जुलाई
July
2024

खंड/Vol. : 49 अंक/Issue : 135
23/07/2024

समाचार पत्रों से चयनित अंश
Newspapers Clippings

डीआरडीओ समुदाय को डीआरडीओ प्रौद्योगिकियों, रक्षा प्रौद्योगिकियों, रक्षा नीतियों, अंतर्राष्ट्रीय संबंधों और विज्ञान एवं प्रौद्योगिकी की नूतन जानकारी से अवगत कराने हेतु दैनिक सेवा

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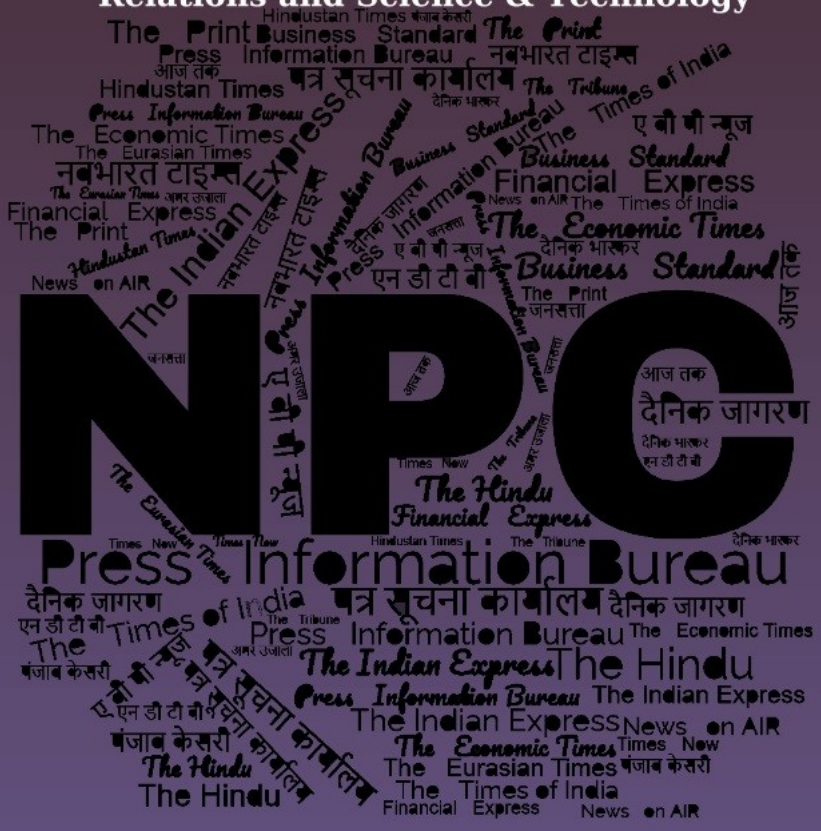

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Mon, 22 July 2024

Accident Onboard Indian Naval Ship Brahmaputra

A fire had broken out onboard Indian Naval Ship Brahmaputra, a multi-role Frigate, on the evening of 21 Jul 24 while she was undergoing refit at ND (Mbi), as reported earlier. The fire was brought under control by the ship's crew with assistance of firefighters from Naval Dockyard, Mumbai {ND (Mbi)} and other ships in harbour, by morning of 22 Jul 24. Further, follow-on actions including sanitisation checks for assessment of residual risk of fire were carried out.

Subsequently, in the afternoon, the ship experienced severe listing to one side (port side). Despite all efforts, the ship could not be brought to the upright position. The ship continued to list further alongside her berth and is presently resting on one side.

All personnel have been accounted for except one junior sailor, for whom the search is in progress. An inquiry has been ordered by the Indian Navy to investigate the matter.

https://pib.gov.in/PressReleasePage.aspx?PRID=2035358

Press Information Bureau
Government of India

Ministry of Defence

Mon, 22 July 2024

Handing Over Of Hydrogen Bus By Indian Oil Corporation Limited To Indian Navy

Under the auspices of the GOI's green initiative and the National Green Hydrogen Mission, a collaborative effort by the Indian Navy and Indian Oil Corporation Limited has resulted in handing over of a Hydrogen Fuel Cell Bus by the IOCL to Indian Navy for trials and performance testing.

This is considered a significant step towards Nation's commitment to sustainable development and environmental stewardship.

By harnessing the potential of hydrogen as a clean fuel, Indian Navy is paving the way for a new era of adoption of sustainable transportation in the Armed Forces. The hydrogen powered bus unveiled today represents collective efforts by the IOCL and Indian Navy to reduce carbon footprint, improve air quality and achieve the national environmental goals.

An MOU has been signed between IOCL and Indian Navy, under which IOCL has undertaken to provide the Hydrogen Fuel Cell Bus to the Indian Navy, for running and trial purposes.

The MoU was signed by VAdm Deepak Kapoor, Controller of Logistics, Indian Navy and Dr Kannan Chandrasekaran, Executive Director, IOCL in the presence of Adm Dinesh K Tripathi, Chief of the Naval Staff and Mr Shrikant Madhav Vaidya, Chairman, IOCL.

The Operation of the bus by Indian Navy will facilitate a comprehensive study in terms of performance, durability and operational reliability of Fuel Cell Bus for public transit application. The handing over of this hydrogen-powered bus symbolizes the determination to embrace innovative solutions that address the pressing challenges of climate change and energy security.

https://pib.gov.in/PressReleasePage.aspx?PRID=2035208

THE ECONOMIC TIMES

Tue, 23 July 2024

Air forces in Indo-Pacific unite to counter Chinese threat

Once upon a time, China was invited to large multilateral military exercises, with RIMPAC in Hawaii being an obvious example. However, China's belligerent approach to regional territorial disputes has seen it banished from Western-led military exercises.

Nonetheless, China is "contributing" to such exercises in other ways, primarily by encouraging concerned nations to get together and train, so as to present a united front against Chinese aggressive behaviour.

This is being demonstrated in an air force exercise currently ongoing in Australia. Exercise Pitch Black 2024, held from July 12 to August 2, is the largest-ever exercise in the 43-year history of the exercise series. A total of 140+ aircraft and 4,435 personnel from 20 countries descended upon Australia, primarily at air bases in its Top End. The unprecedented scale of the exercise speaks of mounting alarm over Chinese intentions in the Indo-Pacific region and beyond.

The 20 countries contributing assets include Australia, Brunei, Canada, Fiji, France, Germany, India, Indonesia, Italy, Japan, Malaysia, New Zealand, Papua New Guinea, the Philippines, Singapore, South Korea, Spain, Thailand, the UK and USA.

This list is notable, as it includes numerous countries that have a beef with Chinese territorial ambitions, either along its land border or in troubled maritime areas. This includes India, Japan and

the Philippines, for instance, with the latter getting involved in Pitch Black for the very first time. Indeed, the Philippine presence with four FA-50PH light fighters is important, since it has never deployed its fledgling fighter force overseas before.

Colonel Randy M. Pascua, Contingent Commander of the Philippine Air Force, said, "For us, this is not a preparation for anything that is happening in our country. Our main purpose for being here is to develop our operational capability, focusing on the development of the skills of the fighter pilots, as well as the maintenance, which is necessary when we get the higher level of aircraft, which is the multirole fighter."

His reference to the Philippines' current competition to obtain new multirole fighters is relevant again to China's threat. It could be argued that Manila's desire for more capable fighters, which are destined for territorial defence, is a direct response to the threat that China's People's Liberation Army (PLA) poses.

The other significant development in Pitch Black 2024 is a very heavy European involvement--France, Germany, Italy, Spain, and the UK--as various countries on the far side of the globe express alarm at China's stomping of international norms and regulations in places like the South China Sea and Taiwan Strait, arteries through which global maritime trade passes en masse. This year, Italy and Spain were joining a Pitch Black exercise for the very first time.

Furthermore, Italy sent its aircraft carrier Cavour to the event as part of a wider five-month deployment around the Indo-Pacific region. In addition, three nations--France, Germany, and Spain--are conducting a hugely complex air force deployment called Pacific Skies. Aircraft from these three countries are progressively training in Alaska, Hawaii, Japan, Australia, and India.

The refrain from participating nations is almost identical--words such as partnership, interoperability, and shared values. As the Royal Australian Air Force's (RAAF) Air Commodore Peter Robinson, Officer Commanding Exercise, put it, "We have brought like-minded nations that will come together and exercise together. We build capabilities together, we build friendships together, we build relationships together, and we leave the exercise much stronger as partners."

Lieutenant Colonel Ryan Nickell, US Air Force (USAF) Pitch Black Detachment Commander, expressed similar sentiments: "Pitch Black is a great opportunity for us to exercise closely with our allies and partners to bolster our combined and joint capabilities. True integration takes understanding and trust. This is our opportunity to learn from each other and contribute to stability in the region through longstanding partnerships."

Participants that spoke to were at pains to point out that Pitch Black scenarios are not aimed at any single country, such as China, and that interoperability is instead the key aim. Of course, interoperability is vital, because allies must know how to operate together in peacetime, in case they are ever required to fight side by side.

Thus, it is true to a certain extent that Exercise Pitch Black 2024 is not aimed specifically at China, although it does send a message of unity. As Lieutenant Colonel Ty Bridge, Deputy Chief, Exercises Division of Headquarters, US Pacific Air Forces, told ANI, "There are other exercises that INDOPACOM has a focus both in our strategic messaging, our posture, and our combined joint warfighting."

The USAF planner continued, "What Pitch Black allows us to be able to do is focus on the allies and partners, and the interoperability, and allow us to be able to plan in other venues and other times to be able to get at working with those other countries that are focusing on deterrence and a free and open Indo-Pacific."

Incidentally, this year is the first time that the USA dispatched F-22A Raptor fighters, the apex predators of the USAF, to Pitch Black. These fighters have flown to Australia before, but they have never formally been part of the exercise. The US is prioritising sending its most advanced aircraft to the IndoPacific region.

When ANI asked whether Pitch Black 2024 is directed against any country, Group Captain Gary Sadler of the Royal Australian Air Force (RAAF), responded, "The simple answer is no, there isn't a particular threat, if you like, that we're trying to address. All of the countries get to be both blue and red [forces] in this scenario, because that's where we get the maximum benefit for all of the countries and the combinations of different types of aircraft in the airspace at the same time. In terms of the strategic challenges around the globe at the moment, we certainly acknowledge those when we are talking about the activities that we're trying to look out for in the exercise. And whilst they may have a broad shaping effect, there's no specific activity within the exercise per se."

Again emphasising the common refrain, Gr Cpt Sadler said it is "really around making sure that we can interoperate and cooperate in terms of safe and professional aviation operations".

It is a huge logistical effort to run such a large, multinational exercise in Australia's Northern Territory, and here again, the threat from China plays a role. Australia's National Defence Strategy document, released in April, listed six priorities for the Australian Defence Force. Among them was improving the ability to operate from northern bases in Australia, "holding an adversary at risk farther from our shores," and employing a strategy of denial.

The National Defence Strategy's five other priorities for Australia are to: invest in nuclear-powered submarines; enhance long-range precision strike and manufacture munitions domestically; introduce disruptive, new technologies; grow the defence workforce; and deepen Indo-Pacific partnerships. These are all, either directly or indirectly, reactions to the growing threat from China's communist leadership and its armed wing, the PLA.

The imperative to buttress northern Australia and the country's maritime approaches is seen in major renovations and expansions of facilities at air bases such as Darwin and Tindal. At the latter, for instance, new aprons are being constructed to accommodate USAF B-52 bombers. In any conflict with China, northern Australia would play a vital role. Australia is also overhauling other remote air bases across the north so that they can be used in an expeditionary manner in case of contingencies.

France is Europe's only "Pacific nation," and its Ambassador to Australia, Pierre-Andre Imbert, said, "These air combat training exercises provide us with a great opportunity to develop interoperability between the latest-generation fighters (F-35, Rafale), so as to be ready for tomorrow's high-intensity conflicts."

Indeed, France is getting ready for conflict in the region. ANI understands that, last year, a deployment of Rafale fighters to New Caledonia saw the aircraft rehearsing countering a notional

enemy attacking from the north. North is the direction that PLA forces would naturally take if they were planning to invade the South Pacific.

Numerous countries in the Asia-Pacific are getting ready in similar ways. No. 75 Squadron of the RAAF, for example, which flies the F-35A fighter from Tindal Air Base, is at the tip of the spear in terms of countering any threat from the north. It is emphasising readiness to counter any sudden threats from the likes of China.

Discussing Pitch Black 2024, Gp Cpt Sadler added: "Bringing all these countries together, it's about the shared values that we have for security, stability, peace, and prosperity in the region for all participants. And I think this sort of activity reflects the commitment to transparency, to make sure that everybody is fully aware of what we're trying to achieve and how we're going about it."

As this loose coalition of nations builds, major powers like the USA are keen to broaden the base and deepen relationships. As Lt Col Bridge of the USAF explained: "Well, it reflects the mutual trust and respect, in my opinion, and the intent for everyone to be able to come together and focus on air tactics regardless of policy or politics that may be out there. It has been extremely impressive to be able to see the variety of different aircrews and the professionalism they have..."

With 20 countries coming together like this, it also underscores China's own very limited circle of friends. Apart from counterterrorism-type exercises conducted under the Shanghai Cooperation Organisation (SCO), PLA international exercises tend to be bilateral, partnering with the likes of Cambodia, Iran, Pakistan, Russia, and Thailand.

The Pentagon said in its most recent report on the PLA that Beijing will "continue to expand the PLA's global military presence through humanitarian assistance, naval escorts and port calls, peacekeeping operations, arm sales, influence operations, and bilateral and multilateral military exercises. Through these engagements, Beijing can strengthen and expand its diplomatic relationships to advance its foreign policy goals, to include shaping the international system to align with the PRC's interests, gaining operational experience for the PLA, and attracting foreign interest in hosting PLA bases and dual-use installations abroad."

The US annual report added, "Beijing often relies on senior military visits, bilateral and multilateral exercises and training, peacekeeping, and military assistance to promote the PRC's foreign policy objectives."

In July, China was working militarily with Russia in a naval exercise called Joint Sea-2024 in waters near Zhanjiang in the south of China. Zhang Xiaogang, spokesperson for China's Ministry of National Defence, said: "The ongoing exercise is to demonstrate the resolve and capabilities of the two sides in jointly addressing maritime security threats and preserving global and regional peace and stability."

https://economictimes.indiatimes.com/news/defence/chinese-threat-catalyses-numerous-air-forces-to-defend-freedoms-in-indo-pacific/articleshow/111943353.cms

THE ECONOMIC TIMES

Mon, 22 July 2024

Sukhoi-30MKIs may get a Rs 63,000 crore hightech makeover soon

India is finalizing an extensive plan to upgrade its fleet of Russian-origin Sukhoi-30MKI fighter jets, transforming them into advanced 'Super' Sukhois. This enhancement involves advanced radars, avionics, longer-range weapons, and multisensor fusion, significantly boosting their combat capabilities for the next 30 years. The defense ministry has prepared a draft note for the Prime Minister-led Cabinet Committee on Security (CCS) to approve the first phase of upgrades for 84 jets at a cost of around Rs 63,000 crore, sources told The Times of India.

Upgrade Details

The 'Super' Sukhois will approach fifth-generation fighter capabilities, lacking only in stealth. "They will also have manned-unmanned teaming capability to operate with advanced autonomous drones using AI and data links," a source told TOI. The Indian Air Force (IAF) aims to extend the operational life of these Sukhois until 2055.

Criticalfor IAF's Strength

The Sukhoi upgrade is crucial as the IAF currently operates 30 fighter squadrons, against the sanctioned strength of 42, necessary to counter potential threats from China and Pakistan. Hindustan Aeronautics Limited (HAL) will upgrade all 84 twin-engine Sukhois over approximately 15 years. The development and flight-testing phase will take seven years, followed by the gradual induction of upgraded jets.

Backbone of Combat Fleet

IAF's fleet includes 259 Sukhois, most of which were produced under license by HAL for over $12 billion from Russia. An additional 12 Sukhois are being ordered for Rs 11,500 crore to replace those lost in crashes. Another source indicated, "In another 15 years, India will have its own 5th-Gen fighter, the AMCA (advanced medium combat aircraft), with futuristic technologies incorporated into the next tranche of Sukhois."

Technological Enhancements

The current upgrade project will equip Sukhois with indigenous ‘Virupaksha’ advanced electronically scanned array (AESA) radars, enhancing detection range by 1.5 to 1.7 times compared to existing Russian radars. This improvement will support the integration of longer-range weapons like the Astra-3 air-to-air missiles, boasting a beyond visual range of 350 km.

Indigenous Systems

All electronics, except the fly-by-wire system, in the upgraded Sukhois will be indigenous. "This includes all three mission computers with better algorithms. Of the 51 systems to be upgraded, 30 are by HAL, 13 by DRDO, and eight by the private sector," a source explained.

BrahMos Capability

Currently, 40 Sukhoi fighters have been modified to carry BrahMos supersonic cruise missiles. The range of BrahMos has been extended from 290 km to 450 km, with plans to increase it to 800 km, enhancing the IAF's precision-strike capabilities.

Defence Spending and Roadmap

India's ambitious Sukhoi upgrade project is part of a broader defense strategy. The Union Budget has earmarked significant funds for defense, focusing on modernizing the armed forces and boosting indigenous production capabilities. With an eye on increasing defense exports and self-reliance, India aims to position itself as a global player in defense manufacturing. This aligns with the nation's goal to develop and deploy advanced military technologies by 2030, ensuring robust defense capabilities amid evolving regional security dynamics.

Future Prospects

As part of its long-term defense strategy, India is also working on developing its own fifth-generation fighter, the Advanced Medium Combat Aircraft (AMCA). These futuristic technologies will be integrated into the Sukhoi upgrades, ensuring that the IAF remains equipped with cutting-edge capabilities well into the future. India's comprehensive plan to upgrade its Sukhoi-30MKI fleet underscores its commitment to enhancing national security and maintaining a formidable defense posture in the region.

https://economictimes.indiatimes.com/news/defence/sukhoi-30mkis-may-get-a-rs-63000-crore-high-tech-makeover-soon/articleshow/111928650.cms

THE HINDU

Mon, 22 July 2024

India now among top 25 arms exporter nations: Economic Survey

India has transitioned from being an arms importer and found a place in the list of top 25 arms exporter nations, the Economic Survey revealed on Monday.

Between 2015 and 2019, India held the distinction of being the world’s second-largest arms importer, but the narrative has changed now. Defence production has grown substantially in the country, from ₹74,054 crore in the financial year 2016-17 to ₹108,684 crore in 2022-23, boosting defence exports.

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In addition, there has been a rise in the number of export authorisations issued to the defence exporters, it added. "From 1,414 export authorisations in FY23, the number has increased to 1,507 in FY24."

About 100 domestic companies are exporting a wide range of defence products and equipment such as the Dornier-228 aircraft, artillery guns, BrahMos missiles, Pinaka rockets and launchers, radars, simulators, and armoured vehicles, the survey noted.

Stating that the government has taken several policy initiatives over the past 10 years to boost defence exports, the survey said export procedures have been simplified and made industry-friendly, with end-to-end online export authorisation curtailing delays and facilitating ease of doing business.

"Further, the Aatmanirbhar Bharat initiatives have helped the country by encouraging indigenous design, development and manufacture of defence equipment, thereby reducing dependency on imports in the long run," it added.

While defence exports have gone up, India continued to remain the world's top arms importer in the period 2019-23, with imports going up by 4.7% compared with the period 2014-18, according to a report in March from the Swedish think tank Stockholm International Peace Research Institute (SIPRI).

India came back to the top slot in arms imports after briefly ceding space to Saudi Arabia in the past. In the interim Budget presented in February, the total allocation for the Defence Ministry was ₹6.2 lakh crore, of which the capital allocation, for new procurements, was ₹1.72 lakh crore, 5.78% higher than the Budget Estimates of the previous year.

Note of caution

Earlier this week, sounding a note of caution on the push on Aatmanirbharta, or selfreliance, Vice-Chief of the Indian Air Force (IAF) Air Marshal A.P. Singh said that Aatmanirbharta cannot be at the cost of nation's defence.

"Nation's defence comes first and foremost," he said, while stating that when it comes to national defence, "there will be compulsions to deviate from their path" in case they do not get the things they need or the kind of systems and weaponry that is required to survive in today's world. Talking of the indigenous technological development under way he said the "rate at which we are getting our equipment at the moment is too low".

https://www.thehindu.com/business/budget/india-now-among-top-25-arms-exporter-nations-economic-survey/article68433092.ece

FINANCIAL EXPRESS
Read to Lead

Mon, 22 July 2024

Indian Army Enhances Research in Warfare Studies through CLAWS

The Indian Army took a significant step towards bolstering its research capabilities in land warfare studies with the inauguration of “Manthan Prangan” at the Centre for Land Warfare Studies (CLAWS) in New Delhi. This state-of-the-art facility, unveiled by General Upendra Dwivedi, Chief of the Army Staff, on July 22, 2024, in the presence of other high-ranking military officials, marks a new chapter in fostering strategic thought and innovation.

CLAWS, an independent think tank dedicated to national security, conventional military operations, and sub-conventional warfare, aims to shape strategic thought, foster innovation, and provide actionable insights through “Manthan Prangan.” The facility will serve as a hub for research and collaboration, accessible to think tanks and agencies engaged in defence and security matters.

A significant feature of the event was the establishment of nine Chairs of Excellence, designed to attract top-tier scholars and practitioners to enhance CLAWS’ research capabilities.

These chairs will focus on various strategic and technological areas, driving forward-thinking research critical for addressing future conflicts:

Army Technological Chair of Excellence: Established by the Deputy Chief of the Army Staff Capability Development and Sustenance, this chair focuses on advancing military technologies for enhanced defence capabilities.

Captain Gurbachan Singh Salaria, Param Vir Chakra, Chair of Excellence: Sponsored by the Deputy Chief of Army Staff (Information System and Coordination), this chair fosters research in military innovations and strategies.

Civil-Military Fusion Chair of Excellence: Sponsored by the Deputy Chief of Army Staff (Information System and Coordination) and executed by the Territorial Army Directorate, this chair aims to enhance interoperability and strategic coordination.

Major General Harkirat Singh Chair of Excellence: Established by the Engineer-In-Chief Branch, this chair focuses on advancing military engineering technology and innovation for enhanced defence capabilities.

Director General Infantry Chair of Excellence: Under the Infantry Directorate, this chair aims to advance infantry tactics, technology integration, and strategic doctrine to enhance operational effectiveness and readiness.

General Zorawar Chair of Excellence: Sponsored by the Jammu and Kashmir Rifles Regiment, this chair focuses on strategic studies and regional security, fostering research and dialogue on northern border security.

Roaring Fours Manoeuvre Chair of Excellence: Sponsored by the 44 Armoured Regiment, this chair focuses on advancing armoured warfare strategies and tactics through rigorous research and innovative military education.

Director General Artillery Chair of Excellence: Under the Artillery Directorate, this chair focuses on advancing artillery strategies, technologies, and operational doctrines to enhance the Indian Army's combat effectiveness.

Defence Chair of Excellence: Sponsored by Adani Defence and Aerospace, this chair fosters research and development in defence technologies to enhance India's military capabilities and strategic autonomy.

These initiatives aim to foster a culture of innovative research at CLAWS, promoting public-private partnerships in advanced military studies. By combining the expertise of military personnel and external scholars, CLAWS seeks to address contemporary security challenges with cutting-edge solutions.

Additionally, General Dwivedi released two significant books during the event: "India and the Gulf: A Security Perspective" by Dr Manjari Singh and "Securing the Future: Youth Perspective on National Security Challenges." These works provide valuable insights into current security issues, contributing to the broader discourse on national and international security.

The inauguration of "Manthan Prangan" and the establishment of the Chairs of Excellence represent the Indian Army's robust commitment to advancing national and global security. Through strategic research and innovation, CLAWS is poised to play a crucial role in addressing the challenges of future conflicts, ensuring the Indian Army remains at the forefront of military thought and technology.

https://www.financialexpress.com/business/defence-indian-army-enhances-research-in-warfare-studies-through-claws-3561225/

ThePrint

Mon, 22 July 2024

China's Pangong Tso bridge, capable of carrying tanks, completed in Eastern Ladakh

China has this month completed the construction of a bridge in the territory held by it overlooking the Pangong Tso in Eastern Ladakh, making it easier for movement of troops.

Latest satellite images show that the black topping has been completed this month.

ThePrint was the first to report in January 2022 that the People's Liberation Army (PLA) was building a bridge over the Pangong Tso on its territory in Khurnak, the narrowest part of the lake.

It was later revealed that the structure was being used as a service bridge for the construction of the main bridge, work on which was started.

Publishing latest images, satellite imagery expert Damien Symon, who goes by the 'X' handle _Detresfa, said the bridge connecting the north and south bank of Pangong Lake shows signs that indicate it might be ready for use shortly.

The bridge enhances the mobility of Chinese forces and helps cut down the time needed to launch a quick operation. It will help Chinese troops along with their tanks access areas in the southern banks like the Rezang La where they were outsmarted by the Indians in 2020.

Cutting down a 180-km loop from Khurnak to the south banks through Rutog county in Tibet, the bridge will also give the Chinese the capability to bring heavier war fighting equipment to the finger areas in the northern bank of Pangong Tso.

While the stand-off was on in the southern banks of Pangong Tso, between September 2020 and mid-2021, the Chinese had built a new road to the Moldo garrison to circumvent the visibility arc of the Indian soldiers and equipment on top of advantageous heights.

https://theprint.in/defence/chinas-pangong-tso-bridge-capable-of-carrying-tanks-completed-in-eastern-ladakh/2185957/

The EurAsian Times

Mon, 22 July 2024

BrahMos: Wonderful, But Not Useful! US Expert Calls India's Supersonic Missile Ineffective For Philippines Sans C4ISR

A former Adviser to the US State Department has made a startling assertion that in the absence of C4ISR capability, the BrahMos supersonic cruise missile is not much of an operational use for the Philippines. However, the architect of the Indian Navy's C4I systems deployed on the force's frontline warships contends that the missile is lethal even in its 'standalone mode.'

India's sale of BrahMos supersonic cruise missiles to the Philippines has been seen as a strategic turning point, with New Delhi taking a stand in the South China Sea disputes.

Tata Chair for Strategic Affairs and a senior fellow at the Carnegie Endowment for International Peace, Ashley Tellis, while conceding that BrahMos is a remarkable contribution to the Philippines' security, said that in the absence of the C4ISR capability, the Southeast Asian country will not be able to use it "effectively."

The US Department of Defense often uses C4ISR for "command, control, communications, computers (C4), intelligence, surveillance, and reconnaissance (ISR)." In simpler words, C4ISR is the "nervous system" of the military aimed at increasing situational awareness. Various systems work in tandem to collect massive amounts of data from multiple sensors and databases. This data, as an end product, is used for targeting.

C4ISR technologies are the bedrock of any mission, and the components must work in tandem to effectively enable the "muscle" side of the military—weapons, platforms, and troops. C4ISR networks collect massive amounts of data from multiple sensors, databases, and other sources worldwide. The data is fused, processed into usable information, and shared securely among authorized users.

The former senior advisor to the US State Department said that the missile was a "wonderful symbol but not of much operational use." Speaking at a two-day Defense News Conclave in New Delhi organized by the US Consulate in Kolkata and think tank CUTS International, Tellis discussed strengthening the capabilities of the littoral countries in the Indo-Pacific and made a case for India and the US to do it in concert.

Tellis said that the US could help. "But we want to avoid situations where we are doing post-facto remediation. What we want to do is premeditated cooperation. And so, when we pursue initiatives of this kind, it is useful for the partners to talk to one another."

Indian Navy official Commander Milind Kulshrestha (retired), who integrated BrahMos for Indian Navy's C4I for the first time, told the EurAsian Times that BrahMos is "easily integrable to enhance capabilities for exploitation. In each form, Brahmos is a lethal deterrent for the Philippines."

The Philippines is the first export customer for the BrahMos cruise missile. India delivered the missiles to the archipelagic country in 2024 amidst rising tensions with China in the South China Sea. The country is constructing its first BrahMos anti-ship missile base at the Naval Station Leovigildo Gantioqui in Zambales, Western Luzon. Satellite imagery reveals that the missile base faces the contested South China Sea. It includes a high-bay facility for missile maintenance and assembly and a sheltered magazine bunker for storage. The base is strategically positioned to bring the disputed Scarborough Shoal occupied by China within the missile's strike envelope.

Commander Kulshreshtha said: "When used as a C4ISR system component, Brahmos is a force multiplier in the larger frame of tactical warfare capability…. Brahmos is a very effective and deadly missile system for Surface Warfare in a standalone mode and also, as part of the Cooperative Engagement Capability (CEC) of any military." He sees Brahmos as a key armament in the emerging Indo-Pacific scenario. He contends that the missile system can be integrated conveniently into any of the C4ISR systems the Philippines or any other nation would like to take up, and hence, inherently integrable.

The C4ISR Technology To Guide BrahMos

In simpler words, the Philippines needs to see far to shoot far. Without long-range ISR capabilities, the country is unlikely to exploit the full range of the BrahMos missile.

The island country does not have over-the-horizon (OTH) radar, long-range reconnaissance unmanned aerial vehicles, or dedicated airborne warning and control (AEW&C) aircraft.

Without Command and control (C2) systems, the Philippines will find it quite challenging to defend its BrahMos missile systems and integrate the missile into an effective kill chain.

"Within the precincts of C4SIR principles, a missile system like Brahmos forms an integral part of Threat Perception & Resource Allocation," Kulshreshta said.

He adds: “The deployment of BrahMos by the Philippines shall become a primary deterrent to the Chinese maritime militia, who would avoid venturing into the Brahmos kill zones. Here, the Philippines, too, has the option to operate the Brahmos as a cluster of SSMs (Surface to surface-to-surface missiles) with Command & Guidance mobile units. During any hostilities, the mobile version of a missile complex stands a better survivability chance when compared to a fixed land-based missile site.”

Also, Scarborough Shoal is a stationary target whose coordinates are well known, so the country would not need sophisticated ISR technology to target it. BrahMos’ mid-course guidance utilizes the Inertial Navigation System, and the terminal phase relies on the homing radar seeker. The GPS or GLONASS link augments the accuracy of this missile guidance. This capability gives it to take a shot at moving targets.

Nonetheless, the allies’ role also becomes significant in building the country’s C4ISR capability. Amidst increasing collisions among the Philippines forces with the Chinese coast guard, the US temporarily stationed MQ-9 Reapers on a “rotational” basis. This has been in line with the 2014 EDCA (Enhanced Defense Cooperation Agreement), providing continuous aerial surveillance capability to the Philippine military. “Temporarily” is a key word here, as the country’s 1987 constitution prohibits the permanent basing of foreign military forces in its territory.

The US Marine Corps MQ-9A started operating from the Philippine Air Force base Basa at Manila’s request to support intelligence-sharing efforts between the US Indo-Pacific Command and the Armed Forces of the Philippines. Under EDCA, Basa is also slated to receive a slew of US-funded upgrades. So far, it has undergone runway renovation and expansion, received a new command and control facility, and also had a humanitarian assistance and disaster relief warehouse.

https://www.eurasiantimes.com/brahmos-wonderful-but-not-useful-us-expert/

The EurAsian Times

Mon, 22 July 2024

J-31 Fighters For Pakistan – Why IAF Will Not Bet On F-35 Stealth Aircraft To Defeat Chinese-Origin Jets? OPED

The Chinese J-31 fighter aircraft has been in the news recently. The latest pictures of yet-to-be-operational aircraft are floating around.

China has ‘supposedly’ offered J-31 stealth fighters to the Pakistan Air Force (PAF). As usual, hyperactive Indian strategists have gone into a tailspin and started suggesting that the IAF examine the ‘unlikely’ offer from the USA of selling F-35s.

J-31 “Stealth” Fighter Aircraft

Before discussing the yet-to-be-operated J-31 platform, a look into J-20 development and operational employment merits consideration.

While tall claims have been made about J-20, with a satellite photo showing around 10 J-20s parked on an apron in one of the PLAAF bases in Tibet, there has been no report yet of sustained operations of J-20 from high-altitude airfields in the Tibet Autonomous Region (TAR).

Two previous attempts of J-20 deployment in TAR during the last few years failed almost entirely due to adverse weather phenomena, such as strong surface winds, icy cold temperatures, ice accretion on the runway, etc.

Mention of J-20 employability is essential because the JF-17 experiment with PAF has not been successful. It may not be out of place to mention that JF-17s have failed to meet PAF requirements and that their induction has been near failure.

However, China never offered the J-20 to the Pakistan Air Force (PAF). Or is it that the PAF is wary of Chinese platforms? The Chinese 'offer' of J-31, which is under development, appears to be more of an appeasement offer rather than of any significant operational value.

No technical details are available about J-31, but it would not be hard to guess that it will be equipped with AESA radar, various types of AAMs (Air-To-Air Missiles), ALCMs (Air-Launched Cruise Missiles), and possibly the much-talked-about hypersonic anti-shipping missile.

It will, in all likelihood, have around nine hot points, four under each wing and one under the fuselage, an AAR facility, and a combat radius of action of at least 750 km with maximum load.

Even more important than the operational parameters would be the timeline for inducting J-31s in PLAAF (Chinese Air Force) and PAF.

As a reference point, it would be pertinent to mention that the USAF took 20 years to go from freezing the QRs (qualitative requirements) to IOC (initial operational clearance) in the case of the F-35. Even if China manages to cut down the time frame by 10 years, J-31s are likely to be employed in an operational role (if at all) with PLAAF not before 2035.

Would China be in a position to equip Pakistan simultaneously with J-31s?

F-35s For Indian Air Force (IAF)?

The backbone of IAF at present is the Su-30 MKI, supported by the latest Rafales and slowly but surely dwindling fleets of MiG-29s, Mirage-2000s, and Jaguars. Two squadrons of LCAs are also in the fray, with nearly 100 more to follow.

Time line of induction cannot be fixed because of shifting deadlines by HAL. AMCA and TEDBF are not even in the prototype stage. Hence, IAF needs a platform on priority.

HAL cannot meet the requirement. The exercise to induct 126 fighters has been going on for a long time. Why it has not fructified does not deserve any discussion. Platforms that might be available in large numbers are F-21s and Rafales. F-15EX and F-35s are not likely to be available immediately.

F-35 induction in the USAF and other EU nations has been less than a success story. To date, F-35s have a few very serious issues related to operations that need to be resolved. In 2023, the USAF lost six F-35s due to crashes.

The problem with F-35 development has been its overambitious nature. As of date, there are 14 variants of F-35s, causing enormous confusion in maintenance. "Extensive" differences in the

variants are complicating maintenance and sustainability, contributing to the program's poor readiness, the Government Accountability Office said in its report.

USAF was in a hurry, and in fact, before the design was frozen, prototype production had already commenced. As the development progressed, it caused numerous problems regarding new requirements, upgrades, etc.

Delivery by Lockheed has been in batches having nearly similar configurations. Will or should IAF accept such a mode of delivery if it decides to acquire the platform?

The F-35 maintenance schedule has been meeting numerous roadblocks due to various equipment malfunctions at random intervals. The IAF needs a sturdy platform that can operate in Rajasthan's near 50-degree temperatures and the extremely humid conditions of northeast and eastern India. F-35s are unlikely to meet that requirement.

To date, nearly 1,000 F-35s have been manufactured, but the operators have called the platform underdeveloped. According to a government report, the program has 845 open deficiencies, including six Category 1 deficiencies. The IAF does not need such a platform.

Futuristic Platforms

Futuristic platforms viz FCAS of Europe and NGAD of USA are merely at the concept stage. Even if these platforms fructify, the timeline will be 2045 and beyond. For records, USAF Fighters timeline from concept to IOC has been as follows;

- F-4 and F-104 – 10 Years
- F-15 – 15 years
- F-22 – 20 years
- F-35 – 20 years

The IAF needs a proven, easy-to-maintain, and sturdy platform. The F-35 does not meet any of these requirements, and the cost issue has not been discussed deliberately.

https://www.eurasiantimes.com/j-31-stealth-fighters-for-pakistan-why-iaf/

THE ECONOMIC TIMES

Tue, 23 July 2024

Growing cooperation between Russia and China in Arctic, says Pentagon

Russia and China are increasingly cooperating in the Arctic region, which could impact regional stability, the U.S. military said as it released its strategy for the Arctic region on Monday.

Russia has reopened hundreds of Soviet-era military sites in the Arctic, thereport said. China, which describes itself as a "near-Arctic" state, also has ambitions there and has said it intended to

build a "Polar Silk Road." China has its eye on mineral resources and new shipping routes as ice packs recede with rising temperatures.

“Increasingly, the (People's Republic of China) and Russia are collaborating in the Arctic across multiple instruments of national power," the Pentagon's report said.

"While significant areas of disagreement between the PRC and Russia remain, their growing alignment in the region is of concern, and (the Department of Defense) continues to monitor this cooperation," it added.

Arctic sea routes are increasingly being used for connecting major economies across the Pacific and Atlantic Oceans as global warming shrinks ice packs and allows for longer ice-free periods at sea.

China and Russia have been working together to develop Arctic shipping routes as Russia seeks to deliver more oil and gas to China amid Western sanctions while China seeks an alternative shipping route to reduce its dependence on the Strait of Malacca.

The Pentagon report added that China was looking to leverage "changing dynamics in the Arctic to pursue greater influence and access, take advantage of Arctic resources, and play a larger role in regional governance."

The Pentagon's report added that the U.S. military had a "monitor-andrespond" strategy in the region that was built on intelligence collection, cooperation with allies and the ability to deploy military assets.

This month, the U.S., Canada and Finland will form a consortium to build icebreaker ships, intended to bolster the allies' shipbuilding and counter Russia and China in increasingly strategic polar regions.

The deal - which the three NATO members aim to sign by year-end - will pool demand from allies to scale shipbuilding capacity, the official said, adding that it was designed to send a message to Russia and China.

https://economictimes.indiatimes.com/news/defence/growing-cooperation-between-russia-and-china-in-arctic-says-pentagon/articleshow/111943007.cms

THE ECONOMIC TIMES

Mon, 22 July 2024

Next-generation US jet fighter program may get hit by budget woes

The U.S. Air Force's ambitious nextgeneration fighter jet program, envisioned as a revolutionary leap in technology, could become less ambitious as budget pressure, competing priorities and changing goals compel a rethink, defense officials and industry executives said.

Initially conceived as a "family of systems" centered around a sixth-generation fighter jet, the Next Generation Air Dominance (NGAD) program is meant to replace the F-22 Raptor and give the United States the most powerful weaponry in the sky well into the mid-21st century.

When it was first proposed, expectations were high, including an unmatched stealth capability to keep it invisible from even the most sophisticated radar, laser weapons and onboard artificial intelligence to process masses of data coming from the latest in sensor technology.

However, sources said the current development budget of $28.5 billion over five years ending in 2029 could be spread out over more time or scaled-back as the Pentagon searches for a cost-effective solution.

Sources briefed on the Air Force's internal budget deliberations said the anticipated 2026 fiscal-year NGAD budget of $3.1 billion would be slashed as funding shrinks, with one source adding that diminishing funds could stretch development by two more years.

While it is unclear how much the overall program will cost, it could eventually total well over $100 billion if 200 aircraft are produced, including initial costs - plus maintenance and upgrades over time. There are currently 185 F-22s in service - the plane NGAD is meant to replace.

The Air Force is also reviewing the concept for the jet - perhaps moving to a larger single-engine jet, from what is believed to be a two-engine design, or even shifting more funding to a less expensive unmanned drone to best address future air superiority needs given the potential budget cuts, industry experts said.

"NGAD was conceived before a number of things: before the threat became so severe, before CCAs (drone program) were introduced into the equation and before we had some issues with affordability that we are currently facing," Air Force Secretary Frank Kendall said on Saturday at Britain's Royal International Air Tattoo, the world's largest military air show.

"Before we commit to the 2026 budget, we want to be sure we are on the right path," he added on a program that will be a popular talking point at the Farnborough International Airshow this week.

The shift in focus comes as the Air Force grapples with substantial cost overruns in several vital, and expensive, programs. For example, its Sentinel intercontinental ballistic missile (ICBM) program, which is set to replace the aging Minuteman III missiles, has ballooned 81% over budget, to around $141 billion.

Budget pressure has forced the Air Force to reassess its spending priorities across various modernization efforts which also include increasing production of the new B-21 bomber made by Northrop Grumman.

U.S. aerospace and defense companies Lockheed Martin and Boeing have responded to the Air Force's request for proposal for the NGAD system, sources told Reuters.

While defense firms are not exactly desperate for orders with conflicts in Ukraine and Israel driving already-strong demand, NGAD was one of several potentially giant programs many hoped would feed the bottom line in the years ahead.

An Air Force spokesperson told Reuters the department is currently building its fiscal 2026 budget which will be released early next year. Representatives for Boeing did not return requests for comment. Lockheed would not comment on NGAD.

"The part that seems to be getting stalled and re-evaluated is the air vehicle itself, the central platform," said J.J. Gertler, a senior analyst at aerospace and defense analysis firm the Teal Group.

"The Air Force is now making sure that that's what they actually want and possibly changing their mind," he added. Possible new configurations might be shifting to a single engine for the jet to save on up-front cost and long-term maintenance. Twin-engine jets are much more expensive to buy and operate, but they are more dependable and faster, therefore more deadly in a dogfight than their single-engine foes.

Another key component emerging from this restructuring is the possibility of shifting funds toward the unmanned fighter drone known as the Collaborative Combat Aircraft initiative. Development of the less expensive drone platforms, designed to operate alongside the main jet, does not face budget changes.

https://economictimes.indiatimes.com/news/defence/next-generation-us-jet-fighter-program-may-get-hit-by-budget-woes/articleshow/111915057.cms

Science & Technology News

THE ECONOMIC TIMES

Mon, 22 July 2024

India's R&D investment lags behind global peers, private sector involvement low: Economic Survey

India has shown significant progress in research and development (R&D) according to the Economic Survey 2023-24, presented in Parliament. Despite these advancements, the country’s R&D investment remains comparatively low when measured against global leaders.

Significant R&D Achievements

India's R&D sector has demonstrated impressive growth, with nearly one lakh patents granted in FY24, a substantial increase from under 25,000 patents in FY20. The survey, citing data from the World Intellectual Property Organization (WIPO), notes that India experienced a 31.6% rise in patent filings in 2022. This growth underscores the evolving innovation landscape and potential for further expansion in intellectual property creation.

"India is making rapid progress in R&D, with nearly one lakh patents granted in FY24, compared to less than 25,000 patent grants in FY20," the survey highlights. This upward trend is also reflected in India's improved position on the GlobalInnovation Index (GII), where it advanced from

81st place in 2015 to 40th in 2023. Moreover, India climbed to the 9th rank in the Nature's Index 2023, surpassing Australia and Switzerland, marking a significant achievement in high-quality research.

Investment and Private Sector Contribution Despite these positive developments, the survey points out that India's R&D investment as a percentage of GDP stands at just 0.64%. This figure is notably lower compared to China (2.41%), the US (3.47%), and Israel (5.71%). Additionally, the private sector's contribution to R&D in India is at 36.4% of the country's gross expenditure on R&D (GERD), whereas China and the US have contributions of 77% and 75%, respectively.

The survey notes, "India’s R&D investment as a percentage of GDP stands at 0.64 per cent, compared to China (2.41 per cent), the US (3.47 per cent), and Israel (5.71 per cent)." Furthermore, while GERD in India has more than doubled from Rs 60,196.8 crore in FY11 to Rs 127,381 crore in FY21, the need for increased investment and private sector engagement remains pressing.

Challenges and Recommendations

The Economic Survey underscores the need to strengthen the link between higher education, industry, and research to better translate GERD into research output. It points out that institutions in India develop technologies, but their transformation from the lab to societal benefit is slow. The survey states, "Another challenge is low 'Land to Lab' time. Institutions in India develop technologies, but their transformation rate from the lab to the society for the benefit of the people remains low."

Although India's share of high-quality research articles increased by 44% over the past four years, it remains significantly lower than that of China and the US, each of which produces over 20,000 articles. On the human resources front, the total number of PhD enrollments in India rose to 2.13 lakh in FY22 from 1.17 lakh in FY15, indicating a growing focus on advanced research training.

In summary, while India is making strides in R&D with notable improvements in patent filings and global rankings, addressing investment gaps and enhancing the commercialization of research are crucial for achieving greater impact.

https://economictimes.indiatimes.com/news/science/indias-rd-investment-lags-behind-global-peers-private-sector-involvement-low-economic-survey/articleshow/111927926.cms

THE NEW INDIAN EXPRESS

Tue, 23 July 2024

National Space Day celebrated by IIT-BBS, ISRO and SDSC-SHAR

The Research and Entrepreneurship Park of IIT, Bhubaneswar in collaboration with the Indian Space Research Organisation (ISRO) and Satish Dhawan Space Centre, SHAR, marked the National Space Day by hosting a two-day exhibition and other events on its campus here.

The highlights of the two-day event that will conclude on Tuesday are a mobile exhibition of ISRO's innovations and achievements 'Space on the Wheels' and static floor exhibitions of scaled-down models and equipment being used in the space sector.

The event also comprises space quiz for school students, popular talks by leading scientists of ISRO, space startups, academicians and experts in the field. The inaugural day of the event witnessed participation of around 2,500 persons including students from nearby schools.

NISER director Prof Hirendra Nath Ghosh said the space technology sector requires brilliant minds to serve the nation in a different manner. He urged the students to be focused towards making a difference through their contributions in different fields.

https://www.newindianexpress.com/states/odisha/2024/Jul/23/national-space-day-celebrated-by-iit-bbs-isro-and-sdsc-shar

FINANCIAL EXPRESS
Read to Lead

Mon, 22 July 2024

Dr Vivek Lall bags World Leaders Award at UK Parliament for critical tech

Dr Vivek Lall, a renowned scientist and global leader in critical and emerging technologies, was honoured with the World Leaders Award at the UK Parliament last week. The prestigious award recognizes his significant contributions in the field and was presented in the presence of several world leaders. This accolade adds to his distinguished career, which includes receiving the Lifetime Achievement Award from the President of the United States.

Transformative Defence Deals

Lall's impact on defence cooperation between India and the United States is monumental. His visionary leadership has facilitated several significant defence deals, transforming the landscape of bilateral defence relations. Among the notable deals are:

– Boeing Company's procurement of P8I Anti-Submarine Warfare (ASW) aircraft worth US$3 billion for the Indian Navy.

– Acquisition of 22 Anti-ship Harpoon missiles from Boeing in a deal valued at US$200 million.

-Procurement of AH-64E Apache Guardian Attack Helicopters and CH-47F (I) Chinook helicopters for the Indian Air Force (IAF) in a deal worth US$5 billion.

– Acquisition of 10 C-17 Globemaster III heavy-lift transport aircraft for US$4 billion. Currently, he is leading negotiations for the acquisition of 31 MQ-9B Predator drones from General Atomics a deal that is yet to be signed and is valued at under US$3 billion. His relentless pursuit of strengthening India-US defence relations has ushered in an era of technological advancements and strategic collaboration.

High-Profile Advisory Roles

Dr Lall's influence extends to various high-profile advisory roles. In 2023, he was appointed to the Advisory Board of the Quad Investors Network, an initiative announced by The White House. Furthermore, he was appointed through the Pentagon as a United States Technical Team member to the NATO Science and Technology Organization (STO). His expertise is also sought after by the American Society of Mechanical Engineers (ASME), where he serves on the Industry Advisory Board.

In addition to these roles, he is an active member of several US Chamber of Commerce Boards. He sits on the Board of Directors of the US Japan Business Council and the US India Business Council, both based in Washington DC. His academic contributions are significant as well; he serves as a Senior Advisor to the Center for Commerce and Diplomacy at the University of California, San Diego, and is on the Board of the Center for Advancing Global Business at San Diego State University.

Key Advisory Role in Aviation

In 2018, Dr. Lall was appointed to a key advisory role by the United States Government, advising the US Cabinet Secretary heading the Department of Transportation. This position encompasses entities like the Federal Aviation Administration, impacting both US and global aviation policies and technologies.

Fostering US-India Technology Cooperation

For the past two decades, Dr Lall has been a pivotal figure in fostering high-end technology cooperation between the US and India. His work with major US companies, including Boeing, Lockheed Martin, and General Atomics, has been instrumental in strengthening technological ties and advancing innovations in both nations.

https://www.financialexpress.com/business/defence-dr-vivek-lall-bagsnbspworld-leaders-award-at-uk-parliament-fornbspcritical-tech-3560652/

THE HINDU

Tue, 23 July 2024

ISRO conducts experimental flight of Air Breathing Propulsion System

Indian Space Research Organisation (ISRO) successfully carried out the second experimental flight for the demonstration of Air Breathing Propulsion Technology.

The second experimental flight for the demonstration of Air Breathing Propulsion Technology was carried out at 7 a.m. on July 22. The propulsion systems were symmetrically mounted on either side of a RH-560 Sounding Rocket and launched from Satish Dhawan Space Centre, Sriharikota.

RH-560 is a two-stage, solid motor based sub-orbital rocket that is designed to be utilised as a cost-effective flying test bed for the demonstration of advanced technologies. It is the heaviest sounding rocket in the ISRO's family of sounding rockets, and is launched from Sriharikota.

According to ISRO, the flight test achieved satisfactory performance of the Sounding Rocket along with successful ignition of the Air Breathing Propulsion Systems. Nearly 110 parameters were monitored during the flight to assess its performance. The flight data from the mission will be useful for the next phase of development of Air Breathing Propulsion Systems.

Prior to the mission, multiple ground tests were carried out at Vikram Sarabhai Space Centre (VSSC), Liquid Propulsion Systems Centre (LPSC), ISRO Propulsion Complex (IPRC), and at the CSIR -National Aerospace Laboratories (CSIR-NAL), Bengaluru.

https://www.thehindu.com/sci-tech/science/isro-conducts-experimental-flight-of-air-breathing-propulsion-system/article68432854.ece

INDIA TODAY

Tue, 23 July 2024

Chandrayaan-3 anniversary: How Isro guided Vikram to land on the Moon

The mood inside the Indian Space Research Organisation's Telemetry Tracking and Command Network (Istrac) was tense, yet a sense of calm prevailed as engineers manoeuvred the Chandrayaan-3 spacecraft nearly 3,80,000 kilometres away from Earth — above the Moon.

The moment had come when four years of handwork, unflinching dedication, rigorous testing, and intricate planning were about to be put to the test. The spacecraft was about to begin its final descent to attempt a soft landing on the Moon.

What made the atmosphere even more exhilarating was the fact that all of it was to happen autonomously, fully commanded by the onboard computer, navigation software, with no human help.

Engineers, scientists, lunar geologists and the entire India remembered what happened when Chandrayaan-2 began the descent to the Moon four years back in 2019. It crashed.

But, this time Isro was prepared, India was prepared.

As India celebrates the first anniversary of the Chandrayaan-3 mission that launched on July 14, we look at the final moments of the landing that happened on August 23.

Vikram On Approach

The final descent phase began at an altitude of 30 kilometres above the Moon, with the lander Vikram firing its engines to slow down from a speed of around 6,000 kilometres per hour. As the lander approached the surface, it had another big challenge, switching from a horizontal to a vertical position, a critical manoeuvre that had caused the failure of the previous Chandrayaan-2 mission in 2019.

The landing site, chosen for Chandrayaan-3, was in the southern polar region of the Moon, a largely unexplored area that promise that launched ins to reveal valuable insights about the Moon's composition and history. This was the first attempt by any nation on Earth to land near the lunar South Pole.

Days ago, Russia had tried with their Luna-25, but the spacecraft crashed even before it began the descent phase. India had learnt the lesson.

The lander's legs, this time, were strengthened to withstand a landing speed of up to 10.8 kilometres per hour, and absorb any impact that was to follow in case the software glitched in those final moments.

Vikram Sticks The Landing

With the spacecraft slowly descending to the Moon, the thrusters kicked it, adjusting the course as the onboard navigation software and hazard cameras began intricately choosing a landing site, and began the spacecraft's orientation.

Isro had made several changes to Vikram compared to Chandrayaan-2. These included a bigger fuel tank to allow for last-minute adjustments, more solar panels on all four faces of the lander for increased power generation, and the addition of a Laser Doppler Velocimeter to precisely calculate the lander's speed during descent.

The innovation worked, moments later Vikram touched down on the Moon as an emphatic Isro chief announced to the world "India is on the Moon. Chandrayaan-3 has landed."

As the lander touched down, a wave of jubilation swept across India, with celebrations breaking out in cities and towns nationwide.

Prime Minister Narendra Modi hailed the achievement as a testament to India's growing prowess in space exploration, emphasising that the success belonged to all of humanity and would aid future lunar missions by other countries.

Pragyan Takes A Walk

The landing marked the beginning of the scientific phase of the mission, with the deployment of the Pragyan rover to study the lunar surface's seismicity and thermal properties, and search for water-based ice.

The rover's findings, combined with data from the lander's five scientific instruments, promise to unlock new insights into the Moon's formation and evolution, as well as its potential as a resource for future human settlements and deep space exploration.

The success of Chandrayaan-3 also points to the global surge in lunar missions, with countries like Russia, the United States, and China also actively pursuing lunar exploration programs. India's achievement is all about the power of perseverance, innovation, and scientific collaboration in pushing the boundaries of human knowledge and exploration.

As Isro prepares for Chandrayaan-4, Vikram and Pragyan remain in sleep mode at Shiv Shakti Point awaiting India's next arrival.

https://www.indiatoday.in/science/chandrayaan-3/story/chandrayaan-3-moon-landing-anniversary-isro-vikram-pragyan-shiv-shakti-point-moon-south-pole-2570384-2024-07-23