Ukraine Conflict UAV Evolution

UAVs in Ukraine are constantly evolving, forcing rapid innovation within small windows of advantage

Fixed Wing ISR	Quadcopter	One Way Attack (OWA)	First Person View (FPV)	Autonomy

Orlan-10 · Forpost · "Baba Yaga" · DJI Mavic 3 · KUB-BLA · Shahed – 136 · FPV w/RPG · FPV w/FRAG · R18 · Zala 421-16E

Start of Conflict	Early 2022	Mid – Late 2022	Mid – Late 2023	Late 2023 – Early 2024
Real-time forward observation, fires direction/adjustment, & cueing of strike systems	Engage dismounted or defiladed troops, armored systems, & other targets w/dropped munitions	Expendable w/integrated warhead to detonate upon target impact, providing accurate, long-range strikes	Enabling hunter-killer teams to destroy targets by delivering munitions via virtual "kamikaze" strike missions	Operates autonomously…intelligent detection & recognition of objects by class & type in real time

Fixed Wing ISR

Platform Characteristics
- Fixed Wing
- Medium – Large
- Long-range, longer duration
- Military

TTPs
- Battlefield Transparency – Observed/Directed fires
- Reusable

Innovations
- Comms link for constellations of lo-alt UAVs
- Laser Target Designator

Quadcopter

Platform Characteristics
- Quadcopter & Multi-rotor
- Small – Medium
- Short-range, limited duration
- Commercial

TTPs
- Battlefield Transparency
- Daytime/Nighttime
- Top attack
- Repeaters extend range & mitigate EW jamming
- Reusable

Innovations
- "Motherships"
- Thermal Imagers
- Teaming – ISR/Strike/Repeaters

One Way Attack (OWA)

Platform Characteristics
- Fixed wing
- Small – Medium
- Longer-range, longer duration
- GPS Waypoint
- Military

TTPs
- Battlefield Transparency – Precision fires
- Daytime/Nighttime
- Loitering Munition/OWA
  - Fixed Targets
  - Small – Medium Targets

Innovations
- Military Import (Iran)
- Loitering Munition/OWA
- Counter Jamming

First Person View (FPV)

Platform Characteristics
- Quadcopter
- Small & Fast
- VR Guided
- Commercial

TTPs
- Battlefield Transparency – Precision fires
- Daytime/Nighttime
- Loitering Munition/OWA
  - Moving targets/Vulnerable points
  - Enter small, confined areas

Innovations
- "Cottage Industry" Manufacturing
  - 3D Printed
- Laser Target Designator

Autonomy

Platform Characteristics
- Multi-rotor & Fixed Wing
- All sizes
- Military & Commercial
- Longer-range, longer duration

TTPs
- Battlefield Transparency
- Kill-box – Targeting
- Daytime/Nighttime
- Repeaters extend range & mitigate EW jamming
- Reusable & Loitering Munition

Innovations
- AI-enabled Machine Vision & Learning
  - Target/Terrain recognition
- Fully autonomous lethality
- Immune to EW jamming

Evolution driven by EW, attrition, munitions shortages, precision, & cost-effectiveness

UAVs' continued evolution towards greater autonomy & interconnectivity within kill chains represents a major shift in the character of war -- proliferating precise & massed strike capability