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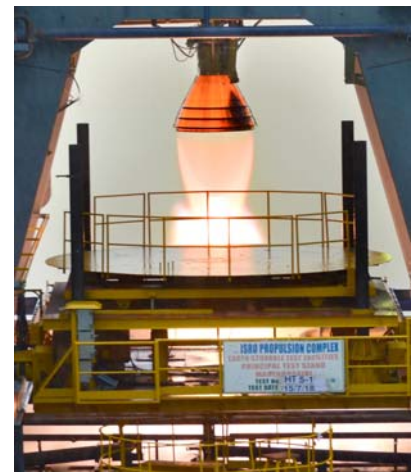
Upgraded Vikas engine — with more thrust — will boost ISRO’s rockets

All three satellite launch vehicles of the Indian Space Research Organisation (ISRO) are set to add muscle to their spacecraft lifting power in upcoming missions this year. The space agency has improved the thrust of the Vikas engine that powers all of them. The agency said the high-thrust engine qualified after a ground test lasting 195 seconds (over three minutes).

Main beneficiary

The main beneficiary of the high-thrust Vikas engine is said to be the heavy-lifting GSLV-Mark III launcher, which ISRO expects will now put 4,000-kg satellites to space. This would be the third Mk-III and the first working one to be designated MkIII Mission-1 or M1.

The first MkIII of June 2017 started with a 3,200-kg satellite and the second one is being readied for lifting a 3,500-kg spacecraft. The Vikas engine “will improve the payload capability of PSLV, GSLV and GSLVMk-III launch vehicles,” ISRO said. The improvement effort, the second such since December 2001, was conducted at ISRO Propulsion Complex in Mahendragiri, Tamil Nadu. Mr S. Somanath, Director, Launch Vehicles Centre, Vikram Sarabhai Space Centre, said the incremental benefit of the upgraded engine should be seen in the PSLV and GSLV missions over the coming months. MkIII-D2, the second test flight of the heavy-lifter, is being assembled. The new engine will be used in the subsequent mission — M1. The Vikas engine is used in the second stage of the light lifting PSLV; the second stage and the four add-on stages of the medium-lift GSLV; and the twin-engine core liquid stage of Mk-III. Mr. Somanath said that, eventually, ISRO will phase out Vikas by replacing it first in Mk-III with a cleaner and safer semi-cryogenic engine. The semi-cryo engine is ready for trial; its stage has just been approved. “I cannot predict when it [the replacement] can happen,” he said.



Source: <https://www.thehindu.com/>

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India's most potent missile Agni-V to be inducted soon

India's longest-range ballistic missile, Agni-V, will be inducted into the nuclear arsenal very soon, according to official sources. Agni-V is an Intermediate Range Ballistic Missile (IRBM) with a range of over 5,000 km and can reach most parts of China. "It is a strategic asset which will act as a deterrent. We are at the fag end of the strategic project," said an official with the Agni-V programme.

'Improved accuracy'

The official said the missile features the latest technologies for navigation and improved accuracy. Earlier variants of the Agni family of long-range missiles have already been deployed. Last month, the canisterised variant of the missile was successfully test-fired by the user, the Strategic Forces Command (SFC). A few more user trials are planned in the next few weeks. The Agni series of missiles constitute the backbone of India's nuclear weapons delivery, which also includes the Prithvi short-range ballistic missiles and fighter aircraft. The submarine-based nuclear arsenal, which assures second strike capability in the face of the proclaimed No-First-Use policy, is taking shape. While one nuclear ballistic missile has been inducted, more submarines and longer range submarine-launched ballistic missiles are under various stages of development.

Source: <https://www.thehindu.com/>

Given a national mandate, India could target the first human flight in space within next 6-7 years

Indian Space Research Organisation will turn 50 next year. **Dr K Radhakrishnan**, ISRO's former head who oversaw the Mars Orbiter Mission (popularly called 'Mangalyaan') – which established India as the first country to have a successful mission to Mars in its maiden attempt – gives an overview of the organisation's performance and future goals in a conversation with Mr Sugandha Indulkar:

India's satellite launch vehicles have proved their commercial value. What's the next stage of development?

Global market for small satellites (below 500 kg) continues to be buoyant and our competitive edge for PSLV (polar satellite launch vehicle) needs to be sustained. GSLV (geosynchronous satellite launch vehicle) Mk3 has the prospect to place 4,000 kg communication satellites into geostationary transfer orbit (GTO) and it could be upgraded with semi-cryogenic stage to loft up to 6,500 kg. Meanwhile, advent of electric propulsion will replace hefty mass of chemical propulsion system and many of the upcoming communication satellites, domestic and foreign, might well be within this envelope. The new focus for development could be reusable orbital re-entry vehicle for cargo and human transportation between Earth and Moon within a decade.

In recent times what would you consider as the top achievements of ISRO? And its top failures?

Within a span of 50 days (5 May–23 June 2017), ISRO launched a PSLV, a GSLV and GSLV Mk3, successfully orbiting three classes of satellites namely Cartosat-2 (high resolution remote sensing), GSAT-9 (South Asian Satellite) and GSAT-19 (forerunner of next generation communication infrastructure). Failure of a PSLV after an unblemished record of 39 flights was a wake-up call for quality management, but ISRO came back with success in January 2018. Loss of communication with GSAT-6A was disquieting, but ISRO took swift actions to avert such failure modes in satellites in the pipeline. Recalling GSAT-11 (first satellite of India's high power 6K satellite for nation-wide data connectivity) from the launch base is a case in point. ISRO had a few failures of the Rubidium atomic clocks imported for IRNSS-1 series. Indigenous route for such highly accurate, ultra-stable atomic clocks is progressing well.

What are the concerns apart from funding that ail Indian space research? What solutions can you offer to overcome these problems?

ISRO's precious human capital should be maximally earmarked for cutting edge research in pristine domains of space exploration, development in frontiers of space technology and innovations in space applications. We need a national industrial entity to take charge of producing and servicing the growing domestic needs for operational satellites and launch vehicles, with minimal hand-holding from experts of ISRO. We have an excellent base in the country of nearly

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150 firms to count upon for this mammoth task, but the challenge is their elevating themselves to handle higher levels of value chain, and to orchestrate towards an ecosystem to deliver the mission as ISRO does today.

How long will India take to enter the arena of commercial space travel?

India has to venture into the next logical step for human presence in solar system. What we need is a national intent and road map for human spaceflight to the Earth's orbit, Moon and then maybe at a later date to Mars – that is fundamental to India's positioning among the space comity in the future.

Coming to specifics, ISRO has done extensive studies and taken a few baby steps in critical new technologies and re-entry and recovery experiment of unmanned crew module. ISRO is now quite active on the next steps forward. My assessment is that, given a national mandate, India could target the first human space flight within next 6-7 years or even earlier if international cooperation is feasible.

US is the undisputed leader when it comes to space research. How long do you think India will take to at least equal its achievements?

We are not in any space race. Each nation has its own vision, road map and priorities for space activity, consistent with their needs, aspirations and resources.

Global media talks about intellectual and technical cooperation between nations when it comes to space research. Is this realistic?

Space missions are quite large, complex and risky, besides the large gestation time and associated costs. Hence partnerships – bilateral or multilateral – have come to stay even while competition exists. The cardinal consideration is individual partner's strengths and ease of working.

What was the most challenging moment in your tenure as chairman of ISRO?

Obviously, the Mars Orbiter Mission with all its complexities and the self-imposed schedule to fly it in 2013. The second challenge was flying GSLV successfully, that too with Indian cryogenic stage. Thirdly, development of GSLV Mk3 and its maiden experimental flight along with an unmanned crew module was a new terrain to traverse.

Source: <https://blogs.timesofindia.indiatimes.com/>

Airbus C Series: New, state-of-the-art jetliners single-aisle aircraft

Airbus now owns a 50.01% majority stake in C Series Aircraft Limited Partnership, while Bombardier and Investissement Québec own approximately 34% and 16% respectively. CSALP's head office, primary assembly line and related functions are based in Mirabel, Québec. Airbus' global reach and scale combine with Bombardier's state-of-the-art jet aircraft in the C Series, now being produced in a partnership between Airbus and Bombardier. Airbus manufactures, markets, and supports C Series aircraft under the aegis of the Airbus-Bombardier partnership, with Bombardier's two C Series jetliners being brought into the Airbus commercial aircraft line-up. These airplanes fill an important niche – covering the segment that typically accommodates 100-150 seats – and responding to a worldwide aviation market for smaller single-aisle jetliners estimated at some 6,000 such aircraft over the next 20 years. Series aircraft have been specifically designed for the 100 -150 seat market, resulting in efficiencies inherent in purpose-built aircraft with an unmatched environmental scorecard. What's more, the CS100 and CS300 have over 99 percent parts commonality between them, as well as the same pilot type rating, facilitating the family's addition to an airline's fleet. Up to 5,440 kg lighter than their competitors, C Series jetliners were designed using state-of-the-art computational aerodynamics combined with 21st century supercomputing capability; the result is a family of aircraft with optimal aerodynamic performance and reduced drag. Powering the aircraft are twin Pratt & Whitney PurePower PW1500G geared turbofan engines specifically designed for this jetliner product line. With a bypass ratio of 12:1 – one of the highest of any turbofan engine in the world – the engines feature 20 percent lower fuel burn per seat than previous generation aircraft, half the noise footprint, and decreased emissions. Together, the C Series represents the most efficient aircraft in the skies in their class, with up a low cost per trip, as well as the lowest noise levels of any commercial jet in production. This makes the C Series aircraft ideal for urban operations and noise-sensitive airports C Series aircraft are designed to deliver the feel of a widebody jetliner in a single-aisle aircraft. The cabin provides space where it matters the most, leading to an unparalleled passenger experience. Overhead bins, with the largest stowage capacity in their class, are easily accessible. The windows, extra large and plentiful with more than one at each row,

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are positioned high on the cabin sidewall to provide an optimal viewing angle and an abundance of natural light. Wide seats –18 inches or more – provide personal space without compromise, and the newly designed engines contribute to the quietest cabin in the C Series' class.

Source: <https://www.eturbonews.com/>

Boeing, Embraer in 'advanced' talks over merger

US aerospace giant Boeing and Embraer are in “advanced negotiations” over a much-anticipated tie-up, the Brazilian aircraft manufacturer said. The proposed merger, which would need the go-ahead from the Brazilian government, would leave Boeing as the majority partner, according to Brazilian newspaper Valor. Embraer would, however, keep sole control of its military activities. Valor said the two aircraft manufacturers had “already prepared the memorandums of understanding and requested a meeting to present” their project to the Brazilian government.

Source: <https://business.mb.com.ph/>

Civil aviation research centre to come up in Hyderabad

A ₹ 250-crore Civil Aviation Research Organisation (CARO) will come up within 18 months at Begumpet in Hyderabad. Laying the foundation stone for the CARO project to be implemented under the Airports Authority of India, Union Civil Aviation Minister Mr Suresh Prabhu said the focus of the centre will be on pursuing inter-disciplinary solutions to improve the civil aviation sector. The Minister said, “The country’s civil aviation sector is growing at a hectic pace of over 20 per cent and we expect this growth momentum to continue. This would require significant improvement to the existing infrastructure and creation of new infrastructure to keep pace with the progress.” The Government is in an advanced stage of finalisation of a cargo policy which will play a complementary role to the civil aviation policy. The idea is to use the airport infrastructure and vacant spaces in airport area in a more efficient manner and promote movement of cargo when there is less traffic, he said. The Government is keen to further accelerate the growth of the aviation sector, which has immense potential and make it accessible to the common man. This would require creation of fresh capacity and infrastructure to keep pace with the growing demand. Safety, convenience of passengers is a prime concern while keeping pace with the growth. The new research centre is expected to play a role in developing solutions and addressing problems airports currently face, the Minister explained. AAI CARO Division has already entered into agreements with Mitre Inc of USA, Honeywell Technology Solutions, Boeing Industries, Indian Institute of Technology, Madras, Indian Statistical Institute, New Delhi to facilitate collaborative research. The CARO Phase-I will have a built up area of around 40,000 sq meters and include laboratories, simulators, residential and hostel facilities and accommodate about 600 R&D personnel in the phase I.

Source: <https://www.thehindubusinessline.com/>

Aerospace rockstar WITH A VISION Roddam Narasimha, the man for all seasons

A recent news report – ‘Monsoon Covers the Entire Country 17 Days Ahead of Schedule’ – must have been music to Professor Roddam Narasimha’s ears. One can easily imagine the connoisseur of Indian classical music enjoying the monsoon showers, listening to Pandit Bhimsen Joshi’s sonorous voice: “Mile sur mera tumhara... Baadalon ka roop lekar, barse halke halke”. July is a special month for Prof Narasimha. Born on July 20, he will turn 85 in less than a fortnight. Besides, it was on July 27, 1994 that then director of Indian Institute of Science (IISc) CNR Rao inaugurated the Centre for Atmospheric and Oceanic Sciences (CAOS) at IISc – a department that Prof Narasimha conceived of, way back in the 1980s. Prof Narasimha is ‘DST Year-of-Science Chair Professor’ at the Engineering Mechanics Unit of Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) in Jakkur. CAOS While the monsoon has many chasers now, back in the 70s, Prof Narasimha once recalled, there were hardly any scientists studying the phenomenon. With his expertise in fluid dynamics and aerospace engineering and his interest in monsoon clouds – an offshoot of a childhood fascination – Prof Narasimha requested Satish Dhawan, the then director of IISc, and his mentor to allow him to bring together scientists within the country to work on this fascinating inter disciplinary area of atmospheric sciences. He thus sowed the seeds for the country’s first Centre for Atmospheric Sciences, later to be rechristened CAOS at IISc. Prof Narasimha scouted for talent and brought together Dr Sikka, Dr Sulochana Gadgil, Dr J Srinivasan and Dr Sankara Rao, the core working group, each scientist complementing the other in their areas of specialisation. More scientists from around the country would later join the team. With government funding coming in, Prof Narasimha proposed MONTBLEX (Monsoon Trough Boundary Layer Experiment), which involved extensive experiments in the IndoGangetic Plains, with stations in Balasore, Jodhpur, Delhi, Benares and Kharagpur. The experimental set-ups were all home-built; a majority of the components were sourced from the local electronics market. Prof Narasimha recalled that it was the first time that microprocessor chips were used in their electronic

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circuitry and to ensure that there were no glitches in the experiments, which were to be carried out in the harshest of environments – the extreme heat of the Jodhpur desert area and extreme humidity in the Balasore sea zones – they convinced the microprocessor supplier to send in a technician to handle emergencies. With these efforts, and the first satellite images beamed back by early ISRO satellites, the scientists were able to eventually predict several hitherto unknown aspects of the Indian monsoon. Their painstaking work resulted in the discovery of the northwards movement of the monsoon trough, christened the “30-40 days mode”, based on the number of days it took the monsoon trough to move from the southern to the northern parts of the country. Father of the LCA Among the many unknown facets of Prof Narasimha is that he is the father of the light combat aircraft (LCA), also known as TEJAS. It was he who suggested that the country needs an aircraft with short flying range but maximum performance. He made a presentation to this effect in 1979 to the Indian Air Force. His proposal was supported and taken forward by the defence ministry, thanks in many ways to Prof Raja Ramanna. Thus, the LCA project was born. But Prof Narasimha wanted the country to have capabilities, not just in fighter aircraft, the mainstay of our air force, but also civilian aircraft. With his experience and expertise in aerospace engineering, he advocated the use of Carbon Fiber Composites (CFC) for which he successfully put together a team of scientists which eventually mastered this new composite material technology. The Flosolver: It was under the stewardship of Prof Narasimha, when he was director of the National Aeronautical Laboratory (NAL), now National Aerospace Laboratories, in 1984-1993 that work began on the first-generation Flosolver. He suggested that it was necessary to “design, develop, fabricate and use a suitable parallel processing computer for application to fluid dynamics and aerodynamical problems”. Prof Narasimha groomed a brilliant young scientist, Dr UN Sinha, and his team and they came up with the Mark-1 Flosolver, the first high speed parallel processing computer built in the country. In a career spanning five decades, Prof Narasimha straddled many fields. His stint as director of National Institute of Advanced Studies (NIAS), Bengaluru, gave us insights into his deep commitment to the cause of India’s security vis-a-vis our nuclear programme. He also became interested in the ‘history of science’, in philosophy and in the task of enriching the leadership in industry, government and public affairs.

Source: <https://epaper.timesgroup.com/Olive/ODN/TimesofIndia/#>

Tejas’ price can’t come down

Even as the Indian Air Force has got the Defence Ministry’s nod to get the Light Combat Aircraft (LCA) Tejas’s price reviewed by a committee following reports that the Hindustan Aeronautics Limited (HAL) has quoted an exorbitant price for the MK-1A version of the aircraft, the Bengaluru- headquartered defence Public Sector Undertaking has defended its price tag. Defence Minister Mrs Nirmala Sitharaman last week said that a committee had been formed to look into the cost of products manufactured by defence Public Sector Undertakings and among the first products that would be examined is the LCA MK-1A. HAL had in April reportedly quoted Rs 463 crore for LCA MK-1A which is said to be more expensive than the frontline fighter Sukhoi 30 Mki or other fighter jets of the Tejas’s class. The committee, headed by Defence Ministry’s Director of Costs, has been given 60 days time to review the cost of the LCA MK-1A. HAL has a Request for Proposal to supply of 83 LCA MK-1A aircraft. The production of the 83 LCA MK-1A aircraft will start after the first 40 aircraft which will be the Initial Operational Clearance (IOC) and Final Operational Clearance (FOC) configuration aircraft order is completed. The production will happen from 2019-2020 onwards. An HAL official, while defending the quoted price, said that the LCA MK-1A aircraft will have many advance features which include Active Electro-nically Scanned Array (AESA) radar, additional electronic warfare suite, special data link packages, self protection jammer, satellite navigation systems, improved flight control, electrical and electronics system among others”. “The LCA MK-1A with all these hi-tech features will be a 4.5 generation aircraft and it is unfair to compare it with cost of the Sukhoi 30 Mki which is a fourth generation aircraft. Besides the production of the 83 aircraft will start in 2019-2020 or there after the production cost during this period will be higher than it is now,” the official said. To manufacture the 83 Tejas MK -1A aircraft and speed up the production of the aircraft from 8 to 15 per year, HAL has readied a second assembly line which was earlier used to manufacture Hawk trainer aircraft.

Source: <https://bangaloremirror.indiatimes.com>

Counter-drone strategy for country’s airports is ready

Aviation security watchdog BCAS has finalised a strategy to neutralise drones near airports, with the government set to unveil a framework to regulate unmanned aircraft systems in the country. The counter-drone plan prepared by a committee headed by Director General of BCAS (Bureau of Civil Aviation Security) Kumar Rajesh Chandra has proposed neutralising drones through a “soft kill” approach which will include entrapping or jamming drones instead of destroying them. The strategy deals with drones operating near aerodromes as the body is mandated to ensure aviation security.

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The Ministry of Home Affairs may prepare a separate plan to deal with drone attacks in sensitive zones such as Parliament, said a government official. The official added that a “soft kill” approach instead of a hard kill approach has been suggested because destroying a drone with a payload of explosives or biochemical will result in an attack and serve the purpose of their handlers. Therefore, the official said, the best approach is to entrap them and not destroy them. The Ministry of Civil Aviation had released draft rules for unmanned aircraft systems in November last year and proposed to ban their operation within 5 km radius of an airport and 50 km from an international border. It also barred drones within 5 km radius of Vijay Chowk in New Delhi. The BCAS will now conduct a trial to examine effective technology to neutralise drones, following which it will prepare technical specifications.

Source: <https://www.thehindu.com/>

ISRO to launch rocket solely for foreign satellites in September

Highlights

- ISRO is gearing up for full-fledged commercial launches from September onwards
- A PSLV rocket will be launched in that month solely for foreign satellites
- The full-fledged commercial mission is scheduled after many years

To compete with rivals in the satellite launch market, Indian Space Research Organisation (ISRO) is gearing up for full-fledged commercial launches from September onwards. A PSLV rocket will be launched in that month solely for foreign satellites. Talking to TOI, ISRO chairman K Sivan said here, “Of various missions lined up this year, the first launch will be of a PSLV rocket in September that will solely be for commercial purpose. Two UK satellites weighing 450 kg each will be the main payload. UK will use these satellites for earth observation. There will not be any Indian satellite.” Sivan said, “Subsequent two PSLV missions will also carry foreign satellites. However those missions will be on sharing mode (it will also have a desi satellite).” The full-fledged commercial mission is scheduled after many years. On April 23, 2007, ISRO had for the first time launched a rocket solely for commercial purpose. Its PSLV-CA carried Italy’s astronomical satellite AGILE as the main payload. Thereafter, on July 10, 2015, ISRO achieved another milestone when it carried out the heaviest commercial mission successfully as its PSLV-XL lifted off with five UK satellites together weighing 1,439 kg. Antrix, ISRO’s commercial arm, is widely seen as a serious contender in the global satellite market due to low prices and high success rate of the PSLV rocket, which is ISRO’s reliable workhorse. Of the 43 launches till now since 1993, the PSLV was unsuccessful in only three missions with a success rate of 94%. The rocket had completed various difficult and versatile missions like launching satellites in different orbits in one mission to lifting off 104 satellites in one go. Till now, ISRO has launched 237 foreign satellites of 28 countries. ISRO is, therefore, making all efforts to be competitive and wants to capture a lion’s share in the global market. Unfortunately, ISRO still holds a miniscule 0.6% share in the global satellite launch market, which is estimated to be worth Rs 36,000 crore. On the other hand, Elon Musk-owned US private space agency SpaceX, which had 5% share in the commercial satellite launch market in 2013, continued to grow and gobbled up 45% share in 2017 due to its cheap and reusable rockets. It is projected to eat up 60% share this year. The US government-owned space agency NASA and Space X together capture over 65% of the market share, followed by European space agency Arianespace.

Source: <https://defenceupdate.in/>

Naval prototype, with an arrestor hook, undertook a test sortie this week after a gap of more than a year

The Light Combat Aircraft (LCA) Navy programme, which has been lying low for almost a year, has once again taken to the skies. It was reportedly kept on hold after Indian Navy rejected the project, saying that it did not suit the requirements. Pictures of LCA Naval Prototype (NP-2), with an arrestor hook, has been doing rounds for the last few days, indicating that the programme has been revived. NP-2 took to the skies on July 23 and this was the 56th flight of the jet’s technology demonstrator. Importantly, this flight of the prototype was the first since March 2017. The Bengaluru-based Aeronautical Development Agency (ADA), the nodal design and development agency of the LCA programme, confirmed that a successful test was carried out on July 23. NP-2, a single-seat fighter, is one of the two technology demonstrators of the LCA Navy programme, with the other one being NP-1, a two-seat aircraft. In 2016, questions were raised about the future of the LCA’s Naval variant after Navy chief Sunil Lanba said that the aircraft wouldn’t suit its aircraft carriers. He even said the Navy was looking for an alternative solution. Since then, questions have been raised about the future of LCA Naval programme and the number of test sorties has also come down drastically. The last test flight, involving NP-1, was in May 2017. The LCA Naval programme commenced in 2003 and the first flight of NP-1 was in 2012, and the maiden flight of NP-2 in 2015. The flight of NP-2, with an arrestor hook, assumes significance as it indicates that the aircraft is now readying itself for tests in the days to come at a designated facility in Goa. NP 2 is the lead aircraft for arrestor hook integration, according to sources.

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The aircraft's technical features

- LCA will operate from an Aircraft Carrier with a concept of Ski-jump Take off But Arrested Recovery (STOBAR). Aircraft gets airborne over a ski jump in about 200 m and lands 90 m using an arrester hook
- Derived from the Air Force version it is a longitudinally unstable fly-by-wire aircraft, making it an agile war machine.
- Flight Control system is augmented with Leading Edge Vortex Controller (LEVCON), helping reduction in approach speed for Carrier Landing
- Auto-throttle function reduces pilot load by maintaining constant angle of attack during the critical phase of a flare-less carrier landing
- Fuel Dump System enables safe landing by reducing weight in event of an emergency landing immediately after launch from carrier

Source: <https://bangaloremirror.indiatimes.com>

BrahMos flight-tested in extreme weather conditions

Supersonic cruise missile BrahMos was successfully flight-tested under extreme weather conditions as part of the service life extension programme for the Army. "The missile followed the designated trajectory and the key components functioned perfectly. BrahMos has again proved its all-weather capability, flying in sea state 7, with waves as high as nine metres," the Defence Ministry said in a statement. (Sea state is the degree of turbulence at sea, generally measured on a scale of 0 to 9 according to average wave height). The missile was fired from a mobile autonomous launcher at 10.17 a.m. from the Integrated Test Range at Balasore, Odisha. BrahMos, a joint venture between India and Russia, has been demonstrated in various configurations in land-attack, anti-ship and from the air. The Army and the Navy have already inducted the missile, while the air-launched variant is undergoing trials. It has a strike range of around 290 km and is described as the world's fastest supersonic cruise missile.

Nirmala congratulates scientists

Defence Minister Ms Nirmala Sitharaman congratulated the scientists, officials of Brahmos and the Army for the successful test firing of the missile. Senior Army officials and scientists from DRDO and Brahmos witnessed the trial. "Brahmos missile has established itself as a major force multiplier in modern-day complex battlefields with its impeccable land-attack, anti-ship capabilities with multi-role and multi-platform abilities," the Ministry said. Flight-testing follows the May 21 and 22 trials, in which the major sub-systems manufactured indigenously under the 'Make in India' campaign were tested.

Source: <https://www.thehindu.com/>

Indian Army to soon get armed drones from Israel

Indian Army would soon have armed drones in its inventory. During the annual joint working group discussion between India and Israel held in South Block, both sides moved forward to finalise the deal to provide 10 Heron TP armed drones for Indian Army. The deal worth \$400 million had been pending for over three years. The drones, to be acquired under 'Project Cheetah', will help the force hit target (enemy) with air-to-ground missiles after tracking it down. Till date, Indian security forces use UAVs or drones only for surveillance and reconnaissance missions. Only a few countries have armed drones, which include the US, the UK, China, Israel, Pakistan, Iran, Iraq, Nigeria, Somalia, and South Africa. "Armed drones will certainly be a force multiplier. The Army has been trying to acquire it for long," said a senior defence ministry official who added that the 'Project Cheetah' was first initiated during the UPA tenure, but was put in the cold storage. In 2015, Prime Minister Mr Narendra Modi-led government decided to revive the project to give a fresh push to defence cooperation between India and Israel. Simultaneously, India is trying to crack a deal with the US to acquire its armed Predator drones. A delegation led by Israel defence secretary Major General (Retd) held the annual joint working group discussion on bilateral defence cooperation with his Indian counterpart Sanjay Mitra in South Block. Besides Heron TP, other pending procurements from Israel were also discussed during the talk. The purchase of two more PHALCON radar systems for Airborne Warning and Control System, to be mounted on Russian IL-76, was also taken up along with the ongoing programme of upgrading of Heron unmanned aerial vehicles. Indian security agencies are using unarmed Heron drones for surveillance. Defence sources said that Israel also raised the long pending deal of Spike anti tank guided missile systems for Indian Army, which is facing shortage of such fire-and-forget missile system. Military sources maintained that India will also be losing its edge over Pakistan Army, which has

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equipped its infantry soldiers with such missiles that can strike Indian tanks and bunkers from a distance of 3-4 km. India's equivalent missiles have a range of just 2 km.

Source: <https://www.theweek.in/>

TECHNOLOGY

ISRO's Chandrayaan 2 Will Land A Rover On Moon In October, Dig Out Helium 3 For No-Waste Energy

This week, the Indian Space Research Organization (ISRO) announced its Chandrayaan-2 mission, which will have the space agency send a rover to the south-side of the moon later this year. It will be India's second lunar mission and the first time any country has visited that region of the lunar surface. For its part, ISRO's six-wheeled rover will study the land crust for traces of water and helium-3, an isotope that it wants to use to develop fusion energy on Earth. Of course, the technology is years away, but India wants to be at the centre of production when it does arrive. "The countries which have the capacity to bring that source from the moon to Earth will dictate the process," Dr Kailasavadivoo Sivan, ISRO's chairman, told Bloomberg. "I don't want to be just a part of them, I want to lead them." Nuclear fusion is what we see powering the sun, where hydrogen atoms collide and output vast amounts of energy. If we can begin replicating it artificially, it would be an almost limitless energy resource. The problem is the entire process is devilishly complex. Today, fusion reactors use a combination of two hydrogen isotopes called deuterium and tritium, that's fired with an intense burst of concentrated energy to kickstart. Unfortunately, we've not yet been able to ever extract enough power from this reaction to even offset the amount that has to be used as the ignition in the first place. The reason for this is that, with deuterium and tritium fusion, high energy neutrons are the energy output. The problem is they tend to react with the walls of reactors instead of the protons in the mix, which would have continued the chain reaction. In addition, because they aren't charged particles, it's hard to contain them using electric or magnetic fields. If the tritium is instead replaced with helium-3 however, protons are produced instead of neutrons. These being positively charged particles can be manipulated and contained, thus netting more energy output in the process. Basically, helium-3 makes these fusion reactors non-radioactive (because there's no radioactive tritium) and also more efficient. The main problem here is that, despite promising test runs, helium-3 is incredibly rare on Earth. However, one thing NASA managed to discover during its Apollo missions in the 1960s and 70s is that there's plenty of the stuff in the lunar crust, thanks to the lack of atmosphere. In fact, scientists estimate the amount of power we could harvest from the helium-3 on the Moon would be 10 times as much as in all the fossil fuels on Earth. Of course, ISRO isn't alone in pursuing this idea. At least one private space company in the US has received permission from the government to go to the moon and begin helium-3 mining, and even China has a similar plan in the works. India will soon be a contender in what may turn out to be the next Gold Rush, except in space.

Source: <https://www.indiatimes.com/>

China aims to outstrip NASA with super-powerful rocket

China is working on a super-powerful rocket that would be capable of delivering heavier payloads into low orbit than NASA, a leading Chinese space expert was quoted as saying. By 2030, the Long March-9 rocket under development will be able to carry 140 tonnes into low-Earth orbit — where TV and earth observation satellites currently fly — said Long Lehao, a senior official from the Chinese Academy of Engineering, according to the official Xinhua news agency. This compares to the 20 tonnes deliverable by Europe's Ariane 5 rocket or the 64 tonnes by Elon Musk's Falcon Heavy, which in February catapulted one of the U.S. entrepreneur's red Tesla Roadster cars towards Mars. It would also outstrip the 130 tonnes of NASA's Space Launch System, which is due to become operational in 2020. China's Long March-9 would have a core stage measuring 10 metres in diameter and boast four powerful boosters, each with a diameter of five metres. Xinhua quoted Mr. Long as saying the rocket could be used in manned lunar landings, deep space exploration or constructing a space-based solar power plant. In addition, China is working on a reusable space rocket, which is expected to make its maiden flight in 2021. The first stage and the boosters will be retrieved after a vertical landing, Mr. Long said in a speech in Beijing. China is pouring billions into its military-run space programme, with hopes of having a crewed space station by 2022, and of sending humans to the Moon in the near future. The Asian superpower is looking to finally catch up with the U.S. and Russia after years of belatedly matching their space milestones. China is also planning to build a base on the moon, the state-run Global Times said in early March.

Source: <https://www.thehindu.com/>

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New NASA Satellite Could Be Powered By a Synthetic Solar Sail

Previous attempts to power spacecraft with giant solar sails, like the abandoned Soviet-Russian Zmaya project and the successful Japanese IKAROS, relied on giant, reflective, metallic sails to move through space and to reflect light back to Earth. Now, RIT scientist Grover Swartzlander is now calling to abandon these reflective materials in favor of metamaterials, synthetically created materials with properties that don't occur naturally. Swartzlander's solar sails would power CubeSats, the tiny satellites that have become en vogue due to their low cost and ability to be built with low cost. "CubeSats are becoming of great national importance for science, security and commercial purposes. The potential to raise, de-orbit or station-keep hundreds of CubeSats from low Earth orbit would be a recognized game changer that would build enthusiasm and advocacy among the growing small-satellite community of students, entrepreneurs and aerospace scientists and engineers," Swartzlander said in a press statement.

Speaking to NASA in March, Swartzlander said that his "proposed new aerospace architecture could, for example, provide a low cost and efficient means for raising hundreds of low-Earth orbit CubeSats and other satellites to higher orbits." The metamaterial Swartzlander is proposing would have several advantages over the reflective materials of the past. Swartzlander's sails would have lower heat absorption rates due to their diffractive nature which would scatter solar rays, and the ability to re-use what Swartzlander told NASA was "the abundant untapped momentum of solar photons" to fly through the cosmos. Swartzlander is leading an exploratory study through NASA's Concepts program. With nine months and \$125,000, his research team will work on a NASA satellite called the Near-Earth Asteroid Scout, or NEA Scout for short. A robotic reconnaissance mission, NEA Scout is a CubeSat meant to explore asteroids. NEA Scout would be NASA's first craft to be powered by sails. "Developing a sail to harness the sun's energy to fly through space was once thought impossible. Just in this decade we've seen innovation and progress on this promising technology and NEA Scout is another step to using solar sails to explore our solar system," said Mr Joe Matus, NEA Scout project manager at NASA's Marshall Space Flight Center in Huntsville, Alabama, in a press statement from June.

Source: <https://www.popularmechanics.com/s>

NASA set to launch world's first mission to touch the Sun

NASA is on schedule to launch mankind's first mission to the Sun - a car sized probe that will swoop to within 4 million miles of the solar surface, facing heat and radiation like no spacecraft before. The Parker Solar Probe, which is expected to take off no earlier than August 6 aboard United Launch Alliance Delta IV Heavy, will study the Sun closer than any human-made object ever has. "We've been studying the Sun for decades, and now we're finally going to go where the action is," said Alex Young, associate director for science in the Heliophysics Science Division at NASA's Goddard Space Flight Center in the US. Our Sun is far more complex than meets the eye. Rather than the steady, unchanging disk it seems to human eyes, the Sun is a dynamic and magnetically active star. The Sun's atmosphere constantly sends magnetised material outward, enveloping our solar system far beyond the orbit of Pluto and influencing every world along the way. Coils of magnetic energy can burst out with light and particle radiation that travel through space and create temporary disruptions in our atmosphere, sometimes garbling radio and communications signals near Earth. The influence of solar activity on Earth and other worlds are collectively known as space weather, and the key to understanding its origins lies in understanding the Sun itself. "The Sun's energy is always flowing past our world. And even though the solar wind is invisible, we can see it encircling the poles as the aurora, which are beautiful - but reveal the enormous amount of energy and particles that cascade into our atmosphere," Nicky Fox, Parker Solar Probe's project scientist at the Johns Hopkins University Applied Physics Lab. "We don't have a strong understanding of the mechanisms that drive that wind toward us, and that's what we're heading out to discover," said Fox. The Parker Solar Probe carries a lineup of instruments to study the Sun both remotely and in situ, or directly. Together, the data from these instruments should help scientists answer three foundational questions about our star. A Sun-skimming mission like Parker Solar Probe has been a dream of scientists for decades, but only recently has the needed technology - like the heat shield, solar array cooling system, and fault management system - been available to make such a mission a reality. Parker Solar Probe will explore the corona, a region of the Sun only seen from Earth when the Moon blocks out the Sun's bright face during total solar eclipses. The corona holds the answers to many of scientists' outstanding questions about the Sun's activity and processes.

Source: <https://www.moneycontrol.com/>

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NASA INSTALLS 'REVOLUTIONARY' HEAT SHIELD ON FIRST SPACECR

Ahead of its August launch, NASA's Parker Solar Probe — the mission aiming to get closest to the Sun than ever by any human-made object — has got its “revolutionary” heat shield permanently attached to the spacecraft, the US space agency said. The probe's heat shield — called the Thermal Protection System, or TPS — was reinstalled on the spacecraft on 27 June, **NASA said in a statement** on 5 July. The reinstallation of the heat shield — which was briefly attached to the spacecraft during testing in the autumn of 2017 — marks the first time in months that Parker Solar Probe has been fully integrated. A mission 60 years in the making, Parker Solar Probe will make a historic journey to the Sun's corona, a region of the solar atmosphere. With the help of its heat shield, the spacecraft's orbit will carry it to within four million miles of the Sun's fiercely hot surface, where it will collect data about the inner workings of the corona. The eight-foot-diameter heat shield will safeguard everything within its umbra, the shadow it casts on the spacecraft, NASA said. At Parker Solar Probe's closest approach to the Sun, temperatures on the heat shield will reach nearly 1,371 degrees Celsius, but the spacecraft and its instruments will be kept at a relatively comfortable temperature of about 29.4 degrees Celsius. The heat shield is made of two panels of superheated carbon-carbon composite sandwiching a lightweight 4.5-inch-thick carbon foam core. The Sun-facing side of the heat shield is also sprayed with a specially formulated white coating to reflect as much of the Sun's energy away from the spacecraft as possible. Because Parker Solar Probe travels so fast — 69,2018 km per hour at its closest approach to the Sun, fast enough to travel from Philadelphia to Washington, DC, in about one second — the shield and spacecraft have to be light to achieve the needed orbit. The heat shield itself weighs only about 72.5 kg, NASA said.

Source: <https://www.firstpost.com/>

ISRO conducts pad abort test for Indian human space flight program

India took another step forward with its human spaceflight program, as ISRO tested the crew escape system for its crew capsule in an emergency pad abort situation. The test lasted about 220 seconds, during a two-hour window that opened at 06:00 local time (00:30 UTC). ISRO is yet to confirm the test, but Indian media are claiming it was a success. While the Indian Space Research Organisation (ISRO) has not made manned space missions one of their highest priorities, the agency has been quietly proceeding with work on a capsule that would launch atop the GSLV Mk.III rocket and carry a crew of two into orbit. The project's most high-profile test came three and a half years ago, when the Crew Module Atmospheric Reentry Experiment (CARE) successfully demonstrated that the spacecraft could withstand the rigors of atmospheric reentry. The test, which was unmanned, is designed to validate the launch escape system that would carry the spacecraft and its crew to safety in the event of a major malfunction during the early stages of a future manned launch. Unlike CARE, which was carried to an altitude of 126 kilometers (78.3 miles, 68.0 nautical miles) on the first test flight of the GSLV Mk.III, the flight took place entirely within Earth's atmosphere. While the test had a two-hour launch window, running from 06:00 to 08:00 India Standard Time (00:30 to 02:30 UTC), the target liftoff time was understood to be 07:00 local (01:30 UTC). The mission had previously been scheduled to fly last year, but ISRO has not announced the reason for it being delayed. ISRO has not made many details of the mission public. However, the crew capsule will likely lift off from atop a dummy booster, allowing it to simulate separating from a failing rocket. Under the power of its abort motors the capsule will rise into the sky above Sriharikota and head out to sea — reaching an altitude of around 2.5 kilometers (1.6 miles, 1.3 nautical miles). The powered phase of flight will have lasted approximately twenty seconds, after which it would take the capsule another 200 seconds to descend back to Earth. The spacecraft landed offshore, using parachutes to slow its descent. ISRO has not announced whether the spacecraft will be recovered, or left in the ocean following its mission. The capsule flying the abort test is fitted with an altimeter and satellite navigation receivers to track its position. It was to use India's NavIC, or IRNSS, navigation system as well as the US Global Positioning System (GPS), augmented by GAGAN transmitters on Indian geostationary satellites. Telemetry was to be transmitted to the ground directly, and also uplinked to the GSAT-6 satellite in geostationary orbit. Overall the test vehicle stands 14 meters (46 feet) tall, with a mass of 12,500 kilograms (27,600 lb). The mission was conducted from the Satish Dhawan Space Centre on Sriharikota Island, using one of the center's sounding rocket launch areas. This facility is located less than 200 metres (660 feet) from the Sriharikota coastline, about two and a half kilometres (1.6 miles) to the south of Satish Dhawan's Second Launch Pad (SLP) that supports PSLV and GSLV missions, and three and a half kilometres (2.2 miles) north of the derelict launch complexes that were used by the earlier SLV and ASLV rockets. The sounding rocket complex consists of several hardpoints and rail launchers to support different types of vehicle and launch profile. A crescent-shaped road runs around the pads, with a chord and perpendicular roads providing access. The abort test will use a surface pad at the north of this area that has been specially widened. Formerly known as the Sriharikota High-Altitude Range (SHAR), Satish Dhawan has been the launch site for all of India's orbital launches, with its First and Second Launch Pads both currently used by

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the PSLV rocket and SLP also serving the GSLV Mk.II and GSLV MK.III vehicles. The next orbital launch from the site could happen later this month, with a GSLV Mk.III slated to deploy the GSAT-29 communications satellite. The test demonstrates a launch pad abort, where a problem before or at the moment of liftoff requires that the crew be ejected to safety from their rocket. This is the scenario in which the escape system of a Soviet Soyuz 7K-ST spacecraft saved the lives of cosmonauts Vladimir Titov and Gennady Strekalov, the only time an escape mechanism has so far been called upon during an actual manned mission. The Soyuz incident, which occurred in September 1983, came as the cosmonauts were preparing for launch to the Salyut 7 space station aboard a mission that would have been designated Soyuz T-10 had it reached orbit. Ninety seconds before the planned liftoff, one of the Soyuz-U rocket's boosters began leaking propellant onto the launch pad. This ignited, and the fire quickly spread to the rocket. Hampered by the fire, which had eaten through the primary communications lines to the vehicle, ground controllers were able to send a backup radio signal to activate the abort system, carrying the crew to safety in their Descent Module just seconds before the rest of the vehicle exploded. A launch escape system can also protect the crew against a failure during the early stages of ascent. Like Soyuz, as well as the US Mercury, Apollo and Orion spacecraft and China's Shenzhou, ISRO's abort system uses a tower structure mounted at the top of the vehicle, with small but powerful motors that fire to pull the spacecraft away from the rocket. Once the rocket has climbed out of the lower atmosphere, less force is needed to initiate the abort and the escape system is typically jettisoned, with the spacecraft then relying on its own engines to pull it clear should the need arise. This happened during the late-ascent abort of another Soyuz mission, in 1975, when two cosmonauts en route to Salyut 4 were forced to abort their mission after their rocket's second and third stages failed to separate properly. In contrast, the Starliner and Dragon spacecraft currently under development by Boeing and SpaceX for the US Commercial Crew program use "pusher" abort systems with motors mounted on the spacecraft itself to push it away from a failing booster. The Soviet Vostok spacecraft, America's Gemini and the first four Space Shuttle missions used ejection seats to provide rapid egress for the crew instead of recovering the whole spacecraft, while later Shuttle missions and the short-lived Soviet Voskhod did not incorporate launch escape mechanisms. While no engineer hopes that a launch escape system will ever be needed, it must still be well tested as it is vital to protect the lives of astronauts in what is still a dangerous occupation. NASA has conducted two pad abort tests for its Orion spacecraft – the first, Max Launch Abort System (MLAS) in 2009, tested a pusher-type system that was proposed for use with the Ares I rocket. The second, a year later, demonstrated the tower-based system that will be used on future missions. SpaceX conducted a pad abort test with the Dragon v2 spacecraft in 2015. Boeing will conduct a similar test ahead of Starliner's first manned mission. Such tests are nothing new – similar trials were conducted ahead of the Mercury and Apollo programs, while the Soviet Union flew pad abort tests before putting cosmonauts aboard the Soyuz. The pad abort test is one of two types of test typically used to validate a launch escape system, the other being an ascent abort, where the capsule is carried to altitude atop a rocket and fires its abort system during its climb. ISRO has not announced any plans for such flights. However, images have shown what appears to be the design of an in-flight-abort test vehicle with a solid-fueled first stage. Similar vehicles, named Little Joe I and Little Joe II respectively, were used in the Mercury and Gemini abort test programmes, while Northrop Grumman is building an abort test booster for Orion based on the first stage of the now-decommissioned Peacekeeper missile. SpaceX plans to use a recovered Falcon 9 first stage for their ascent abort test with Dragon.

Source: <https://www.nasaspacelight.com>

BUSINESS

Aircraft manufacture, one million jobs part of Aviation plan 2035: Mr Prabhu

Terming the creation of infrastructure a big challenge, Civil Aviation Minister Mr Suresh Prabhu said India will need at least 1,000 planes in the next few years as it prepares a comprehensive and integrated plan for 2035 to boost the sector. "To create infrastructure for aviation is a big challenge and we, therefore, are preparing a comprehensive and integrated plan for 2035...Aviation is one of the sectors that can play a leadership role in the world," Mr Prabhu said at an event organised by CII here. Delivering the Suresh Neotia Memorial Lecture on "Future of World Trade in Rising Clamour for Protectionism", Mr Prabhu said the government was also preparing a cargo policy that has a tremendous growth potential. "Separately, we are preparing a cargo policy as it has a huge potential to grow with the growing need to transport cargo from one place to another. Cargo flights can move at night with the policy coming in," he said. The minister stated that the country's aviation sector would log the highest continuous growth in the next few years, with technology and land being the key factors. "We need to create infrastructure on the ground to make flying successful. Procuring land for infrastructure projects is a challenge in India and land is going to be the driving force for many development projects in India. "Technology is going to play a big and key role," he said. He said India was also preparing a plan for manufacturing planes in the country. "We need at least 1,000 planes in the next few years and

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don't want to import them. We are separately preparing a plan for manufacturing these planes in India," he said. Another plan was afoot for making drones. "Drones will now play an important role and drones itself is a trillion dollar market. For which we are preparing a plan." Pointing out that a million jobs would be created in the aviation sector, the Minister said: "We need skilled man power and we are working on a skilled development programme."

Source: <https://www.business-standard.com/>

Rs 1 crore ISRO's lithium ion cell technology gets overwhelming initial response

Over 130 companies have shown interest in the Indian space agency's lithium ion cell technology and the pre-application conference will be held, said a senior official. "The response to our announcement to transfer the lithium ion cell technology is overwhelming. More than 130 companies have purchased the RFQ document. The pre-application conference will be held," Mr S. Somanath, Director, Vikram Sarabhai Space Centre (VSSC), told IANS. The Indian Space Research Organisation (ISRO) in June announced its decision to transfer its own lithium ion cell technology to the Indian industry on a non-exclusive basis for usage in automobiles for Rs 1 crore. The space agency had said the initiative will accelerate the development of the indigenous electric vehicle industry. The VSSC, located in Kerala, will transfer the lithium ion cell technology to the successful Indian industries/start-ups on a non-exclusive basis to establish production facilities in the country that can produce cells of varying size, capacity, energy density and power density catering to the entire spectrum of power storage requirements, ISRO had said. According to Mr Somanath, the transfer of technology will start from transfer to documentation. "Successful companies can come to VSSC and familiarise themselves about the battery technology. We do not have the manpower to depute to the technology buyer's place," Mr Somanath said. According to him, the lithium ion cell battery technology buyers can innovate further so address the market needs. "Batch manufacturing of lithium ion cells is sufficient for ISRO's needs. Whereas in the case of mass production it is only the industry that can do it," he added. Mr Somanath said the ISRO makes lithium ion cell batteries of various sizes and power (1.5 ampere to 100 ampere) to power its rockets and satellites. "ISRO will not get any royalty from the buyers of its lithium ion cell technology. Our idea is to enable the industry to develop," Mr Somanath said. He said ISRO for its use will source lithium ion batteries from Bharat Heavy Electricals NSE -1.61 % Ltd (BHEL) as the technology has been transferred to the power equipment major. Last month, ISRO issued the RFQ containing a brief description of the qualification process and technology transfer process, instructions to applicants, eligibility criteria, timelines and other details. All queries or request for additional information concerning the RFQ will be addressed at the pre-application conference, the space agency had said. ISRO also said that the "competent firm's security deposit will be adjusted against the technology transfer fee of Rs 1 crore. The security deposit (Rs 400,000) of unsuccessful applicants or withdrawn applications will be returned, without any interest". The one-time technology transfer fee has to be paid within 30 days of the qualification date. "Technology shall be transferred to all/any of the competent firms who qualify the eligibility criteria as specified in the RFQ. The required process documents shall be provided by ISRO at the time of signing of technology transfer agreement and payment of technology transfer fee," ISRO had said. Presently, the lithium-ion battery is the most dominant battery system finding applications for a variety of societal needs including mobile phones, laptops, cameras and many other portable consumer gadgets apart from industrial applications and aerospace. Recent advances in the battery technology have made it the preferred power source for electric and hybrid electric vehicles also.

Source: <https://economictimes.indiatimes.com/>

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