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Thu, 23 Jan 2020

Update: Indian MoD approves procurements for the army worth USD716.6 million

By Rahul Bedi

New Delhi: India's Ministry of Defence (MoD) approved on 21 January the procurement of indigenously developed equipment worth INR51 billion (USD716.6 million) for the Indian Army (IA).

The MoD's Defence Acquisition Council (DAC), which is headed by Defence Minister Rajnath Singh, gave the green light for the acquisition of an undisclosed number of electronic warfare (EW) systems that will be designed by the state-owned Defence Research and Development Organisation (DRDO) and manufactured locally.

The IA will deploy these systems in the country's plains and desert regions to "provide comprehensive electronic support and counter-measure capabilities to field formations", according to a statement by the Indian government's Press Information Bureau (PIB).

The DAC also approved prototype testing of DRDO-designed trawl systems for the IA's T-72 and T-90 main battle tanks to give them a mine-clearance capability.

The council also cleared a shortlist of local 'Strategic Partners' (SPs) to progress Project 75I (India), which is aimed at locally building six diesel-electric submarines for the Indian Navy (IN) for an estimated INR450 billion in collaboration with a foreign original equipment manufacturer (OEM).

Although neither the shortlisted SPs nor the OEMs were identified in the PIB statement, industry sources told *Jane's* that the shortlisted SPs include state-owned Mazagon Dock Shipbuilders Limited (MDL) and private-sector Larsen & Toubro (L&T), adding that the inclusion of a third SP is being considered by the MoD.

The selected OEMs include Naval Group (France), ThyssenKrupp Marine Systems (Germany), Rubin Design Bureau via Rosoboronexport (Russia), Daewoo Shipbuilding and Marine Engineering (South Korea), and Navantia (Spain), added the sources.

(This story, first published on 21 January 2020, has been updated with additional information.)

https://janes.ihs.com/Janes/Display/FG_2651181-JDW

नेवी की परमाणु पनडुब्बियों को जल्द मिलेगा टॉरपीडो, रेस में फ्रांसीसी और जर्मन कंपनियां

**भारतीय नौसेना ने स्कॉर्पीन श्रेणी की पारंपरिक और अरिहंत श्रेणी
की परमाणु पनडुब्बियों के टॉरपीडो के लिए टेंडर निकाला था।**

नई दिल्ली: भारतीय नौसेना को करीब 100 हेवीवेट टॉरपीडो की आपूर्ति के लिए जर्मनी की कंपनी 'एटलस इलेक्ट्रॉनिक' और फ्रांस की कंपनी 'नेवल ग्रुप अंतिम रेस' में हैं। इन टॉरपीडो को स्कॉर्पीन श्रेणी की पारंपरिक और अरिहंत श्रेणी की परमाणु पनडुब्बियों में लगाया जाना है।

रक्षा सूत्रों ने बताया, 'निविदाओं का जवाब देने की आखिरी तारीख 17 जनवरी थी और इस संबंध में सिर्फ दो कंपनियों जर्मनी की एटलस इलेक्ट्रॉनिक और फ्रांस की नेवल ग्रुप ने जवाब दिया है। ये निविदाएं इसलिए अहम हैं क्योंकि फ्रांसीसी स्कॉर्पीन श्रेणी की पनडुब्बियों का निर्माण भारत में मझगांव डॉकयार्ड लिमिटेड में किया जा रहा है और अभी तक इनमें नए टॉरपीडो नहीं लगाए गए हैं। स्कॉर्पीन श्रेणी की पनडुब्बियों को अब कलवरी श्रेणी नाम दिया गया है। आइएनएस कलवरी नामक इस श्रेणी की पहली पनडुब्बी नौसेना में शामिल की जा चुकी है और संचालन में है।

'मेक इन इंडिया' कार्यक्रम के जरिये होगी आपूर्ति

परियोजना के विवरण के मुताबिक, नौसेना के लिए हेवीवेट टॉरपीडो की तात्कालिक जरूरतों को विदेश से खरीद के जरिये पूरा किया जाएगा, लेकिन दीर्घकालिक जरूरतों को 'मेक इन इंडिया' कार्यक्रम के जरिये पूरा किया जाएगा। नौसेना ने वैश्विक आपूर्तिकर्ताओं से यह आश्वासन हासिल कर लिया है कि उनके देश की सरकारें उनके टॉरपीडो को अरिहंत श्रेणी की परमाणु पनडुब्बियों में लगाने की अनुमति प्रदान करेंगी।

सिर्फ दो कंपनियों ने ही दिया जवाब

बता दें कि नौसेना के लिए हेवीवेट टॉरपीडो के लिए फ्रांस, स्वीडन, रूस और जर्मनी के वैश्विक निर्माताओं को निविदाएं जारी की गई थीं, लेकिन सिर्फ दो कंपनियों ने ही इसका जवाब दिया। इससे पहले नौसेना ने इटली की कंपनी 'वास' के ब्लैक शार्क टॉरपीडो का चयन किया था, लेकिन यह कंपनी अगस्ता वेस्टलैंड घोटाले में फंसी दागी कंपनी फिनमैकेनिका ग्रुप का हिस्सा थी। लिहाजा विवाद के चलते नौसेना को अपना चयन निरस्त करना पड़ा।

<https://www.jagran.com/news/national-french-german-firms-in-final-race-to-supply-torpedoes-for-nuclear-scorpene-submarines-19961225.html>

French, German firms in final race to supply torpedoes for Indian Navy's Scorpene submarines

Global manufacturers from France, Sweden, Russia and Germany were issued tenders for the heavyweight torpedoes for the Navy but only two firms have responded

New Delhi: German Atlas Elektronik and French Naval Group are in the final race for supplying heavyweight torpedoes for the Indian Navy's tender to acquire around 100 of them for the Scorpene class conventional and Arihant class nuclear submarines.

"The last day for responding to the tenders was January 17 last week and only two firms including German Atlas Elektronik and French Naval Group have responded to the request for proposal issues in this regard," defence sources told ANI here.

The tender assumes significance as the French-origin Scorpene submarines, being built in India at the Mazagon Dockyards Limited (MDL), have not yet been equipped with new torpedoes.



The Scorpene-class boats have now been named the Kalvari class. The first boat of the class called INS Kalvari has already been inducted into the Navy and is carrying out operational duties.

As per the details of the project, the immediate requirement of the Navy for heavyweight torpedoes would be met by the acquisition to be made through the foreign vendors, while the long-term bulk requirement would be fulfilled through the 'Made in India' route.

The Navy has also taken assurances from global suppliers that their torpedoes would be allowed by their respective governments for being deployed on the Arihant class nuclear powered ballistic submarines.

Global manufacturers from France, Sweden, Russia and Germany were issued tenders for the heavyweight torpedoes for the Navy but only two firms have responded.

The Navy had earlier selected the Black Shark torpedos belonging to the Italian firm WASS which was part of the scam-tainted Finmeccanica group in the AgustaWestland chopper scam. However, it had to be cancelled in the wake of the controversy.

<https://www.newindianexpress.com/nation/2020/jan/22/french-german-firms-in-final-race-to-supply-torpedoes-for-indian-navys-scorpene-submarines-2092999.html>

India's Submarine Plan

IN OPERATION

- 9 Sindhughosh (Kilo) class of Russian origin
- 4 Shishumar (HDW 209) class of German origin
- 2 Kalvari (Scorpene) class of French origin
- 1 Arihant class nuclear-armed: Indigenous**
- 1 Chakra class nuclear-powered from Russia



MIDDLE PATH

India is looking for submarines that can stay underwater for weeks and can be stealthy too. This is possible with the new **air-independent propulsion (AIP)** technology that can generate oxygen from on-board fuel



India needs 6 such submarines, categorised as Project 75I (I is for India)

AIP ADVANTAGE

Technology on offer from Russia, France and Germany



The nextgen submarines will be able to travel **undetected virtually across the Arabian Sea and deep into the Indian Ocean**. This will give them the ability to surprise enemy ships far from shore, enforce trade blockade at vital ports and strike both land and sea targets.

CONVENTIONAL VS NUCLEAR

India has traditionally relied on conventional ones for defence and attack. These diesel-electric submarines are quiet and ideal for coastal warfare but have a fatal flaw – they need to surface regularly to collect oxygen for the crew and to burn fuel



The nuclear-powered one like 'Chakra' can remain underwater for weeks as they generate their own oxygen



MAKE IN INDIA

The Navy, which has been at the forefront of promoting indigenous equipment, has mandated that the six submarines, to be acquired at an **estimated cost of ₹45,000 crore**, be made in India by a domestic shipyard. This would ensure that all future submarines after P 75I are designed, built in India



STRATEGIC PARTNERSHIP MODEL

The mega project is being processed under the Strategic Partnership model, in which **Indian companies are to be selected through a competitive process for large manufacturing contracts.**

Idea is to help Indian companies emerge as global players



COMPETITION

The competition to select an Indian company and its foreign collaborator kicked off in June 2019

Indian companies who bid – L&T, MDL, Reliance Naval and HSL-Adani

Foreign collaborators: Naval Group (France), TKMS (Germany), Rosoboronexport (Russia), Navantia (Spain) and Daewoo Shipbuilding and Marine Engineering (South Korea)



SHORTLISTING PROCESS

After evaluating Indian yards and scrutinising foreign companies' technical bids, **Navy's empowered committee shortlisted L&T and MDL** from the Indian side and all five foreign collaborators

Reliance Naval: Rejected on financial parameters

HSL-Adani: Rejected as joint venture was not in place



TUSSLE

After protest, Department of Defence Production asked Navy to consider HSL-Adani's bid to encourage public-private partnership

High-powered Defence Acquisition Council goes with the decision of the empowered committee to select L&T and MDL only



POSSIBILITIES

L&T likely to tie up with Russia's Rubin Design Bureau

MDL likely to choose French Naval Group, also in talks with Germans TKMS

If things go as per plan, the first Indian-built AIP submarine could be ready for commissioning by 2027



NEXT STEP

Navy will now issue request for proposals to the two Indian entities

Indian entities will choose foreign collaborators and formulate a techno-commercial proposal for the Navy

Navy to carry out all required tests and evaluations to determine if the two proposals are technically valid

Proposals to go to the next stage of commercial evaluation

Lowest bidder will then be awarded contract

CRPF facing critical shortage of armoured troop carriers

By Rakesh K Singh

The Indian Ministry of Defence (MoD) has announced the inclusion of a scheme to promote innovation in small businesses into the country's military acquisition processes.

Amid heightened threat to its troops and Amarnath Yatra pilgrims later this year, the CRPF — the lead agency for internal security and conduct of Yatra — is facing a critical shortage of armoured troop carriers to transport the paramilitary personnel in Jammu & Kashmir.

Officials said, the paramilitary is facing a shortage of up to 40 per cent of the sanctioned strength, a figure being withheld in order to avoid any risk to the troopers from the terrorists in the Valley.

The preparation for the Amarnath Yatra begins in March and a meeting was held in the Home Ministry for procurement of the armoured troop carriers, sources said.

The shortage of the armoured troop carriers has accrued over the years as the paramilitary has not been able to procure bullet proof vehicles from Original Equipment Manufacturers during the last one decade, leading to an alarming shortfall in such vehicles, they said.

The security forces especially the CRPF is facing enhanced threat from the terror groups post-abrogation of Article 370 and reorganisation of the erstwhile State of Jammu & Kashmir into two Union Territories — J&K and Ladakh, officials said, adding approvals for procurement of the specialised vehicles are yet to see the light of the day despite the Pulwama incident last year in which 40 CRPF personnel were killed while travelling in a convoy consisting of non-armoured buses.

“The sanctioned numbers of bullet-proof bunker vehicles are badly needed as additional deployment of 25 battalions of the CRPF was made in the Valley in anticipation of aggravated law and order situation following nullification of Article 370 that granted special status to Jammu and Kashmir,” an official said.

The Amarnath Yatra that is held between July and August is estimated to be tough from the security perspective as it will be the first such Yatra to be conducted after change in the special status of J&K.

The terror groups are also seeking to find traction among the youth as the jihadi ranks are facing crisis due to the wiping out of the terror leadership in the Valley owing to counter-terror action by the security forces in the last two years.

Last year, the Amarnath Yatra was called off midway ahead of the decision to scrap Article 370 on August 5 as a well calculated move to avoid any risk to the pilgrims.

In 2017, Amarnath pilgrims were targeted by the terrorists in July 2017 in which eight religious tourists were killed and over 30 others injured.

Likewise, in June 2016, the banned terror group Lashkar-e-Tayyeba ambushed a convoy of CRPF vehicles in Pampore and killed eight uniformed men of the paramilitary and injuring over 20 others.

<https://www.dailypioneer.com/2020/india/crpf-facing-critical-shortage-of-armoured-troop-carriers.html>

Thu, 23 Jan 2020

India to include 'innovation' scheme in procurement procedures

By Jon Grevatt

The Indian Ministry of Defence (MoD) has announced the inclusion of a scheme to promote innovation in small businesses into the country's military acquisition processes.

The MoD said in a statement on 21 January that the 'Innovations for Defence Excellence' – also known as iDEX – will be included in the official Defence Procurement Procedure (DPP).

"This [will] provide avenues in capital procurement for the armed forces to startups and innovators working for iDEX and provide [a] huge fillip to their budding efforts," said the MoD about the move.

The MoD added that the decision to include iDEX in the DPP was approved by India's Defence Acquisition Council (DAC), which is headed by Defence Minister Rajnath Singh.

iDEX was launched by the Indian government in April 2018 with the intention to develop what New Delhi said at the time is an "ecosystem to foster innovation and technology development in defence and aerospace".

The scheme aims to support local industry – including new and small businesses, individual entrepreneurs, private research institutes, and academia – through state funding and grants to undertake research and development (R&D) in cutting-edge defence and aerospace technologies.

Under the scheme small companies can receive funding of up to INR5 billion (USD70 million) for certain R&D projects. Funding for iDEX is provided by a new Defence Innovation Organisation (DIO), which has been established by the Indian government as a 'not for profit' company.

The DIO is supported initially by India's two largest state-owned defence production enterprises, Hindustan Aeronautics Limited (HAL) and Bharat Electronics Limited (BEL), although over time other public corporations in the defence sector will also be expected to participate and submit funding.

https://janes.ihs.com/Janes/Display/FG_2651811-JDW

THE TIMES OF INDIA

Thu, 23 Jan 2020

Army Chief arrives on two-day maiden visit to J&K

Jammu: Army Chief Gen Manoj Mukund Naravane on Wednesday arrived here on a maiden two-day visit of Jammu and Kashmir to review the prevailing security situation, an army officer said.

Gen Naravane, who took charge of Chief of the Army Staff on January 1, is likely to meet the Lt Governor G C Murmu and visit the forward areas along the Line of Control (LoC) during his two stay in Jammu region, the officer said.

"The COAS has reached this evening and is scheduled to review the security situation at a high level meeting at Northern Command in Udhampur tomorrow (Thursday)," he said.

After the meeting, the officer said the army chief will visit the forward areas along the LoC in Rajouri district and interact with the soldiers before returning back to Jammu where he is likely to meet the Lt Governor besides paying a visit to the army base at Nagrota.

On January 9, the COAS paid a visit to the forward posts in Siachen sector in the Union Territory of Ladakh and was briefed on the operational readiness being maintained in the sector by commander, Siachen Brigade.

<https://timesofindia.indiatimes.com/india/army-chief-arrives-on-two-day-maiden-visit-to-jk/articleshow/73524058.cms>



Thu, 23 Jan 2020

First unmanned mission, part of Gaganyaan, this December: ISRO

It is also in talks with Nasa and other space agencies and industries on how it can collaborate on human space flight and learn from their experience

HIGHLIGHTS

- ***ISRO will undertake two unmanned missions in December 2020 and June 2021***
- ***The unmanned missions will take place ahead of India's maiden human flight to space Gaganyaan in December 2021***
- ***ISRO chairman K Sivan said the missions will help set up a new space station for 'continuous space human presence'***

Ahead of the launch of India's maiden human spaceflight venture Gaganyaan in December 2021, the Indian Space Research Organisation (ISRO) will undertake two unmanned missions in December 2020 and June 2021, its chairman K Sivan said on Wednesday.

Addressing the inaugural session of a symposium on "Human Spaceflight and Exploration - Present Challenges and Future Trends", K Sivan said the Gaganyaan mission not only aims at India's maiden human flight to space but also setting up a new space station for 'continuous space human presence'.

"We are doing all this [Gaganyaan] on three points - short term plan of two unmanned mission in December 2020 and June 2021, followed by human space flight demonstration in December 2021.

"We have the mid-term goal of sustaining the human space programme and continuous space human presence in space on a new space station," K Sivan said.

In this regard, the Isro has initiated a full-fledged astronaut training facility in close proximity to Bengaluru for meeting its future requirements.

It is also in talks with Nasa and other space agencies and industries on how it can collaborate on human space flight and learn from their experience.

The Gaganyaan will also assist in Isro's long term goal of inter-planetary mission.

"Inter-planetary mission is also on the agenda in the long term," the Isro chief said.

On the Gaganyaan mission, K Sivan said the space agency has already developed and demonstrated key technologies such as having an operational launcher with 10-tonne payload capability to lower orbit, demonstration of mission design and management and recovery system like space qualified parachutes.

"The only missing elements were human life science and life support system, which we are developing now," K Sivan said.

ISRO, K Sivan said has taken onboard many national labs, academic institutions, Defence Research and Development Organisation (DRDO) labs, Indian Air Force (IAF), Council of Scientific and

Industrial Research (CSIR) lab as well as many industries as stakeholders for the Gaganyaan programme.

Noting that four astronauts have been selected from a pool of Indian Air Force test pilots, K Sivan said the generic space flight training will commence in India shortly.

Later, speaking reporters, K Sivan said the number of astronauts going to the space will be decided towards the end of the project.

"In the first mission people will be very cautious. So, how many people will go and how many days they will be there in the first mission - that will be decided much later," K Sivan added.

K Sivan refused to share the details about the astronauts selected for the mission.

"At the right time that will be known to the outside people," K Sivan added.

Along with the humanoid, micro gravity experiment will also fly in this unmanned mission in December 2020, K Sivan said.

A mission specific training will be carried out in India using a host of simulators and other facilities near Bengaluru, K Sivan added.

On the Chandrayaan-3 mission, the Isro Chairman said the work has started and it is going on in full steam.

It may be launched in the beginning of next year.

<https://www.indiatoday.in/science/story/first-unmanned-mission-gaganyaan-december-isro-nasa-iaf-drdo-csir-1639207-2020-01-22>

hindustantimes

Thu, 23 Jan 2020

ISRO unveils humanoid that will take Gaganyaan flight

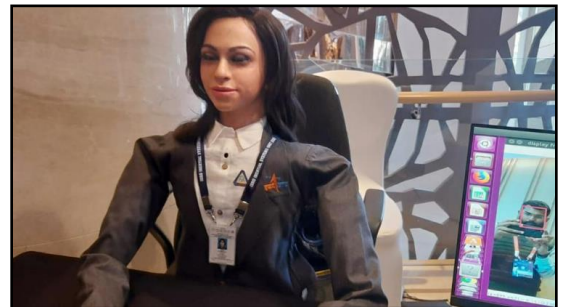
ISRO Chairperson K Sivan told HT that the humanoid Vyommitra would also be able to record biological parameters

By Anonna Dutt

A woman humanoid, Vyommitra (literally friend of the sky), unveiled by the Indian Space research Organisation on Wednesday will travel to space on two unmanned flights of the Gaganyaan mission scheduled for December this year and June next year before the four men shortlisted to be India's first astronauts or vyomanauts.

The humanoid who can talk and perform all functions of a crew was unveiled at a three-day symposium on "Human Spaceflight and Exploration" organised by the International Academy of Astronautics in Bengaluru.

"I am the prototype of the half-humanoid being made for the first unmanned Gaganyaan mission. I can monitor crew module parameters, alert you, and perform life-support operations. I mimic all crew activities like switch panel operations, ECLSS (environment control and life support system) functions, etc. I can also be your companion, can converse with the astronauts, recognise them and can also respond to their queries," Vyommitra said, introducing herself.



Earlier this month, Isro chairperson K Sivan told HT that the humanoid would also be able to record biological parameters.

“The two unmanned flights will let us determine whether everything is working well, the environment in the modules remains under control, and it is safe for humans. Like any programmes, after two successful test flights we will undertake the operational flight,” Sivan added then.

At the symposium on Wednesday, the Isro chairperson also talked about the challenges and preparedness of India’s human spaceflight mission.

“Our Prime Minister announced Gaganyaan programme as a national goal to demonstrate human spaceflight capability before the 75th anniversary of India’s independence in 2022. It is a very ambitious target. However, this decision was taken knowing that Isro has already developed and demonstrated key technologies (required),” said Sivan.

For instance, Isro already has an operational launcher with 10-tonne payload capability to low earth orbits; it has demonstrated the working of a re-entry module; it has space-qualified parachutes for recovery of the astronauts; and it has tested a crew escape system.

“The only missing elements were the human life science and life support system, which we are developing them now. Isro created a vertical of human spaceflight in its portfolio,” he said. Apart from the Bengaluru-based Human Spaceflight Centre, Isro has also started work on establishing an astronaut training facility in Challakere, 200-km from Bengaluru.

The batch of four selected vyomanauts will be trained in Russia but those on all future missions will be trained at the 400-acre centre.

“We will set up our own astronaut training facility for all future missions. The Challakere centre will have facilities similar to those in Russia to train astronauts in space environment,” a senior official from Isro said on condition of anonymity.

The four selected vyomanauts will undergo physical training in Russia for 11 months, after which they will receive module-specific training in India. It is likely that the first manned mission carries just one astronaut and the duration may be much less than the planned seven days, Sivan said in the interview.

After the first manned mission scheduled for December 2021, Isro wants to have a sustained human spaceflight programme and has also announced the creation of its very own space station.

“Our short term goal is to ensure two unmanned and a manned spaceflight in December 2021. We have the goal of sustaining the human spaceflight programme and continued presence of humans in space on a new space station. As more and more nations come up with space programmes, one space station may not be sufficient to meet the global aspirations. Inter-planetary missions are also on Isro’s agenda in the long term,” Sivan said on Wednesday.

The space station, which will be developed by India indigenously, will weigh around 20 tonnes and be able to house astronauts for about 15 to 20 days in a 400 km low earth orbit.

<https://www.hindustantimes.com/india-news/isro-unveils-humanoid-that-will-take-gaganyaan-flight/story-zUzb78pyEK1hcZt4djOp2I.html>

Meet Vyommitra: ISRO's half-humanoid will go to space before astronauts

Introducing itself to the audience, Vyommitra (vyoma-space, mitra-friend) said: "Hello everyone. I am Vyommitra, the prototype of the half-humanoid, made for the first unmanned Gaganyaan mission."

Bengaluru: About 10 seconds after its camera system captured the image of Dr S Somnath, director of the Indian Space Research Organisation's Vikram Sarabhai Space Centre, at a booth at an international conference on 'Human Spaceflight and Exploration' here on Wednesday, 'Vyommitra', a "half-humanoid", said: "Hello Dr Somnath, director VSSC". Introducing itself to the audience, Vyommitra (vyoma-space, mitra-friend) said: "Hello everyone. I am Vyommitra, the prototype of the half-humanoid, made for the first unmanned Gaganyaan mission."

The artificial intelligence-based robotic system is being developed at a robotics lab at the VSSC in Thiruvananthapuram for an unmanned flight of ISRO's GSLV III rocket in December 2020, which, along with a second unmanned flight in July 2021, will serve as the test of ISRO's preparedness for its maiden manned space mission, Gaganyaan, being targeted for 2022 to mark 75 years of India's independence.

Vyommitra, equipped with a head, two arms and a torso, is built to "mimic crew activity inside the crew module of Gaganyaan", a scientist from the robotics lab at VSSC said. "It is basically an artificial intelligence-based system. It recognised the face of the VSSC director from the attached computer database and converted text to speech to speak out the identity," the scientist said.

Once it is fully developed, Vyommitra will be able to use equipment on board the spacecraft's crew module, like safety mechanisms and switches, as well as receive and act on commands sent from ground stations.

Explaining its role, Vyommitra told the audience: "I can monitor through module parameters, alert you and perform life support operations. I can perform activities like switch panel operations..." It said it can also be a companion and converse with the astronauts, recognise them and respond to their queries.

"Attaining launch and orbital postures, responding to the environment, generating warnings, replacing carbon dioxide canisters, operating switches, monitoring of the crew module, receiving voice commands, responding via speech (bilingual)," are among its functions listed. It will have a human-like face, with lips synchronised for movement to mimic speech.

The robotic system has been developed even as ISRO works to make the GSLV III rocket system suitable to fly humans. "Work is in progress for human-rated GSLV Mk III. It will be ready for the first unmanned flight by the year-end with a humanoid," said Somnath.

"There will be a lot of ground testing. The unmanned flight will be the first test flight. We are designing a crew escape system — whether it is functioning properly will be tested in flights before the first unmanned test flight. The unmanned test flight with a humanoid will be the first human rated flight of the GSLV Mk III," said ISRO chairman K Sivan.

"In Gaganyaan, many systems need to be tested before the flight — the human rating of the propulsion modules, crew escape system, air drop tests... We are targeting the first unmanned mission soon. A major part of the work will be done this year," he said.

With ISRO set to be the first to attempt to send a manned mission to space without carrying out tests with animals, the flight with Vyommitra will serve as a test of the capabilities of the rocket

system to take a human to space and back. Among the key parameters that will be tested is the efficacy of the crew module where astronauts will fly, whether its environment is conducive for human flight, and the safety factor.

“We are now moving rockets from mission-critical to safety-critical launch nature, where the human being comes into play in a rocket — where human life becomes more important,” said Somnath.

ISRO has used robotic and autonomous system for many of its missions, including the recent Chandrayaan-2 mission where the Vikram lander was functioning in autonomous mode — using data stored in its systems — while attempting to make a soft landing on the moon’s surface.

Meanwhile, four Indian Air Force pilots have been picked, from a pool of 60 pilots, after a rigorous selection process in India and Russia, to be the first astronauts on Gaganyaan. “Astronaut selection has been completed from a pool of IAF test pilots and their generic test flight training will commence shortly. Thereafter, mission specific training will be conducted in India using a host of simulators and other facilities,” the ISRO chairman said.

<https://indianexpress.com/article/technology/science/ahead-of-manned-flight-isro-plans-a-december-launch-half-humanoid-vyommitra-will-go-to-space-6230682/>

गगनयान से पहले स्पेस में भेजी जाएगी ये रोबॉट

■ भापा, बेंगलुरु

प्रधानमंत्री नरेंद्र मोदी की महत्वाकांक्षी गगनयान परियोजना को समय पर पूरा करने के लिए इसरो ने कमर कस ली है। इस मानवयुक्त अंतरिक्ष उड़ान के लिए 2022 के शुरुआती महीने का लक्ष्य निर्धारित है। गगनयान की उड़ान से ठीक पहले इसरो 'व्योममित्र' को अंतरिक्ष में भेजेगा और अध्ययन करेगा। यह इंसानी महिला रोबॉट अंतरिक्ष से इसरो को अपनी रिपोर्ट भेजेगी। इसरो ने बुधवार को व्योमित्र को दुनिया के सामने पेश किया और इसकी खूबियों के बारे में बताया।

महिला रोबॉट स्पेस में अध्ययन कर इसरो को देगी रिपोर्ट, एजेंसी ने दिखाई झलक

इसरो के वैज्ञानिक सैम दयाल ने मीडिया से बातचीत में कहा, 'व्योममित्र अंतरिक्ष में एक मानव शरीर की एक्टिविटी का अध्ययन करेगी और हमारे पास रिपोर्ट भेजेगी। हम इसे एक परीक्षण

के रूप में अंजाम दे रहे हैं।' बताया जा रहा है कि 'व्योममित्र' अपने आप में बेहद खास रोबॉट है। यह बात कर सकती है और मानव को पहचान सकती है। यह रोबॉट अंतरिक्षयात्रियों के द्वारा की जाने वाली एक्टिविटी की नकल कर सकती है।

सवाल का जवाब दे सकती है व्योममित्र: व्योममित्र बातचीत कर सकती है और लोगों के सवालों का जवाब दे सकती है। इस रोबॉट को इसरो ने विकसित किया है। बुधवार को व्योममित्र को बेंगलुरु में पेश किया गया। इस दौरान व्योममित्र ने यह कहकर लोगों का अभिवादन किया, 'हाय, मैं हाफ ह्यूमनॉइड (इंसानी) हूँ।' इस रोबॉट को हाफ ह्यूमनॉइड इसलिए



इसरो ने लोगों के सामने पेश किया व्योममित्र, गगनयान का मॉडल भी दिखाया

कहा जा रहा है क्योंकि इसके पैर नहीं हैं। वैज्ञानिक दयाल ने कहा कि यह रोबॉट केवल आगे और साइड में झुक सकती है।

अंतरिक्ष यात्रा के चार कैंडिडेट्स का चयन: इसरो चेरमैन के. सिवन ने कहा है कि अंतरिक्ष यात्रा के कुल 12 में से पहले चार कैंडिडेट्स का चयन हो चुका है और वे रूस में इस महीने के आखिर में ट्रेनिंग शुरू करेंगे। इन कैंडिडेट्स की पहचान गुप्त रखी जा रही है। हां, इतना जरूर पता है कि ये सभी भारतीय वायुसेना के टेस्ट पायलट्स हैं। ट्रेनिंग प्रोग्राम नवंबर महीने से शुरू होगा और 15 महीने तक चलेगा। इस मिशन पर 10 हजार करोड़ रुपये खर्च होंगे।



चंद्रयान-3 पर तेजी से काम चल रहा है।



गगनयान को अंतरिक्ष में मानव भेजने के अभियान के तौर पर ही

नहीं देखा जाना चाहिए। नया स्पेस स्टेशन बनाना भी मकसद है। - के. सिवन

The superpowers of super-thin materials

In materials science, 2-D is the new 3-D

By Amos Zeeberg

In recent years, internet-connected devices have colonized a range of new frontiers — wrists, refrigerators, doorbells, cars. But to some researchers, the spread of the “internet of things” has not gone nearly far enough.

“What if we were able to embed electronics in absolutely everything,” Tomás Palacios, an electrical engineer at the Massachusetts Institute of Technology, said recently. “What if we did energy harvesting from solar cells inside highways, and had strain sensors embedded in tunnels and bridges to monitor the concrete? What if we could look outside and get the weather forecast in the window? Or bring electronics to my jacket to monitor my health?”

In January of 2019, Dr. Palacios and his colleagues published a paper in *Nature* describing an invention that would bring that future a little closer: an antenna that can absorb the ever-thickening ambient soup of Wi-Fi, Bluetooth and cellular signals and efficiently turn it into usable electrical energy.

The key to the technology is a promising material: molybdenum disulfide, or MoS₂, deposited in a layer just three atoms thick. In the world of engineering, things can’t get much thinner.

And thin is useful. For instance, a layer of MoS₂ could wrap around a desk and turn it into a laptop charger, without any power cords.

As researchers like Dr. Palacios see it, two-dimensional materials will be the linchpin of the internet of everything. They will be “painted” on bridges and form the sensors to watch for strain and cracks. They will cover windows with transparent layers that become visible only when information is displayed. And if his team’s radio wave-absorber succeeds, it will power those ever-present electronics. Increasingly, the future looks flat.

“There’s been absolutely explosive interest,” said Jeff Urban, a 2-D materials researcher at the Molecular Foundry at Lawrence Berkeley National Laboratory, in California. “There’s no other way to characterize it.”

Flattening will get you everywhere

The craze for 2-D chemistry began in 2004, when two researchers at the University of Manchester used cellophane tape to peel one-atom-thick layers of carbon from chunks of graphite, forming graphene. Graphene is identical to graphite and diamond in composition, but the thinness gives it very different properties: It is flexible, transparent, extremely strong and an exceptional electrical and thermal conductor.

Researchers quickly set out to make all kinds of new and improved gadgets from it. Recently several companies released headphones with diaphragms — the vibrating membranes that produce sound in audio devices — made of graphene. Some paint manufacturers are adding graphene to their formulas to make longer-lasting coatings. Last October Huawei introduced the Mate 20 X, a large, powerful cellphone that uses graphene to help cool the processor. Samsung used graphene to develop a faster-charging battery, which may appear in phones in the near future.

Dr. Urban is working with 2-D materials to improve fuel cells, which have drawn interest as a clean propulsion system for green vehicles. Most fuel cells generate electricity from hydrogen, but even under high pressure hydrogen gas takes up several times more space than a comparable amount of gasoline, making it impractical to use in automobiles.

Instead, Dr. Urban is embedding hydrogen atoms in solids, which are much denser than gases. In March, he and his colleagues announced a new storage medium: tiny magnesium crystals wrapped in narrow strips called graphene nanoribbons. Hydrogen stored in this manner, they found, could provide nearly as much energy as the same volume of gasoline, while weighing much less.

Dr. Urban compared the process to baking chocolate chip cookies, where magnesium is the chocolate chip — the key part — because it holds the hydrogen. “We want a chocolate chip cookie with as many chocolate chips as possible,” he said, and graphene nanoribbon makes excellent cookie dough. The nanoribbon also helps hydrogen enter and exit the magnesium crystals quickly while boxing out oxygen, which competes with hydrogen for space in the crystals.

Dr. Urban peers into the super-thin realm at the Advanced Light Source, a domed laboratory with an expansive view of San Francisco and the neighboring bay. There, electrons are accelerated to near the speed of light, generating powerful X-rays that can be used to finely probe the atomic structure of materials.

At the A.L.S., Dr. Urban and his colleagues learned exactly how graphene wrapped around and bonded tightly to magnesium. Those bonds, they believe, are what make the composite material stable over long periods — an important trait for real-world use.

Elsewhere, researchers are taking super-thin layers of materials and stacking them into three-dimensional blocks that have properties distinct from both 2-D and conventional 3-D materials.

Kwabena Bediako, a chemist at the University of California, Berkeley, published a study last year in *Nature* that described how he and his colleagues had embedded lithium ions between many layers of two-dimensional materials, including graphene.

“We start out with a piece of bread, slap on some mayo, bring it down on cheese, bring it down on some ham,” he said. “You can do that as many times as you want and create a sandwich.”

By varying the different layers in the three-dimensional stack, the researchers were able to fine-tune how the materials stored lithium, which could lead to the development of new, high-capacity batteries for electronic devices.

Xining Zang, a postdoctoral candidate in materials science at M.I.T., recently discovered a surprisingly easy way to build stacks of 2-D materials using gelatin, the ingredient that gives Jell-O and marshmallows their structure. She and several colleagues combined gelatin, metal ions and water. The gelatin assembled itself into layers (as it does when it forms Jell-O), thereby arranging the metal ions into layers, too. Some of the carbon in the gelatin then reacted with the metal to produce two-dimensional sheets of metal carbides; these worked as catalysts to help split water into oxygen and hydrogen, a process that could be employed to generate electricity in fuel cells.

“I hesitate to say the technique was crude, because it was really elegant when you think about it,” said Nate Hohman, a staff scientist formerly at the Molecular Foundry and an author on the paper. “It’s right at this interface between high-tech and low-tech.”

Growing thinner

One place where two-dimensional materials are blossoming is in Singapore, in the lab of Liu Zheng, at Nanyang Technological University. Singapore is known as the Garden City, and the tiny country has zealously filled its land with greenery — including at the university, which has placed gardens in spare nooks all around its modern buildings.

Dr. Zheng sees his research as a different kind of cultivation. “I’m a gardener,” he said. “There is a 2-D garden, with all kinds of flowers. They’re all beautiful.”

Last year Dr. Zheng and his colleagues drastically expanded this garden by creating dozens of new 2-D materials from a class of compounds called transition metal chalcogenides, or T.M.C.s. The key discovery was in using ordinary table salt to lower the temperatures at which the metals are typically melted; this allowed the metals to be vaporized and deposited in thin films.

“One day a student told me, ‘I can make all of the T.M.C.s with salt,’” Dr. Zheng said. “I was really surprised. This was my dream for many years.”

One set of shelves in Dr. Zheng’s busy lab is stacked with clear, airtight containers; these hold silicon wafers, on which the 2-D materials are deposited. The films often form a visible triangle or hexagon, according to the geometric structures of the crystals in each material.

After the films are deposited, Dr. Zheng’s team moves to a nearby lab to study the resulting structures in detail. The room is dominated by a transmission electron microscope that stands a dozen feet tall and weighs a ton and a half — a giant device for viewing individual atoms.

Many T.M.C.s, including the MoS_2 used by Dr. Palacios to absorb radio waves, show potential for various industrial uses. The two-dimensional platinum selenide made in the Singapore lab could make for cheaper fuel cells, which typically use the precious metal platinum to separate a hydrogen atom’s proton from its electron. Switching to two-dimensional platinum selenide could reduce the amount of platinum used by 99 percent, Dr. Zheng said. Nanyang Technological University is in talks with manufacturers about commercializing the technology. The future isn’t yet two-dimensional, but it’s getting closer.

“I see really great commercial potential of this material,” Dr. Zheng said. “We can make a huge impact in the market.”