CENTRE FOR LAND WARFARE STUDIES

ISSUE BRIEF

No. 307 October 2021

Drone Wars in Syria and Nagorno-Karabakh: Lessons Learnt

Colonel PMS Kohli, is an Alumni of NDA, Khadakwasla and was commissioned into the Army Air Defence in Dec 1997. A graduate of LGSC, DSSC & HDMC, the officer has commanded an Air Defence Regiment as part of an Armoured Division. The officer has also held various Staff and Instructional appointments. He is presently posted at Army AD Directorate at IHQ of MoD (Army).

Historically, every minor skirmish has served as a dress rehearsal for the bigger ones to follow. This necessitates that each skirmish is studied in detail to gain an insight into the Tactical Battle Area (TBA) of the future. Prior to the wars in Syria & Nagorno-Karabakh, drones / Unmanned Aerial Vehicles (UAV's) were considered as an ideal platform for Intelligence, Surveillance and Reconnaissance (ISR) with limited precision strike capability. However, in both Syria and Nagorno-Karabakh, drones demonstrated their capability as a game changing airpower platform that can enable even lesser powers to reverse decades of status quo.[1]

Key Points

- The recent drone war demonstrated the emergence of drones as an alternative airpower platform, capable of achieving decisive military victories.
- The wide variety of drones and their continued advancement highlights their ability to undertake different missions with profound military implications.
- The outcome of future wars depends upon the balance of power between drones and AD systems.
- Full Spectrum AD is essential for the preservation of combat assets against large scale employment of drones.
- Induction of few pieces of modern AD system cannot make the entire AD network effective.
- For multiple echelon defence, non-kinetic measures offer only a partial solution which, in addition to being cost prohibitive, will always remain one step away from obsolescence.

Lessons: Air Warfare

- ***Drones: An Extension of Air Power.*** By steadily increasing their own ability to project force, drones are now not only augmenting but also successfully expanding the capability of airpower.

- **Old Wine in New Bottle.** In both these wars, drones emerged as a 'platform of choice' as against the more traditional airpower platforms. However, while the platform of choice changed, what did not change was the essence of employment of airpower and its desired impact.
- **Evolution and Not Revolution.** Employment of drones in both these conflicts marks only a progressive evolution and not a revolution in the application of airpower.[2] This evolution however, signals the dawn of a new Artificial Intelligence (AI) driven revolution. USA and China have already showcased vehicles akin to the Smerch or Grad BM-21[3] wherein the rockets have been replaced by drones (Switch Blade 600[4] & CH-901). In the future, AI controlled swarms armed with cameras and/or warheads will provide an edge over the adversary. On 06 March 2020, Elon Musk— during an Air Warfare Symposium— articulated that the "era of the fighter jet has passed" and these "would be replaced by the drones". [5] Even as skeptics continue to scoff at the idea, we are witnessing drones carrying out air-to-air refueling of fighters (MQ-25A Stingray)[6] and jet powered, radar invisible drones (see **Figure 1**) like the Okhotnik (Russia) and the XQ-58 Valkyrie (USA) take to the skies with the sole purpose of initially assisting (Loyal Wingman) and subsequently replacing the manned fighters.

Figure 1: Drone Revolution

- **Text vs Context.** As far as the impact of drones on the tactical battle area (TBA) is concerned, Turkish drones seem to have both developed

and outperformed the UAVs used by USA. While the text may be complete however, it conceals the context, that drones were always capable of executing such missions. This delay in recognition, stems from the fact that, by the time drones were employed in the Gulf, the enemy ground troops had already been overwhelmed. This effectively relegated the role of the drones to a Counter Insurgency (CI) role. The subsequent use of the drones for search and engagement of targets with the pilot sitting somewhere else further led to the bracketing of drones as a platform ideally suited for ISR and CI.

- **An Attractive Proposition.** When compared to the costly fighter aircrafts, drones offer the advantages of airpower, to small and middle powers at a highly discounted price. Moreover, the use of drones by Azerbaijan followed by Hamas (Shehab [7]) in May 2021 over skies covered by the S-300 and the Iron Dome illustrates the ability of drones to successfully reach and operate in areas where fighters cannot go. This makes them a valuable asset even in an Anti-Access Area Denial (A2AD) environment. As a result, in 2021 Morocco, Poland (a NATO member) and Ukraine purchased the Turkish drone— Bayraktar. Another critical area to which the drones are suited is the Grey Zone. Not only can they perform all Grey Zone tasks efficiently, but they also run a limited risk of escalation. Pakistan for instance, has been employing drones to drop arms into India without the fear of escalation or reprisal.[8]
- **Drones vs Helicopters.** Both these wars highlighted the need to debate the requirement of helicopters in the TBA. *Firstly*, in both these conflicts, drones successfully executed nearly all the tasks that a Helicopter can undertake (including attack helicopters). While drones did not carry out casualty evacuation or logistical support however, with Israel on 07 May 2018 showcasing casualty evacuation by using the 'Cormorant' drone and with PLA carrying out transportation of material in their recent standoff with India, these too may be just a step away. *Secondly*, helicopters have a considerable Radar Cross Section (RCS) and are slow which makes them easy to detect and difficult to outrun missiles. *Thirdly*, due to the proliferation of the Man Portable AD Systems (MANPADS), the risk of loss of both— the helicopter and its aircrew, remains constant. Some argue that aircrews are best employed

piloting multiple drones onto their targets and in case some drones are lost, then the same aircrew can plot the next wave of drones. *Lastly*, drones are less expensive (Australia bought 29 Apache for $4.5 Bn[9], while Ukraine bought 12 Turkish Bayraktar for $69 Mil) and easy to maintain.

- ***Beyond Visual Range (BVR) Missiles.*** The impact of BVR Missiles is not restricted to air and transcends dimensions.
    - **The Indian Experience.** A short air to air skirmish on 27 February 2019, brought home the reality of all future operations being undertaken in a BVR environment. Seized of the likelihood of PAF employing F-16 with AMRAAMs, IAF had been practicing keeping its aircrafts beyond the Dynamic Attack Zone of the AMRAAM.[10] On the opposite end, since IAF was operating the Su-30MKI with R-77 hence, neither side chose to close in on the other and maintained distance. With India now inducting the 'Meteor', the looming issue is, what will be the impact of BVR missiles on the TBA?
    - **The Syrian Experience in Idlib.** Some may argue that the India-Pakistan air skirmish was a one-off event. However, on 01 March 2020 (Battle of Idlib) the same sequence of events unfolded when two Syrian Su-24 were shot down by Turkish F-16 armed with AMRAAMs and supported by AWACS.[11] Thereafter, Syria never employed its air assets to challenge either the Turkish aircrafts or their drones and relied entirely on their Ground Based Air Defense Weapon Systems (GBADWS) for AD.
    - **The Armenian Experience.** One major point of criticism that emerged after the Nagorno-Karabakh war was the futility of Armenia purchasing four Su-30SM in 2019 for $120 million. Turkey on its part, had based its AWACS and F-16 armed with AMRAAMs in Azerbaijan and used them (outside Armenian S-300 range) to sweep the skies for any Armenian aircraft. Armenia in turn obliged by keeping these aircrafts on ground for fear of losing them or getting Turkey engaged in the war. This in effect, handed Air Supremacy to the Azeri's on a plate who used it to decimate the Armenian ground troops.
    - **Impact of BVR on TBA.** Hence, one can conclude that the BVR missiles will compel nations to maintain distance (at least initially), while actively employing AWACS for better Situational Awareness (SA). While it can be argued that, the 5th Generation aircrafts (which only PLAAF has) can operate with some degree of immunity however, most aircraft will need better SA

along with better packaging and tactics. All of this, points towards the likely risk of denuding of the TBA of air cover and leaving it vulnerable to drones for extended periods of time.

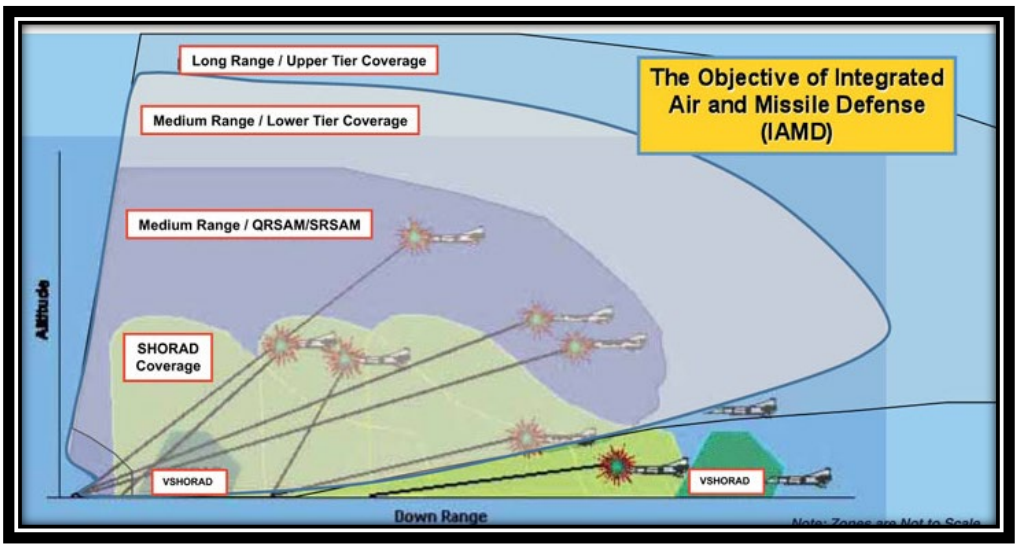
Lessons : Land Warfare

- ***Reliance on Air Supremacy for Air Defence (AD).*** There are pundits who advocate the Western formula of reliance on Air Supremacy for AD of ground forces. However, the moot question is, that in case Air Supremacy cannot be assured then who defends the ground forces? Further, there are two additional issues that need to be considered. *Firstly*, the drone threat is omni present meriting a 24x7 air cover. *Secondly*, aircrafts are best employed for strike and bring the war to an early conclusion, rather than be held back for providing a really expensive air cover. Since, the achievement of Air Supremacy in the sub-continent by any side, can at best be described as 'misplaced optimism' and the attainment of Favorable Air Situation as a 'partial solution' therefore, neither of these options are practical.
- ***AD of TBA.*** Possibly the people best equipped to deal with air threat are those who are going to be at the receiving end of it. Accordingly, the West has chosen to arm their field armies with a series of GBADWS. Even the Israelis and the Taiwanese rely extensively on a series of GBADWS as their first line of defence while Russia and China assign their GBADWS an even larger role of A2AD. Closer to home, all air bases have tiers of overlapping AD coverage with guns providing terminal AD. Hence, the bottom line is that AD is an art best exercised from ground and not from the air.

  On 24 November 2015, a Russian Su-24 was downed by Turkey in Syria[12] (with the usual suspects involved). What followed thereafter is an example of how GBADWS can be employed to restrict the freedom of action of air power. The Russians immediately deployed the S-400 Triumf AD System in Syria thereby putting into place a major A2AD system which covered the entire airspace of Syria and half of Israel and Turkey. Consequently, the freedom of movement of even the USAF got restricted, bringing air strikes by fighters to a near halt. Subsequent air strikes were spearheaded either by the Tomahawk cruise missiles, F-22 Raptor or the drones. The caution on the use of airspace was further amplified when on 10 February 2018, an Israeli F-16 was shot down by the Syrian SAM, making it the first Israeli jet downed in conflict since 2006.[13]

Drawing parallels, the Indian sub-continent is home to various long and medium range SAMs like the S-400, S-300, HQ-9, LY-80 and FD-2000, all of which are potent A2AD platforms. These systems, in conjunction with other point AD systems, (see **Figure 2**) are adequate for providing the TBA with the requisite AD cover.

Figure 2: Integrated Air and Missile Defence[14]



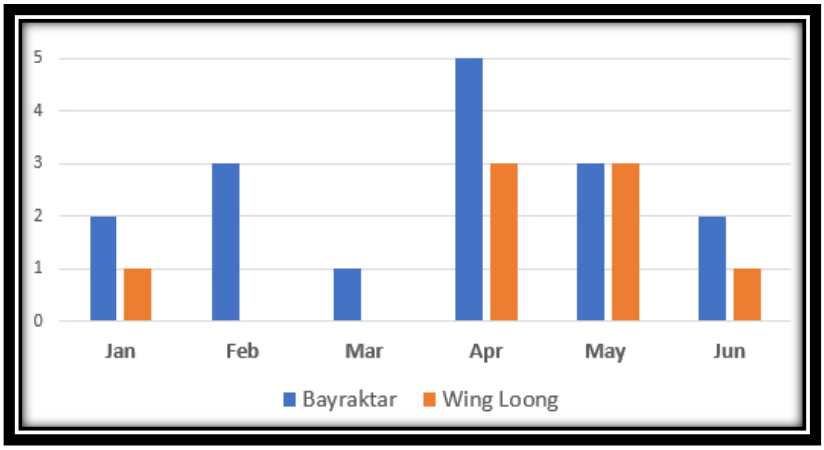
Source: https://www.spsshownews.com/defexpo-india-2012/news/?id=34&h=1-1-3-Making-air-and-missile-defence-affordable

- ***LR SAM as a Solution.*** The question that is often asked is that, can LR SAMs like the S-400 take on Drones? The answer is an emphatic "yes", although it would be an extremely expensive overkill. Since, the Radar Horizon restricts the range of all Radars, the LR SAMs are vulnerable to low altitude attack by cruise missiles or drones, which in large numbers, can overwhelm, as was the S-300 in Nagorno-Karabakh.[15] To overcome the issue of Radar Horizon, LR SAMs generally employ High Masts which makes them an even bigger target. Hence, most LR SAM opts to trade some of their long range for depth and deploy in the rear areas. This measure however, results in the ceding of the airspace over the TBA to low flying aircrafts or drones. It is due to these reasons that the Russians employ a large number of embedded GBADWS for AD.
- ***Legacy AD Systems.*** Both the wars have decidedly put to rest the argument on the efficacy of Legacy AD Systems against drones. During the "Four Day War" in 2016, Israel supplied Azerbaijan with Harop UAVs, which, despite the presence of the Armenian Stela10M and Osa-Ak, were used to great effect.[16] The Armenians however, ignored this valuable combat experience and during the period between the

two wars, bought from the Russians MANPADS, TOR and more Osa-Ak from Jordan.[17] Hence, rather than buying more advanced AD systems, Armenians invested more in their ground forces and cheaper Legacy AD systems, thereby exhibiting a complete failure to adapt. As it turned out, the legacy systems such as the Strela10m (fair weather and without radar) and Osa-Ak (which was never designed to deal with a drone) were systematically taken apart by the Azeri drones. Therefore, a smaller balanced ground force, well-protected from air attacks is a wiser investment than investing in a large body of troops, that lack full spectrum AD cover.

- ***Performance of Modern AD Systems.*** On 14 September 2019, Houthi drones slipped through 500 kms of territory, guarded by billions of dollars worth of air superiority fighters and Patriots, and successfully attacked two key Saudi oil installations. This event followed by events in Syria and Nagorno-Karabakh does raise some questions on the performance of modern aircrafts and AD systems against drones.
    - **System on System Matchup.** An on-paper, system-on-system matchup is not especially revealing and hence, should not be generalised. The modern day armies, like those of the Russians and Chinese, have an integrated and automated AD system that provides an interlocking AD umbrella both in range and altitude and hence, can easily respond to any situation. This was also demonstrated more recently by the Israelis and hence, any comparison of these systems with the ones fielded by the Syrians or Armenians would be a costly mistake.
    - **Drones vs GBADWS.** Reports indicate that 23 Pantsir AD systems were destroyed by the Turkish drones in Syria and Libya.[18] This story however, should not be oversold as reports also indicate that during the Libyan Civil War 17 Turkish Bayraktar and 8 Chinese Wing Loong UAVs were lost within a span of six months.[19] The overall tally, cited by most sources is as high as 40 drones lost in the first six months of 2020, 28 in 2019 and 19 in 2018 (see **Figure 3**). Syrians also contend that they were not prepared for a Turkish onslaught and hence, suffered initially. Subsequently, the Syrian AD systems were able to stabilise the situation enabling them to regain control over the strategic city of Saraqib.

Figure 3: Turkish /UAE Drones Crashes in Libya, Jan-Jun 2020[20]



Source: *Drone Wars UK*

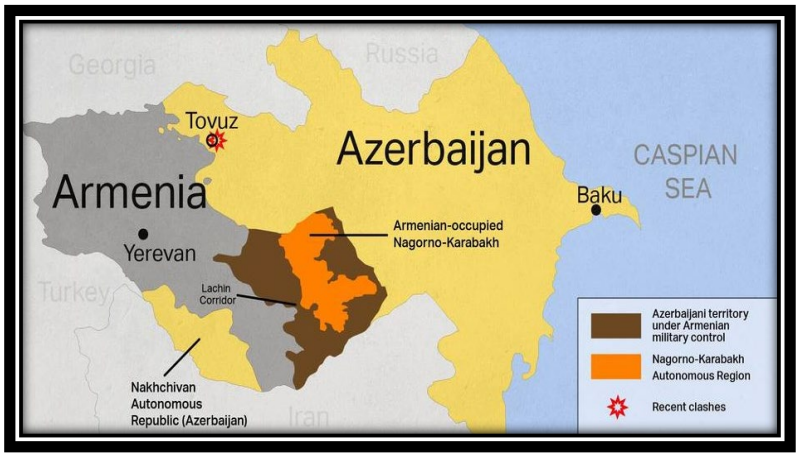
- **Too Little and Too Late.** As the war progressed, Armenians realised that the *Bayraktar* was operating at standoff ranges. To counter this, Armenia staged forward their latest *Buk* and *Tor-M2* AD systems which paid dividends in the form of shooting down of few drones.[21] However, these measures were too little and too late to have any impact on the outcome of the war. This clearly illustrates, that the induction of a few pieces of modern AD systems, cannot make the entire AD network effective.
- **Innovative Use of Drones.** Azerbaijan converted some of its An-2 Colt Biplane into a drone and continuously flew them over the Armenian defences in order to trigger the Armenian AD into revealing their positions. Such innovative measures coupled with poor AD drills enabled Azerbaijan to swiftly pinpoint Armenian AD assets for destruction by drones which were always flying in close proximity.
- **Numbers Matter.** Joseph Stalin famously said "quantity has a quality of its own". As a consequence, he threw in masses of cheap Soviet Tanks bringing the Nazi Blitzkrieg to a halt. Similarly, for air superiority over the TBA the number of platforms is the key. Seized of this fact, Azerbaijan imported drones amounting to $123 million from Turkey in the first nine months of 2020. [22] From a purely military point of view, it was essential for Armenia to also ramp up its AD (both in quality and quantity). However, it failed to get the requisite numbers of AD systems in place, due to which its military might accounted for nothing.

- ***Training.*** On 09 January 2018, 13 drones were launched against the Russians in Syria. While the Russian Pantsir downed seven the other six were downed by the Russian EW systems.[23] During the entire course of the war, a total of 60 drone

attacks were repulsed by the Russians. However, the success of the Russians was not mirrored either by Syrians or the Armenians. One of the major attributing factors was the lack of proficiency. For example, the Syrian operators were handicapped by a decade long war and large attrition in its ranks. Therefore, training is critical due to which the same system performs differently from nation to nation.

- ***Modernisation.*** In 2017, Armenia's military expenditure amounted to $450 M (3.6% of GDP) with heavy reliance on tanks and artillery. In contrast, from 2015-2019, Azerbaijan took great strides in an effort to both modernise and diversify its military with 60% of its arms purchased from Israel, 31% from Russia, 3.2% from Turkey and the remaining 5.8% from Ukraine, Belarus, Pakistan and China.[24] Another aspect of modernisation involves upgradation of the existing systems like the Russians have been progressively upgrading their AD systems. Hence, while the AD systems fielded by the Russians in Syria may appear identical to their Syrian or Armenian counterparts however, under the skin they are completely different.
- ***Overlapping AD Coverage.*** Azerbaijan extensively exploited its territory on both sides of the Nagorno - Karabakh corridor for progressing its drone operations (Nakhichevan Autonomous Region, see **Figure 4**). This resulted in the spreading out of the limited number of modern Armenian AD assets over extended distances, with independent deployment becoming the norm. Since, most of the AD resources in the TBA were short range AD hence, their spreading out resulted in the loss of overlapping AD coverage which the Azeri drones exploited. Each individual AD systems are designed primarily for a purpose and have certain shortcomings. These shortcomings are generally overcome by two or more AD systems being deployed together. This has been the hallmark of all the past wars including Yom-Kippur where the Egyptians had the Kvadrat system providing medium range AD cover. Whenever the Israelis decided to go low and exploit the Radar Horizon, they ran into the AD provided by the Strela-2M & Schilka weapon system which were deployed for this very purpose. Hence, when deploying AD assets, it is essential that there is an overlapping AD coverage and deployment below the recommended Basic Scale of Defence is discouraged.

Figure 4: Map of Armenia & Azerbaijan[25]



Source: Trt World

- ***The Maginot Line Syndrome.*** The Maginot Line Syndrome is essentially organising the defences in a manner that they are pointed in a direction that is the most probable direction of attack. The drawback of this system is that it is resource intensive and can be bypassed. Similarly, Armenia was confident of defending their positions based on the 'Bagramyan Line' straddling the Nagorno-Karabakh–Azerbaijan border. However, due to the extensive surveillance by drones the Azeris were able to find and fix Armenian targets which were then engaged by artillery/drones. Similarly, both India and Pakistan have also established a series of fortifications between them with India currently undertaking the establishment of another series of fortifications on its Northern Front. Since, majority of the troops in the TBA have no/limited access to air power assets hence, there is a case to take a leaf out of the Azeri book. By employing drones, Commanders can have their own air assets for undertaking both ISR and strike missions.
- ***Relevance of Armour.*** When viewing the drone strike footages on You Tube, one wonders if armour is obsolete? The answer to this question probably lies in the past, when a similar obituary of the tank was written when the Anti-Tank Guided Missile surfaced on the battlefield. A deeper analysis of the data available reveals that the Azeri drones targeted not just tanks but all types of combat assets including infantry. The confirmed Armenian losses stand at 185 T-72s, 90 AFVs, 182 artillery pieces, 73 multiple rocket launchers, 26 SAM systems, 14 radars/jammers and 451 military vehicles.[26] Hence, both Syria and Nagorno-Karabakh show that it is becoming increasingly difficult to preserve combat assets in the face of sophisticated, precision strikes.[27] So where does that leave the tanks in face of the drones? Simply put, there

is no other platform that has the perfect combination of firepower, protection and mobility which can create all around criticalities for the enemy.[28] Therefore, one needs to take a relook at the protection aspect for tanks. For example, equipping individual tanks with a Counter UAV System and embedding AD will impart the necessary protection to both Armour and other co-located elements including infantry. Another advantage accrued by the presence of AD is that, it will necessitate undertaking of missions such as Recce & Destruction of Enemy AD (DEAD) thereby shifting their focus.

- ***Passive AD.*** The numerous videos of both the wars also highlights the utter disregard to Passive AD. Both sides were repeatedly seen massed together with little or no camouflage. In this age of high battlefield transparency and superior target acquisition, the reduction in visible, thermal and electronic signature is critical. There has to be renewed focus on camouflage, hardening and most importantly dispersal with improvement in mobility exploited for achieving concentration in time and at the point of application.
- ***Tools for Propaganda.*** The video evidence generated by the drones in both the campaigns had a dramatic effect in selling a narrative. Imagine a Balakot like scenario in which drones were employed instead of the manned aircraft. Apart from the ease of execution and logistics, Pakistan would not have been compelled to use PAF. Additionally, the drones could have remained on station to show to the world the, before and the after effects of the strike, thereby ensuring that these images remain permanently etched into the memories of all.
- ***Non- Kinetic Response.*** Most nations are currently undertaking the development and deployment of Non-Kinetic counter drone measures. With EW emerging as the front runner, two pieces of exploits of EW systems from Nagorno-Karabakh stand out. The *first* was the use of Russian Polye-21 EW system which disrupted the Azeri drones for four days and the *second* was the Russian claim of downing nine Bayrakhtar drones at Gyumri in Armenia on 19 October 2020, using the Krakushka EW system.[29] However, while the Non-Kinetic counter drone measures show tremendous promise, there are some other factors that need to be considered.
    - **Proliferation Cost.** At a whopping price tag of $42 Mn the Polye-21 EW system highlights the extremely high cost involved in proliferating Non-Kinetic measures in order to establish a multiple echelon defence.[30] This cost does not include either the cost of development or the cost of failure.
    - **Hardening.** An analysis of the matchup between the UAVs and Russian EW jammers brings to fore, that the effectiveness of the Polye-21 EW system was

not as desired. Certain components such as the R-330ZH Zhitel jamming communication station (successfully employed in Ukraine since 2016) proved to be unsuccessful against the UAVs.[31] This mere fact, details how a system can be rendered ineffective by simple process of hardening/shielding.

- **Limited Shelf Life.** What is potentially most damaging, is the limited shelf life of the system. In 2019, as the Russians were still in the process of inducting the system[32], Armenians were already encountering systems such as the Israeli Harop which could operate through it.
- **Kinetic vs Non-Kinetic Means.** Given the pace of development of technology, all Non-Kinetic means are always just one step away from being rendered completely obsolete. Kinetic means such as guns on the other hand, will remain relevant as long as they have ammunition. Consider the obsolete yet extremely versatile Zu-23mm-2B gun which can not only engage a host of aerial and ground targets but is also immune to enemy jamming. It also does not suffer from issues such as 'Dead Zones' and need to achieve a 'lock' on the target. With automation of drives, advance ammunition and thermal sights even obsolete guns can be made contemporary, Non-Kinetic means will require a complete redesign and redevelopment.
- **Electronic Interference.** EW systems tend to interfere with the functioning of own systems operating in close proximity or on the same frequency band. This makes both frequency management and interference free operation of own systems a challenge. Additionally, they also have to cater for reduction of their own electronic signature.

- ***The Cost Factor.*** The spectacular success of drones in Syria and Nagorno-Karabakh have spurned a school of thought that the drones offer an extremely cost effective option to boost the numbers of strike aircraft. Purely in financial terms, the advantages that drones offer are unmatched. This poses the difficult question of how does one justify the requirement of a multimillion dollar aircraft for executing a precision strike when drones can do the same at a fraction of the cost? As things stand, anyone can buy a simple $100-$1000 drone from the internet, strap on explosives and guide it onto an aircraft / convoy of vehicles. Further, drones are easy to conceal, quick to deploy and easier to replace.
  - At $5 Mn, the cost of a Turkish Bayraktar is nearly twice that of the T-90 Tank. However, when compared to a F-16 (Block 70) or a F-35, it is cheaper by nearly 14 and 20 times respectively. A few drones can effectively take out an entire squadron of fighters parked at an airbase or when they take-off, making it a billion

dollar write off. In the Battle of Idlib, Turkey lost 19 *Bayraktars*, which would have costed about $80-90 million to replace while Syria lost eight *Pantsir* systems ($14 Mil each), which would cost $112 million USD to replace.[33] Some may highlight the high cost of AD systems and say that the cost is too high. However, it is this very non-investment that led to the Armenian Military losing nearly $4 Billion worth of military equipment.[34]

- The current crop of drones does not come with the burden of high cost of aircraft, pilot training, infrastructure, GBADWS to defend these airbases, risk to the pilot, his recovery/capture costs, diplomatic fallouts etc. All this makes drones a tempting alternative to a smaller nation or for situations that require response short of war. Till date, the manned aircrafts have been the beneficiary of maximum fund allocation. Given the exploits of the Azeri's drones, perhaps planners will now review their financial outlays for various platforms.
- Modern day SAMs are not cheap, with some such as the S-400 costing in excess of $1,00,000 per missile. Since a radar operator, really cannot differentiate between a cheap $10,000 drone from $1-5 Mn drone, he is dammed (financially) if he uses a SAM against it and dammed (politically or tactically) if he chooses not to. In case the modus operandi of an adversary is to employ SAMs (such as a $80,000 SAM of Iron Dome[35]) then the simple solution lies in making the adversary expend these missiles on rockets and drones. This will not only bleed him financially, but it will also create a window for employing drones subsequently. Since, the use of a BVR (in excess of $3,00,000) or a close in missiles (like the Sidewinder) is cost prohibitive, the use of short-range SAM is most appealing. However, the best solution against drones is the employment of radar-controlled AD Guns firing the Advance Ammunition which will bring down costs ($2000 per round) while enhancing the kill probability.

Conclusion

Before the Battle of Idlib and Nagorno-Karabakh UAVs had been stereotyped as platforms ideally suited for dull, dirty and dangerous missions. However, the employment of drones in both these wars have shown, that aerial capabilities are no longer the exclusive domain of large powers, and can be employed to great effect by any military regardless of its size or funding. Both these wars have made it incumbent upon military planners to carry out a realistic assessment of the aerial threat in the TBA and the measures to counter them.

End Notes

[1] Alexander Stronell, "Learning the lessons of Nagorno-Karabakh the Russian Way", *International Institute on Strategic Studies*, 10 March 2021.

[2] Micheal Kofman, "A Look at the Military Lessons of the Nagorno-Karabakh Conflict", *The Moscow Times*, 21 December 2020.

[3] David Hambling, "China Releases Video of New Barrage Swarm Drone Launcher", *Forbes*, 14 October 2020.

[4] David Hambling, "Aero Vironment Aims to Disrupt Industry with New Loitering Missile", *Forbes*, 01 October 2020.

[5] "Elon Musk Shocks the Air Force with His Candid Prediction About the Future", *You Tube*. Accessible at https://www.youtube.com/watch?v=ZKJ-uS55mhM&t=111s. Accessed on 06 September 2021.

[6] Gareth Jennings, "Stingray passes fuel to Super Hornet", *Janes*, 07 June 2021.

[7] Emanuel Fabian, "Hamas releases video of 'Shehab' kamikaze drone", *The Times of Israel*, 14 May 2021.

[8] Shishir Gupta, "Pakistan terror groups use Chinese drones to airdrop 80 kg weapons in Punjab for J&K", *The Hindustan Times*, 22 September 2020.

[9] Malcolm Davis, "Australia chooses Apache as Tiger helicopter replacement", *The Strategist*, 15 January 2021.

[10] Shishir Gupta, "Pakistan went back on its F-16 promise to US: How India fixed the gaps with Rafale", *The Hindustan Times*, 27 February 2021.

[11] David Gauthier, "Turkey Shoots Down Two Syrian Jet Fighters, Testing Russian Resolve to Support Assad", *Wall Street Journal*, 01 March 2020.

[12] Jonathan Maracus, "Turkey shoots down Russian warplane on Syria border", *BBC World*, 24 November 2015.

[13] Tom Bateman, "Israeli jet downed during Syrian attack: What happened?", *BBC World*, 10 February 2018.

[14] "1+1=3: Making air & missile defence affordable", *SPs Show News*, *DefExpo India ,* 2012. Accessible at *https://www.spsshownews.com/defexpo-india-2012/news/?id=34&h=1-1-3-Making-air-and-missile-defence-affordable*. Accessed on 8 Jul 2021.

[15] Peter A Wilson and John V Parachini, "Russian S-400 Surface-to-Air Missile System: Is It Worth the Sticker Price?", *RAND*, 06 May 2020.

[16] Alex Gatopoulos, "The Nagorno-Karabakh conflict is ushering in a new age of warfare", *Al Jazeera*, 10 October 2020.

[17] Hovhannes Nazaretyan, "Arms Supplies to Armenia and Azerbaijan", *Evn Report*, 17 February 2021.

[18] "23 Russian Pantsir AD Systems Destroyed in Syria, Libya: Reports", *Defense World.Net*, 09 June 2020. Accessible at https://www.defenseworld.net/news/27161/Some_23_Russian_Pantsir_Air_Defense_Systems_Destroyed_in_Syria__Libya__Reports#.YWANAJLhWM8. Accessed on 22 July 2021.

[19] "Libyan War Claimed 25 Large military Drones in 2020", *Defense World.Net*, 02 July 2020. Accessible at https://www.defenseworld.net/news/27332/Libyan_War_Claimed_25_Large_military_Drones_in_2020#.YWAPz5LhWM8. Accessed on 21 July 2021.

[20] Chris Cole and Jonathan Cole, "Libyan war sees record number of drones brought down to earth", *Drone Wars UK*, 07 July 2020.

[21] Sebastein Roblin, "Endgame In Nagorno-Karabakh: Two Weeks That May Reshape The Caucasus", *Forbes*, 11 November 2020.

[22] Gubad Obadoglu, "Why Azerbaijan Won", *Institute of War and Peace reporting*, 17 November 2020.

[23] David Reed, "A swarm of armed drones attacked a Russian military base in Syria", *CNBC*, 11 January 2018.

[24] N.22.

[25] Murat Sofuoglu, "Why Azerbaijanis and Armenians have been fighting for so long", *Trt World*, 16 July 2020,

[26] Robin Dixyon, "Azerbaijan's drones owned the battlefield in Nagorno-Karabakh and showed future of warfare", *The Washington Post*, 12 November 2020.

[27] Hal Brands, "Armenia-Azerbaijan war has lessons for America and Russia", *Gulf News*, 10 October 2020.

[28] Jagatbir Singh, "Death by Drones: Exposing chinks in the enemy's armour", *Financial Express*, 21 October 2020.

[29] Stephen Bryen, "Russia knocking Turkish drones from Armenian skies", *Asia Times*, 26 October 2020.

[30] Shaan Sheikh and Wes Rumbaugh, "The Air and Missile War in Nagorno-Karabakh: Lessons for the Future of Strike and Defense", *CSIS*, 08 December 2020.

[31] Sergey Sukhankin, "The Second Karabakh War: Lessons and Implications for Russia (Part One)", *The Jamestown Foundation: Eurasia Daily Monitor Volume: 18 Issue: 2*, 05 January 2021.

[32] "Latest jamming system arrives for electronic warfare troops in central Russia", *Tass*, 13 November 2019.

[33] Ridvan Bari Urcosta, "Warfare: The Lessons from the Idlib De-Escalation Zone", *The Air Force Journal of European, Middle Eastern and African Affairs*, 31 August 2020.

[34] Mushvig Mehdiyev, "Armenia's Military Equipment Loss in Recent Karabakh War Stands at $4 Billion, Exceeding State Budget", *Caspian News*, 06 December 2020.

[35] Krishn Kaushik, "Explained: How Israel's Iron Dome intercepts rockets", *The Indian Express*, 13 May 2021.

CENTRE FOR LAND WARFARE STUDIES (CLAWS)
RPSO Complex, Parade Road, Delhi Cantt, New Delhi 110010
Tel.: +91-11-25691308, Fax: +91-11-25692347, CLAWS Army No. 33098; Email: landwarfare@gmail.com
Website: www.claws.in