Autonomy, Artificial Intelligence & Robotics (AAIR)

The Necessity of Precision, and its Implications for Ground Robotic Platform Lethality and Tactics

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What Ukraine is Teaching Us About Precision

- First Phase: Russian Invasion of Ukraine (and especially the attack on Kiev):
  - Precision in ISR can offer opportunities to operationally counter opponents
  - Precise tactical weapons offer a way to effectively counter mass
  - In war "The moral is to the physical as three is to one…" And precision has helped to tip the morale balance.

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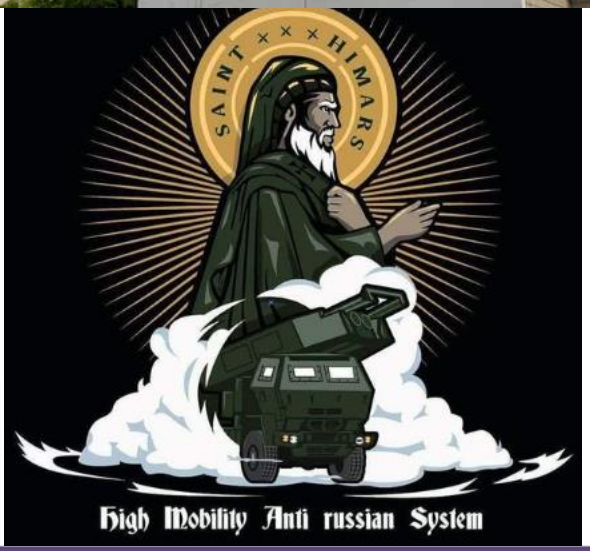
- Second Phase: Russian Realignment/Concentration in the SE (and especially the attack on Donbas):
  - Precision in fires (especially at ranges that exceed the opponent's) is powerful
  - Precise ISR paired with Precise Fires offers the potential for exceptional operational outcomes
  - Tactically precise long-range weapons can have a greater than tactical impact
    - continue to affect the morale of the Russian forces
    - Allows focused attacks aimed at disintegrating weak systems
    - Casts an opponent who cannot deliver precision as a war criminal

Zelensky: "The word 'HIMARS' has become almost synonymous with the word 'justice' for our country, and the Ukrainian defense forces will do everything to ensure that the occupiers experience more and more painful losses every week thanks to these very effective systems."

What Ukraine is Teaching Us About Precision



Phone Intercept – Russian Soldier's phone call to his Wife:

"You're stupidly going forward, and they *Ukrainians* are waiting for you…"

"Once you reach it they throw missiles at you…"

"They start firing at you from 3-4 kilometers away. You have nowhere to fire…"

(R): Here, you know, here they just send you into a slaughter. There's no competency here, at all. You're going forward, just stupidly going forward, and they *Ukrainians* are waiting for you, waiting… They already have a fix on these trenches, when you reach them, a specific point. They're observing you, sitting there, drinking coffee. Pressing buttons. And once you reach it they throw missiles at you. Where are we meant to shoot? Who are we meant to shoot at? There's nobody. F*ck knows. So you're just running around like a f*cking retard. So many of our tanks have been burned here, so much equipment. Meanwhile our retards can't even hit them. They can't figure them out. Our retard brigade… Our army. And these retard commanders… f*ck… Every day people are dying here. For nothing.

(W): But why, aren't you supposed to fire from tanks from long distance?

(R): You can't. They start firing at you from 3-4 kilometers away. You have nowhere to fire from the tank.

(W): Don't you have these vehicles?

(R): We don't have specialists. We have no specialists! They must have fired 20 coaches worth of missiles into nothingness.

What Ukraine is Teaching Us About Precision






Introduction – Where Are We Now?

- Current Limitations
  - Transportation
  - Communication
  - Firing
  - Operator's Situational Awareness

- Improvements
  - Advanced Weaponry
  - Advanced Remote Weapon Stations with Enhanced Fire Control Systems
  - Modern Munitions
  - Optional Third Effectors (ATGM/SAM)

"…unmanned vehicle with a 2-man crew…"

- Rapid transition from environment dominated by .50 caliber/ 12.7mm/14.5mm weapons to 30mm and larger weapons
- Other forces using Unmanned Aerial Systems (UAS) to gain an asymmetric advantage
- Learning from Ukraine
  - The old Soviet Way of War is vulnerable
  - Clearly learning the importance of operational precision
  - May not have learned about advantages of tactical precision

2A72 Cannon on BMP-2

Iranian Shahed 191 armed drone

Counter Measures – Bring a Cannon

- Weapon system (weapon and mount) must be precise, reliable, modular and deliver medium caliber effects
- UGV must have the capability to effectively detect and engage targets. 2km+ effector range is best.
- Must be able to function when a round misfires or when experiencing a feed failure – **Chain gun is the best option**

Counter Measures – Bring a Cannon

M230LF/XM914 – A Great Example

- Already in US Army inventory
- Provides 30mm x 113mm chemical energy munitions
- Linked feed system
- Low weight – 170 lbs
- Relatively high rate of fire – 200 rounds per minute
- One of the most lethal, capable, resilient direct-fire weapons available pound-for-pound
- Low muzzle velocity - 838 meters/second

M230LF

Better Bullets

- Advantage of 30mm
- XM1198 High Explosive Dual Purpose – Self Destruct (HEDP-SD)
  - Self destructs if it misses intended targets
  - Will detonate before hitting the ground, reducing risk of collateral damage
- XM1211 High Explosive Proximity (HEP) – currently in development
  - Round detonates when it senses it is near a target
- M230LF High Explosive Dual Purpose (HEDP)

Linked XM1211 HEP Rounds

EOS R400S RWS on Pratt Miller EMAV

M230LF is most effective in C-UAS role when provided with a radar cued vector and mounted on a stabilized high-performance remote weapon station (RWS)

- Combines stable platform with sophisticated fire control solutions
- See further with on-board electro optical and thermal sensing cameras
- Precisely apply greatly increased levels of lethality

Weapon system must account for

- Meteorological factors
- Attributes of weapon
  - Recoil
  - Cyclic rate of fire
  - Cold & hot performance
- Attributes of Ammunition
  - Turn rate/velocity/mass/recoil
  - Velocity effects from temperature/pressure
  - Terminal stability
- Characteristics of mobile platform
  - Stability/recovery
  - Cant
  - Vibrations
- Open software architecture is crucial

See first, shoot first, kill first

- Detect, recognize, identify and engage targets day and night
  - Advanced electro optical and cooled thermal sensor unit
  - Eye safe laser range finder
- Complimentary situational awareness systems
- For most of a robot's life, it will be watching rather than killing

Precision

Precision is key in an environment where resupply is seriously constrained

- Fewer rounds per engagement
- Faster kills enhance survivability
- More stowed kills
- Extend mission profile
- Force the enemy to react – can't simply let the robot drive by

Third Effectors – The Unfair Advantage

RWS Firing Javelin ATGM

UGV w/30mm & Javelins

APKWS rocket fire from BAE Systems' Robotic Technology Demonstrator

Third Effectors offer the potential for longer range precision and operational effects

Next Generation RWS Slip Ring

- Current Limitations
  - Physical capacity limits data and power bandwidth
    - Unable to use advanced cameras and power-hungry weapons
    - Radars above the slip ring can overwhelm both power and digital capacity
    - Unable to pass both thermal and day camera feeds simultaneously
- Fiber Optic Slip Ring
  - Data transfer at the speed of light
  - Provides capacity for multi-gig data transmissions
  - Enables better image analysis
  - Allows physical slip ring to be dedicated to power alone to support missiles and other effectors without additional batteries

- Understand what is “expendable” and what is “attritable” and how much risk to accept for each
- Do not simply use precise systems as an “unmanned manned system”
- Take different tactical risks to gain greater reward
  - Bait opponents with precision UGVs to make them commit to the wrong course of action
  - “Spider hole” tactic
  - Unmanned formation offensive attack
  - Sacrifice to achieve an end - disaggregate an opponent’s ability to apply combined arms

Conclusion

An armed robot can significantly alter the balance of power on the future battlefield. To make a real difference, it will have to be carefully shaped to offer the right capabilities. One of the key capabilities it must have is **Precision**.

Questions?

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