Asymmetric Competition Ahead for Indian Air Power

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This article deliberates on some 'disruptive' issues that will affect employment, doctrine, force development and the very future of exclusive manned air power. Currently, causing asymmetry on the battlefield is considered a virtue rather than a weaker adversary's option. Pakistan's strategy against India and Chinese anti-access/area denial (A2/AD) are examples of cheaper but effective means. Driven by rapid advances in technology and confluence of emerging scientific capabilities, warfighting's character is changing. The article discusses a myriad of issues, like risk-taking with manned/unmanned platforms, futuristic unmanned aerial vehicle (UAV) employment, effectiveness of traditional air support in battle, airspace control, applicability of the observe–orient–decide–act (OODA) loop and multi-domain and fresh doctrinal approaches, among others. The current imbroglio on the Line of Actual Control (LAC) is also briefly explored for asymmetries that both sides, namely, India and China, will aim for in air power employment.

Introduction

This article takes into account some issues that will gravely affect employment, doctrine, force development and the very future of air power employment, especially exclusive manned aircrafts. A number of new ideas and concepts of employment are keeping military strategists fully involved, such as those causing asymmetry and disruption and hybrid and grey zone competition. Since air power takes considerable

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time, cost and effort to build, deploy and sustain, it is important that it is insulated against cheaper and effective 'disruption'.

T.E. Lawrence, the doyen of irregular means of war, once said, 'Irregular war [is] far more intellectual than a bayonet charge.'[1] The United States (US) military has a penchant for classifying and using terms such as irregular, unconventional, asymmetrical, hybrid and grey zone to describe any style of combat not resembling a regular war, like the Battle of the Bulge in World War II. All these terms work because they disguise war as peace, until it is discovered too late by an adversary.

Is Asymmetry a Virtue?

Asymmetric warfare manifestations, such as hybrid, irregular conflicts and grey zone campaigns, have been discussed for the last two decades in strategic debates across the world. However, the trend of carrying out such actions has been around since warfare came into being. It has always been the weaker opponent's means of levelling the battleground to some extent. Also, brilliant military campaigners have always looked for exploiting vulnerabilities and weaknesses of the adversary rather than pitting strength against strength.

In today's context and existing conflict scenarios, asymmetry is seen to be a virtue and is considered innovative. So, not only the underdogs or desperate adversaries with their back against the wall but also powerful peer competitors plan strategies that incorporate such ways and means. Air power, with its might, unbridled reach and technological prowess, is a prime target of asymmetric counters. No wonder Chinese anti-access/area denial (A2/AD) has many components aimed at reducing the effectiveness of expensive offensive air power and naval capabilities of the US. All in all, thinking and planning asymmetrically is the sensible military option for causing disruption and creating dilemmas in adversaries with conventional mindsets.[2]

Another example is Pakistan's asymmetrical strategy of bleeding India with a thousand cuts, which India has not been able to deter despite superiority in conventional capabilities. This warfare, in particular, has been enabled by a China assisted and engineered nuclearisation of Pakistan. India's doctrine of no-first use and overwhelming response in retaliation has not been enough to convince Pakistan of an existential threat of an armoured strike by India. Therefore, India's deterrent strategies have not paid dividends in terms of forcing Pakistan to stop using terrorism as an instrument of state policy against India, particularly in fomenting

trouble in Jammu and Kashmir (J&K). Adding to the confusion are the tactical nukes by Pakistan to deter any deep thrusts by the Indian Armed Forces, raising global concerns on potentially destabilising escalatory mechanisms.[3]

Changing Character of Air Warfare

The character of warfighting is changing fast due to rapid advances in technology and confluence of emerging scientific capabilities. Networked synergies of multiple domains are becoming the norm and the race is to outcompete in the observe–orient–decide–act (OODA) cycle at all levels, that is, tactical, operational and strategic. Quite clearly, networks would be prime targets of an adversary, with cyber-based attacks through a pre-planned and adaptive strategy at the forefront. Also, since networking is tied to space capabilities, the aerospace domain would assume critical significance. Effective monitoring, denial and domain dominance will become a core area of competence and capability development of powerful militaries.

Since networking and connectivity are the foundations of a multi-domain battle, it obviously becomes a lucrative and primary target for any adversary. Data linking is underlined by a need for accuracy and addressing vulnerabilities that can lead to degradation.[4] Besides built-in redundancy against soft and hard-kill effects, an important point is recognising the degree of degradation which allows reconfiguration or other measures to allow the battle tempo to continue. With shorter OODA loops enabled by technology and artificial intelligence (AI), it is imperative that this happens equally fast. Protecting a network's reliability is possibly a more important issue than acquisition of large, expensive platforms. Most networks are robust enough to avoid any single-point failure architecture; however, ingenuity of the human mind assisted by machine algorithms will continue to throw up new challenges. There will always be a need for constant human–machine interface for innovation and adaptability to counter this.

One character of war that technology has surely changed is the blurring of offence and defence in and around the battlespace. This is a result of hi-tech networking grid of shooters and sensors, deeper reach of ground-based weapons, precision and accuracy. The Russians demonstrated it quite effectively by decimating two Ukrainian mechanised battalions in a matter of three minutes. It was an example of the convergence of networking, lethality, reach and true multi-domain strategy. A similar

effect was put in place in Syria, led by Russian air power, against Islamic State and Syrian rebels. Information and perception shaping formed the core of both these successes; and quite obviously, cyber and electronic warfare domains extended on both sides of actual combat. In Ukraine, the partnership of recce unmanned aerial vehicles (UAVs) with long-reach ground weapons in producing quick time response was so effective that just the sound of UAVs would make troops dive for cover. This fear effect was used to the hilt by the Russians. All this is exactly how the Russian Armed Forces Chief, General (Gen) Gerasimov, had conjured up the concept of a 'Hybrid War'.

Man behind the Machine

The single-most expensive and irreplaceable (quickly) military asset that needs to be shielded against attrition is the man behind the machine or the commander in the decision-making chain. Newer fields such as AI, machine learning and robotics are allowing capabilities—unmanned systems in the air, land or sea—that take the man out.[5] Besides, the increasing complexity of the battle allows these very fields to assist in quick decision making that is impossible for humans to handle in the timeframe. Further developments too are allowing swarms of unmanned assets to be deployed across all domains for bolder risk-taking concepts to be employed.[6] For example, swarms can degrade or saturate current air defence systems quite easily. It could make expensive warships and aircraft carriers vulnerable to cheaper massed unmanned attacks at sea.

The current fifth-generation air warfare incorporates many radical concepts that essentially aim for transferring every asset into a sensor–shooter–disseminator.[7] For instance, networked F-35s could be part of the forward sensor grid (Airborne Warning and Control System [AWACS]) of the tactical battle area (TBA), at the same time giving AD cover and possess ready-to-use precision-guided munitions (PGMs) on targets of opportunity. This could be further revolutionised by networking 'loitering munitions' at all levels and domains of the armed forces.[8] It would increase the complexity of control of the battle tempo, and that is where human–machine teaming with AI would assist decision making. There is an exorbitant cost factor in equipping for such scenarios. It would also require restructuring, including reduction in echelons of command and control.

However, innovation and creativity will still have important roles in adapting to surprises and reverses, proving to be game changers at times.

In a world of plethora of commercially available off-the-shelf possibilities, innovative minds with newer ideas would create novel employment of forces on the battlefield. At the same time, cognitive workloads in and outside weapon platforms will rise, and its very nature and attendant responsibilities may be redefined. It behoves a cultural shift in mindsets from the current comfort zones, for example, fighter cockpit views that dominate air power thinking. Nonetheless, any participant in such conflicts will have to be ready for surprises and have a steep learning curve to adapt quickly. A simple scenario to be envisaged is a degraded or temporarily down networks (partially or completely). To be able to continue the engagement and fight effectively could be a crucial factor for victory.

Autonomy

Advances in technology do not make warfare simpler[9] and if anything, the cognitive load on military commanders has increased exponentially. Artificial intelligence has complicated it further in terms of uncertainty and unpredictability ahead; but it may hold the answers for relieving this stress.[10] That is the reason that competition in the AI race is considered a defining thread to future dominance on the world's stage, both economically and militarily.[11]

An autonomous system refers to 'any particular machine or system capable of performing an automated function and potentially learning from its experiences to enhance its performance'.[12] The belief is that AI will accelerate one's own OODA loop by enabling faster situational awareness, swifter decision making and executing more precise battlefield effects than an adversary. Undoubtedly, incorporation of AI in completely autonomous systems will be faster and easier in defensive roles rather than offensive where ethics will figure heavily. However, without an accepted regulatory framework, the fear will always be that an adversary will achieve disruptive capabilities. Humans-in-the-loop in offensive role is desired to address runaway autonomy of machines, but a non-rules-based regime, such as Chinese Communist Party in China, may put achieving game-changing disruption ahead of such concerns.[13]

Irregular and Hybrid Warfare

Gen Gerasimov's doctrine on modern (hybrid) warfare considers the mind as the main battlespace. Hence, new-generation wars will be dominated by information and psychological warfare so as to achieve

superiority in troops and weapons control and affect the morale of the enemy's armed forces and civil population. For example, in Crimea, the effort of hard military power was reduced to the minimum, resulting in sections of the Ukrainian military and civil population supporting the assault.[14]

Special operations warfare is the core around which activities involving a combination of lethal and non-lethal actions are taken. It is executed by a specially trained and educated force that has a deep understanding of cultures and foreign language, proficiency in small unit tactics and the ability to build and fight alongside indigenous combat formations in a permissive, uncertain or hostile environment. These operations are not only highly complex and uncertain, but quite often throw up unpredictable results and higher-order effects. The Indian example of the Indian Peace Keeping Force imbroglio in Sri Lanka comes to mind. Quite clearly, the politico-strategic aim cannot be an end state but an acceptable and durable political arrangement to be achieved.

In asymmetrical scenarios such as irregular or hybrid conflicts, most military failures are a result of non-existent fast learning curve, as a result of which there is lack of adaptation and anticipation of wild cards. Fast and objective assessments, as well as the ability to recognise and accept setbacks, are indicators of a willingness to learn. This does not take away from cardinal principles of presence, patience and persistence in such situations, but only stresses on an open and agile mind of leaders to adapt, modify or take hold of fleeting opportunities.[15] The Russian military has displayed this in its campaign in Syria while synergising air and land forces.

Objective assessments based on facts help challenge long-held assumptions and decide if a rebalance of ways and means is required. This assessment must factor in contextual issues, such as stakeholders' interests and alignment with broad political aims. Employing the right means, that is, core competencies and capability, is half the battle won. Top leaders must have contextual knowledge of ways and means at hand. In these less-than-war uncertain and unpredictable environments, there are bound to be grey areas in 'leading' issues and therefore, militaries need to be flexible in their interpretation of command and control.

An approach of a comprehensive campaign, and not just a military design plan, is required in such hybrid scenarios. This helps in orchestrating all activities towards the predetermined strategic objectives. The campaign design includes identifying the resources necessary (for

example, forces and funding), permissions and authorities, accounting for transitions and demobilisation and other necessary factors and issues.

The annex to the US National Defense Strategy (2020) defines irregular warfare as a struggle among state and non-state actors to influence populations and affect legitimacy.[16] It favours indirect and asymmetric approaches, though it may employ the full range of military and other whole-of-government capabilities in order to 'erode an adversary's power, influence, and will'.[17] China and Pakistan have long been practitioners of campaigns of disinformation, deception, sabotage and economic coercion, as well as proxy, guerrilla and covert operations. Both will increasingly rely on irregular approaches in their competitive strategies to check India's strategic growth. They have been colluding on this plank against India for decades, especially in J&K. Indian air power has to plan for countering this by an ability to understand and control the competitive tempo, promise of prohibitive costs as an effective deterrence, manage escalation dynamics and have a faster OODA loop in shaping the competition. It is indeed a wide canvas and spectrum to address.

Battlefield Tangibles and Imponderables

A Speedier OODA

A favourite cognitive model used in all facets of warfighting is the OODA loop. Colonel John Boyd, a fighter pilot, developed this iterative feedback model after his experience of dogfighting in the Korean War. But what does it actually mean to get inside an opponent's loop? Let us take two examples of the 1971 Indo-Pak War—that led to the creation of Bangladesh—which were results of non-linear and asymmetric thinking. One, getting to Dacca was never in the original operational directive for the Indian forces (army). However, as the land battles progressed, especially the thrusts from the east by IV Corps, the Indian Army quickly realigned to go for the jugular. Their OODA loop was faster and more accurate than the demoralised Pakistani Army, thereby allowing such adaptation.[18]

The second example from the same war is about a commander who had a far better OODA loop than anyone around and who was able to create this opportunity for the Indian Army. Gen Sagat Singh's IV Corps was envisaged more as a deception to lock down parts of the Pakistani Army. He understood the difficulties of a highly riverine terrain,

appreciated the mobility helicopters could provide and knew the trick was to get into the mind of Gen Niazi. The saga of well-documented special helicopter-borne operations across the Meghna surprised not only Niazi but also the Indian Army! Niazi's fatal error in redeploying his assets to counter this proved the proverbial nail in the coffin.

The question now is: does the OODA loop mean faster cycles, as would be applicable in a dogfight within a fighter cockpit? Boyd's actual OODA loop in his famous slide presentation, 'The Essence of Winning and Losing', was much more detailed. He portrayed it not as a linear cycle but more as an ongoing, interactive analytical process; a cybernetic process with multiple built-in feedback mechanisms. 'Observation' was not a single step, but more about constantly developing awareness based on changing circumstances and uncertain information. Similarly, 'orientation' constantly evolved to incoming new data; any error in data and analysis would have to be reprocessed and here speed may not be useful. The 'decide' and 'act' were also connected to the overall feedback loop, with actions taking place either simultaneously or in sequence.

Taking the two examples into consideration, it is clear that the situation on ground, including battle tempos (rate and rhythm of activity), would define the speed of the OODA cycle or gross errors can be made. To break the enemy's tempo, a deeper understanding (orientation) of his OODA functions is helpful. It is also applicable to air power, especially in joint and integrated settings. This dictates the speed of OODA iterations, allowing one to see when the opponent is most vulnerable, thus breaking his rhythm and causing disruption.

A2/AD: An Asymmetric Approach

In *How the Weak Win Wars: A Theory of Asymmetric Conflict (Cambridge University Press, 2005)*, Ivan Arreguin-Toft studied all irregular wars between 1800 and 2003 and found that 28.5 per cent wars were won by weaker adversaries. In fact, between 1950 and 2003, the stronger side won just under 50 per cent times. In other words, creating and employing asymmetry does give dividends. Asymmetry in the application of air power can be categorised under asymmetry of technology, battlespace and concepts of operations. While technology is evident as in the use of cheaper expendable drones, battlespace is more about shifting the space between tactical and strategic to upset tempo and rhythm of larger conventional forces. The last category of concepts of operations is a larger

domain that can be employed by regular forces, for example, Iranians against US air power. An example is A2/AD.

Anti-access/area denial is fundamentally an extension of vital point/area defence system comprising integrated air defence systems (IADS), aircraft, anti-aircraft guns and short-range surface-to-air missiles. Newer developments of weapons have allowed a layered air defence system, adding: distributed sensors with variety and built-in redundancy; long- and medium-range surface-to-air missiles; electronic, cyber and space warfare; and other deterrence means that are integrated into common operating picture (IADS). It promises high, crippling and unacceptable attrition to attacking forces. Therefore, this system-of-systems A2/AD is primarily an asymmetrical counter to offensive air power creating planning dilemmas for attacking forces. The template is applicable to the Line of Actual Control (LAC) since most systems are mobile. The US countermeasure to A2/AD is fast developing around a 'swarm' concept backed by hard kill by dispersed elements, and electronic and cyberattacks to overwhelm and degrade the system. Indian planners must take note of this.

Main Custodians of Battlefield: Air Power Support

Unlike sea and land forces, forces in the third dimension, that is, air power, are not restrained by geography and are also less constrained in the dimension of time in terms of readiness, reach and deployment. In the form of missiles, such as ballistic and hypersonic weapons, they are even less constrained and have an element of surprise. These elements can prevail across the strategic, operational and tactical landscape with the same sets of platforms or systems, having an 'immediate' value as a deterrent to adversaries. Also, they can swing between offence and defence, and even do both at the same time. A popular notion and a fundamental truth is that air power alone never wins wars, but without it wars can be easily lost. Therefore, another truism is that effective air power in war campaigns is fundamentally employed in a 'joint or an integrated' construct.

Air power or rather aerospace power consists of many elements covering many roles:

> it provides the air picture (intelligence, surveillance, reconnaissance and target acquisition); ensures command & control and communication; controls the air space (air policing, air superiority, air dominance, no-fly zone enforcement); conducts integrated

> air to ground operations (close air support); provides the bulk of a deterrent force and it enables mobility (strategic, operational, tactical).[19]

Today, precision defines all employment of air power roles. Whether it is precise surveillance, targeting, insertion of special forces or enabling effects-based concepts, advances in technology have redefined what can be achieved with less, including being more sensitive to time and space. Even logistics support has been overhauled with concepts and means to effect 'precision airdrop' and 'point-of-use delivery'. Personnel recovery, a vital morale factor in operations, is being enabled with combat search and rescue platforms such as modern manned and unmanned helicopters, thereby redefining risk mitigation.

The offence–defence dynamics and the countermeasure competition will keep minds alive in reframing and improvising continuously, especially with fast-paced technological changes. Future developments in countering or employing air power are uncertain and unpredictable. For example, long-cherished prowess like stealth and speed could be countered by newer sensor fusion and directed-energy weapons. The future bodes myriads of combination of teaming manned and unmanned platforms. Multi-domain synergy will allow anyone to carry out a non-traditional role in support of other domains. This synergy is the main aim of a net-centric integration of all domains. Contrary to traditional doctrines based on core competency or turf, the new environment will demand increasing decentralisation and distribution of command and control. Teaming manned and unmanned platforms will redefine tactics, allowing combined air power packages to seize the initiative and effect surprise, deception, deterrence and saturation on an adversary.

Close Air Support Possible in an A2/AD Age

While this is a disruptive and disturbing thought, all pointers indicate so. At the same time, technology application holds the answers. The Indian Air Force (IAF) uses the term Counter Surface Force Operations (CSFO) for offensive air operations in and around the TBA. This is further bifurcated into battlefield air interdiction (BAI) and close air support (CAS). Terminology aside, 'close' is defined by proximity to friendly forces and collateral fallouts. Its context is highly situational that requires close joint integration and specialists, such as forward air controllers (FACs) and ground liaison officers (GLO). So, whether you use CAS or battlefield air support (BAS), it connotes own or friendly

forces close to or in contact with the enemy and tighter integration of fire control. It also denotes a higher degree of control of the air in that limit of time and space, which allows unimpeded and accurate operations. These factors can and do dictate the choice of weapons carried by strike platforms. In certain combinations of contested airspace, even unguided munitions in large quantities may be the only option.

Besides a favourable air situation that allows BAS and BAI, the other factor that weighs heavily is timely support since windows of opportunities to make a decisive difference may be short and fleeting. On-call airstrikes would be the demand of ground troops in contact with the enemy. There are time-tested ways of aircraft on standby at bases nearby, helicopter support at forward arming and refuelling points in or around the TBA and strike aircraft patrolling the concerned areas.

With a future of contested airspace with numerous unmanned systems and long-range weapons providing close support, airspace de-confliction is going to be extremely challenging with attendant delays. Tactics such as use of spatial borders, time windows and kill boxes may not be optimum or efficient. This ideally requires a concept of close joint support (CJS), where close proximity to own forces is still the defining parameter. It will include full spectrum of joint capabilities and assets, and not just air-delivered munitions. The level of integration must be high and situational awareness of the whole battle will be key. This will include combat helicopters, which are anyway more tightly integrated with ground troops, to take on targets that are difficult for fixed-wing assets. New capabilities of helicopters may redefine their employment. An example is the Defiant (Sikorsky and Boeing), with a compound coaxial rotor with a pusher-propeller behind. It has the potential to fly twice as fast and twice as far as compared to many of the current conventional helicopters, besides enhanced low-speed manoeuvrability and exceptional hover control, decreasing susceptibility to traditional helicopter threat systems.

Dynamic airspace synchronisation (DyAS) is made possible by allocating airspace to multiple systems with scalpel-like precision, allowing for many more users in more closely positioned sections. The sharing is safe with aircraft and projectiles operating in spatially closer positions that are not feasible with current airspace control measures. It will also accommodate stand-off weaponry to pass through, digitally synchronising aircraft positions and possible future flight paths with

projectiles coming from CJS assets based on land, air, sea, below the sea and space.

The North Atlantic Treaty Organization's (NATO) Joint All-Domain Command-and-Control (JADC2) is proposed as a system-of-systems that will increase the role of AI and intelligent machines in decision making at senior command levels.[20] A network of all constituents will enable high velocity and volumes of information flow in a battle which would be impossible for humans to keep track. The AI algorithms will not only process large and varied information but also help in making informed combat decisions by providing commanders with a menu of viable courses of action based on real-time analysis. This will allow faster and timelier adaptation.

However, there is always a danger of these being biased and distorted by an over-reliance on the combat-oriented scenarios chosen by military professionals who, by training, are first and foremost worst-case thinkers. Even the US has launched a JADC2 initiative to have disruptive capabilities, such as unmanned fighter jets taking off unmanned carriers or an AI-powered system selecting the best fighters or carriers in an area and ordering defensive missile strikes. Satellite-based communication is critical in this model, therefore the imperative to make this network resilient, redundant and fail-proof.

Unmanned Air Vehicles

General Charles Q. Brown, Jr believes that the US' ability to maintain air dominance against peer competitors in any future war is in serious jeopardy.[21] He advocates a mental preparation to fight through high combat attrition rates. It does put a question mark on concepts that rely on, for example, an F-35 joint strike fighter requiring two decades to develop, costing around $90 million each and requiring years to build. Despite a newer form of 'rapid prototyping', the answer to this dilemma may lie in capable but expendable army of drones. This is a good example of forward disruptive thinking at the highest level, keeping in mind asymmetric approaches of the adversary.

UAVs are cheaper, simpler to operate and easily available (commercial off-the-shelf or COTS), making them an ideal weapon for those seeking asymmetric response to superior and dominating air power. Asymmetric aerial threats are highly complex and allow novel applications and creativity; and therefore, the difficulty of countering their surprise can never be considered a straightforward application of conventional air

power at the lower end of the spectrum. There could not be a better hard sell than the attack by a combination of drones and cruise missiles on 14 September 2019 on Saudi Arabian oil production facilities. The demonstration of a swarm of UAVs and missiles to fool a sophisticated air defence system and achieve mission objectives was a wake-up call for all powerful militaries. Drones and unmanned systems have caught further attention after employment in operations such as the recent Armenian–Azerbaijani conflict in Nagorno-Karabakh.

The US Air Force's Skyborg programme is an initiative to acquire game-changing capabilities in the form of relatively inexpensive, reusable and expendable unmanned aircraft that can leverage AI and accompany manned platforms (as controllers) into battle.[22] There are already some great showpieces around, for example, Kratos Defense's XQ-58A (Valkyrie) experimental drone and Lockheed-Martin Skunk Works' UAV models with open architectures that allow different organisations to add technology. The US Air Force Research Laboratory is committed to providing future unmanned aerial system solutions that support a variety of missions required for the future battlespace.

Another example is the MQ-25 of US military that is currently being tested as a carrier-based tanker aircraft which will accompany maritime strike and CAS aircraft on their missions. Unmanned aircraft systems (UAS) with signal intelligence (SIGINT) sensors can be used to find, fix, track and target critical nodes of the systems attempting A2/AD with electronic countermeasures and electronic warfare to own strike packages, or even hunting and locating critical A2/AD nodes. These can complement the Suppression of Enemy Air Defences (SEAD) effects of anti-radiation missiles (ARMs), designed to detect and guide to a specific or group of emitters. In the future, multiple expendable UAS may be grouped in a swarm and employed as decoys to deceive, congest or saturate enemy air defence radars. Swarms of autonomous low-cost cruise missiles can saturate enemy air defence systems, and also can be used for close support to ground troops in critical times.

Diverse developments, such as AI, 3-D manufacture, robotics and unmanned systems, allow a kind of mosaic warfare, which is about an effective warfighting whole made up of many diverse and fluid pieces. The idea is to take simpler and expendable systems networked together to share and collaborate to produce the effects desired. It will demand a coming together of interfaces, robust communications links, precision navigation and timing software as part of dispersed yet homogenous

entity in purpose. The concept will be to send so many weapon and sensor platforms that the adversary's sensors and shooters are overwhelmed—in effect, turn complexity into strength. This will be an attack in parallel across a wide front, with sensors, shooters, decoys, loitering munitions and others means, massing firepower without having to mass forces.

Chinese UAVs, such as the CH-5 Rainbow, operate at relatively low altitudes with more modest payloads than comparable US systems. Newer UAVs in development, such as Wind Shadow, aim to expand the capabilities of China's indigenous systems. As per Stockholm International Peace Research Institute (SIPRI; August 2020), China is the world's leading exporter of combat UAVs covering, among other nations, Algeria, Nigeria, Jordan, Zambia, Iraq, Saudi Arabia, Ethiopia, Turkmenistan, Pakistan, Myanmar and even Serbia, a NATO ally. Libya has been a fertile ground to prove these in the world. Chinese military analysts propagate them as providing low-cost and high-impact means to generate combat effects, with reduced casualties and better personnel morale. Military sales allow China to test and refine its military hardware on contemporary battlefields without direct political risk.[23] High-altitude operations in Ladakh are questionable, but the People's Liberation Army (PLA) could spring surprises with hitherto non-declared capabilities.

Learning Lessons

In recent American campaigns, a hard sell of technological marvels was effectively done. However, most concepts and systems seem very vulnerable against peer competitors who use asymmetry as a way of war. Since everyone is networked to fight integrated campaigns, the information domain would be severely contested; thus, protecting one's own information space while degrading the adversary's space would be paramount. Also, the OODA loop processing in speedier cycles is more relevant in the information domain than any other. Situational awareness of actual state of the network, both own and the enemy's, can allow actions to ensure resilience, robustness and redundancy. Sensing, processing, distilling and distributing information at a pace faster than the adversary will allow own air power assets and operations out-competing the enemy's OODA cycle. Emerging technologies, such as rapid prototyping, hypercomputation speeds, advanced and hardened communications, battles in electromagnetic spectrum and increased automation within combat systems, will affect this battle for control of the air.

Asymmetry with the PLA at the LAC

PLA's Concept of Operations

Xi Jinping's dream of Chinese rejuvenation and world dominance is also centred on the 'best' military by 2049. In 2015, he personally laid out the main guidelines that emphasised the centrality of information in future military conflicts that were premised on net-centric capabilities. The Academy of Military Science laid the foundation in 2013 through *The Science of Military Strategy*, which details theatre commands and operational methods of integrated forces. Besides breaking turf issues between services, it, importantly, breaks hierarchies to allow integration at all levels of command.

A recent RAND report analyses key concept of operations of the PLA as an integrated fighting force based on open literature.[24] Within the different domains, PLA strategists identify information, air and maritime as key to degrading an adversary's system-of-system; and target-centric warfare provides guidance for its destruction through hard and soft precision attacks. This allows a control over the pace and intensity of conflict and escalation, which has to balance the tension between intensity and seizing the initiative. Modern weaponry and technology allow unprecedented ability to speed up destruction to create decision dilemmas for the adversary.

Unlike 'combat space' which is limited to area of physical contact, a larger 'war space' encompasses both tangibles and intangibles, such as information, space, electronic warfare and cyber battles. The PLA commanders will plan and execute operations across all domains, emphasising actions in the intangible space, especially in the initial phases. Therefore, while kinetic attacks on an adversary's space or intelligence, surveillance and reconnaissance (ISR) assets may be conducted to enable operations in the information domain, major conventional attacks will await suitable degradation of enemy capabilities. The 'cognitive' battle is considered crucial to victory. For example, PLA writings talk of a strong psychological frightening force against an adversary.

LAC Face-off and Air Power

In the context of our two prime adversaries, air power is a positive asymmetry in favour of India. Pakistan cannot match the technological and numerical superiority and relies, mainly, on a defensive bubble aiming to cause unacceptable attrition. On the other hand, though China

has larger assets, it suffers from a geographical complexity affecting aeroplanes. In plain terms, IAF strike aircraft will take off from lower-altitude bases with far larger armament load, strike multiple targets in a coordinated mass action across the LAC, while achieving a temporal favourable air situation to keep adversaries from interfering.[25]

All this is possible because our bases and dispersed sites are at lower altitudes and close to the scene of action. In comparison, Tibet bases are at high altitude with severe penalty on weapons carriage, besides being vulnerable to Indian counter-air.[26] If there is anything that negates the Chinese superiority of infrastructure that allows it to mass forces and firepower better than the Indian forces, it is this edge in the third dimension. Quite obviously, the Chinese game plan would include aiming for high attrition to Indian air power; but, after Kargil, both Indian Army and IAF are fully geared to meet these challenges.

The Chinese Armed Forces would expect to counter the more effective manned Indian air power with an attrition-based air defence. Besides the real threat of attrition on Indian air power with a massive first strike on airfields, aviation infrastructure, etc., by the People's Liberation Army Rocket Force (PLARF), it would include, among other things: networked air defence systems encompassing short-, medium- and long-range missiles; large and small well-dispersed radars as sensors; and large numbers of man-portable air defence systems (MANPADS) with good overall built-in redundancy. The idea could be to synchronise the placement of assets, such as armour, artillery guns and ammunition, in well-defended places that lure, trap and cause heavy attrition to Indian air power. This would also include attacks on the network with electronic warfare, jamming and hard kills with surface-to-surface missiles. It must not be forgotten that China is a world leader in manufacturing of unmanned aerial platforms and could use swarming tactics against Indian forces.

In fact, it would be a smaller version of its A2/AD concept against the US forces on its eastern seaboard.[27] However, a pertinent question is: would China show its major cards in terms of assets, concepts and tactics that it is going to use against the mighty forces of the US coalition, that too for a limited but bloody encounter with India that is likely to remain a stalemate? After all, the US forces would be keenly watching and assessing PLA concepts. The Indian Armed Forces should be ready for surprises and not just preset PLA routines. The PLA would endeavour to cause

confusion and unpredictability in the minds of military commanders, which in turn would permeate to political leadership.

Lastly, since attrition would be key, IAF needs to be prepared to face high levels of it in the first few days, unless it is able to out-think and out-fox the PLA game plan. The Chinese ground troops, by all reckoning, are averse and more sensitive to mortality issues, and that would be crucial to getting an upper hand on the PLA.

Cognitive Warfare

The science and art of strategic shaping by big powers today involves coercive whole-of-government approach that aims to sow ambiguity and confusion in an adversary's calculus and intentions. Increasing complexity, uncertainty and large risk perception in the adversary's cognitive domain should result in multiple dilemmas and a sense of loss of control in their minds. In other words, 'attrition of the mind' must be a priority. Quite clearly, this needs to be planned and coordinated at the highest levels of the government since timing, sequencing and tempo are critical when dealing with such complex variables.

"China's A2/AD strategy is primarily aimed at keeping superior US naval and joint capabilities away from where they can be devastatingly effective. This is tailored to its eastern seaboard where all the maritime claims would inevitably cause friction and conflicts. Rarely has a medium power achieved a superpower status without conflict. China is getting ready for that, albeit planning to fight a war that it can through asymmetric approaches and not the one that the US wants it to fight."[28] This would, in all likelihood, be across all domains exploiting unique US vulnerabilities.

The strategy of A2/AD is essentially multi-domain, with an integrated mix of sensors and shooters based on land, air and maritime platforms.[29] Weaponry includes long- and medium-range artillery, rocket regiments, surface-to-surface missiles, air-launched munitions, a variety of anti-ship and anti-aircraft missiles, long-range cruise and ballistic missiles, etc. More importantly, they are all networked to align and respond quickly as per a larger strategic intent.[30] Space-based prowess and anti-satellite weapons add by improving own situational awareness, while degrading that of the adversary. The final picture is completed with capabilities in the cyber and information realms. Primary targets for hard kill would be large platforms in the carrier fleet, airborne command and control aircraft, airborne refuellers and such others that would effectively curtail

full spectrum freedom in the designated zone. All this would be done along with a core effort to degrade the US' superior network-centric set-up.

The war in the domains of space and information (cyber and EM) would start in right earnest well before the deployment in other domains. The PLA reforms implemented since 2015 show a distinct trend towards 'informationisation'.[31] In addition to theatre commands to allow multi-domain operations, China established a Strategic Support Force (SSF) under the Central Military Commission (CMC), with a mandate to directly integrate and function with theatre commands.[32] Besides joint and integrated operations with theatre commands, the mandate includes: full spectrum ISR; management of satellite operations; defence of the electromagnetic spectrum and cyberspace tasks; and providing all these services to users.[33] This architecture clearly recognises the validity of multi-domain operations. "The Chinese believe that a potent mix of space, cyber and electronic warfare is key to the overall information campaign. The SSF integrates these quite tightly."[34]

Preparing for Uncertainty

Adaptability

Adaptability has two facets: the ability to sense a change in situation demanding a change in response; and the ability to commit to that requirement. What does complexity leadership entail in terms of asymmetric thinking? Evolved leadership needs to balance administration control and generative impetus for allowing creativity. "The control part regulates the generation of adaptability and newer ideas from going into a chaotic status. The environment thus created will do both, explore and exploit emergence at lower levels."[35]

The Australian Army replaced the famous OODA loop with an act, sense, decide and adapt (ASDA) loop that deals better with non-linear, complex and unpredictable states. In the ASDA cycle, action is first because in uncertainty one needs to prod to elicit a requisite response for assessments to be made. Decisions are made based on these assessments, followed by deeper reflection and adaptation. However, the situation prevailing for decisions to be taken will dictate what to apply, that is, OODA, ASDA or something else.

An example, also given earlier in the article, from 1971 war is illustrative. "Dacca was never an objective even in the final operational

instruction by Army HQ to Eastern Command."[36] However, the famous probes by Mi-4s ordered by Gen Sagat Singh of Indian IV Corps, caused chaos and a wrong decision by Pakistani Gen Niazi to defend Sylhet by two brigades rather than defending river Meghna crossings towards Dacca. It "allowed IV Corps to reach the doorsteps of Dacca almost eight days earlier than possible. Deeper reflection allowed the Indian Army to quickly go for the jugular and reach the doorsteps of Dacca." This example of mental flexibility and agility is not unique, it is ever-present in battlefields with the victors.

Multi-domain Capabilities

Clausewitzian theory is focused solely on physical force and attrition. However, with great advances in technology and morphing of asymmetric threats, pure physical capabilities of air, land and naval forces are no longer enough to manage conflict. Comprehensive national power will include elements of diplomacy, information, military and economic, and their synergy. At the strategic, operational and tactical levels, these elements operate on land, in the air, at sea, as also through informational, cyber and electronic means—in other words, a multi-domain endeavour. Synergised national capabilities should look to create zones of dominance to enable successful pursuit of national objectives and end states.

A corollary is that mental and physical dislocation of an adversary capable of multi-domain networked operations is crucial. "Armed forces with multiple capabilities, working as part of joint, inter-organisational and multinational teams, will provide national leaders multiple options across all domains needed to deter and defeat highly potent adversaries. It demands agile, curious, creative and questioning minds to gaze ahead and build adaptive capabilities, resilience and defences against attacks on these networks. Asking difficult questions and posing disruptive thoughts is a good start to face such a future."[37]

Air Power Doctrine or Dogma?

Doctrine is largely driven by studying history and drawing necessary lessons from successes and failures, as well as a careful consideration of current developments and policy imperatives. While there are deep links between national security strategy and strategic military doctrines, the latter have primarily served as a framework around which commanders have innovated and adapted creatively. While theoretical foundations are

important, any doctrine must be viewed as a 'live' being with necessary attributes of flexibility, adaptability and an ability to evolve fast.

Air power being inherently dynamic and sensitive to technological advancements demands even more dynamism in its doctrinal postures. It must continually evolve within its range of employment contexts, emergent situations requiring quick responses and broader geopolitical demands. Technology is also a driver of fast-evolving theoretical abstractions which turn into novel operational practices and concepts. However, there are practical considerations, such as the economy, defence allocations in budgets, status of defence industry capacity and research and development (R&D), immediate threats and concerns and the national vision for a country's role in the world, that will and must temper doctrine formulation. Another overriding influence is the actual experience of the nation across the combat spectrum.

Early theorists propounded the cardinal pillar of air power doctrine as the 'control of the air'. This has been increasingly questioned, mostly in terms of achievability. Against peer competitors and formidable defensive systems, this is a formidable task, unless there is doctrinal tweaking to allow all other roles of air power that enable joint operations. More than control of the air by an air force, it is time to talk about domain dominance in time and space by an integrated force. Precision and survival of attackers has been improved by combining with special forces in 'hot' zones.

An information explosion in a hyper-connected world has made the issue of casualties and collateral damage to civilians a central issue. Numerous cases exemplify the strategic consequences of tactical errors by airmen when large numbers of civilian deaths are flashed on every media possible, for example, Syria and Nagorno-Karabakh recently. Therefore, besides proper and well-thought targeting, it is imperative to be prepared for a defence against post-truth and false narratives. This needs to be factored in doctrinally in terms of evidence gathering and pre- and post-damage photographs, among other measures.

A Pandora's box of unmanned concepts, such as dispensable UAVs, human teaming and swarming, is emerging. It is a mind-boggling series of choices and scenarios which will redefine risk-taking and proactive actions possible. Doctrines must be extremely capable in terms of flexibility, adaptability and evolution to absorb this before an adversary springs this as a surprise.

Conclusion

A new genre of 'political warfare' is diffusing the space between war and peace. The notion that 'war is politics by other means' (Clausewitz) has transformed into 'politics is war by other means'. Nothing remains below-the-belt if attributability can be avoided. Air power capabilities need to cope in this dynamic and disruptive competition. Take the case of targeting, so crucial in precision and effects-based operations. Unless there is better and holistic understanding of adversaries' strengths and vulnerabilities as a system that is dynamic, unpredictable and disruptive, targeting may miss the mark. More importantly, this is a game in continuity which may not be so easy to predict or shape. Strategists have to not only out-think the adversaries in protecting vulnerabilities of air power capabilities but also offer novel solutions to create disruption in them.

The gap between the predicted (or preferred) war and the actual war that unfolds will only increase in terms of uncertainties and unpredictability. Flawed training and exercises based on the need to hear and see what one wants to will only lead to increasing this gap. Mental adaptability and flexibility will suffer. Therefore, war colleges and institutions need to embrace openness to disruptive ideas that will, in turn, propel tactical innovation. Risk aversion, cognitively speaking, must be treated as a handicap and not as a step to promotion of one's career.

This article has explored the changing character of air warfare driven mainly by rapid advances in technology. The costs, timelines and effort in air power force development demand that careful thought is given to the possibility of future disruption by adversaries with cheaper and more effective asymmetries. It suggests deep impacts on force structuring, employment and integration models. Concepts of hybrid and irregular warfare as applicable to air power are also discussed in light of future nature of conflicts. A look is taken at various issues, such as BAS and airspace control, OODA loop in current contexts, A2/AD and unmanned platforms and the overall viability of exclusive BAS. The current imbroglio on the LAC is also briefly explored for asymmetries that both sides will aim for in air power employment. In preparing for the inevitable uncertainty, adaptability, multi-domain synergy and fresh doctrinal approaches are suggested as a way ahead.

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