

AI and the Future of Air Combat in India

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In his autobiography *Hawkeye*, Israeli fighter ace Giora Even-Epstein recalls flying the Fighting Falcon F-16, and comments that “Flying an F-16 was different than any other plane I’d ever flown. It felt like it was the computer more than the pilot that was flying the plane.”¹

After gunpowder and nuclear weapons, the use of Artificial Intelligence (AI) in warfare can be considered the next revolution in warfare.² AI applications are increasingly being incorporated in military systems, autonomous weapons, reconnaissance and surveillance platforms, among others. Being a dual-use technology, its implications on the distribution of military power in the future is being widely discussed all over the world. The possibility of AI-ushered advancements has opened the scope of an arms race where conventional military capabilities will matter much less as time progresses. Reports state how AI has beaten professional pilots in simulations. In 2020, an American Air Force official and an AI agent ALPHA engaged in a dogfight, in which ALPHA successfully shot down the American official each time.³ Additionally, it is claimed that once trained, AI running systems in cheap computers or smartphones may outperform human pilots.⁴ In future, a vast number of tiny, stealthy drones would swarm an enemy’s airspace/AD systems, and severely damage many vital targets.⁵ Unmanned platforms will rapidly proliferate, and using both manned and unmanned platforms will become a common practice, regardless of the ongoing arguments

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about the concept of a machine being able to outperform humans in flight.

AI IN AIR COMBAT

The Russo-Ukrainian War has demonstrated how AI has improved on the battlefield. Ukraine used TB2⁶ drones to drop laser-guided bombs and for artillery attacks. Russia's Lantset drone, which the country reportedly used in Syria and could use in Ukraine, has similar capabilities, allowing it to navigate and crash into pre-selected targets.⁷ According to the RAND Corporation's 2018 report, the US, China and Russia are increasingly incorporating AI into a variety of military applications in order to gain competitive advantage in fighting wars.⁸ China has progressed extensively in developing stealthy Unmanned Combat Aerial Vehicles (UCAVs). Many variations of the Caihong⁹ family of high-altitude long-endurance Unmanned Aerial Vehicles (UAVs) are used for surveillance and warfare operations. The rapid development of intelligent UAVs by the Chinese government is also demonstrated through WZ-8, an advanced stealth hypersonic reconnaissance drone, and the GJ-11 Sharp Sword, a UAV with superior stealth characteristics.

However, the pace of development of India's Autonomous Unmanned Research Aircraft (AURA) programme is extremely slow. In his book, *The Last War: How AI Will Shape India's Final Showdown with China*, Pravin Sawhney has stated that "if India and China were to fight a war in the future, India would lose within 10 days".¹⁰ The author refers to how the Chinese military has made tremendous growth in AI integration as compared to India. India is under pressure, in this regard, to join the AI race in defence sooner rather than later.

Today's fighter aircrafts are purposefully designed to be aerodynamically unstable for improved manoeuvrability. Hence these aircraft use digital 'fly by wire' technology¹¹ using which on-board computers make adjustments during flights to keep them stable. On the verge of the 2020s, the possibilities of AI have increasingly been used in aviation, and have resulted in making autonomous flights, preventive maintenance, and Air Traffic Management (ATM) optimisation possible.

The sixth-generation of fighter planes is presently being developed by militaries throughout the world in response to changing battlefield circumstances, and the evolving character of armed warfare. Currently, there are a number of countries with sixth-generation fighter jets in development. For example, Japan has the Mitsubishi F-X, while the US

is working on the F/A-XX, and the UK is working with Italy and Sweden on its BAE Systems Tempest.¹² These programmes are all designed to provide the respective nation the ability to claim aerial dominance and market domination. The upcoming sixth-generation machines take the multi-role concept of performing a variety of tasks when in service, ranging from air-to-air refuelling, reconnaissance, surveillance, electronic warfare, and traditional combat. With lasers, drones and AI at disposal of future pilots, it looks like what science fiction was yesterday might well become a technological fact tomorrow.

A major discussion on a topic that needs significant attention is whether inhabited or uninhabited combat aerial vehicles will come to dominate the strike elements of the air forces. The Unmanned (Combat) Aerial Vehicles (UCAVs), or drones, have greater precision, long endurance, low risk of loss of life, low fear of being captured, and can be deployed and operated with relatively minimal experience. In disputed circumstances, where command-and-control is constrained, autonomy is necessary; or, wherever there are regulatory limits, manned aircraft can be deployed. The UCAV–AI combo, despite its split-second timing and accuracy, is still not seen as totally trustworthy because of the fear of failure and political repercussions, and also taking the responsibility for letting the AI take control of the mission. There is not even a single country in the world which has a fully autonomous lethal system, either airborne or surface.¹³ There exists a human cognitive element of trust-distrust that leads to the political reluctance to give freedom to employ fully-automated combat vehicles. States consider that the risks associated with military AI will require human operators to maintain positive control in its employment. As a result, while AI will be used to help UAVs and UCAVs operate, it is certain that, when the use of lethal force is contemplated, a human will always be present in the decision-making loop.

AIR POWER AND FUTURE WARS IN INDIA

The targets hit at Balakot, the downing of a Pakistani F-16¹⁴ by the Indian Air Force's (IAF) airstrikes, and the following dogfight sparked a war of words between India and Pakistan. Twelve Air Force pilots risked their lives to target and eliminate terrorist targets.¹⁵ The Balakot strike has shown that only a technological military edge can stop the economically weak Pakistan from meddling into the internal affairs of India. The country is already advancing in the AI race with the HAL Advanced

Medium Combat Aircraft (AMCA). It is India's first fifth-generation stealth aircraft programme (prototype is that of sixth-generation fighter) and the HAL Tejas as a fourth-generation fighter. Designed by Aeronautical Development Agency (ADA) and Defence Research and Development Organisation (DRDO), and manufactured by Hindustan Aeronautics Limited (HAL) and an Indian private company, the AMCA shall be a twin-engine, multi-role, all-weather fighter, having super-cruise capability, stealth, an enhanced Active Electronically Scanned Array (AESA) radar, super manoeuvrability and advanced avionics. It is also thought to be a derivative of Russia's Sukhoi Su-57. The IAF is tasked with ensuring that the latter is unaffected by the delays in the development of the former. If HAL and Indian private firms can develop the AMCA without relying on foreign assistance, India's aim of deploying an indigenously made stealth fighter aircraft would come true. The HAL AMCA and the subsequent AI-enabled fighter jets and UCAVs are the need of the hour for India, considering the nature of the recent skirmishes with China and Pakistan.

India's strategic geopolitical location forces it to engage in high-altitude combat, such as the Galwan valley in Ladakh. Only if India's future battles are connected to AI, can wars be won in these challenging and hostile environments. The government has also started incorporating AI applications in remotely piloted UAVs. The NITI Aayog and the Ministry of Defence set up a task force (in 2018) for the strategic implementation of AI for national security and defence. The Committee's report, which was published in June 2018, mostly addressed defence manufacturing, and included proposals as well as identifying military challenges and funding for innovative solutions.¹⁶ On 9 July 2022, the IAF, under the aegis of UDAAN (Unit for Digitisation, Automation, Artificial Intelligence and Application Networking) inaugurated the Centre of Excellence for AI, becoming the first among services to establish a dedicated centre of excellence for AI.¹⁷ The centre shall specialise in AI with physical equipment wherever feasible. DRDO has also started working on indigenous combat drones for enhancing fire power as part of its 'Atmanirbharata' initiative. The reliance on drones is also increasing in India, with Harop being the first combat drone for offensive strikes. Two unmanned projects in development—Rustom II UAV and Ghatak UCAV—are also based on AI and computer vision processing.¹⁸

AI will be of tremendous aid to India in its future military operations. When the AI system is trained, it may primarily be used

for reconnaissance missions, like locating enemy missile launchers, and perform in-flight functions like a co-pilot. AI shall make it simple to conduct high-altitude reconnaissance missions for mapping terrorist hotspots and surgical attacks, among others. With proper training, terrorist outposts and launch pads in locations such as Gilgit-Baltistan may be monitored, and potentially targeted with air attacks. Also, with the proper integration of AI into the IAF, Chinese border incursions may be observed, mapped, and even effective measures taken.

In the case of the maritime domain, while maritime strategy has received significant attention, an 'air strategy' provides significant untapped potential in the Indian Ocean Region (IOR) that warrants thoughtful consideration. AI can transform maritime security by using aerial surveillance to defend India's maritime borders. In July 2022, the Pakistan Navy cruiser, *Alamgir*, attempted to enter Indian waters, but was promptly detected by a Dornier maritime surveillance aircraft.¹⁹ AI may be utilised to undertake maritime surveillance and effective countermeasures as well as improving trade relations with countries in the region. Air power is crucial for the Indian Navy's transformation into a blue water navy, and gain control over the IOR.

CHALLENGES

It is important to take note of the challenges associated with a future Air Force equipped abundantly with autonomous systems. It is the goal of autonomous system designers to create these systems that mimic human thought and reasoning processes. Human pilots can only dream of the autonomous AI's decision-making powers, its ability to learn and adapt, and its precision. As a result, when humans are fully cut-off from the loop, and/or AI opposes human commands and acts on its own, the repercussions will be catastrophic. The US Deputy Secretary of Defense has stated clearly that the US will not delegate lethal authority to a machine to make a decision in the use of military force.²⁰ However, if strategic competitors like Russia or China shall delegate lethal authority to machine, he is of the opinion that the situation shall be different. China is already a pioneer in its 'swarm intelligence', and has launched a record-breaking swarm of 119 fixed-wing unmanned aerial vehicles, setting a world record.²¹ This race of giving complete autonomy to machines shall result in running the risks of safety and reliability, especially when nuclear weapons are involved. Additionally, when nuclear-armed nations use AI-enabled swarm drones to safeguard their strategic assets,

a weak nuclear state would respond by declaring a “use them or lose them” scenario.

Despite the cons, it is apparent that the AI-enabled systems will be the backbone of future aerial combat. However, given the former functions as the pilot’s wingman, winning the pilot’s trust will be challenging. In the case of pilotless aerial vehicles, the AI system shall be free from errors, as a single unidentified bug can result in casualties and tarnish a country’s reputation. Another concern is the threat of GPS jamming, and related attacks. There have been several cases of commercial aircraft losing their GPS location in the US as a result of GPS interference tests. As a result, AI systems that aid in aerial battle should be created to overcome GPS denial, and assist the pilot with current location as well as other anti-electronic warfare technologies. The AI system shall also be free to function despite weather conditions, including environment factors such as lightning, thunder, fog, etc. Hence, a bright future in aerial warfare will be initiated by efficient multitasking AI systems, with detailed and deep learning algorithms concentrating on challenges.

THE ROAD AHEAD FOR INDIA

In India, a significant part of the defence budget is being spent on traditional systems—that is, more than on autonomous systems—and there is a slow pace in the development of advanced fighter jets. The time-frame for the development and manufacture of aircraft frequently hampers the development of the Indian aerospace industry. Though India has entered the AI race, China will continue to lead in AI development even in the coming ten years. AI is 6th out of the 69 priority tasks of the Chinese government in its current five-year plan. At present, India should seek peace with China rather than challenge its huge AI lead, while also improving its technological capabilities, and invest in areas where it has not so far focused its resources. Effective collaboration with the private sector can also aid in the timely production and deployment of aircraft. India must create a credible defence system coordinated with AI, in conjunction with its considerable advancements in the space programme, in order to thwart any hostile attempts by China to destroy its satellites. The nation can also choose to implement severe AI-supported monitoring in the Kashmir valley in order to avoid technological setbacks, like those that led to the Balakot incident.²²

A powerful aerospace force must be prepared to strike swiftly, precisely, and with little collateral damage. AI, hypersonic weapons, and space-based sensors and tools will all play a vital role in such a situation. The country also faces significant brain drain when it comes to AI talent, hindering the R&D conundrum. India should invest more with a stronger AI focus, create a quick task force to concentrate on the upcoming challenges in its neighbourhood, and make suggestions for preparing for future war. India must devote time and resources to high-end technology research in strategic systems, defence, and aerospace if it wants to be a key geostrategic player.²³

Unlike the technological programmes in developed countries which can afford to fail first and fail faster, India does not have this luxury due to the paucity of resources. It is, therefore, necessary to recognise what kind of AI India needs. Research institutes and start-ups need a substantial push in the coming years for undertaking programmes on AI. The AI market for civilian purposes in the country is also on the rise. Given its huge military power, every action done by the nation will be keenly scrutinised, and taking the lead on this topic would allow India to set the global agenda on its own terms.

NOTES

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