IRRS missions are designed to strengthen the effectiveness of the national regulatory infrastructure, while recognizing the responsibility of each State to ensure nuclear and radiation safety.

"Canada has a comprehensive framework for nuclear and radiation safety covering current facilities and activities," said team leader Marta Ziakova, Chairperson of the Nuclear Regulatory Authority of Slovakia. "Moreover, CNSC strives to continuously upgrade its regulatory framework to address new challenges in relation to upcoming technologies, such as small modular reactors." Nuclear power generates about 15 per cent of Canada's electricity. The country has 19 operating

The US provides support in strengthening nuclear security and implementing modern approaches to physical protection of the Joint Energy and Nuclear Research Institute Sosny of the National Academy of Sciences of Belarus. Expert and technical support is also provided to further enhance the nuclear and radiation safety in the country. Belarusian and American scientists have been successfully conducting joint research.

nuclear power reactors at four sites and develops and exports reactor technology. Canada also operates uranium mines and mills, processing and fuel fabrication facilities, and waste storage sites. Canada uses radiation sources in medical and industrial applications and in science and research. It operates five research reactors.

"While we are always looking for opportunities for improvement and welcome recommendations from our international colleagues, the IRRS review confirms that the CNSC has a strong regulatory framework and continues to ensure the safe operation of nuclear facilities in Canada," said Ramzi Jammal, CNSC Executive Vice-President and Chief Regulatory Operations Officer. The 24-member team comprised 20 senior regulatory experts from 17 countries, as well as four IAEA staff members.

"This mission recognizes Canada's ongoing commitment to continuous improvement and the implementation of the IAEA safety standards, which serve as the recognized international basis for nuclear and radiation safety," said David Senior, Head of the IAEA's Regulatory Activities Section. "The findings will help to enhance regulatory effectiveness in nuclear power plant ageing management and the safe handling of radioactive waste."

The team observed regulatory inspection activities at power and research reactors, radioactive waste management facilities, a site with decommissioning activities, research centres, a conversion facility, a hospital, a radioactive sources production facility with transportation activities, an industrial radiography facility and an industrial irradiator. The team identified several good practices, including: (1) The CNSC is highly transparent about its regulatory activities and decisions. (2) Health Canada has raised public awareness of naturally occurring radon.

The team provided several recommendations and suggestions aimed at enhancing Canada's

regulatory framework, including: (1) The Government should enhance the policy and strategy for radioactive waste management. (2) The CNSC should consider better aligning its radiation protection requirements with IAEA safety standards. The final mission report will be provided to the Government in about three months. The Government plans to make the report public.

Source: <https://www.iaea.org>, 13 September 2019.

NUCLEAR WASTE MANAGEMENT

JAPAN

Experts are Outlining why it's 'OK if Japan Dumps Radioactive Fukushima Water' into the Ocean.

Nuclear power generates about 15 per cent of Canada's electricity. The country has 19 operating nuclear power reactors at four sites and develops and exports reactor technology. Canada also operates uranium mines and mills, processing and fuel fabrication facilities, and waste storage sites. Canada uses radiation sources in medical and industrial applications and in science and research. It operates five research reactors.

News broke of Japan's Environmental Prime Minister Yoshiaki Harada announcing his preferred solution for an impending overflow of toxic water at Tokyo Electric Power Company's Fukushima Dai-ichi nuclear power plant: dump it into the Pacific Ocean. According to TEPCO, in 2022, they will run out of storage space

for the contaminated water that's been used in cooling pipes that have kept fuel cores from melting since a 2011 earthquake caused the meltdown of three reactors. To be exact, they already have more than 1,000 storage tanks and now more than 250 million gallons of contaminated water.

"The only option will be to drain it into the sea and dilute it," he said on 10 September, according to Reuters. "The whole of the government will discuss this, but I would like to offer my simple opinion." Officially, the Japanese government is waiting on a report and recommendations from an expert panel to decide what they'll do. While we don't need a scientist to describe to the world why dumping nuclear waste into the Pacific Ocean is potentially dangerous, it does require some

expert analysis to argue the contrary. And some in the know are obliging, outlining exactly why it might be okay to dump contaminated water from a nuclear power plant into said ocean.

“Although not intuitive, this is a very good idea,” author and Earth and environmental sciences expert, James Conca wrote in *Forbes*. Conca and Professor Neil Hyatt from the University of Sheffield, who is also an expert in radioactive waste management, are just two people familiar with the idea who advocate for dumping the contaminated water into the ocean as a means to diluting it. Never mind the fact that a 2018 study revealed toxic water was actually flowing into the nearby bay for five years after the 2011 disaster that caused the meltdown in the first place. So really, the debate now is whether or not to purposefully dump it all into the water. “All of the other radioactive elements have been removed from the water by chemical treatment and the amount of other elements in the water is relatively small and wouldn’t pose a hazard,” Conca writes in his piece.

Hyatt explained to CAN... that the process of cooling damaged reactors leaves the water (mostly) with a radioisotope called tritium, which is considered harmless to people and regularly dumped into the ocean by coastal power plants. And by Hyatt’s (and Yoshiaki Harada’s) logic, the ocean is really big so it will actually just dilute the contaminated water. CNA’s anchors didn’t exactly let Hyatt off the hook though, considering that even though the Pacific Ocean is, in fact, really large, the dumping will still take place in concentrated areas. On top of that, TEPCO and Harada didn’t reveal exactly how much waste would need to be dumped to solve their storage problem. Hyatt explains that “if done correctly,” the process is quite safe. CNA’s anchors again went after Hyatt, reminding him that the entire reason TEPCO landed in this predicament, to begin with, was because of an unpredictable massive earthquake. Newly-appointed

Japanese environment minister Shinjiro Koizumi shares a similar sentiment, arguing that Japan should scrap Nuclear reactors after Fukushima precisely because earthquakes can’t be predicted or controlled, and another disaster is always a possibility. ...

Source: <https://www.theinertia.com>, 12 September 2019.

RUSSIA

Prosecutors Find Insufficient Anti-Terrorist Protection at Murmansk Nuclear Waste Sites

An inspection by the prosecutor’s office in Murmansk revealed poor anti-terrorist measures at Saida Bay, Andreeva Bay and Gremikha, Kommersant reports. The law enforcement officials brought the violations in for court, asking to oblige the defendant to install extra physical barriers of protection and other means to enhance security. All three sites are operated by SevRAO, the Murmansk branch of Russia’s Federal State Enterprise RosRAO which is responsible for handling and storing of radioactive waste. The law says all sites storing materials that could harm human health and environment, or be vulnerable to theft of radioactive materials, should have systems promptly detecting unauthorized actions and hinder them, while neutralizing violators.

RosRAO admits the violations identified by the prosecutor’s office, but asked for a prolonged time period to implement the required measures with improved protection. The entity also said some of the violations were already implemented; like a diesel generator as back-up for electricity to the alarm- and sensor systems at Gremikha. The Leninsky District court in Murmansk, however, did not give SevRAO the requested period until December 2024 to improve physical protection, but ruled that all new barriers should be in place by December 2022. Rosatom, Russia’s State Atomic Energy Corporation says on its portal that

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“Security at nuclear facilities represents our top strategic priority; it is viewed as a prerequisite for successful performance in the nuclear industry.”

Andreeva Bay is the main storage site for spent nuclear fuel and solid radioactive waste from the navy's operations of submarines during the Cold War. Work is already underway to ship out casks with the uranium fuel. First with ship to Murmansk, then with train to Mayak which is Russia's reprocessing plant in the South-Urals.

European Nuclear Safety Aid: Both Norway and Great Britain have contributed to new infrastructure, including buildings, electricity, roads and fences in Andreeva Bay. In Saida Bay, Germany and Italy have paid hundreds of millions of euros for construction of the huge onshore storage pad and handling facility for reactor compartments and solid radioactive waste. According to the claims by the prosecutor's office, the single concrete fence topped with barbed wire isn't sufficient enough to stop terrorists. The facility should be equipped with a physical barrier around the entire boundary.

Anti-terrorist measures and protection of nuclear

objects are a priority for Russia. In April 2018, Chechen special forces, the so-called Flying Squad and Terek groups had a joint exercise with regional security forces at Atomflot, the base for nuclear-powered icebreakers in Murmansk. The drill involved a group of terrorists taking over one of the nuclear icebreakers, before being defeated by the special anti-terrorist rapid response teams, the Barents Observer reported. Both Chechen Flying Squad and Terek are part of Rosgvardia, the National Guard of Russia.

International Cooperation: In 2010, world leaders, including Russia's then-President Dmitry Medvedev, met at the Nuclear Security Summit and agreed that nuclear terrorism is one of the most challenging threats to international security, and strong nuclear security measures are the most effective means to prevent it. The US and Russia suspended their nuclear security cooperation in 2014, following the annexation of Crimea. Norway and several other European countries do still maintain cooperation with Russia on nuclear safety, including projects for physical protection.

Source: <https://thebarentsobserver.com>, 11 September 2019.



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Centre for Air Power Studies

P-284

Arjan Path, Subroto Park,

New Delhi - 110010

Tel.: +91 - 11 - 25699131/32

Fax: +91 - 11 - 25682533

Email: capsnetdroff@gmail.com

Website: www.capsindia.org

Edited by: Director General, CAPS

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

Composed by: CAPS

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