Research on Unpiloted Vehicles

# Attributes of UAVs

## Concepts

* Propulsion type
* Overall dimension (L x W x H)
* Fuel type – Diesel vs Battery
* Max payload (weight)
* Take-off type: Vertical Take Off and Landing (VTOL) technology vs. runway
* Max. Speed – 370 km/h
* Max. elevation
* Max. Range (1000 km)

## Issues to investigate

Electric is battery powered. Is battery type a factor in simulation?

Russian Drones [SwarmAttack]

* Written Sept, 18, 2025
* Can have 200 drones in one swarm.
* Immune to EW attack
* Packed with explosives and used like missiles
* Countered with Interceptor Drones that can chase down targets.
  + Cheap drones fast enough to catch up to attack drone and ram into it with small warhead.
  + Need to be twice as fast as drones to catch them.
  + FPV drone

FPV drone

* Drone controlled from First-Person perspective/View (FPV). Pilot wears goggles that transmit live video feed from camera on the drone.

# Propulsion Systems

[Propulsion]

Fixed-Wing drone propulsion – Rely on wings for lift. Propulsion is typically located in the rear or front. Provide forward thrust rather than vertical lift.

* Engines used in fixed-wing: both electric and internal combustion.

Multi-Rotor Propulsion – e.g. quadcopters. Known for agility, stability, and ability to hover in place.

* Can change motor speeds dynamically and maneuver precisely, maintain stability even in challenging conditions.

Gas-Powered Drones internal combustion engines

* Use fuel sources like gasoline or diesel
* Electric is more efficient in small-scale drones
* Combustion engines for larger drones or long-duration flights.

Type of propulsion system depends on the application of the drone.

* Military Drones – hybrid or combustion engine systems for extended range, high-speed flight, endurance. Used for surveillance, reconnaissance, and sometimes offensive operations.
* Commercial Drones
  + Agricultural monitoring, delivery services, infrastructure inspection
  + Electric or hybrid systems
  + Short-range tasks – electric
  + Hybrid – greater range and flight duration
* Consumer Drones
  + Photography, videography – electric propulsion – simplicity, low cost, ease of maintenance
* Industrial Drones
  + Tasks requiring heaving lifting
  + Construction, search and rescue, firefighting,
  + hybrid or fuel-based propulsion systems – higher power output

Future Trends

* Hydrogen Fuel Cells – alternative to traditional batteries & combustion engines
* Solar Power Integration – extended missions due to recharging during flight
* Autonomous Power Management – AI & machine learning used to optimize power distribution in real-time based on flight conditions and energy availability
* Distributed Propulsion – multiple small motors across drone’s frame.
  + Increases redundancy, improves stability, reduces likelihood of total system failure.

# References

[Propulsion] [Drone Propulsion Systems - Fly Eye](https://www.flyeye.io/drone-technology-propulsion/#:~:text=Engines%20Used%20in%20Fixed%2DWing,required%20range%20of%20the%20drone.) retrieved 19 Sept 2025

[SwarmAttack] [Ukraine says Russia's new jet-powered attack drone is full of foreign parts and immune to electronic warfare](https://www.yahoo.com/news/articles/ukraine-says-russias-jet-powered-134732243.html?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAADGpkBJtZ4aGobAEd9lElNU6iPuEnF2oiTaPEEhQUBLEWv8pEL7GZ6mEtHnI6MgMU7My5qk5EFYuKH-e_vxILuJvdWyyuIyJhlvi-qUVLgFy3jPI7-etWQ9aRN4VxjGJtwG6WgM6CSEk9jep49dODXeLPw78Tnx_HCnNtNBmmo2e) retrieved 19 Sept 2025, but written 2022.