Flying high: India's indigenous UAV programmes

India has been developing unmanned aerial vehicles for almost a decade, predominantly driven by domestic defence requirements. *Akshara Parakala* explores the platforms being developed and potential markets

Since India began developing unmanned aerial vehicles (UAVs), the country has made great strides in the fields of small- and medium-class platforms.

To satisfy the growing demand of India's armed forces, research and development (R&D) organisations such as the Aeronautical Development Establishment (ADE), the National Aerospace Laboratories (NAL), Hindustan Aeronautics Limited (HAL), and Bharat Electronics Limited (BEL) have been developing UAVs with ISR, targeting, and weapon guidance capabilities.

The Nishant UAV is one of several indigenous UAV developments that India has undertaken to cater for the needs of its armed forces. (IHS Markit/Patrick Allen)

1510247

Private organisations such as Israel Aerospace Industries (IAI), ideaForge, and Edall Systems are involved in the development or part manufacture of these UAVs in collaboration with government-owned research organisations. Academic institutions such as the Indian Institute of Technology (IIT) Bombay and IIT Kanpur are also playing a vital role in the development of these indigenous Indian UAVs.

India's defence forces have already begun using UAVs in reconnaissance, border security, maritime patrol, and surgical strike. To meet the growing demands of the armed forces, the Indian government has invested millions of dollars in domestic and foreign-made UAVs, largely from Israel. The developments in India mostly encompass micro UAVs (MAVs), mini UAVs, tactical UAVs, and

medium-altitude long-endurance (MALE) UAVs, where the designs were started from scratch but integration was undertaken with the help of foreign companies.

[Continued in full version…]

Suchan

The Council of Scientific and Industrial Research (CSIR) – NAL in particular has been leading development of MAVs and mini UAVs to meet the requirements of India's military and civil forces. The organisation, which was previously succeeded in the development of three MAVs (Black Kite, Golden Hawk, and Pushpak), is now developing a mini UAV named Suchan. It was started under a government planned CSIR project that was proposed in 2012, and was ready to be tested in its baseline configuration in 2014. This electrically powered vehicle has an indigenously developed autopilot enabling it to undertake autonomous flight with the aid of GPS. The system can be transported easily, is electrically operated, hand-launched/belly landed, and robust enough for operations from any location.

The Suchan UAV has been developed by the Council of Scientific and Industrial Research - National Aerospace Laboratories. (IHS Markit/Mathew George)

1682670

The Suchan is being improved, and while the model showcased at Aero India 2017 carried an interchangeable daylight or infrared (IR) camera, the improved version can carry both simultaneously. The circular fuselage on the older version is replaced with a rectangular one to increase the room to place both cameras. This not only provided extra room for avionics but also improved the stability of the system by shifting the gimbal placed on the nose to the belly.

The vehicle's endurance has now increased from 75 to 120 minutes due to a reduction in the all-up weight through the use of composites and an increase in the wingspan from 1.6 to 1.85 m. Further, to improve the endurance, the incidence of the wings is reduced making it more suitable for low-altitude operations. The glide ratio has also been improved by introducing a retractable gimbal, which can be housed in the fuselage when not in use.

The operating altitude of the Suchan ranges from about 300 to 900 ft above ground level, while its service ceiling is 4,600 ft with an all-up weight of 3.5 kg. The Suchan, which can operate in a short take-off and landing (STOL) configuration with static object tracking, geo tagging, terrain following, and software image stabilisation and mosaicking, is now expected to operate in a vertical take-off and landing (VTOL) configuration with moving object trajectory within a year. The current system has GPS-aided waypoint navigation and loiter, and can be controlled via a user-friendly ground-control station (GCS) with real-time video and recording. It features a 'safety pilot' and a return-to-home facility should the link be lost or the battery run down, and it can be easily assembled by a team of two.

The newly developed Suchan UAV. (CSIR-NAL)

1717966

The Suchan can be used for border and coastal security, battle damage assessment, forest-fire detection, weather data collection, commercial aerial surveillance, mapping applications, and search-and-rescue operations. The system has been used by a number of India's government departments and tested by the Indian Air Force.

[Continued in full version…]

Target tracking from the Suchan UAV. (CSIR-NAL)

1717967

Imperial Eagle

India's Defence Research and Development Organisation (DRDO) has extensive experience in the development of UAVs, especially in the mini and medium categories. It has proven the capabilities of its older systems like Kapothaka, a mini remotely piloted vehicle (RPV) demonstrator; Ulka, an air-launched target; Nishant, a tactical UAV system; Lakshya, a pilotless target aircraft (PTA); Imperial Eagle (IE), a mini UAV designed and tested in collaboration with CSIR-NAL; Netra, a quadcopter designed and developed in collaboration with ideaForge; and Rustom, MALE UAV. The DRDO is now working on projects to improve several of these platforms, and is developing others such as the Rustom-II, Panchi, and Lakshya-2. Future projects named Rustom-H, AURA (indigenous unmanned combat air vehicle [UCAV]), and Abhyas are also being considered.

Among the platforms produced by DRDO, the IE and Netra have been the most successful and these are being used by many organisations. IE is a mini UAV jointly developed by the DRDO and CSIR-NAL. The mini UAV is used for surveillance and target tracking, and its brushless DC motor enables it to fly at speeds of up to 90 km/h. Its lightweight structure weighs 2.3 kg, has a high wing spanning 1.6 m, and affords a high endurance of 60 minutes with its sleek-podded fuselage of 1.2 m. It has a maximum range of 10 km and service ceiling of 14,000 ft.

The Imperial Eagle is billed as having a 10 km range and 14,000 ft service ceiling. (Akshara Parakala)

1717961

IE can be carried in a backpack ahead of being launched by hand. Being fully autonomous, the operator needs no flying skills, and the aircraft's navigational waypoints can be changed during the flight with a real-time operating system (RTOS). The total system comes with a ground tracker system, autopilot, orientation control by RTOS, and is provisioned to carry a daylight camera or night-vision/high-definition (HD) IR camera. It can feed continuous imagery to a ground station within a range of 10 km. Further, the UAV can be tracked with automatic gain control- or GPS-based systems.

[Continued in full version…]

Netra

Another DRDO-developed UAV is Netra, which was launched in 2012 in collaboration with ideaForge. This quadcopter is a fully autonomous manportable micro UAV. Since the vehicle uses counter-rotating propellers, it can easily perform VTOL operations, further minimising the piloting skills needed to operate the system. The vehicle's overall size is less than 0.9 m^3, making it suitable to launch from a confined space. The propellers are battery powered which enables the vehicle to hover at a maximum altitude of 6,500 ft to a range of 10 km and have an endurance of more than 50 minutes. The vehicle can operate in up to 16 kt cross winds. It can carry a day-light camera or HD-imaging payload with 10x optical zoom, or a night-imaging payload with 4x optical zoom and a 360° pan and 90° tilt. This enables it to be used for surveillance, reconnaissance, and rescue operations during day and night with real-time footage, image stabilisation, and autonomous target tracking.

The Netra UAV prior to launch for flight-tests. (Akshara Parakala)

1717962

Netra is supported by a GCS which includes a rugged laptop or tablet; remote control (RC) for camera control and settings; a map display with symbology for UAV location, trajectory, and flight plan; and real-time video footage captured by the UAV. Netra has the ability to auto-land in the case of a low battery, and has a return-to-home facility in case of communication failures or out-of-limits wind conditions.

[Continued in full version…]

Nishant

Another project undertaken by the DRDO is Nishant, whose design started in 1995 and had its first flight in 2008. Nishant is a multipurpose tactical UAV used for intelligence gathering, reconnaissance, training, surveillance, target tracking, artillery fire correction, and damage assessment. It is also used for electronic intelligence (ELINT) and signals intelligence (SIGINT).

Nishant weighs 385 kg, and is launched using a hydro-pneumatic launcher and recovered via parachute and an impact attenuation system.

[Continued in full version…]

The Nishant UAV has had a chequered history with the Indian armed forces, with the army cancelling its participation in the project in 2015 following a spate of crashes. (DRDO)

1717963

Panchi

A wheeled version of Nishant called Panchi, capable of taking-off and landing using short runways, is to be launched by the DRDO later this year. It had its successful maiden flight in 2014 with the aid of external radio-controlled flight. Panchi is said to have all the capabilities of Nishant, except that the performance has been improved and it will have a longer endurance as it will not be loaded with air bags or a parachute system. It is estimated that Panchi will fly at 150 km/h with a domestically built Wankel engine developed with CSIR-NAL and Vehicle Research and Development Establishment (VRDE).

[Continued in full version…]

Rustom II/TAPAS BH 201

Rustom, which was designed to be a technology demonstrator for Rustom-II, was successfully flown in 2010. Rustom was designed by CSIR-NAL Light Canard Research Aircraft (LCRA) in the 1980s. Rustom-II has done away with the original canard configuration, using instead a conventional high-wing with T-tail configuration. It also features wing-mounted turboprop engines and a retractable tricycle landing gear.

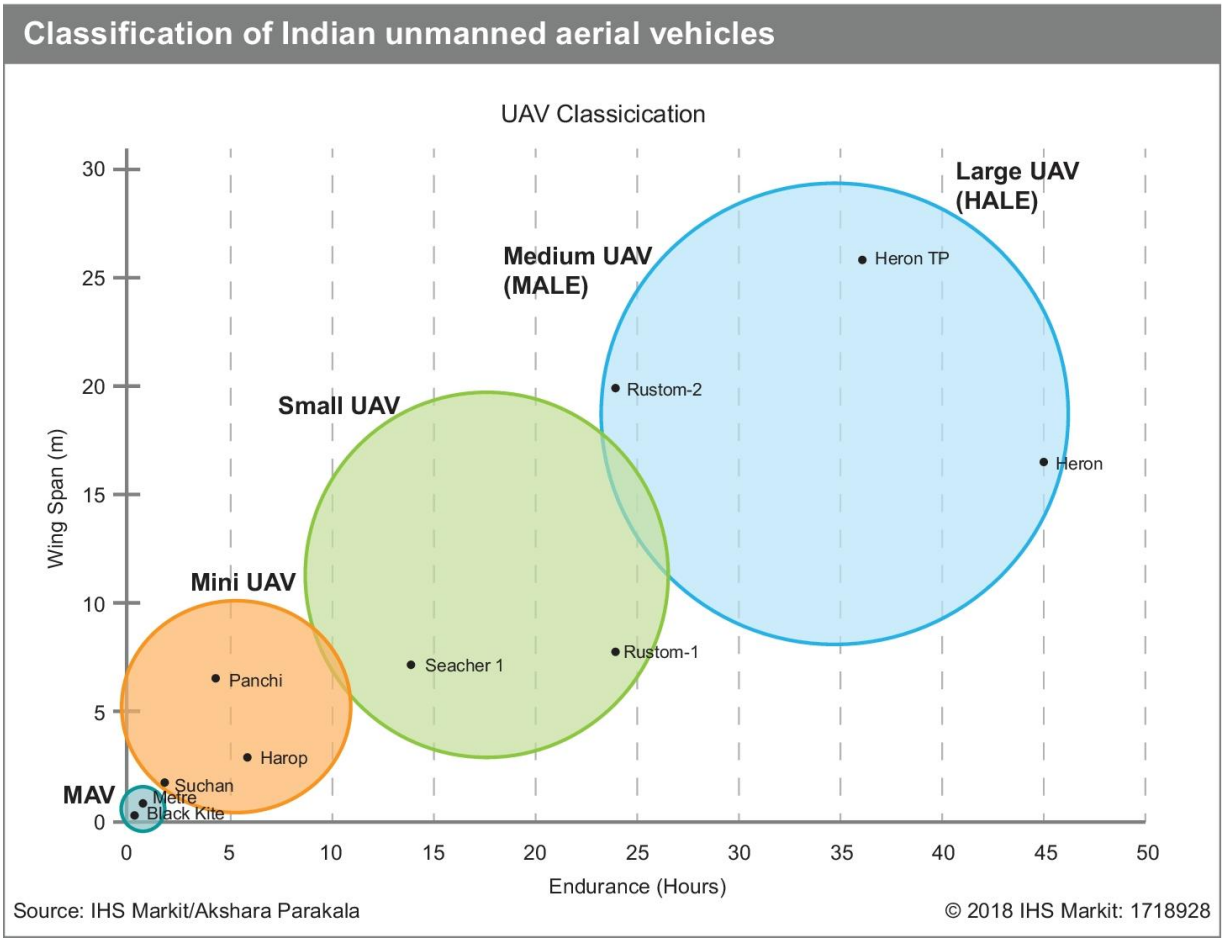
Rustom-II has been renamed Tactical Air-Borne Platform for Surveillance-Beyond Horizon 201 (TAPAS BH 201) and is believed to perform only non-combat roles, chiefly surveillance. It had its maiden flight on 16 November 2016 at the Aeronautical Test Range (ATR). This 2.1-ton aircraft spanning 20.6 m can achieve an altitude of roughly 22,000 ft, making it suitable for ISR roles requiring an endurance of about 24 hours. Reports say that TAPAS BH 201 is capable of carrying different combinations of payloads. These include ELINT, communication intelligence (COMINT), medium-range electro optic (MREO), long-range electro optic (LREO), synthetic aperture radar (SAR), maritime patrol radar, situational awareness payloads (SAPs) to perform missions during day and night, and a collision avoidance system.

[Continued in full version…]

AURA/Ghatak

The DRDO is also looking to deliver state of-the-art UAV systems to the Indian armed forces that incorporate technologies beyond those in use today. Futuristic programmes from the DRDO include the Autonomous Unmanned Research Aircraft (AURA), the Unmanned Combat Aerial Vehicle (UCAV), as well as other multirole and solar-powered UAVs.

AURA is being designed to be a tactical stealth aircraft able to deliver laser-guided weapons. Initial design images show it to be powered by a domestically built Kaveri turbofan, and equipped with internal weapons bays. The vehicle can operate at a maximum altitude of 30,000 ft out to a range of 300 km, with an all-up weight of 1.5 tons. The programme was started in 2009 and has been stopped and restarted several times since then. The latest restart in 2014 follows a collaboration with the Aeronautical Development Authority (ADA) and has seen the AURA revived under the name Ghatak (Lethal). The AURA/Ghatak is expected to be flown by many Indian agencies, such as the Aeronautical Development Establishment (ADE), the Defence Electronics Application Laboratory (DEAL), the Defence Avionics Research Establishment (DARE), and the Gas Turbine Research Establishment (GTRE) – all divisions of the DRDO. Low-speed testing is expected in the Indian Institute of Kanpur, with a fully developed flying prototype expected to be complete by 2023.



Classification of Indian UAVs. (IHS Markit/Akshara Parakala)

1718929

Hindustan Aeronautics Limited (HAL) is developing the Gagan tactical UAV in conjunction with the DRDO. It is understood to operate at an altitude of 20,000 ft with a 250 km range. Also, HAL is expected to work with IAI in converting the Indian Navy's Chetak helicopters into unmanned NRUAV platforms. The DRDO is likely to be joint ventured with IAI to produce the Pawan mini UAV, which has a maximum range of 150 km and endurance of five hours and is comparable to Israel's Eye View, Hermes 180, and Silver Arrow. The details of the above programmes have not yet been revealed.

[Continued in full version…]