JRCentral

OCTOBER ISSUE

Who Said Is Not Important, What Said Is Important

INDIA'S CONTRIBUTION TO DEFENCE TECHNOLOGY

VOL I, ISSUE III


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Ancient Mythology Edition
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Acknowledgement

We are deeply grateful to Prof. (Dr.) Balvinder Shukla, Hon'ble Vice Chancellor, Amity University Uttar Pradesh, for giving us the valuable opportunity to share our project and the vision behind this magazine with her. Her kind encouragement and keen interest in our initiative strengthened our confidence and reminded us of the importance of curiosity and collaboration in research. Her words of appreciation and motivation continue to inspire us to carry this endeavor forward with greater enthusiasm.

We extend our sincere thanks to Dr. W. Selvamurthy, President of Amity Science, Technology and Innovation Foundation & Director General of Amity Directorate of Science and Innovation, for giving his precious time to our magazine. His thoughtful feedback and insightful suggestions helped us refine our initial vision, offering new perspectives on how to take this initiative ahead with clarity and purpose. We deeply value the time, encouragement, and guidance he shared with us at this important beginning.

We also express our heartfelt thanks to Dr. Sanjay Singh, Head of Department, for providing the facilities and a supportive environment that made it possible to bring this idea to fruition. Our deepest gratitude goes to Dr. V. R. Sanal Kumar, whose mentorship, knowledge, and constant encouragement have been invaluable throughout this journey. His guidance has not only shaped the essence of this magazine but also inspired us to approach research and creativity with deeper understanding and purpose.

04 President Shivansh Rana

It gives me immense pride to present this edition of our Research Club Magazine, dedicated to India's Contribution to Defence Technology. Through decades of perseverance and innovation, our nation has transformed from a technology seeker to a technology creator — shaping a legacy of self-reliance, resilience, and scientific excellence.

From the first flight of indigenous aircraft to the launch of advanced missiles and the rise of cutting-edge aerospace systems, every milestone reflects the vision and determination of countless scientists, engineers, and defence personnel who dared to dream beyond boundaries. This issue pays tribute to their spirit — the spirit that continues to strengthen our nation's security and inspire the next generation of innovators.

As students of science and engineering, we find in these stories not just achievements, but lessons in courage, creativity, and commitment to a greater purpose. Defence technology, at its heart, is more than machines and missions — it is the pursuit of knowledge for protection, progress, and peace.

I extend my heartfelt gratitude to our editorial team, contributors, and every member who made this issue possible. May these pages remind us that innovation thrives where passion meets purpose — and that every breakthrough in defence is, above all, a triumph of human spirit and national pride.

— Shivansh Rana
President, JRCentral

Editor's Note
Daksha Tuteja

In every era, a nation defines its strength not just by the weapons it wields, but by the vision and ingenuity that build them. India's journey from importer to innovator stands as a powerful testament to this truth.

This special edition of Journal Research Central is a tribute to that transformation — to the engineers, scientists, designers, and dreamers who have shaped India's defence identity over the decades. From the HAL Marut, our first indigenous jet fighter, to the Tejas, Dhruv, Arjun MBT, INS Vikrant, and the upcoming AMCA, each creation represents a milestone in self-reliance and technological maturity.

These pages are more than records of machines; they are chronicles of determination — of ideas that took flight, rolled across deserts, and sailed through oceans, all under the tricolour.

As Editor-in-Chief, I am proud to present this issue not just as a reflection of our nation's defence achievements, but as an invitation to the next generation — to innovate, to build, and to believe that India's finest era in defence technology is yet to come.
Here's to the minds that dare, the hands that build, and the nation that believes.

— Daksha Tuteja
Editor-in-Chief, JRCentral

06 Head of R&D
Sameeha Khan

In this edition of our Research Club Newsletter, we turn our gaze toward the frontiers of defence and aerospace — fields that embody precision, resilience, and the pursuit of excellence. Every innovation in these domains begins as an idea — a question about how we can protect, advance, and redefine the limits of human capability.

Our club continues to thrive in that transformative space between imagination and implementation, where ideas are not only tested but strengthened through persistence and purpose. In exploring India's growing contribution to defence and aerospace, we celebrate a legacy of innovation built on courage, intellect, and collaboration — from the laboratories that design, to the skies that inspire.

This issue aims to capture that spirit of inquiry that safeguards and innovation that uplifts. By highlighting diverse perspectives, achievements, and research efforts, we reaffirm our belief that progress is born from curiosity and sustained by collective effort. Through every experiment, every challenge, and every breakthrough, we move closer to a future where knowledge continues to serve both science and society.

— Sameeha Khan
Head of R&D, JRCentral

Articles

Achievements

W. SELVAMURTHY SUCHANDRA BANERJEE

AEROSPACE TECHNOLOGY SUPREMACY IN NATIONAL SECURITY

W. SELVAMURTHY* & SUCHANDRA BANERJEE**

* PRESIDENT, AMITY SCIENCE TECHNOLOGY & INNOVATION FOUNDATION

** ASSISTANT PROFESSOR, AMITY UNIVERSITY, NOIDALIC

The evolution of warfare from the conventional to asymmetric and noncontact warfare has brought the focus on the importance of aerospace systems and technologies. Recent conflicts between Russia and Ukraine as well as Operation Sindoor witnessed extensive and impactful use of these technologies including fighter aircrafts, drones, missiles, air Defence systems long range radars, drone detection systems and even directed energy weapons such as high-power lasers & high-power microwaves and highly lethal bombs and warheads.

Fighter Aircraft

India has built high level of competence, strength, capability and capacity for design, development and manufacturing of state-of-the-art aerospace systems for the national security. This includes: the most prestigious light combat aircraft (LCA), christened as Tejas (shown in Fig. 1) which has already been inducted into Indian Air Force. This is 4+ generation fighter aircraft highly maneuverable, light weight using composite airframe, fly-by-wire technology, digital cockpit (Fig. 1), modern avionics, long range radar fitted as well as lethal weapons integrated in this system of systems. This capability developed by DRDO, Aeronautical Development Agency and manufactured by Hindustan Aeronautical Ltd. will be a grate value addition to our Indian Air Force. In addition, efforts are on to develop civilian transport aircraft.

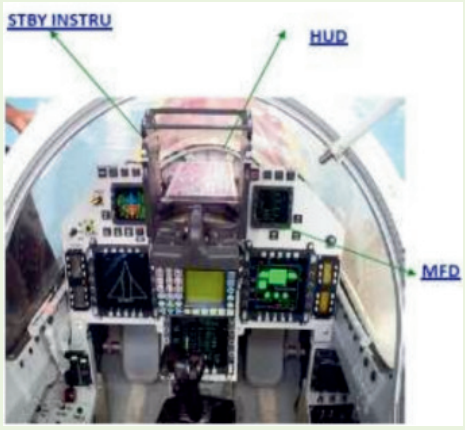


Figure 1: Light combat aircraft (LCA), christened as Tejas (ref. 1) with digital cockpit (ref. 2)

This tacit knowledge created had led to the development of Advance Medium Combat Aircraft (AMCA) which will be the next generation fighter aircraft. Though the aircraft engine (GE 414) for LCA is presently imported from USA, the indigenous Kaveri engine (Fig. 2) development also has reached the maturity level of even more than 70 Kilo newton (KN) thrust. This capacity will contribute to the development of engine for AMCA, which requires even much higher thrust (110-130 KN).

Figure 2: Advanced Medium Combat Aircraft (AMCA) (ref. 3) and Kaveri Engine GTRE GTX 35VS development by the Gas Turbine Research Establishment (GTRE), a lab under DRDO in Bengaluru, India (ref. 4) [Left]

Figure 3: Light Combat Helicopter (LCH) (ref. 5) [Above]

Figure 4: Drones in defence (ref. 6) [Above]

Helicopter

Light Combat Helicopter (LCH) (Fig. 3) and Advanced Light Helicopter (ALH) developed by HAL with R&D support of DRDO will be very valuable for the close combat nearer to the boarders and will also be used for transportation of troops and weapon systems such as bombs. These helicopters have been manufactured by HAL and have potential for export.

Drones

Unmanned aerial vehicles particularly Drones (Fig. 4) of different configuration, size, payload capacity and endurance find wide application in conventional and non-contact warfare for surveillance, reconnaissance and combat. It is one of the cheaper options instead of deployin a fighter aircraft which is a very expensive proposition. Swam of drones will be a cost-effective option for different operations. India is one of the leading countries today for having developed niche capability of developing and manufacturing different categories of drones. Many industries including start-ups have sprouted for drone manufacturing at the national and global level as it's a dual application technology useful for Defence as well as civilian sector. Drones are being used in agricultural practices, infrastructure project implementation like roads, bridges, dams and other assets. It is also being used for urban planning and development, pollution monitoring, precision agriculture, crop health monitoring and other civilian applications as well as in disaster management.

This drone application for security has also warranted the development of drones detection systems indigenously developed by DRDO with industry participation as well as neutralizing the targets by using soft and hard skill either a kinetic weapon or using EW system or directed energy weapon.

Radars

In Air Defence Systems, radars play a very significant role for early detection of aerial targets, India has indigenously developed a family of radars starting from Indra PC Radars (Fig. 5a) Rajendra Phase Array Radars (Fig. 5b), Central Acquisition Radars (Fig. 5c), multi-Mode Radar (Fig. 5d), and aircraft mounted radars (Fig. 5e). In fact, radars are indigenously developed by DRDO and manufactured by Bharat Electronics Ltd. (BEL) and other Private sector industries and exported to other countries..

Figure 5: (a) Indra PC radar (ref. 7), (b) Rajendra Phased Array Radar (ref. 8), (c) Central Acquisition Radar (ref. 9), (d) Multi-mode radar (ref. 10), (e) Aircraft mounted radar and phased array fighter radar (ref. 11 & 12)

Missiles

Missiles with different range and payload capacity have been indigenously developed by DRDO as it is a technology which a country cannot acquire by 'love or money'. Integrate guided missiles development programme (IGMDP) (Fig. 6) has led to the successful development of Agni, Prithvi, Akash, Nag, Trishul, most of them are already manufactured and inducted into tri services applications. This has led to more recent development of QR-SAM, loitering munition, Air to Air missile (Astra), Subsonic loitering missile Helina and other strategic and tactical missiles.

BrahMos is the fastest supersonic missile in the world jointly developed by Brahmos Aerospace Corporation India, which is a joint venture between India and Russia. It has both strategic and tactical application.

Figure 6: Integrated guided missiles development programme (IGMDP) (ref. 13)

Aerial Bombs

DRDO has developed a variety of aerial bombs (Fig. 7) for strategic as well as conventional operations for causing lethality. Bombs which can be dropped from different aerial platforms such as fighter aircrafts, combat drones are already in the inventory along with missiles which will carry both nuclear warhead and conventional warhead.

Figure 7: Gaurav long range glide aerial Bombs (ref. 14)

Parachutes

India has successfully developed through DRDO a variety of parachutes to drop men, materials and even heavy vehicles including battle tanks and guns. Combat Free Fall (CFF) (Fig. 8) systems is another unique contribution by DRDO to drop soldiers close to the border of in enemy territory, dropped from high altitude above 30,000 Ft. DRDO has also developed aerostat and balloon barrage for surveillance around strategic assets including Airports, seaports etc.

Figure 8: Combat Free Fall (CFF) (ref. 15)

Aerospace technology sector has emerged as a green field, and it could offer opportunities for stealth platforms such as fighter aircraft with stealth capabilities and drones and other aerial platforms which cannot be detected by enemies. Artificial Intelligence (AI) and Quantum Technology (QT) applications in aerospace sector will further augment the power of aerospace technology. In the field of materials opportunities exist for high temperature tolerant materials, smart materials like shape memory alloy for self-healing, stealth coating materials to reduce the RCS signals, meta materials, nano materials, anti-corrosive materials and anti-fouling materials and Quantum materials will be potential areas of future.

AI & Quantum Technology (QT)

Application of Artificial Intelligence (AI) integrated with Aerial Platform will augment the autonomous functions, decision support and combat efficiency. Similarly, QT including Quantum Computing, Quantum Communication and Quantum Sensing will further bring new dimension in Warfare.

Students, you are fortunate to be in this domain of aerospace in which you can make a mark by developing innovative, disruptive and novel technologies, which will have both Defence and civilian applications. I compliment the students at Amity Institute of Aerospace Engineering for this welcome initiative of creating a platform through this journal, which I wish, will reach thousands of students not only within Amity Group but across the globe.

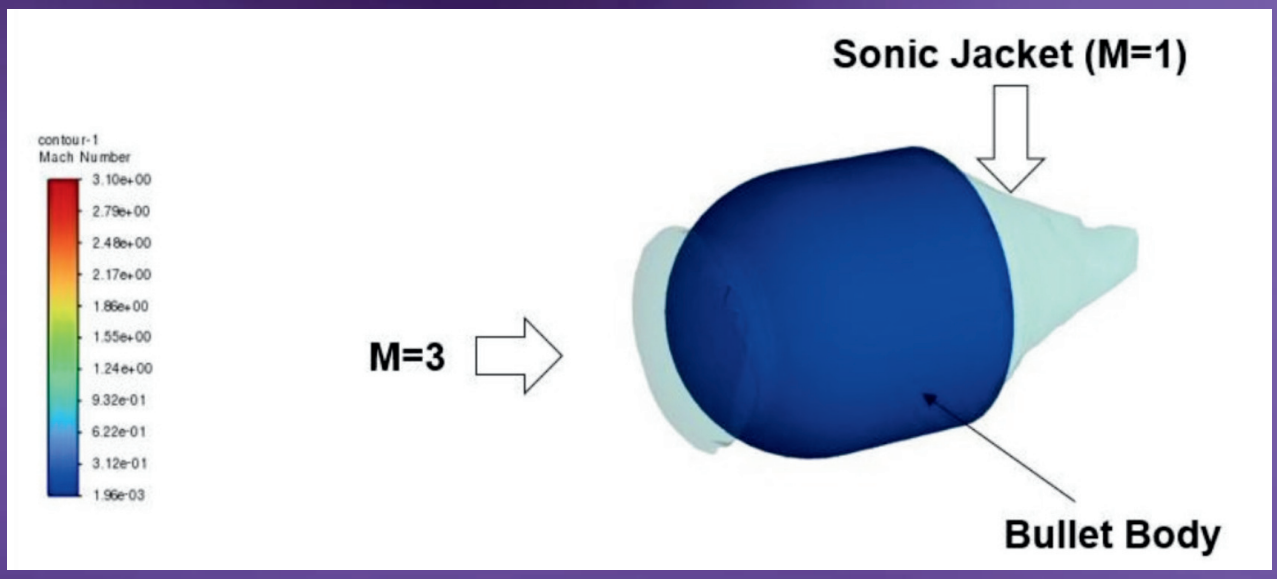
SONIC RING : The veil of Mach 1

When an object races through the air at several times the speed of sound, the familiar rules of aerodynamics begin to break down. At these hypersonic velocities, air is no longer a smooth, invisible medium; it becomes a dense, reactive field of compressed gas, shock waves, and heat. In this extreme environment, researchers have uncovered a subtle but transformative phenomenon: the “Sonic Ring.”

The Sonic Ring describes a region where the surrounding air reaches sonic conditions (Mach 1) not directly on the surface of a vehicle, but slightly away from it. Because all real fluids are viscous, the air just next to a solid body slows to zero velocity, forming what is known as the no-slip boundary layer. As we move away from the surface there lies a band of points where the airflow locally attains the speed of sound. Connecting these points forms a continuous ring, or in three dimensions, a “Sonic Jacket,” that envelops the vehicle like an invisible acoustic shell.

This region is not just a curios event; it governs how energy and heat move around a vehicle traveling at hypersonic speeds. As the freestream flow turns around the body, it compresses and produces strong shock waves. These shocks generate entropy waves—disturbances that carry thermal energy—resulting in intense aerodynamic heating. The standoff distance of the Sonic Ring, or the gap between the vehicle surface and the Mach 1 contour, determines how close this high-entropy zone lies to the structure. A smaller standoff distance means the hot, compressed gas sits closer to the surface, amplifying heating and thermal stress.

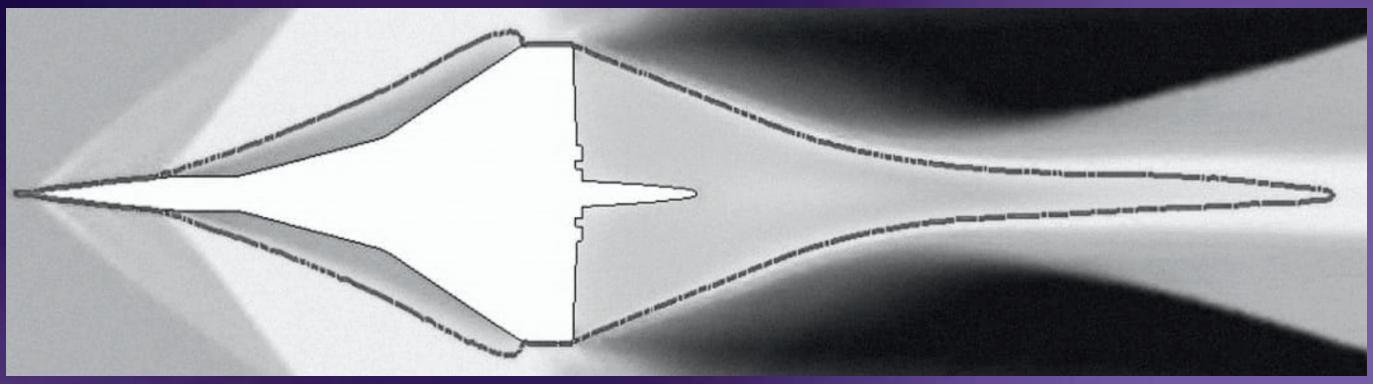
The physics behind this phenomenon are rooted in the principle of streamtube choking, where localized compression forces the flow to reach sonic conditions. This process, driven by variations in temperature, viscosity, and pressure ratio, defines the formation and stability of the Sonic Ring.

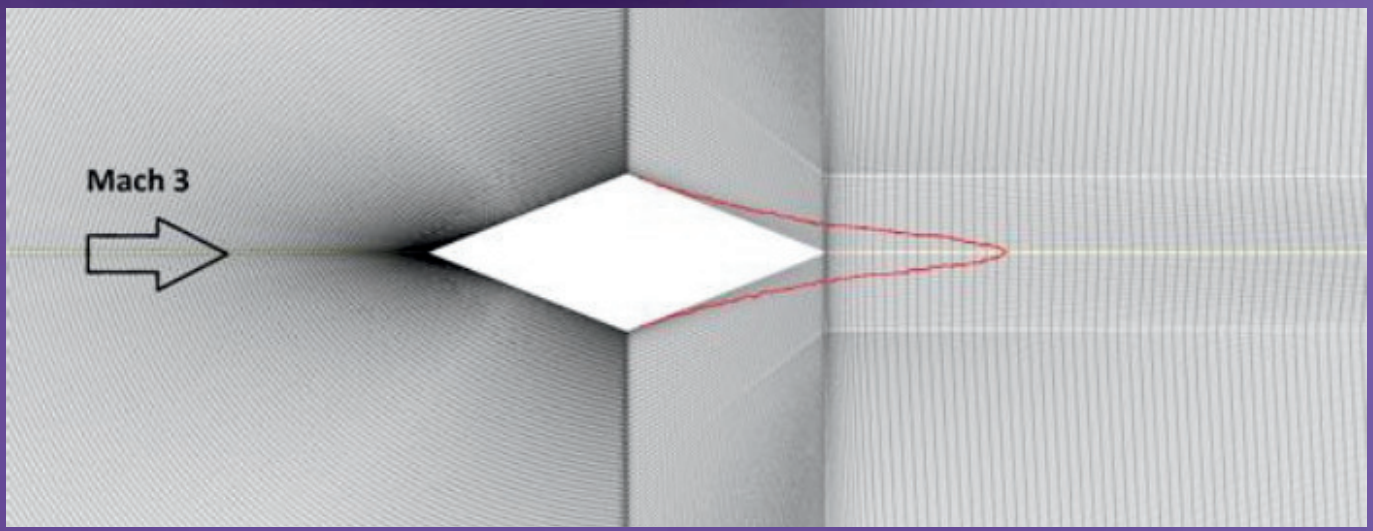


If the total-to-static pressure ratio exceeds a critical limit, the flow cannot accelerate further and “chokes,” creating a sonic barrier. Around this threshold, the ring manifests as a delicate transition zone between subsonic and supersonic regimes.

By manipulating the standoff distance through geometric shaping or by adjusting flow parameters such as gas composition or temperature, engineers could potentially control the position of the Sonic Ring. Moving it outward could expand the protective buffer of air between the hot, shock-dominated zone and the vehicle surface, reducing heat transfer and material stress. Bringing it closer might enhance lift and flow attachment, improving aerodynamic performance in certain regimes.

The Sonic Ring thus represents both a scientific insight and an engineering opportunity. It unites fluid mechanics, thermodynamics, and geometry into a single framework that explains how hypersonic vehicles interact with the air that resists them. Understanding the Sonic Ring could redefine how we design and protect vehicles in the unforgiving frontier of hypersonic flight.





HAL MARUT

The First Indigenous Jet Fighter

A SYMBOL OF AMBITION IN A YOUNG REPUBLIC

When India achieved independence, its skies were guarded by foreign aircraft. Yet by the early 1960s, a dream took shape in the hangars of Hindustan Aeronautics Limited (HAL) — to build a jet fighter designed by India, for India. The result was the HAL HF-24 Marut, the nation's first indigenous jet fighter.

Designed under the guidance of renowned German engineer Kurt Tank, who had once built the Focke-Wulf 190 during World War II, the Marut represented India's early engineering courage. It first flew in 1961, achieving speeds of Mach 1 and entering service in 1967.

Despite its underpowered engines (the Rolls-Royce Orpheus 703), the Marut proved its worth in the 1971 Indo-Pak War, carrying out ground attack missions with reliability and precision. It marked India's first step toward self-reliance in military aviation — a vision decades ahead of its time.

"The Marut wasn't perfect, but it proved that Indian skies could be guarded by Indian wings."

The Marut's program cultivated invaluable expertise in aerodynamics, materials, and systems integration — foundations upon which India's future aircraft, from the Dhruv to the Tejas, would later soar.

HAL TEJAS

India's Light Combat Aircraft

FROM DEPENDENCE TO DOMINANCE

The HAL Tejas embodies the spirit of modern India — agile, innovative, and determined. Conceived in the 1980s as a replacement for the aging MiG-21 fleet, Tejas became the cornerstone of India's indigenous fighter development.

Developed by the Aeronautical Development Agency (ADA) and built by HAL, Tejas features fly-by-wire flight control, composite airframe, and glass cockpit avionics — technologies that place it among the most advanced light combat aircraft in its class.

After its maiden flight in 2001, Tejas entered service with the Indian Air Force in 2016, and later with the Indian Navy in a navalized variant. The Tejas Mk-1A, with enhanced radar, electronic warfare suite, and air-to-air refueling, represents a leap toward combat-ready self-reliance.

In the 21st century, Tejas is not merely an aircraft; it's an assertion of sovereignty. It has reduced foreign dependence and inspired India's next generation of aerospace engineers.

"From concept to combat-ready — Tejas is not just an aircraft, it's a statement of capability."

Its successors, Tejas Mk-2 and Twin-Engine Deck-Based Fighter (TEDBF), promise to further bridge the gap between fourth- and fifth-generation performance — solidifying India's position as a designer, not just a user, of frontline aircraft.

INS VIKRANT

Indigenous Aircraft Carrier

INDIA'S PRIDE ON THE HIGH SEAS

When the Indian tricolour first unfurled aboard the INS Vikrant (IAC-1) in 2022, it marked not just the commissioning of a warship — but the emergence of India as a true blue-water naval power capable of designing and building its own aircraft carriers.

Constructed by Cochin Shipyard Limited (CSL) under the guidance of the Indian Navy's Directorate of Naval Design, the Indigenous Aircraft Carrier embodies 21st-century Indian engineering.

With a displacement of 43,000 tonnes, 262 m length, and 29 knots top speed, Vikrant is a floating airbase equipped to operate MiG-29K fighters, Kamov-31 AEW helicopters, and future carrier-borne aircraft like the TEDBF.

"INS Vikrant is not merely a ship — it is a symbol of national capability, crafted in Indian steel and powered by Indian resolve."

Nearly 76 percent of the carrier's components are indigenous — from its hull steel developed by the DRDO and SAIL to advanced sensors, cables, and aviation facilities produced by Indian industries. The project engaged over 500 domestic firms and 2,000 SMEs, creating a ripple effect across India's maritime ecosystem.

Operationally, Vikrant extends India's naval reach deep into the Indian Ocean, ensuring sea-lane security and rapid deployment during crises. It reinforces India's commitment to safeguarding its maritime borders and supporting allies in the Indo-Pacific.

"Vikrant sails as a testament to what India can achieve when its science, industry, and spirit unite toward a common horizon."

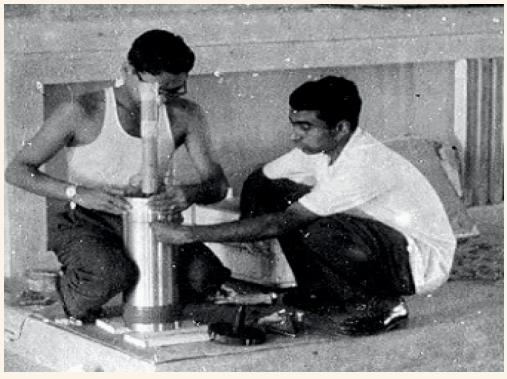
As the first indigenous aircraft carrier, INS Vikrant stands alongside the Tejas, Dhruv, Arjun, and AMCA as a living emblem of Atmanirbhar Bharat — proof that India no longer just equips its defenders, but engineers its destiny.


AKASHGANGA
AKASHGANGA
AKASHGANGA

INDIA'S CONTRIBUTION IN DEFENCE TECHNOLOGY

From being an Import oriented country of critical technologies to developing advanced indigenous platforms. India came a long way, owing success to all project leaders such as Dr. A. P. J. Abdul Kalam, Dr. Homi J. Bhabha, Dr. Vikram Sarabhai, Dr. V. S. R. Arunachalam, and many more prominent personalities. The vision of Atmanirbhar Bharat (Self-Reliant India) and the Make in India initiative have accelerated this journey, ensuring that the country not only secures its borders but also contributes to global defence markets.

One of the most significant achievements is the development of indigenous missile systems in the famous IGMDP program. The Agni and Prithvi series established India's strategic deterrence, while the BrahMos supersonic cruise missile, developed jointly with Russia, is among the fastest and most precise in the world. The Akash surface-to-air missile further strengthens India's air defence.



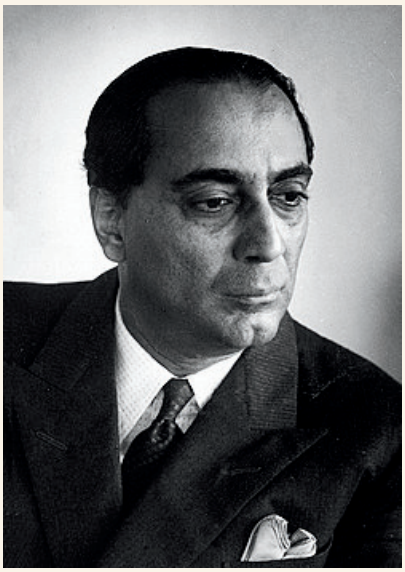


Fig: Dr. A. P. J. Abdul Kalam (above)
Dr. Homi J. Bhabha (Right)
Dr. Vikram Sarabhai (Extreme Right)

In aerospace, the Tejas Light Combat Aircraft (LCA Mk1, Mk2 being built) showcases India's engineering excellence, while the Prachand Light Combat Helicopter is designed for high-altitude operations. Naval strength has been boosted with the INS Arihant, India's first indigenously built nuclear-powered submarine, and advanced warships like the INS Vikrant, the country's first indigenous aircraft carrier. ISRO further developed critical cryogenic technologies for it's series of launch vehicles which provides launching capabilities of military and research satellites at sustainable costs.

Anti-Satellite (ASAT) Tests were also tested to safeguard interests in space against enemy probes. AI, Laser technology, Sensor Fusion, Advanced platforms are being developed by DRDO, HAL, ISRO, Other PSUs, MSME startups, etc. TDF and iDEX platforms are there to promote research in the field. Defence exports are rising Rapidly showcasing India's Rise in the Defence Technology

Aditya Chauhan, 1st year (AIAE)

BRAHMOS: THE SUPERSONIC DEMON REVOLUTIONIZING MODERN WARFARE

The BrahMos missile, often referred to as the Supersonic Demon, represents a groundbreaking achievement in military technology, symbolizing the pinnacle of Indo- Russian defense collaboration. This hypersonic cruise missile has emerged as game-changing weapon system that has dramatically transformed strategic military capabilities.

Developed jointly by India and Russia, BrahMos combines the best of both nations' technological expertise. Named after the Brahmaputra and Moscow rivers, the missile is capable of being launched from multiple platforms - land, sea, submarine, and air - making it incredibly versatile.

ISRO's journey from launching Aryabhata in 1975 to achieving the historic Chandrayaan-3 lunar landing, Mangalyaan (MOM) mission, Aditya-L1 solar mission which showcases the power of innovation against all odds. These missions have demonstrated India's capability to execute omplex space explorations with cost-effective precision and earning worldwide respect. ISRO currently holds the position of one of the world's leading space agencies, ecognized for its cost-effective, high-impact missions standing alongside NASA, ESA etc.

Recent successful tests and international interest have further cemented BrahMos reputation as a formidable weapon system. Its continued development and potential export to friendly nations underscore its importance in modern military strategy, earning its nickname as the Supersonic Demon of contemporary warfare.

Most remarkable feature of BrahMos is its unprecedented speed, traveling at nearly 3.5 times the speed of sound (Mach 3.5), which makes it virtually impossible for existing defense systems to intercept.

Russian-Indian BrahMos supersonic cruise missile

The BrahMos anti-ship missile was jointly developed by Russia's Engineering Research and Production Association (NPO) and the Indian Defense Ministry's Defense Research and Development Organization (DRDO)

Specifications

Lift-off weight:	**3,000 kg** (sea-launched version), **2,500 kg** (air-launched version)
Warhead:	**Up to 300 kg**
Flight altitude	**From 5 to 14,000 meters**
Maximum speed:	**Mach 2.8**
Diameter:	**70 cm**
Wingspan:	**1.7 meters**
Range:	**290 km**

Designation

The missile is designed to hit all classes of warships

The missile is fired from mobile self-contained launchers installed onboard submarines, warships and fixed-wing aircraft

History and prospects

The BrahMos Aerospace Private Limited joint venture was established in 1998 and started working on the project

Twenty successful tests were conducted

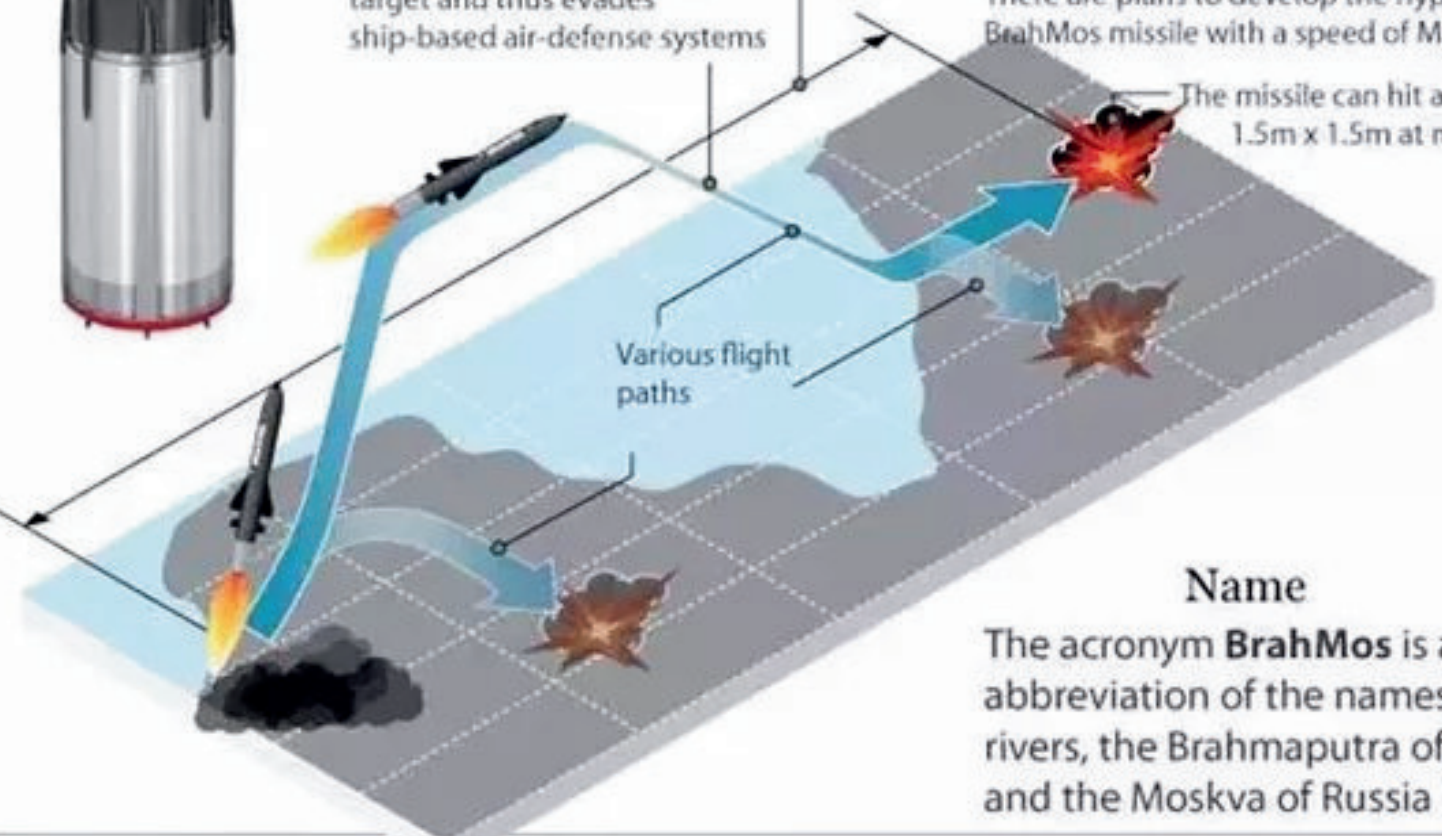
The Indian Air Force has already adopted the missile

BrahMos Aerospace is ready to enter the international market. Prospective clients include 14 countries

The Indian Air Force requires 1,000 BrahMos missiles

In all, 2,000 Brahmos missiles can be exported

There are plans to develop the hypersonic BrahMos missile with a speed of Mach 5



Name

The acronym **BrahMos** is an abbreviation of the names of two rivers, the Brahmaputra of India and the Moskva of Russia

POKHRAN

When the desert awoke

The Thar desert is known for Silent winds, sand dunes, and the sun's rays hammering endless sands. But twice in history, a roar broke the stillness, permanently altering India's course. It was Pokhran. Under a veil of secrecy, Indian scientists trained for the Smiling Buddha mission in 1974. A deep rumble arose from beneath the desert on the morning of May 18. The nuclear era had arrived in India. When told, Prime Minister Indira Gandhi merely remarked, "The Buddha has smiled." For Indians, it was a moment of intense pride a sign that the country could forge its own course while the rest of the world responded with sanctions and mistrust.

Pokhran resurfaced almost twenty-four years later. Operation Shakti was conducted in May 1998 was conducted in the utmost secrecy so careful that even the US satellites were misled. Only at night did soldiers move equipment, and camel herds covered their tracks. Then the sands were shaken by five nuclear devices: a thermonuclear bomb, 3 sub-kiloton, and a fission. Prime Minister Atal Bihari Vajpayee declared in Parliament that "India is now a nuclear weapons state," while Dr. A.P.J. Abdul Kalam and his team were hailed as heroes. India also pledged nuclear restraint while upholding credible deterrence by announcing a No First Use (NFU) policy..

The tests brought sanctions, but also respect. They became a symbol of India's scientific self-reliance and strategic autonomy, inspiring advancements in missile systems like the Agni and Prithvi series. What began under secrecy grew into confidence: India could not just defend itself, but also shape global security dialogues.

Pokhran is not just a test site. It is the story of courage, of scientists who dared to dream, and of a nation's refusal to bow. Each tremor beneath that desert was India's heartbeat, declaring to the world: "We are strong, self-reliant, and here to stay."

WHEN MACHINES DECIDE WHO LIVES AND WHO DIES: THE RISE OF AI IN WARFARE

In the age of AI, the battlefield is transforming faster than ever before. Autonomous drones can identify and strike targets with exteme precision. Algorithms can predict enemy movements, jam communications, and even recommend tactical maneuvers in real time. The promise of this technology is efficiency, speed, and the reduction of risk to soldiers. However the real point to ponder upon is what happens when machines, not humans, decide who lives and who dies?

Artificial intelligence is now deeply woven into modern warfare. From reconnaissance drones that scan vast terrains to missile defense systems reacting faster than any human ever could, AI already has a front row seat in decision-making. Military leaders argue that automation saves lives by minimizing human error and keeping soldiers at arms length way. But as systems grow more autonomous, the line between human oversight and machine control becomings a rope that mankind keeps on skipping. The notion that a computer is making a kill decision and it decides weather a life is worth living or not based solely on pattern recognition, probability scores, or target classification—raises profound ethical and moral concerns.

Machines do not understand compassion, context, or even the value of human life. They operate according to data, not conscience. In war, that can mean a deadly mistakes. A faulty algorithm might misidentify a civilian as a combatant, and no one could fully explain why—the "black box" nature of many AI systems makes accountability elusive. Who bears responsibility for such an act? The programmer? The commander who deployed it? Or the government that authorized its use?

As responsibility becomes diffused, the traditional moral and legal frameworks of warfare begin to collapse.

Legal scholars argue that fully autonomous weapons violate the principles of international humanitarian law, which demand distinction between combatants and civilians, proportionality in force, and human accountability. Without meaningful human control, these principles risk becoming theoretical rather than practical. Moreover, the deployment of AI weapons could trigger a dangerous arms race, as nations rush to outdo each other in developing smarter, deadlier machines—each update making the prospect of human control more remote.

There is also the psychological danger of distance. When decision-making becomes a matter of clicking a button—or worse, allowing a machine to click it—war becomes easier to wage. The emotional and moral weight of killing, long a restraint on human aggression, begins to fade. If AI warfare lowers the cost of combat, leaders might resort to violence more readily, trusting algorithms to do their bidding.

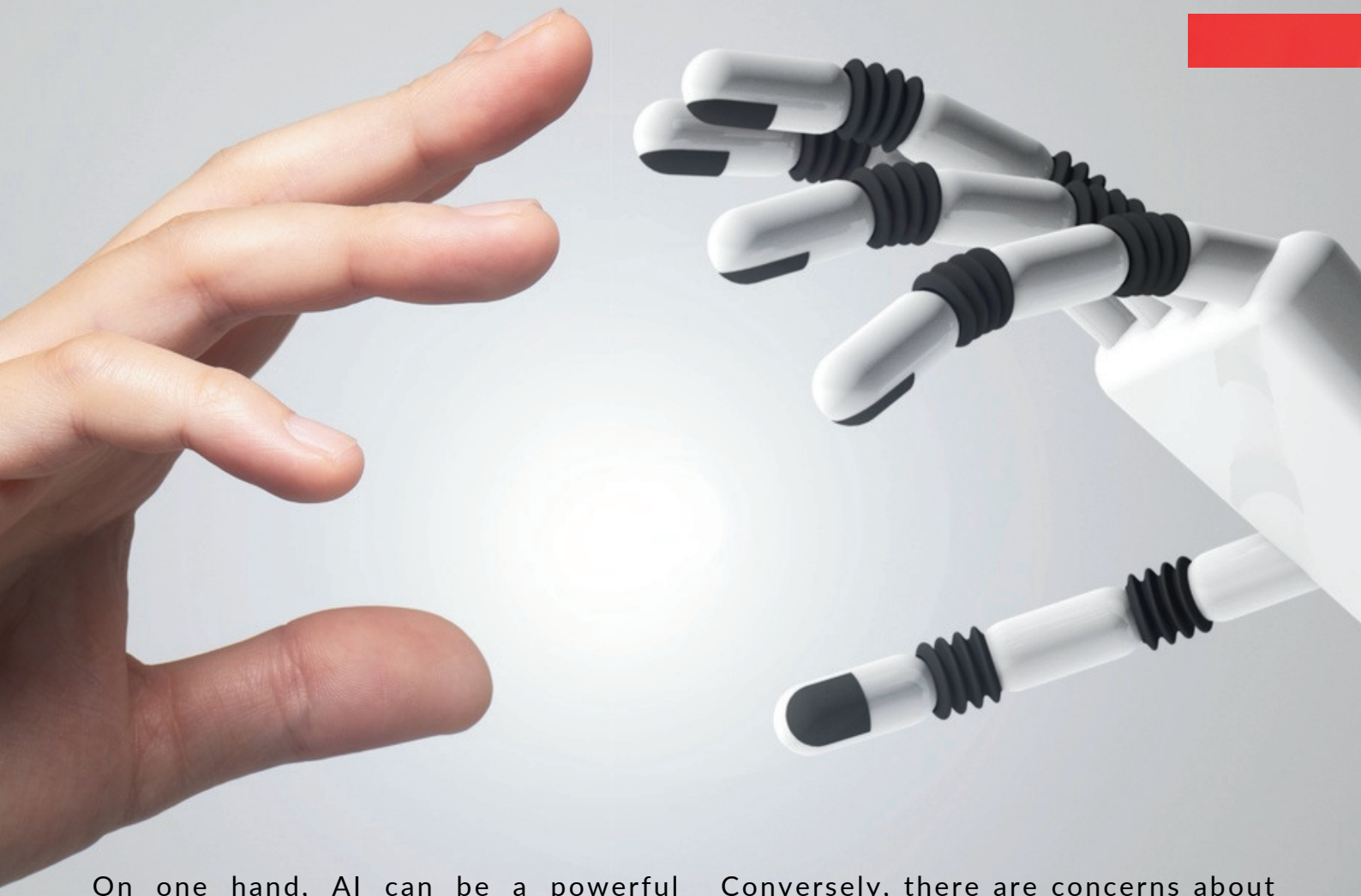
The debate over AI in warfare is not just about technology; it's about humanity. Efficiency should never come at the cost of moral responsibility. As powerful nations and defense companies push the limits of autonomy, the world faces a pivotal choice: do we enshrine human judgment as the final authority in matters of life and death, or do we allow machines to decide for us? The answer will define not just the wars of the future, but the kind of civilization we choose to be.

RETHINKING INTELLIGENCE: HOW AI IS INFLUENCING OUR COGNITIVE ABILITIES

Let's be real. It's 1 AM, the assignment submission is due tomorrow, and a blank cursor is mocking you. The temptation to turn to an AI for a "starting point" is immense. In today's academic world, AI is no longer a futuristic concept; it's a powerful tool sitting in the next tab over.

The critical question we all face, however, is not if we should use it, but how. Are we leveraging it to become next-level thinkers, or are we simply becoming skilled operators of a sophisticated copy-paste machine?

From personalized learning algorithms to advanced recommendation systems, AI offers unparalleled access to information and novel ways of problem-solving. However, this transformative technology also presents a double-edged sword, prompting crucial questions about its long-term effects on young minds.



On one hand, AI can be a powerful enhancer of cognitive abilities. Tools that personalize educational content can foster deeper understanding and critical thinking by adapting to individual learning styles. AI-powered applications that automate repetitive tasks can free up cognitive resources, allowing youth to focus on higher-order thinking, creativity, and complex problem-solving.

Conversely, there are concerns about potential drawbacks. Over-reliance on AI for tasks like information retrieval or even basic calculations could lead to a decline in certain fundamental cognitive functions. If AI consistently provides immediate answers, it might reduce the need for sustained effort in research, memory recall, and analytical thinking.

This "outsourcing" of cognitive load could potentially weaken neural pathways associated with these skills. There's also the risk that constant exposure to AI-curated content could limit exposure to diverse perspectives, potentially hindering the development of independent thought and critical evaluation.

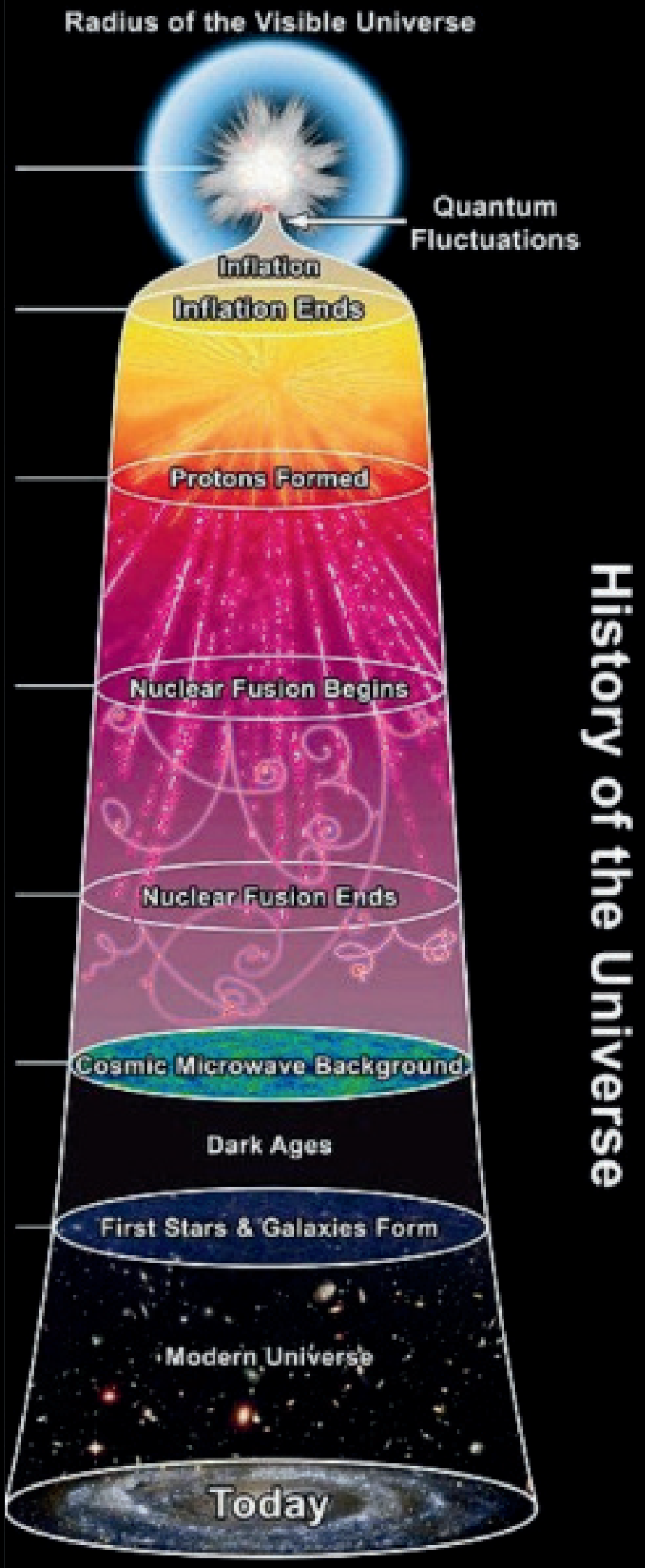
The key lies in fostering a balanced approach. Educators and parents must guide youth in using AI as a tool for augmentation rather than a substitute for effortful thinking. Encouraging critical engagement with AI outputs, promoting off-screen activities, and emphasizing foundational cognitive skills like problem-solving, creativity, and analytical reasoning will be crucial. The future cognitive landscape of youth will largely depend on how we integrate AI responsibly, ensuring it serves to enrich, rather than diminish, human intellect.

QUANTUM FLUCTUATIONS IN DARK MATTER: A HYPOTHETICAL CATALYST FOR THE BIG BANG

The formation of universe from the well-known big bang theory can be thought of as due to the "Quantum vacuum fluctuations in dark matter in the quantum field". Quantum fluctuations, governed by the uncertainty principle $\Delta E\ \Delta t \gtrsim \hbar/2$, are intrinsic features of quantum fields. In a pre–Big Bang vacuum dominated by dark matter, these fluctuations could have introduced irregularities in the density field that gravity naturally amplified. Unlike ordinary matter, dark matter interacts almost exclusively through gravitation, making its energy variations a fertile ground for instability. A fluctuation in energy density can be expressed as –

$$\delta\rho/\rho \propto (H/2\pi)\dot{\phi}$$

where H is the Hubble rate at quantum scales and $\dot{\varphi}$ is the dynamic parameter of the underlying field. Interpreted in a dark matter context, such perturbations could have exceeded a threshold $\delta\rho/\rho \gtrsim 1$, destabilizing the vacuum state. If the vacuum energy density is written as $\rho v\ \Lambda$, a fluctuation coupled to gravity might shift it into a runaway expansion, resembling inflation. This suggests a scenario where dark matter, typically studied as an outcome of the Big Bang, instead catalyzed its eruption. The invisible scaffolding of dark matter, agitated by quantum tremors, would then bridge two domains of physics: the microscopic randomness of quantum mechanics and the macroscopic birth of the cosmos itself.


Radius of the Visible Universe
Quantum Fluctuations
Inflation
Inflation Ends
Protons Formed
Nuclear Fusion Begins
Nuclear Fusion Ends
Cosmic Microwave Background
Dark Ages
First Stars & Galaxies Form
Modern Universe
Today
History of the Universe

3rd International Conference on Modern Research in Aerospace Engineering (MRAE 2025)

The 3rd International Conference on Modern Research in Aerospace Engineering (MRAE 2025) was held on 25–26 September 2025 at Amity University Uttar Pradesh, Noida. Centered around the theme "Promoting Innovation and Research in Aerospace Engineering for Viksit Bharat," the conference brought together researchers, academicians, and students from across India and abroad to share ideas and showcase their work in emerging areas of aerospace science and technology.

Over 200 presentations were delivered across multiple parallel sessions in both in-person and virtual formats. Participants represented a wide range of universities and research organisations, and presented papers on topics spanning aerodynamics, propulsion, CFD, aerospace materials, AI applications, UAV design, flight dynamics, and space systems. The diversity and creativity of the research presented reflected the growing momentum of aerospace innovation in India and beyond.

The conference featured keynote and invited lectures by eminent experts, including:

- Prof. R. S. Pant (IIT Bombay) – "Hybrid Electric Multi-Lobed Airships for Cargo Transportation"
- Dr. Sanjay M. R (KMUTNB, Thailand) – "Natural Fiber Composites for Sustainable Development and Engineering Applications"
- Dr. Om Prakash (UPES, Dehradun) – "ANN (AI) Based Rocket Performance Prediction"
- Prof. D. K. Chakrabarty (IIT Guwahati) – "Thermal Analysis of Hybrid Propellant Rockets"
- Dr. Rohit Singh (DRDO) – "Structural Design and Aeroelastic Considerations in High-Speed Aircraft"

The conference proceedings were published in Springer (Scopus-indexed), with the top ten papers recommended for publication in the Journal of Aeronautics, Astronautics & Aviation (SCI-Q3)

The event was professionally hosted and managed by the students and faculty of the Aerospace Engineering Department, who ensured seamless coordination, organization, and hospitality throughout both days. Their collective effort, along with the active participation of students from multiple universities, contributed greatly to the success of MRAE 2025—marking it as a proud and memorable milestone for the department.

Amity Aerospace Researcher's Landmark Study Recognized in Journal of Applied Thermal Engineering and Circulation Research

ELSEVIER

Applied Thermal Engineering
Volume 280, Part 5, 1 December 2025, 128471

Research Paper

Microbubble dynamics in hydrocarbon fuels under reduced pressure: experimental insights into acoustic softening and Sanal flow choking

Dhruv Panchal [a b], Sanjay Singh [a], Rakesh Kumar [c], V.R. Sanal Kumar [a]

Meeting Abstract: Abstracts From the American Heart Association's Basic Cardiovascular Sciences Scientific Sessions 2025: Advances in Cardiovascular Science: From Discovery to Translation

ABSTRACT | Originally Published 8 October 2025 |

Check for updates

Abstract Fri015: Microbubble-Induced Shock Waves in Blood: Investigating Multiphase Sanal Flow Choking During Decompression

SANAL KUMAR V R, Ph.D., PDF, Pradeep Radhakrishnan, PhD, MB ChB, MBA, MD, MBBS, Dhruv Panchal, M.Tech, (Ph.D), Raunak Sharma, B.Tech, (M.Tech), Yaman Vohra, (B.Tech), Shivansh Rana, (B.Tech), Vinay Dekkala, M.Tech, (Ph.D), Yash Raj, M.Tech., (Ph.D), and Sanjay Singh, Ph.D | AUTHOR INFO & AFFILIATIONS

35 *Important Dates*

AVIATION FORUM

8–12 June 2026

San Diego, California

Dates to Remember

Abstract Submission Begins:
16 September 2025

Abstract Deadline:
13 November 2025, 8 p.m. ET, USA

Author Notification:
9 February 2026

Manuscript Deadline:
5 May 2026, 8 p.m. ET, USA

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- Plasmadynamics and Lasers (click to show)
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- Transformational Flight (click to show)
- Uncrewed and Autonomous Systems (cli
- Unidentified Anomalous Phenomena (cli

2025 Region VII Student Conference

1 December 2025 – 2 December 2025

University of Sydney Student Branch, Sydney, Australia & Online

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