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Guest lecture on "UAV Systems – An Overview"

The Department of **Aeronautical and Aerospace Engineering** organised a **Guest lecture** titled **UAV Systems – An Overview** on to provide students with insights into the design, development, and applications of Unmanned Aerial Vehicles (UAVs).

Schedule of the Event

- **Date:** November 7, 2025.
- **Time:** 10:00 AM – 12:00 PM.
- **Venue**Seminar hall 1, M V J College of Engineering
- **OrganiSed by:** Department of Aeronautical and Aerospace Engineering.
- **Speaker:** Dr. P. Patrick Joseph Kennedy
  Scientist 'H' and Outstanding Scientist (Retd.)
  Former Programme Director, Cruise Missiles and Associate Director, ADE, DRDO

Dr Kennedy began by explaining the evolution of UAV technology and its significance in modern aerospace and defence systems. He highlighted the key components of UAVs, including airframe design, propulsion systems, avionics, and payload integration.

Introduction:

Unmanned Aerial Vehicles (UAVs), commonly referred to as drones, are aircraft operated without an onboard human pilot. They have become an integral part of modern aviation and defence systems, offering capabilities for surveillance, reconnaissance, logistics, and combat missions. A UAV system combines advanced aerodynamics, propulsion, communication, and control technologies to perform a variety of civilian and military applications. The following report provides a comprehensive overview of UAV configurations, classifications, recovery techniques, and examples of notable UAV systems used globally.

Figure 1: Inauguration of the Guest Lecture

Figure 2: Honouring the Guest by HOD

UAV System Configuration:

A UAV system configuration includes hardware and software components that support autonomous or remote-controlled flight for specific missions. The major components are described below:

- Air Vehicle (UAV Platform): The UAV consists of the main airframe, which can be fixed-wing, rotary-wing, or hybrid. It includes propulsion systems such as electric motors, propellers, or jet engines. The power supply may be from Li-Po or Li-ion batteries, fuel cells, or small gas engines. Additional parts include flight control surfaces like ailerons, rudders, and elevators, along with landing gears for take-off and landing operations.
- Flight Control System (FCS): The flight control or autopilot unit contains microcontrollers like Pixhawk or DJI N3, integrated with sensors such as IMU, gyroscope, accelerometer, magnetometer, GPS, and barometer. These ensure stable flight and navigational accuracy.
- UAVs use telemetry links for real-time data transmission, RC control links for manual operations, and FPV (First Person View) links for live video. Ground Control Stations (GCS) enable mission planning and monitoring via laptops or tablets.
- Payload: Payloads depend on mission type—RGB or thermal cameras for surveillance, LIDAR for mapping, delivery mechanisms for logistics, or weapon systems for defence applications.
- Power Management: The power management unit includes Battery Management Systems (BMS), Electronic Speed Controllers (ESCs), and voltage regulators to ensure efficient energy distribution.
- Guidance and Navigation: UAVs use GPS/GNSS and INS for positioning, while obstacle avoidance is achieved via ultrasonic, LIDAR, or vision-based systems.
- Software Components: Mission planning and flight control software such as Mission Planner or QGroundControl support autonomous operations. Features like Return-to-Home (RTH), geofencing, and auto-landing enhance safety and precision.

Figure 3: The guest addressing the gathering

UAVs in Modern Warfare:

In contemporary conflicts, UAVs play a decisive role in reconnaissance, precision strikes, and electronic warfare. For instance, during the Ukraine-Russia war, drone swarms and AI-enabled UAVs have revolutionised tactical strategies. Countries are investing in swarm tactics and autonomous combat drones, highlighting their strategic importance in modern defence.

Outcome of the event:

The guest lecture on "UAV Systems – An Overview" successfully achieved its objectives of enhancing students' understanding of Unmanned Aerial Vehicle technologies.

- Knowledge Enhancement: Students gained insights into UAV design principles, operational roles, and emerging trends such as AI integration and swarm technology.
- Industry Exposure: The lecture bridged the gap between academic concepts and real-world applications in defence and civilian sectors.
- Research Motivation: The session inspired students to explore advanced topics

in UAV systems, fostering interest in aerospace research and innovation.

- United States: MQ-9 Reaper (combat and surveillance), RQ-4 Global Hawk (high-altitude ISR), and Switchblade (loitering munition) are key UAVs. The U.S. also leads in AI-enabled autonomous drones.
- Interactive Learning: The QA segment encouraged active participation, enabling students to clarify technical doubts and learn from the expert's experience.
- Career Orientation: Students were informed about potential career paths in UAV development and related defense technologies.

Conclusion:

UAV technology continues to evolve rapidly, integrating artificial intelligence, advanced materials, and autonomous control systems. From small recreational drones to high-altitude combat UAVs, their applications span across defence, logistics, and research. With nations racing toward self-reliance in UAV capabilities, the future promises more efficient, intelligent, and mission-flexible aerial systems.

Report by: Prof. Irfan Khan and Prof. Gooty Rohan

Affiliation: Faculty in the Department of Aeronautical Engineering, MVJ College of Engineering