

**Plugging up the gaps: Defending a gunline from novel Loitering munitions**

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The present threat from the air on ground operations is clear for any observers of the conflict in Ukraine. A mix of fixed-wing, rotary-wing, cruise missile, electronic warfare, and uncrewed aerial systems (UAS) has wreaked havoc on conventional fighting forces, demanding a substantial change in tactics at every level. For us gunners, we need to be prepared for the likelihood that the next fight will be one in which we do not have air supremacy, be it from commercial off the shelf (COTS) drones or a more conventional air threat.

The responsibility to defend the gunline lies with all members of the corps, not just with the air defence stream. To best understand why this is the case, there is a requirement for a brief introduction to the concepts and practices of air defence. Broadly speaking Air Defence is usually broken into categories of altitude and range. The highest altitude and longest range is the domain of the air defence fighter, followed by High to Medium range Air defence (HIMAD) (i.e. the Patriot missile system), and Short range Air Defence (SHORAD) (i.e. the ADATS system). All these platforms can defend a relatively wide area depending on their deployment; however, they are not able to engage many of the small and low flying targets that fill today's battlespace. Even if they were, they typically prioritize faster, larger, and more strategic threats like enemy aircraft or cruise missiles, simply based on a cost-risk comparison. Very Short range Air Defence (VSHORAD), systems like the stinger or javelin, can hit these targets, however, our doctrine and availability of weapon systems makes it unlikely that these will be dedicated towards the defence of the gunline. While artillery is always considered a high value target and is at a far higher degree of risk from air attack, their mobility and dispersion make them exceedingly difficult to defend. With every position the air defence requires extensive reconnaissance with primary and alternate positions, hides, and command posts, and with the gunline changing positions every time it shoots, such a defence is unsustainable. There is also the issue of how the artillery is

prioritized within a brigade setting. When given only one battery of air defence, (consisting of two troops with 6 detachments each) the focus usually goes towards high value assets, routes, or areas vital to the mission. Given the choice between protecting bridging assets, major C2 nodes, or maneuver force assembly areas close to the FLOT, or mobile artillery assets well behind the FLOT, commanders would likely choose to defend those assets that directly affect their main effort and are close to enemy contact.

Despite artillery not usually being prioritized by air defence, it is still under far greater of a threat than ever before. A recent trend emerging from the frontline in Ukraine shows that the Russian military, famously based around artillery, has started to move away from counterbattery and towards loitering munitions.<sup>1 2 3</sup> According to Bode and Watts, a loitering munition are “...expendable uncrewed aircraft which can integrate sensor-based analysis to hover over, detect, and crash into targets.”<sup>4</sup> They are designed to be deployed in vicinity of a known target, remain on station, and then use its sensor suite to be able locate and strike a target. This acts as a cost-effective precision munition and is beginning to replace the saturation of fire that usually accompanies Russian counterbattery. Instead of firing their own artillery, potentially unmasking their positions or deep-strike assets, they can send a small, expendable UAS to find and strike with tremendous accuracy and effect, even able to strike while the target is on the move.<sup>5</sup> While loitering munitions are the more dangerous trend, other forms of UAS which may only observe are only slightly less dangerous, potentially giving away friendly positions, main service routes, or hides and directing fires on them. The current threat environment is one that is completely

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<sup>1</sup> Bakshi, UAV Reportedly Strikes 500+ Targets Amid Ukraine War!, 2023.

<sup>2</sup> Macaulay, Gunline Survival against Loitering Munitions: Lessons from Ukraine, 2023.

<sup>3</sup> Watling and Reynolds, Stormbreak: Fighting Through Russian Defences in Ukraine’s 2023 Offensive, 20.

<sup>4</sup> Bode and Watts, Loitering Munitions and Unpredictability, 3.

<sup>5</sup> Macaulay, 2023.

saturated with UAS, with one account saying that any 10km stretch along a contested frontage may hold up to 25-50 UAVs from both sides.<sup>6</sup>

The main threat to artillery by far is the Lancet variety of loitering munition. Manufactured by ZALA Aero and operated by the Russian Military, Lancets can travel 40km and operate for 40 min.<sup>7</sup> The Lancet-1 is able to carry a 1kg warhead while the Lancet-3 can carry a 3kg warhead.<sup>8</sup> This warhead can be set with either a proximity or impact fuse. The system has a unique design with a double-X configuration. They have a low speed, at around 100km/h flight speed but have a small radar cross-section and small size making them hard to detect.<sup>9</sup> Despite only being used after July 2022, 507 locations were struck by a Lancet-type UAS in Ukraine by August 2023.<sup>10</sup> Of these strikes, over half were against field artillery assets.<sup>11</sup> While the system can be fired autonomously, following a pre-set flight plan to strike a target or also receive coordinates in flight, it also is used mostly with a human-in-the-loop configuration where it can be guided directly on a target.<sup>12</sup> Most disturbingly the munition is also able to remain on station in a certain area and scan for preloaded target information and attack autonomously.<sup>13</sup> It is for these specific functionalities that the Lancet has been chosen as the primary threat in this essay.

So how can the gunline hope to defend itself and remain effective under such constraints?

Due to the gunline's vulnerability, coupled with its value as an asset and target, requires its defense to be put in the hands of the battery and its own resources using passive and active

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<sup>6</sup> Watling and Reynolds, *Meatgrinder: Russian Tactics in the Second Year of Its Invasion of Ukraine*, 7.

<sup>7</sup> Bode and Watts, 58.

<sup>8</sup> Center for Operational Standards and Training methodology of the Armed Forces of Ukraine, *To the General Military Units For Defense Against Iranian "SHAHED-136" ("GERANI-2") and Russian "LANCET-2" UAVs*, 52.

<sup>9</sup> Hunder, *Cheap Russian drone a menace to Ukrainian troops and equipment*, 2023.

<sup>10</sup> Bakshi, 2023.

<sup>11</sup> Bakshi, 2023.

<sup>12</sup> Center for Operational Standards and Training Methodology of the Armed Forces of Ukraine, 52-53.

<sup>13</sup> Bode and Watts, 59.

measures. The purpose of this paper will be to describe methods that can assist the gunline to defend itself from the emerging UAS threat, using examples from the Ukraine War as supporting evidence. These methods include reinforcement of current standard survivability techniques, adoption of new techniques introduced by the Ukraine war.

### **Reinforcing current procedures**

Air defense is broken into both passive and active roles. While the gunline is not specialized towards air defence in an active role, it is already more than familiar with passive defence. Passive air defence consists of position siting, dispersion, concealment, control of movement, hardening, deception, and warning. Of these, the gunline need only reinforce its current considerations for siting, dispersion, concealment, and advanced warning.

Siting of good positions of fire with a mind towards avoiding areas exposed to observation from far away, avoiding recognizable geographic features and using the terrain to disguise movement and flash are already standard operation procedure for the gunline. While this is a great starting point, siting with regards to the air needs to be considered with the same wariness as armoured recce. Finding positions that require the enemy to expose themselves to see you and using local foliage and terrain to mask your position is just as important as ever.<sup>14</sup>

Dispersion is a concept understood and employed by field artillery/ the gunline. Use of dispersion increases the batteries survivability by minimizing the effect of enemy fires. Ukraine has been operating according to this doctrine, effectively deploying troop dispersed and allowing for individual gun detachments the freedom to conceal their own positions, usually in groups of three guns.<sup>15</sup> This allows for a far smaller footprint and greater flexibility in avoiding detection.

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<sup>14</sup> Macaulay, 2023.

<sup>15</sup> Colonel Baranov, Future Artillery Conference 2023, 1.

Despite dispersion being a traditional and common-sense tactic, its utility has begun to show its limitations. In the article *Gunline survival against loitering munitions in Ukraine*, the author points out that Russian guns are much less likely to fire on dispersed artillery positions, instead sending Lancets to attack single gun positions.<sup>16</sup> The author further posits that, "...target selection standards become lower with the addition of loitering drones, which further increases the risk that single guns can be targeted."<sup>17</sup> So, while dispersal is still a good tactic and should be maintained, it cannot be relied upon to guarantee the survivability of a position.

Concealment under the threat of loitering munitions is more important than ever in the present environment. Though rather than the ground, concealment needs to focus on the point of view of the drone operator, where they are looking for anything unusual, reflections, shadows and movement.<sup>18</sup> This means maintaining noise, light and track plan discipline, use of cam nets and local vegetation to hide a position, and renewing camouflage anytime the guns are fired to maintain that concealment.<sup>19</sup> In Ukraine, this concealment goes so far to include light hardwood buildings around gun positions, adding higher level of obfuscation than we are currently accustomed.<sup>20</sup> While we do not need to go so far as to create these structures, our willingness and ability to conceal our positions needs to be greatly reinforced.

Advanced warning is vital for effectively repulsing an air attack. The use of air sentries sited to maintain all-round observation will help to prevent being taken by surprise by loitering munitions or being observed by enemy UAS. A Lancet-3 can travel at up to 300 km/h during a dive while only being 1.5 metres long and having a wingspan of 1 metre.<sup>21</sup> As such the ability to

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<sup>16</sup> Macaulay, 2023.

<sup>17</sup> Macaulay, 2023.

<sup>18</sup> B-GL-318-017/PT-000, All Arms Air Defence, chp. 2, sect. 1, para. 6.

<sup>19</sup> B-GL-372-009/FP-001, Counter Uncrewed Aircraft System defence, 2-4.

<sup>20</sup> Colonel Baranov, 1.

<sup>21</sup> Center for Operational Standards and Training methodology of the Armed Forces of Ukraine, 11.

both spot and quickly react to such a threat requires having the earliest warning possible. Ideally air sentries should have some form of communication with the rest of the battery and be equipped with tools to better allow them to spot and identify enemy UAVs, (binoculars, night vision goggles, thermal imagers if possible).<sup>22</sup> There has been evidence from Ukraine showing that troops do have time to run and respond to Lancet threats either from the noise or distinct shape, but having the such a warning could mean the difference between destroying the UAS or being caught unawares.<sup>23</sup> This being the case, all that is required is a small amount of reinforcement on the employment and training of air sentries, knowing what they are looking for and how to find it.

These topics are areas in which the gunline already has a wealth of experience, all that is needed in the future is to reinforce these areas with good drills and planning that takes them into consideration.

### **Adoption of new methods of Passive defence**

Methods of passive defence in which the gunline needs to adopt are in the areas of control of movement, hardening, and deception. There also needs to be renewed importance placed on active air defence, creating sanctioned room in local defence plans and training personnel specifically to fill these roles. While the gunline does exercise control regarding these topics, the war in Ukraine has displayed significant changes that would be required should we be involved in a conflict of that type.

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<sup>22</sup> Counter Uncrewed Systems Defence, 3-3.

<sup>23</sup> Cranny-Evans, Russia's Artillery War in Ukraine: Challenges and Innovations, 2023.

In the context of field artillery, control of movement usually refers to survivability moves. However, when the primary threat becomes loitering munitions and UAS observation, moving rapidly away from the sight of a recently unmasked gun position is a far more dangerous tactic. The conflict in Ukraine shows a different approach to avoiding detection and attack by UAVs. Instead, Ukrainian gunners have stayed on position and conceal themselves and their guns.<sup>24</sup> This way they reduce the probability of being detected and coming under air attack while also avoiding direct observation. Although this put the guns at risk of being lost to counterbattery, it comes down to the balance between a chance of being hit or detected by enemy fires while static, or the near certainty of destruction if caught on a road move with no means of defence from loitering munitions. This technique includes changing routes, as high trafficked routes will soon become targets of pre-registered artillery strikes or surveillance by UAS.<sup>25</sup>

The proliferation of loitering munitions and UAV makes hardening a challenge to gunlines. In the field artillery context, hardening refers to slit trenches or even pre-built dug outs made with engineer support, which seems like a waste of time, effort, and exposure if you are going to relocate after firing. In Ukraine they have found a simple and cost-effective way to defend gun positions from direct attack. Using wire mesh, much like a chain-link fence, Ukrainian artillery has been able to catch loitering munitions before they are able to detonate, effectively deleting the effect of an impact fused munition.<sup>26 27 28</sup> Online there have been numerous examples of such a tactics working, some of which are compiled in the Forbes article *Ukraine Uses Camouflage Nets to Snare Russian Drones Attacking Its Artillery*, showing how

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<sup>24</sup> Macaulay, 2023.

<sup>25</sup> Macaulay, 2023.

<sup>26</sup> Macaulay, 2023.

<sup>27</sup> Colonel Baranov, 1.

<sup>28</sup> Hunder, 2023.



both wire mesh enclosures and cam nets can stop Lancet UAS from delivering their effects.<sup>29</sup> Although many of the examples from the frontline are clearly improvised by experienced troops, these lessons and techniques are effective and can be easily added to our own operations, possibly through reinforced camouflage nets or wire mesh kits designed specifically for our artillery.

Deception is by far the greatest deviation that Ukrainian techniques have from our own. As detailed during our discussion on the control of movement, Ukrainian detachments will conceal their gun positions and fall back to a position safe from counterbattery fire on finishing a method. Further, they also have a system of decoys that they will set up beforehand, consisting of wooden guns and replete with empty casings, garbage, and footprints.<sup>30 31</sup> The decoys are designed to be believable, and not a, “...set and forget...”<sup>32</sup> position. The munition is deployed to the area of unmasked guns and on arriving in the vicinity, finds the decoys which draw its attention and attack away from the real position. This approach attempts to induce human error. Implementing this into our own techniques has the potential to become complex and cumbersome, requiring a dedicated system for setting and maintaining these decoys, however, should the conflict arise where we face such a high loitering munition threat, this may just pay for itself with the lives and equipment of gunners.

Active kinetic destruction of loitering munitions is not something with which the gunline is experienced. The Canadian Armed Forces has procedures for all arms air defence (AAAD) and now Counter-Uncrewed Aircraft which contain techniques and drills for countering air platforms like those mentioned in this essay. While both contain relevant information that all

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<sup>29</sup> Roblin, Ukraine Uses Camouflage Nets to Snare Russian Drones Attacking Its Artillery, 2023.

<sup>30</sup> Macaulay, 2023.

<sup>31</sup> Colonel Baranov, 1.

<sup>32</sup> Colonel Baranov, 1.

members of the Artillery need to read and understand before operating in vicinity of contested airspace, Ukraine has a few lessons to consider carefully. The first is the dedication of fire teams specifically for countering Kamikaze type drones. These teams should include a machine gunner, as well as 3-4 troops with rifles.<sup>33</sup> These should be situated next to an object on which it can be propped up and used to support firing. The machine gun should include a high tracer mix in ammunition to allow accompanying troops to mass their fire on the same point.<sup>34 35</sup> The next lesson is the control of this defensive technique. The AAAD and counter-uncrewed aircraft manuals both cover this well, however the specifics of attacking these types of aircraft with small arms is what needs to be passed on. The command to fire should hold until the aircraft is approximately 500m away, at which point it is continuously fired upon for 20-25 seconds.<sup>36</sup> Assigning arcs and deploying such teams are in accordance with our current doctrine, giving arcs no more than 2100 mils and deploying according to the principles of all around defence, mutual support, and early engagement on the target. Should gunline leaders take these lessons, in addition to common practices of air sentries and establishing and enforcing air attack SOPs and drills, they should be far better equipped for engagement by enemy loitering munitions.

## **Conclusion**

The current environment is rapidly changing. New C-UAS systems are frequently introduced and become more plausible to deploy in an operation. The day may come where every major concentration of troops is equipped with C-UAS weapon systems or jammers. However, that day is still far away and those resources will never be a guarantee of safety from

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<sup>33</sup> Center for Operational Standards and Training methodology of the Armed Forces of Ukraine, 24.

<sup>34</sup> Center for Operational Standards and Training methodology of the Armed Forces of Ukraine, 42.

<sup>35</sup> CounterUncrewed systems Defence, 3-6.

<sup>36</sup> Center for Operational Standards and Training methodology of the Armed Forces of Ukraine, 42.

air attack. As such, leaving the responsibility for the protection of the gunline with the gunners, and giving them the knowledge and techniques to do so, is the most practical and reasonable course of action moving forward. Every local defence plan in our post-Ukraine world should include a detailed and thoughtful air defence plan, using the available resources to best facilitate an effective defence both passively and actively. Through reinforcing the procedures we already have in place, and by instituting lessons learned on the frontlines in Ukraine, the gunline will be able to take its first steps on tomorrow's battlefield with the confidence.

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