Asymmetric Air Power
Employing Guerrilla Warfare Principles in Air Warfare

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Technology is a key driver of air power. Technology asymmetry has shown decisive results in the history of air warfare. It is evident in any war that US air power has been employed post World War II. It also leads to a belief that the air power capability of a nation is a direct reflection of its industrial and technological base. Therefore, the result of an air war is perceived to be more of a depiction of technical and industrial superiority than anything else. However, this article argues that such advantages do not seal the fate. It looks at guerrilla warfare strategies to overcome technological and industrial asymmetry. Guerrilla warfare is a strategy wherein a weak adversary can inflict disproportionate losses against a stronger adversary using minimal resources. This article examines the principles employed by the guerrillas and explores possible ways of adapting those to mainstream employment by the regular air forces. At present, the use of guerrilla warfare in air power is limited to tactical employment of the principles of 'agility and mobility'. This article expands to examine all four basic guerrilla warfare principles as espoused by Mao Zedong and explores possible applications in the employment of air power. By this, it attempts to offer viable military options (air power) to a nation against an adversary that is several times superior in terms of economy, industry and technology.

Keywords: *Air Power, Guerrilla Warfare, Guerrilla Warfare Principles; Asymmetric Air Power*

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The mountain and the squirrel
Had a quarrel,
And the former called the latter "Little Prig";
Bun replied,
"You are doubtless very big,
But all sorts of things and weather
Must be taken in together
To make up a year
And a sphere.
And I think it no disgrace
To occupy my place.
If I'm not so large as you,
You are not so small as I,
And not half so spry:
I'll not deny you make
A very pretty squirrel track.
Talents differ; all is well and wisely put;
If I cannot carry forests on my back,
Neither can you crack a nut."

Ralph Waldo Emerson[1]

This is a hypothetical case of power asymmetry where each has its strength that is neither replaceable nor comparable. Everyone has independent space and relevance. Thus, the argument, 'If I cannot carry forests on my back, neither can you crack a nut?'. This has been the fundamental employment philosophy of irregular forces where they exploit their small size and corresponding agility to their advantage against conventional forces that are huge and lethal, but come with additional baggage. Much to the chagrin of air power enthusiasts, air power has been claimed to be defeated in such irregular warfare. An anonymous meme wittily described the situation of air power against irregular forces with an image captioned 'Modern Warfare: A 2-billion-dollar plane dropping a $40,000 Bomb on a $100 tent'.

Martin Von Crevald, an Israeli author on the question of 'How air power has fared' against irregular warfare mentions the answer as, 'very badly'.[2] He further says, 'Supposing that twenty-first-century wars will be mainly of the low-intensity kind, there probably is no compelling case for independent air power at all'.[3] While the failures of conventional employment of air power against irregular adversaries have been documented in detail, the success of the guerrilla has received scant attention. What did they do so well that they could not be overpowered by the mighty enemy? Will those successful principles be

valid in the aerial domain? What if the airman plays the guerrilla himself? To answer these questions, this article seeks to study the guerrillas and explore their principles to adapt them for employment in air power. These principles enable a weak adversary to generate a favourable asymmetry to overcome the technological and industrial superiority of a much superior adversary.

Conflicts of the Past Century

The World Wars

In the past, wars were decided on the battlefield between two armies or navies and the outcome was enforced on the loser. With the emergence of the military–industrial complex, a country's military potential expanded to include material strength of industries, transportation and oil. Thereafter, wars became total. Success or defeat of armed forces was no longer restricted to the destruction of the combatants alone. A country as a whole had to be defeated. During World War I, areas beyond the battlefield became accessible through the medium of air. However, the capabilities of air power then were inadequate to cause the level of destruction desired to destroy war-waging potential. By World War II, the capability of air power to unleash violence and destruction grew significantly. With the introduction of nuclear weapons, the scale of destruction meant mutual annihilation. As Thomas Schelling stated, 'Brute force succeeds when it is used, whereas the power to hurt is most successful when held in reserve…. It is latent violence that can influence someone's choice.'[4] Hence, the birth of an era of nuclear deterrence. However, the primitive nature of nations to fight for fear, honour or interest did not change. Thus, instead of a situation of no wars, fighting continued to happen, but below a threshold.

The Cold War

The Cold War was a period of intense competition in military technology. Air power and space were at the forefront of that. Engineering marvels such as hypersonic aircraft, long-range missiles, satellites, precision munition, stealth, Global Positioning System (GPS) and computers were developed. These developments came at huge R&D costs. They were justified as a requirement of national security. Therefore, the cost of aerial weapons and platforms continued to increase at a phenomenal scale even to date. To quote an example, the F-35 Lightning II Joint Strike Fighter programme of the

US is estimated to cost US$ 1.7 trillion to buy, operate and sustain.[5] This is almost half of the estimated Indian GDP for the year 2023. Therefore, aerial warfare becomes so expensive that there are times when the economic cost does not justify the tactical victories. The single shot cost of a modern medium-/long-range Surface to Air Missile (SAM) typically costs between 1.5 and 5 million dollars.[6] When this intercepts and successfully destroys a 20,000-dollar drone, is it a success or a failure? It becomes a case of 'Heads, I win, Tails, you lose'.

Air Power Theory: An Overview

What is Air Power?

The Indian Air Force doctrine of 2022 does not contain a specific definition of air power. It mentions aerospace power as 'the sum of a nation's aerospace capabilities'.[7] The North Atlantic Treaty Organization (NATO) defines air power as 'the ability to use air capabilities to influence the behaviour of actors and the course of events'.[8] The United States Air Force (USAF) defines air power as, 'Airpower is defined as the ability to project military power through control and exploitation in, from and through the air'.[9] These definitions draw from the social sciences with origins from Max Weber who defined power as, 'the probability that one actor within a social relationship will be in a position to carry out his own will despite resistance'.[10] These two definitions offer a narrow perspective of the use of air power in competition as a means to impose one's will. A more holistic definition was put forth by Billy Mitchell in 1926, 'Air power is the ability to do something in or through the air, and, as the air covers the whole world, aircraft are able to go anywhere on the planet'.[11] For this article, we would consider air power as, 'the use of the medium of air for achieving desired objectives'.

Characteristics of Air Power

Water covers 71 per cent of Earth. Man lives on land which covers about 29 per cent of the Earth. It is limited by obstacles such as glaciers (10 per cent), mountains, deserts, swamps and inland water bodies. The medium of air covers 100 per cent and offers all platforms the capability to move across without hindrance (which may be imposed politically as air is not a global commons such as seas). This continuous availability throughout the globe offers elevation (height) and reach (distance). The lack of physical obstructions

offers speed. This combination translates into unmatched mobility and flexibility that was otherwise not possible on both land and sea. How these characteristics can be blended with the principles of guerrilla warfare will be seen subsequently.

Principles of Guerrilla Warfare

The guerrillas bring to the battlefield a set of characteristics that produce spectacular outcomes from meagre resources. We look at Mao Zedong to study them. He states that the focus of the guerrillas is in the enemy's rear. This requires deception, agility and self-sustained logistics. These requirements were met by employing the four fundamental principles of guerrilla warfare. They are:

(a) Mobility, agility and dispersion
(b) Support from the masses
(c) Sustenance on local resources
(d) Successful propaganda

Mao Zedong elaborates these by saying, 'Dispersion, concentration and constant change of position – it is in these ways that the guerrillas employ their strength'.[12] On support from the population, Mao Zedong stated that 'guerrilla warfare basically derives from the masses and is supported by them'.[13] About equipment, he states, 'The standard equipment is of a low order and they must depend for their sustenance primarily upon what the locality affords'.[14] Propaganda is another significant aspect of guerrilla warfare. Irregulars can attract undue media attention to portray the failure of the military even against their modest success. Success in war is finally decided by whose will prevails over the other. To draw a parallel, according to the government data on road accidents in India, a total of 1,53,972 people lost their lives in the year 2021.[15] On the contrary, in the same year, a total of 334 people lost their lives to incidents of terrorism (including security personnel, civilians and terrorists).[16] This figure is lower than the average number of deaths due to road accidents in a single day figure of 421. However, the disproportionate media attention that incidents of terrorism receive and national assets diverted to combat terrorism are phenomenal compared to the actual damage done. It is a similar case in every other country. Since propaganda is better executed through cyber, it is excluded from this article. Let's see how the three other principles can be employed by air power to effectively counter a superior adversary.

Why Did Air Power Not Employ Guerrilla Warfare?

For air power to employ guerrilla warfare, it needs to be dispersed, agile, mobile and operate using local resources. The existing literature on the subject suggests the application of 'hit and run' tactics alone.[17] While mobility and agility are inherent characteristics of air power (they are routinely employed), the next two interrelated principles of drawing strength from the masses and sustaining through local resources could not be exploited due to the following reasons:

(a) Until recently, the primary form of employment of air power was through manned aircraft and missiles. These could not be manufactured at home or through community participation.
(b) Most aircraft need a runway to operate. Therefore, air power was dependent on a base with suitable resources.
(c) Air power needed special tools and equipment for even routine replenishments/maintenance. Even the grade of fuel is different from what is locally available. Therefore, it could not be sustained on local resources.

The support required from a base to operate is widely recognised. They were listed as a limitation to the employment of air power under the term 'Base Dependency' in the previous edition of the Basic Doctrine of the Indian Air Force (2012). They are listed as 'Dependency' under the section of 'employment considerations of air power' in the Australian Air Power Employment Manual (2022),[18] which essentially talks of limitations. Therefore, there was nothing much the masses could contribute to air power due to air power's special needs. Air power was out of reach for the guerrillas due to the cost of the resources and access to the resources that were controlled by a few companies. The possibility of waging a guerrilla air war in totality did not exist.

Things have changed. Advancements in technology and access to technology have created the possibility of full-fledged guerrilla air warfare. They have democratised the employment of air power by significantly lowering the entry barrier. What are these technologies and how they enable guerrilla warfare will be dealt with in the subsequent paragraphs.

Technologies that Support the Guerrilla Air Power

One of the founding air power theorists, Douhet, said, 'Victory smiles upon those who anticipate the changes in the character of war, not upon those

who wait to adapt themselves after the changes occur'.[19] Gone are the days when technology was first born in the military and transferred to the civil. Private space exploration is a reality now. Three key technological evolutions can be credited with facilitating guerrilla warfare: smartphones, open-source technologies and 3-D printing.

Smartphones

In Crimea, August is a good time to relax on the beach. A tourist was sunbathing in August 2022. He shared his picture in beachwear on Twitter. While he probably was keen to display himself, keen eyes were curious about the items in the periphery. He had accidentally revealed the precise location of one of the most potent Russian air defence systems, the S-400. Militaries typically spend millions to track such systems, which can now be tracked through smartphones by community participation. In air power, the key to targeting is intelligence. A basic smartphone today is essentially an array of sensors. Every smartphone has a camera, mic, location sensor, accelerometer, compass and data transfer capability of several MBPS. Ukraine formalised such community participation through an Android app—ePPO.[20] Through this app, common citizens can report video/ text input of any flying object along with the associated data of location/ audio, etc. This is automatically analysed and appropriate air defence systems are alerted for interception. In the case of a ground target such as the S-400, suitable targeting is undertaken. Further, a smartphone is also a capable drone controller with the right software.

Open-Source Technologies

In the past, the source code of the software was under the custody of the owner who had the authority to determine how it would work, and what can be done and what cannot. The user had no control over it. However, with open-source technology, the source code is visible and legally available to freely modify and employ as needed. This feature is extended to hardware as well. There are many commercial off-the-shelf open-source development kits that can be programmed to perform innumerable tasks. It is a significant change in the ecosystem. This democratised product development and reduced the entry cost for informal operators—any common citizen can now design and distribute freely.

3D Printing

Doesn't owning a small manufacturing facility at home not entice anyone? It was one such product, a 3-D printed gun and bullets, that was responsible for

the killing of former Japanese Prime Minister, Shinzo Abe.[21] A combination of open-source software to design and a 3-D printer to manufacture is all that is required to constitute a domestic military weapons industry. Today, it is possible for a common citizen to manufacture military air power right at home using a 3-D printer, running on an open-source system and controlling it using mobile networks and smartphones.

Therefore, with the convergence of three groups of advancements in technology, the complete guerrilla air warrior is now a possibility. Let's see a case study to understand it further.

Case Study: Guerrilla Air Power in the Russia–Ukraine War

The Russia–Ukraine war is the first instance that ticks all the boxes of air guerrilla warfare. The following paragraphs will explain.

Principle I: Dispersion, Mobility and Agility

An interesting aspect of the Russia–Ukraine war is the innovative use of the first principle through Man-Portable Air Defence Systems (MANPADS). MANPADS are designed to be used by agile combatants from dispersed locations. Ministry of Defense, Ukraine claims that a total of 1,572 cruise missiles have been destroyed as of 7 December 2023.[22] Cruise missiles destroyed by Surface-to-Air Missiles (SAMs) are routine. But what is unique is the destruction of cruise missiles by MANPADS. A video of the successful destruction of a Russian cruise missile by a Ukrainian soldier firing a MANPAD was shared on the official Twitter page of the Territorial Defense Forces of Ukraine on 10 October 2022.[23] While the independent credibility of the video is not established, technical feasibility exists to support the claim. Most cruise missiles do not envisage a threat to themselves. Therefore, they do not contain systems that detect missiles fired at them and take any action in self-defence. Thus, they are easy targets once detected in time. Earlier, MANPADS had very little reaction time to be effective. With the community-based reporting through the app, adequate lead time is available to intercept the cruise missiles.

Principle II: Support from the Masses

During World War II, Japanese oil supplies were interrupted by enemy action. To support aviation, more than 34,000 small stills were set up to distil oil from pine needles. This process while being extremely laborious, produced oil adequate to generate about 7,000 sorties.[24] This is a case of

support from the masses in air warfare. In Ukraine, this second principle is evident in scale. To quote an example, a window manufacturing unit has become a military drone manufacturer with an average daily production of 400 drones. How was that possible? A team of volunteers using available drone designs on the internet 3-D printed the mould for the frames.[25] These moulds were used in the existing old machinery of the window manufacturer to mass produce the drone body/structure. The hobbyist electronics stores offered motors, cameras, control systems, wireless communication, etc. The weapon release systems were developed from open-source designs and 3-D printed. These drones were originally designed to perform the role of crop sprayers; they were now modified to carry anti-tank mines or grenades, which were further modified to provide an air blast and shrapnel. These drones are cheap and can be mass-produced from local resources. They do not require any intense training to operate. They proved virtually immune to battlefield electronic warfare systems as they operated in a different band (civilian) than the traditional military systems. Their outcome has been disastrous. A tank is disabled when the explosive is dropped at the exact time when the hatch is open, which is seen from a camera. This kills the operator and destroys the onboard electronic systems that control engines, weapons and communication. This damage to electronics cannot usually be repaired in the field thereby immobilising the tank. The offensive air power is now produced by the common people using local sources.

An air defence system relies on a lot of sensors (usually radars) to pick up threats and a reliable communication system to pass this information. Every Ukrainian citizen armed with a smartphone with the 'ePPO' app could report any enemy air or ground activity in the form of video, audio, response to chatbot, etc. As seen earlier, air power relies very much on the ability to fly low to avoid radar detection. But these citizen sensors can offset this advantage. A total of over 4,50,000 reports have been made in the first year of operation of the app, indicating the large scope of inputs. These suggest a complete community-run air defence sensor network that is independent of any radar and working on civil mobile communication/Starlink.

Principle III: Sustenance on Local Resources

The drone manufacturers, MANPADS operators and citizen sensors sustain on local resources. The drones are either electrically powered or use automotive fuel. They communicate using hobbyist wireless set-ups available at stores. Long-range flights beyond the visual range have been possible by strapping on a Wi-Fi dongle using mobile networks even deep

inside enemy territory—relying on local cellular network resources. The entire citizen intelligence network sustains using local electricity and mobile data/Starlink.

Therefore, all three principles of guerrilla warfare are demonstrated. It would be fair to say that air guerrilla warfare in its entirety has seen action in the Russia–Ukraine war. The next section will explore its impact on air warfare.

Impact on Air Warfare

Disruption of Existing Air Power Strategies

Several theories of air warfare exist. They range as widely from one extreme of complete destruction of cities/industries as suggested by Douhet to specific targets aimed at systems paralysis by Warden or preventing military mobility by attacking rail, roads bridges (called 'interdiction') as suggested by Slessor. To achieve any of these, all of them agree that the prerequisite is a degree of control of air (the situation when the enemy cannot interfere with your air operations). This is achieved by targeting the enemy's air power. Counter air campaign is targeted at enemy air bases, aircraft, radar, air defence systems, etc.

How will you target an enemy's air power when its source or location is dispersed and diverse? Going back to the Ukraine example, how will you target the 3-D printer that is in the study room of a teenager in a multi-storey apartment? How many window-making factories can be targeted? How will you target the drone designer who may or may not be in the country but extends technical support online? To kill all the citizen sensors network would mean targeting anyone with a smartphone–only possible to achieve by using nuclear weapons. Similarly knocking out a mobile network or Starlink completely is almost impossible from the air due to lack of concentration. Therefore, none of the existing theories of air power are capable of handling an air adversary employing guerrilla warfare.

At the core of every plan is to identify and destroy an enemy's Centre of Gravity (CoG). While there are different models of CoG, they all agree to mean a point of strength. Guerrilla warfare surviving on local resources with dispersed command and control essentially rules out concentration at a single point. Without the identification of CoG, no meaningful air plan can be made. Therefore, survivability is ensured. However, mere survivability can only tire the attacker and wean his strength over a long period. Being on the

defensive is unlikely to win wars. Is it possible to use air guerrilla warfare for the offensive? The following section answers this question.

Employment in Interdiction

Offensive employment can be achieved using the same mindset as a guerrilla. Guerrilla warfare is targeted against the enemy's rear and his supplies. One of the best ways to stop a rail network is to derail a train in a turn at crucial points.[26] It can be carried out by a drone carrying an Improvised Explosive Device (IED) and laying it hours before. The movement of any train can be tracked online using apps that every railway has. An IED can be triggered by a passing train or through video. Two trains carrying military equipment such as tanks have been derailed by Ukraine using IEDs but not delivered by drone.[27] It can be applied to the road as well. A drone-delivered IED can be used to disrupt a convoy when passing over a bridge or a narrow mountain pass. Drones controlled through mobile networks have no line-of-sight limitations. Drones have proved effective against oil installations as learnt from the Saudi Aramco attacks where they managed to sneak through one of the most advanced air defence systems—the Patriot.

Thus, selective employment of drones can help achieve interdiction, and industrial and economic targeting as well—at a much lower cost and risk than conventional means.

Employment Against Air Target Systems

Offensive Counter-Air Operations (OCA) are those that are mounted to destroy enemy air power and achieve the desired degree of control of air. Enemy air power broadly consists of aircraft, airfield infrastructure, communication networks and Surface to Air Guided Weapons (SAGW).

Drones redefine precision to such an extent that it is possible to achieve pinpoint accuracy when flying using First Person View (FPV)—a front-facing camera. Drones can micro-manoeuvre and hit aircraft under hardened aircraft shelters as well. They can find gaps in airfield infrastructure and hit where it hurts the most.

Every military airfield is fortified with tiered air defences. Runway rehabilitation following an air attack is so effective that the runway can get back to action in less than six hours. This makes any attempts to launch an aerial attack on an airfield appear worthless. But a bunch/swarm of drones with strap-on IEDs can be made to occupy runways. They can be launched from a mother drone and spread on the runways/tarmac. Their disposal would need special equipment and skill—an air base is likely to be equipped for air

armament disposal and not an IED. During the attack on Pathankot Airbase in 2016, an expert from the National Security Guard (NSG) was killed while defusing an IED. It can be inferred that external expertise (NSG) was utilised since the air base probably did not have in-house IED disposal capability. It does not make sense for any air base to possess resources to defuse IEDs. Even if such a capability is developed in future by adversaries, every disposal costs time and runway operations can be suspended temporarily without physical destruction. In the same manner, there can be drones in hibernation (non-transmitting mode) in the neighbourhood of the airfield without getting detected. Just minutes before the take-off of an aircraft, they can fly to the runway and explode in proximity. The disposal of a weapon-loaded aircraft that has suffered an IED blast while on take-off would certainly impose a meaningful delay on operations from the airfield.

Similarly, occupants in underground buildings can be harassed by gas-releasing drones that target the ventilation systems. Non-toxic gas that smells bad can cause temporary chaos and is sufficient to cause human errors, leading to failures in a high-stress environment without violating the Conventions on Chemical Weapons.

Potent air defence systems such as the S-300 have proved to be vulnerable to drone attacks during the Armenia–Azerbaijan conflict. A Russian study indicates that small drones cannot be intercepted due to their low visibility, radar signature and low altitude.[28] No current equipment can provide detection beyond 4 kilometres. In a Tungushka trial, at a distance of 3 kilometres, it took 4–13 thousand rounds of ammunition to achieve a 50 per cent probability of hitting a small drone. While the study relates to trials of Russian systems against small drones, the laws of physics remain the same. China has been extensively promoting the concept of anti-access/area denial through tiered and high-density air defence systems in an area. This has occupied the mindset of some air power practitioners to such an extent that it features in the Royal Air Force doctrine as a restriction on the employability of air power.[29] As Chinese SAGWs are mostly reverse-engineered Russian systems, it would be safe to assume that they have the same flaws as observed in the Russian systems described earlier. Thus, exploiting these vulnerabilities by employing guerrilla tactics is already a proven success.

Thus, guerrilla air warfare offers adequate possibilities in the offensive as well. While the offensive employment depicted above would appear like merely substituting manned aircraft with drones, it is not so. It merely highlights the possibilities of employment of guerrilla air warfare where local resources from masses operating in dispersed locations can influence

outcomes in the aerial domain. The philosophy of employment is contrary to a conventional form of employment. Conventional employment favours concentration whereas a guerrilla relies on dispersion.

Possible Shortcomings of Guerrilla Air Warfare

Employment of air power is always a complex issue in any war. The flexibility offered by air power increases the complexity of planning. Experience reveals that even coordination within the military in the employment of air power has always been an area of concern across the globe. While command and control amongst the various arms of a military is an issue, coordinating with the masses would be a next-level challenge. Control and coordination of a large number of small, diverse and non-standard weapons operated by people with non-standard training is a huge challenge. Integration is essential to avoid fratricide. In the ongoing conflict in West Asia, Israel is said to have shot down over 40 per cent of its own drones, mostly the small ones.[30] The proliferation of aerial weapons and their designs in the masses also poses challenges after the end of the war. With no effective defence against these, it can be a significant internal security threat. Further, resorting to guerrilla air warfare strategies can also be stigmatised as accepting one's position as the weaker side. No strong country resorts to such tactics (except to some extent in the tactics adopted by Special Forces).

While some challenges exist, it is not impossible to solve them. The situations in West Asia and Ukraine are responses to contingencies. Therefore, such rates of untoward incidents can be expected and cannot be taken as standard outcomes in future. The outcome would be different in a well-planned, rehearsed and executed campaign by professionals. For example, companies globally are investing heavily in air taxis. Identification and traffic management of such flying objects is an essential sub-system in these systems. These could be easily adapted to develop Identify Friend or Foe (IFF) in guerrilla air warfare.

Is There Something in Here for India?

The geography of India has oceans on three sides and the Himalayas on one leaving very little space for large-scale military action. The size of the country combined with this favourable geography typically restricts the scale of military conflicts. That is evident from the scale of conflicts since independence are all small wars when compared to the others globally.

Guerrilla warfare as a response emerges when survival is at threat from external forces. That is unlikely in a large and strong country like India. Therefore, it can be opined that the participation in guerrilla air warfare by the common population would be limited. Thus, the associated risks of danger from the proliferation of offensive air power in the hands of the masses are mitigated. Even in Ukraine, the weapons (explosives) and their integration were with the military while the drones were manufactured countrywide. However, the principles can still be applied to generate superior outcomes from limited resources. This has significant applicability to the Indian Armed Forces in the employment of air power.

Guerrilla warfare is nothing new to India. During the 1971 Indo–Pak War, the Mukti Bahni Frogmen, the naval resistance fighters of erstwhile East Pakistan, sank/damaged over 1,00,000 tonnes of shipping employing guerrilla tactics.[31] Resource constraints at the national level are considered a perennial challenge to air power.[32] Being a per capita cost-intensive instrument, globally air power is the preferred option for cost-cutting in government spending. A small numerical reduction or cancellation of a single asset procurement can show a huge amount of savings immediately.[33] On the other hand, troop reduction can show effects much later (even beyond the electoral cycle) and is dependent on the metrics set to calculate the costs involved such as pension, longevity, etc. This can be gleaned from the fact that there is a continuous reduction in the strength of fighter squadrons of the Indian Air Force and no reduction in standing military strength. Over a while, this has aggravated the asymmetry with China while reducing the advantage over Pakistan. Guerrilla air warfare offers promising results. Let's explore some of the possibilities.

During the 1920s, much before radar technology was developed, aircraft used to be picked up by acoustic radars.[34] Long tubes were used to hear the sound of approaching aircraft. Trigonometry was used to estimate height and bearing. Even now, picking up low-flying aircraft, especially in hills is still being done by specially trained observers using visual means in radar blind zones. The smartphone with geotagging can do a combined visual and auditory reception in one step. All the user has to do is submit a geo-tagged audio/ video to a central server. Radar avoidance tactics such as stealth rely on low radar signatures. Flying tactics to avoid detection rely on flying low or taking cover of mountains. But the aircraft are still visible and can be heard. They cannot be hidden or silenced. Therefore, it is possible to overcome the asymmetry posed by an adversary holding an inventory of extremely advanced platforms such as stealth aircraft by using thousands of

networked mobile devices connected to a common platform sharing data using mobile internet. While this example talks of existing technology and proven demonstrations, it is also possible to design and deploy a network of weatherproof devices on mountaintops. These devices can contain all the necessary sensors of a smartphone while running on solar power autonomously supplying the sensor information using mobile networks. Audio and video fingerprinting algorithms can even identify the type of aircraft/missile. Sonobuoys have been doing something similar in the oceans for decades.

The terrain along the Line of Actual Control is mountainous and detrimental to radar operations. The vulnerability of modern long-range air defence systems to guerrilla air warfare has already been demonstrated in the previous section. They are even more vulnerable in hills. Thus, offensive guerrilla air operations can create a safe passage/corridor for manned aircraft to execute their missions. This can offset the dense air defence network of an adversary to a desirable extent.

Widely dispersed MANPADS in huge numbers can intercept any low-flying aircraft or missile. These are especially effective in hills where aircraft have limited options to escape once detected. The dispersion, mobility and passive nature of the MANPADS limits enemy intelligence from picking them up in time. There is an extremely low probability of engaging a MANPAD location due to the low signatures.

On 27 March 1999, a US stealth fighter, F-117 was shot down over Serbia by a S-125 SAM system.[35] This SAM system is of 1960s vintage. The aircraft was picked up getting airborne from Italy by observers on the ground (agents). Information was passed on the telephone. Thus, a stealth aircraft picked up visually and informed telephonically was successfully destroyed by a vintage SAM system. Twenty-five years have passed since this event, and with Moore's Law in action shouldn't the possibility increase many times now?

Conclusion

Frank Abagnale Jr is one of the most popular con artists of all time whose life was the inspiration for the 2002 Hollywood movie, *Catch Me if You Can*.[36] Instead of just prescribing punishments for his crimes, the FBI used him as a consultant for over 37 years to design security algorithms towards financial fraud prevention. Like an ex-conman being a valuable source for crime prevention, a guerrilla who evaded air power is ironically a valuable resource of

air power employment. His methods provide spectacular results from meagre resources. A guerrilla has demonstrated the capability to generate favourable asymmetry at a chosen time and place against any adversary. Technology has now made it possible to wage guerrilla air warfare in its fullest sense. When fully studied and integrated with conventional warfighting, it offers solutions, especially to weaker adversaries.

Mao wrote his book to help handle Japanese imperialism in the late 1930s. Therefore, not everything that is written would be relevant now. Air power was still nascent then. However, the core tenets and relevant portions have been borrowed and adapted in this write-up to suggest a new form of air power employment to generate favourable asymmetry.

Col John Warden stated in 1988 that there was a lull period in the writings on the operational level employment of air power post World War II.[37] This led to the writing of his widely acclaimed book, *The Air Campaign: Planning for Combat*. This model significantly altered the way air power is employed. A lot of countries still base their air power doctrines based on his work. However, this work by John Warden is over 35 years old since first published. However, the character of wars has changed significantly in the aerial domain during this period. Therefore, something new is essential to guide the application of air power in modern wars. Sporadic improvements and tactical ingenuity cannot be a substitute for an outcome from a focused academic pursuit. While the relevance of old models can be debated, the emergence of guerrilla air warfare cannot be ignored.

It must also be remembered that fundamentally guerrilla warfare is never independent of conventional conflict—both exist simultaneously. They operate differently but are aligned. While India was conventionally engaged with Pakistan simultaneously Mukti Bahni was employing guerrilla warfare. Thus, it is not a debate of conventional versus guerrilla but a guerrilla alongside the conventional. How much portion of the fighting would be conventional or guerrilla is dependent on the situation.

Till now, the entire application of air power is conventional barring a few tactical actions. The time has come to expand the scope. This would require a reimagination of the present doctrines around the employment of air power. A direct path to disastrous outcomes is applying existing theories to the new means available. The next route to disaster is ignoring the new capabilities altogether and maintaining the status quo. Not employing an available and viable alternative reduces the chances of defeating an adversary. Therefore, instead of the question of the effectiveness of air power against irregular warfare, the focus must turn towards employment of air power as

guerrilla warfare. The ingredients of mobility and agility existed since the time of the birth of air power. Other characteristics of dispersion, support and sustenance from masses are available now.

A significant territory remains to be explored. This article is just a modest beginning to highlight the possibility. Much effort would be required to make it work.

Notes

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