ISSN 2230-9225

SP's aviation

AN SP GUIDE PUBLICATION

www.sps-aviation.com

VOL 29 ISSUE 9 • 2026

SHARP CONTENT F N C E

SPECIAL ISSUE
94TH ANNIVERSARY OF INDIAN AIR FORCE

EXCLUSIVE

"AS THE INDIAN AIR FORCE ENTERS ITS 95TH YEAR, IT IS ON COURSE TO BECOME MORE CAPABLE, MORE NETWORKED AND MORE SELF-RELIANT THAN AT ANY POINT IN ITS HISTORY"

— AIR CHIEF MARSHAL A.P. SINGH, CHIEF OF THE AIR STAFF, IAF

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Subscription/Circulation
Annual Inland: ₹2,400 • Foreign: US$320

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Under the leadership of Air Chief Marshal A.P. Singh, the Indian Air Force continues to soar high and has transformed into a formidable global aerospace power, driven by the integration of next-generation technologies across its operational and strategic spectrum.

(***Cover Photo**: Indian Air Force)*
COVER DESIGN BY: *SP's Team*

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AT THE CONTROLS OF THE INDIGENOUS TEJAS, THE CHIEF OF THE AIR STAFF, AIR CHIEF MARSHAL A.P. SINGH, TAKES TO THE SKIES FOR HIS LAST FIGHTER SORTIE — A DEFINING MOMENT IN A DISTINGUISHED CAREER SHAPED BY AN ABIDING PASSION FOR FLYING AND AN UNWAVERING COMMITMENT TO SERVING THE NATION.

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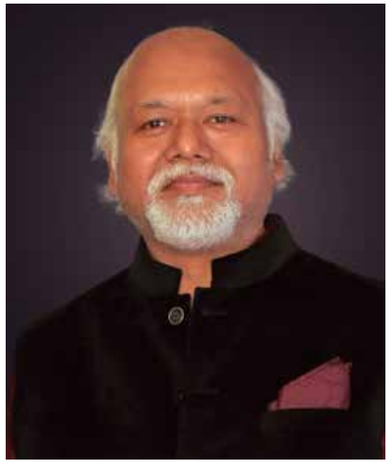
BACA Awards 2017 SPECIAL CONTRIBUTION TO BUSINESS AVIATION

Aerospace Media Awards — Asia
11th February 2020 – Singapore

Air Chief Marshal A.P. Singh completes his tenure and hands over the baton on October 31, 2026. Among the most affable and charming Chiefs the Force has known, he leaves behind the legacy of a true 'leader', a consummate professional and a complete gentleman. We wish him the very best in all his future endeavours!



THE LEAD STORY IS AN EXCLUSIVE INTERVIEW WITH OUTGOING Chief of the Air Staff, Air Chief Marshal A.P. Singh, reflecting on his tenure and outlining the Indian Air Force's long-term readiness priorities. Citing Operation Sindoor as a defining milestone, he details a modernisation strategy centred on technological sovereignty, operational superiority and accelerated capability enhancement through indigenous aircraft, weapons, radars and air defence systems. He discusses the roles of drones, manned–unmanned teaming and Artificial Intelligence in warfare, alongside technological and cyber vulnerabilities. Addressing China's advanced fighter programmes, he emphasises integrated combat capabilities over platform generations, reaffirming that human judgement, leadership and skilled personnel will remain central to the IAF.

Reporting on the IAF Day press conference, Manish Jha highlights CAS's call to prioritise indigenous fighter programmes amid modernisation challenges. With 29 squadrons against the sanctioned strength of 42, the IAF faces serious operational pressures. The Chief stressed the need to streamline the Tejas Mk1A, Tejas Mk2 and Advanced Medium Combat Aircraft (AMCA) programmes, while advancing the Multi-Role Fighter Aircraft (MRFA) acquisition to bridge capability gaps. Focused priorities and predictable delivery timelines, he argues, are essential to meeting evolving regional national security challenges.

Former Chief of the Air Staff, Air Chief Marshal V.R. Chaudhari (Retd), traces the evolution of the IAF's international engagements through bilateral and multilateral exercises. From early initiatives such as Garuda and Cope India to drills including Pitch Black and Red Flag, he charts the expansion of India's air power diplomacy. The account culminates with Exercise Tarang Shakti 2024, India's first multinational air combat exercise, hosted in two phases to accommodate partner air forces and strengthen defence cooperation.

Amid the ongoing global debate on manned versus unmanned systems, we have included two expert analyses on this subject. Air Marshal A.K. Bharti (Retd), the face of Operation Sindoor, advocates integrating manned platforms and unmanned systems rather than treating them as alternatives. Although drones and unmanned aerial systems (UAS) have demonstrated operational value in conflicts, they cannot independently secure strategic victory or replace human judgement, ethics and improvisation. As counter-UAS technologies, electronic jamming and advanced radars threaten to erode drones' cost and stealth advantages, he identifies Manned-Unmanned Teaming (MUM-T) as essential to combining human judgement with unmanned efficiency.

Group Captain Akash Godbole similarly views unmanned aircraft as force multipliers, not replacements for manned platforms. Drawing lessons from modern conflicts, he argues that low-cost drones widen operational options, but strategic outcomes still depend on manned capabilities and command structures. For India, effective MUM-T requires addressing fighter squadron shortages, developing resilient data-linked kill webs, establishing clear operational doctrines and training commanders to coordinate integrated combat systems.

In remembrance, Air Vice Marshal Prashant Mohan (Retd) pays tribute to the iconic MiG-21, which officially retired from IAF service in September 2025 after more than six decades. Drawing on personal experience as a trainee, instructor and squadron commander, he recalls the aircraft's robustness, its role in conflicts and its contribution to training generations of fighter pilots.

All this and more in this issue of *SP's Aviation*. Welcome aboard and we wish you safe landings!

JAYANT BARANWAL
PUBLISHER & EDITOR-IN-CHIEF

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EXCLUSIVE

AIR CHIEF MARSHAL A.P. SINGH,
CHIEF OF THE AIR STAFF, INDIAN AIR FORCE

PHOTOGRAPH: INDIAN AIR FORCE

"HUMAN ASSETS REMAIN, AND WILL REMAIN, THE MOST IMPORTANT ELEMENT OF THE INDIAN AIR FORCE" — AIR CHIEF MARSHAL A.P. SINGH

Speaking to **Jayant Baranwal, Editor-in-Chief** of ***SP's Aviation,*** on the occasion of the 94th Indian Air Force Day, the outgoing **Chief of the Air Staff, Air Chief Marshal A.P. Singh,** reflects candidly on his tenure, outlines his vision for the IAF, and details the modernisation plans that will build a future-ready force

SP's Aviation (SP's): How would you define your tenure as the Chief of our air force?
– What stands out as the single highest peak, and
– The toughest challenge of your journey?

Chief of the Air Staff (CAS): I would define my tenure as a period in which the Indian Air Force proved itself in combat while transforming itself for the future, and did both at the same time. Our responsibility has been to remain operationally ready for today's contingencies while preparing the Air Force for tomorrow's wars.

The single highest peak, without doubt, was Operation Sindoor. Our responsibility was clear: to achieve the objectives assigned to us by the national leadership, while retaining the ability to respond to any escalation. The IAF delivered precise and calibrated effects at considerable ranges, struck with indigenous weapons deep into enemy territory, and protected our own airspace with a home-grown, networked air defence shield, all with a commitment to zero collateral damage that reflected the ethos of our Service. Perhaps most significantly, the operation restored to national consciousness the immense impact of offensive air power. Seeing every element of the Air Force, and our sister Services, work together as one was the proudest moment of my service.

As for the toughest challenge, I would rather refer them to as demanding moments. Sustaining combat readiness while transforming the force at the pace modern warfare demands is never easy. But, I was blessed with an extraordinary team at Air Headquarters and across our Commands. Above all, I had the privilege of commanding air warriors whose professionalism, dedication and spirit turned every challenge into an opportunity. Whether it was in the skies during Operation Sindoor, on remote locations in harsh weather, or in a maintenance hangar late into the night, they rose to every occasion. When you command such men and women, challenges do not overwhelm you, they bring out the best in the entire Air Force.

> "I had the privilege of commanding air warriors whose professionalism, dedication and spirit turned every challenge into an opportunity"

SP's: Would you like to comment on the progress of overall modernisation process of Air Force?

CAS: India's quest for advanced and critical technologies is central to building a credible, future-ready aerospace power. The Indian Air Force is driving a comprehensive modernisation strategy built on three pillars: technological sovereignty, operational superiority and rapid capability enhancement. That strategy is now visibly turning plans into capability.

Our modernisation is anchored in a clear long-term vision. The IAF has formulated a Capability Perspective Plan-2047, which sets out long-term priorities based on emerging technologies. It feeds into our intervening long-term plans, which run on ten-year cycles and are updated periodically. Every acquisition we make today is therefore a deliberate step towards the Air Force the nation will need in the decades ahead.

The progress is already significant. We have made substantial gains in surveillance radars, surface-to-air guided weapons, utility and combat helicopters, light combat aircraft and unmanned platforms. Indigenous radars designed by DRDO, including the Ashwini, Rohini and Mountain Radars, are steadily entering service. The Defence Acquisition Council has cleared Astra Mk-II missiles

for the IAF. It has also accorded Acceptance of Necessity for the Multi-Role Fighter Aircraft, for combat missiles with deep-strike capability, and for High Altitude Pseudo Satellites for persistent surveillance. Over the next few years, we expect further progress in medium helicopters, air-to-air and air-to-ground weapons, combat platforms, airborne radars, self-protection suites, secure communication systems and networked operations.

Our priorities are clearly defined. We are enhancing our combat potential through contemporary fighter platforms and long-range, high-precision aerial weapons with stand-off ranges. We are also strengthening self-protection systems and secure communication, networked operational capability, and combat enablers such as airborne early warning and control aircraft and in-flight refuellers. Unmanned systems capable of operating in a contested environment are another priority. One area has emerged as especially critical: multi-layered ground-based air defence, backed by gap-free surveillance and built to be mobile and easily deployable.

Increasingly, this modernisation is being delivered from within India. A majority of our projects are sourced indigenously. Where critical technologies are not yet available at home, or certain platforms are unlikely to be available in the foreseeable future, we explore appropriate global options. Even then, each acquisition carries commensurate plans to strengthen the domestic industrial ecosystem.

Modernisation is a continuous journey, not a destination. As the Indian Air Force enters its 95th year, it is on course to become more capable, more networked and more self-reliant than at any point in its history. It remains ready to meet whatever challenges the future may bring.

FOSTERING INTERNATIONAL CO-OPERATION: (TOP) CAS TAKES A FAMILIARISATION FLIGHT ON AN F-15EX EAGLE II AIRCRAFT; (ABOVE) IAF CHIEF FLIES THE INDIGENOUS TEJAS FIGHTER AIRCRAFT WITH GENERAL TAKEHIRO MORITA, CHIEF OF STAFF, JAPAN AIR SELF-DEFENSE FORCE (JASDF).

SP's: Do you think drones are being overhyped, or are they now essential to the revolution in military affairs?

CAS: I would not describe drones as overhyped. Nor would I call them a magic wand that replaces traditional warfare or a complete substitute for crewed platforms. The truth lies in between, and it is more significant than either extremes. Drones are an essential component of modern warfare and a vital force multiplier. They are also the primary catalyst for a transition towards distributed lethality. Their importance comes not from being the only weapon that matters, but from forcing every other weapon system to evolve. In that sense, drones are the engine driving the current revolution in military affairs.

Recent conflicts around the world, and our own experience in Operation Sindoor, leave little doubt about this. As I have often said, drones have evolved from eyes in the sky to claws in the sky. Beyond persistent, low-cost ISR, they now strike, decoy and saturate. They are the physical manifestation of network-centric warfare, shrinking the time between detecting a target and neutralising it from hours or minutes to seconds. Operation Sindoor demonstrated both sides of this reality. On our side, unmanned systems contributed to success as part of an integrated effort alongside ISR, combat aircraft, precision weapons, electronic warfare and networked command and control. On the adversary's side, the drones launched against us were defeated by the air defence shield I spoke of earlier. A force that ignores drones today does so at its peril, whether it intends to use them or to defend against them.

Yet drones are not replacing conventional air power. I see them as an evolutionary step in air power, not a replacement for it. They reduce, and in some missions eliminate, the risk to human life, and they take on missions that are dull, dirty and dangerous, often at lower cost. But they do not replace the judgement, flexibility and decision-making that a crewed platform provides. Tellingly, the multiple sixth-generation combat aircraft programmes now under way around the world share one common thread. At the heart of each is a manned fighter, working alongside unmanned systems rather than being replaced by them. The future, therefore, is not manned or unmanned. It is manned and unmanned, fighting as a team.

PHOTOGRAPHS: WWW.NELLIS.AF.MIL, IAF_MCC / X

PROMOTING TRI-SERVICE SYNERGY: (TOP) CAS FLEW A MIG-29KUB SORTIE FROM INS VIKRAMADITYA; (ABOVE) CAS VISITED THE LADAKH SECTOR AND INTERACTED WITH IAF AND INDIAN ARMY PERSONNEL DEPLOYED IN THE REGION.

The true revolution lies in integration. Drones deliver their full value only when they are woven together with sensors, secure networks, Artificial Intelligence and other combat assets to generate operational effects at scale. For the IAF, the priority is to build the optimal mix of manned, unmanned and counter-unmanned capabilities, while continuously adapting to the way these systems alter the character of conflict. Since 2019, the IAF has been the lead Service in articulating the Operational Requirements for Manned–Unmanned Teaming to HAL. At Dronathon-2026 in September, we assessed unmanned and counter-unmanned systems from over 20 Indian industry partners under realistic operational conditions. We also released 'The Indian Air Force Unmanned & Autonomous Roadmap' there, to give industry clarity on our priorities.

Drones, then, are neither hype nor a cure-all. They are a transformational force, and their real power lies in how well they are integrated. The IAF is committed to harnessing that power fully, with Indian industry as our partner, so that we stay ahead of the revolution in military affairs rather than reacting to it.

SP's: How do you view the rise of AI, and to what extent could it present opportunities or risks for our Air Force in safeguarding national security?

CAS: Artificial Intelligence represents a critical evolutionary shift in warfare, and the Indian Air Force views its rise with both conviction and clear eyes. AI offers enormous opportunities for operational efficiency and superior decision-making. It also exposes a force to new vulnerabilities, from new vectors of cyber-attack to instability in autonomous systems. The nation that harnesses AI wisely, while guarding against its risks, will hold a decisive edge. Maintaining a competitive edge in AI is therefore essential to safeguarding national security and to ensuring air superiority in the contested environment of the future.

The strategic value of AI lies in a single idea: compressing the time it takes to sense a situation, understand it, decide and act, the cycle we know as the OODA loop. In air warfare, where outcomes can turn in seconds, that compression can be decisive. The opportunities span the entire spectrum of our operations: situational awareness, decision speed, mission planning, ISR exploitation, logistics, predictive maintenance and autonomous operations. Equally important, AI can be inserted across our existing fleets and systems without waiting for complete platform replacement. This makes it one of the fastest routes to enhancing capability in the medium term.

We are equally clear-eyed about the risks. AI introduces vulnerabilities involving data quality, adversarial manipulation, cyber-attack, model failure, lack of explainability, automation bias and dependence on vulnerable digital infrastructure. An adversary may try to deceive our algorithms, not just our sensors. These risks must be actively managed through rigorous testing and continuous validation, secure development practices, representative operational data and red-teaming, and, above all, through human oversight. Our principle is firm: AI will assist and accelerate human decision-making, but judgement on mission intent, rules of engagement and accountability will remain with a human being.

This is why the IAF has invested in its own AI ecosystem, including its AI Centre of Excellence, UDAAN, and high-end computing and data capabilities. This matters a great deal. It allows AI solutions to be developed, tested and evaluated within our own operational environment, rather than adopted as black-box technologies whose workings we cannot fully verify. It also means our AI capabilities are built with indigenous expertise and shaped by the operators who will use them.

PHOTOGRAPHS: IAF_MCC / X

LEADING FROM THE FRONT: CAS CHAIRS SOUTH WESTERN AIR COMMAND COMMANDERS' CONFERENCE

AI is neither a threat to be feared nor a technology to be embraced uncritically. It is a capability to be mastered. The IAF is committed to mastering it: harnessing its power to see further, decide faster and act more precisely, while ensuring that it remains secure, reliable and firmly under human control in the service of the nation.

SP's: As per the reports, China seems to be moving ahead with its 6th-Gen fighter programme, having already fielded operational 5th-Gen fighters. How do you perceive these developments?

CAS: China's progress in advanced combat aviation is a development that we monitor closely and evaluate objectively. While we take these technological advancements seriously, air superiority is rarely decided by a generation label or a single platform. As I said in the context of drones, the real power lies in integration. Ultimate combat effectiveness depends on how seamlessly we integrate platforms, sensors, long-range weapons, AI, autonomous systems and resilient networks. It also depends on how rapidly we adapt to counter or outpace the threat through innovative tactics, techniques and procedures. That is where the Indian Air Force's focus lies, and we will ensure that we remain ready for any challenge in our neighbourhood.

SP's: With the overwhelming advent of a broad spectrum of digital activities and platforms, including AI, where will you place human assets in practical terms (we believe human assets still remain the most important, though)?

CAS: I agree entirely: human assets remain, and will remain, the most important element of the Indian Air Force. Digital platforms and Artificial Intelligence are powerful tools. They enhance efficiency, accelerate data analysis and expand what our people can achieve. But they are supporting tools, not replacements. Technology will change the nature of the human role, but it will not diminish the importance of human judgement. If anything, it will make that judgement more valuable.

In a highly automated battlespace, machines will increasingly handle what they do best: high-volume data processing, pattern recognition, correlation and routine optimisation. What becomes scarce, and therefore more precious, is uniquely human. It is the ability to frame the right problem, interpret uncertainty, understand context and make accountable decisions under pressure. That is why we see AI as an augmentation technology. As I said earlier, the decision to employ force, and accountability for it, will always rest with a human being. Human judgement remains the critical fail-safe in strategic decision-making and leadership.

In practical terms, this is reshaping how we prepare our people. Training is evolving beyond platform-specific proficiency towards digital literacy, data awareness, an understanding of AI, and human–machine teaming. Our personnel must be equally comfortable exploiting an AI recommendation and questioning it. Trust in a machine must always be matched by the confidence and competence to override it when judgement demands. The future IAF will need air warriors who understand both warfare and technology, and who can bring the two together in the moment of decision.

> "The future IAF will need air warriors who understand both warfare and technology, and who can bring the two together in the moment of decision"

Technology will continue to advance, but the heart of the Air Force will always be its people. The IAF will keep investing in our air warriors, in their skills, their judgement and their character, so that they remain masters of the machines they command, and never the other way round. SP

PHOTOGRAPH: IAF_MCC/X

AIR CHIEF MARSHAL A.P. SINGH, CHIEF OF THE AIR STAFF, INDIAN AIR FORCE ADDRESSING THE MEDIA ON THE OCCASION OF THE IAF DAY

IAF CHIEF SAYS PRIORITISING THE VARIOUS FIGHTER JET PROGRAMMES, FLAGS CHINA-PAKISTAN NEXUS AMID SECURITY CHALLENGE

Indian Air Force Chief Air Chief Marshal A.P. Singh has called for a sharper focus on fewer indigenous fighter aircraft programmes, warning that prolonged delays in delivering combat platforms are directly affecting the IAF's modernisation plans.

By MANISH KUMAR JHA

PHOTOGRAPH: MANISH KUMAR JHA

"There is a requirement to reduce the number of programmes that are going on at any time, no doubt."
—Air Chief Marshal A.P. Singh, Chief of the Air Staff, IAF

INDIAN AIR FORCE CHIEF AIR CHIEF MARSHAL A.P. SINGH has called for a sharper focus on fewer indigenous fighter aircraft programmes, warning that prolonged delays in delivering combat platforms are directly affecting the IAF's modernisation plans.

Responding to the question raised by the author, while addressing his annual press conference ahead of Air Force Day on October 8, Singh said India needs to prioritise defence aerospace projects instead of spreading its resources and technological capacity across too many programmes simultaneously.

"There is a requirement to reduce the number of programmes that are going on at any time, no doubt," Singh said, responding to a question on the efficacy of multiple fighter aircraft development programmes being pursued in India.

His remarks come as the Aeronautical Development Agency (ADA), the country's principal design agency for combat aircraft, is handling several major programmes, including the Tejas Mk1A, Tejas Mk2, Advanced Medium Combat Aircraft (AMCA) and potential Multi Role Fighter Programme (MRFA) for the co-design.

The numbers are stark. 29 fighter squadrons today, 36–40 aircraft required every year, and a sanctioned strength of 42 that the Air Chief himself suggests may no longer be enough. The answer will not come from one programme. It will require Tejas Mk-1A to arrive, Tejas Mk-2 to mature, MRFA to move, AMCA to remain on schedule, indigenous weapons to advance, drones to proliferate, AI to be integrated, space capabilities to expand and ultimately India to develop its own fighter engine.

Singh agrees that India needs additional institutional capacity to manage the growing number of aerospace projects, pointing to the need for a more focused development structure and clearly defined priorities.

The IAF Chief's central concern was not the number of projects alone, but the lack of tangible progress and predictable delivery timelines. For the IAF, delays in indigenous platforms create a difficult operational dilemma as the service faces the challenge of maintaining its combat strength while waiting for next-generation aircraft.

The AMCA programme is particularly critical. Singh said that if the indigenous fifth-generation fighter is delayed, the IAF would have to examine alternative platforms to bridge the capability gap.

"As far as other platforms are concerned, we have to look at some platform in case there are delays in the AMCA. If we have to fill in the gap... we need to look at something," he said.

The warning underlines the difficult balance facing the IAF. While the service remains committed to indigenous aircraft development, it cannot allow operational requirements to be compromised by uncertain timelines.

CHINA-PAKISTAN NEXUS

Singh also flagged the growing security challenge posed by cooperation between Pakistan and China on a fifth-generation fighter aircraft.

He described Pakistan's reported plans to acquire Chinese J-35 stealth fighters—and reports that Pakistani pilots are already training in China—as a "cause for worry". However, he firmly asserted that it is not an insurmountable threat, stating that India possesses the necessary capabilities to respond effectively.

"It is a cause for worry," he said, while stressing that the IAF has multiple capabilities and cannot afford to become overly dependent on any single weapons platform.

The message is significant for India's aerospace establishment. Indigenous development has become central to the country's defence strategy, but the IAF needs aircraft to enter service within operationally relevant timelines. A technologically ambitious programme that arrives years late can create a capability gap that becomes increasingly difficult and expensive to close.

At the same time, the IAF is looking at imported aircraft to supplement indigenous programmes. Singh said the government is working towards finalising the Multi-Role Fighter Aircraft (MRFA) deal by the end of the current financial year, subject to the process proceeding as planned.

India had in February cleared the long-pending proposal to acquire 114 fighter aircraft under a government-to-government framework with France. The programme, centred on the Rafale, is intended to provide a major boost to the IAF's depleted fighter fleet and strengthen its combat capability while indigenous platforms mature.

The MRFA programme, however, is not a substitute for India's indigenous fighter ecosystem. The larger challenge is to ensure that the Tejas Mk1A, Tejas Mk2 and AMCA programmes move from development promises to predictable production and induction schedules.

Singh's remarks therefore point to a broader lesson for India's defence modernisation: fewer programmes, clearer priorities and firm delivery timelines may be more valuable than a long list of ambitious projects.

For the IAF, delays are not merely administrative setbacks. Every year lost in development and production affects squadron strength, operational planning and the ability to respond to a changing regional threat environment.

India's aerospace ambitions will ultimately be judged not by the number of programmes announced, but by how quickly capable aircraft reach the flight line. SP

Manish Kumar Jha is a Consulting & Contributing Editor for SP's Aviation, SP's Land Forces and SP's Naval Forces and a security expert. He writes on national security, military technology, strategic affairs & policies.

EXERCISE TARANG SHAKTI 2024: INDIAN AIR FORCE (IAF) HOSTED THE MULTI-NATIONAL AIR COMBAT EXERCISE, DESIGNED TO BOOST INTEROPERABILITY AND MILITARY COOPERATION WITH GLOBAL PARTNERS

IAF'S INTERNATIONAL ENGAGEMENTS

PHOTOGRAPH: IAF_MCC / X

The IAF's expanding international engagements through bilateral and multilateral exercises have strengthened operational learning, interoperability and professional ties with partner air forces. From participating overseas to hosting them, these engagements have also emerged as an important instrument of India's strategic partnerships.

By **AIR CHIEF MARSHAL V.R. CHAUDHARI (RETD),**
FORMER CHIEF OF THE AIR STAFF, INDIAN AIR FORCE

THE VISUALS OF EXERCISE (EX) VEER GUARDIAN AT JODHPUR, especially those of the IAF Chief and his Japanese counterpart flying alongside in Tejas aircraft, brought back a flood of memories of international exercises in the last five to six years.

The IAF's engagement with other air forces began at the turn of the century with Ex Garuda, a bilateral exercise with the French Air Force. This was followed by Ex Cope India with the USAF the next year. In the subsequent years the IAF participated in Cope-Thunder in Alaska, Ex Golden Eagle in South Africa, Ex Indradhanush in the UK along with Joint Military Training (JMT) with the Republic of Singapore Air Force taking place in India every year. The pattern of one "out" exercise and one "in" exercise every alternative year had been set and the bonds of friendship with fellow air warriors were growing.

My first visit abroad as the Chief of the Air Staff was to Egypt to attend their flagship defence exposition, EDEX and participate in the air power conference hosted by the Egypt Air Force (EAF). During the bilateral meeting with the host, Air Marshal Mohamed Abbas Helmy, we discussed the feasibility of IAF participating in their Tactical Leadership programme, akin to our

IAF SPECIAL

course at TACDE. He visited India shortly thereafter and reiterated the benefit of the proposal. Fortunately, I got the in-principle approval from India's Defence Minister and it set the ball rolling for increased interaction with the EAF. Barely a month later, our Su-30 MKI aircraft were in the Combat Commander's School in Egypt, sharing knowledge on tactics and maintaining cohesion with an assorted fleet of aircraft that we both possess.

In the following months our Defence Minister visited Egypt (where he signed a MoU for defence cooperation), the Egyptian President Sisi was the Chief Guest at our Republic Day celebrations and finally Prime Minister Modi made a state visit to Egypt. The upshot of these engagements was that another request to participate in Ex Bright Star in Egypt, met with immediate approvals!

The JASDF Chief of Staff General Izutsu Shunji (Bert) had visited India in late 2020 and I had the honour of hosting him as the AOC-in-C of WAC. In 2022, prior to the 2+2 meeting in Japan, I was hosted by the JASDF CAS. During our meeting we agreed to take forward our engagements of Ex Shinyuu Maitri (airlift and mobility exercise) to include aerial combat exercises with fighter aircraft. The 2+2 forum that discussed bilateral military cooperation, gave the green flag to hold the first exercise in Japan. But a word about the Japanese penchant for perfection. During my visit, almost seven months before Ex Veer Guardian, they had prepared Hyakuri air base for welcoming the IAF. In a tour of the base, they showed me the hangar, work stations, briefing rooms and crew rooms earmarked for the Indian contingent, with Indian flags and IAF crests adorning the entrance to every room in that building!

I was fortunate to fly a simulated interception sortie in the JASDF F-2B over the foggy Pacific Ocean with 'Bert' filming me from another F-2 in close formation.

When I discussed participation of Koku-Jeitai (JASDF) in any future multi-lateral exercise, I had got a positive response. In September 2024, when we conducted Ex Tarang Shakti, the JASDF had committed to send three F-2's, but unfortunately, due to bad weather and some technical issues, they could not reach India before the exercise got over. However, their 100+ strong ground contingent and their CAS, General Hiroaki Uchikura were in Jodhpur, witnessing the events.

The years 2022-2023 saw the IAF being invited by almost all major air forces of the world for bilateral or multi-lateral exercises. In 2018, IAF had for the first time flown the Su-30 MKI across to Darwin to take part in Ex Pitch-black, a multi-lateral exercise in Australia. IAF again took part in the exercise in 2022, 2024, and just a month ago. On return from Australia, the IAF routinely engaged with the Royal Malaysian Air Force in Ex Udara-Shakti.

During the 75th anniversary of the USAF in Washington DC, a global Air Chief's conference was held that was attended by over fifty Chiefs. In a spate of bilateral meetings planned on the side-lines, I met the Hellenic Air Force Chief, Lt General Themistoklis Bourolias, who headed an air force that saw 80-100 fighter scrambles every month, against intruding Turkish Air Force aircraft. He readily accepted my invitation to visit India and within a few months he came over to discuss taking forward mutual cooperation. This resulted in the IAF taking part in the multi-lateral exercise Iniochos held every other year at Andravida air base.

PHOTOGRAPHS: PIB, IAF_MCC / X

(TOP) IAF CONCLUDES HIGH-TEMPO MULTINATIONAL EXERCISE PITCH BLACK; (ABOVE) MULTINATIONAL EXERCISE GARUDA 2025 TAKES OFF.

In the same forum I also met the German Air Chief, (Inspector of the Air Force) Lt General Ingo Gerhartz with whom I bonded over WhatsApp chats and later had the chance to do a 1 vs 1 on Typhoons over the Baltic Sea! We discussed the feasibility of doing a joint exercise and after his brief visit to India, (where he only wanted to see our combat training institute, TACDE), he was convinced that we should move forward on the idea. The GAF was scheduled to take part in Ex Pitch Black in Australia and found it difficult to fly all the way to India for another exercise.

By now our squadrons had experienced multi-lateral exercises literally across the globe. In addition to those mentioned, the IAF also took part in Ex-Cobra Warrior in the UK, Ex Volfa in France and Ex Desert Eagle in UAE. I saw no reason why we could not conduct one of our own! At Air HQs we worked out a broad plan and presented it to the ministry and in no time we received the go-ahead for conducting the first multi-lateral exercise on Indian soil in over 60 years.

> The pattern of one 'out' exercise and one 'in' exercise every alternative year had been set and the bonds of friendship with fellow air warriors growing

But the calendar for 2024 was fast filling up with many engagements for the Air Force. The year was to begin with Ex Vayu Shakti, the fire power demonstration, which in 2022 was cancelled on the last day due to the conflict having broken out in Ukraine. Then we had planned for Ex Gagan Shakti, an exercise involving the mobilisation and deployment of the entire Air Force as per the war plans. This ideally is done before the onset of summers, for a variety of reasons. We had already accepted participation in Ex Red-Flag, the premier, advanced multinational aerial combat training exercise hosted by the US Air Force in Alaska. This was the first time the IAF was to deploy its newly acquired Rafale aircraft to an exercise that saw crew from the US, UK, Singapore, Germany, and the Netherlands, participate. Added to this was the commitment to send a contingent to Australia for Ex Pitch-Black. As if it was not enough, following Vayu Shakti, an Army led tri-service exercise Bharat Shakti was planned at short notice.

Therefore, the window for conducting our first multi-lateral exercise had narrowed down to the month of September, when the monsoons would have abated. Ex Tarang Shakti was thus planned for early September and invitations were sent to all friendly foreign countries. Not surprisingly, we received a positive response from over twenty countries! Most were willing to come with their assets, while a few only wanted to come as observers.

Going back to my conversations with the German, French, Spanish and UK Air chiefs, they had all agreed in principle to take part, but the timing was not suiting them as Ex Pitch Black ran from July to early August. The answer was simple; split Ex Tarang Shakti into two phases, first one with the Europeans and the second with the others! It did not require much convincing and the Germans, French and Spaniards agreed to stop-by in India for the exercise, on their return from Australia. The first phase was re-worked to be held in Sulur near Coimbatore, for the convenience of the visitors, who ferried in from Malaysia. The joint formation was ferrying into our country was led by the IG of GAF, Ingo Gerhartz himself. To welcome them, Air Chief Marshal A.P. Singh (then the Vice Chief of Air Staff) got airborne in a Tejas and escorted them over the last 100 kms to Sulur! Phase 1 had the Eurofighter Typhoons (GAF and SAF), Rafales (FASF) pitted against our Su-30 MKI, MiG-29, M-2000 and Tejas aircraft, supported by A400 and A330 tanker aircraft.

After a successful 10-day exercise, we shifted to the deserts of Rajasthan for the next phase. The USAF, Hellenic Air Force, JASDF, Sri-Lankan AF, Australian AF, UAE Air Force and the Republic of Singapore AF participated with their assets, while 18 other countries sent their observers for the exercise. In this phase the aircraft types were more diverse and included the EA-18G Electronic Warfare aircraft (RAAF), F-16Cs (UAE AF and HAF), C-130, A-10 Warthogs (USAF) and the B200.

Alongside the flying exercise, the personnel of the visiting air forces were treated to yoga sessions, an open-day loaded with music, performances and of course Indian food! Apart from the many Chiefs of respective air forces, some countries were represented by senior military officers from the Army and Navy too. The Germans had come in strength, with many members of their parliament witnessing the exercise. A seminar on 'Air Domain Awareness' and an exhibition by Indian defence industries saw active involvement of all visitors.

A striking feature of all these exercises was the immaculate planning by the Ops staff at Air HQ, and the organisation of flying exercises and other activities by Command HQs. In all our 'out' exercises, the IAF boasted of nearly 100 per cent serviceability and despatch rate, thanks to the stupendous efforts of the maintenance teams.

As the IAF prepares for the second edition of Ex Tarang Shakti, my best wishes to all the participants for an enriching experience. Remember that such engagements not only enhance the learning from air combat exercises, but serve to strengthen our strategic partnerships.

Keep the flag flying high, IAF! SP

EXPERT'S ANALYSIS

IAF SPECIAL

IAF SUKHOI-30 MKIS, JAGUARS, AWACS & AEW&C AIRCRAFT JOINED ROYAL NAVY F-35BS FROM HMS PRINCE OF WALES FOR A JOINT EXERCISE OVER THE INDIAN OCEAN REGION

PHOTOGRAPH: IAF_MCC / X

THE FUTURE LIES IN MASTERING THE INTEGRATION OF THE MANNED WITH UNMANNED

MANNED VS UNMANNED?

The future of warfare lies not in choosing between manned and unmanned systems, but in integrating them. Human cognition, judgement and ethical decision-making, combined with the scale, affordability and versatility of unmanned platforms, can create a more effective and resilient combat capability.

By **AIR MARSHAL A.K. BHARTI (RETD),**
FORMER DEPUTY CHIEF OF THE AIR STAFF, INDIAN AIR FORCE

PHOTOGRAPH: LOCKHEED MARTIN

IF THE ARMENIA-AZERBAIJAN CONFLICT OF 2020 BROUGHT to fore the significance of unmanned aerial systems (UAS) on the modern battlefield, the ongoing Russia-Ukraine conflict has only cemented the position of unmanned systems as being the platforms of choice for the warring sides. In the recent Iran-US-Israel conflict, both sides, particularly Iran, has used the unmanned systems extensively.

This has led many to believe that the days of manned systems are numbered. While it is true that modern battlefield is undergoing its most profound transformation, something akin to the advent of the gun powder in medieval period and then more recently, the mechanised formations and the aviation platforms; it may be premature to write an ode to the manned systems, even in the distant future!

THE DISCOURSE

The discourse therefore need not be one versus the other – manned vs unmanned, rather it needs be manned with unmanned. The ready availability of relatively cheap unmanned systems, coupled with advancements in AI has incentivised even weaker protagonists to get into/ stay in conflict (Ukraine, Iran, Houthis). This is also the reason why modern conflicts rage on endlessly. The human as well capital costs with the present day small unmanned systems are low, there is no public pressure or incentive for countries to negotiate an early end to conflict. It has become relatively easy to get into conflict, and quite complex to get out of it.

This makes outside commentators believe that unmanned systems can do similar functions and bring about similar results (read victory) to the side employing it more effectively. However,

UNMANNED SYSTEMS ALONE CANNOT ATTAIN THE OVERALL OBJECTIVES OF A CONFLICT, NOT TODAY, AND NOT IN THE FORESEEABLE FUTURE

PHOTOGRAPH: GA-ASI

one misses out the attainment of overall objectives of the conflict by these unmanned systems alone. Let us not get swayed by what one wave of 1,000 drones achieves, no doubt it carries explosives and is precise, and would cause damage to the intended target, but are such waves sufficient to achieve victory? The results of ongoing conflicts prove otherwise. In Russia-Ukraine context, both sides employ unmanned systems heavily, but none has achieved victory. Same with Iran. Houthis obviously are not fighting to win, at the most – to harass.

And therein lies the answer to what unmanned systems can achieve today and in the foreseeable future. It can slow down an advance, it can harass a defending force, but it cannot give you outright victory – definitely not today, and not in the foreseeable future. Victory is shaped by pulverising weight of attack, shock, speed and cognitive decision making, none of which are likely to be available as a package with any unmanned systems in near future. True, with the advancement of AI algorithms, the systems will get more and more autonomous, but battlefield is all about variables and improvisation, wherein human cognition would remain irreplaceable, at least for the near future.

And why I keep referring to 'near future' is due to the fact that I expect something to happen in this timeframe which will annul the advantage of mass, low observability and affordability of these low cost UAS. That something is the advent of robust counter UAS systems! Countries are already investing heavily into these systems and soon the advantage enjoyed by the present day UAS would be comprehensively challenged. If I were to draw a simile, we are in an era wherein the combat aircraft just came in – wait for the invention of radar (WW-II) – the balance would soon tilt. Effective counter UAS systems are on the horizon!

Unmanned systems rely heavily on numbers (to saturate enemy defences), data links and autonomous algorithms. Already, swarm interceptors are evolving which would negate the advantage of numbers, and data links are increasingly becoming susceptible to jamming and deception. Autonomous algorithms can be hacked into. Wait for quantum techniques to mature and the scenario with these autonomous systems would be different. Low observability of these platforms are soon going to be challenged with the advent of systems like Frequency Modulated Continuous Wave (FMCW) high band radars and Passive Coherent Locators. In their infancy, work on these systems is on and it is only a question of time before they are combat ready.

SYNERGISTIC EMPLOYMENT

Therefore, it may be premature to summarily write off the manned systems, because once effective counters for unmanned systems are in place (it is bound to happen- that is the cycle of military technology), the entire doctrine of employment of unmanned systems would need a relook. The future lies not in replacing one with the other, but in mastering their integration. The discourse needs to move from Manned VERSUS unmanned to Manned WITH Unmanned.

Therefore, in times to come, a modus-vivendi would have to emerge between the manned and unmanned systems. The concept of MUMT (Manned Unmanned Teaming) is already taking shape. Commentators have been discussing this teaming for some time now, countries have been putting their R&D efforts in it, but in the noise of ongoing conflicts and glamorisation of swarm unmanned systems, their voices have largely been drowned. However, the future belongs to this team – the manned with unmanned. The human in the loop (or even on the loop) retains the cognition of the human mind, reacts to variables on the battlefield, sticks to ethics and commands the unmanned. The unmanned with their advantages of doing the dull, dirty and dangerous duties, synergise to pulverise the adversary and ensure victory, bringing the conflict to an expeditious end. SP

— The author was Director General Air Operations at Air HQ (VB), wherein he actively planned and coordinated missions during Operation Sindoor.

PHOTOGRAPH: US PACIFIC AIR FORCES

UNMANNED AIRCRAFT ARE FORCE MULTIPLIERS FOR MANNED PLATFORMS, NOT SUBSTITUTES

BEYOND THE BINARY: MANNED VS UNMANNED

The future of air power lies in integrating manned and unmanned platforms rather than treating them as competing alternatives. For India, translating technological advances into operational capability will require sustained procurement, industrial scale, clear doctrine, and commanders trained to employ these systems effectively.

By GROUP CAPTAIN AKASH GODBOLE

IN SEPTEMBER 2026, THE INDIAN AIR FORCE CONDUCTED ITS inaugural Dronathon at the Pokhran Field Firing Range. More than twenty domestic manufacturers, startups, and MSMEs demonstrated unmanned aerial systems under operational conditions in the desert. The Vice Chief of the Air Staff released the IAF Unmanned and Autonomous Systems Roadmap. The venue says everything. Not an aerospace exhibition. A firing range. The sky above Pokhran was filled with unmanned systems — ISR platforms, loitering munitions, swarm drones, and electronic warfare systems. The focus was entirely on the unmanned. The IAF was not there to watch. It was there to evaluate.

This trend is reflected globally. Ukraine produced 2.2 million drones in 2024. By early 2025, it was rolling out 2,00,000 FPV drones a month. In June 2025, 117 drones costing a combined $1,17,000 struck five Russian airbases simultaneously and damaged or destroyed over 40 aircraft worth more than $7 billion. This is war economics at scale. The argument

PHOTOGRAPH: BAYKAR

LOW COST DRONES CAN BE EFFECTIVE IN OPENING THE DOORS FOR THE MANNED FORCES TO WALK IN

from those numbers is seductive. Drones are cheap. They are expendable. They do not bleed. Why build a billion-dollar aircraft when you can build a thousand loitering munitions for the same cost? It is not a wrong question — rather, an uninformed one. But it is understandable why it gets asked.

The mass-scale deployment of drones was first observed during the Nagorno-Karabakh conflict in 2020. Azerbaijan deployed its Bayraktar TB2 drones that cost roughly $5 million each. They systematically dismantled Armenian armour, air defences, and logistics. Armenia lost over 245 main battle tanks. All this at a fraction of the cost of a single manned fighter. Manned aviation on both sides barely featured after the opening exchanges. The lesson seemed clear that drones had arrived as decisive weapons.

But Nagorno-Karabakh had a specific condition. Armenia had legacy air defence systems. Its radar systems were destroyed before they could respond. Its EW capability was overwhelmed within days. The TB2 didn't win because drones are inherently superior to manned aircraft. It won because Armenia had no credible counter. Change the adversary and the equation changes entirely.

In Ukraine, where both sides field capable EW, FPV drones are jammed routinely. Russia adapted by saturating numbers. Ukraine adapted by switching to fibre-optic-guided drones. This was a technological regression to mid-twentieth-century solutions. Three years of the most drone-intensive conflict in history have not produced a verdict in favour of drones alone. They have produced a constant adaptation cycle. No single platform dominates for long.

> What is missing is not technology. It is the scale of order that makes industry treat this as a serious line of business rather than a development project

Operation Sindoor was a live demonstration of the unmanned case for the Indian audience. Scores of drone swarms engulfed the border skies several times during those 88 hours of the conflict. However, the strategic outcome that forced Islamabad to beg for a ceasefire came via manned systems themselves. Be it the longest recorded surface-to-air kill by an S-400 system, or the huge craters created by the Brahmos cruise missiles, they were operated from a manned platform. Despite the software advances in terms of network, synthetic radar displays, and data links, the decision and the action to shoot the enemy down were taken by a man/woman. The drones opened the door. The manned force walked through it.

However, Op Sindoor also exposed a structural vulnerability that drones cannot fix. The IAF's present fighter squadron strength stands at a lowly 29 against a touted figure of 42. In contrast, the PLAAF is inducting J-20 fifth-generation fighters at an estimated 100-plus airframes per year. Even Pakistan has contracted Chinese J-35A stealth aircraft likely to be delivered by

IAF SPECIAL

MODERN BATTLE REQUIRES AN AIR BATTLE MANAGER WHO CAN ORCHESTRATE CCAS AND UCAVS WHILE FLYING HIS OWN AIRCRAFT

PHOTOGRAPH: QINETIQ

2027. Realistically, India cannot close this gap with manned platforms alone. The only viable option remains to diversify. Build upon unmanned inventory to offset the manned advantage. This is possible at scale and within the timelines that no unmanned system can promise presently.

WHERE THE WORLD HAS LANDED

Every serious air force has reached the same conclusion. The answer is not replacement. It is collaboration. The US Air Force's Collaborative Combat Aircraft programme selected two designs in 2024 — the General Atomics FQ-42A and Anduril FQ-44A. Both flew in 2025. Production contracts were awarded in June 2026, four months ahead of schedule. The target is more than 150 aircraft by the end of the decade, eventually approaching 1,000. The unit cost is approximately $30 million — one-third of an F-35. Unmanned aircraft are force multipliers for manned platforms, not substitutes.

China has also chosen to follow the MUMT path. The PLAAF released the first confirmed footage of its GJ-11 Sharp Sword UCAV flying in formation with a J-20 stealth fighter and a J-16D electronic warfare aircraft. Analysis hints at the J-20S as the intended command node, possibly controlling and directing unmanned wingmen while managing the entire air battle.

India itself subscribes to this idea. Dr Samir Kamat, DRDO Chairman, said in May 2026 that "manned fighters will form the backbone of aerial combat for the next two decades." He said that the human in the loop remains irreplaceable in its present form. IAF Vice Chief Air Marshal Ashutosh Dixit said in June 2025 that fighter jets are here for a century. But the future belongs to Manned-Unmanned Teaming. Air Chief Marshal A.P. Singh put it most directly — drones are no longer merely eyes in the sky. They have become claws in the sky. The consensus thus suggests that MUM-T is the direction. The question now is whether India can build what MUM-T actually requires.

> Unmanned aircraft are force multipliers for manned platforms, not substitutes

WHAT MUM-T NEEDS

Agreeing on the concept is the easy part. Building the ecosystem is the hard part. MUM-T is not a feature you add to an existing air force. It requires five things simultaneously.

The network comes first. The kill chain is dead. What replaces it is a kill web. Any sensor talking to any shooter through a resilient datalink, with a battle manager pairing them dynamically. That web must degrade gracefully under EW attack. Full connectivity when available. Autonomous fall back when not. NavIC on every combat platform, a hardened IACCS architecture, datalink resilience at all levels. These are minimum operational prerequisites.

Warfare is not all numbers; it is also a lot about the art of combat employment. Training is the answer to it all. One can be a brilliant aviator, but modern battle requires much more than that. It requires an air battle manager. One who can orchestrate CCAs and UCAVs from his cockpit in the air while flying his own aircraft. In a way, this is already happening. Modern aviators control their wingmen due to better data exchange owing to datalinks. The AMCA and Tejas Mk2 cockpit interfaces must be designed for MUM-T orchestration from day one, not retrofitted. EW literacy must be a baseline competency. The selection pipeline must reflect this. A pilot selected for his individual virtuosity but not his network instinct is the wrong man for the next war.

IAF SPECIAL

THE MASS-SCALE DEPLOYMENT OF DRONES CAN HELP OFFSET THE MANNED ADVANTAGE OF THE ADVERSARY

PHOTOGRAPH: ANDURIL

An industry with such initial capital investment would only sustain with scaled production. Indian ecosystem has still not projected such an appetite. The IAF places orders in tens, when the business requires hundreds, if not thousands, for any profit-making. The arithmetic is quite simple. One Tejas Mk1A costs roughly ₹550 crore. The same can fund 18 to 22 CATS Warriors at ₹25–30 crore each. The DAC greenlighting four Ghatak squadrons is just a beginning. India has the foundational programmes. HAL's CATS Warrior is a low-observable loyal wingman designed to fly alongside Tejas, Rafale, and the future AMCA. DRDO's Ghatak, a 13-tonne flying-wing stealth UCAV, has its SWiFT demonstrator already flown. The private sector ecosystem is maturing fast. Dronathon itself is evidence of that. What is missing is not technology. It is the scale of order that makes industry treat this as a serious line of business rather than a development project.

Doctrine must precede procurement, not follow it. India is building unmanned platforms without a published employment philosophy for them. Where does the human decision-maker sit in the MUM-T architecture? How much autonomy does the unmanned node carry? Under what conditions does it act independently? These questions have no public answers in Indian doctrine. Platforms without doctrine are expensive ornaments. The Dronathon released a roadmap for the industry. It's time the forces imagine and articulate the employment principles in the form of a doctrine.

India has historically been a rule-taker in international standards, not a rule-maker. As the rules are being written in the form of datalink standards, autonomy frameworks, and sensor fusion architectures, it is time India participates in the process. One doesn't want to be inheriting these regulations five years down and rue a lost opportunity. Dronathon at Pokhran is precisely the mechanism that keeps industry and operators in a continuous learning loop. It must not remain an annual exhibition. It must become a permanent posture.

THE QUESTION THAT WAS NEVER THE RIGHT ONE

Manned versus unmanned was always a false choice. No serious practitioner has argued for pure substitution. The question has been doing the rounds for over a decade. The platforms have changed beyond recognition since then. The principle has not.

The right question is rather what is the correct combination at this stage of technological evolution? That question has no fixed answer. It shifts with every new EW system the adversary fields, every new loitering munition that enters inventory, every change in the order of battle on both sides of the line. Which is precisely why it cannot be answered by a procurement programme. It cannot be answered by doctrine alone. It has to be answered by the commander.

For Guderian, it was not a choice of tanks versus infantry. He understood how to combine them effectively in a battle to gain an upper hand against an enemy. Patton outsmarted the adversary by mastering the tempo of operations. These were military geniuses at play who used the same assets differently and innovatively.

But this time, there is a difference, and it matters. Rommel drove to the forward edge to read the ground. Guderian was present at the Meuse crossing. Their genius expressed itself in the battle. In a kill-web environment, where sensor-shooter pairing happens at the speed of electrons, the commander cannot be present in that sense. The battle moves faster than any human can follow at the point of execution. So the military genius moves. The commander moves upstream — into force design, into doctrine, into the architecture of the kill web itself.

A defence acquisition policy cannot decide the optimum ratio of manned to unmanned. In the end, it has to be decided by the commander who understands both the machine and the moment and has the judgement to know how to employ them. India is acquiring the platforms. The harder task is producing commanders who know how to use them. The question was never manned versus unmanned. It was always: what and how to employ? SP

(CLOCKWISE FROM TOP LEFT): ACQUIRED IN MARCH 1963, THE MIG-21, A LEGENDARY FIGHTER & THE FIRST SUPERSONIC AIRCRAFT IN THE IAF INVENTORY COMPLETED 60 YEARS BEFORE RETIRING. HERO OF THE 1971 WAR & UPGRADED OVER THE YEARS TO UNDERTAKE MULTIPLE COMBAT ROLES, THE AIRCRAFT SERVED THE NATION WITH DISTINCTION, LEAVING BEHIND A PROUD LEGACY.

PHOTOGRAPHS: IAF_MCC/ X, INDIAN AIR FORCE

REMEMBERING THE BROTHER-IN-ARMS: THE MIG-21

The MiG-21 left Indian Air Force service in September 2025 after decades of yeoman service to the Nation. A pilot who flew it, with utmost respect, instructed on it and commanded a squadron of it recalls a machine that demanded respect and repaid it in full.

By **AIR VICE MARSHAL PRASHANT MOHAN (RETD)**

ON SEPTEMBER 26, 2025, AT CHANDIGARH, THE INDIAN AIR FORCE bid farewell to the MiG-21. The aircraft had joined the service in 1963. For more than sixty years it flew from and over almost every terrain of the country, fought in every major conflict and trained generations of fighter pilots.

For those of us who spent our defining flying years in its narrow cockpit, the MiG-21 was never, just another type in the IAF inventory. It was a brother-in-arms. This is one pilot's remembrance of that companionship.

FIRST IMPRESSIONS

The first feeling was of awe. Its shape, and its sheer dynamism overwhelmed a young pilot. Even when standing still on the ground, it carried a mystique that was hard to define. Its swept delta wing and needle nose seemed to be moving even when they were not.

It did not take long to learn the second lesson. If you did not respect the MiG-21, it did not pardon you. It was never pretentious. It did not have the refinements that later fighters would boast. What it lacked, it made up for by its simplicity and robustness. It always rewarded hard work, and always gave everything it had.

The MiG-21 was never designed to be used the way the Indian Air Force came to use it. Interceptor, ground-attack aircraft, trainer, reconnaissance platform: it was asked to do all of these, often in the same sortie. I am sure its designers would have been amazed at what the IAF achieved from and out of it.

EAST TO WEST: LEARNING THE TRADE

My first sortie in a MiG-21 was at Tezpur, in Assam, as an under-trainee pilot. The tenure was a massive dose of learning flying and above all developing the fighter pilot attitude – i.e. you just don't give up. I learnt the art of healthy competition and, above all, the habit of relentless, uncompromising hard work. There were mistakes made, as there are in every learning process. Mistakes came with learning of lessons, because seniors were always there to hold your hand and guide you to the next level.

That next posting took me from the east to the west, to Pathankot. There, two MiG-21 squadrons shared an airbase and a defined patch of airspace. The spirited fight for flying slots within a day, a week or even a month was relentless. Both squadrons competed over how much they had flown. Course mates compared notes on who had logged more hours, what their range scores were, how many combat sorties they had flown. MiG-21 was always there - ever-ready and ever-smiling– as if it knew the foretold.

It was a healthy competition. Differences of opinion, big or small, were settled over a drink at the bar religiously. The MiG-21 was the great equaliser. It did not differentiate between squadron's pilots. It recognised and rewarded sortie preparation, concentration, hard work and dexterity, and above all, the respect you had for the machine.

From Pathankot, I moved to the edge of the Thar desert, Suratgarh and from there to the foothills of the Himalayas – Bagdogra. MiG-21 continued to be my lifeline in the IAF.

This phase with the MiG-21, which began in 1989, continued without a break until 1996. I then completed the Flying Instructors' Course and went on to instruct on the Kiran Mk I, IA and II. That tour lasted until 1999. Mid 1999, I was posted to the western-most corner of India: Naliya, in Gujarat.

NALIYA: A WELCOME LIKE NO OTHER

I remember the day I arrived at the base. I was walking into the base with my small family when the base hooters went off. I was perplexed. Was this a welcome, or a celebratory announcement of my arrival? It was an announcement yes, but not of or for me. The Kargil operations had begun. The IAF had started flying sorties in the northern sector, and other bases were being placed on maximum alert.

My stay at Naliya brought experience that few tours could match. I saw the Kargil operations from the Western Front. Our MiG-21 unit, (No. 45 Squadron), shot down an intruding

THE CEREMONIAL WATER CANNON SALUTE TO THE MIG-21

PHOTOGRAPH: PIB

Pakistan Navy 'Atlantique' reconnaissance aircraft over the Rann of Kutch on August 10, 1999. Later came the deployments of Operation Parakram. The MiG-21 remained the common denominator throughout.

With the MiG-21 by your side, those were the remarkable years. What changed was the experience one gained in piloting the aircraft in its various avatars. We flew over the Gulf of Kutch, the Arabian Sea, the Rann of Kutch and the Rajasthan desert to name a few. Every mission was different. The aircraft was always the same. MiG-21 took everything that was thrown at it and was always co-operative, provided it was treated with respect.

One learnt to pilot the machine across its full range of operating limits. As a trainee, that meant flying at the speed of the clock (in a trainer), on precise timings. On air tests, it meant taking the aircraft supersonic. On the air-to-ground practice firing range, we dropped bombs, fired rockets and front guns. Scores were good if one understood the theory and translated it faithfully using the platform. The scores were as good, or as bad, as one made them to be. One could never fault the MiG-21.

The healthy competition between MiG-21 squadrons continued at Naliya too, but now between neighbouring airbases. Association with MiG-21, was nothing but pursuing excellence (perfection) in everything one did or thought of doing.

AIR VICE MARSHAL PRASHANT MOHAN (RETD) DURING HIS FLYING DAYS ON THE MIG-21

PHOTOGRAPH: AIR VICE MARSHAL PRASHANT MOHAN (RETD)

FROM TRAINEE TO TEACHER

From the western boundary, I moved north, back to Pathankot. The responsibility was now supervisory: to prepare the next crop of pilots by instructing on the MiG-21. I had done some of this at Naliya, but at Pathankot it was the defining activity of the unit.

Until then, I had been the trainee in the twin-seater. Now I had, the honorous responsibility to train and groom the youngsters, and yet go on being a trainee. That is not a contradiction. One cannot instruct if one does not learn from each MiG-21 sortie. You could never take the machine for granted. It had to be a constant vigil.

Instructing on the MiG-21 was a challenge, no doubt. It was also deeply satisfying. Nothing matched the satisfaction when a trainee came back from his first solo and progressed through the assigned syllabus.

By 2002, the MiG-21 though an elderly statesman held its own, in the air as well as on the ground, against the bigger birds on the block: the MiG-29, the Mirage 2000 and the Su-30 MKI. Flown the way it was meant to be flown, it gave the big birds a scare many a times and a run for their money on other occasions. It offset its lack of modern avionics with its small size, its nimbleness and its maneuverability. It could fight, and fight it did.

COMMAND: PASSING ON THE FAITH

From Pathankot I went to learn the art of staff work in the salubrious climes of the Nilgiris, at the (DSSC) Wellington. This was followed by my command tenure, once again in a MiG-21 squadron. Our primary role was to train ab-initio pilots on the MiG-21, at Bhuj in Gujarat.

It was an extremely satisfying tenure. One could share one's own experiences of the MiG-21 and present MiG-21 to young pilots as a companion. One could teach them that the MiG-21 was extremely faithful and a dedicated friend as long as you respected its limits. Teaching that respect was, perhaps, the most important lesson a commanding officer could pass on.

THE MEN BEHIND THE MACHINE

No tribute to the MiG-21 would be complete without a mention the countless technicians who kept it fly worthy. They always handed the pilot a MiG-21 in pristine condition. Their pride was at stake if the machine did not behave exactly as it was supposed to, which is to say flawlessly.

I was sometimes taken aback by their firmness in refusing to bring an aircraft to the flight line for flying until they were fully convinced of its health. The senior technicians, who had seen almost every season of the aircraft's life, were priceless repositories of knowledge and experience. They taught a lot, and they taught well.

The joy in their eyes when a pilot came back from his/her first solo, and their sadness when a pilot did not come back, cannot be described, seeing is believing. So was the enthusiasm with which they offered an armed aircraft for a gunnery meet, and their unbounded joy when told that the scores were "just there". Hats off to them!

AN EPOCH, NOT JUST AN AIRCRAFT

The MiG-21 has now passed into the annals of history of the Indian Air Force. But its era was an unparalleled epoch, and an unchallenged one. It was a brute, but a sublime one. It was sober to the core, yet it could be mischievous once in a while.

Every pilot who spent the defining years of his life in the MiG-21 cockpit would give the proverbial right arm for more time with this dream machine. To those who never had the chance to enjoy its grace: sorry, chaps, please blame your parents. No kidding.

One thing is certain. There will be no more "MiG-21 types". MiG-21 was pure! SP

— The author is Additional Director General, Centre for Aerospace Power and Strategic Studies (CAPSS)

MILITARY

ADVANCED HIGH-ALTITUDE PARACHUTE FROM DRDO

October 6, 2026 – Defence Research and Development Organisation (DRDO) conducted the maiden live jump of the Advanced High-Altitude Parachute (AHAP) at one of the highest-altitude drop zones, Nyoma (Mudh DZ). The jump was executed at 16,000 feet above mean sea level (AMSL). The parachute was deployed at 15,500 feet AMSL and landing was undertaken at Nyoma (Mudh DZ) which is at 13,700 feet. The jump proved the efficacy and tactical employability of the AHAP parachute at extremely High-Altitude Terrains.

Designed and developed by Aerial Delivery Research and Development Establishment (ADRDE), Agra, AHAP is a static line parachute system for mass drop of paratroopers. The system has been manufactured by Ordnance Parachute Factory (OPF) Kanpur, inspected by DGAQA and certified by CEMILAC, RCMA Kanpur.

DRDO CONDUCTS FLIGHT TRIAL OF HIGH-ALTITUDE PLATFORM

October 6, 2026 – Defence Research and Development Organisation (DRDO) has carried out the successful flight trial of indigenously developed High-Altitude Platform (HAPS). The experimental flight attained an altitude of 21 km above mean level (AMSL) and remained at an altitude of 20 km AMSL for more than 30 minutes, before it was commanded to descend back to ground. The system was successfully recovered and flight performance data was analysed. The High-Altitude Platform, a lighter than air system, a long endurance stratospheric aerial surveillance platform, is being designed and developed by Aerial Delivery Research and Development Establishment (ADRDE), Agra.

HAL HANDS OVER PLATFORMS

September 18, 2026 – Hindustan Aeronautics Limited (HAL) handed over two Light Combat Aircraft (LCA) Tejas Final Operational Clearance (FOC) Twin Seater Trainers & three HTT 40 Basic Trainers to the Indian Air Force (IAF), and four Dhruv Next Generation (NG) helicopters to Pawan Hans Limited (PHL) in the presence of Defence Minister Rajnath Singh and Minister of Civil Aviation K. Rammohan Naidu in Bengaluru, Karnataka.

The handover of Tejas FOC Twin Seater Trainers, HTT 40 Basic Trainers and Dhruv NG helicopters demonstrates HAL's ability to develop and deliver platforms for diverse civil and defence requirements. These two platforms reflect the depth of capability that HAL has built over the years and the strength of the indigenous aerospace ecosystem that supports them.

EMBRAER AND MAHINDRA ADVANCE PLANS FOR C-390 MILLENNIUM

October 1, 2026 – Embraer and Mahindra Group are continuing preparatory discussions and planning activities

APPOINTMENTS

AIR MARSHAL ASHUTOSH DIXIT APPOINTED AS CHIEF OF THE AIR STAFF (CAS)

October 6, 2026 – Air Marshal Ashutosh Dixit, presently serving as Vice Chief of the Air Staff, have been appointed as the 29th Chief of the Air Staff, in the rank of Air Chief Marshal, with effect from the afternoon of October 31, 2026. Prior to assuming charge as the Vice Chief of the Air Staff, Air Marshal Dixit served as Chief of Integrated Defence Staff to the Chairman, Chiefs of Staff Committee (CISC) at Headquarters Integrated Defence Staff (HQ IDS) and Air Officer Commanding-in-Chief, Central Air Command.

ATR APPOINTS VITTORIO LORENZO DELLA BELLA AS CEO AND PATRICK BERGUES AS CFO

September 24, 2026 – ATR's Board Members have appointed the company's new Chief Executive Officer, Vittorio Lorenzo Della Bella, effective November 1st, 2026. Currently President of Leonardo Helicopters US, Vittorio Lorenzo Della Bella previously served as Senior Vice-President Customer Support, Services & Training for Leonardo Helicopters. Over the course of his career, he has held senior leadership positions spanning programme management, business development, customer support and international industrial cooperation.

ATR has also appointed Patrick Bergues as Senior Vice-President Finance and Chief Financial Officer, effective November 1, 2026. Patrick Bergues joins ATR from Airbus, where he most recently served as Chief Financial Officer of Airbus in the US and Chief Financial Officer of Starlab Space.

regarding an industrial and support ecosystem for the C-390 Millennium in India, as the companies jointly pursue the Indian Air Force (IAF) Medium Transport Aircraft (MTA) programme.

As part of their ongoing preparations, Mahindra and Embraer are working with the Government of Maharashtra and have identified Nagpur for a potential Final Assembly Line for Embraer C-390 Millennium aircraft production in India. The proposed facility would support the local assembly and industrialisation of the aircraft in India, subject to the Embraer C-390 Millennium being selected by the Government of India and an order being placed under the IAF's MTA programme.

The companies are working closely with the Maharashtra Government on completion of the associated processes, with the objective of ensuring that the required industrial infrastructure can be progressed expeditiously if the programme is awarded to the partnership.

CIVIL

GE AEROSPACE ANNOUNCES PLANS TO NEARLY DOUBLE SUPPLIER SPEND

October 12, 2026 – GE Aerospace announced plans to nearly double supplier spend in-country from 2025 to 2030 to help meet India's growing demand for flight and leadership in the aviation industry. India's domestic commercial airlines generated approximately $19 billion in revenue in FY26, reflecting the strength of the country's rapidly expanding aviation sector. Through advanced engine technology and high levels of reliability and operational performance, GE Aerospace helps enable the connectivity and efficiency that support an aviation ecosystem sustaining an estimated 3,70,000 direct jobs.

Commercial engines made by GE Aerospace and partners power the majority of commercial airline operations in India with a fleet of more than 1,400 engines, as of December 2025. Those engines have helped Indian carriers post the world's highest passenger load factor at 88.2 per cent and aircraft utilisation rates of 12 to 14 hours per day, well above global figures.

BOEING SUKANYA PROGRAM STEM LAB AND AEROMODELING TRAINING CENTER INAUGURATED

October 11, 2026 – The Governor of Odisha, Dr Hari Babu Kambhampati, inaugurated a Boeing Sukanya Program STEM lab and Aeromodeling Training Center at The Kosala School in Bargarh district, Odisha. The facility will benefit more than 2,000 students annually.

The newly inaugurated learning spaces feature:

- The Boeing Sukanya Program STEM lab: A space enabling students to explore robotics, physical computing, electronics, artificial intelligence, rapid prototyping, and aerospace concepts.
- The Aeromodeling Training Center: A center focused on teaching the practical mechanics of aviation, aerodynamics, aircraft design, flight, and model aircraft construction.

ETHIOPIAN AIRLINES ORDERS BOEING 777 AND 777-8 FREIGHTERS

September 30, 2026 – Boeing and Ethiopian Airlines today announced the African carrier has ordered eight 777-8 Freighters and two 777 Freighters. The airline will pair the proven performance of the 777 Freighter with the next generation 777X capabilities of the new 777-8 Freighter to expand its Boeing freighter fleet.

The order is Ethiopian Airlines' second for the 777X airplane family, building on its purchase of eight 777-9 passenger jets that established the carrier as Africa's first 777X customer. The 777-8 Freighter will be the world's largest and most capable twin-engine freighter, supporting Ethiopian Airlines' expanding global network and advancing its international freight operations.

TURKISH AIRLINES ORDER FOR UP TO 150 737 MAX JETS

September 23, 2026 – Boeing and Turkish Airlines today announced an order for up to 150 737 MAX airplanes, concluding the discussions initiated in 2025 and supporting the flag carrier's expansion goals. Turkish Airlines purchased 100 737-8 airplanes and secured options for 50 more 737 MAX jets, making this the airline's largest Boeing single-aisle order. The agreement includes substitution rights for the 737-10, the largest 737 MAX variant, so Turkish Airlines can comfortably serve more passengers on more routes to meet growing demand. By adding more 737-8 jets to its fleet, the airline will leverage the airplane's range, payload flexibility and fuel efficiency to serve high-demand domestic and international routes.

BIMAN ORDERS 11 MORE BOEING JETS

September 23, 2026 – Boeing and Biman Bangladesh Airlines announced today the national carrier placed an order for 11 787 Dreamliner and 737 MAX airplanes to grow and renew its fleet. The purchase, which includes five 787-10 and six 737-8 jets, builds on the airline's largest-ever order for 14 787 Dreamliner and 737 MAX airplanes earlier this year. Biman currently operates 787, 777 and 737 Next-Generation airplanes across its international network, connecting Bangladesh with major hubs in the Middle East, South and Southeast Asia, and Europe. The 787 Dreamliner and 737 MAX families deliver 20-25 per cent more fuel efficiency compared to the airplanes they replace, supporting the airline's strategy to modernise its fleet and expand global connectivity.

UPCOMING

SP'S CIVIL AVIATION YEARBOOK 2025-2026

SIXTH ISSUE

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