

UAV-based remote sensing in defence

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Key takeaways:

- *UAVs are an ideal surveillance tool to monitor large land areas with relatively little manpower*
- *Drones of the future should have the capability to be equipped with sensors across multiple spectrums*
- *Drones that can effectively deploy AI, operate as a swarm, perform network-centric operations, etc. will have a decisive advantage in the modern battlefield.*

Drones or unmanned aerial vehicles (UAVs) have been used by India's defence and security forces for well over a decade. These platforms come in various size categories ranging from nano drones weighing less than a kilogram to large and heavy drones weighing almost a ton. From the beginning, it was evident that these platforms are an ideal surveillance tool, capable of monitoring large land areas with relatively little manpower.

Today, as these platforms and sensors get more advanced, global militaries are looking at drones to fulfil multiple additional roles, such as active combat/surgical strikes, electronic warfare, mid-air refuelling, delivery of critical cargo to remote locations, etc. The rapid improvements in sensors as well as software, hardware and deployment tactics mean that there is a great amount of change, both for original equipment manufacturers (OEMs) that manufacture them as well as security forces that operate them.

Maritime reconnaissance

In the marine environment, drones are used to track ship traffic and scan over the horizon to assist in targeting and providing a lookout for piracy/other criminal activities. Military drones being deployed in a maritime environment may require the endurance of a fixed-wing aircraft while operating from the limited deck space of a ship. This would require the drone to have a launch and recovery mechanism or vertical take-off and landing (VTOL) capabilities, similar to aircraft/helicopters operated from decks.

Infantry level/tactical battlefield surveillance

Drones play a vital role in providing real-time situational awareness on the battlefield, which is often the primary determinant of success in modern operations. Drones are used to scout enemy positions and movements, provide real-time spotting data for artillery guns and help establish a Line of Sight (LoS) virtual network. A drone operated by an infantry team would need to be lightweight, rugged and simple to operate with a small audio and visual signature.

Counterinsurgency and border surveillance

In the role of counterinsurgency and border surveillance, drones act as force multipliers. This is especially pertinent in a country with as diverse geography as India, where physical patrols pose a significant challenge in terms of manpower and logistics. Drones equipped with thermal and infrared cameras also provide round-the-clock vigilance, including at night and in adverse weather.

Electronic intelligence gathering and airborne early warning

Electronic Intelligence (ELINT) is one of the most important aspects of modern surveillance and data gathering. Drones with extremely sensitive and sophisticated sensor equipment are used to monitor enemy transmissions, radar emissions, communications and aircraft movements. Drones are ideal for this role, as

they can be designed to operate stealthily and have long endurance, and can be deployed in theatres of operations too risky for human pilots and ELINT operators.

In terms of sensory capabilities, the drones of the future should have the capability to be equipped with sensors across multiple spectrums. The user may, depending upon the mission requirements, need either infrared, night vision or digital high-resolution imagery of the area of operations. For some of the larger drones, such as those used for airborne early warning or ELINT operations, the ability to operate in an electronically cluttered environment, withstanding the enemy's electronic jamming and the ability to switch/jump between frequencies would be critical.

As drones across the globe move towards more efficient designs for their specific category of tasks, the software that they run on will be one of the major differentiators. Drones that can effectively deploy Artificial Intelligence (AI), operate as a swarm, perform network-centric operations, etc., will have a decisive advantage in the modern battlefield. This is also where the next phase of opportunities in the military drone market may be found, with some of the largest global drone manufacturers looking for partners to provide the necessary software capabilities. Indian firms, which are already working in the fields of technology, may seek to explore the possibility of developing the same for drones. Given that the threats of the modern battlefield are ever evolving, and the drone being hacked or attacked electronically is a possibility, the software would need to account for the same, build in the appropriate redundancies and provide regular update patches.

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