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The Contested Ukrainian Airspace

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Key Points

- Despite overwhelming superiority in Air Power Platforms, the Russians have failed to achieve air supremacy due to the presence of Ukrainian AD Systems.
- Lack of air supremacy has resulted in increased Russian employment of missiles and artillery.
- The Ukrainians have resorted to extensive employment of Drones and Loiter Ammunition as an alternative to the Ukrainian Air Force.
- Long Range Air Defence systems are a priority target for Enemy's air, resulting in their deployment in depth.
- Due to the presence of long and medium range Air Defence systems, the air operations at lower altitude have increased significantly.
- Soft Kill systems are still a project that is under development and currently lack s the desired potency.

Introduction

The argument that, 'wars of the future will be non-contact' was the first assumption to be proved wrong when on 24 February 2022, Russia launched its 'biggest military operation' on another European State—Ukraine, since the end of the Second World War. As the war enters its third month, it has dispelled two more assumptions namely 'that the wars in the future will be short' and that the 'economic sanctions can deter wars and should deterrence fail then bring about an early cessation of hostilities'. The fourth assumption to be dispelled is the belief that 'investment in alliances can offset a portion of the military spending which can now be right sized to fight the short wars of the future'. The Ukrainian belief in this notion has so far resulted in the displacement of 10 million Ukrainians, reduction of several Ukrainian towns and cities to rubbles, death of thousands of citizens and the loss of one-fifth of their territory which includes nearly their entire southern coastline. Last, but not the least is the Russian myth of a quick victory, which even after 100 days of war, remains

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elusive. This paper is an attempt to analyse the reasons of the failure of Russian Air Power in Ukraine which, at the time of commencement of operations, was considered absolutely vital for the achievement of a quick Russian victory.

Successful Ukrainian Resistance

One of the key reasons for Russians' difficulty in winning is the support being provided by NATO (which includes three of the P-5 countries). This overt support has led the Russian Foreign Minister to accuse NATO of being engaged in a proxy war in Ukraine against Russia.[1] When we consider that US is currently spending nearly $100 million per day[2] with a stated aim to weaken Russia (not regime change) to a degree that it cannot invade more countries like Ukraine[3], then this argument gains ground. The support extended by US includes thousands of sophisticated Anti-Tank Missiles, Man Portable Air Defence Systems (MANPADS), Artillery, Ammunition, Air Defence (AD) systems, aircrafts, helicopters, drones, spares and above all intelligence. Given the multitude of latest equipment being employed by both the East and the West, this war is indeed a treasure trove for military learning and for understanding what has failed and what has succeeded. Two spheres wherein the Russians held complete dominance at the time of commencement of operations was in tanks and air power platforms. However, both these platforms have been 'put to the sword' by the Ukrainians and like the on-ground situation, the Ukrainian airspace continues to remain contested.

Contested Ukrainian Air Space

Even after 100 days, the Russians have failed to achieve the overwhelming air supremacy that was expected of them. This is particularly glaring given the superiority that the Russians enjoy— both in terms of platforms and precision strike capability. However, despite the interdiction of majority of Ukrainian Air Bases, the fact remains that the Ukrainian Air Force continues to operate, while their AD assets continue to bring down Russian aircrafts. This lack of air supremacy has manifested into the increased Russian employment of missiles

and artillery. Apart from the hundreds of ballistic missiles such as the 'Iskander' and 'Tochka-M', it is estimated that Russia has so far fired more than 2125 precision guided missiles at Ukraine (including the hypersonic Kinzhal). [4]

Ukrainian Air Power

Despite overwhelming odds, what has been most remarkable is that the Ukrainian Air Force is still in action. One of the major contributing factor is the help extended by the Western Powers— both in terms of aircrafts and spares.[5] Another factor has been the reduced number of visits by the Russian aircrafts to Western Ukraine when compared to the East. However, some caution needs to be exercised before we jump to any conclusions. As per the Pentagon, Ukraine conducts only 5-10 sorties per day, compared to roughly over 200 sorties by Russia.[6] This clearly highlights that the operations of the Ukrainian Air Force are extremely limited both in depth and scope. Ukrainians have also been exercising due caution in order to ensure that no sortie develops into a fight under unfavorable conditions as the Russian fighters come armed with active homing 'R-77 missiles'. Another aspect for the low sortie generation by Ukraine is the serviceability state of aircrafts. While a high serviceability state can be expected during the commencement of operations, however, sustaining it is a different matter altogether. As the war progress, most Air Forces experiences a drop in the serviceability rate—smaller nations run the risk of flying themselves into the ground in an attempt to try and match their opponents. This along with training is one of the reasons why the Ukrainians are keen to accept the supply of old Mig-29 Jets from other NATO countries. US believes that transferring these jets to Ukraine is critical as, without re-supply, Ukraine would run out of airplanes even before they run out of pilots.[7]

Drones as an Alternative

Ukrainians have been employing drones such as the 'Bayraktar TB2' (Turkish drones) since the beginning of the war. This has been complimented by Loiter Ammunition/ Kamikaze Drones such as the 'American Switch Blades' to strike Russian tanks, Command setup,

artillery and other vehicles. This action has helped to not only inflict casualties and reduce the speed of advance of the Russians but has also enabled the Ukrainians to rapidly switch forces as they operate on interior lines of communication. What is even more notable is that, due to the near complete withdrawal of the Ukrainian Air Force from the skies, majority of the combat missions are now been undertaken by the TB2. This clearly highlights that drones are omnipresent and if required can replace/ augment manned air power platforms. Realising their efficacy, the US is now augmenting the Drone/Loiter Ammunition arsenal with the 'Phoenix Ghost'. This, in effect, also underlines that kamikaze drones have the potential to replace anti-tank missiles as well. One major task that drones seem to have performed in this campaign is the direct engagement and direction of own artillery fires from coastal batteries onto Russian naval targets at sea. Commercial off-the-shelf drones such as the Da Jiang Innovations (DJI), are being used extensively by both sides for gaining intelligence, surveillance, and reconnaissance. So much so that on 25 March, Ukraine created a Facebook post, asking its citizens to use commercial drones and participate in a mass patrolling programme to conduct reconnaissance of movement of the Russian Army.[8] Such rampant use of drones necessitates the need for the Russians to conduct anti-drone operations at a scale never witnessed before.

Long Range AD as a Deterrent

On 25 February 2022, the 'Russian S-400 Battery' located in Belarus, shot down an Ukrainian Su-27.[9] This incident not only marks the first kill achieved by the Russian S-400 in Combat but in doing so it destroyed a target at a distance in excess of 150 km. Similarly, on 15 April, the S-400 yet again shot down one of the two Ukrainian *Mi-8* in the Chernihiv region, while they were returning after striking targets in Russia (village in Russia's Bryansk area).[10] While both these incidents clearly established credentials of the *S-400* however, what is striking is Russia's reluctance to stage forward these systems in accordance with the pace of advance of the Russian ground forces. This is especially curious given the heavy employment of *Bayraktar TB2* and the occasional use of

fixed/rotary wing aircrafts at extremely low altitudes by the Ukrainians.[11] Similar to the Ukrainians, the Russians have been losing large number of aircrafts to the Ukrainian medium and long range AD Systems such as the Buk-1M, and the S-300P (Ukrainians possessed around 100 active batteries of the same at the start of war). Not satisfied by the significant holdings of S-300P, on 16 March, the Ukrainian President in his address to the US Congress, requested for more S-300P or similar systems as an alternative to the imposition of a "No Fly Zone".[12] So, was the Ukrainian request an overkill? The simple answer is an emphatic NO, as the mere presence of these systems have made flying, at both medium or high altitude, an extremely risky proposition for both the Ukrainians and the Russians alike. Seized of the threat, the Russians have opted to target the Ukrainian S-300P batteries during the initial onslaught by missiles[13] by either flying low or by employing the Kh-31P Anti-Radiation Missiles mounted on the Su-35S and Su-30SM. As a consequence, by the end of week seven, the Russians 'had knocked out' at least 21 out of 100 hundred S-300 launchers. While the actual figure maybe higher however, what it does confirm is that *firstly*, for both the medium and high altitudes, the long range SAMs are effective and can be considered as an alternative to employing Fighters for AD. *Secondly*, all long range systems will be a priority target for missions such as Destruction of Enemy's AD (DEAD) thereby forcing their deployment in the depth. *Thirdly*, despite the presence of these systems, low altitude operations by air power platforms can continue hitherto fore. However, when aircrafts fly low, not only does it lead to the reduced situational awareness but more notably it places them into the realm of MANPADS.

The Realm of MANPADS

Perhaps the single most effective AD system in the war has been the Man Portable AD System (MANPADS). At the time of commencement of hostilities, the Ukrainians had limited quantities of 'Igla'— a simple, easy to use Infrared (IR) homing MANPADS. Seized of the issue and the lack of their proliferation, the initial stages of the war saw a large number of Russian helicopters flying low along with the constant use of IR flares. However, despite

generous use of flares, the Ukrainians were still able to inflict losses onto the Russian Aircrafts with a variety of aircrafts ranging from Mi-8, Mi-35, Ka-52 and the Su-24 being shot down. Soon, NATO systems such as 'FIM-92 Stinger' and 'Starstreak' started to find their way into the hands of the frontline Ukrainians who in turn were able to employ them effectively. Moreover, since systems such as the 'Starstreak' do not operate in the IR spectrum, therefore, this added to the problems of the Russian pilots as their IR flares are simply not effective against the laser guided missiles. Given their ease of proliferation, mobility, speed and passive attributes, the pilots have limited time to detect and react. The majority of 19 confirmed Russian and 11 Ukrainian fast jet losses have likely been caused by MANPADS and ground fire.[14] One of the two major reasons attributed to the effectiveness of MANPADS in Ukraine has been the lack of large inventories of precision weapons and targeting pods forcing the pilots to fly low— both for the accurate release of unguided munitions and to avoid the long and medium range SAM.[15] Since, the overwhelming number of Russian and Ukrainian aircraft losses are mainly in the Tactical Battle Areas (TBA) and on aircrafts flying low, therefore, it is imperative that all defenders need to possess a complete family of sophisticated AD systems to deal with all kinds of threat as simply having reserves of long range SAM is not adequate.

Stockpiles are the Key

Due to limited range of MANPADS and the large frontages that needs to be secured, proliferation of MANPADS is a key to its success. Therefore, in order to cover a large frontage, ensuring proliferation and catering for long drawn-out campaign, stockpiles are the key. Since stockpiles are an expensive proposition, one possible solution used by nations during times of crisis is 'resorting to emergency procurement'. Although practical however, this solution runs the risk of not only being expensive (opportunity costs) but also runs the risk that the delivery of these weapons happens either in limited quantities or in some cases well after the crisis is over, example being the delivery of long range Rockets by NATO to Ukraine. Another possible alternative would be to ask for foreign help for example USA

provided the Ukrainians with over 1400 Stingers between February to April 2022. .[16] The USA in turn has not purchased any Stingers since 2003 with total availability at the time stated as 11,600 missiles. With testing and training losses of 1% per year, the remaining inventory is estimated to be around 8,000.[17] With the Stinger production line having closed in 2020[18] and the US having already sent about a quarter of its inventory to Ukraine, the US now has its own supply side issues. Additionally, some promises of foreign help may simply lack the bite. One such promise was the German promise of supplying 2700 Strela-2M MANPADS which were declared obsolete in 2014; of 2700 missiles, 700 were so badly damaged that they could not be supplied.[19] All this help needs to be viewed in the light of the projected Ukrainian requirement of 500 Stinger missiles daily.[20]

Ground Based AD Weapon Systems (GBADWS)

Russia has been proactive in searching and destroying Ukrainian GBADWS since the commencement of the campaign. To ensure their survivability, the Ukrainians has been careful in identifying their targets and post engagement resorting to re-deployment of their AD assets, to prevent giving away their location to the Russians. It can be argued that with the Ukrainian Air Force taking a backseat, perhaps it is the effectiveness of the Ukrainian AD assets, that prevented the Ukrainian military from collapsing during the initial 'heavy' stages of war and accorded the Ukrainians time to procure more resources from NATO. Similarly, even the Russians seem to have benefitted from their own embedded AD elements which, due to their matching mobility, can be seen moving along with the Russian armour— just the mere presence of these systems has been adequate to deter the Ukrainian Air Force from targeting not only the tanks but even the Russian convoys (at times 40 km long) of soft skinned vehicles with only meaningful engagements being the attacks by Ukrainian drones. Ukrainian drone operators have also been careful in their target selection hence, most of the times these drones can be seen targeting Russian GBADWS that were either getting into position or on the move. This is in stark contrast to the images of Nagorno-Karabakh wherein the GBADWS are seen to be tactically deployed and operational. As the war

progresses from days to weeks and is centralised around the Donbas region where the terrain is more suited for the employment of GBADWS, Ukraine has largely stopped posting footages from their TB2, thus, raising suspicion about the losses (and supported by evidence) of TB2s to Russian GBADWS. Although, not independently verified however, Russia claims to have shot down 583 Ukrainian drones during the three-month plus war.[21] Not to be outdone, even the ship based Russian AD systems have also downed Ukrainian drones at sea as they expanded their area of operation.

Importance of Terminal AD

Given the increased employment of cruise missiles and drones in the tactical battle area, one aspect that cannot be overlooked is the requirement of Terminal AD systems, and Terminal AD is best exercised through guns. This is a valuable lesson painfully driven home after the sinking of the Russian Cruiser 'Moskva'. Had the Russian vessel been armed with state- of–the- art gun firing advance ammunition, then the outcome could have been different. Similarly, had the Ukrainians possessed a reliable terminal AD system against the 183 Kalibr missiles fired at Ukraine[22], then maybe the destruction of Ukrainian assets could have been limited. Seized of the requirement, Germany is now sending in 50 Gepard AD systems— AD guns mounted on a tank firing the Advanced Hit Efficiency and Destruction (AHEAD) class of advance ammunition.[23] The popular perception that exists is that guns are ineffective stems from the past experiences wherein guns were seen to have poor 'Kill Probability'. This has been augmented by the fact that, the design of guns has more or less remained the same over the past one to two decades. However, what the naysayers tend to overlook is that, it's not the gun but its fire control system and the ammunition that has undergone a radical change thereby massively altering their Kill Probability—at 1-4 km the 3P or the AHEAD class of ammunition is nearly 17 times more effective than the standard ammunition. As the size and cost of drones continue to reduce and the threat posed by them increases, it is becoming increasingly uneconomical for the drones to be engaged by missiles. Since, a battle area can be effectively subjected to multiple visits by multiple drones

at all times hence, guns are the only cost-effective option. Additionally, guns can rapidly switch from one target to another allowing multiple engagements and do not have a dead zone which all missiles have.

Deconflicting

Friendly fire incidents between GBADWS and other air space users has been an issue for all air forces. Whenever, there are many AD assets (both ground and air based) and other air space users operating in a given area, the ability of air power platforms to operate safely post de-conflicting poses a major challenge. This challenge gets further multiplied when adequate levels of command, infrastructure, close inter-service cooperation, communications and practice have not been put in place. In the case of Russian Air Force, the combat experience gained in Syria is nowhere comparable to the one being gained by them in Ukraine. Russian operational commanders have very little practical experience on how to plan, brief and coordinate complex air operations involving tens or hundreds of assets in a high-threat air environment.[24] This issue has become complicated further due to increased reliance of Russians on GBADWS for AD cover on account of enhanced threat from Ukrainian drones and loitering ammunition. As the swathe of Russian intervention increases, the presence of Russian AD systems will increase further thereby compounding the complexity of deconflicting.

Failure of Soft Kill

Video evidence highlights the presence of Russian Electronic Warfare Systems in large numbers. However, no evidence has so far emerged of any Ukrainian drone being brought down by any of the DEW/ Electronic Warfare systems. On the contrary, adequate evidence exists of Electronic Warfare systems being destroyed by drones. This clearly highlights that the ‘Soft Kill’ systems are still a project under development and currently lacks the desired potency. What is also evident is that, drones are progressively evolving to deal with contemporary anti-drone ‘soft kill’ measures. Given the drone kill claims of both the

Ukrainians and the Russians, it is clear that 'Hard Kill' continues to remain the only effective option to deal with drones.

Training

The effect of any weapon is totally contingent on its user' tactics, skills and employment, all of which are dependent on the levels of exposure and practice in a realistic scenario. It has been highlighted that, the current generation of Russian pilots have limited levels of experience and training with most pilots averaging around 100 hours of flying time per year. Apart from the pilots, 25% of the Russian Armed Forces comprise of conscripts— both of which indicate inadequate levels of training in both technical and tactical level handling of equipment. The result is easy to see as the initial movements of the Russians were non-tactical wherein crews were often seen to be deserting their equipments by the roadside, poor gunnery skills, equipment often seen to be out of action and non-tactically deployed during short halts and poor radio discipline resulting in Russian losses both in terms of equipment and lives. Since, an average Ukrainian soldier has demonstrated remarkable technical skills, NATO has been able to supply the Ukrainians with an ever increasing number of sophisticated weaponry. In case the Ukrainians had been technologically challenged in absorbing new technologies, then the outcome of most of the tactical engagements would have been different.

Conclusion

As Ukraine continues to resist, the Ukrainian AD has emerged as one of the key elements to have a decisive impact on the battlefield. The loss of 26 combat aircrafts and 39 helicopters since the start of the invasion[25] has made Russian pilot's risk averse and as a consequence they prefer not to spend much time in Ukrainian airspace. As the Russian Air Force cedes air supremacy to the Ukrainians, the flow of weapons from the West to the frontline intensifies adding more teeth to Ukrainian defences. As casualties and losses mount, Russia is forced to 'dig in deep' and divert more and more reinforcements in an effort to offset these losses.

As the war continues, all military planners are presented with an opportunity to revisit large number of issues such as A2AD, layered AD, missile defence (including anti - ship), role of drone, requirement of AD Guns etc. and draw appropriate lessons. Perhaps, the most notable aspect that now needs to be looked at is the ability of an air campaign to achieve its stated objectives when faced with sophisticated GBADWS. It would indeed be wasteful if we continue to observe, read, write, discuss and yet fail to implement the lessons learnt from this war. One must never forget that 'history not only repeats itself but it also rhymes and it rhymes too regularly for comfort'.

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