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INDIA SURGING AHEAD IN STEALTH UNMANNED COMBAT AERIAL VEHICLE

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The Ministry of Defence (MoD), on December 15, 2023, announced that the Defence Research and Development Organisation (DRDO) had successfully completed a flight trial of the autonomous flying wing technology demonstrator from the Aeronautical Test Range (ATR) at Chitradurga in Karnataka, bringing India one step closer to developing its own stealth Unmanned Combat Aerial Vehicle (UCAV) that can fire missiles and drop bombs.[1] The Stealth Wing Technology Demonstrator (SWiFT), is another name for the system that underwent flight testing in the tailless configuration. With this flight test, India has become a member of a select group of nations that have perfected the flying wing technology. The Aeronautical Development Establishment (ADE) of DRDO had been undertaking the design and development of UCAV, which made its first flight in July 2022. Six flight trials in various developmental configurations using two locally manufactured prototypes were conducted subsequent to the 2022 flight. The development of reliable aerodynamic and control systems, an integrated real-time and hardware-in-loop simulation, and a cutting-edge ground control station were made possible by these flight tests. In order to achieve this successful seventh flight in the final configuration, the DRDO team optimised the avionic systems, integration, and flight operations. This recent test is an important milestone towards creating domestic stealth UCAVs and a testimony to the *AatmaNirbhar* initiative of India.

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Use of Drones in Conflict Zones: A World View

Like most nations across the world, India has also stepped up its pace of UCAV development under the *AatmaNirbhar* initiative while procuring such capability to urgently fill the existing voids in the domain.

The concept of Unmanned Flight for targeting started way back in 1839 when explosive-filled, unmanned balloons carrying Austrian soldiers invaded Venice.[2] The first unmanned vehicles were created in the United States and Great Britain during World War I. March 1917 saw the first test flight of Britain's Aerial Target, a small radio-controlled aircraft. After the UK created the Queen Bee, a biplane modified to be controlled by radio from the ground, the term "drone" was first used at that time. The US Air Force was the first to successfully equip Predator drones with Hellfire missiles in 2001. Since then, the US has carried out numerous armed drone strikes in Yemen, Somalia, Afghanistan, Iraq, and Syria between 2004 and 2020. The UCAVs came into prominence during these conflicts, and in the absence of any worthwhile anti-drone system, they became a major tool for precision attacks on most targets, gaining further prominence in the Russia-Ukraine conflict.

The Turkish Bayraktar TB2 and the Akinci, a Medium-Altitude Long-Endurance (MALE) UCAV and a High-Altitude Long-Endurance (HALE) UCAV respectively, supplied to Ukraine, succeeded in destroying numerous Russian tanks, artillery guns, troop concentration zones and multiple military hardware storage areas. The kamikaze flying wing stealth drone, Shaheed, supplied by Iran, was seen extensively being used by Russian forces to destroy multiple military targets of Ukrainian forces. The precision killing of Al Zawahiri on July 31, 2022, by the hellfire missiles fired from the “Reaper” (MQ 9B Predator) UCAV of USA[3] also highlighted the superior capabilities of such low-cost options of precision attacks in urban warfare and war against terror. Like most nations across the world, India has also stepped up its pace of UCAV development under the *‘AatmaNirbhar’* initiative while procuring such capability to urgently fill the existing voids in the domain.

Unmanned Aerial Vehicle Journey of India

All facets of human endeavour and innovation have changed as a result of technology, including how we fight wars and conduct business. These changes are embodied in drones, also referred to as Remotely Piloted Aircraft (RPAs) or Unmanned Aerial Vehicles (UAVs). The journey of drones started in India during the Kargil conflict in 1999 and has been thereafter primarily used by the military for a range of Intelligence Surveillance and reconnaissance (ISR) tasks.[4] About a decade later in the turn of the century the drones rapidly came into prominence in non-military domains. The commercial usage of drones expanded quickly from merely in media entertainment & marriages to more professional fields. Precision agriculture, crop monitoring, 3D mapping during construction, aerial surveys, disaster management, logistics, supply of

critical medicines, and many such applications.[5] Between 2010 to 2020, India witnessed exponential growth in both military as well as civil sectors of drone application albeit controlled by heavy imports of drones from Western countries and China. However, in 2010, the entry of UCAVs on the world stage changed the military drone dimensions rapidly. The AatmaNirbhar Bharat Abhiyaan (Self-reliant India campaign) launched on May 12, 2020, by our PM issued a clarion call to the nation and unveiled a special economic and comprehensive package for promoting drone development in India.[6]

The Government under the *AatmaNirbhar* initiative has tasked 12 central ministries to monitor and support the domestic demand for drone services in India, in an effort to position the country as a global drone hub by 2030. The following reform initiatives have been put into place by the central government to support India's developing drone industry:

(i) Production Linked Incentives (PLI): The government declared a total incentive package worth INR1.2 billion (about USD162 million) over the course of three fiscal years for the drone industry, start-ups, and manufacturers.

(ii) Revision of Import Policy: In February 2022, as a measure to promote the 'AtmaNirbhar' initiative, the government declared that while drone components could still be imported, the import of foreign drones was restricted.

(iii) Drone Shakti: In its 2022 budget statement, along with a revision of import policy, the union government unveiled the Drone Shakti programme, which aims to facilitate and promote drones as a service through businesses.

Defense Application and UCAV in India

The inherent advantage of drones with larger endurance, ease of operation, and stealth with the capability of carrying a variety of intelligent systems has changed the landscape of warfare by providing improved surveillance with reduced cost, minimising human capital loss to zero with enhanced flexibility. Drone employment in warfare, during the last decade, has rapidly moved on from the basic ISR role of 'passive participation' to 'active participation' by way of firing aerial weapons through UCAV and 'kamikaze' drones to accurately hit the target and destroy it. India is confronted with a growing threat from adversarial entities, including terrorist organisations, China, and Pakistan, who use drones for smuggling, reconnaissance, surveillance, intelligence gathering, sabotage, or attacks. This increases India's need not only for surveillance drones but also for UCAVs and counter-drone systems.

The journey of indigenous RPA in India commenced with the Indian Army finalising its General Staff Qualitative Requirements (GSQR) for such a system in 1990. DRDO, once tasked with it, developed the Nishant Remotely Piloted Vehicle (RPV), which conducted its maiden test flight in 1995. The Indian Army used the Nishant UAV system

for the first time in combat with insurgents in July 1999.[7] In the next decade, DRDO progressed from Nishant and Lakshya Pilotless Target Aircraft (PTA) to Rustom-1 Medium Altitude Long Endurance (MALE) UAV primarily for ISR role to augment already existing 'Searcher' and 'Heron' UAVs of Israeli origin. The success of initial indigenous efforts paved the way for the DRDO to surge ahead with its other programmes of drones for Intelligence Surveillance, Target Acquisition and Reconnaissance (ISTAR) and UCAV role. The UAVs developed under each of these categories are:

TAPAS with its higher-end technology capability adoption would be able to embrace Satellite Communication (SATCOM) against regular Line-of-Sight (LOS) communication, which would give an inherent advantage against jamming and spoofing.

(i) TAPAS-BH: As a MALE UAV, with a working altitude of 30,000 feet and a 24-hour endurance, TAPAS-BH is a military system that integrates the best Electro-Optical (EO) and Synthetic Aperture Radar (SAR) payloads available towards the designed role. TAPAS is expected to significantly enhance imagery for the Indian Armed Forces ISTAR range of operations throughout the terrain over land and sea.[8] Onboard Indian GPS Aided Geo Augmented Navigation (GAGAN) system, would be used to augment the integral ISTAR systems capable of identifying and detecting small targets. TAPAS with its higher-end technology capability adoption would be able to embrace Satellite Communication (SATCOM) against regular Line-of-Sight (LOS) communication, which would give an inherent advantage against jamming and spoofing. Additionally, it addresses the fundamental issues of Automatic Take-Off and Landing (ATOL) that were missing in the initial Rustom 2 prototype.

(ii) Ghatak: Stealth UCAV: DRDO designed and developed Ghatak which is an autonomous stealth UCAV. Autonomous Unmanned Research Aircraft (AURA) was its earlier designated name. As a stealth technology demonstrator, with an internal weapons bay, SWiFT Ghatak UCAV will be able to hold multiple weapons, ranging from bombs, and missiles, to any indigenous munition. Onboard computers, Secure Data Links (SDL), Identification Friend and Foe (IFF) systems, and fire control systems with very high precision capability would make Ghatak one of the most potent UCAVs amongst its competitors.

Future Technology Upgrades for Ghatak UCAV

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UCAVs have completely changed warfare through precision strikes and remote engagement. They support ground forces and engage high-value targets with precision-guided munitions. Combat drones minimise collateral damage, lower human risk, and improve operational effectiveness. They provide strategic

advantages and increase mission success by acting as force multipliers. Ghatak UCAV truly represents the 'AatmaNirbhar Bharat' concept initiated by the honourable Prime Minister. DRDO is constantly working towards technology upgrade of this indigenous platform and some of the initiatives are:

(i) AI-Based Autonomous Capability: In the drone industry, autonomous drones are a major technological development that allows UAVs/UCAVs to function without even an external pilot, by using AI-powered navigation and operational software. These autonomous drones are capable of taking off and landing, inspecting and surveying aerial sites, and performing weapon delivery with the capability to make decisions and perform tasks independently. DRDO is focusing on adding all these capabilities to Ghatak UCAV.

(ii) Swarm Drone Capability: Swarm drones, which use multiple drones that coordinate and cooperate with each other to accomplish various missions in a synchronised manner, are a major technological upgrade in drone employment in hostile environments. Swarm drones can be used for intensifying surveillance, electronic warfare and weapons towards precision strikes and overwhelming enemy defences. A fully functional decentralised swarm of twenty-five drones that flew with little assistance from humans was displayed by DRDO during the inaugural day of a three-day defence function held at Jhansi, MP.[9] DRDO is now working towards inducing similar capability in stealth drones Ghatak.

(iii) Accelerated 3D Mapping: In the drone industry, accelerated 3D mapping is a crucial technology that makes it possible to quickly and precisely create 3D models of the surrounding area using drone footage. Applications for it include construction, mining, agriculture, surveying, inspection, disaster relief and targeting. It can shorten the time and expense of gathering and processing data, increase the precision and quality of 3D models, and help users make better decisions and plan ahead. DRDO has moved forward in developing this capability too for the Ghatak UCAVs.

Conclusion

India's aspirations for technological advancement and self-reliance are driving the rapid growth and transformation of all sectors including defence in general and drones in specific. This change is being driven by the government's AatmaNirbhar Bharat initiative, which includes corporate partnerships, streamlined regulations, dedicated drone corridors, waivers for pilot permits, and manufacturing incentives. The government's commitment to increasing drone manufacturing and services is reflected in these initiatives. As regulatory barriers decrease and innovation and scalability are encouraged, this synergy creates opportunities for start-ups in industries such as defence, infrastructure, healthcare, and agriculture.

DRDO being the lead agency in defence development has moved some notches up with

this indigenous stealth UCAV Ghatak. It has not only placed India in the league of the top few self-reliant nations of the world but has also added a higher level of deterrence value to our defence capability against China and Pakistan in the neighbourhood.

The government-backed initiatives leading to these changes, foresee drone start-ups revolutionising a range of industries, including defence, healthcare and precision agriculture, by improving productivity and gaining data-driven insights.

The government-backed initiatives leading to these changes, foresee drone start-ups revolutionising a range of industries, including defence, healthcare and precision agriculture, by improving productivity and gaining data-driven insights. The drone startup ecosystem emerges as a source of innovation, driving advancement on both the regional and international arenas, as India continues to grow technologically and economically self-sufficient. Unprecedented expansion and influence lie ahead, as India's drone startups reimagine possibilities. Agencies like DRDO must take the lead in harnessing the talent from technical institutes like IITs/ NITs and the corporate sector be encouraged to fund Start-ups for the adoption of technology to make the Indian defence sector truly *AatmaNirbhar* in every aspect of equipment, operating system, support services, weapons and training.

Notes:

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[2] Richa Tyagi, "History of Drones in Conflict Zones," *GeoSpatial World*, April 3, 2023, https://www.geospatialworld.net/prime/business-and-industry-trends/history-of-drones-in-conflict-zones-2/. Accessed on December 24, 2023.

[3] Jim Garamone, "U.S. Drone Strike Kills al-Qaida Leader in Kabul," DOD News, August 2, 2022, https://www.defense.gov/News/News-Stories/Article/Article/3114362/us-drone-strike-kills-al-qaida-leader-in-kabul/. Accessed on December 24, 2023.

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[6] Ibid.

[7] "Drdo Nishant," *Academic Accelerator,* https://academic-accelerator.com/encyclopedia/drdo-nishant. Accessed on December 19, 2023.

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[9] Rahul Singh, "DRDO displays drone swarm in offensive role," *Hindustan Times,* November 18, 2021, https://www.hindustantimes.com/india-news/drdo-displays-drone-swarm-in-offensive-role-101637150019067.html. Accessed on December 26, 2023.

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