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# India's biggest Make in India project gets wings

**Sandeep Unnithan**

Decks have been cleared for the country's largest ever defence order, over Rs 2 trillion for 100 Light Combat Aircraft (LCA) Tejas. At a crucial November 27 governing body meeting of the DRDO's Aeronautical Development Agency (ADA) that included manufactures Hindustan Aeronautics Ltd (HAL), the IAF brought down a wishlist of 57 outstanding maintenance issues with the aircraft down to 43, all of which can be executed by ADA and HAL without changing the aircraft design. "We are now hopeful of an order for 100 Mark 1-As before the end of the current financial year," DRDO chief Dr S Christopher told Mail Today. The meeting of the governing council headed by Dr Christopher follows the September 23 signing of new aircraft specifications between the four key stakeholders in the three-decade old LCA project-the IAF, DRDO, MoD and HAL. The agreement has launched the struggling LCA Tejas project on a new trajectory. Designs of the Mark-1A will be complete by 2017 and the modified aircraft could enter production beginning 2019. HAL is currently supplying the IAF with 20 variants of the basic LCA Tejas. The DRDO chief says the Mark 1-A Tejas will address other shortcomings indicated by the IAF like the lack of an Active Electronically Scanned Array or AESA radar and Electronic Support Measures (ESM) which will be carried on a pod instead of within the fuselage. The modified Mark 1-A was proposed by HAL this year as a stop gap because the Mark 2 with uprated GE-414 engines and a lengthened fuselage, will not be ready for induction before 2024. "Re-positioning of major (aircraft) aggregates for the ease of maintenance has nullified the requirement to stretch the fuselage that would have increased aerodynamic drag to such levels as to require the more powerful F-414 engine. This negates the requirement to have LCA Mk2 for the IAF," says Air Vice Marshal Manmohan Bahadur (retired) of the Centre for Air Power Studies. Significantly, HAL has assured the IAF that it will double production capacity in its Bengaluru facility to roll out 16 aircraft each year. The Mark 1-A is meant to arrest the alarming shortfall in the IAF's fighter squadron fleet from a sanctioned strength of 39.5 squadrons to the present 35 squadrons. These squadrons are projected to further dip by 2022 when over 200 MiG-21 and MiG-27s are phased out. The ADA is now designing the LCA's Mark 2 variant only for the Indian Navy and the design will be ready by 2022. The agency also hopes to complete designs of a generation 4.5 Advanced Medium Combat Aircraft by 2022.



The Mark 1-A is meant to arrest the shortfall in IAF's fighter squadron fleet.

**The Indian Express**

**01 December 2015**

## India conducts first missile test firing from nuclear submarine INS Arihant

India's first locally developed nuclear submarine INS Arihant has completed test firing of an unarmed medium-range missile, developed by Defence Research Development and Organisation (DRDO). The firing of DRDO's unarmed B-05, India's first submarine-launched ballistic missile (SLBM), which is capable of carrying a nuclear-tipped warhead will allow the country to launch a nuclear missile from air, land, and sea, reported IANS. Marking the completion of the country's nuclear triad, the test fire was conducted at a remote location by the Strategic Forces Command (SFC), the country's nuclear command authority, which is tasked with creating nuclear deterrence. Additionally, the submarine has completed its critical diving tests and power option tests, meeting most of the designated parameters. However, before the submarine is formally inducted in the Indian Navy as INS Arihant, it will perform the test firing of armed missiles, reported the news agency. Powered by an 85MW capacity nuclear reactor, INS Arihant can achieve surface speeds of 12k to 15k, and submerged speeds of up to 24k, carrying a crew of 95. In addition, the 6,000t nuclear submarine is equipped with torpedoes and missiles, including 12 ballistic missiles. The country's other nuclear-powered submarine, the INS Chakra, which has been leased from Russia, is said to be currently incapable of firing nuclear missiles.

## Indo-Israeli Barak-8 missile may win orders worth billions

India and Israel are likely to win orders worth billions of dollars following the successful test last week of the jointly developed multi-purpose Barak-8 missile system, a media report said. "In addition to India and Israel, which are procuring it, other armies around the world have signed with IAI ( Israel Aerospace Industries) to procure the advanced system. Assembly line production of the missiles and their accompanying systems has already begun", IAI Programme Director for Air & Missile Defence Systems Boaz Levy told Globes business daily. "The recent trial has given the system a substantial boost among countries that are still considering whether to procure it, and we believe that in the coming years, we will increase the number of signed contracts for its procurement. This is the spearhead of the defence systems, and a key growth engine for us," Levy said. Representatives of Defence Research and Development Organisation (DRDO), an equal partner in the joint venture right from the outset, also participated in the recent trial with the next test of the system likely to happen onboard Indian naval vessel INS Kolkata in December this year, defence officials here told PTI. Designed to defend against a variety of short-to-long -range airborne threats, including fixed-wing aircraft, helicopters, drones and projectiles, Barak-8 incorporates a state-of-the-art phased array multi-mission radar, two-way data link, and a flexible command and control system, enabling users to simultaneously engage multiple targets day and night and in all weather conditions. The missile system is being jointly developed by IAI, DRDO, Israel's Administration for the Development of Weapons and Technological Infrastructure, Elta Systems, Rafael and other companies. Sources involved in the development of the missile system told the business daily they believe that the Israeli Navy will be able to declare it operational within a few months. A Barak-8 battery, including the Adir radar system made by IAI subsidiary Elta Systems, a command and control system, and the missile launchers, is already installed on the deck of Israeli Navy ship Lahav, from which the new interceptor was fired last week as part of a complete trial of the system. "All of the instruments related to the weapons system had been tested in the recent trial at the height of which an interceptor missile had been fired from the Lahav's deck," Levy was quoted as saying. "The missile was aimed at a UAV simulating an enemy target. The system's radar spotted the threat, monitored it in flight, and the data were transferred from it to the Barak-8 command and control centre, which launched the interceptor missile at the UAV. "Using its homing-in device, the missile aimed itself at the target, made an accurate hit, and destroyed it completely. The missile blew it into fragments. The Barak 8 system, including all of its components, successfully met all the objectives set for it," Levy said. The trial focused on the system's capability in its naval application and the interceptor missile launched at the target was simulating a deep-sea target. IAI is also testing land-based applications of the system. The radar and command and control systems stationed on land are said to have also successfully identified and monitored the target, and calculated its trajectory, but did not launch an interceptor missile at it. The Barak 8's interceptor range is said to be 70 kilometres, making it capable of handling several threats posed against Israel's defence, including missiles like the Yakhont which the Israeli army believes is a part of Lebanese Shia militant group Hezbollah's arsenal and can be used to hit Israel's ports, navy ships, merchant vessels, and Mediterranean natural gas facilities. Professional sources told the Globes that Barak-8 is also capable of providing a solution for surface-to-surface missiles and accurate rockets possessed by Hezbollah that threatens infrastructure facilities in Israel and essential Israel Defence Forces (IDF) bases all over the country. Barak-8, an upgraded version of the missile Barak system already being used by India and Israel, is designed to defend naval vessels against incoming missiles, planes and drones. India's Bharat Dynamics Limited (BDL) will be assigned the task of producing the missiles with 32 initial ones to be fitted on INS Kolkata. srael made MF-STAR radar system, which is capable of simultaneously tracking hundreds of airborne targets to a range of more than 250 kilometres, adds value to the marketing potential of the new system.



## CVRDE Scientist Bags DRDO's Top Award

A scientist at the Combat Vehicle Research and Development Establishment here has bagged the DRDO's Scientist of the Year Award 2013. V Balaguru, Scientist 'G', has been instrumental in designing and integrated Improved chassis and Turret mechanical system of Arjun MBT Mark II Prototype in record time and later was elevated as trial Team Leader, an official release said. He pioneered the incorporation of improved medium fording capability with improved sealing efficacy and also undertook stringent user trials, Accelerated Usage and Reliability Trials and country evaluation trials of Arjun Main Battle Tank Mark I trials. At an award function held at Hyderabad recently, Balaguru was presented the award by Defence Minister Manohar Parrikar, it said.

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Deccan Herald

01 December 2015

## IAF chief eyes Rafale deal by year-end

The deal between India and France for 36 Rafale combat jets could happen before the end of the year, the Indian Air Force (IAF) chief, Air Chief Marshal Arup Raha, said on Saturday but to go by the manner in which the negotiations have spluttered in the last seven months, this could be a tall order. "I hope it will happen by the yearend," Air Chief Marshal Raha told IANS, when asked when the deal for the jets, in fly-away condition, was expected to be inked. "We expect it to happen quickly," he added. The deal for the jets, manufactured by Dassault Aviation, was announced during Prime Minister Narendra Modi's visit to Paris in April, but on the French side there is some frustration at the long-winded nature of the negotiations. The IAF, which badly needs to replace its aging fleet of Soviet MIG aircraft, was looking forward to the new planes, but the offsets clause that requires 50 percent of the deal, estimated at \$8 million, to be pumped back to the Indian defence industry, is believed to be a stumbling block, as also the pricing. While India and France are still involved in the sticky negotiations, Egypt has already welcomed three Rafale jets into the country in July - five months after inking a deal for 24 planes. French Defence Minister Jean-Yves Le Drian visited Cairo a few days after France delivered the jets. He was to visit India on August 31 during which the deal was expected to be inked. However, he flew straight on to Europe after it became known that the negotiations were not likely to be concluded soon. The Indian defence ministry had, at the time, refused to confirm his visit. According to French envoy Francois Richier, the defence minister had to fly to Europe to attend a EU defence ministers meeting. The progress in negotiations was reviewed by the Defence Acquisition Council (DAC), the top acquisition body of the defence ministry, chaired by Minister Manohar Parrikar on September 1. Sources said the progress in talks between both sides was "satisfactory". "The negotiations are on the right track. The DAC was briefed about it, and they gave the go ahead," an official had told IANS, not wanting to be identified. The Rafale had, in January 2012 emerged the winner of an IAF tender for 126 medium multi-role combat aircraft beating out five other contenders in a bruising competition that began in August 2007 with the floating of a request for proposal (RfP). Days after the announcement that India was purchasing the 36 Rafale, Defence Minister Manohar Parrikar admitted that the tender for 126 air craft was "effectively dead". Given this scenario, and the fact that Air Chief Marshal Raha had expressed similar hope on October 3, informed sources said it would be a touch-and-go affair if at all the deal for the 36 planes was to be inked by year-end. The IAF chief was in Hasimara, around 15 km from India-Bhutan border a crucial air base in India's eastern sector for the presentation of standards by President Pranab Mukherjee to two squadrons. The base has two squadrons of Mig 27s, which are likely to be phased out in the next few years. According to sources, at least one of the Rafale squadrons is expected to be based here. At an interaction with journalists earlier, Raha said that Rafale was one of the replacements for the Migs being phased out. "The Mig 27, the ones which have not been upgraded, are going to retire in next 2-3 years. We have a roadmap for replacements," he said. "Rafale is on the table. There are Su30 MKIs, the ones being made in India, and the LCA," he said. The Indian Air Force is expected to be down to 32 squadrons by the end of this year - 576 fighter jets - and way below the 750-strong fleet required as per the IAF vision document, in case of a two-front war with Pakistan and China. At least three squadrons of the vintage Soviet Union-origin MiG-21 and MiG-27 single engine aircraft are scheduled to be phased out, officially by the year-end. The IAF currently has 33 combat squadrons against a sanctioned strength of 39.5, which is sought to be raised to 42.

## Make in India in defence: New acquisition rules this month

Ministry of Defence has conveyed to a delegation from US companies - they held a meeting with ministry officials Monday morning - that the DPP rollout date has been scheduled for December 15.

by Pranav Kulkarni

The Defence Procurement Procedure (DPP), which will be the roadmap for the government's flagship Make in India programme that is being pushed as the future of defence acquisitions, is likely to be rolled out by the middle of December. The Indian Express has learnt that the Ministry of Defence has conveyed to a delegation from US companies - they held a meeting with ministry officials Monday morning - that the DPP rollout date has been scheduled for December 15. Last Saturday, Defence Minister Manohar Parrikar promised a "perfect" document "soon". "A meeting was held on Monday morning with representatives of US defence companies. The ministry has promised that the new DPP, as well as the defence offset policy, shall be rolled out in December," a ministry official said. An industry representative, who was at the meeting, confirmed the ministry's commitment. The representative said December 15 has been promised as the DPP announcement date. The DPP-2013, which presently serves as the guiding document for India's defence acquisitions, has been under revision. While existing guidelines facilitate defence acquisitions under various categories such as 'Make Indian', 'Buy and make Indian', 'Buy global', the new policy will incorporate suggestions by the Dhirendra Singh committee for better facilitation of Make in India in defence. Going beyond indigenous production, the new procedure is expected to define blacklisting of firms, role of agents/middlemen in defence procurements, integrity pact, offsets besides other crucial parameters governing defence acquisitions. The DPP is crucial for Make in India because critical acquisition programmes are awaiting guidelines for a final go-ahead.

The Tribune

01 December 2015

## Northern Command chief to visit Beijing mid-December

After China denied visa in 2010 to then Northern Command chief Lt Gen BS Jaswal, Lt Gen DS Hooda will be the first Northern Command chief to visit Beijing in mid-December this year. Lt Gen Hooda will be meeting his Chinese counterpart. In August 2010, India had cancelled defence exchanges with China after Beijing refused to allow the visit of Lt Gen Jaswal because he was responsible for Jammu and Kashmir, a state that China maintained was disputed. "The General Officer Commanding-in-Chief, Northern Command, Lt Gen DS Hooda is likely to visit China in mid-December. The exact date of his visit will be intimated later," said defence spokesperson Col SD Goswami. After the denial of visa to Lt Gen Jaswal, New Delhi had refused permission to two Chinese defence officials to come to India for a course at National Defence College. A subsequent visit by Indian military officials to China was also cancelled by India. Taking a tough posture, New Delhi had told Beijing that the unexpected decision to block Lt Gen Jaswal's visit to China was reason behind India's reactionary decisions. While both armies regularly hold border personnel meetings on the Line of Actual Control (LAC) in the Ladakh region, Lt Gen Hooda's visit to China will definitely ensure more synergy and understanding between the two sides, said Army sources. During Lt Gen Hooda's visit, the talks will be held on maintaining tranquillity on the LAC in order to avoid stand-offs, the sources added. "Though we have had stand-offs on the LAC but notably not even a single bullet was fired between us because of various border mechanisms in place to avoid any skirmishes. It also shows the resolve of both countries to maintain peace and tranquillity on the LAC," said a source.

### Defence exchanges stopped in 2010

- \* In August 2010, India had cancelled defence exchanges with China after Beijing refused to allow the visit of then Northern Command chief Lt Gen Jaswal because he was responsible for J&K, a state that China maintained was disputed
- \* Lt Gen Hooda will now be holding talks with his Chinese counterpart on maintaining tranquillity on the Line of Actual Control



# Tests showcase missile vs. missile technology

By Allison Barrie

In a battle of missile versus missile, the PAC-3 continues to blast threats out of the sky. In two separate tests at White Sands Missile Range in New Mexico earlier this month, the PAC-3 performed well. As part of U.S. Army upgrade testing on the Patriot Air Defense System - essentially a military and civilian missile shield - Lockheed Martin's missile successfully detected, tracked and intercepted a Patriot missile on Nov. 19. The missile was modified to be consistent with the sorts of tactical ballistic missiles forces face. On Nov. 12, a PAC-3 also intercepted an airborne target as part of the Army's Integrated Air & Missile Defense Battle Command System (IBCS) fight test at White Sands, according to Lockheed Martin.

**How does it destroy threats?** - Missiles like PAC-3 play a key role as a defense layer against incoming threats like cruise and tactical ballistic missiles, drones and aircraft. The missiles have been used by the military in the likes of Operation Iraqi Freedom. The PAC-3 Missile is a high-velocity interceptor that uses a "hit to kill" approach to obliterate threats. Hit to kill technology intercepts missile threats in a way often described as a bullet hitting a bullet. Rather than using an explosive to destroy the threat, hit to kill harnesses the immense power of the high velocity collision to wipe it out. Before it launches, a ground-based computer identifies an intercept point. The point is then embedded in the engagement control station and the missile blasts off, heading towards the programmed intercept point. To navigate to its target, the missile uses a combination of solid propellant rocket motors, altitude control motors, aerodynamic controls and inertial guidance. During the missile's journey, the operator can use a radio frequency uplink/downlink to update the target trajectory data. Just before it arrives at the intercept point, the PAC-3 Missile's on board Ka band seeker acquires the target. It then selects the optimal aim point and initiates the terminal guidance phase. In the forebody of the missile, there are small solid propellant rocket motors. In that very last stretch before impact, these small motors fire explosively to further tailor the missile's course to ensure a collision yielding maximum threat destruction.

**Defeating missiles armed with WMDs** - The PAC-3 MSE (Missile Segment Enhancement) is the next generation of PAC-3. The design is enhanced and ramps up Patriot's rapid reaction big firepower. Lockheed describes the missile as "the world's most advanced, and capable theater air defense missile." If Tactical Ballistic Missiles armed with weapons of mass destruction are launched, then the PAC-3 MSE - now armed with greater lethality - can blast off to defeat them. Upgrades include larger fins as well as a larger, dual pulse solid rocket motor. The better motor means that the range of the missile is extended - a key advantage. PAC-3 MSE features increased maneuverability and upgraded guidance software. The thermal batteries also help increase the performance of the missile.

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The Tribune

01 December 2015

## Australia gets three bidders for huge submarine contract

Three international bidders are seeking a contract worth up to Aus\$50 billion (US\$36 billion) to build a next-generation submarine fleet for Australia, it was confirmed Monday. Submissions have been received from DCNS of France, Germany's TKMS and the Japanese government, Australia's Defence Minister Marise Payne announced as the deadline closed. The contract is to replace the nation's current diesel and electric-powered Collins Class submarines. Besides matching their range and endurance, the next generation of subs are expected to offer superior sensor performance and stealth capabilities. The tender process has been politically sensitive, with Canberra keen to maximise Australian industry involvement and jobs. There are fears that any off-the-shelf purchase could kill off the domestic shipbuilding industry. Payne said in a statement the assessment of the bids "will include the level of Australian industry involvement that will be possible under each option". In Tokyo a defence ministry official said Japan's proposal includes plans to build the submarines in Australia. The official said Tokyo was "confident" its bid would win but disclosed no details. During his visit to Australia earlier in November, Japan's Defence Minister Gen Nakatani said picking Tokyo could help ensure maritime security in the Asia-Pacific. He alluded to the importance of regional allies such as the US, Japan and Australia working together in the face of China's growing military might. Nakatani added that if Japan were chosen, it would be a "model for strategic cooperation between Australia, US and Japan". For Australia, however, cooperation with Japan -- whose Soryu is widely seen as the best submarine of its type -- risks angering its biggest trading partner China. The French and German bidders have also said they would build a large part or all of the new submarines in Australia.

# North Korea Submarine Missile Launch Test Fails

**A nuclear-capable North Korean missile falls into the sea.**

**By Kyle Mizokami**

A test of North Korea's first submarine-launched ballistic missile ended in failure Saturday. The Bukkeukseong-1 ("Polaris-1") missile disappeared from sight of foreign observers shortly after launch. The launch was likely the first full flight test of a missile expected to carry a nuclear warhead. According to South Korea's Yonhap News Agency, the missile was launched from a floating barge off the coast of the port city of Wonsan. The launch occurred between 2:20 and 2:40pm, but South Korean intelligence lost track of the missile shortly afterward. Debris from the missile were later spotted floating on the surface of the Sea of Japan. The test was likely a disappointment for North Korean leader Kim Jong-un. South Korea's spy agency, the National Intelligence Service, reports that he was likely on hand to observe the launch. Kim has been photographed observing other rocket and missile tests in the past. The Bukkeukseong-1's was last seen in May, when the missile ejection system was tested. Submarine-launched ballistic missiles are first ejected from the launch tube by a shot of compressed gas, which clears the missile from the submarine before the rocket motor ignites. The May test was reported by North Korea to be a success. The Bukkeukseong-1, known to the Pentagon as the KN-11, is believed to be a copy of the old Soviet SS-N-5 submarine-launched ballistic missile. North Korea is thought to have received a handful of the obsolete missiles at the end of the Cold War. The missile will be carried by a new submarine, dubbed the Sinpo-class, which appears to have a launch tube built into the submarine conning tower (see photo below.) North Korean submarines are noisy and easily tracked. In the event of a crisis, a North Korean nuclear-armed submarine would have to evade a dragnet of South Korean, Japanese and American anti-submarine warfare ships, planes, and submarines. It's unlikely a North Korean "boomer" would be able to break out of the Sea of Japan into the Pacific Ocean. The missile's short range is another disappointment. A missile based on the SS-N-5 will have a maximum range of 890 miles-too short to even reach the American territory of Guam. That having been said, South Korea and Japan would be within range, and North Korea-if it can successfully develop the weapon-would have the ability to threaten an American ally at will.

**The Times of India**

**01 December 2015**

## Could N-plants function for 80 yrs? US to decide

The US is set to become the first nation to decide whether its safe to operate nuclear power plants for 80 years, twice as long as initially allowed. The majority of the nation's 99 reactors have already received 20-year extensions to their original 40-year operating licenses. Now, operators led by Dominion Resources want to expand the time frame further, potentially creating a precedent for an aging global fleet at a time when the economics of the industry are undergoing dramatic change. Dominion said earlier this month it will request an extension from the US Nuclear Regulatory Commission, which oversees the industry. The plan has already raised the ire of anti-nuclear campaigners who cite decades of wear and tear on the nation's reactors, as well as the 2011 Fukushima disaster in Japan. The NRC will release a draft report next month outlining safety measures needed to extend the time line. "The reality of life is the risks go up" as plants age, said Dave Lochbaum, director of the nuclear safety project at the Union of Concerned Scientists, a Cambridge, Massachusetts-based advocacy group. "If you don't respond with more aggressive risk management, then you-'re inviting disaster." An approval may determine the fate of the world's oldest nuclear fleet, one that's being battered by high operating costs, expensive safety upgrades and an abundance of cheap natural gas that's squeezing profits. If allowed, Dominion's Surry plant in Virginia would be the first to outlive the average human being in the US with a lifespan of 78.8 years. A final decision won't come before the early part of the next decade. Global nuclear retirements of as much as 144 gigawatts are expected by 2030, about 38% of current capacity, according to the International Atomic Energy Agency. "We are probably ahead in terms of the renewal process just because of the age of the fleet in the US," Stephen Burns, chairman of the NRC, said last month in Washington. Utilities are seeking extensions as some reactors shut early, unable to compete with the shale boom that's flooded the market with cheap and abundant supplies of natural gas. The US is the first country to set out a path for reactors to run to 80 years, Tom Kauffman, a spokesman for the Washington-based Nuclear Energy Institute, an industry advocate, said by email.

The science of climate change

# Supermodels

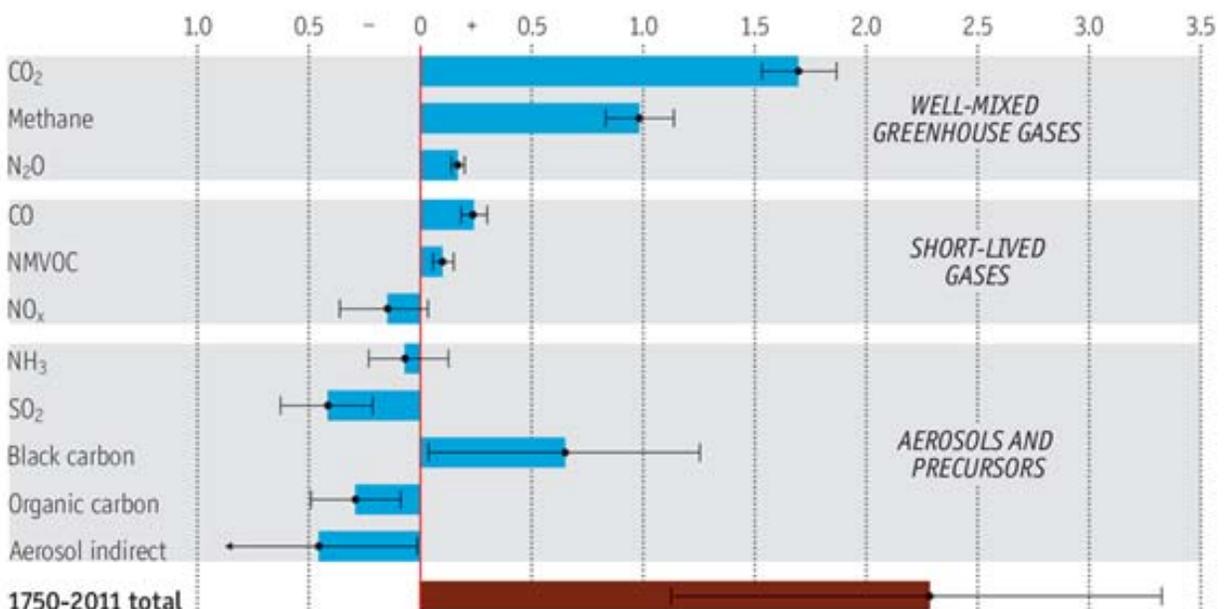
## What is known about global warming-and what remains dark

IN AN APPROPRIATELY sweltering lecture theatre at the University of Pierre and Marie Curie in Paris, scientists gathered earlier this year to discuss a phenomenon called the global-warming hiatus. Between 1998 and 2012 humans pumped unprecedented quantities of greenhouse gases into the atmosphere, but the average global temperature barely rose. Why? Because much energy went into melting ice, explained one. Because it was absorbed by the oceans, said another. Because many small volcanic eruptions threw particles into the atmosphere, deflecting solar radiation, explained a third. Nonsense, said a fourth. There was no hiatus at all-1998 was a freakishly hot year, so it was hardly surprising that temperatures bumped around the same level for a few years. At the end, the moderator summed up: "Well, that's science!" This sort of thing drives green-minded politicians mad. It is hard enough to persuade voters that global warming is a serious danger that they must pay to avoid, in the form of higher energy bills and unsightly wind farms. If the scientists seem unsure, the task becomes impossible. Despite appearances, though, key parts of climate science are settled. Although the remaining uncertainties are a little larger than green groups generally admit, they are not nearly as big as global-warming sceptics suppose. The greenhouse effect itself is straightforward; it just does not work much like a greenhouse. About one-third of the energy that pours into the Earth from the sun reflects off clouds and the planet's surface and heads back into space. Much of the rest is absorbed by the land and the oceans, which then emit it largely in the form of infra-red radiation. This is absorbed by trace gases in the atmosphere, which in turn release infra-red upwards, sideways and downwards to the Earth's surface. It is this bouncing around of energy that is known as the greenhouse effect. It is essential to life on Earth; without it, the average temperature at the Equator would be -10°C. The most important greenhouse gas is water vapour. Were there no water vapour or clouds, the greenhouse effect would be only about one-third as powerful as it is. Carbon dioxide is the second most important, followed by methane, then chlorofluorocarbons (CFCs), industrial chemicals that were cracked down on in the 1980s and 1990s because of their ozone-depleting properties but are still hanging around. These gases are more or less potent and durable. Tonne for tonne, methane is a much more powerful greenhouse

### ■ It adds up

Components of anthropogenic radiative forcing  
1750-2011, watts per square metre

— 95% confidence limits



Source: IPCC  
Economist.com

Contd...

part-2

# Supermodels

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gas than carbon dioxide, but it breaks down more quickly. Carbon dioxide, which reaches its maximum warming effect about ten years after being released, is so stable that even 1,000 years after a bump in emissions, atmospheric levels will still be substantially higher than normal. The basic science is hardly novel. In the 1890s a Swedish scientist, Svante Arrhenius, ran some "tedious calculations" on the greenhouse effect and went on to explain how burning fossil fuels might intensify it (living in a cold country, he thought this a thoroughly good thing). Things get complicated when scientists try to work out what happens to the extra energy that remains in the Earth system and how other human activities, beyond emitting greenhouse gases, might also affect the climate.

**Beware the feedback loops** - Greenhouse warming sets off a cascade of effects known as feedbacks, which are harder to measure. On balance, warming begets more warming. Higher temperatures enable the atmosphere to hold more water vapour. Oceans absorb huge amounts of carbon dioxide, keeping a lid on climate change-but as they warm up, their absorption capacity declines. Melting ice produces dark pools of water that absorb more energy. Partly for this reason, the Arctic is warming faster than other places. Inadvertently, though, humans also cool the Earth. Although the overall effect of deforestation is to warm the planet, replacing trees with crops or grassland makes the land paler and more reflective. Particles created from sulphur dioxide-the cause of acid rain-reflect lots of light back into space. China has probably been shielded from higher temperatures by air pollution, and might heat up quickly if it gets serious about scrubbing its skies. The greatest mystery is the effect of human activity on clouds. Because clouds grow on aerosol particles, more of them are likely to form in a more polluted atmosphere. Clouds are also affected by temperature changes. But precisely how is unclear-and this matters, because whereas high clouds tend to keep the Earth warm, low clouds tend to cool it. Part of the problem in measuring their effect is that many clouds are small. Climate models tend to simplify the world by dividing the atmosphere and the oceans into boxes, perhaps 50km by 50km in the horizontal plane, and treating these as pixels in a giant three-dimensional computer simulation. To capture cloud processes properly might require climate models with cells just tens of metres square. No computer in the world could handle that. Add up all these difficulties, throw in some problems with measuring temperatures, and you get a lot of uncertainty. The chart on the previous page, which shows the estimates by the International Panel on Climate Change (IPCC) of "radiative forcing"-perturbations to the Earth's energy system from human and other activities-contains black bars showing 95% confidence ranges. Some of those bars are long. It is especially hard to be sure of the effect of aerosols. If the past is a little hazy, the future is more so. Not only does it depend on the outcome of physical processes that are inadequately understood. It also depends on human actions. How many people will be living in 2100? How rich will they be? Will they make strenuous efforts to cut greenhouse-gas emissions, do nothing, or something in between? If mankind makes heroic efforts, the Earth system will remain within familiar bounds, making predictions easier. If concentrations of greenhouse gases increase steeply, though, things become highly unpredictable. Passing irreversible tipping points, such as the collapse of the Greenland ice sheet, becomes more likely. If nothing were done to avert climate change by 2200, the IPCC estimates, the world would probably warm by between 3°C and 10°C. That enormous range is manageable at one end, unimaginable at the other. Much remains unknown, then. But, equally, much has been settled-it is just that the settled stuff generates fewer papers and conference panels, because researchers have moved on. Some possibilities that seemed troubling a few years ago have been probed and revealed to be less so. It now appears unlikely, for example, that climate change will lead to the irreversible collapse of the Gulf Stream. Melting permafrost will emit methane, but not as much as some once feared. Even those mysterious clouds are giving up some of their secrets. Satellite-based radar and laser measurements have enabled scientists to peer into clouds; small-scale models designed to capture their behaviour have been refined and plugged into global models. It seems increasingly likely that low cloud cover will diminish as the Earth warms, speeding the process. Most important, the basic proposition of climate change-the causal relationship between greenhouse-gas emissions and higher temperatures-has become almost unassailable. As it happens, the interesting debate about the global-warming hiatus has a boring coda: 2013 turned out slightly hotter than 1998, and 2014 was roasting, setting a new record. That will not stand for long.

## **72% Indian companies faced cyber attack in 2015: KPMG**

Incidences of cyber crime in India shot up drastically in 2015, with 72 per cent companies in the country falling prey to online attacks this year, KPMG Cybercrime Survey Report 2015 said. Incidences of cyber crime in India shot up drastically in 2015, with 72 per cent companies in the country falling prey to online attacks this year, a survey report said. "Around 72 per cent of Indian companies faced cyber attacks this year alone. 94 per cent respondents indicated that cyber-crime is a major threat faced by organisations, but surprisingly only 41 per cent indicated that it forms part of the board agenda," the KPMG Cybercrime Survey Report 2015 prepared by KPMG in India, a professional services firm, said. The survey report was released in the presence of Mumbai Police Commissioner Ahmed Javed here today. Eighty three per cent respondents of the 250+ C-suite executives that participated in the survey indicated that there is usually external involvement in cyber-attacks with directors/management being most vulnerable according to 64 per cent, the report said adding, "It was also alarming to note that 54 per cent indicated that spend on cyber defences is less than five per cent of the IT spend." City police commissioner urged the companies to approach police instead of leaving such incidents go unreported. "The reason for this (incidents being unreported), usually, is that the company is afraid of its reputation being spoilt in the market or his shares might come down," said Javed. Also, the advancement and adoption of technology has enabled criminals to leverage upon it to carry out crime, he said. The Mumbai police has a dedicated cyber police station and is continuously strengthening itself by undertaking trainings to deal with cyber-crime cases, he informed. "It is critical for the citizens, both corporates and individuals, to be aware of cyber risks and not fall a prey to the phishing scams. We are undertaking a drive to educate and create an awareness among citizens with reference to cyber-threats," Javed said. Mritunjay Kapur, Partner and Head, Risk Consulting, KPMG in India, said, "The last few years have seen multifold increase in cybercrimes across regions and sectors. Given the proliferation of connected technologies, organisations today face a significant challenge to be resilient against cyber-attacks and incidents." "It is also important that the management realises that these are no longer a one-time phenomenon. The nature of cybercrime is constantly evolving, specifically with attackers having a solid arsenal of the ever evolving stealth attack," he said. According to Mohit Bahl, Partner and Head Forensics, KPMG in India, cyber criminals have understood the potential of an illicit financial gain and have begun executing highly sophisticated technology-driven frauds. "These cyber-frauds, by nature, are complex and difficult to detect. Organisations need to strengthen their cyber incident response process along with building strong prevention and detection systems. Cyber forensics, therefore, is becoming a critical component of fraud investigations," Bahl added.