



04DEC25

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Air and Missile warfare

Observations on the technical evolutions in the Ukraine war

Introduction: a word on the main actors



Introduction: a word on the main actors



1991 - 2008

3 Separate Commands
VVS Air Force (DA-FA-VTA)
Air Defence (PVO strany) - Army
Russian Naval Aviation

- Budget cuts
- Poor Maintenance
- Declining Pilot Standards



2008-2015

One command - 4 districts
VVS Air Force (DA-FA-VTA)
Air Defence (PVO strany)
Russian Naval Aviation

- Streamline command
- Better Trg and Readiness
- Modernise Fleet



2015 -

One air force
VKS Vozdushno – Komsicheskiye Silly
3 Branches

- Air Force VVS
- Air and Missile Defence (GBAD)
- Space Force

Unified Aerospace Theatre
Active Defence
Non-Contact Warfare (precision and EW)



1991-2004

Ukrainian Air Force

- 3rd largest Air Force (2000 soviet aircraft)
- 1992 Budapest memorandum
- (majority of AC and Missiles back to RUS)
- Underfunding and mothballing



2004-2021

Ukrainian Air Force

- Air Defence merges with Air Force
3 Branches
 - Aviation
 - Anti Aircraft Missile forces
 - Radio Technical Troops



2022 -

Ukrainian Air Force

- 2 Branches – 4 Regional Commands
 - IAMDS
 - Tactical Aviation
 - Survive
 - Attrit VKS
 - Deny VKS Air Superiority

Introduction: a word on the main actors

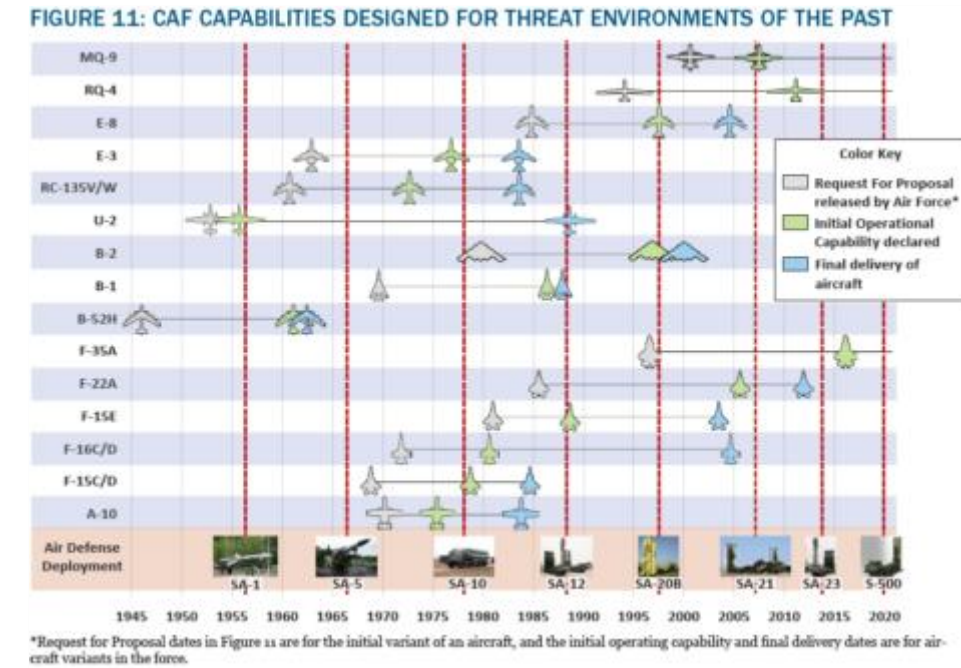
- The VKS and UAF share common historical roots.
- The History of Air Power EAST vs WEST: fundamentally different.
- Heavily influenced by Army doctrine (Aircraft = Long Range Artillery or Transport)



So, what happened post 1991 ?

- Soviet era – defeating NATO air force head on = impossible
 - Proven by Desert Storm
- NATO – and the subsequent distrust towards the west.
 - “Expansionist West” - rhetoric
 - “Abuse of Russian opposed mandates” proven through operations like Allied Force, Iraq 2003, Unified Protector
- Air Defence remains the focus – defeat technology (GBAD – EW)
 - Syria 2015 – considered a strategic win for the VKS (in supporting Bashar Al Assad’s army) compared to the Western Air Force.

No real doctrinal (r)evolution post 1991 – Defence in Depth



Five_Priorities_For_The_Air_Forces_Future_Combat_Air_Force_Web2.pdf

Bias warning: A comparison with the Western Way of Air War is a dangerous approach.



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A summarized time-line of the conflict

Mar'22

2022|2023

2023|2024

2024|2025



Feb-Mar'22
The Conventional Clash



Spring - Summer'22
"Drone War" rising



Autumn'22- Winter'23
"Missile Terror" Campaign



2024 – Mid 2025
Widening the frontline



Mid 2025 –
Oct 2025
Contested
Escalation

A summarized time-line of the conflict

Feb-Mar'22 The Conventional Clash Major Battles

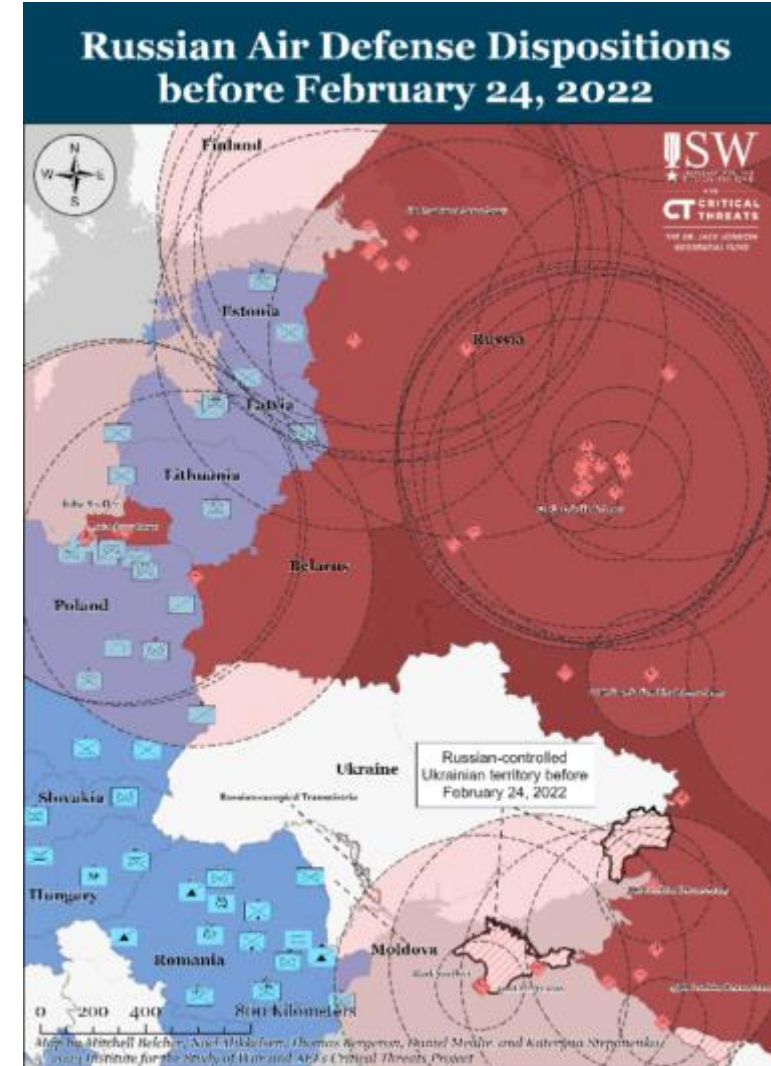
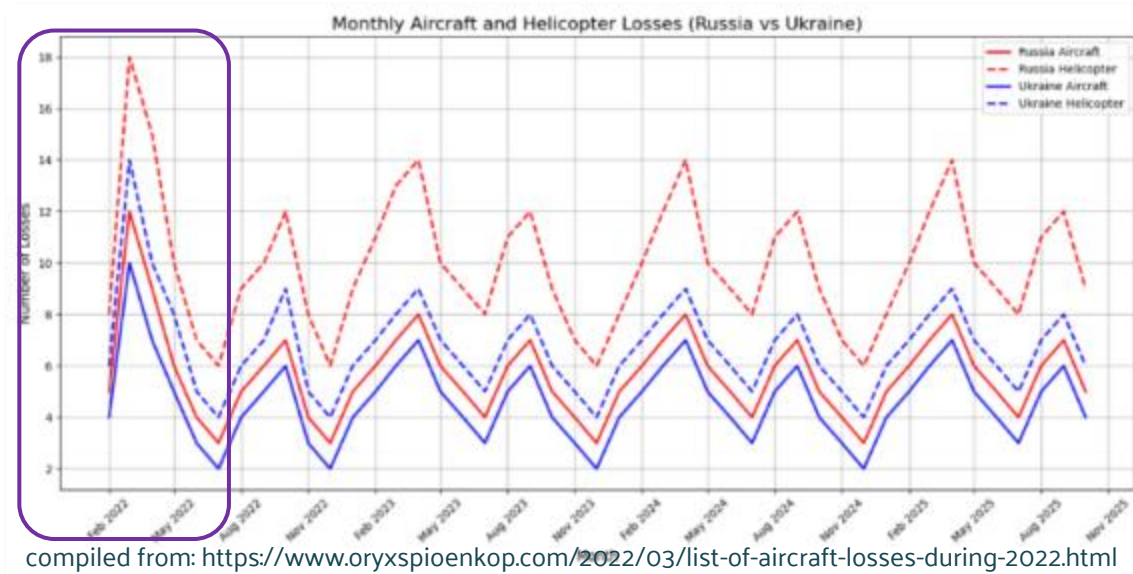
- Kyiv (Hostomel – Bucha – Irpin)
- Kharkiv, Sumy, Chernihiv
- Advance Kherson, Mariupol, Melitopol

Russian Side

- Attempt to gain air superiority
- Initial strikes with missiles (Iskander, Kalibr)
- Difficult coordination for SEAD
- Drones for ISR (Orlan-10)

Ukrainian Side

- Retreat jets to the west
- Air Defences: Mobile and Effective GBAD, forcing VKS to fly low into MANPAD territory.
- Ghost of Kyiv





Spring - Summer'22 “Drone War” rising

Major Battles

- Battle for Donbas
(Severodonetsk, Lysychansk)
- Snake Island reclaimed

Russian Side

- Withdrawal of manned A/C after sustained losses
- Stand-off strikes
- Challenged by UKR Air Defence and Long Range Precision strikes

Ukrainian Side

- UKR GBAD good effect on missiles and aircraft but running out
- Emergence of FPV drones for ISR and crude bombing
- Arrival of HIMARS

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A summarized time-line of the conflict

2024 – Mid 2025 Widening the frontline

Major Battles

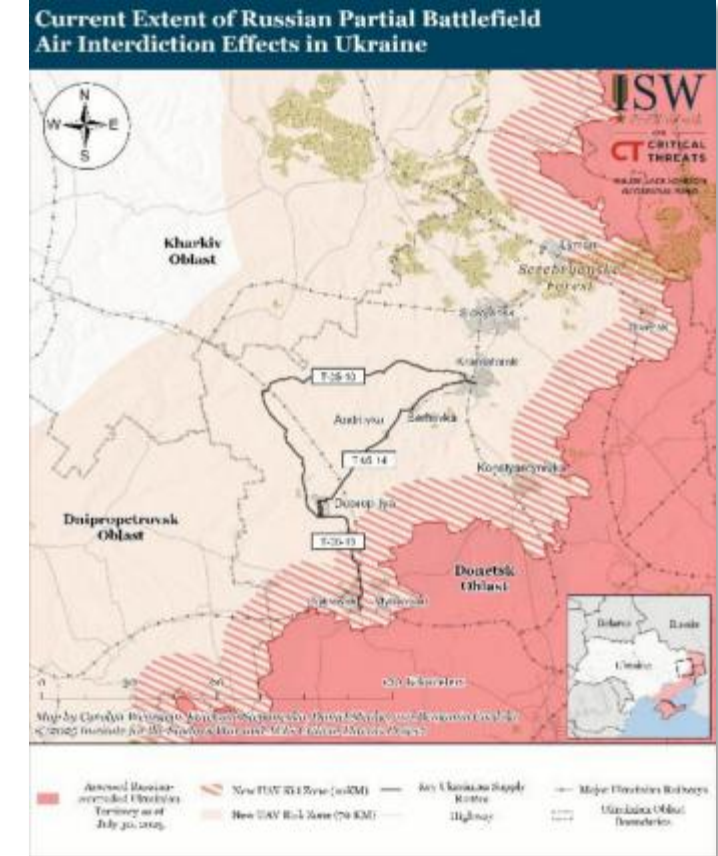
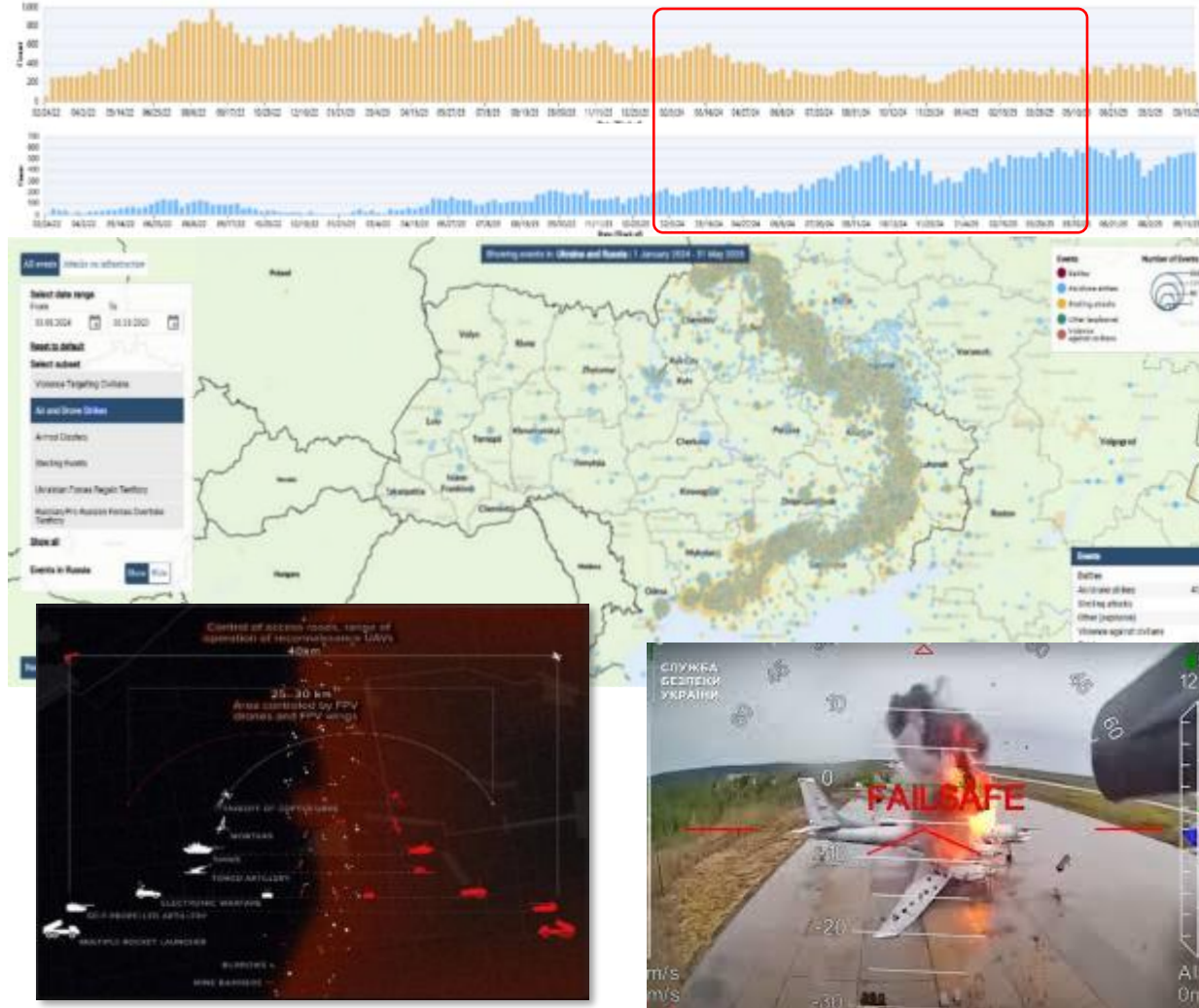
- Kursk Incursion
- Avdiivka, Pokrovsk, Chasiv Yar

Russian Side

- Glide bomb dominance (UMPB kits) advantage in Avdiika
- Increase in drone production (up to 2000 per month)
- New types Lancet loitering munition, mass use of Shahed/Geran
- EW jamming & Anti-jamming

Ukrainian Side

- UKR produced deep strike drones (Neptune – Peklo)
- AI enabled drones to avoid jamming
- Start of swarmer tech
- EW jamming & Anti-jamming
- Arrival first F-16's
- Taurus & tomahawk debate



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A summarized time-line of the conflict

Mid 2025 – Oct 2025 Contested Escalation

Major Battles

- Operation Spiderweb
- Pokrovsk, Chasiv Yar, Kupiansk
- Sumy, Kharkiv

Russian Side

- Increased combined strikes 50 missiles + 500 OWAD's
- Targeting critical Energy Infra
- Missile Evasion Tactics with Hypersonics
- Improved UPMB-5 Kits
- Rubikon Drone innovations

Ukranian Side

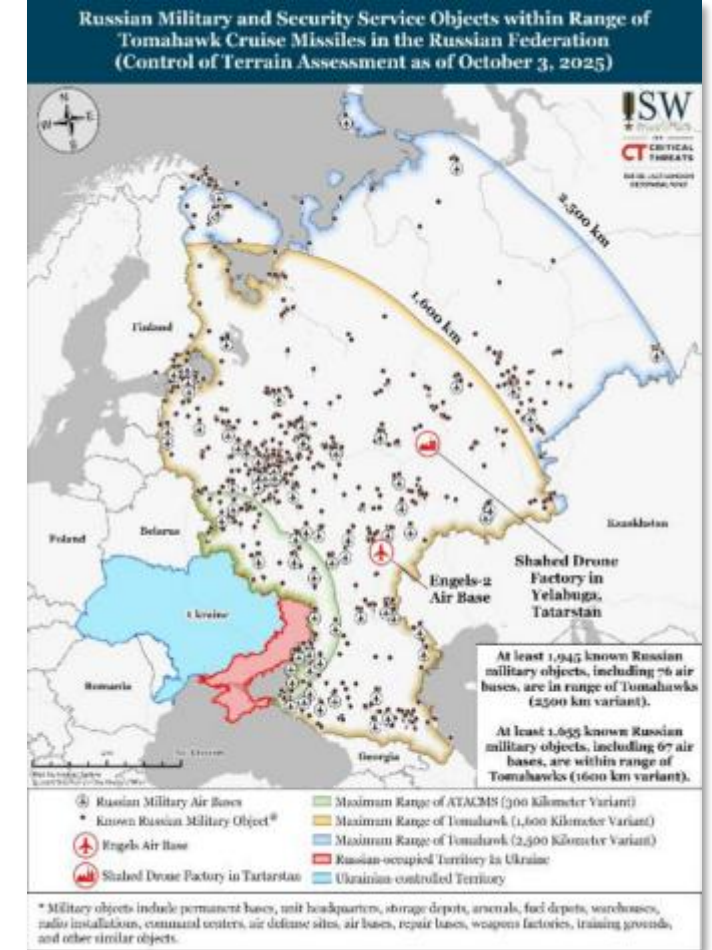
- Drone strikes up to 2100km beyond the RUS border (Tyumen) – FP-1
- FP-5 cruise missiles
- Frontline drone labs

NATO territory

- Airspace violations
- Drone sightings



Figure 1: Fire Point FP-5 Flamingo cruise missile



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Revolution or Evolution: observations so far

"Les avions sont des jouets intéressants mais n'ont aucune utilité militaire" Maréchal Foch

"History is old things happening to new people" Peter Marin

"Ukraine is a 19th century war, fought with 20th century tactics, using 21st century weapons." Serhii Plokhyy - *The Russo-Ukrainian War, 2023*



➤ The Drone – “the poor man’s Air Force”



➤ The Transparent Battlefield



➤ The renaissance of Air Defence



➤ Missiles evolved



➤ Innovation and Industrial Base



➤ Manned aircraft have a side-role



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Revolution or Evolution: observations so far



➤ The Drone – “the poor man’s Air Force”



- Cheap - attritable
- Multi-use (Tac – Ops – Strat) & Diverse
- Autonomous
- Expanding range



Revolution or Evolution: observations so far



➤ The renaissance of Air Defence



- The layered attacks force a layered defence (the missile math problem)
- Point defence vs Area Defence



Revolution or Evolution: observations so far



➤ Innovation and Industrial Base



- Rosie the Rivetter is now Polina the Programmer
- Drone vs Counter-drone
- Upscaled production



Revolution or Evolution: observations so far



➤ The Transparent Battlefield



- Death zones
- The new CNN effect
- The gamification of war



Revolution or Evolution: observations so far



➤ Missiles evolved



- Combined arms with drones
- Evasive manoeuvring



- The Arrow – Bow – Archer – Quiver theorem



Revolution or Evolution: observations so far



➤ Manned aircraft have a side-role



- Remain outside GBAD range
- Army Support where possible
- Stand-off Air Interdiction
- Drone & Missile Interdiction



So what ? Future Implications

The “Transparent Battlefield” & Information Dominance:

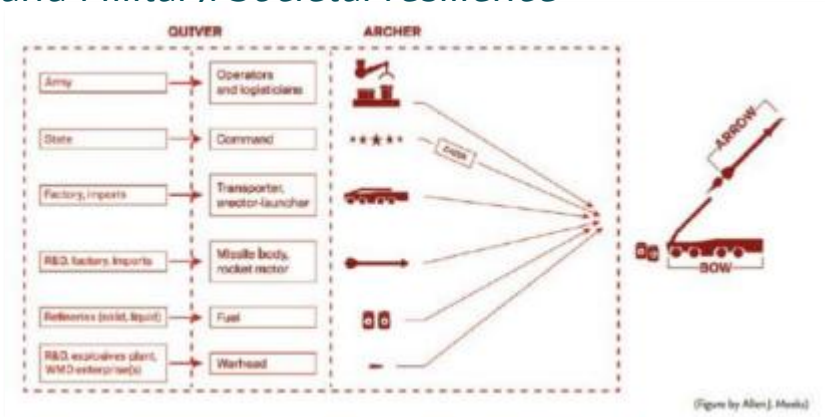
- Ubiquitous sensors / battlefield highly transparent.
- Critical role of information / the new high ground
- Hiding in the physical and information battlespace

➔ *ACE and Information sharing initiatives*

The quest for depth:

- The Arrow-Bow-Archer-Quiver theorem (CoG).
- no longer contained geographically

➔ *ACE and Military/Societal resilience*



Shrinking ODAA loop:

- AI's growing role in target identification, prioritizing, overcoming jamming, and potentially autonomous targeting

➔ *The speed and amount of data is growing beyond human capabilities, AI is no longer just a facilitator – it's becoming an enabler by enhancing the human capabilities.*

Rapid Innovation and “War at the speed of relevance”:

- It took the steam engine 120 years to reach around the globe, ChatGPT took less than 3 months
- Military innovation cycles are shrinking, requiring rapid prototyping, testing, and deployment of new technologies.
- The importance of disaggregated supply chains and decentralized decision-making for faster adaptation.

➔ *Solidify the Military Industrial Base, embrace innovation, review military procurement strategies and philosophies*



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So what ? Future Implications

The “Transparent Battlefield” & Information Dominance: Shrinking ODAA loop:

The quest for depth:

Old tech to defeat new tech:

- Revival of the Anti-Aircraft-Artillery
- Acoustic sensors provide cross platform drone detection
- Aircraft / helicopters hunt drones using 2.75in (70mm) APKWS rockets.

➔ *Most OWAD slow & low moving assets – ideal AAA target but close in homing*

Rapid Innovation and “War at the speed of relevance”:

Quality through mass paired with quality through tech:

- Mixing ballistic missiles (high tech) with drone swarms (mass) to confuse air defences
- Layered defence systems – Many Acoustic sensors paired with lots of AAA guns followed by radar sensors mixed with missile defence systems overflowed by 4th gen aircraft (F-16’s)

➔ *Teaming / pairing is key – don’t put all eggs in the same basket.*



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(Preliminary) Conclusions

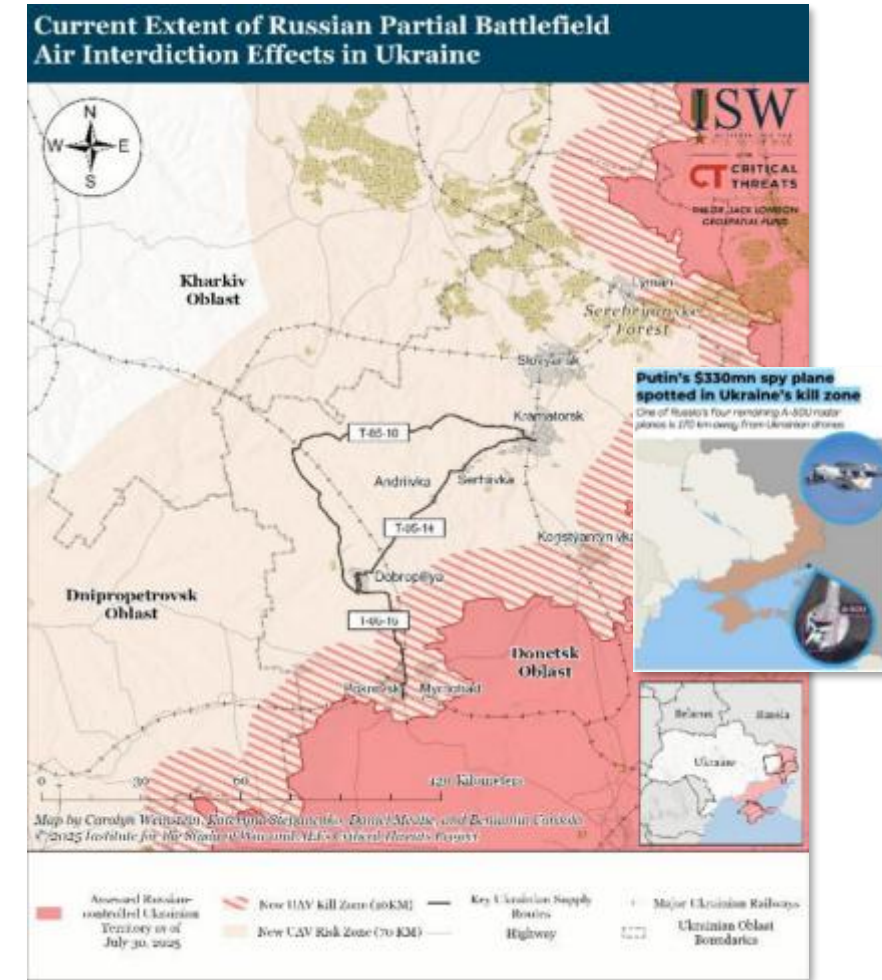
Air War evolved ... so far

An evolution rather than revolution through broadening of the Air Domain.

- The return of battlefield air interdiction
- It is no longer the sole domain of the manned aircraft; it will co-exist with the drone from the littoral up and the missile from high altitude down.
- There is still very much a fight for air superiority going on in the air

The Future of Air and Missile Warfare

- Expect continued proliferation of drones and advanced missiles.
- Greater emphasis on integrated air and missile defence,
- The increasing importance of EW, cyber, and AI.
- The "Trojan Horse" tactics (drones transported via ground vehicles) and the challenge of defending vast territories.
- 4th and 5th gen pairing is key
- MUM-T to increase the success of the 5th Gen opening moves



(Preliminary) Conclusions

Air War evolved ... so far

The Future of Air and Missile Warfare

The Eroding Sanctuary – Blurring Borders

- Deeper stand-off strikes with decreasing reaction times have an oil stain quality in this conflict,
- Growing beyond the geographical borders.
- Between services forcing the adoption of Multidomain Operations focussed
- Cover and concealment no longer limited to the physical battlespace.
- Increase in hybrid warfare activities

➔ *A strong defence will keep you the fight, but without offensive capabilities the enemy retains the initiative.*



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First appearance of the “Tank”, the British Mk I at the Battle of Flers-Courcelette in the Somme Region
September 15th, 1916

Tanks Were Just Tanks, Until Drones Made Them Change

They’ve been a mainstay in battle since the early 20th century. But in just three years of war in Ukraine, tanks have evolved.

By [Marco Hernandez](#) and [Thomas Gibbons-Neff](#) Sept. 8, 2025

Article posted in the NY times Sept 8, 2025

<https://www.nytimes.com/interactive/2025/09/08/world/europe/ukraine-russia-war-drones-tanks-military.html#>

Thank You for your attention