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Thu, 15 Dec, 2016

Results in defence sector within year, says Parrikar

Defence Minister Manohar Parrikar today said results of the work done by the ruling NDA combine in the defence sector will start showing in a year.

Parrikar has initiated several steps to invite investors by opening up the defence sector for greater share of foreign direct investment; allowing Indian private sector to participate in more manufacturing; and giving preference to “Make in India” initiative.

Speaking at a seminar organised by an industry chamber, Parrikar said: “I am still clearing up the mess of the previous regime.”

He said being self-reliant was the only answer in the long term. The Defence Research and Development Organisation DRDO had been asked to take private industry on board in new projects.

“We’ve done certain things. Results will come from next year. Defence procurement has a long gestation period,” Parrikar said.

He asked the industry captains to replicate the “success of the automobile sector in defence manufacturing. I am sure it will happen”. He refused to answer queries on the selection of new Chiefs of the Indian Army and the Indian Air Force (IAF).

IANS adds: Explaining why the government could not clear defence deals in haste, Parrikar said: “If you don’t go through the fine print, we will end up buying 272 fighters without any real transfer of technology. How do you explain that?” India has purchased 272 Su-30 MKI fighters from Russia. The deal was signed in 2000 between the two countries to manufacture 140 aircraft at the Hindustan Aeronautics Limited.

Thu, 15 Dec, 2016

Infosys Invests in Drone Startup ideaForge

By Jochelle Mendonca

Infosys has invested an undisclosed amount in drone startup ideaForge, founded by three Indian Institute of Technology, Bombay, graduates, and plans to tap its solutions for industrial uses.

ideaForge's UAVs, or unmanned aerial vehicles, have been used by the Indian armed forces for surveillance, crowd monitoring and rescue operations and have commercial applications in verticals such as energy, utilities, telecom and agriculture, said Infosys' Wednesday statement.

“ideaForge's high performance UAVs, which have been designed and built in India, have significant potential in industrial use cases. We are looking forward to working with idea Forge and bringing their technology, expertise and solutions to our clients to unlock new business insights from operational data that has previously been difficult to obtain,” Ritika Suri, global head of corporate development & ventures at Infosys, said. The ideaForge investment is the IT major's eleventh investment out of its \$500 million investment fund. Infosys has also invested in venture firms Vertex Ventures and Stellaris Venture Partners. ideaForge was listed as one of the top 50 hot startups to watch out for next year by ET.

“We are very excited to have Infosys as an investor and a partner for exploring UAV services and solutions for global customers. This partnership will play an important role in our industrial expansion to address a wide variety of data acquisition and analysis needs,” said Ankit Mehta, cofounder of ideaForge.

Diary bomb drops on 'pol family'

Agusta Papers: Middleman Michel's notings point to millions of euros in kickbacks to UPA regime bosses

Bribes as high as 16 million Euros may have been routed to one of India's most powerful political families to swing the now scrapped AgustaWestland luxury helicopter deal during UPA rule, secret notes allegedly written by British arms agent Christian Michel reveal.

India Today TV has exclusively accessed these handwritten notes, faxes and emails that shed light on how the chopper scandal may have been orchestrated. The Congress, which has been facing heat over the scam-tainted deal, insisted on Wednesday that the BJP-led government act on the exposé. Meticulously maintained by the master-middleman, Michel, the notes provide compelling evidence of how shadowy agents steered the `3,600-crore contract that the Manmohan Singh government signed in 2010.

BUDGET SHEET

- 1) AF
- 2) DDC
- 3) PDSR
- 4) TPT
- 5) BC
- 6) BURE
- 7) DS
- 8) JSAS
- 9) APFA
- 10) CVC
- 11) AP
- 12) AF
- 13) Fam

MARCH 15, 2008
ATIN MR. PETER HULETT
Dear Peter,
As Mrs. Gandhi is the driving force behind the V.I.P., she will not fly any more in the Mi-8.
Mrs Gandhi and her closest advisers are the people the High Commissioner should target.
KEY ADVISERS
1) Manmohan Singh
2) Ahmed Patel
3) Pranab Mukherjee
4) M. Veerappa Moily
5) Oscar Fernandez
6) M. K. Narayanan
7) Vinay Singh
Regards,
CHRISTIAN

Who is stopping the govt to take action? Whatever action was taken, it was taken by UPA, from starting the process to blacklist the company to the seizure of helicopter. Question is why all this happening now.
—**RANDEEP SURJEWALA**

The 'budgetsheet' documents submitted before Italian court show that Christian Michel claimed he had paid 6 million euros to Air Force officers, 8.4 million to bureaucrats and 16 million to politicians. In the political section (marked in red), 3 million euros are written after 'AP' and 15/16 million before 'fam (family)'. He does not mention who AP and family are.

His jottings, which were seized by Italian police and handed over to the CBI later, show AgustaWestland's parent company, Finmeccanica, set aside 52 million euros to bribe decision-makers in India to clinch the deal. Michel, who Finmeccanica hired as a broker for the Indian business, sent regular updates to his bosses in Europe and also to Guido Haschke, the other alleged middleman in the agreement, the notes show. Updates, according to the highly-placed CBI sources, were sent through fax and email.

The investigating agency, they told India Today TV, has confirmed contents of Michel's diaries by questioning his secretary, who typed some of them. In entries dated March 15, 2008, he named some of India's top politicians in and outside of government offices. "As Mrs Gandhi is the driving force behind the VIP, she will not fly any more in the Mi-8," the letter reads. It listed then prime minister Manmohan Singh and Ahmed Patel among Congress chief Sonia Gandhi's key advisers. Separately, Michel mentioned 15 to 16 million euros for a "family" and another three million for "AP". "Who is stopping the government from taking action in the matter," Congress chief spokesperson Randeep Surjewala said.

“Whatever action was taken, it was taken by the UPA, from starting the process to blacklisting the company to the seizure of the helicopter. Now the big question is why is all this happening now? What was the government doing for two and a half years?” The diaries, however, reveal Michel may have paid six million euros to Indian air-force officers, 8.4 million to bureaucrats in addition to 15-16 million to a political family.

They also show that he had knowledge of intimate details of meetings of the high-profile contract negotiation committee (CNC). Michel also claimed to have paid off influential people in India, who helped reject Russian and American choppers. Besides, he claimed to be in touch with officials from the PMO, SPG, CVC and defence ministry. “Presentation of offer saw the Russians being rejected through a technicality, which was no accident,” reads a note dated April 10, 2008. “We are consciously and deliberately trying to disqualify competition at this stage.” Michel also apparently had prior information about meetings.

POLITICAL PAYMENTS	<p>CVC: CENTRAL VIGILANCE COMMISSION</p> <p>AUDITOR GENERAL: COMPTROLLER & AUDITOR GENERAL</p> <p>Total payment = 8.4 million euros</p>
<p>AP: 3 MILLION EUROS</p> <p>FAMILY: 15/16 MILLION EUROS</p> <p>■ (Michel does not mention who AP and family are)</p>	AIR FORCE PAYMENTS
PAYMENTS TO BUREAUCRATS	<p>DCH: DEPUTY CHIEF OF AIR STAFF</p> <p>PDSR: PROJECT DIRECTOR SERVICE REQUIREMENT</p> <p>FTT: FIELD TRIAL TEAM</p> <p>DG MAINTENANCE: DIRECTOR GENERAL AIR FORCE MAINTENANCE</p> <p>■ Total payment = 6 million euros</p>
<p>DS: DEFENCE SECRETARY</p> <p>JSAF: JOINT SECRETARY AIR FORCE</p> <p>AFA: ADDITIONAL FINANCIAL ADVISOR</p> <p>DG ACQ: DG ACQUISITIONS</p>	

He may have been able to offer big money whenever an opportunity for bribing from his staggering budget of 52 million euros arose, senior investigators say. His kickback sheet recorded 6 million euros to at least four different IAF officers, cited mostly with the initials of their official titles – DCH (deputy chief of air staff), PDSR (Project Director Service Requirement), FTT (Field Trial Team) and DG Maintenance (Director-General Air Force Maintenance). His diaries recorded bribes purportedly paid to the defence ministry under then minister AK Antony. A tidy 8.4 million euros may have been given to at least five senior bureaucrats in the MoD and also to the CAG, coded in his diaries as DS (Defence Secretary), JSAF (Joint Secretary Air Force), AFA (Additional Financial Advisor Air Force), DG ACQ (DG Acquisitions), CVC (Central Vigilance Commission), Auditor General (Comptroller and Auditor General).

“The family want their agreement honoured,” said a line in another letter, which pegged the “agreement” with the “family” at 28 million euros. “Now it’s been proven that not just the PMO, but even the Gandhi family was involved in the deal,” BJP leader Kirit Somaiya said. “I will give a notice in Parliament tomorrow for a discussion on the matter.” On April 10, 2008, the diaries also recorded that the CCS (cabinet committee on security) had appointed a “spokesperson to interact with us to facilitate an understanding.” A February 8 letter the same year claimed the CVC chairman “was willing to be persuaded”.

“(The) Maintenance Command is ready to work with us on all technical issues to make the above possible,” Michel wrote. According to top CBI investigators, former air-force chief SP Tyagi— now in custody over allegations of reducing the flying ceiling of the helicopter from 6,000m to 4,500m to put AgustaWestland in the race— had made cash investments worth `2.5 crore in real estate while in office.

Tyagi, however, claims he had reinvested money he received from the sale of his land. But the CBI suspects the cash came from Agusta payoffs. Investigators, most senior officials said, would file their first charge sheet in the next few weeks. They believe they have sufficient evidence to establish the deal was compromised. Top CBI sources say their probe would now focus on suspect bureaucrats and politicians.

Dilemma over the N word

By G Parthasarathy

India needs to make its nuclear doctrine relevant

Ever since India commenced building a nuclear arsenal after the Pokhran tests of 1998, queries have been raised about what the size of its arsenal should be, accompanied by a discourse on how to fashion its nuclear doctrine. Quite clearly, India's nuclear weapons have to be primarily targeted on its two neighbours, Pakistan and China, which possess nuclear weapons and with whom India has serious territorial and other differences. This strategy has also to take into account the fact that while Pakistan has relatively limited indigenous research and development capabilities, its nuclear weapons and missile programmes are predominantly based on Chinese designs and technology transfers.

India's nuclear doctrine, first officially enunciated on January 4, 2003, asserts that it intends to build and maintain a "credible minimum deterrent". While adopting a policy of "no first use", the doctrine clarifies that India's nuclear weapons will only be used in retaliation against an attack on Indian territory, or on Indian forces anywhere, in which nuclear weapons are used. India also retains the right to use nuclear weapons in the event of attacks on Indian territory, or on Indian forces anywhere, in which chemical or biological weapons are used. Pakistan has not officially enunciated its nuclear doctrine. It justifies its entire nuclear weapons programme as being an equaliser to balance Indian conventional military superiority. More importantly, it constantly uses nuclear blackmail by threatening to use nuclear weapons if India responds to cross-border terrorist attacks by military action on its soil. The sad reality is that substantial sections of our so-called "intellectual" and "liberal" elite panic at such Pakistani tantrums. Pakistan's generals live too comfortably to commit collective suicide. Moreover, one has to rationally analyse what needs to be done to deal with Pakistan's nuclear bluff, bluster and blackmail. One hopes some reality has dawned on this "elite" after the recent surgical strikes across the LoC. Pakistan should not be allowed to get the impression that this was a one-time occurrence.

While Pakistan has not formally enunciated a nuclear doctrine, Lt Gen Khalid Kidwai, head of Pakistan's Strategic Planning Division of its National Command Authority, told a team of physicists from Italy's Landon Network that Pakistan's nuclear weapons were "aimed solely at India". According to the report of the Landon team, Kidwai added that Pakistan would use nuclear weapons if India conquers a large part of Pakistan's territory, or destroys a large part of Pakistan's land and air forces. Kidwai also held out the possibility of use of nuclear weapons if India tries to "economically strangle" Pakistan, or pushes it to political destabilisation.

General Kidwai, who is highly regarded internationally, enunciated these views over a decade ago, when he was head of the Pakistan's Strategic Forces Command. He has since retired. But, anyone who understands the strategic thinking of the Pakistan army, realises that the "red lines", enunciated by General Kidwai, especially in regard to the fallout of an Indian attack, would remain the basic parameters of current strategic thinking. There is, however, one significant difference in Pakistan's capabilities since then. Thanks to Chinese assistance, Pakistan has now built plutonium reactors and reprocessing facilities in the Fatehjang-Khushab plutonium complex, enabling it to assemble an arsenal of tactical nuclear weapons and miniaturised plutonium warheads. But, in practical terms, Pakistan cannot use these tactical nuclear weapons in the Punjab area, which is densely populated. They can perhaps be used in the Sind/Rajasthan desert, with Pakistan presuming that such an attack will not prompt India to resort to a full-scale nuclear conflict as enunciated in India's nuclear doctrine, as this would result in mutual destruction.

Viewed in a global context, the entire theology of a nuclear "no first use", which was enunciated by the Soviet Union during the Cold War and rejected by the US and its NATO allies, has few adherents today. The Russian

Federation does not subscribe to “no first use” of nuclear weapons. The US and NATO now aver that NATO members can use nuclear weapons against states armed with biological and chemical weapons, even if those states have signed the NPT. China has expressed its readiness to sign “no first use” agreements with the other “recognised” nuclear powers and affirmed its commitment not to threaten or use nuclear weapons against non-nuclear weapons states, China thus appears to have maintained a measure of ambiguity on whether its “no first use” pledge will be applicable to India. An unambiguous clarification on this issue has to be sought from China.

The BJP manifesto in 2014 had declared that it would “study in detail” India’s nuclear doctrine and revise and update it to make it relevant to the challenges of current times. The manifesto spoke of a credible minimum deterrent in tune with “changing geostrategic realities”. Defence Minister Manohar Parrikar’s response at a book launch in Delhi on November 10, 2016, brought the issue into public focus. Referring to India’s “no first use” doctrine, he said: “Why should I bind myself [to the nuclear no first use doctrine]? I should say I am a responsible nuclear power and I will not use it irresponsibly”. Given the change in the strategic scenario since the transfer of plutonium facilities from China to Pakistan for developing tactical, battlefield nuclear weapons, it is imperative to have a serious internal debate on our nuclear posture to consider available rational options. Moreover, our nuclear deterrent will not be “credible” in Chinese perceptions till the Agni 5 missile is operationalised and our sea-based nuclear missiles are positioned on the INS Arihant and future nuclear submarines built by us.

India has played an active role in nuclear disarmament. This gave us a moral stature. We should continue to initiate and promote measures for universal and complete nuclear disarmament. Moreover, there is growing concern in many parts of the world about the endless production in Pakistan of dangerous fissile material which could fall into wrong hands. We should join others to push for a non-discriminatory treaty ending the production of fissile materials for nuclear weapons. We should also reiterate our commitment for de-alerting all nuclear weapons and separating nuclear warheads from their explosive packages. Interestingly, the US and its NATO allies are likely to be the main opponents of such a move.



Thu, 15 Dec, 2016

Pakistan wary of NSG 'exemption' for India

Highlights

- *Pakistan suspects that powerful nations could force smaller countries to support India's NSG membership bid.*
- *Pakistan said India's NSG entry would have serious repercussions.*
- *Pakistan too has been trying for NSG membership.*

Islamabad: Pakistan is wary of powerful countries pressurising smaller nations to exempt India in the admission process to the NSG and feels that strategic stability in South Asia would be undermined if Pakistan's application was not treated equally with that of India.

Pakistani official suspect that powerful countries could force the smaller partners to support India's Nuclear Suppliers Group (NSG) membership bid+ despite a growing realisation for a criteria-based approach for joining the 48-member elite grouping.

"We are pretty confident that NSG countries would not go down the exemption way, but if they ultimately do so and give exemption to India," director general of disarmament at the foreign office Kamran Akhtar said while speaking at a workshop on 'Defence, Deterrence and Stability' in South Asia.

"...there would be serious repercussions not just for Pakistan, but also for other non-nuclear weapon states that may feel being unjustly denied their right to peaceful uses of nuclear energy," he said.

At the same time, Pakistani officials feel encouraged by growing support in the Nuclear Suppliers Group (NSG) for establishing criteria for membership of non-NPT countries, Dawn reported.

"There are a lot of countries that now recognise the need for a criteria-based approach rather than granting exemptions, but pressures are still being exerted on smaller countries," he said.

The workshop was jointly organised by Islamabad-based think-tank Centre for International Strategic Studies (CISS) and London's International Institute for Strategic Studies (IISS).

Last month in Vienna, NSG members, for the second time in a year, failed to reach consensus on the admission of non-NPT countries. The NSG members have been divided between countries demanding strict adherence to the NPT criteria and the bloc wanting to embrace India immediately.

A growing support within NSG has been noted for developing criteria for non-NPT states and the Chinese proposal for a two-step approach for new admissions which involves developing criteria in the first stage and then inviting applications for the membership.

He said it was now up to NSG countries to decide if they wanted the group to be seen as being driven by political and commercial interests or else they would want non-proliferation goals to be strengthened.

The official warned that strategic stability in South Asia would be undermined if Pakistani application was not treated equally with that of India.

Pakistan has been pushing for its membership in the group by adopting a uniform criteria for any new country to join NSG despite US backing for India to join through a selective waiver of conditions.

Foreign Office's additional secretary Tasneem Aslam said the issue of membership of non-NPT countries was deeply linked to strategic stability in South Asia. "Today, the NSG stands at crossroads, once again, as it considers membership for non-NPT states. An even-handed and non-discriminatory approach by the NSG at this juncture would be of far-reaching significance for strategic stability in South Asia and global non-proliferation efforts," she said.



Thu, 15 Dec, 2016

Pak test-fires missile that can hit many Indian cities

Islamabad: Pakistan Army successfully test-fired an enhanced version of an indigenously-designed cruise missile that can hit targets at 700 km with all kinds of warheads, bringing many Indian cities within its range,

Called 'Babur' after Mughal invader and founder of the dynasty of same name, the missile is part of Babur Weapon System version-2 because it is enhanced version of earlier missile.

The army said in a statement that it incorporates advanced aerodynamics and avionics that can strike targets both at land and sea with high accuracy. "It is a low flying, terrain hugging missile, which carries certain stealth features and is capable of carrying various types of warheads," it said.

The missile is equipped with state-of-the-art navigational technologies of Terrain Contour Matching (TERCOM) and all time Digital Scene Matching & Area Co-relation (DSMAC), which enables it to engage various type of targets with pinpoint accuracy even in the absence of GPS navigation.

Pak to approach India by Dec end on Indus Water treaty

Islamabad: Pakistan will approach India by the end of this month to address its concerns on the Ratle and Kishanganga projects, a day after the World Bank paused the separate processes initiated by the two sides under the Indus Water Treaty to allow them to resolve their disagreements, according to a media report today.

“Pakistan’s Indus Water Commissioner would establish a telephonic contact with his Indian counterpart till the end of this month and ask him to address Islamabad’s concerns on the design of Ratle and Kishanganga projects,” The Nation said.

Citing official sources, the paper said Pakistan will again approach World Bank in February “if India refuses to accept our demands for change in design of the projects or tries to use delaying tactics.”

In September, the World Bank, which had mediated the Indus Water Treaty, had said it was approached by India and Pakistan and it is “responding in its limited, procedural role as set out in the treaty”.

The bank said the Indus Waters Treaty, 1960, is seen as one of the most successful international treaties and has withstood frequent tensions between India and Pakistan, including conflict.

India had taken strong exception last month to the World Bank’s decision to set up



a Court of Arbitration and appoint a Neutral Expert to go into Pakistan’s complaint against it over Kishenganga and Ratle hydroelectric projects in Jammu and Kashmir.

“We are announcing this pause to protect the Indus Waters Treaty and to help India and Pakistan consider alternative approaches to resolving conflicting interests under the Treaty and its application to two hydroelectric power plants,” World Bank Group President Jim Yong Kim said yesterday.

The World Bank president said Pakistan and India should consider resolving the conflict mutually and within the bounds of the Indus Water Treaty.

“We have decided in prin-

ciple to re-approach India, but will not compromise our position. We also fear India will not change the design of projects according to the treaty,” an official told the paper, seeking anonymity.

Pakistan’s former law minister and Supreme Court lawyer Barrister Ahmer Bilal Soofi said the historic Indus Water Treaty was perpetual and cannot be terminated unilaterally.

Speaking at a seminar on ‘Pakistan-India: Avoiding a Water War’ organised by the Institute of Strategic Studies Islamabad (ISSI), Soofi said time had come that Pakistani engineers and lawyers need to sit together to interpret the Indus Water Treaty in a holistic manner. **PTI**

Thu, 15 Dec, 2016

First boron detection on Mars points to habitability

Washington: NASA'S Curiosity rover has detected boron for the first time on the surface of Mars, which indicates that the groundwater may have possibly been suitable for hosting microbial life in the ancient past.

"If the boron that we found in calcium sulfate mineral veins on Mars is similar to what we see on Earth, it would indicate that the groundwater of ancient Mars that formed these veins would have been 0-60 degrees Celsius and neutral-to-alkaline pH," said Patrick Gasda, a postdoctoral researcher at Los Alamos National Laboratory in the US.

The temperature, pH, and dissolved mineral content of the groundwater could make it habitable. The boron was identified by the rover's laser-shooting Chemistry and Camera (ChemCam) instrument

Boron is famously associated with arid sites where much water has evaporated away. However, environmental implications of the boron found by Curiosity are still open to debate.

Scientists are considering at least two possibilities for the source of boron that groundwater left in the veins: It could be that the drying out of part of Gale lake resulted in a boron-containing deposit in an overlying layer, not yet reached by Curiosity. Some of the material from this layer could have later been carried by groundwater down into fractures in the rocks.

The changes in the chemistry of clay-bearing deposits and groundwater may have affected how boron was picked up and dropped off within the local sediments.

The discovery of boron is only one of several recent findings related to the composition of Martian rocks. Curiosity is climbing a layered Martian mountain and finding rock-composition evidence of how ancient lakes and wet underground environments changed, billions of years ago, in ways that affected their favourability for microbial life. As the rover has progressed uphill, compositions trend toward more clay and more boron.

These and other variations can tell us about conditions under which sediments were initially deposited.

Thu, 15 Dec, 2016

Drawing Water Out of Thin Air

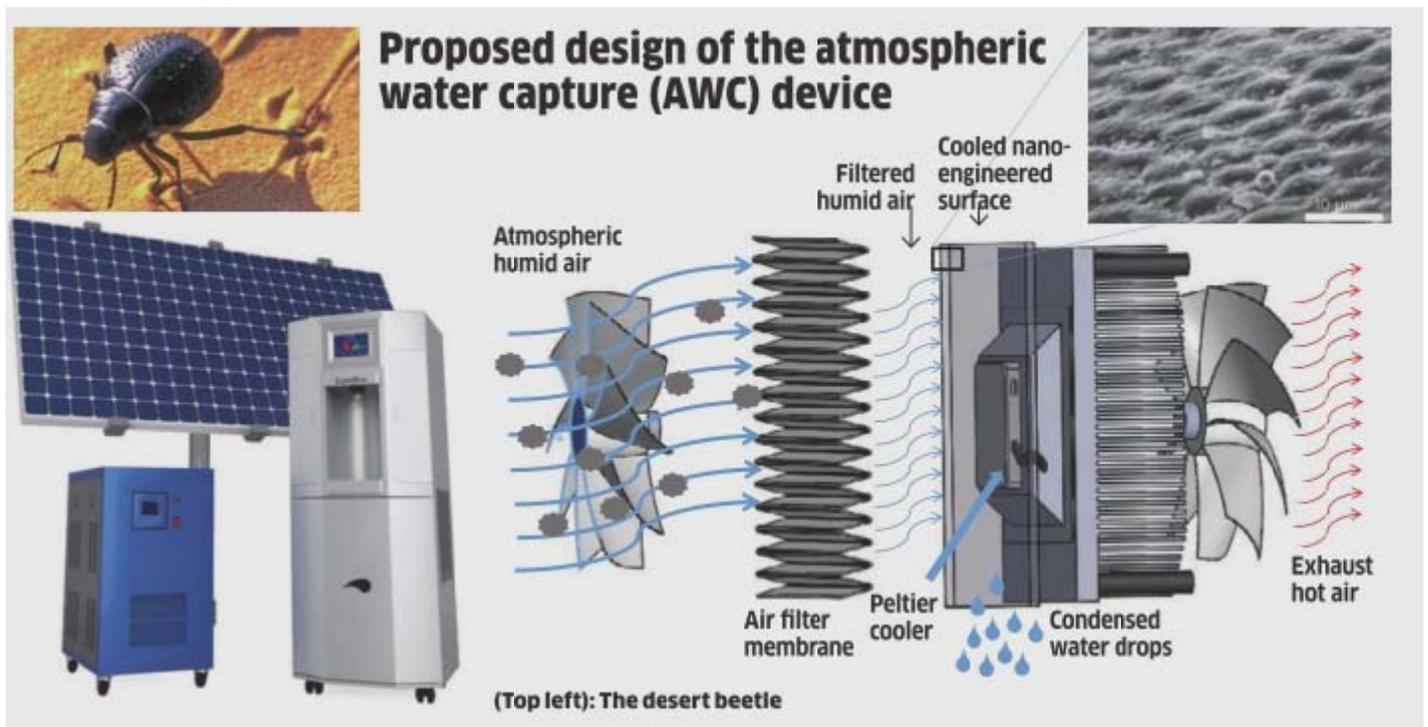
By Hari Pulakkat

Devices that capture water from the atmosphere are common, but an IIT team is developing one that would perform the task faster and at an absurdly low cost, writes Hari Pulakkat

When T Pradeep, professor at IIT Madras, began to work on solving the world's water scarcity problem, one of his first inspirations was the darkling beetles living in deserts. These tiny creatures have learned to live in the driest of environments, by developing a mechanism to draw water out of thin air. Humanity will have enough water if it learns to mimic the insects, and yet do it in a large scale with minimum energy consumption. It is a tall order, but Pradeep and his team set to work on the problem two years ago.

Pradeep is a chemist who develops and probes nanostructures, surfaces that show their properties at scales of a few billionths of a meter. He had made a surface on which water droplets would collect, and was working on developing a device when he heard about an XPrize challenge to draw water from the atmosphere. IIT Madras

quickly assembled a 30-member team with Pradeep as the lead. They would have two years to develop a product that can draw 2,000 litres of water from the atmosphere in one day.



The XPrize challenge was announced late last month, and its parameters went well beyond what anybody could do at the moment. The winning team has to use only renewable energy, and has to produce 2,000 litres of water costing two cents (roughly 14 paise) per litre. There are a large number of water capture devices selling around the world, but none that could work at this efficiency and cost. “To make water at two cents a litre is audacious,” says Zenia Tata, executive director of global development at XPrize.

Several companies around the world make and sell atmospheric water capture devices. In India, the first product was launched in 2004 by WaterMaker, a Mumbai-based company. It had bought the technology initially from a US company called Air Water Corp that later closed down. WaterMaker was primarily an exporter of a water capture device to the middle-east, but set up its first plant in Jalimudi in Andhra Pradesh. Last year, it set up another plant at Gandhinagar in Gujarat, and it produces 2,400 litres of water a day. The smallest device of the company is about four feet tall, and can make 120 litres of water in a day. In the last few years, WaterMaker has been joined by other startups. Electrowater Technologies, founded in Mumbai by IIT Delhi graduate Amit Asthana and a partner, had a prototype that is being developed into a commercial product. WaterMaker and Electrowater produce water at costs between `2 and `8 a litre, depending on the humidity and electricity cost. The costs are well above the requirements of an XPrize, primarily because of the costs of electricity. Making water at 2 cents a litre would require free electricity, apart from cheap raw materials. And an efficient process too.

Difficult Task

So making water at 14 paise a litre is a big technical challenge that requires deep science and engineering. Engineers will have to apply knowledge from many fields, and yet find a way to make the materials cheaply. The IIT Madras team has two other professors apart from Pradeep: material scientist TG Thomas and applied mechanics professor AP Baburaj. It has students from other institutions as well. “Large-scale engineering of the device is a big challenge,” says Pradeep.

The atmosphere holds enough water for humanity's use. Even dry air has plenty humanity's use. Even dry air has plenty of water that condenses on the surface of leaves at night. Plants and insects often depend on this water for survival, and nature has solved the problem through some intricate engineering. Grass, for example, has tiny pointed tips that are cooler than the rest of the surface, allowing water to condense. Insects have a

surface with tiny bumps where water droplets can condense, and troughs nearby where the condensed water runs off and collects. It is exquisite and efficient, but nature works at slow speeds. It also had hundreds of millions of years at its disposal.

Engineers try to solve the problem in many different ways. Some companies use a cool surface without nanostructures, some use a nanostructure, and some others use a solvent in which water can dissolve. Electrowater Technologies uses a solvent and then a membrane to separate the water from the solvent, and the company has three patents on its process. It is a method used by other companies and organisations around the world. For example, Sanakvo, a not-for-profit foundation based in Switzerland, uses a liquid that can absorb the water and then heats up the liquid to release the water.

Sanakvo's device collects the water at night in the solvent and releases it during the day using the sun's energy. "We use technologies that can be used at economies of scale," says Jan-Marc Lehky, cofounder of Sanakvo and member of its board. The device needs no electricity, and can make five litres of water a day per square metre. The product is not commercially launched, and is aimed to work without using electricity.

Pradeep's team, on other hand, uses no solvent but tries to mimic nature. One of his students has made a small glass torch that can make a silver metallic grassland where water can condense. They have published the work recently in the journal *Advanced Materials*, and is beginning to develop a refrigerator-like device that can dispense water collected from the air. The XPrize challenge has now speeded up the development.