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Only those to whom the study of war is novel permit themselves to be swept away by novel elements in the present war.

– Bernard Brodie

If we lose the war in the air, we lose the war and lose it quickly.

– Bernard Montgomery

Introduction

The war in Ukraine has underlined the importance of airpower in a contemporary conflict like never before. Initially, this emphasis was not a result of airpower's omnipresence and effects, but rather of its absence, that is, the lack of offensive airpower on both sides.

The question arises, what lessons, if any, can be deduced from the war in Ukraine in general or in potential future conflicts. Ever since the start of the Russian full-scale invasion, discussion has focused on what this war would mean for the position of Taiwan vis-a-vis the Chinese intention to include the island-nation in the People's Republic of China, either by diplomatic, economic or military force. As the Taiwanese people have as of yet not expressed a desire to become part of the PRC, Chinese military action is expected to play a decisive role in trying to acquire the island by force. Like in many other parts of the world, the military establishment in China is watching closely how events unfold in the war in Ukraine. The same goes for Taiwan. What lessons from the war in Ukraine can be learned and applied to a possible future conflict in and around the island of Taiwan? This paper will focus on the lessons for airpower, be it crewed or uncrewed, and ground-based air defense.

The air war in Ukraine

During the first days of the full-scale invasion in 2022 Russia sought to gain air superiority in Ukrainian airspace, where it was met by fierce resistance from Ukraine's ground-based air defense systems. The inability of the Russian air force to achieve air superiority in Ukrainian airspace, and provide support to ground troops led to a deceleration and subsequently the Russian ground offensive culminated. After losing 450 aircraft and helicopters in the first month, the Russian air force largely gave up on achieving air superiority. The concept of air denial resulting from Ukraine's ability to swiftly move its ground-based air defense systems scored a three-pointer.

Thus, another artillery war unfolded, not by design or by choice, but by lack of decisive offensive airpower options on both sides. Russia largely withheld its airpower from operating deep in enemy airspace, while Ukraine had no offensive airpower to speak of after losing 180 aircraft and helicopters. This resulted in a strategic stalemate and WW1-like attritional battles on the ground, where Russia, despite its supremacy in artillery and personnel numbers failed to achieve a strategic breakthrough.

Yet, both sides sought to compensate for this lack of decisive airpower.

First of all, in 2022-2023 Russia made several attempts at attacking and effectively degrading Ukraine's energy generating system with massive composite airstrikes by a combination of ballistic missiles, cruise missiles and drones. These attacks were not well planned, coordinated or precise, resulting in a 70-90% loss ratio caused by Ukrainian ground-based air defense. Though Ukraine's energy generating system was severely degraded, the resilience of its forces and people, and the support of western allies pulled the country through the winter cold of '22-'23.

Nevertheless, it was also clear that Russia's attacks would resume and that Ukraine needed a lot more air defense to protect its vital infrastructure and its population. Moreover, as time would tell, Russia would vastly improve on its coordination and planning of the massive missile and drones attacks, seeking to avoid Ukrainian air defense by navigating around it, sometimes even flying close to NATO airspace, with several incursions as a troubling consequence. It was also clear that despite the initial effectiveness of its ground-based air defense, preventing these massive attacks from happening would be far more effective than merely defending against them. Ukraine needed to be able to conduct a counter-offensive air campaign against launchpads, air bases, air command & control centers and related industry. And this would require strikes deep into Russian airspace.

Still, what followed was an ongoing arduous journey for the Ukrainian president and his cabinet members. Stressing the need for western multi-role fighter aircraft, long-range ballistic rockets and cruise missiles, they visited many western capitals. The results were mixed. They got the long-range rockets and cruise missiles, though not the permission to use them against targets deep in Russian territory. They got the fighter aircraft, with more of them promised in the future, but it was clear from the outset that they would not be ready for use in deep strike missions. Instead, they would be put to use to defend against cruise missiles. And gradually they would be used for launching mid-range weapons against ground targets, although flying closer to the frontline would expose them to Russian air defense forces. Lacking some degree of air superiority, be it local and or temporary, the provided F-16s are very vulnerable to Russian S-400 air defense systems. Permission to use weapons like ATACMS and Storm Shadow beyond the Russian border areas is still pending, while the German Taurus is still not available.

This means that a coherent and effective Ukrainian counter air offensive is still a long way from becoming a reality. Consequently, Ukrainian vital infrastructure and population are still at risk, and Ukrainian ground forces still lack the close air support they need to defend effectively against the Russian numerical superiority on the ground. Let alone take back all or even some of the conquered territories. Air superiority offers an essential advantage: freedom from attack and freedom to attack. Failing to achieve that, Ukraine could lose the war.

That brings us to the second method of compensating for the lack of decisive airpower: drones.

In the first couple of months after the full-scale invasion, Ukraine made effective use of Turkish built Bayraktar TB-2 drones. These medium-range combat UAVs compensated somewhat for the loss of fighter-bombers. However, they also appeared very vulnerable to Russian air defense systems, resulting in the loss of 24 aircraft in the first month alone.

In the meantime, ground forces on both sides of the front experienced what it means to fight ground battles without air cover. As we have seen more than a hundred years ago, fighting a war primarily using artillery and infantry leads to large scale devastation of infrastructure, materiel and soldiers. Russian numerical superiority (10 to 1 in some places along the front) in artillery and infantry forced the Ukrainian armed forces to seek effective technological alternatives. Javelins, western artillery and tanks would surely help, but in a largely static kind of warfare it would not suffice. Finding and destroying Russian artillery positions was essential to survival on the battlefield.

Pretty soon commercially available camera equipped microdrones found their way from Ukrainian trenches to Russian positions, allowing Ukrainian artillery to pinpoint their targets and destroy them. This was quickly followed by the realization that these types of drones could also be used to drop grenades on Russian positions. Not much later, drones were equipped with anti-tank grenades and made to fly against Russian equipment to destroy it. Remote control of these drones was executed by way of virtual reality goggles allowing the pilot to navigate this deadly weapon with precision. The deployment of these 'First Person Vision' drones would expand enormously within a couple of months. It created havoc among Russian troops who complained that they could not get out of their trenches without being spotted and consequently attacked. Yet, the Russians soon followed suit. And the Ukrainians moved on from the experimental phase to an organization structure that incorporates reconnaissance drone teams in every unit, while every army brigade has an assault drone company. At this moment tens of thousands of small drones are being employed on both sides of the front. This has created a whole new kind of warfare, and a technological arms race very similar to the first months of WW1, when manned aircraft were introduced, evolving from aerial reconnaissance to bombers, fighters and the emergence of anti-aircraft artillery. Right now, we are seeing drones chasing each other, forcing mid-air collisions to destroy their opponents, resulting in the installation of rear cameras, evasive maneuvering and ultimately unmanned dog-fights. We are also seeing counter-UAS systems developing, ranging from radar directed rapid-fire guns to electronic jamming devices to disturb radio-data links between the operator and the drone. As a consequence, new ways are being found to reduce an attack drone's dependence on its operator, or even better, eliminate it altogether. Autonomous drones are not completely new, as they have been developed years ago to counter ground-based air defense systems and radars. But the use of artificial intelligence to recognize, follow and attack tanks, armored vehicles and other equipment items opens up a completely new chapter in aerial warfare, the consequences of which will have a lasting effect on the way we fight our wars.

The other lesson concerning drones deals with the so-called long-range kamikaze drones, such as the Iranian produced Shahed drones and Ukrainian Mugin, Beaver, Scythe and other drones. Technologically they are considered drones, but from an operational point of view they are in fact a different class of cruise missiles. But what is more essential is that they are much cheaper to build or buy than 'conventional' cruise missiles and can be produced and employed in vast numbers. Failing to obtain western permission to strike deep into Russia with western weapons, Ukraine is quickly developing a vast array of these long-range drones which enable it to do just that: strike deep. This class of long-range weapons will also be part of future warfare.

So the lessons of air warfare in Ukraine are manifold.

- Aerial denial employing defensive counter air systems is very essential in the first phase of an enemy attack. The effect, however, is not lasting as an opponent will seek to overcome it and may succeed in doing so, causing damage and loss of life.
- Long-range offensive counter-air, be it crewed or uncrewed, is essential to keep the enemy from attacking friendly rear areas and frontline positions.
- Air superiority, partial or complete, locally or theater-wide and temporary or permanent, is another essential prerequisite for freedom of maneuver and supporting ground troops at the front.
- Technological innovation is often spurred by warfare, especially if one of the belligerents is confronted by enemy numerical superiority. Lack of effective offensive airpower led to completely new developments in uncrewed aerial warfare with small drones.
- Artificial intelligence in combination with uncrewed aerial vehicles, small or large, will be part and parcel of future warfare.

What could this mean for a potential conflict in and around Taiwan?

First of all, the theater could not be more different. Drawing lessons from a continental theater to be implemented in a primarily maritime theater is therefore challenging. Nevertheless, some lessons may apply.

Taiwan is a small insular nation facing a vastly more powerful opponent. Contrary to Ukraine, which is almost completely land-locked and has sufficient supply routes connecting it to neighboring allies, Taiwan can only be supported by sea or by air. The main initial threat therefore is a blockade of sea ports and air space, simultaneously executed with attacks against its air defense structure and air bases. Sea borne and airborne operations will then attempt to land troops on the island, after which a land battle will ensue.

Air denial and achieving and maintaining some degree of air superiority will probably be part of military doctrine on both sides of the conflict. Maritime superiority will also be contested by both parties. To prevent Taiwan's allies, primarily the US, from supplying the island with military support, China will aim to restrict foreign access to the region using air and naval assets.

The initial assault will therefore be dominated by battles at sea and in the air. The island itself will be prepared as a 'Fortress Taiwan', expecting fighting on the beaches, in towns and villages. At present the Taiwanese army is suffering from aging equipment, too few modern missile systems, an obsolete army command structure, tactics and doctrine not updated for the last 50 years, front-line units with 60% manning, non-existent counter-intelligence and a broken military conscription system, which originally lasted 12 months, then shortened to 4 months for a couple of years, and recently restored back to 12 months. This means that in the short term the Taiwanese army is not well suited to a possible confrontation with the Chinese People's Army.

What the war in Ukraine has taught us, is that modernization should concentrate on long-range fires, air defense and dedicated aerial and land drone units at all tactical levels. This can be achieved in a relatively short term.

Further lessons from the war in Ukraine may be drawn from what has been developed and practiced on the battlefield and even from what was missing in the order of battle on both sides. They primarily concern air superiority and close air support, long-range artillery, counter-battery fire, fire and movement, and the extensive use of drones. While China will almost certainly enjoy a massive long-range fires advantage, Taiwan could –with massive support from the US – concentrate on counter-battery fires, using ballistic rockets and long-range drones. To disturb Chinese sea operations and prevent or break up a naval blockade, aerial and naval drones may be of use, supported by anti-ship missiles and airpower.

Another important lesson for the war in Ukraine is that Taiwan should become less dependent on foreign aid. As long as there is no armed conflict, massive support from the US and other nations should not only address the present shortcomings of the Taiwanese armed forces, but also concentrate on the expansion of the Taiwanese defense industry so it is able to sustain military production and operations while the island is isolated by a Chinese blockade.

As for the PRC's huge numerical superiority, Taiwan's only hope is to cause a massive casualty rate and loss of equipment by using long-range, precision, crewed and uncrewed airpower against Chinese air-, sea-, and land power, combined with an effective layered air defense system across the island.

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