Drone Warfare
History, Evolution and Future

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When Tesla and SpaceX Founder Elon Musk, in a room full of US Air Force personnel, asserted that autonomous drone warfare is the future and will replace fighter jets, it sparked a controversial but crucial debate.[1] The decade post 9/11 saw the proliferation of drones in the military domain. Drones and Unmanned Aerial Vehicles (UAVs) have been used extensively to disable conventional weapon systems in Afghanistan, Syria, Iraq, Yemen, Libya and Ukraine. Hence comes the conundrum of replaceability and disruptiveness of conventional warfare vis-à-vis drone warfare. UAVs are a 'product of deep integration of technology and Information systems'.[2] Further, rapid advancements in cloud computing, big data, networking, and artificial intelligence have propelled the desirability of using drones due to their superior surveillance and strike capabilities.

The recent conflict (12–16 July 2020) between Armenia and Azerbaijan, during which drones were used to destroy tanks has further ignited the long-going debate on the future of drone warfare. Will drones just be a part of the military arsenal or will they replace the existing military arsenal? The Nagorno–Karabakh conflict has kindled research on unmanned hunter-killer systems like the Harop and Orbiter 1K swarming that can devastate the air defence systems of the country being attacked. The Chinese and Americans particularly have multiple programmes to

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develop drone swarming technology.[3] Whilst the advantages of using drones are overwhelming (reduced risks to soldiers, fewer mistakes, and reduced civilian causalities[4]), the limitations of relying on drones can't be refuted. To what extent should the 'human element' be removed from the future of warfare, especially drone warfare, will depend on how states mould their policy to accommodate these emerging technologies instead of these technologies moulding the way wars are fought.

History of Drone Warfare

The first UAV was developed by the UK in 1916–17, and was named the 'Ruston Proctor Aerial Target'.[5,6] Since then, drones have become essential for reconnaissance and surveillance and have been used extensively by the US, Israel and Russia. The Ryan Model 147 reconnaissance drone was used in the dense forests during the Vietnam War in the 1960s[7] and Israel excelled in using drones as loitering munitions as the anti-radar solution in the 1970s and 1980s during various Arab–Israel conflicts.[8] In the 1990s, the Gulf Wars changed the way wars were conceptualised, especially the use of Information and Communication Technologies (ICT) by the US that facilitated the use of drones. The 1990s saw the use of UAVs in the Gulf, Afghanistan, Kosovo, Arab–Israel, and Iraq wars. UAVs were initially used as surveillance platforms but their potential for precision striking was soon realised. For example, the General Atomics MQ-1 Predator drone, which was designed as a reconnaissance platform, was modified into a strike-drone when a Hellfire missile was launched from it. Since then, the US military has been using MQ-1 and MQ-9, its younger version, as a surveillance and attack platform with more clocked-in flying time than all the US Air Force fighter jets combined.[9]

In terms of drone warfare, the Armenia–Azerbaijan conflict has compelled the strategic community to look at the evolving space of drone swarming technology. The US Navy, in 2016, tested the effects of 130 micro-drones swarming around the China Lake in California. This test showcased the urgent need to develop counter-drone capabilities.[10] The US has two programmes to research on drone swarming technology—Gremlins programme of the Defense Advanced Research Projects Agency which 'launches number of small UAVs from aircraft to carry out coordinated and distributed operations'; and the Office of Naval Research's Locust (Low-Cost UAV Swarming Technology) programme that 'launches the swarm of small UAVs from ships'.[11] The Russians and Chinese too have conducted several swarming experiments where drones

loiter over the battlefield to hunt, designate, and target autonomously or through an operator.[12]

The non-state actors are not oblivious to affordability and potency of drone warfare. There are multiple instances of non-state actors like terrorists, militants and insurgents who have used drones to create havoc to achieve their political objectives. From 1994 to 2018, around 14 non-state drone attacks have taken place. The first drone attack, although unsuccessful, was in 1994 when the Japanese doomsday cult, Aum Shinrikyo, used a remote-controlled helicopter to spray chemical agent sarin gas. The Al-Qaeda, in 2013, had planned a drone-swarming attack on Pakistan which was stopped by the intelligence agencies. Since 2014, the ISIS has been using 'homemade and off-the-shelf' drones to attack Iraqi and Syrian military. The year 2018 witnessed two attacks by non-state actors—one was the unsuccessful assassination attempt through a GPS-guided drone on Venezuelan President Maduro and second was the swarm attack by 13 drones on Russian military bases in Syria.[13]

Another domain that has sprung for discussion in the realm of drone warfare is the role of cyber power to counter the proliferation and use of UAVs. Apart from air defence artillery systems, cyber and electronic attacks are being employed to stop drone attacks. The first instance of this was perhaps in 2011 when US RQ-170 Sentinel UAV was lost in Iran possibly due to GPS spoofing. Further, data leaked by Edward Snowden shows video footage from Israeli UAVs that were intercepted in Cyprus by the British signals collection installations. The most active cyber/electronics attacks to counter Ukrainian drones have been done by the Russians.[14]

Advantages of Drones

When it comes to security, drones can have multiple applications. For military use, drones can be employed for 'intelligence, surveillance, reconnaissance (ISR) and target acquisition'[15] along with 'night vision operations, navigation aid, and transporting logistics',[16] and for civilian purposes like 'border control, monitoring, law enforcement, search and rescue, journalism, and transportation'.[17] The most pertinent reason for acceptance of drones in the security set-up is because they are considered 'a step forward in the humanitarian technology' and seem to easily adapt the principles of 'Just War'[18] while being affordable and safe.

The advantages of using drones can be analysed based on their three functionalities: surveillance, lethal use of force, and overwhelming the

air defence system of the enemy. When it comes to ISR capabilities, it is easier for drones to move over the international borders. Their loitering abilities provide constant intelligence without putting humans are risk.[19] Furthermore, drones can operate in different climates and terrains and are therefore ideal for ISR requirements. Drones are particularly useful for counter-insurgency operations that need a lot of intelligence inputs.

In terms of striking targets, drones exhibit profound accuracy and airstrike, which significantly diminishes the collateral and civilian casualties as compared to other weapon systems. In the battlefield, the response time for a commander to get access to conventional air defence systems is relatively higher than their access to drones in their arsenal. This greatly saves critical time to take action during a war.[20]

Another area that consolidates the case for drones is its ability to overwhelm and disband the enemy's air defence systems. Kamikaze style drones swarming is key to overpowering highly sophisticated air defence systems. For example, the defences of high-tech Russian air defence systems have been futile in countering drone attacks. Turkey and Israel have been successful in destroying/defeating 'Russian Pantsir short-range air defense systems (SHORADS), S300, S400 High Altitude Defense Systems (HIMADS), Buk-M1 medium range surface-to-air missile (SAM) systems' by using drones carrying precision guide munitions.[21] Hence, the modularity of drones makes them suitable for varied military applications.

Limitations of Drones

Drones can be classified into three categories—Class I, II, or III based on their types of sensors, speed, weight, and cost.[22] But compared to fighter jets, they have lower mobility and are easy to strike down. It is tough for drones to survive in airspaces with active air force and air defence artillery systems. Even though drone swarming technology is being employed to counter this issue, currently not all countries have swarming capabilities. Even with air dominance, drones cannot reach dense (vegetation, infrastructure, population) areas that obscure their vision. Whilst drones have precision strike rates, it is not prudent to always strike and neutralize the target as drones take away the opportunity to collect additional intelligence from the target or other physical proof from the strike location.[23]

Another reason why drones are being lauded in the strategic community is due to their autonomous 'fire and forget' capability. But

the real impact of autonomy in these UAVs is open to contestation. For example, autonomous drones like RQ-4 Global Hawk are used for ISR operations by the US Air Force but these UAVs only work autonomously because 'they follow a programmed mission track and return home safe with near certainty'.[24] Besides, UAVs, autonomous or not, have multi-level human presence. For example, drone operations involving, MQ-1 Predator and MQ-9 Reaper, have substantial human presence in/ on: (1) Base from where the drone is launched, (2) remote base in the region from where they are controlled, (3) from the informants providing information about the combat zone, and (4) government agents collating and finalising the target list.[25] Therefore, even though the risks to pilots per say is diminished, there is still considerable risk to personnel and informants operating the drone from that location. In the 2009 US Forward Base Chapman suicide bombing in Afghanistan, around seven CIA employees were killed in a drone programme.[26]

An emerging problem pertaining to the sustainability of reliance on drones has come to the forefront in recent times. UAV attacks are actively being deterred by using cyber and electronic attacks. Using cyber techniques to disband drone attacks is proving to be more potent than conventional air defence artillery systems. The use of cyber and electronic warfare by non-state actors to hack or control drones used by civilians for recreational activities can be detrimental for national security. Although programmes like High Assurance Cyber Military Systems (HACMS) by the US Military aim to 'build cyber resilience' to protect various UAV systems, such programmes only pertain to military UAV systems and the civilian drones can still be hacked (which has been the case in the Eastern Ukrainian conflicts). The major challenge with such cyber-attacks is the attribution of UAV activities. It would be difficult to pinpoint the location from where the drone attack has been launched.[27]

Armenia–Azerbaijan Conflict Case Study: Lessons for India

The 2020 Nagorno–Karabakh conflict and Azerbaijan's drone strategy to incapacitate the Armenian armour and infantry has rekindled the debate on conventional weapon systems vs autonomous weapon systems. Azerbaijan, with the help of Turkey and Israel, had used three drones to not only overwhelm Armenian air defence systems but also to destroy several Armenian tanks. In the same league as the MQ-9 Reaper, the Turkish Bayraktar TB2 (which interestingly operates on technology provided by

the Canadian defence company L3Harris, although, after this conflict Canada banned the trade of this technology to Turkey[28]) carried out infrared-guided and laser-guided anti-tank munitions. Kamikaze drone attacks and reconnaissance support was provided by Israeli drones Obiter 1K and Harop. The brilliant strategy to incorporate these three drones paralysed the Armenian Army and made sure Azerbaijan's decisive victory.[29]

This conflict not only consolidates the case of drones and their pivotal role in the future of warfare, but also showcases the significance of air force to provide air cover to the army and navy. To focus solely on UAVs at the cost of ignoring fighter jets will be disastrous. Drones should be seen as a part of the military arsenal instead of as replacement of the military arsenal. In India's case, former Chief of Army Staff, General Manoj Mukund Naravane, has stated that:

> Imaginative and offensive use of drones, riding on algorithms, first in Idlib and then in Armenia-Azerbaijan, have challenged the traditional military hardware of war: the tanks, the artillery and the dug in infantry.[30]

The improvised explosive device (IED) drone attack by terrorists on the Indian Air Force's Jammu base on 27 June 2021, and the 100–150 sightings of surveillance drones along the western border of the India is a telling sign for India to hasten its drone-swarming and counter-drone capabilities.[31] India already has drones like Heron (Israel Aerospace Industries-IAI), Heron II (IAI), Searcher (IAI), Sea Guardian (General Atomics Aeronautical Systems, USA), Switch UAV (IdeaForged Technology, India), Quadcopters (DRDO), Harpy and Harop (IAI). Along with other drone programmes, India currently has Project Cheetah which is divided into two separate programmes—one is the upgradation of Heron drones for the Indian Air Force and the other is the procurement of 30 MQ-9 Reaper Predator B drones for all three services.[32]

The drone threat to India is a serious concern. The last few years have witnessed increased use of drones to drop off drugs, weapons and ammunition. On multiple occasions, the Border Security Force has shot down these drones.[33] The Defence Research and Development Organisation (DRDO) is actively working on drone-swarming and counter-drone technologies. They have already developed a 'detect-and-destroy technology' for drones, which was employed during the Prime Minister's speeches during the Republic Day, Independence Day, and during US President Donald Trump's visit to the Motera Stadium in

Ahmedabad.[34] Such counter-drone systems should be further developed and incorporated in the protection of all critical infrastructure rapidly. Although the Ministry of Defence of India is working actively with the US to work on Air Launched Unmanned Aerial Vehicle (ALUAV) under the Defence Technology and Trade Initiative (DTTI)[35] and with Israel (Project Cheetah), it is prudent to also actively collaborate on developing counter-drone technologies that employ anti-radar, cyber and artillery defence systems in a matrix.

The Future

Drones are bound to be an essential part of the future of warfare, but they have tactical limitations and hence cannot replace the traditional weapon systems entirely. They are just one piece of the entire military puzzle. Based on the analysis above, the following can be concluded:

1. Even with autonomy, it is difficult to remove the human element from the UAV systems.
2. The use of drones safeguards the pilots but puts the personnel operating the drone from the combat zone at risk.
3. Drones have the ability to disband the most sophisticated air defence systems.
4. Cyber and electronic attacks like data link intercepts and navigation spoofing are the biggest threats to drone warfare. Attribution of these drone activities is a challenge.
5. Drone warfare is a reality, therefore, for strategic edge, countries should focus aggressively on counter-drone capabilities.

Hence, a tactical strategy to use drones in permutations and combinations based on the available adversary parameters (arsenal, terrain, climate, strategy, etc.) should be the key to mastering drone warfare.

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