



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

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OPINION – G Parthasarathy

Pakistan’s Islamic Bomb

In his prison memoirs, while awaiting execution, Zulfiqar Ali Bhutto lamented in 1977 that while the “Christian, Jewish and Hindu” civilisations had nuclear weapons capability, it was the “Islamic civilisation” alone that did not possess “full nuclear capability”. Saudi Arabia, Libya and others initially financed fulfilment of this Bhutto dream and aspirations. Bhutto’s successors were liberal in transferring nuclear weapons technology and designs to Libya and Iran and offering such technology to Iraq.

These pan-Islamic views were and are shared by a number of Pakistan’s nuclear scientists. Shortly after the 9/11 terrorist strikes, two senior Pakistani nuclear scientists, Sultan Bashiruddin Mehmood and Chaudhri Abdul Majeed, were charged with helping the Al-Qaeda acquire nuclear weapons. Two other scientists, Suleiman Asad and Ali Mukhtar, wanted for questioning about their links with the Al-Qaeda and Taliban, mysteriously disappeared while on a visit to Myanmar.

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secret that AQ Khan’s successor, Samar Mubarak Mand, is also a hard-core Islamist, no less India obsessed than AQ Khan. Pakistan’s contacts and partners for nuclear proliferation extended to Saudi Arabia, Iraq and even North Korea, with which it struck a deal for supplying enrichment technology in exchange for liquid fuelled Nodong missiles. It is not surprising that, given this dubious track record on nuclear proliferation, Pakistan has few backers for receiving an Indian style “nuclear deal”, in the international community, apart from its “all-weather friend” and partner in nuclear proliferation, the PRC.

Having acquired nuclear weapons, Pakistan was initially at a loss to spell out its nuclear doctrine,

apart from repeating the mantra that its nuclear deterrent was exclusively "India centric". About a decade ago, Lt General Khalid Kidwai, the longtime head of Strategic Planning of Pakistan's National (Nuclear) Command Authority, declared that Pakistan's nuclear weapons were "aimed solely at India". Kidwai added that Pakistan would use nuclear weapons if India conquers a large part of Pakistani territory, or destroys a large part of its land and air forces. He also held out the possibility of the use of nuclear weapons if India attempted to "economically strangle" Pakistan, or pushes it to political destabilisation.

In the decade that has elapsed since General Kidwai spoke, Pakistan has used its plutonium reactors and reprocessing plants in Khushab, located 200 km south of Islamabad, which have been supplied by China, to build light, relatively low-yield tactical nuclear weapons, mounted on short-range Nasr missiles.

Pakistan describes this development as indicating that it now has "full spectrum nuclear capability" to launch low-yield tactical weapons against Indian army formations along the international border. On 21 October 2015, Pakistan Foreign Secretary Aizaz Chaudhry proclaimed: "Pakistan has built the

infrastructure to launch a quick response to Indian aggression....Usage of low-yield nuclear weapons would make it difficult for India to launch an attack against Pakistan." While this may appear to make sense in the Rajasthan-Sind region, it is certainly not feasible in Punjab, where the border areas in Pakistan are densely populated. Surely, the Punjabi-dominated Pakistan army does not intend to use its inability to fight a conventional war, to nuke its own Punjabi brethren, on its borders with India.

India's nuclear doctrine, first officially enunciated in January 2003, asserts that it intends to build and maintain a "credible nuclear deterrent". While

adopting a policy of "no first use", it clarifies that its nuclear weapons will be used against an attack on Indian Territory, or on Indian forces anywhere, in which nuclear, or chemical weapons are used. There is no ambiguity about the Indian doctrine. An attack on its territory, or armed forces, in which nuclear weapons are used, irrespective of whether they are low-yield tactical nuclear weapons, or strategic high-yield nukes, will face a massive nuclear response. The Pakistani civilian and military elite in Punjab will find the costs of an Indian response, to Pakistan's use of low-yield tactical nuclear weapons against Indian forces anywhere, not merely "unacceptable", but also "unbearable". Pakistan will be very foolish to test out Indian resolve to respond massively to its use of tactical nuclear weapons.

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Pakistan will be particularly well advised to bear the reality in mind that its Punjab province, where both its civilian and military elite live, is densely populated. Its cantonments facing India are in this province. Moreover, Pakistan's army has mounted military operations, involving the use of air power in certain cases, in populated areas of its three other provinces – Khyber Pakhtunkhwa, Baluchistan and Sind.

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Pakistani civilians have perished in the damage the army has inflicted. The Punjabi army elite evidently regards people in these provinces as less than equal – a mindset that cost them dearly in Bangladesh. In seeking to dominate the Pashtuns in their homeland, the Punjabi-dominated army seems to forget that historically, it is only the Sikhs in Punjab who have prevailed over the Pashtuns, till the Khyber Pass. It is self-evident that Gen Raheel Sharif is no Hari Singh Nalwa, who led the forces of Maharaja Ranjit Singh.

Dealing with Pakistani nuclear illusions and delusions needs a multi-pronged approach. First and foremost, Pakistan should be presented a stark

picture of what would happen to its Punjab province, if it resorts foolishly to nuclear adventurism, whether tactical or strategic. Diplomatically, India should expose the consequences to global nuclear safety and security of Pakistan's refusal to join the FMCT. Given the Islamist inclinations of its nuclear scientists and a wide cross section of its Punjabi military-nuclear establishment, and their past proliferation record, it will be necessary, for responsible countries, to seriously take note of the dangerous implications of Pakistan's nukes falling into wrong hands. An equally serious effort needs to be undertaken to expose China's role in the development and expansion of Pakistan's nuclear and missile arsenal. China, which has violated every international norm to curtail proliferation of missile and nuclear weapons technology, believes it is not accountable to anyone, because it is a Permanent Member of the UNSC. This arrogance, by a country that professes to be a votary of peace, needs to be exposed.

Source: <http://www.tribuneindia.com>, 19 November 2015.

OPINION – K.S. Parthasarathy

Are Indian Nuclear Power Plants Safe?

The accident at Fukushima nuclear power plant shook the confidence of the public all over the world. Are Indian nuclear power plants safe? India took the accident seriously. Soon after the accident, the AERB set up a committee to review the safety of Indian nuclear power plants against external events of natural origin and to make appropriate recommendations.

NPCIL set up six separate task forces depending on the differences in the safety features of its nuclear power plants. BWR at Tarapur Atomic Power Station (TAPS 1&2); PHWRs at Rajasthan Atomic Power Station (RAPS 1&2); PHWRs at

Madras Atomic Power Station (MAPS 1&2); subsequently constructed standardized PHWRs from Narora Atomic Power Station onwards; Kudankulam reactors and PHWRs of 700 MWe capacity. These committees revisited the adequacy of the safety features of India's nuclear power plants:

The earthquake that hit Fukushima was very powerful at magnitude 9 in the Richter scale; the plants tripped on receiving the signals from the seismic sensors.

Earthquake did not damage the reactors. The devastating 15 metre high tsunami that followed it did. Tsunami snatched away all electric power sources. Even after the reactors were shut down

coolant must flow uninterrupted to remove decay heat. As the coolant pumps failed due to loss of power, cores of three reactors melted releasing copious amounts of radioactive material later causing the serious accident.

NPCIL made fail proof provisions to cool the reactor cores of its nuclear power plants in case of total power loss.

PHWR which form the backbone of the current Indian nuclear power programme have a notable safety feature. Their cores may be cooled during shut down state by flow of coolant by natural convection. If power fails totally, operators can add water using diesel engine- driven pumps to keep the core cool.

In 1993, the operators at Unit1 in Narora could successfully maintain reactor core cooling by using fire water system when fire knocked out all power sources; there was no power in the grid for 17 hrs.

NPCIL installed seismic trips in all reactors. They recalculated the possible flood levels at plants where there was such a possibility. For instance, they asked what if the upstream dams at Unit 2 of the Rajasthan Atomic Power Station break. They provided two additional emergency diesel

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generators (air cooled) at higher elevation for supplying essential power needs in case of such a flood.

NPCIL provided seismically qualified hook-up arrangements kept above possible flood level to add cooling water to various systems in case flood occurs; additional air compressor at higher elevation for supplying instrument air to critical valves and dampers and seismic strengthening of additional water storage tanks.

NPCIL reassessed the flood level at MAPS-1&2 and revised it from 8.9m to 12.9m. To take care of the impact of floods, NPCIL provided 200 kVA air cooled, Emergency Diesel Generators (EDGs) at higher elevation; flood protection measures for existing EDG and an additional uninterruptible power supply to feed power to vital instruments to monitor how the plant behaves if power is not available for long.

NPCIL provided seismically qualified hook-up arrangements to add cooling water if needed, to various systems including spent fuel pool in both units. Presently, all stations have additional backup diesel generators (air cooled mobile/ installed at higher elevation). NPCIL found the need for additional diesel driven pumps for specific purposes and additional mobile pumps and fire tenders and augmentation of onsite water storage to enhance safety. These measures are in progress.

NPCIL provided additional emergency lighting, backed up by solar cells in some stations. All reactors now have external hook up points to add water to steam generators and other systems which require cooling.

Some long term upgrades such as strengthening hydrogen management provisions; provision for

venting of containment; creation of an On-site Emergency Support Centre capable of withstanding severe flood, cyclone & earthquake are in progress

At units 1&2 of Tarapur Atomic Power Station NPCIL provided enhanced flood protection measures for Station Black Out. If severe floods occur, diesel generators, and emergency core cooling pumps & valves kept at higher levels will be operable. NPCIL has provided alternate routes through multiple points to inject water in to the Reactor Pressure Vessel. There is alternate provision to replenish water in spent fuel pool inside the reactor

building and Away From Reactor (AFR) storage facility. NPCIL is taking steps to implement nitrogen inerting of primary containment at TAPS 1&2.

On May 6, 2013 while disposing of the PIL against Kudankulam Nuclear Power Plant, the Supreme Court thus cautioned the authorities:

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“The AERB as the regulatory authority and the MoEF are obliged to perform their duty that safety measures are adequately taken before the plant commences its operation. That is the trust

of the people in the authorities which they can ill afford to betray, and it shall not be an exaggeration to state that safety in a case of this nature in any one’s hand has to be placed on the pedestal of “Constitutional Trust”.

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Source: *The author is a former Secretary of the AERB. <http://www.dailyexcelsior.com/are-indian-nuclear-power-plants-safe/>, 19 November 2015.*

OPINION – Claudia Rosett

The Next Failure of Imagination: Nuclear Terrorism?

In exploring how and why America failed to avert the al Qaeda attacks of Sept. 11, 2001, despite a warning system “blinking red,” the 9/11 Commission Report listed, among other things, a failure of imagination. In the multitude of jihadi terrorist attacks since then, there have been horrors enough that there might seem little left to imagine. Monstrous acts have been inflicted on people going about their daily lives in – to name just some of the cities targeted – Madrid, London, Amsterdam, Mumbai, Benghazi, Nairobi, Sydney, Ankara, Copenhagen, Bamako and Paris. Add to this the depravities of al Qaeda and the Taliban in Afghanistan, Boko Haram in Nigeria, Al-Shabaab in Somalia, ISIS in Syria and Iraq, and the declared dedication of Iran-backed Hezbollah in Lebanon, and Hamas in Gaza, to the annihilation of the democratic Jewish state of Israel.

But is there yet another failure of imagination in the making, on a scale that could dwarf the horrors that have become ritually familiar in the headlines? Is the clock ticking toward some unimaginable midnight of terrorism gone nuclear? Not that no one has imagined this. Thriller writers from Tom Clancy to Vince Flynn have imagined it in detail, Hollywood has made movies about it, policy experts have held conferences and written papers, government committees have delved into it, and there are government security procedures and agents trying to monitor and thwart any such catastrophe.

But do the folks in the cockpits of western policy take this threat seriously? No such attack has happened to date. In the habitual human calculus

that tends to amount to an expectation that somehow it won't; that however real the danger, the chances of it happening are still a matter of improbable odds. It still belongs to the realm of fiction. Map the dots, however, and ask yourself if the probabilities are rising. The world right now is blinking red. While Obama touts the receding tide of war, the containment of ISIS, and the progress toward his dream of a nuclear-weapons-free world, the real world is on a very different course. Reports have been surfacing that ISIS is already in pursuit of chemical and biological weapons. With America in retreat, threats of many

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kinds have been multiplying so prolifically that there simply isn't room in the weekly news cycle for all of them – they get their 15 minutes of infamy, and then drop out of the headlines.

That doesn't mean they have gone away. On the

contrary, there is a rising agglomeration of actors hostile to the free world, and while they may not all love each other, they do appear to learn from each other. One act of aggression emboldens those who would commit the next. The common target tends to be the free world, along with those who aspire to join it. Under President Putin, an expansionist and rearming Russia has given asylum to Edward Snowden with his cyber trove, humiliated Obama – repeatedly – over Syria, moved back into the Middle East and snatched Crimea from Ukraine (that in 2014, does anyone remember?). A restive China, with its legions of cyber warriors, is wielding its rising military power to bully its neighbours. Iran, while extending its reach in the Middle East, is pocketing a nuclear deal that effectively blesses its quest for the bomb. And North Korea is honing its missiles and amassing a nuclear arsenal.

Meanwhile, America's president continues to abdicate world leadership to the vagaries of luck and that long “arc of history.” Speaking about ISIS, in a press conference at the G-20 meeting in Antalya, Turkey, Obama declared himself “too busy” for “posing or pursuing some notion of

American leadership or America winning." Chiding those who want to "pop off and have opinions about what they think they would do," he defaulted to his stock formulation: "Our goal, as I've said many times, is to degrade and ultimately destroy this barbaric terrorist organization."

Under the umbrella of that lazy US timeline and half-baked campaign, ISIS has been training recruits, expanding its reach, striking afar, readying more terror to come and setting new benchmarks for barbarism. Have no doubt, its rivals and sympathizers are taking note. The calculus on which the West has based its hopes that none of this rising tide of terrorism will go nuclear is the idea that the logistics of such an attack would be complex, costly and detectable, and that nation states in possession of nuclear materials would consider it potentially suicidal to allow them to reach the hands of terrorists. There is, presumably, a point at which the US would have to retaliate in kind.

But as the American-led world order erodes, as some of the worst rogue states – terror-sponsoring Iran, nuclear-arming North Korea – are de facto allowed to pursue their nuclear ventures, as jihadi terrorists in various combinations either collaborate or compete for monstrous strikes around the globe, surely the probabilities are rising that this old calculus is a decaying guide to what lies ahead. In writing a column on "Bearing Witness to a Nuclear North Korea," I took a look back at some of the warnings issued by various authorities and experts over the years about the threat of terrorists getting hold of nuclear wares. While I did not make a statistical study of the phenomenon, I do have the strong impression that we were hearing a lot more in the way of warnings back in the 1990s, and just after Sept. 11, 2001, than we are hearing 20 November 2015.

If that's accurate, it is also profoundly troubling, because the avenues and opportunities for such

atrocities are on the rise. Just for openers: Pakistan, having announced itself with a nuclear test in 1998, and trafficked in proliferation via its A.Q. Khan network with the likes of North Korea and Iran, maintains a nuclear arsenal on some of the most troubled turf in the world. Iran is within easy distance of the bomb (if, indeed, it has not secretly arrived there already). North Korea – long time weapons vendor and proliferator to the Middle East – has carried out three nuclear tests since 2006, two of them on Obama's watch, and is amassing a nuclear arsenal.

There is a trajectory here that might yet be reversed, but that won't be done merely by way of diplomatic pow-wows, farcical deals, half-hearted strikes and "strategic patience" in the face of rising dangers. It needs strategy, determination, leadership, real red lines genuinely enforced, and a will to win. Otherwise...it is not a comforting thought, but brace for the unimaginable.

Source: <https://pjmedia.com>, 20 November 2015.

OPINION – New York Times

Beware of China's Safety Record

It was like what we were told a nuclear bomb would be like," Zhao Zhencheng, a truck driver, told the Associated Press. "I never even thought I'd see such a thing." In the still of the night of Aug. 12 in Tianjin port, some 90 miles from Beijing, an explosion ripped through a warehouse housing volatile chemicals, killing more than 170 people. Hundreds more were injured. Chinese social media blazed with grief and indignation, but little surprise. "This will happen again, the only question is when and where," a friend of mine said on the night of the disaster.

Ten days later, on Aug. 22, an explosion rocked a chemical factory in Zibo in Shandong Province. On Aug. 31, another Shandong chemical factory blew up. And on Oct. 12, two months after the

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explosion at the docks, an inferno tore through a different Tianjin warehouse. Meanwhile, too many Chinese buildings prove to be less sturdy than a house of cards, collapsing to the ground, killing occupants. Among recent examples, a two-story building under renovation in Henan Province collapsed to dust on Oct. 30, taking with it 17 lives. Mega-engineering projects are not immune from low building standards. From 2007 to 2012, 37 bridges reportedly collapsed, with a toll of 182 deaths.

These disasters are concealed by headlines touting China's economic miracle. They are a result of the government's love of mega-projects combined with rash planning, endemic corruption and careless construction, supervision and regulation. As Chinese capital flows abroad, dangerous practices are at risk of being exported. China's experience at home should serve as a warning to other governments and companies. Chinese firms may offer the lowest bid on an infrastructure project, but Chinese construction brings tremendous risks. Teams of Chinese state-owned companies are rushing across the world to run super projects. In Sudan, a Chinese group is erecting a huge dam. In Ecuador, along with a dam, the Chinese are constructing an oil refinery. Chinese companies are helping to build bridges in Cambodia, Bangladesh and Kenya.

The construction and managing of nuclear power plants abroad are especially troubling. In October 2015, President Xi Jinping and the British government signed deals paving the way for China to help build at least two nuclear power plants in Britain. In China, however, nuclear power projects are controversial, with some observers saying that China does not take safety seriously enough. He Zuoxiu, a nuclear expert and Communist Party loyalist, has expressed dissatisfaction with the safety provisions, describing the government's ambitious nuclear plans as "insane." From everything we know of Chinese building and

supervision practices, an accident in a Chinese nuclear power station is just a question of when and where. There's no reason to expect the safety standards and the quality of building to be higher in China-run projects abroad. As in China, most overseas projects will be managed by Chinese state-owned companies. Many of the site workers are imported, low-paid Chinese laborers, and the high-level company managers are mainly Chinese government appointees, or even government officials.

Chinese practices have not gone unnoticed. The transportation minister of Vietnam publicly criticized a Chinese company for its role in a series of accidents at the construction site of a rail line in Hanoi. The World Bank blacklisted at least 12 Chinese companies suspected of fraud and corruption, banning them from projects funded by the bank. Corruption is rampant among company leaders. Take the case of the CNPC, which is financing the oil refinery in Ecuador. In recent years, a large number of company officers, including the chairman and chief accountant, have been investigated or arrested for corruption. Although accidents linked to careless construction practices are certainly not rare in other parts of the world, China is distinct because the same kinds of disasters happen again and again. People keep dying, and they keep dying for the same reasons. When disaster strikes, the Chinese government goes into emergency mode, organizing rescue and relief, demanding answers, and at every turn, displaying a staggering lack of professionalism.

During the Tianjin catastrophe, fire fighters did not know how to deal with a fire caused by a chemical explosion. And for the first 10 hours after the explosion, the most influential local TV station still broadcast soap operas; not a mention was made of fatalities. The Chinese authorities have learned nothing from these frequent accidents. The only government competence on show is with information control: hiding facts, forbidding media

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reporting and rapidly closing social media accounts suspected of spreading “rumors.” The government’s instructions are always described as “brilliant” and the victims’ families are always “emotionally stable.” Each disaster becomes an occasion for government self-congratulation. Meanwhile, lessons go unlearned and responsibility unclaimed.

For many government leaders, Chinese corporate global expansion means a boost to their incomes. The Chinese government has greatly expanded its overseas investments, but the profits, we can fairly

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assume, go mostly to officials and their families. Rarely is a moral audit taken of these projects, which bring little benefit to ordinary Chinese people. Chinese people have paid the heaviest price for this flawed system. Now that Chinese-style construction and management are going global, what price is the world prepared to pay?

Source: <http://www.nytimes.com>, 25 November 2015.

NUCLEAR STRATEGY

UK

Brendan O’Hara Argues Britain should Scrap its Nuclear Weapons to Keep them Away from ‘President Trump’

A member of parliament for the Scottish National Party delivered an unexpectedly convincing justification for scrapping Britain’s nuclear deterrence – to keep the weapons out of the hands of “President Donald Trump.” Speaking in the House of Commons, Brendan O’Hara, MP for Argyll and Bute and the the SNP’s defence spokesperson, stated that Britain’s “independent nuclear deterrence” isn’t “all that independent” as it is unlikely any British PM would unleash the

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weapons without first appraising the White House. As such, the US president will choose how and when Britain’s nuclear arsenal is deployed. “In reality, it will be an American US commander in chief who will ultimately decide, and in 18 months time that commander in chief could be President Donald Trump,” he said.

Most of Britain’s nuclear stockpile is housed in Scotland, with four Vanguard class submarines based at Clyde. The SNP has long demanded the abolition of Trident, using 24th parliamentary debate to bemoan the weapons

system as “political ego trip” that will never be used. The SNP debate followed 23rd’s SDSR in which PM David Cameron revealed the cost of renewing the nuclear submarine programme could be as much as £40 billion over 20 years. However, MPs overwhelmingly rejected the SNP’s motion to scrap the system, opposing its abolition by 330 votes to 64 with Defence Secretary Michael Fallon calling Trident a key “insurance policy”.

Labour leader Jeremy Corbyn, who also opposes Trident, had dismissed the SNP debate as a stunt, and demanded Labour MPs stay away. Many did, though 20 defied his instruction to abstain. Fortunately for the UK, even if Trump does win the presidency in 2016 November, the property tycoon

has indicated a reluctance to destroy the world. When asked in a recent GQ interview whether he’d be able to push the button, the Republican Party frontrunner said: “Well, I don’t want to talk about that subject because that’s not a subject that, you know... that has to do with that whole.... I just

don’t want to talk about it.” The property mogul concluded that it was “highly, highly, highly, highly unlikely” he would ever “be using them.”

Source: <http://www.huffingtonpost.co.uk>, 24 November 2015.

BALLISTIC MISSILE DEFENCE

INDIA

Upgraded Interceptor Missile Successfully Hits Virtual Target

India's BMD capability received a boost with the successful launch of an upgraded version of the interceptor missile against an electronically simulated target missile over the Bay of Bengal. The anti-ballistic missile, called AAD, took off at 9.40 a.m. from the A.P.J. Abdul Kalam Wheeler Island soon after it received the command to waylay and destroy an incoming target missile in the endo-atmosphere (below 40 km altitude) after the conditions for the latter were electronically simulated without the actual launch of the missile. Conditions similar to the launch of a target missile from Balasore were simulated electronically and upon receiving its coordinates, the interceptor missile, travelling at supersonic speed, engaged and destroyed the "virtual target" in mid-flight.

India's BMD capability received a boost with the successful launch of an upgraded version of the interceptor missile against an electronically simulated target missile over the Bay of Bengal.

India plans to deploy a two-tiered BMD system to protect important cities and vital installations from enemy attack. The first phase seeks to destroy incoming enemy missiles of 2,000 km range, while the second phase envisages killing incoming missiles of more than 2,000 km. With this mission, DRDO has conducted 11 interceptor missile tests. While eight of the missions were in endo-atmosphere, the remaining were in exo-atmosphere. Nine of the missions had been successful.

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Source: <http://www.thehindu.com>, 22 November 2015.

JAPAN

Japan Mulls THAAD Missile Defense System Amid North Korea Threat

Japan is considering deployment of the US's THAAD ballistic missile defense system to counter any

potential strike from North Korea, defense minister Gen Nakatani told reporters in Hawaii, *Kyodo News* reported. Nakatani's comments come as the US and China square off over the possible deployment of the anti-missile system in South Korea—a source of tension between the world's two biggest economies as they vie for influence in Asia. Adoption of the technology by Japan could also agitate China, which has criticized PM Shinzo Abe's bid to strengthen the role of Japan's military, and chill a nascent recovery in ties between Asia's two biggest economies. Abe told President Barack Obama that he supported US naval patrols to assert free navigation in the South China Sea, where China has built artificial islands as a platform to assert its claims to more than 80% of the waters.

The THAAD issue has left South Korean President Park Geun Hye caught between the US, which maintains more than 28,000 troops in the country to defend against North Korea, and China, its biggest trading partner and ally in efforts to resolve historical and territorial disputes with Japan. North Korea on 15 November declared a no-sail zone off its eastern coast, suggesting the country may be preparing to test- launch a missile in the sea that lies between the Korean peninsula and Japan, according to *Yonhap News*. The test could involve a new type of proprietary ballistic missile that separates into several "sub-missiles" at high altitude, the South Korean news agency reported.

Source: <http://www.livemint.com>, 24 November 2015.

NATO

Thales Sub-Contracted for NATO BMD Test Activities

Thales is to perform test and integration support activities to help validate NATO's BMD capability.

The work, under a sub-contract from US-based Leidos, is to be conducted as part of Leidos' multi-national team for NATO's BMD architecture. The team is responsible for the design, development and test of the BMD sensor interfaces with NATO's weapons and sensors and those of member states. Thales said the testing and integration activities it will perform will occur at an integrated test bed in the Netherlands. Details of testing activities, however, were not detailed by the company. The contract from Leidos is for four years with options for extension. The monetary value of the award was not given.

"This contract reinforces Thales's activities in ballistic missile defense," Thales said. "The first success in this field came in 2006 with the modified Thales SMART-L volume search radar tested on board (the Dutch ship) HNLMS Tromp. The radar tracked a ballistic missile from moments after being launched and provided a real-time uplink of the missile's trajectory." In 2014, Thales was awarded contracts to update the four SMART-L radars on Dutch Navy ships to give the radars true BMD capabilities. In 2015 Thales demonstrated its sensor technology for detecting and tracking extraterrestrial objects at the international Maritime Theater Missile Defense Forum.

Source: <http://www.upi.com>, 20 November 2015.

NUCLEAR ENERGY

GENERAL

Are Mini-Nuclear Reactors the Answer to the Climate Change Crisis?

Industry looks to the UK to develop factory-built reactors ready to provide affordable, low-carbon energy wherever it is needed – but issues around security and waste disposal remain. Mini nuclear power plants could be trucked into a town near you to provide your hot water, or shipped to any country that wants to plug them into their

electricity grid from the dock. That is the aim of those developing "small modular reactors" and, from the US to China to Poland, they want the UK to be at the centre of the nascent industry. The UK government says it is "fully enthused" about the technology. With UN climate change summit in Paris imminent, the question of how to keep the lights on affordably, while cutting emissions, is pressing. SMRs aim to capture the advantages of nuclear power – always-on, low-carbon energy – while avoiding the problems, principally the vast cost and time taken to build huge plants. Current

plants, such as the planned French-Chinese Hinkley Point project in Somerset, have to be built on-site, a task likened to "building a cathedral within a cathedral".

Instead, SMRs, would be turned out by the dozen in a factory, then transported to sites and plugged in, making them – in theory – cheaper. Companies around

the world, including in Russia, South Korea and Argentina, are now trying to turn that theory into practice and many are looking at the nuclear-friendly UK as the place to make it happen. "There's a lot of terrific things about the UK market that makes it the right place to deploy new nuclear technology," said Tom Mundy, head of programme development at US company NuScale, one of the frontrunners. "It's got a government committed to reducing carbon and seeing nuclear as one of the solutions, and it has got a substantial and pre-eminent legacy of nuclear operations – a trained and capable workforce and a nuclear supply chain." The UK has commissioned five studies since July 2015, costing £4.5m, to explore the potential of SMRs and energy secretary Amber Rudd told MPs earlier in November 2015: "We are fully enthused about SMRs. We are doing as much as we can in terms of supporting the technology. SMRs would be an excellent way forward."

A government-funded report from the UK's NNL in December 2014 suggested there was

Industry looks to the UK to develop factory-built reactors ready to provide affordable, low-carbon energy wherever it is needed – but issues around security and waste disposal remain. Mini nuclear power plants could be trucked into a town near you to provide your hot water, or shipped to any country that wants to plug them into their electricity grid from the dock.

potentially a “very significant” global market for hundreds of SMRs (65-85 GW) by 2035, with dozens of the SMRs (7GW) sited in the UK. This market would be worth £250-£400bn, the NNL estimated, saying it represented an economic opportunity for UK plc. SMRs are reactors that produce less than 300MW (0.3GW) of electricity, much smaller than the 1,000MW (1GW) of many existing nuclear plants. An additional advantage is that SMRs can vary their output quickly, meaning they could be used to balance intermittent wind and solar energy, unlike big nuclear plants.

SMR Graphic: Small reactors have been operated for more than 50 years, particularly on military submarines and ships. But, Mundy said: “The application they are designed for is completely different from civil nuclear electricity.” Small reactors have also run a remote site at Bilibino in Siberia since 1976, with the excess steam supplying a district heating system, while a US base in Antarctica was powered by a tiny reactor in the 1960s. But no true SMRs, rolling off a factory assembly line, have yet been built. Determining the best companies for SMR designs means looking for scale and experience, says Giorgio Locatelli, at the University of Leeds. He points to US nuclear giant Westinghouse, NuScale, Korea – which has signed an agreement with Saudi Arabia – and the CNNC. “The Chinese government has a pile of money to invest,” Locatelli said.

Danrong Song, CNNC’s chief designer for SMRs, attended an SMR conference in London in October 2015 and pitched a “technical plan and proposal for cooperation with UK industry” – the company is already cooperating with Rolls Royce. This plan would see the first CNNC SMR produced in the UK, with subsequent SMRs being sold around the world, he said, mirroring the plan to build a large Chinese nuclear plant at Bradwell in Essex. Song said China itself could provide a big market: “A lot of air pollution in China is caused by fossil

fuel plants, so with SMRs we can reduce that.” Large nuclear plants needed a lot of cooling water and were therefore mainly built on the coast, he said, limiting their use. “But inland, you can build SMRs and use air cooling,” Song said.

CNNC’s design, the ACP100+, would produce 120MW of electricity, be refuelled every two years and could even be put on a ship, said Song. CNNC signed an agreement with Lloyd’s Register in October 2015 to develop marine nuclear regulations. Such ships could be floating power plants, said Kristiina Soderholm, at Finnish energy company Fortum, which runs several nuclear plants. She said an SMR could be put on a barge, taken to a country, plugged into grid from the port and then, when its fuel was used up, sail back again. “For newcomer countries [to nuclear], that could be a very attractive way to do it,” she said. It has happened before: in the late 1960s a former US military nuclear-powered ship moored by the Panama canal and provided onshore electricity. Russia, which has long experience of marine nuclear power, has been promising a floating SMR for several years. But the project has been repeatedly delayed, although it is unclear whether the reason is technical or financial.

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Westinghouse, part of Toshiba and one of the world’s biggest nuclear companies, is staying on land with its 225MW (electricity) SMR, which it says could be deployed by 2027. “There’s a unique opportunity for the UK to move from being a buyer to a provider, said Jeff Benjamin, head of new build and major programmes. “We hope the build out of our SMR will happen here in the UK ... but then use this as a base to export globally.” Westinghouse made a proposal to the UK in October 2015 to put its designs into a new company in which the UK government and industry took a stake and then shared the development costs. “This is what is going to be necessary to move this market forward in the UK,” said Benjamin. “We are not asking the UK government

to swallow the elephant all at once." UK ministers are considering the offer.

One big potential customer in Europe is coal-dependent Poland, seen as the biggest nuclear market in Europe and often chastised internationally for its reluctance to reduce the carbon emissions that drive climate change. "I want to persuade the UK to partner with Poland: it has the skills, we have the need," Grzegorz Wrochna, director of Poland's National Centre for Nuclear Research, told the London summit. Compared to Westinghouse's SMR, that from NuScale is much smaller – 50MW of electricity. This to maximise the number of places it can be sited, said Mundy, with the 23m-long unit being "the biggest you can get on the road". If more power is needed, multiple reactors could be installed side-by-side. The company, backed by a \$217m (£143m) cost-sharing deal from the US DoE, aims to start generating electricity for its first customer in Idaho by 2023, Mundy said.

Other SMR contenders include US-based Generation mPower, also backed by the US DoE, while more novel technology, such as that from Bill Gates-backed Terrapower, are seen as prospects further in the future. The pilot plant closest to completion is CAREM in Argentina and was initially intended for use in submarines. But for all the activity, the nascent SMR industry faces familiar nuclear challenges: cost, public acceptability, security and waste disposal. The nuclear industry has a long record of broken promises over cost – Hinkley-type reactors being built by EDF in France and Finland are billions over budget and years behind schedule.

Developing SMRs is not going to be cheap either. Design alone will cost £500m, estimates David Orr, head of nuclear business development at UK engineering firm Rolls Royce, which is "actively engaged" in the technology. He said 40-70 SMRs would need to be ordered to make building a factory worthwhile. Industry figures say the cost

of electricity from the first SMRs should be about the same as large nuclear power plants, then get cheaper. But Locatelli said: "We don't yet know if the cost of electricity from an SMR is going to be cheaper than from big plants, but the risk is lower" because the capital needed is smaller. All the while, the competition from renewable energy gets hotter as it falls in price.

Most new energy projects – from nuclear to fracking to windfarms – face some opposition. But Professor Andrew Sherry, chief scientist at the UK's NNL said: "Political support for [large nuclear power plants] has been unified and public support

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is quite strong." However, SMRs could be much closer to people's homes, he said, and might be used to provide hot water for central heating as well as electricity. "Small factory-built nuclear plants could

be located closer, say within 20 to 40 miles, to users and provide a combined heat and power function," said former UK environment secretary Owen Paterson in 2014. Sherry asks: "Would people accept district heating from nuclear?" Security is also a key issue for nuclear plants. Canada's Bruce Power runs the biggest operational nuclear site in the world in Ontario, with 6.3GW of capacity across eight reactors. Protecting the site requires armed guards and Frank Saunders, head of nuclear oversight and regulatory affairs at Bruce Power, said the company has "the largest tactical unit outside the military" in the province.

The challenge for SMRs is that security costs soar relative to power output if there are small reactors in many locations to protect. "The security costs are hugely magnified when you go to smaller units," said Saunders. While SMRs may need refuelling less frequently – potentially decades – and use uranium more efficiently than earlier generations of reactor, the permanent disposal of nuclear waste remains a vexed issue around the world. No deep geological repository has yet gained final approval. Despite the challenges, engineer Gordon Waddington, who led the NNL

report, is confident SMRs have a future because of the demand for low-carbon electricity. For example, he said: "I am absolutely certain that China will get very good at [SMRs]. They need it and they will get there. Waddington said the next two to three years are critical if SMRs are to be deployed widely in the next decade, and the UK has a once-in-a-generation chance to be at the heart of it: "The window of opportunity for the UK is there – but it will not be open forever."

Source: <http://www.theguardian.com>, 24 November 2015.

INDIA

Nuclear Club Eyes Indian Inclusion, but Risks Pakistan's Ire

Diplomats have quietly launched a new push to induct India into a club of nuclear trading nations, but rather than increasing stability in South Asia, the move could escalate strains with rival Pakistan. The chairman of the NSG visited New Delhi recently to meet foreign minister Sushma Swaraj as part of a diplomatic "outreach" that seeks to build a consensus to admit India at its annual meeting in June 2016. Membership of the 48-nation club would bring India into the nuclear fold 41 years after it tested its first nuclear bomb, and give the nation of 1.25 billion a vested interest in curbing the world's most dangerous regional arms race.

"It's a very delicate process, but I think there is less and less justification for the impasse," Rafael Grossi, the Argentinian ambassador to Vienna who heads the NSG, told Reuters in an interview. Yet there are doubts. For one, India has not signed the NPT, or, which seeks to prevent the spread of nuclear weapons. And Pakistan, an ally of China, also aspires to join the NSG. With a history as a proliferator, Pakistan's accession would be a tough sell. Because the NSG operates by consensus, admitting India alone would mean it could then

bar its western neighbour from the club, potentially pushing Pakistan further to the fringes.

Meanwhile, Pakistan has been testing missiles that can reach all of India, and very short-range missiles that it insists could be used only if Indian troops cross onto Pakistani soil. A seat at the NSG would strengthen India's geopolitical clout and help it capitalize on nuclear trade and technology transfer opportunities, while also raising concern in Pakistan. "India has a nuclear deal with the US, with France, it will soon have deals with Australia and Japan. So all this will of course complement its effort to get into NSG," said a senior Pakistani security official with knowledge of nuclear issues. "But people don't understand that India will use all this additional fuel (through civil nuclear deals) to make energy and have a lot more left over to use to make weapons. "So at the end of it, the need for even more deterrence from our side will grow, not decrease."

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Upper Hand: Pakistan sees a nuclear lead as vital insurance against possible aggression by its larger neighbour, and it appears to be gaining the upper hand over India in the nuclear contest. Analysts Toby Dalton and Michael Krepon estimate Pakistan is producing 20 nuclear warheads a year to India's five. Yet defending that

lead is a "losing proposition" that imposes huge costs on Pakistan's economy and strains its social fabric, they said. In a report for the Carnegie and Stimson think tanks, Dalton and Krepon argued Pakistan should abandon its goal of "full-spectrum" deterrence against India and satisfy itself with "strategic" deterrence, or the ability to launch an effective counter-strike in the event of an attack.

India and Pakistan have fought three wars since independence and partition in 1947, two over Kashmir. Their disputed frontier is one of the world's most heavily militarised regions. Border clashes and incursions pose a constant risk of

escalation. The US state department declined to comment on specific discussions over Pakistan, but an official said Washington had not entered into talks on a civil nuclear pact with it. Nor was it seeking a waiver for Pakistan to trade with the NSG. The US was continuing to integrate India into the "global non-proliferation mainstream", this official also said, adding that Washington supported India's membership in the four multilateral export control regimes. One of those is the NSG.

Comfort Level: India's long road to nuclear legitimacy began with a bilateral deal with the United States in 2005 that, three years later, yielded an exemption allowing it to trade in sensitive nuclear technology with NSG nations. New Delhi expressed its interest in 2010 in formally joining the nuclear club. But India's lobbying has met with scepticism from European countries like Austria and Switzerland, who have questioned its refusal to sign the NPT and give up nuclear weapons. Indian negotiators now detect a change of tone, and are focusing on winning over European sceptics. That, in turn, could bring round China, they calculate.

"We are optimistic; there is a desire within the NSG to bring this process to a conclusion sooner rather than later," one Indian diplomat told Reuters.

"People are comfortable with India." Despite two summit meetings between PM Narendra Modi and Chinese President Xi Jinping, Beijing has yet to signal its assent and may not agree, analysts caution. Despite those concerns, India is upbeat: "France joined the NSG before ratifying the Non-Proliferation Treaty," said the Indian diplomat. "It's not about arms controls. It's about export

controls."

Source: <http://timesofindia.indiatimes.com>, 24 November 2015.

Series of Foreign Pacts to Give Fillip to India's Nuclear Industry

India's domestic nuclear industry is expected to get a fillip with series of foreign civil nuclear collaboration beginning with much awaited signing of nuclear pact with UK during PM's trip and announcement of conclusion of processes to implement Indo-Australian civilian nuclear deal. The Indo-UK nuclear pact, sealed five years after declaration, is a significant as it would enable industrial collaboration between two countries including sharing of views as US Nuclear major

Westinghouse is building nuclear power plants in both Britain and Gujarat. Besides Indo-UK cooperation would entail joint research in nuclear science and technical level cooperation, senior officials told ET.

While UK does not possess any uranium mines, it has a slightly bigger nuclear industry than India. The country, however, possesses plutonium from which India can benefit, indicated people familiar with nuclear industry. With the conclusion of pact with

UK, India now has civil nuclear cooperation with four out of five permanent members of UNSC. The partnership also marks significant stepping up of civil nuclear cooperation with Europe. India has growing nuclear energy partnership with France and contemplating an arrangement with Spain. However, French nuclear major Areva which is building nuclear power plant in Jaitapur

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(Maharashtra) is undertaking internal changes and this has slowed commercial negotiations with Nuclear Power Corporation of India Limited. It is understood that the process is expected to pick up in 2016.

The icing on the cake for Delhi could be the Indo-Japanese Inter Governmental Agreement – when PM Shinzo Abe visits India mid-December 2015 for the annual Summit – after years of tough negotiations. Japan is the only country in the world to have been nuked and therefore sensitive to cooperation with a non-NPT signatory state like India. It is only earlier in 2015 that Tokyo agreed to reprocessing rights for India. The nuclear deal with Japan will also give momentum to implementation of Indo-US nuclear deal and Westinghouse's proposed plant in Gujarat. Japan's industry major Toshiba has major stakes in Westinghouse. Japan has state-of-the-art nuclear technology and globally competitive price. Interestingly Indo-US contact group to discuss Westinghouse plant in Gujarat and working of Liability Law with participation of lawyers and insurers will hold their next meeting in Washington, officials indicated.

The December 2015 meeting will also see action when first tranche of uranium from Canada arrives here after four decades following conclusion of commercial agreement during the PM's trip to Toronto in April 2015. As agreed under the deal, Canada will supply 3,000 metric tonnes of uranium to energy-hungry India under a \$254 million five-year deal to power Indian atomic reactors. Canada was the world's largest uranium producer till 2009, accounting for about 22% of global output, when it was overtaken by Kazakhstan. India has also signed five year uranium supply deal with Kazakhstan. This will be followed a likely announcement by PM for a second site to Russia for setting up nuclear power plant in this country after Kudankulam. This site that could be allotted in Andhra Pradesh is expected to be announced when Modi is in Moscow in the second half of December 2015. This visit could also see conclusion of documents for fifth and sixth reactors in Kudankulam. Officials indicated that partnership with Russia would involve serial

production of nuclear reactors - six at Kudankulam and another six at second power plant.

Meanwhile the conclusion of deal with Australia after it was ratified by its Parliament and with the successful negotiations of the administrative arrangement, the commercial negotiations for supply of yellow cake by Australia would begin soon, hinted people familiar with the developments. Australia has the world's largest reserves of uranium but has tighter non-proliferation rules for a non-NPT signatory state like India. Officials point out that it needed hard negotiations but change of PM in Canberra did not make any difference in Australia's policy.

Source: <http://articles.economictimes.indiatimes.com>, 20 November 2015.

MIDDLE EAST

Why More Middle Eastern States are Building Nuclear Power Stations

Egypt's "long dream" is finally coming true, says Abdel-Fattah al-Sisi, the president. Not the dream of a capable government or reliable services—but the one in which Egypt's nuclear-energy programme, started back in 1954, finally produces a watt of usable power. The government signed a deal with Russia on 19th November 2015 to build its first nuclear plant in Dabaa, on the Mediterranean coast. Nuclear power has gone out of fashion in much of the world. The share of electricity generated by nuclear reactors has fallen to 10.8%, from a peak of 17.6% in 1996. More reactors have closed than opened of late. But the industry is not in crisis. China, Russia and India are all expanding their nuclear programmes. And several countries in the Middle East are pursuing nuclear power, creating what some have unfortunately called a "boom" in the region.

Some fear where this may lead—a nuclear-arms race pitting Sunni states, led by Saudi Arabia, against Shia Iran in pursuit of the bomb. A nuclear deal between Iran and the West, signed

in July 2015, has somewhat allayed those concerns. Nuclear fuel in the region remains mostly under the control of international suppliers. Moreover, there are legitimate reasons for the countries of the Middle East to seek alternative power sources. Demand for electricity is rising, along with pressure to lower carbon emissions; nuclear plants tick both boxes. Diversification away from fossil fuels must come sooner or later, say experts. Short of oil and gas of their own, Egypt and Jordan in particular want nuclear power to shore up the security of their energy supplies, which have been disrupted by violence in the region. (Both have looked to Israel for gas, causing controversy at home.) They face big obstacles. The site chosen by Jordan for two planned reactors, also to be built by Russia, lacks water (necessary for cooling) and is opposed by local tribesmen. Egypt has assuaged its own locals, but previous plans have come to nought due to political upheaval and safety concerns. Financing is also a challenge for these cash-strapped countries, though Egypt claims that it will pay off its deal—over a period of 35 years from now—simply by producing electricity, which it will be able to buy at a low marginal cost.

The nuclear plans of Saudi Arabia and the UAE are more plausible. Both countries hope to free up oil and natural gas, which they now use for electricity generation, for export. To that end, Saudi Arabia has reached agreements with five countries, including Russia, to build 16 reactors by 2032. The UAE is already working with its partner South Korea on four planned reactors, which should begin supplying power in 2017. When the project is completed three years later,

a quarter of the country's electricity needs are expected to be met by nuclear energy. The projects in Saudi Arabia, which burns oil it could more efficiently sell abroad to produce power, and the UAE, which got a bargain on its reactors, make some economic sense.

But in general, nuclear energy is a bad deal for the Middle East. Most reactors would replace gas-fired plants, which are common in the region. But the nuclear sites hardly match up in terms of cost and productivity, say Ali Ahmad and M.V. Ramana of Princeton University. According to their calculations, a country like Saudi Arabia would benefit from nuclear power only if it could charge potential customers abroad several times the going price for its gas (otherwise, it is cheaper to burn it at home and forgo building reactors). Importers, on the other hand, should stick with gas-fired plants so long as the gas price does not rise dramatically.

Over the long term, as fossil fuels are depleted, nuclear power makes more sense. But only if you ignore the most bountiful—and safest—source of power in the region. It has been estimated that solar radiation could provide a country like Iran with 13 times its total energy needs—and decrease its dependence on Russia, which has withheld nuclear fuel in the past. Photovoltaic panels aren't a spectacular target for terrorists. And the declining cost of solar power has made it an increasingly good deal. Indeed, it attracted more investment worldwide than nuclear energy in 2014. Some in the region are thinking this way. Morocco, which currently imports electricity from Spain, is constructing one of the largest solar-power plants in the world for slightly less than

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the price of Jordan's two nuclear reactors. It hopes to get 42% of its electricity from renewables by 2020—and to eventually export power to Europe. Saudi Arabia and the UAE have also splashed out on large projects; other countries in the region brag of big plans. Yet analysts say the sun-drenched Middle East, with its vast near-desert spaces, could be doing much more.

Less glamorous options also exist for countries looking to improve their power supplies. Fixing decrepit transmission lines in Iran would save more electricity than is produced by the country's lone nuclear-energy plant in Bushehr. Egypt's old power grid is in need of repair. But there is more prestige attached to nuclear power, which is often seen as a hallmark of technological progress, and which, of course, also allows for the development of skills that could one day be turned to bomb-making. "A few of these countries want to set up nuclear-power plants regardless of expense," says Mr Ramana. In most cases it is a matter of national pride—and a poor use of resources.

Source: <http://www.economist.com>, 24 November 2015.

URANIUM PRODUCTION

NAMIBIA

Bannerman Resources Tastes Further Success at Etango Uranium

Bannerman Resources has substantially de-risked heap leaching operations at its Etango uranium project in Namibia with more success in an ongoing plant demonstration program. The latest results from the program have further supported assumptions and projections outlined in the Definitive Feasibility Study as well as subsequent DFS optimisations. A recent optimisation of Etango resulted in a dramatic improvement of the project's net present value from US\$69 million to US\$419 million, with production averaging 7.2 million pounds of U3O8 a year over an initial 15.7-year open pit mine life. The new demonstrate plant work has underlined the feasibility of this outlook with fast and high leach extraction on a 60-tonne sample.

Average total leach extraction ranged from 91% to 93% during the trials, compared to an 87% rate projected in the DFS. A sulphuric acid consumption recorded at a rate of 18 kilograms per tonne in the DFS was further reduced to 15 kg per tonne. Visual observation confirmed uniform percolation through the material and integrity of the agglomerate while other performance metrics indicated the DFS scale-up factors would be conservative. Large-scale testing of 180 tonnes of material since the start of heap leach demonstration plant work has established a significant metallurgical database.

Improved Economics: Success in process plant demonstrations has coincided with studies which have outlined a 17% reduction in life-of-mine operating costs to US\$38 per pound of U3O8 and a 9% reduction in pre-production capital costs to US\$793 million. Post-tax internal rate of return has also improved from 9% to 15%, with payback from first production now expected in 4.4 years. Total operating cash flow has been estimated at US\$3.7 billion before capital and tax, while free cash flow of US\$1.6 billion is expected after capital and tax. Peak annual free cash flow is contemplated at US\$392 million. Bannerman can also reduce upfront capital by about US\$56 million through the use of leased equipment in its fleet.

Importantly, the streamlined economics at Etango are supported by both better-than-expected results from the heap leaching operation, logistics improvements and enhanced mining metrics, including a reduction of strip ratio from 3.3 in the original DFS to 2.8. This will flow from a 16.4% increase in annual output during the first five full years of production to 9.2 million pounds of U3O8. Measured and indicated resources at Etango total 165 million pounds of U3O8.

Corporate Update: The recent operational refinements at Etango have also paralleled ownership consolidation, debt extinguishing and new funding for Bannerman. The company has confirmed the terms of a move announced in October 2015 to acquire 100% ownership of the project via an arrangement with major shareholders Resource Capital Fund IV L.P., Resource Capital Fund VI L.P. and Mr Clive Jones,

a Bannerman director and shareholder. The transactions will result in Bannerman not only taking full control of Etango, but becoming debt free and securing A\$4 million through a \$1 million cash payment and an equity placement of about 63.3 million shares to RCF VI for \$3 million.

The deal is also set to result in the extinguishment of \$12 million in debt through the conversion of convertible notes held by RCF into Bannerman shares and the sale of a 1.5% royalty over Etango to RCF for \$6 million. The shareholdings of RCF IV and RCF VI would move to about 20.4% and 19.3% of Bannerman's issued share capital, respectively. The shareholding of Clive Jones has the potential to increase to about 19.6%, assuming that all relevant shares are issued to him rather than his nominees.

Analysis: The latest results from the heap leach demonstration program at Etango indicate that the project's DFS and DFS optimisation assumptions may be conservative, with significant room to benefit from increased efficiencies. This will no doubt provide further comfort to those parties interested in future offtake or participation in the project development, or both. Success in the large-scale testing has also supported the project with a substantial metallurgical database and served to de-risk the processing flowsheet, a critical optimisation consideration in the uranium sector.

The results confirm the low technical risk associated with the processing flowsheet. This is in addition to the proven mining configuration adopted in the DFS and DFS Optimisation Studies and location in arguably the premier uranium mining jurisdiction status of Namibia. The demonstration plant results also support the potential to unlock further value suggested by unconverted resources at the site and the recent DFS optimisation work, which resulted in a six-fold increase in Etango's net present value to

US\$419 million. This work further illustrates Etango's early-mover advantage within the consensus forecast improvement for the uranium and establishes a sound project platform for Bannerman to engage with global nuclear players during the marketing process. Etango is clearly at the forefront of the global development pipeline of projects likely to produce at or above 2 million pounds of U3O8 per annum.

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Jurisdictionally, it benefits from proximity to a uranium export-rated port at Walvis Bay, only 47 kilometres away, and political stability in Namibia. Namibia has been ranked the most attractive African investment jurisdiction by the Fraser Institute Mining Company Survey. Also, consolidation

of Bannerman's ownership of Etango is expected to provide considerable structural benefits when project financing is sought for development. The transactions with RCF rend Bannerman debt free with new funds that allow Etango to be taken to the next stage.

Source: <http://www.proactiveinvestors.com.au>, 23 November 2015.

USA

Peninsula Energy Advances US Listing as Uranium Production Nears

Peninsula Energy has achieved major progress in advancing plans to list its American Depositary Shares on the New York Stock Exchange - MKT as the countdown to Q4 2015 Lance production approaches. The move is expected to provide further impetus to a near-term valuation re-rating for Peninsula as well as direct access and much greater visibility of the company's uranium business in the world's largest debt and equity markets. The company has filed a registration statement to register its ordinary shares with the US SEC.

Once this form is declared effective by the SEC, it allows foreign issuers to register securities with

the SEC for trading on a US stock exchange pursuant to applicable US securities laws. Peninsula is seeking a secondary listing of American Depositary Shares on the NYSE -MKT. Peninsula's registration filing with the SEC and forthcoming US stock exchange listing is expected to provide a number of benefits to the company. Home to the world's largest nuclear power generation fleet, the US also provides access to the largest pool of capital globally and access to an active and sophisticated investment market well versed in the benefits of nuclear power generation and the contribution that uranium makes to the nuclear fuel cycle.

Confidence in the uranium markets that will drive Lance is not only rooted in the significant US domestic nuclear market. Price increases for uranium in a tighter global supply-demand scenario are expected to unfold over 2016 with the restart of Japanese reactors and massive reactor construction efforts in China.

In conjunction with its US broking advisors, Peninsula has initiated a systematic and worldwide institutional awareness program that will run over the next four weeks. In keeping with this plan and to establish a significant shareholder base and liquidity in North America, it will be followed in the new year by an extensive US regional high-net-worth and retail roadshow program that will become a quarterly feature of the company's ongoing business plan.

Production Ready: Lance is set to produce at a stage-1 rate of 600,000 to 800,000 pounds of U3O8 per annum, with one well already fully operational and six more planned to sequentially ramp up, establishing a seven-well operation. Operating costs will be curbed dramatically as this rollout takes shape, with an initial all-in cost forecast of US\$41 per pound scheduled to drop to \$29 per pound by stage 3. Stage-1 capital costs are planned to be minimised to \$33 million with toll treatment. Toll treating, however, is expected to be brought in-house in later stages, resulting in lower operating costs and greater economies of scale.

A deep disposal well has been commissioned and is operational, with performance tracking better than forecast. Resin stripping, drying and packaging will be done at the Irigarary plant to

reduce initial capex and commissioning risk. Also, a pre-production inspection by the US NRC was successfully conducted earlier this November 2015. Lance is expected to be cash flow positive in 2016 with its production ramp-up coinciding with a tightening uranium market.

Uranium Market: Confidence in the uranium markets that will drive Lance is not only rooted in the significant US domestic nuclear market. Price increases for uranium in a tighter global supply-demand scenario are expected to unfold over 2016 with the restart of Japanese reactors and massive reactor construction efforts in China. Also,

India has indicated a strategic interest in expanding its nuclear market as sector M&A activity increases and global utility contracting appears to be rebounding. More long-term drivers of the sector are expected to result in a price range of US\$60-70 per pound by 2017-18 with strong global demand growth. This demand will be compounded by insufficient new mine development and declining secondary supply sources, generating a significant deficit by the end of the decade.

Analysis: Peninsula's steps toward a North American listing are important as they assert the company's potential to integrate its business strategy into the massive US nuclear market as macro factors improve the economics of the global uranium sector. A NYSE MKT listing of its ADR's should see a re-rating of the company relative to its North American peers at a time when it is transitioning Lance into an operational mine with no debt obligations. Peninsula is ready to begin production in 2015 at Lance with a clear, low-risk path to expansion. The project benefits from significant production volumes in term contracts and enviable operational metrics that will further streamline with project ramp-up.

This is expected to result in significant operating margins even at the current uranium price.

Weighted average prices for deliveries made under signed term contracts between 2016 and 2020 is US\$59/lb U3O8 – well above current prices. A tightening supply situation and new demand is expected to lift the whole uranium sector and further enhance the economics of Lance. Peninsula shares have been performing well on this outlook, with the stock last trading at A\$1.14, or 34% higher than a low reached in September 2015 and 50% higher than the beginning of the calendar year. Yet this is significantly below intrinsic value of Peninsula's producing Lance projects.

Source: <http://www.proactiveinvestors.com.au>, 16 November 2015.

NUCLEAR NON-PROLIFERATION

IRAN

Iran Expects Nuclear Deal to be Implemented in Early January

Iran expects a deal it reached with world powers in July 2015, under which sanctions will be lifted in return for it scaling down its nuclear program, to be implemented at the start of in 2016, Iranian nuclear negotiator Abbas Araqchi said. "We expect early January," Araqchi told reporters after meeting the director general of the IAEA, which is tasked with verifying whether Iran is keeping its commitments under the deal. Iran is holding parliamentary elections on Feb. 26 and diplomats say Tehran has been working hard to fulfill its commitments under the nuclear deal before that date. Iran's President Hassan Rouhani won by a landslide in 2013, promising a rapprochement with the West and an economic revival based on sanctions' relief.

The IAEA said in a confidential report that Iran had disconnected almost a quarter of its uranium-enriching centrifuges in less than a month. Tehran is also required to reduce its stockpile of low-enriched uranium – currently around 8,300 kg – to 300 kg before the deal can be implemented.

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Iran has reached a deal with Russia to export some of its enriched uranium to Russia in exchange for yellowcake, a form of uranium which has been mined but not yet enriched, Araqchi said. Araqchi said that swap arrangement would be implemented only after the IAEA has closed its investigation into the so-called possible military dimensions of Iran's nuclear past. The IAEA's Board of Governors is due to discuss the agency's assessment of the PMD file on Dec. 15.

Source: <http://www.reuters.com>, 24 November 2015.

NUCLEAR COOPERATION

ARGENTINA-CHINA

Two Chinese Nuclear Plants for Argentina in a 15bn Dollars Deal

About 85% of the cost of the project will be financed by Chinese firms, to be paid back in 18 years at an annual interest rate below 6.5%. More than 60% of the supplies will be Argentine manufactured, while the rest will be imported from China, Economy Minister Axel Kicillof said after signing the agreements alongside Planning Minister Julio de Vido, in Turkey in the framework of the G20 summit. "The agreements are of historic importance. They are very favorable for us as they give us energy and competitiveness. Both plants will be built with a lot of Argentine material," Kicillof said. "Everything that we have done over the past 12 years will be capitalized with the steps we are taking on nuclear energy."

The new deal represents a strong sign of the budding commercial relationship between Buenos Aires and Beijing at a time when Argentina has been locked out of international credit markets due to the legal conflict with the "speculative" funds. Ties between Argentina and Beijing have been deepening since the visit of Chinese President Xi Jinping to the country in 2014. "It's the highest investment anyone has ever made in

the country, considering the preferential interest rate and the payment terms that were included in the agreements," De Vido said. "It's an essential step to diversify the country's energy matrix by increasing the share of the nuclear power, whose development over the past few years has been a state policy."

More than 90% of Argentina's energy matrix relies on hydrocarbon resources. Natural gas is by far the most common fuel in thermal plants that dominate the country's energy sources. That is followed by hydroelectric power and then nuclear power and renewable energy with less than one percentage point. The deal follows other significant Chinese investments in hydroelectric and nuclear energy, plus railway and maritime infrastructure. Argentina is already moving forward with the construction of two large hydroelectric plants in Santa Cruz called Kirchner and Cepernic, a project that will cost US\$4.7 billion and will be financed by Chinese banks.

India this year registered a record production of 1,252 MT of uranium, manufacturing close to double the annual fuel requirement of atomic reactors in the country. The production has far exceeded the country's annual fuel requirement of 650 MT for the PHWRs, which means the country has surplus nuclear fuel that will last several months.

Following the signature of the agreement with China, Kicillof met with his Brazilian counterpart Joaquim Levy and highlighted the relationship between the two countries. "We reviewed the current solutions that are being studied across the globe to solve the world crisis. A serious issue would be if they start to point the finger toward developing countries, saying they're the ones to blame for the world's slow growth rate," Kicillof said.

Source: <http://en.mercopress.com>, 17 November 2015.

CANADA-INDIA

India to Get First Lot of Canadian Uranium Next Month

India will get its first consignment of Canadian uranium by December 2015, in a move that will help in securing fuel for nuclear power reactors

in the country. "The first lot of 250 tonnes of Canadian uranium is already on its way and should land by the first week of December 2015. Since it is imported fuel it will be used in the safeguarded reactors," a senior government official said. The deal, worth CAD 350 million with Canada's largest uranium producing company Cameco Corp, will ensure 3,220 metric tonnes of uranium over the next five years.

Signed in April this year when PM Narendra Modi visited the North American country, the development also assumes importance as Modi during his visit had given emphasis on the nuclear energy aspect. The Indo-Canada civil nuclear cooperation was signed in 2010. Incidentally, Canada had banned exports of uranium and nuclear hardware to India in the 1970s after New Delhi developed a nuclear bomb. India has 21 operational nuclear reactors and six under construction. India this year registered a record production of 1,252 MT of uranium, manufacturing close to double the annual

fuel requirement of atomic reactors in the country. The production has far exceeded the country's annual fuel requirement of 650 MT for the PHWRs, which means the country has surplus nuclear fuel that will last several months.

Every 700 MW of reactor needs 125 MT of uranium every year. However, with the rising number of power reactors in the country, the demand is expected to rise. In the near future, two nuclear reactors of 700 MW each in RAPS and KAPS are coming up. Apart from Canada, India currently procures uranium from Kazakhstan and Russia for its domestic reactors. Fuel for its two foreign reactors at Kudankulam is being taken care of by Russia. It also buys enriched uranium for its two Boiling Water Reactors at Tarapur from Russia. Plus, it is in process of procuring the nuke fuel from Australia.

Four atomic reactors of 700 MW each are also

coming up at the Gorakhpur Haryana Anu Vidyut Pariyojana. Fuel for Kudankulam plant in Tamil Nadu and Jaitapur in Maharashtra, coming up in collaboration with Russia and France respectively, will be made available by the foreign players.

Source: <http://economictimes.indiatimes.com>, 25 November 2015.

RUSSIA-IRAN

Russia Resumes Nuclear Trade with Iran as Sanctions Lifted

The move follows Iran's agreement to international curbs on its nuclear programme. UN sanctions against Iran are to be lifted in exchange for that agreement, under a deal signed in July 2015. Russia says it will help Iran's export of enriched uranium and modification of nuclear facilities at Arak and Fordo. Iran says its nuclear programme is only for civilian, not military, purposes. Mr Putin is in Tehran to attend a summit of gas exporting countries. His talks with Iranian leaders are likely to focus on the war in Syria, where Russia and Iran are the main military backers of President Bashar al-Assad. Russia has been conducting intense air and missile strikes against Syrian rebels including so-called IS, while Iran has been helping Mr Assad's forces on the ground.

Under the July 2015 nuclear deal, six world powers secured a pledge by Iran to set long-term limits on its nuclear research. Iran's low-enriched uranium stockpile will be reduced by 98% to 300kg for 15 years. In a decree published on 23rd, President Putin said Russia would support Iranian efforts to export any surplus enriched uranium - that is, above the 300kg limit - by sending raw uranium to Iran in exchange. Russia will also help Iran to modernise the heavy water reactor at Arak and to modify two cascades at its Fordo uranium enrichment plant. Low-enriched uranium, which has a 3%-4% concentration of the isotope U-235,

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can be used to produce fuel for nuclear power plants. But it can also be enriched more highly to the 90% needed to produce nuclear weapons. Iran's nuclear programme remains controversial and is under close international scrutiny. Israel and many US politicians are staunchly opposed to the deal on lifting sanctions.

Source: <http://www.bbc.com/news/world-europe-34899486>, 23 November 2015.

SOUTH KOREA-USA

South Korea said a new nuclear treaty with the United States that will govern its commercial nuclear activities for the next 20 years is set to enter into effect. The treaty, which replaces a previous accord reached in 1972, will be enforced from 6 p.m., according to Seoul's Foreign Ministry. The countries agreed to the revised treaty in April 2015 after spending several years arguing whether South Korea should have the right to enrich and reprocess US-origin nuclear fuel for commercial purposes.

Uranium-enriching Possible: The revised deal continues to deny South Korea that right, but opens the possibility of the

country gaining the ability to enrich uranium to produce non-weapons grade nuclear fuel depending on future negotiations with the United States. South Korea has been seeking the ability to enrich uranium to produce nuclear fuel, which it says will help reduce import costs and support its reactor exports. It also wants to reprocess spent fuel to reduce its growing storage of nuclear waste.

US Restriction: The US restricts such activities because the same technologies could be used to produce nuclear weapons and fears that supporting South Korea's enrichment ambitions might send the wrong signal to North Korea, which is developing its own nuclear weapons programme. In the revised treaty, Seoul and

Washington agreed to establish a high-level committee to discuss uranium enrichment for nuclear power generation, which Seoul officials described as a step toward securing potential consent for future enrichment. The revised deal also gives more leeway to South Korea for research activities and data collection related to spent fuel.

Source: <http://www.thehindu.com>, 25 November 2015.

NUCLEAR SAFETY

PAKISTAN

Pakistan Says Safety Security of its Nuclear Programme Fully Ensured

Pakistan works closely with the IAEA to strengthen nuclear security and is implementing an action plan in cooperation with the agency, a senior Pakistani diplomat told the General Assembly. Commenting on IAEA's annual report, Khalil Hashmi, deputy permanent representative of Pakistan to the UN, said that his government attaches "highest importance" to the security of its nuclear power plants, all of which were the agency's safeguards, "Even as we have over four decades experience of safely operating the nuclear power plants, we remain mindful of and attach highest importance to the safety and security of our current and future nuclear power plants," the Pakistani delegate added. Pakistan, he said, valued the agency's leading role in harmonizing and coordinating global efforts, in the wake of the Fukushima accident, to improve safety of nuclear power plants. Over the past decade, Pakistan's nuclear regulatory mechanism had grown into an effective system, basing its regulations on the IAEA safety standards, and also offering itself for independent peer reviews, Hashmi told the 193-

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memberAssembly.

He said that for over 55 years Pakistan had sought to enhance the application of nuclear technology for economic and social development, with the IAEA as a valuable partner in those efforts. As one of the agency's earliest members, it had also contributed to its technical cooperation programme through the provision of training and experts. Noting the "upward trajectory" of Pakistan's economy and its severe energy deficit, Hashmi said his country was tapping into all sources of hydro, solar and wind power, as well as nuclear energy. Pakistan had also harnessed nuclear technology in the health and agricultural sectors, as well as in research and development in the physical sciences and engineering.

Vowing to continue playing its constructive role in advancing non-proliferation objectives, nuclear safety and security and peaceful uses of nuclear technology, he said Pakistan viewed its membership of export control regimes, particularly the NSG, as a "mutually beneficial proposition". "We reiterate our call for an equitable, non-discriminatory and criteria-based approach to promote civil nuclear cooperation and membership of export controls regimes," the Pakistani delegate said in conclusion.

Source: <http://www.dnd.com.pk>, 18 November 2015.

PRAGUE

Respekt: Nuclear Safety Inspections had Shortcomings

Safety checks at the Dukovany nuclear power plant, south Moravia, may have been neglected intentionally, SÚJB chairwoman Dana Drábová, said in the latest issue of magazine *Respekt* that

is to come out on 16th. The shortcomings found in photos of piping do not, fortunately, endanger safety directly, according to Drábová. According to state-controlled power utility ĚEZ, which operates Dukovany, the shortcomings were the fault of individuals. Drábová said she could not rule out that a criminal complaint would be lodged.

SÚJB said earlier that its inspection had revealed that X-ray pictures of piping that could detect possible leakage were of poor quality. The authority said the shortcomings concern both nuclear and non-nuclear parts of the power plant. The findings do not, however, concern the most important component parts of the plant, such as the reactor pressure vessel,

it said. According to *Respekt*, the pictures of the pipes were blurred, and some welded seams that were endangered by leakage were marked as flawless. "The question is whether the company Tediko, which made the pictures, just performed a slapdash work, or whether

it was instructed to perform the work in such a way so as to make the shutdown of (Dukovany's) unit as short as possible because it costs a lot of money," Drábová said. Tediko has not commented on the issue.

According to *Respekt*, Drábová's criticism is aimed at ĚEZ's system of hiring external companies for some checks in order to reduce costs. ĚEZ CEO Daniel Beneš told *Respekt* he did not consider it incorrect to hire external companies. "It was rather the failure of particular individuals. We will draw consequences against them," he said. Three out of four units of Dukovany are offline owing to checks of welded seams at present. Power supplies have therefore fallen to a quarter. With regards to the shutdowns at Dukovany as well as at the Temelín nuclear power plant, ĚEZ has downgraded its full-year output outlook. In its release of financial results for the first three quarters, ĚEZ also decreased its full-year target of operating profit by Kč 4 billion to Kč 64 billion.

Source: <http://www.praguepost.com>, 15 November 2015.

NUCLEAR WASTE MANAGEMENT

RUSSIA

Russia Plans to Build Radioactive Waste Storage on Arctic Islands of Novaya Zemlya

Russia's Rosatom state nuclear corporation intends to build a low-and medium-level radioactive waste disposal facility in the area of the Novaya Zemlya archipelago. Rosatom's relevant request is to be considered by deputies

of the Arkhangelsk regional assembly. The press service of the regional assembly reported that before the session the lawmakers held a roundtable discussion to discuss the project. Deputy head of Rosatom department for work with regions Andrei Polosin said: "We do not plan to

build this facility right now. We just need a permission to conduct additional studies." "To get started, we need seven years. It's a very big project, requiring many different approvals," he added.

According to experts, about 50 tonnes of radioactive waste from the operation of nuclear-powered submarines in Severodvinsk have been accumulated in the Arkhangelsk region. The construction of a waste disposal facility on Novaya Zemlya would attract additional investment to the region and create new jobs. Until 1992, the sea off the coast of the Arctic archipelago of Novaya Zemlya had been the main area for sinking solid radioactive waste from the Soviet military and civilian nuclear vessels based in the North. A total of about 17,000 containers with solid radioactive waste, as well as 16 nuclear reactors from submarines and icebreakers were sunk in the Arctic. In 1982, the K-27 emergency nuclear submarine with unloaded reactor was

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sunk in Stepovoi Bay. The radiation situation in these areas is regularly monitored by expeditions of the Emergency Situations Ministry and the Russian Academy of Sciences. According to their data, solid radioactive waste dumped during the Soviet years off the coast of Novaya Zemlya at present poses no threat to the environment, but requires constant monitoring.

Source: <http://tass.ru/en/economy/839293>, 25 November 2015.

USA

Nuclear Waste Firms Complete \$270m Acquisition in US

Salt Lake City, Utah based nuclear waste processing, transporting and recycling firm, EnergySolutions, Inc. has signed a definitive agreement to acquire Dallas based Waste Control Specialists LLC (WCS), which operates a 1338 acre radioactive waste disposal facility on a 14,900-acre site in western Andrews County, Texas, that features a 7 ft (2 metre) thick, steel-reinforced concrete liner system. Energy Solutions said that the deal will see it pay Valhi, Inc. (NYSE: VHI), of which WCS is a wholly owned subsidiary \$270 million in cash and \$20 million face amount in Series A Preferred Stock. It will also assume approximately \$77 million of WCS debt. Additionally, the company added that it will

assume all financial assurance obligations related to the WCS business, but that completion of the sale is subject to certain customary closing conditions outlined in the transaction agreement.

“Combining our capabilities will bring improved operational efficiencies and allow us to deliver a safe and seamless supply chain that better serves the needs of commercial and government customers,” commented David Lockwood president and chief executive officer of Energy Solutions. “In addition to the ongoing utilisation of all the acquired assets, we intend to continue to seek expansion opportunities in the nuclear services area, he added. “Energy Solutions and WCS will continue to operate as independent companies until completion of the sale.” Steven L. Watson, chairman of the Board and chief executive officer of Valhi commented: “The sale of Waste Control Specialists to Rockwell will expand the range of services available to its customers, while providing Valhi the opportunity to deploy the cash proceeds from the sale to take advantage of growth opportunities in its remaining businesses. The continuing equity interest in Rockwell, the parent company of the combined businesses, will allow Valhi to participate in the benefits of the combination.”

Source: <http://waste-management-world.com>, 25 November 2015.



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