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## Air Force likely to get 123 LCA Tejas by 2024-25

*To enable this Hindustan Aeronautics Limited is in the process of setting up a new assembly line.*

If the present development and capacity enhancement plans go as per schedule, the Indian Air Force will have 123 indigenous Light Combat Aircraft (LCA) Tejas fighter jets in its fleet by 2024-25.

To enable this Hindustan Aeronautics Limited (HAL) is in the process of setting up a new assembly line and is also involving the private sector in a big way, said the Chief Managing Director (CMD) of the public sector aerospace major T. Suvarna Raju in a conversation with *The Hindu*.

The IAF has placed orders for 40 jets in two batches of which the first 20 are in the Initial Operational Configuration (IOC) while the remaining 20 are in the Final Operational Configuration (FOC). Last July the IAF for operationalised the first Tejas squadron '45 flying daggers' with three aircraft. Two more aircraft will join the squadron shortly.

Last November the Defence Acquisition Council (DAC) had given initial clearance for 83 aircraft in the Mk-1A configuration with specific improvements sought by the IAF.

Mr. Raju said that about 45 improvements have been implemented in the 1A and HAL has already floated a tender for the Advanced Electronically Scanned Array (AESA) radar and Self-Protection Jammer (SPJ).

On the timeline for the development of the 1A, Mr. Raju said that the tender would be opened by March end after which technical evaluation and commercial negotiations would be held. "We will be able to prove it on the 1A by 2018 and start producing by 2019," he observed.

Apart from the development, the induction is also delayed by the low production rate of eight aircraft per year. The government has recently given sanction for setting another assembly to increase production rate to 16 per year. "The IAF will get Mk-1A in 2019 by that time our capacity will also go up to 16 aircraft per year," Mr. Raju added.

To increase the production of the aircraft HAL has outsourced major parts of the jet. "We are trying to be an integrator rather than a manufacturer, he said.

The IAF is in urgent need of new fighters and the LCAs will replace the Mig fighters that are currently being phased out. IAF is scheduled to phase out all 11 squadrons of Mig-21 and Mig-27 fighters by 2024 on completion of their technical life. On the issue of spares and supports which has been an area of constant concern from the services, Mr. Raju said they have now signed long term supply contracts with their vendors and stated that the availability of all platforms manufactured by HAL has now gone "above 65 percent."

## 7-mth-old Indo-US logistics pact not operational

*By Rajat Pandit*

*Bureaucratic Bottlenecks Causing Delay*

The much-ballyhooed logistics pact between India and the US, which will allow reciprocal access to each other's military bases for refuelling, repair and maintenance of warships and aircraft, is yet to enter into force despite being inked seven months ago. Slow decision-making, bureaucratic bottlenecks and complex accounting procedures, much more from the Indian side than the US one, have held up the Logistics Exchange Memorandum of Agreement (LEMOA) from becoming operational till now.

## US IS LARGEST ARMS SUPPLIER



### 1 US largest arms supplier to India over last 5 yrs, with deals worth \$15 billion since 2007

- Several joint military exercises held every year, from naval Malabar to counter-terror Vajra Prahar & Yudh Abhyas
- Inked Defence Technology & Trade Initiative (2012), 10-year Framework for India-US Defence Relationship (2015), Joint Strategic Vision for Asia-Pacific & Indian Ocean Region (2015), LEMOA (2016) etc

### 3 Basic Exchange & Cooperation Agreement for Geo-Spatial Cooperation (BECA)

- US says BECA will allow it to share advanced satellite & topographical data for long-range navigation & missile-targeting
- But India has its own satellite imaging capabilities. BECA will involve US digital sensors to be positioned on Indian soil

### 2 Communications Compatibility & Security Arrangement (COMCASA)

- Technology-enabler to help transfer high-tech avionics, encrypted communication & electronic systems to India
- US says COMCASA will boost 'interoperability' as well as ensure secrecy of its C4ISR systems
- But US will be able to track & snoop on Indian warships/aircraft equipped with such systems. Could compromise India's tactical operational security



Sources, however, said the Indian defence ministry was “now close to finalising the intricate accounting procedures” under which the two militaries will provide each other with logistical support on “equal-value exchange and reimbursable basis“. It was much easier for the US, which has similar pacts with its allies and others as well as unified theatre commands to handle different parts of the globe, to work out the operational details and submit its “points of contact“ list to India.

However, India, with separate budgets and accounting procedures for the Army , Navy and IAF in the absence

of unified commands, has found the going tough since the LEMOA was inked on August 29 last year. “The complex arrangement on how India will pay had to be worked out. But it should now be finalised and approved in a month or so,“ said a source. The LEMOA represents yet another major milestone in the ever-tightening bilateral strategic clinch, which has seen the US bag arms deals worth \$15 billion from India as well as the two militaries conduct a flurry of combat exercises over the last decade. But the Modi government, wary of being accused of compromising India's traditional strategic autonomy , has taken pains to repeatedly stress that LEMOA will not entail any basing rights or permanent stationing of US troops on Indian soil.

India is also in no tearing hurry to ink the other two “foundational agreements“, in addition to LEMOA, which are being pushed by the US for over 15 years now. These are the Communications Compatibility and Security Arrangement (COMCASA), and the Basic Exchange and Cooperation Agreement for Geo-Spatial Cooperation (BECA). “India is keen on further building interoperability between the two forces but it has to follow capacity-building,“ said an official. While some military officers say working closely with the US is an ineffective way of balancing the long-term threat from China, critics contend the “foundational pacts“ will impact adversely the strategic partnership with Russia.

# DECCAN Chronicle

Mon, 20 Mar, 2017

## Can Indian Navy afford a mutiny?

The Indian Navy has ordered a high-level probe into an incident of insubordination and assault by some young sailors on a senior officer on board its survey ship INS Sandhayak off the coast of the eastern state of Odisha. They now face disciplinary action. INS Sandhayak, under the Eastern Naval Command, is used by the Indian Navy to carry out shallow coastal and deep oceanic survey and collect oceanographic and geophysical data. On March 9, the Indian Navy issued a press statement about the “incident of insubordination” aboard its survey ship INS Sandhayak in which, reportedly, “four sailors” were involved.

The sailors not only “disobeyed orders” but also “exchanged blows with officers on the high sea.” Several words used in the statement need to be noted: “insubordination”, “disobedience”, “blows”, among others. The Navy clarified that the word “mutiny” cannot be applied to describe the incident, as it did not involve a rebellion by the entire crew of the ship. This clarification needs to be revisited with all sincerity. If one refers to Sections 42, 43, 45, 47 and 48 of the Navy Act 1957, which largely deals with disciplinary provisions one realises that the incident pertains to discipline, and discipline only. While Section 42 deals with the description of mutiny, the other sections pertain to the various disciplinary actions that are undertaken in case of mutiny or disorderly behaviour. Hereunder is a brief description of the aforementioned sections for a better understanding.

Section 42: Mutiny defined. “Mutiny means any assembly or combination of two or more persons subject to naval law, the Army Act 1950, or the Air Force Act 1950, or between persons, two at least of whom are subject to naval law or any such Act...”

Section 43: Punishment for mutiny. “Every person subject to naval law, who joins in a mutiny, shall be punished with death or such other punishment as is hereinafter mentioned.”

Section 45: Punishment for striking superior officers. “Every person subject to naval law who commits any of the following offences or strikes or attempts to strike his superior officer, draws or lifts up any weapon or uses or attempts to use any violence shall be punished with imprisonment which may extend to 10 years or five years.”

Section 47: Punishment for disobedience and insubordination. “Every person subject to naval law, who wilfully disobeys his superior officer or shows or expresses intention to disobey his superior officer or uses insubordinate, threatening or insulting language or behaves with contempt to his superior officer shall be punished with imprisonment which may extend to 10 years or three years.”

Section 48: Punishment for quarrelling and disorderly behaviour. “Every person subject to naval law, who quarrels, fights with or strikes any other person or uses provoking speeches or behaves in a disorderly manner shall be punished with imprisonment for a term which may extend to two years.”

From the above it is abundantly clear that there is a disconnect between the relevant sections of the Navy Act 1957 and the press statement issued by the Indian Navy. According to IHS Jane’s Fighting Ships 2016-2017, Sandhayak is a 1981 product of Garden Reach Shipbuilders & Engineers (GRSE) and carries a “complement of 178 (18 officers) plus 30 scientists”. Does it then imply that only if the entire crew, including the 30 scientists, had resorted to collective indiscipline and insubordination, it would have been classified as a mutiny? Time to pause and ponder.

What makes the matter slightly serious is that this is not a “one-off type incident” or “mutiny”, but is part of a series of “incidents”, which have been reported during the past several months for all the wrong reasons, thereby putting the Indian Navy in a spot. Is there any gang or system or foreign hand operating behind this? It is indeed a tricky situation. All the more because the Indian Navy thus far has fared much better than the Indian Army and Indian Air Force so far as the indigenisation programme is concerned. And let us face it, except Russia and Japan, no foreign nation — however friendly — will accept an indigenously-built powerful Indian fleet operating across the Indian Ocean. Any failure to recognise this fundamental point would only put the Indian Navy’s laborious indigenisation enterprise into peril. Critics here may question the fairness and neutrality of singling out Russia and Japan. Point indeed; but there are good reasons. Both Moscow and Tokyo have found the Indian Ocean beyond their strategic goal. Moscow, even in its Soviet-era heyday, could rarely break through the “choke points” of the Black Sea (encircled by foreign land), Gulf of Bothnia and the Siberian port of Vladivostok (winter snow). No doubt they built a formidable navy aircraft-carrier Admiral Gorshkov, but they could rarely match the operational resilience of the Western fleet in the Indian Ocean.

The Japanese Navy too has traditionally been active on the Pacific Ocean owing to its proximity and vastness. Except for its momentous success of sinking the Royal Navy battleship HMS Prince of Wales and battlecruiser HMS Repulse on December 10, 1941 in the South China Sea, it has rarely ventured into the Indian Ocean. Hence, both Russia and Japan are unlikely to have strategic clash of interests with regard to India. Since the Western navies have been naval pioneers and dominated global naval affairs since the beginning of the 16th

century, their retreat in this century cannot be accepted, or acceptable. Dependence to independence may be desirable for India but its unlikely to be so for the powers of yesteryears. One hopes and prays that the happenings onboard INS Sandhayak referred to as micro “incident” and not a “mutiny” is just so. A few words of caution here to avoid such situations in the future. A survey ship is not a warship. It does not have the rigours of excitement or tension of action. Hence, it is surprising that an episode like this happened on a non-combat vessel, as the human mind normally cracks under pressure. One hopes Section 46 of the Navy Act 1957 dealing with ill-treatment will be looked into when punishing the sailors. The act clearly states: “Every person subject to naval law who is guilty of ill-treating any other person... being his subordinate in rank or position, shall be punished with imprisonment up to seven years.” Thus, whichever way one may look at INS Sandhayak, it does not give me any pleasure but to warn that choppy waters lie ahead as the Indian Navy rises in stature, status and strength.

## Business Standard

*Mon, 20 Mar, 2017*

### **Will India Nuke Pakistani Cities, or Bomb its Nuclear Arsenal?**

Former national security advisor (NSA) Shivshankar Menon has shed new light on an especially worrying aspect of India’s nuclear doctrine — New Delhi’s barely credible promise of automatic, “massive” nuclear retaliation against any adversary that targets India, or Indian forces anywhere, with weapons of mass destruction (WMDs).

The credibility gap in this strategy of “massive retaliation”, as pointed out by critics worldwide, is that it would cause carnage in the adversary’s towns and cities but leave intact much of his nuclear arsenal. With those surviving nukes (second-strike capability), the adversary would then wreak havoc on Indian towns and cities. It is hard for New Delhi, globally regarded as a restrained power, to convince analysts and adversaries that it would knowingly trigger the catastrophic deaths of millions of civilians on both sides by responding “massively” to a far smaller attack — even, a single Pakistani Tactical Nuclear Weapon (TNW) that killed perhaps a hundred Indian soldiers deep inside Pakistani territory.

Yet, India’s nuclear doctrine, promulgated on January 4, 2003, undertakes that “Nuclear retaliation to a first strike [by an adversary] will be massive and designed to inflict unacceptable damage.”

Now Menon, in his recent book entitled “Choices: Inside the making of Indian foreign policy”, indicates that India’s threat of “massive retaliation” need not involve nuclear strikes against Pakistani urban centres (“counter-value”, or CV strikes). Instead, India’s “massive response” could take the form of targeting Pakistan’s nuclear arsenal (“counter-force”, or CF strikes), leaving that adversary with a greatly diminished capability of striking back at India.

In a key paragraph in his book, Menon — who, as NSA, oversaw nuclear targeting policy — analyses the meaning of a “massive” strike. He says: “There would be little incentive, once Pakistan had taken hostilities to the nuclear level, for India to limit its response, since that would only invite further escalation by Pakistan. India would hardly risk giving Pakistan the chance to carry out a massive nuclear strike after the Indian response to Pakistan using tactical nuclear weapons. In other words, Pakistani tactical nuclear weapon use would effectively free India to undertake a comprehensive first strike against Pakistan.”

Menon carefully differentiates between “first use” (which Indian nuclear doctrine forbids) and “first strike”, which — in widely-accepted nuclear vocabulary — refers to a disarming CF strike aimed at leaving an adversary without nuclear recourse.

Menon clearly enunciates the logic of a disarming CF strike: “India would hardly risk giving Pakistan the chance to carry out a massive nuclear strike after the Indian response...” In other words, India’s “second strike” (in response to a TNW against its forces) must leave Pakistan with little or no “third strike” capability.

But does a disarming counter-force strike (which Menon terms a “comprehensive first strike”) amount to a “massive” response, which Indian doctrine mandates? A senior Indian official asks: “Who says a “massive” response must necessarily be directed at CV targets?”

Menon’s insights extend the focus of India’s second-strike well beyond counter-value targets to counter-force targets. Contacted by Business Standard, Menon declined to elaborate, stating only: “India’s nuclear doctrine has far greater flexibility than it gets credit for.”

Menon’s book has been in print since November, but only now has this nuance been noted by Vipin Narang, a highly regarded nuclear strategist at the Massachusetts Institute of Technology. This week, Narang tweeted: “Indian strategy following Pak tacnuke (tactical nuclear) use is neither proportional response nor massive retaliation. But [rather, it is a] disarming counterforce strike.”

Even so, serious question marks remain over how effectively, or whether at all, India can actually execute a disarming CF strike that takes out most of Pakistan’s nukes. Partly because of the possibility of Indian attack, Pakistan is building up its nuclear arsenal faster than any other country, running its Khushab nuclear reactor at full tilt to produce plutonium. It is currently estimated to have 120-130 nuclear warheads.

Especially difficult for India to target are Pakistan’s small, highly mobile TNWs that are basically truck-mounted, tube-launched artillery. Furthermore, any impression in Pakistan of Indian counterforce strikes, or the fear that the nukes might soon be lost, would incentivize their early use — the “use them or lose them” dilemma.

Indian public debate has traditionally focused on another aspect of our doctrine — the commitment of “No First Use” (NFU) of nuclear weapons. The Bharatiya Janata Party (BJP) questioned NFU in its pre-2014 election manifesto, before backing off quickly. Then, last year, former defence minister Manohar Parrikar raised questions over the need for NFU, before the BJP dismissed that as his “personal view”.

However, given Pakistan’s conventional military weakness in the face of a sudden Indian offensive under the “Cold Start” doctrine, Rawalpindi’s operationalization of TNWs, and its declared plan to use them early in a conflict, make India’s response a matter of life and death for millions.



Mon, 20 Mar, 2017

## N. Korea tests powerful rocket engine

*It marks the birth of a new indigenous rocket industry, state media quotes Kim Jong-un as telling*

North Korea has tested a powerful new rocket engine, state media said Sunday, with leader Kim Jong-un hailing the successful test as a “new birth” for the nation’s rocket industry.

The test was apparently timed to coincide with the visit of U.S. Secretary of State Rex Tillerson to Beijing on Saturday, where he warned that regional tensions had reached a “dangerous level”.

‘Great victory’

State news agency said Mr. Kim had overseen the operation, and “emphasised that the whole world will soon witness what eventful significance the great victory won today carries”, KCNA reported, hinting that the North could use the new engine to launch a rocket to put a satellite in orbit.

Rocket engines are easily re-purposed for use in missiles. Outside observers say that the nuclear-armed Pyongyang’s space programme is a fig leaf for weapons tests.

“The development and completion of a new-type high-thrust engine would help consolidate the scientific and technological foundation to match the world-level satellite delivery capability in the field of outer space development,” KCNA reported.

“The leader [Kim] noted that the success made in the current test marked a great event of historic significance as it declared a new birth of the Juche-based rocket industry.”

Mr. Tillerson has also visited U.S. allies Japan and South Korea where he said the U.S. would no longer observe the “failed” approach of patient diplomacy with Pyongyang, warning that American military action against the North was “on the table”.

The tougher U.S. talk followed two North Korean nuclear tests last year and recent missile launches that Pyongyang described as practice for an attack on U.S. bases in Japan.

The last ground test of a high-powered rocket engine was in September last year, which was also observed by Mr. Kim.

Mr. Kim at that time hailed the test and called for more rocket launches to turn the country into a “possessor of geostationary satellites in a couple of years to come”.

A geostationary satellite must be propelled to an altitude of 36,000 km and North Korea is showing off its progress in developing a long-range inter-continental ballistic missile that can reach the U.S. east coast, Professor Yang Moo-Jin of the University of North Korean Studies said.

“The North is hinting strongly that it will soon launch a new satellite rocket” from its Sohae satellite launch site, Mr. Yang told AFP.

It may also carry out a secretive intercontinental ballistic missile (ICBM) test using a mobile launcher, he added.

“The test is timed with Chinese President Xi Jinping’s visit to the United States,” and the anniversary of the founding of North’s army, he noted.

North Korea is banned by the United Nations from conducting long-range missile tests, but it claims its satellite programme is for peaceful use, a claim many in the U.S. and elsewhere believe is questionable.



*Mon, 20 Mar, 2017*

## **Inching toward s nuclear war?**

*It's terrifying. North Korea's use of missiles threatens a new global flashpoint which could suck in South Korea, China, Japan and the United States*

At 8.30 in the morning, rush hour is in full swing in the South Korean capital Seoul, home to some 25 million people. Those commuters crammed into the underground system are the lucky ones— initially, at least. When the missile hits, they are protected from the blinding light of the 20-kiloton detonation. But above ground, in the area centred on the Yeouido financial district, all is destruction. Buildings up to a mile from Ground Zero have been vaporised or reduced to rubble. Some 70,000 people are dead, killed by the heat and the blast wave. Many more will succumb to radiation burns and radioactive fall-out over coming days.

The nuclear nightmare that has long bedevilled South Korea—America’s key ally in the region and one of the world’s most dynamic economies—has become reality. North Korea, most rogue of rogue nations, has struck. The nuclear explosion, similar in size to that which levelled Hiroshima, signalled the start of a blitzkrieg-style ground invasion intended to swiftly overwhelm its richer, more advanced neighbour. A second atomic warhead, inbound on a crude Rodong rocket, has been successfully intercepted by America’s THAAD (Terminal High-Altitude Area Defence) anti-ballistic missile system. But Seoul’s torment is only beginning as hundreds of North Korean heavy guns rain down shells on the capital, many containing Sarin nerve gas.



The city, bunched up against the NorthSouth border, is hopelessly vulnerable to a mass sneak attack of the kind now taking place, as hundreds of thousands of North Korean troops, and thousands of tanks, pour out of innumerable underground bunkers built within miles of the Demilitarised Zone between the two countries. The rest of the world watches as the horror is relayed via 24-hour rolling news and on social media. And waits for the next move ..

Could such a scenario ever come to pass? Will Kim Jong-un, latest incarnation of the cult dynasty that has ruled the Communist northern half of Korea since 1948, exchange bluff for action and, one day, deploy his small but lethal nuclear arsenal? That terrifying possibility moved a step nearer this month when, without warning, Kim Jong-un ordered a salvo of missiles to be fired towards his other nervous neighbour, Japan.

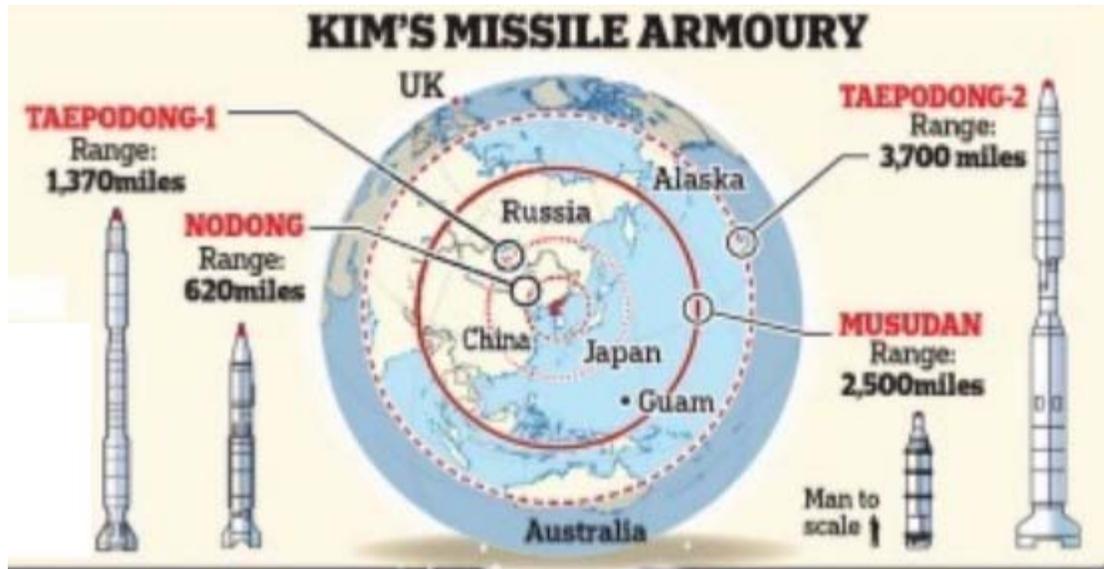
The latest in a series of escalating acts of provocation by the North Korean dictator this year saw three (non-nuclear) missiles land in Japanese waters. North Korean media, which released photographs of the launch 'supervised' by a delighted Kim Jongun, said the missiles had been aimed at American bases in Japan. International condemnation was swift and wide-ranging, with the Japanese prime minister, Shinzo Abe, describing the launch as a 'new level' of threat. The US appears to be losing patience.

Last week on Tuesday, it ratcheted-up the pressure further with the deployment to Korean waters of the super-carrier USS Carl Vinson. The 1,00,000-ton Nimitz-class carrier, with 40-plus F-18 fighters on board, and a powerful escort of cruisers and destroyers, is the ultimate 'big stick' expression of American power—and a provocation to paranoid minds in the North Korean capital, Pyongyang. Sources in South Korea are claiming the heightened military presence—which includes moving in 'Grey Eagle' attack drones—is part of a US plan to 'decapitate' North Korean leadership and demolish key military facilities. Ostensibly, Vinson is there to take part in the annual US-South Korean joint military exercises—codenamed 'Foal Eagle' and 'Key Resolve'—involving 300,000 South Korean personnel and 20,000 Americans. This act of allied solidarity was met, as usual, with blood-curdling threats from Pyongyang. It warned of 'merciless ultraprecision strikes from ground, air, sea and underwater' in retaliation. As the Vinson berthed in the South Korean port of Busan, US Secretary of State Rex Tillerson, on a tour of the region, warned that the 'diplomatic and other efforts of the past 20 years to bring North Korea to a point of denuclearisation have failed'.

The United States, said Tillerson, had provided \$1.35 billion (₹88.3 crore) in assistance to Pyongyang to encourage it to abandon its nuclear programme, but to no effect. A 'new approach' was required— but what that might be, he refused to say. President Donald Trump has stated that 'every option was on the table' when it comes to North Korean aggression. While the phrase was meant to reassure, many Japanese, and South Koreans worry that the Americans are contemplating pre-emptive strikes on North Korean military sites—which would indeed place them in the crosshairs of retaliatory attacks. In unusually graphic language, China, North Korea's reluctant patron, has warned that the communist state and the US are like 'two accelerating trains' speeding towards a head-on crash. The rhetoric may not be misplaced.

Of World War III is to break out anywhere, then it will probably be in this febrile region. North Korea is intent on developing nuclear-tipped missiles that can hit the States. Large areas of Japan and all of South Korea are already in range. Its nuclear arsenal numbers some 20 Hiroshima-size atomic bombs.

What is not clear is if North Korea has the ability to marry these A-bombs to its missiles to create workable devices. But even the most cautious of analysts warns it is only a matter of time. Kim Jong-un, irrational and unpredictable at the best of times, appears increasingly trigger-happy, revelling in his ability to make Western powers squirm. In February, North Korea launched an intermediate-range ballistic missile, superior to anything that had gone before. Just days later came the brazen murder, by a hit squad using powerful VX nerve toxin of Kim Jong-un's estranged halfbrother, Kim Jong-nam.



The manner of the killing, at Kuala Lumpur airport in Malaysia, was intended to strike terror into the hearts of exiled opponents of the Kim regime. (Recently, Interpol issued warrants for the arrest of four North Koreans in connection with the murder.) It is, however, the test-firing of four ballistic missiles towards Japan on March 5 (a fifth is thought to have failed) that most concerns the West.

The missiles themselves are not the most worrying feature. Unlike the one launched on February 12, these were not propelled by solid-fuel motors which allow for quick launches. Nor did they have intercontinental range. Judging by the distance (600 miles) and height (160 miles) reached by the missiles, they were probably what experts call 'extended-range' Scuds, acquired in the Nineties after the fall of the Soviet Union. What truly alarmed was the simultaneous, multiple-firing, which suggests advanced operational skill; the impact area of three of the missiles within 200 miles of Japan; and the threats that followed. North Korea's UN ambassador claimed that the situation on the Korean Peninsula was 'inching to the brink of a nuclear war'.

China's intervention, calling on the US and South Korea to halt military exercises in exchange for North Korea suspending tests seems, not surprisingly, to have fallen on deaf ears, as evidenced by the arrival of the Carl Vinson this week. For the time being, the US military response is defensive, bringing forward the long-planned installation of its anti-ballistic missile system, known as THAAD, on South Korean soil. The system, while not perfect, is designed to knock out Scud type missiles.

China has called the installation of THAAD a provocative military escalation, a claim echoed by Russia. Both nations fear that the system's radar would allow the Americans to peer deep into their territory and monitor their missile tests. China views every US military development in its hemisphere as an attempt to thwart its ambitions for regional dominance. But America needs Chinese help in reining in Pyongyang. The best outcome for all in the region would be for China to use its leverage as North Korea's biggest trading partner and main source of arms, food and energy to persuade Kim Jong-un to halt his nuclear ambitions. China has, in fact, recently put pressure on its troublesome semi-ally, announcing last month that it was stopping imports of North Korean coal, a third of the poverty stricken nation's exports.

However, Beijing has always been cautious about actions that could cause the collapse of the North Korean system, and with it a flood of refugees. Before leaving office, Barack Obama warned Donald Trump that North Korea was the gravest security risk he would face as president. Every day that has passed since the inauguration confirms this assessment. Perhaps the best hope for those living in the shadow of North Korea's nuclear ambitions lies in 33-year-old Kim Jong-un himself. He loves the good things in life, yachts, cars, the best tobacco, even as his people go hungry. War with South Korea means instant war with the United States, and whatever mayhem North Korea can cause during its brief nuclear rampage, it cannot hope to prevail against the world's only superpower. In signing the order to attack South Korea, Kim would be signing his own death warrant. We must hope Kim Jongun is still sane enough to understand that. *Daily Mail*



*Mon, 20 Mar, 2017*

## **Israel threatens to blow up Syria air shield**

Israel's defence minister has threatened to destroy Syria's air defence systems if they are used to target Israeli fighter jets again. The Israeli military said it shot down one of several anti-aircraft rockets fired at its warplanes by Syria last week in the most serious military exchange between the two hostile neighbours. Air force officials said four Israeli jets on a mission to destroy a weapons convoy destined for Iranian-backed Lebanese militant group Hezbollah were attacked by three Syrian surface-to-air missiles, one of which was intercepted by the Israeli Aerial Defence System known as "Arrow."

"The next time the Syrians use their air defence systems against our planes we will destroy them without the slightest hesitation," Avigdor Lieberman said in remarks broadcast on Israeli public radio. Damascus claimed one of the jets was shot down in Israeli-controlled territory and another was hit — a claim the Israeli military denied, saying none of the jets had been hit.

Israel had carried out strikes near Palmyra to help “Isis terrorist gangs and in a desperate attempt to raise their deteriorating morale and divert attention away from the victories which Syrian Arab Army is making in the face of the terrorist organisations”, a Syrian army statement said. Most Israeli air strikes in Syrian territory over the last few years were aimed at preventing weapons from being smuggled to the Hezbollah, which fights alongside Syrian President Bashar alAssad's regime against rebel forces.

While the Israel Defence Force (IDF) does not comment on the nature of its operations, Hezbollah, like Iran, is committed to the destruction of the Jewish state.



*Mon, 20 Mar, 2017*

## **IIT-Kharagpur develops superpower drone BHIM**

*By Jhimli Mukherjeepandey*

A research group at IIT Kharagpur has designed the country's first indigenous superpower drone and named it after Mahabharata's epic warrior Bhima. Under a metre in length, BHIM's uniqueness lies in the unmanned aerial device's state-of-the-art protection shield, superior imagery and hitherto unknown abilities, say its creators.

BHIM can create a Wi-Fi zone within a nearly 1km radius when it flies overhead. Aimed for conflict zones, the drone -which has a battery backup of seven hours -can fly into a disaster (or war) zone and create a seamless communication network for security forces, rescue personnel and even the common man. BHIM's special ability lies in maintaining long flight times and dropping emergency supplies by accurately using

parachutes. It can also be used for rescue operations in remote and hard-to-access areas. The drone can conduct integrity checks for boundary walls and find out breaches if any .

Designed especially for emergency situations, the automated drone has an actual vision-based guidance with built-in intelligence that helps it identify if an area is crowded or not. It will then fly away and land in a safer place.

“Such advanced built-in intelligence is not available in drones now. The design is completely in-house. The controlling and guiding algorithms of the drone have been developed in our lab, “said Sudip Mishra, a faculty member of the computer science and engineering department.



Mon, 20 Mar, 2017

## दो परमाणु रिएक्टरों को हुई 'चेचक!', साल भर से वैज्ञानिक कर रहे हैं जांच

*किसी भी अफरातफरी और किसी अन्य दुर्घटना से बचने के लिए भारतीय परमाणु निगरानी संस्था- परमाणु ऊर्जा नियमन बोर्ड ने प्रभावित संयंत्रों को तब तक के लिए बंद कर दिया है, जब तक रिसाव की वजह का पता नहीं लगा लिया जाता।*

बेहद सुरक्षित भारतीय परमाणु रिएक्टर परिसर में विकिरण रोधी मजबूत पाइपों पर कुछ ऐसी विसंगति देखने को मिली है, जैसी इंसानों में 'चेचक' के संक्रमण के दौरान देखने को मिलती है। इसलिए, बॉलीवुड की एक थ्रिलर फिल्म की कहानी की तरह भारतीय वैज्ञानिक गुजरात के काकरापार परमाणु ऊर्जा संयंत्र में परमाणु रिसाव की गुत्थी सुलझाने के लिए कड़ी मशक्कत कर रहे हैं। 21वीं सदी का यह एटॉमिक पॉट बॉयलर असल में वैज्ञानिकों की कड़ी मेहनत का परिणाम है। इसकी दीवार उस मशहूर संपत्ति से जुड़ी है, जहां जाने-माने बॉलीवुड फिल्म स्टार राज कपूर रहा करते थे। यहां वे दक्षिणी गुजरात में दोहरे रिएक्टरों से हुए रहस्यमयी रिसाव की असल वजह का पता लगाने के लिए अतिरिक्त समय तक काम कर रहे हैं। किसी भी अफरातफरी और किसी अन्य दुर्घटना से बचने के लिए भारतीय परमाणु निगरानी संस्था- परमाणु ऊर्जा नियमन बोर्ड ने प्रभावित संयंत्रों को तब तक के लिए बंद कर दिया है, जब तक रिसाव की वजह का पता नहीं लगा लिया जाता। परमाणु विशेषज्ञों का कहना है कि एक दुर्लभ मिश्रधातु से बने पाइपों के ऊपर 'चेचक' जैसा संक्रमण हुआ है और यह संक्रमण गुजरात के काकरापार में दो भारतीय संपीड़ित भारी जल रिएक्टरों की नलियों में फैल चुका है। इस पर दुखद स्थिति यह है कि एक साल से अधिक समय तक जांच के बावजूद वैज्ञानिक यह नहीं समझ पाए हैं कि गड़बड़ी हुई कहां है। जापान के फुकुशिमा रिएक्टरों में विस्फोटों के ठीक पांच साल बाद 11 मार्च 2016 की सुबह काकरापार में 220 मेगावाट संपीड़ित भारी जल रिएक्टर की इकाई संख्या एक में भारी जल का रिसाव शुरू हो गया और उसे आपात स्थिति में बंद करना पड़ा। स्वदेश निर्मित परमाणु संयंत्र के प्राथमिक प्रशीतक चैनल में भारी जल का रिसाव हुआ और संयंत्र में आपात स्थिति की घोषणा कर दी गई। भारतीय परमाणु ऊर्जा विभाग ने इस बात की पुष्टि की कि कोई भी कर्मचारी विकिरण के प्रभाव में नहीं आया और संयंत्र के बाहर कोई रिसाव नहीं हुआ। भारतीय परमाणु संचालक न्यूक्लियर पॉवर कॉरपोरेशन ऑफ इंडिया लिमिटेड ने कहा, 'रिएक्टर को सुरक्षित ढंग से बंद कर दिया गया है' और 'विकिरण का कोई रिसाव नहीं हुआ'। एनपीसीआइएल ने यह पुष्टि की कि सुरक्षा प्रणाली सही तरीके से काम करती थी। विशेषज्ञ इस बात का पता लगाने की कोशिश कर रहे हैं कि रिसाव का पता लगाने वाली प्रणाली विफल कैसे हुई। वास्तव में इसे सबसे पहले एक अलार्म देना चाहिए था। ईईआरबी के अध्यक्ष एसए भारद्वाज ने पुष्टि करते हुए कहा, 'सभी संपीड़ित भारी जल रिएक्टरों में रिसाव का पता लगाने वाली एक प्रणाली है लेकिन 11 मार्च 2016 को हुए लीक का पता लगाने में वह विफल रही है।' ईईआरबी का कयास है कि दरार इतनी तेजी से बनी कि विद्युत रिसाव पहचान प्रणाली को प्रतिक्रिया देने का समय ही नहीं मिला।

इसके बाद की जांचों में पाया गया कि रिसाव सूचक प्रणाली पूरी तरह से काम कर रही थी और संचालक ने खर्च बचाने के लिए 'उसे बंद नहीं किया था'। पहले रिसाव के कई सप्ताह बाद शुरुआती जांच में पाया गया कि प्रशीतक ट्यूब पर चार बड़ी दरारें बन गई थीं, जिनके कारण इतना भारी रिसाव हुआ। इस दरार का पता लगाना रहस्य की शुरुआत भर थी। इसकी वजह का पता लगाने के अन्य प्रयासों से पता चला कि जो हिस्सा उच्च तापमान वाले भारी जल के संपर्क में नहीं था, वह भी किसी अज्ञात वजह के चलते 'संक्षारित' हो गया था। यह एक बड़ी खोज थी क्योंकि संक्षारित हुई ट्यूब का बाहरी हिस्सा सिर्फ उच्च ताप वाली कार्बन डाइ ऑक्साइड के संपर्क में था और किसी ट्यूब के बाहर ऐसे संक्षारण का कोई ज्ञात मामला नहीं है। एईआरबी ने आदेश दिया कि जिरकोनियम-नियोबियम की विशेष मिश्रधातु से बनी सभी ट्यूबों के बाहरी हिस्से की जांच की जाए। उन्होंने पाया कि दानेदार संक्षारण, 306 ट्यूबों में फैला हुआ था। आम आदमी की भाषा में इसे चेचक जैसा संक्रमण कहा जा सकता है। इसी बैच की अन्य ट्यूबें अन्य भारतीय रिएक्टरों में भी लगी हैं लेकिन निर्बाध रूप से और बिना किसी संक्षारण के काम कर रही हैं। अब शक की सुई कार्बन डाइऑक्साइड गैस की ओर है, जिसे विकिरण के पर्यावरण में बेहद स्थिर माना जाता है। आगे जांच में पता चला कि प्रभावित रिएक्टर की समरूप इकाई-2 में भी एक जुलाई 2015 को ऐसा ही रिसाव हुआ था। हालांकि उस रिसाव की वजह की जांच का कोई ठोस नतीजा सामने नहीं आया है। एक के बाद एक दो संचालित रिएक्टरों में रिसाव के इन दो मामलों के कारण इंजीनियर उलझन में हैं।

मूल वजह का पता लगाने के लिए तत्पर एईआरबी ने आदेश दिया कि सिर्फ प्रभावित ट्यूब को ही नहीं, पूरे समूह को ही सुरक्षित तरीके से निकाला जाए और भारत की मुंबई स्थित प्रमुख परमाणु प्रयोगशाला भाभा परमाणु अनुसंधान केंद्र में विस्तृत विश्लेषण के लिए लाया जाए। भारत में ऐसे ही 16 अन्य परमाणु संयंत्र संचालित हैं। ऐसे में सभी परमाणु ऊर्जा संयंत्रों के प्रशीतक चैनलों की पूर्ण जांच की गई और जांचकर्ता दल ने पाया कि 'चेचक' जैसा संक्षारण काकरापार की दो इकाइयों तक ही सीमित था। इससे एनपीसीआइएल को बड़ी राहत मिली लेकिन काकरापार में हुए रिसाव की मूल वजहों का पता लगाने की जटिलता बढ़ गई। भारद्वाज ने कहा कि आज जांचकर्ता इस बात पर सोच रहे हैं क्या काकरापार में प्रयुक्त कार्बन डाइ ऑक्साइड विषाक्त हो गई है, जिसके चलते पाइपों के बाहर दानेदार संक्षारण हो गया। कार्बन डाइ ऑक्साइड के स्रोत का भी पता लगाया गया और पाया गया कि सिर्फ काकरापार संयंत्र ही अपनी गैस 'नेप्था क्रेकिंग यूनिट' से ले रहा है। ऐसे में संभवतः इसमें हाइड्रोकार्बनों की विषाक्तता हो। इस संदर्भ में अभी फोरेंसिक विश्लेषण जारी है और विषाक्तता का कोई ठोस साक्ष्य नहीं मिला है। संयंत्रों के इतिहास की विस्तृत जांच में पाया गया कि 2012 में काकरापार संयंत्र से दो ट्यूबों को नियमित रखरखाव के तहत निकाला गया था और एक सुरक्षित गोदाम में रखा गया था। जब इनकी 2017 में दोबारा जांच की गई तो जांचकर्ता इस बात से हैरान थे कि ट्यूब के बाहर 'चेचक' जैसा संक्षारण मौजूद नहीं था। इससे जांचकर्ताओं को संदेह हो गया कि शायद 2012 के बाद ही कुछ गड़बड़ हुई है। इसी बीच एईआरबी और परमाणु ऊर्जा प्रतिष्ठान ने इस रहस्य को सुलझाने में मदद के लिए व्यापक वैश्विक परमाणु ऊर्जा समुदाय से भी संपर्क किया है। हालांकि वैश्विक समुदाय भी इन विफलताओं को परिभाषित कर पाने में भारतीय दलों की तरह खराब स्थिति में ही रहा है।

भारत में इस समय कुल 22 परमाणु रिएक्टर संचालित हैं और इनकी क्षमता 6780 मेगावाट है। भारत को उम्मीद है कि वह 2032 तक परमाणु उत्पादन 32 हजार मेगावाट तक बढ़ा सकता है।

# Galactic challenge to Einstein's gravity

The reported discovery of a giant ring of small galaxies raises a possible question mark over the way physics is understood today

## What next

"This gigantic ring forms a serious challenge to the standard paradigm," the university website quotes Marcel Pawlowski, a Hubble Fellow at the University of California, Irvine, who prompted Banik's

discovery. Dr Zhao is applying for a UK Science and Technology Facilities Council grant to follow up the work with detailed simulations of the ring's origin and neighbouring galaxies in alternative gravity.

Compiled by KABIR FIRAQUE

## The discovery

Researchers at the University of St Andrews, UK, have reported that they have found a gigantic ring of galaxies darting away from the Milky Way. Ten million light years wide, the ring is made up of small galaxies and expanding like a mini Big Bang, say the researchers, whose study has been published in *Monthly Notices* of the Royal Astronomical Society.

## Theory versus theory

"If the Milky Way and Andromeda had passed so close to each other under standard Einstein gravity, then their huge dark-matter halos would overlap," PhD student Indranil Banik of St Andrews, who led the research, explains in an email to *The Indian Express*. "The resulting friction would cause the two galaxies to merge fairly quickly, contradicting their current large separation."

## What it means

That Einstein's theory of gravity may have to be rewritten, the researchers suggest. They believe the ring was formed when the Andromeda galaxy flew past the Milky Way at close range. However, "if Einstein's gravity were correct, our galaxy would never come close enough to Andromeda to scatter anything that fast", Dr Hongsheng Zhao of St Andrews is quoted on the university website.

## Proof required

"The important aspect of my work is that it strongly suggests a past close flyby interaction between these now widely separated galaxies, something that our history simply can't contain if Einstein gravity is correct," says Banik, born in Kolkata. "Thus, scientifically at least, attention is now focused on whether this actually happened rather than on how it could do so within our standard theory of gravity."



Interaction between galaxies NGC 5427 and NGC 5426 (90 million light years apart); image released by Gemini Observatory on its website

## CAUSE & EFFECT

"These small galaxies are like a string of raindrops flung out from a spinning umbrella," says lead researcher Indranil Banik

## 1/640

The chance for randomly distributed galaxies to line up in the observed way, according to the researcher

## 1/2

Banik says he traced the origin of the galaxies to a dynamical event when the universe was only half its present age

## 2.5 mn LIGHT YEARS

Distance between Milky Way and Andromeda. If their suggested interaction did take place, Einstein's physics would imply they should have merged rather than separated



# Scientists discover five new sub-atomic particles

*The find will contribute to understanding how three constituent quarks are bound inside a baryon*

Scientists using the world's largest and most powerful particle accelerator have discovered a new system of five particles all in a single analysis.

The uniqueness of this discovery is that observing five new states all at once is very rare, researchers said.

The LHCb experiment is one of seven particle physics detector experiments collecting data at the Large Hadron Collider accelerator at CERN (European Organisation for Nuclear Research).

The collaboration has announced the measurement of a very rare particle decay and evidence of a new manifestation of matter — antimatter asymmetry, to name just two examples.

The new particles were found to be in excited states — a particle state that has a higher energy than the absolute minimum configuration (or ground state) — of a particle called Omega-c-zero.

**Excited states** - Omega-c-zero is a baryon, a particle with three quarks, containing two “strange” and one “charm” quark. Omega-c-zero decays via the strong force into another baryon, called Xi-c-plus, (containing a “charm”, a “strange” and an “up” quark) and a kaon K-.

Then the Xi-c-plus particle decays in turn into a proton p, a kaon K- and a pion p+.

From the analysis of the trajectories and the energy left in the detector by all the particles in this final configuration, the LHCb collaboration could trace back the initial event — the decay of the Omega-c-zero — and its excited states. These particle states are named, according to the standard convention, Oc(3000)0, Oc(3050)0, Oc(3066)0, Oc(3090)0 and Oc(3119)0. The numbers indicate their masses in megaelectronvolts (MeV), as measured by LHCb. The next step will be the determination of the quantum numbers of these new particles — characteristic numbers used to identify the properties of a specific particle — and the determination of their theoretical significance. This discovery will contribute to understanding how the three constituent quarks are bound inside a baryon and also to probing the correlation between quarks, which plays a key role in describing multi-quark states, such as tetraquarks and pentaquarks.



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## **Robots create own language to work together**

*By Aatif Sulleyman*

Robots have learned how to communicate with each other by creating their own language, a new report explains. Experts at artificial intelligence research group OpenAI conducted an experiment that challenged software bots to complete a series of tasks, such as moving to a specific location, in a simple, two-dimensional virtual world. The team used a technique called reinforcement learning, presenting the challenges as cooperative rather than competitive, and rewarding the robots for completing them.

“We’ve just released initial results in which we teach AI agents to create language by dropping them into a set of simple worlds, giving them the ability to communicate, and then giving them goals that can be best achieved by communicating with other agents,” wrote the OpenAI team in a blog post. “If they achieve a goal, then they get rewarded.”

The robots learned to collaborate and communicate through trial and error, remembering the symbols, words and signals that helped them to achieve a goal and storing them in a private recurrent neural network. “If one agent realises that it could have performed a task better if a second agent had sent different information, the first agent can tell the second exactly how to modify its messages to make them as useful as possible,” it continues.

“In other words, agents ask the question: ‘how should I modify my communication output to get the most communal reward in the future?’” The language evolved as the researchers introduced tougher tasks, with the robots eventually learning to work together by composing sentences comprising multiple words. As the language continues to develop and grow more and more complex, the researchers hope to build a translator bot capable of translating their communications for humans.