



P.L.RAJ IAS & IPS ACADEMY

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EDITORIAL OF THE DAY-16.06.2026

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1. Drone Revolution and Modern Warfare

Syllabus

GS Paper III: Internal Security, Defence Technology, Emerging Technologies, Science & Technology

Introduction

The conflicts in Ukraine, Lebanon and West Asia have demonstrated a fundamental shift in the nature of warfare. Drones, once primarily used for surveillance and reconnaissance, have evolved into versatile military assets capable of precision strikes, electronic warfare, logistics support and battlefield intelligence. The proliferation of low-cost unmanned systems has altered military doctrines, reduced the dominance of conventional platforms and transformed warfare into a contest driven by technological innovation, industrial capacity and adaptability.

Analysis

End of Conventional Military Superiority

- Traditionally, military power was measured by the size and sophistication of conventional assets such as tanks, fighter aircraft, artillery systems and missiles. Recent conflicts have shown that inexpensive drones can neutralize high-value military equipment, challenging the conventional understanding of battlefield superiority.

Transformation of the Battlefield

- Drones have created an environment of persistent surveillance where troop movements, logistics routes and military installations are continuously monitored. The battlefield has become increasingly transparent, reducing the ability of forces to conceal operations and increasing the speed of target acquisition and engagement.



Ukraine's Drone Warfare Model

- Ukraine has emerged as a pioneer in large-scale drone warfare. Commercially available drones were rapidly adapted for military applications and integrated into surveillance, artillery spotting, logistics support and deep-strike operations. This model has demonstrated how innovation and rapid adaptation can significantly enhance battlefield effectiveness.

FPV Drone Revolution

- First-Person View (FPV) drones have become one of the most disruptive innovations in modern warfare. Their low cost, high manoeuvrability and real-time targeting capability enable operators to destroy expensive military assets with precision. This has dramatically altered battlefield economics and expanded access to precision strike capabilities.

Evolution of Loitering Munitions

- Loitering munitions combine surveillance and attack functions within a single platform. These systems can remain airborne for extended periods while searching

for targets before executing precision strikes. Their versatility has increased operational reach and improved battlefield effectiveness.

Fibre-Optic Drones and Electronic Warfare

- The emergence of fibre-optic drones represents a significant technological advancement. Unlike conventional drones that rely on radio-frequency communication, fibre-optic drones remain resistant to electronic jamming. Their effectiveness in contested electromagnetic environments highlights the growing importance of electronic warfare in modern conflicts.

Counter-Drone Architecture

- As drones become central to warfare, counter-drone capabilities have gained strategic importance. Modern defence systems increasingly incorporate radar networks, electronic warfare platforms, signal-jamming technologies and drone interception systems. The ability to counter hostile drones is becoming as important as deploying offensive drone capabilities.

Regional Drone Networks in West Asia

- Several actors in West Asia have developed extensive drone networks capable of long-range surveillance and precision strikes. These networks have expanded the operational reach of both state and non-state actors, increasing the complexity of regional security dynamics.

Drone Warfare and Proxy Conflicts

- The affordability and accessibility of drones have enabled proxy groups to project military power at relatively low cost. Drones are increasingly used to target military installations, critical infrastructure and strategic assets, reshaping the nature of proxy warfare and regional conflicts.

Economics of Modern Warfare

- The drone revolution has transformed the economics of warfare. Military effectiveness is increasingly determined by industrial production capacity, technological innovation and the ability to rapidly adapt to evolving threats. Low-cost, mass-produced systems are gradually replacing dependence on expensive conventional platforms.

Implications for India's Defence Preparedness

- For India, the lessons from Ukraine and West Asia highlight the need to strengthen indigenous drone manufacturing, enhance counter-drone capabilities, integrate artificial intelligence into military systems and modernize defence doctrines.

Building a resilient domestic drone ecosystem will be essential for maintaining strategic and technological superiority.

Way Forward

Strengthen Indigenous Drone Manufacturing

1. Promote domestic production of drones and related technologies.
2. Encourage private-sector participation and defence start-ups.

Develop Advanced Counter-Drone Systems

1. Invest in electronic warfare capabilities.
2. Deploy integrated air defence and anti-drone systems.

Enhance Defence Research and Development

1. Increase investments in AI, robotics and autonomous systems.
2. Strengthen collaboration between industry, academia and defence institutions.

Modernize Military Doctrine

1. Integrate drones into operational planning across all branches of the armed forces.
2. Establish specialized drone warfare and counter-drone units.

Expand Defence Industrial Capacity

1. Scale up manufacturing capabilities.
2. Reduce dependence on imported technologies and components.

Conclusion

The drone revolution marks one of the most significant transformations in military affairs in the twenty-first century. As warfare becomes increasingly driven by unmanned systems, software and artificial intelligence, military success will depend on a nation's ability to innovate, manufacture, deploy and counter drone technologies at scale. For India, strengthening indigenous capabilities in drones and counter-drone systems is essential for ensuring national security and strategic autonomy.

Source: <https://www.thehindu.com/news/international/drone-revolution-and-modern-warfare-explained/article71104697.ece>

Practice Mains Question

1. "The proliferation of low-cost drones has fundamentally altered the character of modern warfare." Examine its implications for India's defence preparedness and military modernization. (250 Words)

Introduction (30–40 Words)

The widespread use of drones in conflicts such as **Ukraine** and **West Asia** has transformed modern warfare. Affordable unmanned systems have enhanced surveillance, precision strikes, and operational flexibility, making **technological innovation** and **industrial capacity** central to military power.

Implications for Modern Warfare and India's Defence Preparedness (100–120 Words)

Transformation of Battlefield Dynamics

1. Drones have reduced the dominance of **conventional platforms** such as tanks, artillery, and fighter aircraft.
2. **Persistent surveillance** has increased battlefield transparency and real-time intelligence gathering.

Rise of Low-Cost Precision Warfare

1. **FPV drones** and **loitering munitions** can destroy high-value targets at a fraction of the cost of conventional weapons.
2. Example: **Ukraine's extensive use of FPV drones** against Russian military assets.

Emerging Security Challenges

1. Proliferation of drones among **state and non-state actors** increases threats to critical infrastructure and military installations.
2. Necessitates robust **counter-drone systems** and **electronic warfare capabilities**.

Strategic Implications for India

1. Highlights the need for **indigenous drone manufacturing** and **technological self-reliance**.
2. Requires integration of drones across surveillance, border management, and combat operations.

Measures for Military Modernization (70–80 Words)

Strengthening Indigenous Capabilities

1. Promote domestic drone manufacturing under **Atmanirbhar Bharat**.
2. Encourage defence start-ups and innovation through initiatives such as **iDEX**.

Enhancing Counter-Drone Systems

1. Deploy advanced **radar, jamming, and interception technologies**.
2. Develop **layered air defence architecture**.

Investing in Emerging Technologies

1. Increase investments in **Artificial Intelligence (AI), autonomous systems, robotics, and swarm drone technologies**.
2. Modernize military doctrines to incorporate **drone-centric warfare**.

Conclusion (30–40 Words)

The drone revolution represents a paradigm shift in military affairs. For India, strengthening **indigenous drone ecosystems**, enhancing **counter-drone capabilities**, and integrating **emerging technologies** into defence planning are essential for ensuring **strategic autonomy** and future battlefield readiness.