LOW-TECH/LOWER COST SOLUTIONS TO HIGH-TECH PROBLEMS: FACING THE CHINA CONUNDRUM

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India and its armed forces are faced with an increasingly technology-dependent adversary on the eastern / northern side, and an adversary who has time and again not hesitated in seeking a force-on-force encounter, on the western front. India is sandwiched with a force that does not abhor the bloodshed that accompanies an armed confrontation, to one that perhaps does. China, with its adverse age demographic (as a result of its one- child policy), is perhaps reticent on wanton loss of life. This is, in a way, reflected in its actions of trying to create strategic space between its adversaries and itself by developing tools that provide it this. Some of the latest inventions by China in the field of weapons, especially in the aerospace arena, clearly demonstrate its intentions and choice of long- range vectors over conventional fielded forces.

Many pundits promote the idea that technological supremacy over one's adversary would be a *sine-qua-non* when going forward into the 21st century. There are enough examples of a technologically inferior force like the Taliban in Afghanistan (against the USSR in the late 20th century and against the

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USA in the early 21st century), the Islamic State of Iraq and the Levant (ISIL) against the combined coalition forces (Operation Inherent Resolve) and many more, which have, if not defeated, caused enough attrition on the tech-superior forces, to make them take a step back and reassess the situation. High-slashing attacks by Vietnamese MiG-21 fighters, against the more advanced F-4 Phantoms, are a classical example of how low-tech solutions could be found for high-tech problems faced during wars.

India needs to be prepared for any military action by China on disputed boundaries in the coming decades (perhaps by 2049, when China celebrates its centennial of creation). China, driven by its adverse age demographic (rapidly aging population), has embarked on military modernisation under informatised conditions. This means higher dependence on technology and measures to deny the use of the same to the adversary. Therefore, there is an imminent need for us to identify the gaps that exist in this technologically driven superiority that faces us and seek suitable low-tech solutions to combat the same. This paper would seek to identify the low-tech solutions that can be explored by the Indian Air Force (IAF), as short-term solutions, till our dream of achieving true Network-Centric Warfare (NCW) capability, is fulfilled.

INTRODUCTION

Fig 1: Imaginary Depiction of the Future Battlespace[1]

> *Short-duration strikes and other small-scale offensive actions conducted with specialized military capabilities to seize, destroy, capture, exploit, recover, or damage designated targets in hostile, denied, or diplomatically and/or politically sensitive environments.*
>
> - JP 3-05 Special Operations Manual

The above-mentioned quote, taken from the United States special operations doctrinal publication (the JP 3-05), relates to operating in an uncontested battlespace, meaning supremacy across all domains, with an established support architecture, absent the constraint of denial by a competent adversary.[2] When fighting an adversary that relies heavily on the

1. Ethan Browne, "Low-Tech Supremacy in High-Tech Warfare," https://www.diplomaticourier.com/posts/low-tech-supremacy-in-high-tech-warfare. Accessed on June 11, 2023,
2. Ibid.

informational paradigm in the orchestration of one's forces, technological wizardry can be combatted with low-technology options.

Being an ascendant nation, as described best by the Thucydides trap paradigm,[3] China is likely to foray into a conflict; seeking imposition of its will and world superpower status. History reveals that no nation has risen to superpower status without showing at least some disregard for the loss of lives and material. China could use one of the two outstanding issues, i.e. unsolved boundary dispute with India and the Taiwan imbroglio, to assert itself in the world power arena. The foray across Formosa, attacking Taiwan, would perhaps result in provoking the existing power preponderant, the USA, into a war. Therefore, the chances of China seeking ascendency by either provoking India or outright attacking it are more likely than in the first scenario. India needs to be prepared for any military action, seeking a unilateral decision on the disputed boundary, in the coming decades (perhaps by 2049 when China celebrates the centennial of the creation of the People's Republic of China (PRC). Perhaps driven by its adverse age demographic (rapidly ageing population), China has embarked on military modernisation under informationised conditions. This means higher dependence on technology and measures to deny the use of the same to the adversary. Notable luminaries like Air Marshal Anil Chopra (Retd), have alluded to the increasing capability gap between China and India and the need for India to review its military and geopolitical options in the near-term.[4]

AIM

This paper will outline some low-tech measures that can be used by the Indian military to thwart the Chinese intention of denial of higher technology options in any future conflict.

3. Graham Allison, "The Thucydides Trap: Are the U.S. and China Headed for War?," *The Atlantic*, September 24, 2015, <https://www.theatlantic.com/international/archive/2015/09/united-states-china-war-thucydides- trap/406756/.>
4. Anil Chopra, *China, the Rising Aerospace Power: Implications for India* (New Delhi: Pentagon Press, 2020), p 13.

SCOPE

The low-tech measures suggested in the aim would be covered under the following parts:

- Part-1: Defensive Measures.
- Part-2: Offensive Options.

ADVANTAGES OF LOW TECHNOLOGY SOLUTIONS

Low technology solutions offer several advantages over advanced technology in the context of the armed forces, which can be summarised as follows:

- **Low technology solutions are often more affordable and accessible than advanced technology.** In many cases, the armed forces may not have the resources to acquire or maintain advanced technology, and may need to rely on low technology solutions to overcome their limitations. Low technology solutions can also be improvised using readily available materials, making them ideal for situations where supplies are limited. This applies especially to inhospitable terrains where the Indian armed forces operate (against the northern adversary).
- **Low technology solutions are often more robust and reliable than advanced technology.** This is when operating against an adversary that possesses the capability to deny hi-tech usage to enemy forces. Modern weapons and communication systems can be vulnerable to electronic jamming and other forms of attack, but low-tech solutions are less susceptible to these threats. For example, hand signals and visual cues can be used even when radio and satellite communication systems are disrupted, and improvised weapons such as Improvised Explosive Devices (IEDs) can be difficult to detect and counter.
- **Low technology solutions can be more adaptable and flexible than advanced technology ones.** Low technology solutions can be easily modified and customised to suit the specific needs of a particular situation. For example, improvised shelters can be constructed using local materials and techniques, and can be modified to protect against different types of threats.

Some documents go on to state that one of the foremost campaigns of the People's Liberation Army Air Force (PLAAF) is a denial campaign, in line with its Anti-Access-Area-Denial (A2AD) strategy.

While it is important for the Indian armed forces to continue on the path of modernisation, it is equally important for us to embrace some of the available low-tech solutions, owing to the disproportionate gap that exists in terms of technology between us and the northern adversary. These would act as a low-hanging fruit for employment against our adversary. In the subsequent parts of this paper, some defensive and offensive options, for the Indian armed forces have been highlighted.

PART-1: DEFENSIVE MEASURES

Low technology solutions are defined as simple, affordable, and easy-to-use solutions that do not require high levels of technical expertise. These solutions can range from improvised tools and equipment to traditional techniques and practices. Low technology solutions have been used by the armed forces throughout history to overcome various challenges, from communication breakdowns to a lack of supplies and equipment. In recent years, low technology solutions have become increasingly important in modern warfare as a means to address either the limitations of advanced technology or the denial of it to own forces by the adversary. India's northern adversary, China can isolate a battle zone from all mediums like ground/ air/sea/electro-magnetic/space, etc. Some documents go on to state that one of the foremost campaigns of the People's Liberation Army Air Force (PLAAF) is a denial campaign,[5] in line with its Anti-Access-Area-Denial (A2AD) strategy. Some of the areas where China could impede the Indian armed forces in a conflict have been highlighted in the subsequent paragraphs. All commanders need to have a sound defensive strategy that can accord them a viable tool for force preservation, which could further

5. Annual Report to the Congress, "Military and Security Developments Involving the People's Republic of China 2019", by the Office of the Secretary of Defence. Generated on May 2, 2019. RefID: E-1F4B924

be used in an offensive role at a place of his/ her choosing. Some of the threats, and the relevant low-tech options that can be employed, that exist in the battlespace at present, and those that may emerge soon, are as follows:

The Indian armed forces need to develop low-tech solutions to this problem by using dated techniques like carrier pigeons, dispatch riders, etc.

- **Tactical Communication**: China has developed several systems that accord it supremacy in the geostrategic space in the field of communication. The long-range equipment driven by satellite-based quantum key-protected secure communication makes it extremely difficult to jam or crack Chinese communications during operations. On the other hand, China has several systems like the frequency hopping identifier-based jammers.[6] Using these, the People's Liberation Army (PLA) is likely to be able to isolate a designated combat zone as a no-fly zone, devoid of any existing communication network. One of the main challenges for the IAF in such a jamming situation would be the need for reliable communication systems. The Indian armed forces need to develop low-tech solutions to this problem by using dated techniques like carrier pigeons, dispatch riders, etc. In the air, the IAF could employ radio relay Remotely Piloted Aircraft (RPA) or airborne command posts to relay information from ground-based sensors facing jamming conditions. These systems could burn through the jamming based on proximity to the fighters in the air. These low-tech solutions would be a fallback to high-tech-based communication networks. Other low technology solutions, such as hand signals, flags, and other visual cues, can help overcome these challenges and enable effective communication between troops.
- **Operational Logistics and Transportation**: Another challenge that could be faced by the Indian armed forces is the need for reliable transportation and logistics in some of the theatres against China. Modern warfare

6 G. Li, W. Wang, G. Ding, Q. Wu and Z. Liu, "Frequency-Hopping Reconnaissance and Prediction for Non-Cooperative Communication Network," *China Communications*, vol. 18, no. 12, December 2021, pp. 51-64, doi: 10.23919/JCC.2021.12.003.

often requires the rapid movement of troops, equipment, and supplies across long distances. However, the use of advanced technology such as aircraft, armoured vehicles, and drones can be limited by factors such as fuel availability, maintenance requirements, and terrain. India faces such challenges in the frontier areas that adjoin the Line of Actual Control (LAC) with China, especially in the northeastern part of the country. The terrain is mountainous and has limited axials and laterals for op-logistic functions. China, armed with its precision strike capability, is likely to target the limited roads and choke points in the sector to cut off the forces. This problem is accentuated by what can be construed as a lack of adequate airlift and mobility within the Indian armed forces. Therefore, low technology solutions, such as pack animals, bicycles, and human porters can provide reliable transportation in these areas. Additionally, India needs to invest in heavy load lift Unmanned Aerial Systems (UAS) that can plug the gap between what can be ported by animal transport divisions and what can be air-dropped.

- **Use of Smoke Generators**: Smoke screens can be created using specialised equipment, but also by using natural materials such as burning tyrpes or oil. The ease of deployment of smoke makes it an ideal defensive measure in situations where time and resources are limited. For example, in situations where precision-guided missiles are being used by the enemy, smoke can be used to obscure the target, making it difficult for the enemy to lock onto its intended target. This, coupled with simple low-cost Global Positioning System (GPS) jammers can render most, if not all, smart weapons incapable of finding their intended targets.
- **On-Demand Production Using 3 D Printing**: 3D printing technology has become increasingly popular in a variety of industries, and the military is no exception. The use of 3D printers by the military during wars can provide significant advantages, allowing for on-demand production of essential components and equipment, and reducing the logistical challenges of supplying troops in remote and dangerous areas. In a combat zone, traditional supply chains may be disrupted or unavailable, making

it difficult to obtain the necessary equipment. With 3D printers, military personnel can create tools and equipment on the spot, using available materials. 3D printers can also be used to create prosthetic limbs and other medical devices for injured soldiers. In combat, soldiers may be injured, and traditional medical supplies may be in short supply or unavailable. Whilst some may argue that 3D printers are high-tech, it is opined that the alternative to this would be much more complicated field ambulances that might not be able to make the journey to the combat zones. It might also be cost-effective to enrol some alternative naturopaths into the ranks and files of the armed forces, who could then make use of available flora and fauna to create local herbs and medicines for administering to the troops in need.

- **Use of Pharmacological Means to Enhance Alertness:** The use of pharmacological means, such as modafinil, by soldiers during war goes back to the German use of the pervitin medication for undertaking the *"blitzkrieg"*.[7] Modafinil has also been found to have beneficial effects on cognitive function and mental performance. This medication has been cleared for use in the IAF for aircrew undertaking long missions and sustained operations.[8] Soldiers who are operating in high-stress and high-risk environments need to be alert and focussed at all times. Fatigue can impair their cognitive function and put them at risk of making mistakes that could lead to serious consequences. Modafinil, and such medications, can help soldiers stay awake and alert for longer periods, allowing them to perform their duties more effectively and reducing the risk of errors. Another advantage of using modafinil is its ability to improve cognitive function and mental performance. Soldiers who are under stress may experience difficulties with memory, attention, and decision-making. Modafinil has been shown to improve these cognitive functions,

7 "How Methamphetamine Became Part of Nazi Military Strategy", *Time*, <https://time.com/5752114/nazi-military-drugs/>. Accessed on May 10, 2023.

8 "Go or No-Go? 'Authorised' Pills Helping Indian Air Force Pilots Gain the Edge", *Business Insider India*, <https://www.businessinsider.in/iaf-personnel-taking-authorised- pills/articleshow/50901573.cms>. Accessed on June 11, 2023.

allowing soldiers to perform their duties more effectively and reducing the risk of mistakes.

- **Using Methane Tracking for Estimating Enemy Build-ups**: Satellite-based methane tracking is a technology that can be used to detect the presence of methane gas in the atmosphere. Cattle and other such animal herds emit a lot of methane in their barfs/ vomit.[9] Movement in narrow passes in the hills is often accompanied by animal transport, for places where there are no roadheads. By using satellite-based methane tracking of animal transport herds, military personnel can identify areas where concentrations of methane gas are present, which may indicate the presence of enemy forces. This can enable faster decision-making for the placement of defences/reserves and the selection of appropriate avenues to approach the enemy.
- **Barriers Created Within Valleys**: Hastily created barriers can be a valuable defensive measure in preventing the use of certain valleys by enemy aircraft during wars. In a war zone, terrain features such as valleys can provide strategic advantages for both offensive and defensive operations. By creating barriers in these valleys, military forces can deny the enemy access to these strategic areas and limit their ability to conduct operations**.** Steel cables erected across valley chokepoints can be a major deterrent to the use of aircraft in valleys. This way, either the aircraft would take alternate valleys, where appropriate Air Defence (AD) weapons can be placed, or would be forced to fly above the valley crest, thereby getting detected by radars.
- **Avoiding Fratricide**: Fratricide, or the unintentional killing of friendly forces, is a significant concern in military operations. It can occur due to a range of factors, including poor communication, lack of situational awareness, and the fog of war. To prevent fratricide, low-tech measures can be employed to improve communication, situational awareness, and decision-making processes. Friendly forces in an area can be equipped

9 K. A. Johnson and D. E. Johnson, "Methane Emissions from Cattle", *Journal of Animal Science*, vol 73, issue 8, August 1995, pp. 2483–2492, https://doi.org/10.2527/1995.7382483x

with low-cost smart watches that can be integrated into a larger group on apps like the Google Family. This way, their movements can be easily tracked and a forward line of own troops can be made for ease of target identification, and avoiding fratricide. Low-tech solutions such as coloured smoke, visible markers, and sound signals, are often easy to implement, cost-effective, and require minimal training, making them an important part of any fratricide prevention strategy. Problems of identification by own AD weapons can also be resolved by establishing firing posts for shoulder-fired Surface-to-Air Missiles (SAMs) near or co-located with lightweight mountain radars. This way, the operators can get adequate early warning and a sensor-fused and Recognised Air Situation Picture (RASP), before firing their weapons. These measures will make a significant enhancement in capabilities when encountering a breakdown in communications as a result of jamming.

PART-II: OFFENSIVE LOW-TECH MEASURES

In the uncertain realm of warfare, there are instances where forces with inferior technology find themselves launching an offensive against adversaries equipped with superior technological capabilities. The forces with inferior technology prioritise adaptability and flexibility. They may employ unconventional weapons or repurpose existing resources to create improvised solutions. With limited access to advanced weaponry, they rely on their ingenuity to devise strategies that can disrupt the adversary's technological advantage. This might involve using decoys, camouflage, or engaging in psychological warfare to deceive and confuse the superior enemy. Because collusion between our adversaries in the north and the west is a reality, the proliferation of high-tech into the battlespace is a given. It is, therefore, vital that the Indian armed forces develop the capability to continue fighting, even when the technological balance is tilted in the enemy's favour. Some of the measures that can be utilised by the Indian armed forces are as follows:

One low-tech solution can be the use of trained birds of prey such as eagles or hawks, to take down low-speed UAS. These birds can be trained to recognise drones as prey and could have the capability of catching and disabling them mid-flight.

- **Anti-Unmanned Aerial Systems (UAS):** UAS are increasingly being used for both civilian and military applications. However, the proliferation of these systems also poses significant security challenges, as in no-war-no-peace situations they can be used for illegal activities such as espionage, smuggling, and even terrorist attacks. This problem is likely to be magnified significantly in war-time with the increasing fleet of UAS that the Chinese aerospace industry is producing every year. The low cost of production but high enough damage capacity makes for an interesting conundrum since the air defence weapons that can target these UAS are, presently, many times the cost of the intended target (the UAS). To address this challenge, low-tech anti-UAS solutions need to be developed and deployed in increasing numbers. One low-tech solution can be the use of trained birds of prey such as eagles or hawks, to take down low-speed UAS. These birds can be trained to recognise drones as prey and could have the capability of catching and disabling them mid-flight. This approach has been successfully used in countries such as the Netherlands, where the Dutch National Police have trained eagles to take down drones in sensitive areas such as airports and government buildings.[10] Another low-tech solution is the use of net guns or net launchers to physically capture drones mid-flight. These devices shoot out nets to entangle and disable drones in the air, preventing them from completing their mission. This approach has been used by the police forces in Japan and the Netherlands to neutralise unauthorised drones in sensitive areas.
- **Jamming Enemy Communications**: Using existing radio and TV towers to broadcast wideband noise jamming over identified enemy frequencies.

10 "Dutch Police Train Eagles to Snatch Enemy Drones," Reuters, February 2, 2016, sec. Aerospace and Defence,< https://www.reuters.com/article/us-dutch-police-drones-idUSKCN0VB136>.

By recognising the advantages of low-tech solutions like jammers, the armed forces can become more adaptable and flexible. This form of jamming signal, while it has not been carried out to date, is a field that is proposed for further study.

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- **Using Cell Tower-Based Intelligence Gathering and Denial Plans**: Cellular towers can be used by the forces to create areas of cellular black-out [effective Intelligence, Surveillance, Reconnaissance (ISR) denial plans for masking own avenues of approach] or using the same towers to emit signals similar to enemy cell towers in the area to force mobile phones to log on and thereby enable own forces to track enemy build-up. Open sources do not have adequate information on whether this form of data population is possible or not, but in the general theory, these networks do exist in the border areas of some countries, enabling seamless cross-country connections. This is another area identified for further study.
- **Remote Gun Firing Position**: In hilly/ mountainous terrain, it may not be possible for the forces to guard all the heights nor access all vantage features to provide adequate overlapping firing by guns. It is possible to establish some of the gun positions in advance using an aerial approach at commanding vantage points, guarding identified avenues of approach of the enemy. These gun positions would then be equipped with simple trigger mechanisms that could be the electro-hydraulic or rope and pulley type. Such autonomous firing systems installed with overlapping firing arcs, which can be operated from a distance by simple rope and pulley structures, could result in a far larger volume of fire onto an enemy, with minimal exposure to its troops.

CONCLUSION

In conclusion, low-technology or lower-cost solutions can play an important role in conflict situations against a technologically superior force. While

advanced technology can provide significant advantages in terms of communication, transportation, and weapons, it also has limitations and vulnerabilities. Low-technology solutions can provide simple, affordable, and effective means of overcoming these challenges, and can be used to supplement and enhance the capabilities of advanced technology. As such, the armed forces should continue to explore and utilise low technology solutions as a valuable part of their arsenal, alongside advanced technology. By recognising the advantages of low technology solutions, the armed forces can become more adaptable, flexible, and effective in a wide range of situations. Furthermore, the development of low technology solutions can also provide opportunities for innovation and creativity within the armed forces, allowing the troops to develop new skills and techniques that can be applied in a variety of contexts. As the challenges of modern warfare continue to evolve, the importance of low- technology solutions is likely to increase, and the armed forces must be prepared to utilise them effectively to ensure success in their missions.