# Tactical Transport Operations Along Northern Border

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#### Abstract

Application of airpower in mountainous regions presents both opportunities and challenges in elevated terrain providing a natural advantage for surveillance, radar installations, and communication lines while posing significant disadvantages in terms of airpower employment such as low aircraft performance, inhospitable terrain, extreme weather, and limited infrastructure. India shares lengthy borders with China and Pakistan and the epicentre of its constrained international relations with these countries lies along these shared borders. To deter any hostile engagement from either neighbour, the sustained presence of troops along the borders is imperative. Transport operations in the mountains along the northern border significantly improve the deterrent capability of armed forces by applying the requisite airpower. This article highlights the importance of tactical transport operations along the northern borders.

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#### Introduction

The India-China border dispute dates back to the pre-independence era when China refused to agree to the draft convention drawn up by the British during the Shimla Conference held between Oct 1913 and Jul 1914.1 Nonetheless, the 'McMahon Line' was established on 24 Mar 1914<sup>2</sup>, and despite being involved in a legal process for nine long months, China outrightly rejected the McMahon Line and its application to the India-China border ostensibly on the grounds of 'Imperialist Legacy', but actually foreshadowing its revisionist approach. Since then, the two countries have had numerous disagreements, skirmishes, standoffs, conflicts and even a war in 1962. The India-China border spans Ladakh, Himachal Pradesh, Uttarakhand, Sikkim and Arunachal Pradesh (approximately 3,488 km<sup>3</sup>) with Nepal and Bhutan as buffer states as depicted in Map 3. Routes of Incursion by Peoples' Liberation Army (PLA) in 1962 depicted in Map 4, skirmishes along the Line of Actual Control (LAC) at Cho La, Chumbi Valley depicted in Map 5 and the Galwan Valley clash<sup>4</sup> in Jan 2020, depicted in Map 6, bring out the historicity of terrain centric sensitivities of both countries. In Jun 2017, both militaries had a stand-off over a road construction in Doklam near the trijunction border<sup>5</sup> of India, Bhutan and China.

The McMahon Line dates back to the pre-independence era and its veracity has been contested by both neighbours since its inception, only exacerbating perceptions over time. Given the territorial sensitivity in both countries about territory, the issue is here to stay. Ongoing skirmishes only foreshadow what lies in store for the future.

The area shaded in red and bounded by a dotted red line in Map 6 is China's interpretation of the border and the territorial claims implied thereby.

#### IAF Transport Operations from the Past

Post-independence, in the Oct 1947, three Dakotas carrying troops of the First Battalion of the Sikh Regiment touched down in Srinagar just in the nick of time.<sup>12</sup> In early 1948, Pakistan launched Operation Sledge<sup>13</sup> to seize the areas of Skardu, Kargil and, Zozila and ultimately wrest control of the Leh Valley.



Boundary agreed upon by Sir Henry McMahon and Lonchen Shatra on 24 Mar 1914.



Map 1: McMahon Line<sup>6</sup>

Map 2: LAC map along Northern Sector<sup>7</sup>



Map 3: Indo-China border in Sikkim Sector<sup>88</sup> Sikkim Maps





Map 5<sup>10</sup>



Map 6<sup>11</sup>

In 1962, during the Chinese conflict the Indian Air Force (IAF) was asked to undertake missions for air maintenance nearly three times the normal tasking. During the critical situations in Daulata Beg Oldi<sup>14</sup>, the urgent task of airlifting tanks was undertaken from Chandigarh to Chushul airstrip<sup>15</sup>, which was made of Perforated Steel Planks. Only an airlift of tanks could have counterpoised advancing Chinese armour. The C-130 Hercules aircraft of the United States Air Force (USAF) made their presence felt in the region by landing in Chushul with airlifted tanks for the 20 Lancers, an armoured regiment. This operation was critical as it provided much-needed reinforcements to halt the advancing Chinese forces. The C-130, a versatile military transport aircraft, was renowned for its ability to operate from short and unpaved airstrips, making it ideal for the rugged terrain of the Himalayas. The successful airlift not only showcased the logistical capabilities of the IAF in collaboration with the USAF but also underscored the significance of air mobility in modern warfare.

During the 1971 war, the transport operations included the Tangail Drop<sup>16</sup> in East Pakistan, regarded as a landmark event.<sup>17</sup> A fleet of 36 transport aircraft that included An-12s, C-119s, Dakotas and Caribous, carried out the paradrop of troops, artillery, vehicles and other stores.

In 1971, the An-12s were configured to carry 28 to 36 of 500 pounders for carpet bombing<sup>18</sup> and on 03 Dec 1971 six aircraft from the 44 Squadron bombed Pakistan Army's Changa Manga Ammunition depot. Operation Poomalai<sup>19</sup> or Eagle Mission 4 was the codename assigned to a mission undertaken by the IAF to airdrop supplies over the besieged town of Jaffna. A rapidly maturing and modernising IAF, armed with medium tactical lift An-32 aircraft, was poised to usher in a new era. In a span of just 20 days (11-31 Oct 1987), IAF undertook 2,200 tactical transport and 800 assault helicopter sorties, marking a new beginning. Troops, weapons, and vehicles were flown in and out, without a single loss of own aircraft to enemy fire or accidents, bearing testimony to the professionalism of the IAF.

Baba Mehar Singh, affectionately known as the 'Air Officer', was a pioneering figure in the Indian Air Force (IAF) and played a crucial role in establishing air operations in challenging terrains. His exceptional skills and bold decisions in aviation earned him admiration not only from his peers but also from those involved in aircraft manufacturing. One of his most remarkable achievements occurred in 1968, when he set a world record by landing a Dakota aircraft at Leh, a feat that surprised even the manufacturer of the Dakota. The Dakota, a World War II-era transport aircraft, was not initially designed for the high-altitude conditions and unpredictable weather of the Himalayas. However, Mehar Singh's successful landing demonstrated not only his flying prowess but also the capabilities of the Dakota aircraft in extreme environments. This accomplishment had significant implications for military logistics and operations in high-altitude areas, reinforcing the importance of air power in enhancing strategic mobility and support for ground troops.

These daring operations marked a transformative period for the IAF, heralding a new era for combat support operations. The successful integration of air power in combat operations illustrated the growing recognition of air support as a vital component of military strategy. The ability to airlift troops, equipment, and supplies to remote locations significantly enhanced the operational effectiveness of ground forces, paving the way for the development of advanced air logistics and support capabilities in subsequent conflicts.

AN-12	1 x Squadron (7 x aircraft)		
Dakota	1 x Squadron (8 x aircraft)		
Fairchild Packet	2 x Squadrons		
IL-14	1 Squadron		
Otter/ Caribou (light transport)	2 Squadrons		

 Table 1: Transport Aircraft of the IAF in 1962<sup>20</sup>

 Lessons from Other Operations Across the World

Air mobility refers to the movement of personnel and resources to the right place at the right time. While strategic airlift may occupy centre-stage, tactical airlift may be indispensable in specific situations as evident during World War-I where an estimated 1,000 pounds of supplies were dropped by thirteen aircraft<sup>21</sup> in a crisis. Profound impact of air mobility operations on the siege of Stalingrad in 1942, the siege of Dien Bien Phu<sup>22</sup> in 1954, and the siege of Khe Sanh<sup>23</sup> in 1968 can hardly be overstated. The local examples include Operation Tangail Drop<sup>24</sup> in 1971 in erstwhile East Pakistan and Operation Poomalai<sup>25</sup> in Sri Lanka. In the 21<sup>st</sup> Century, given the high tempo of operations, the ability to quickly and decisively deliver combat forces with equipment is vital to achieving military objectives.

The employment of airpower has had a profound impact on the conduct of mountain warfare. The third Anglo-Afghan war<sup>26</sup> and Pink's war<sup>27</sup> successfully delivered airpower under the Air Control Policy in a mountainous region. The roles assigned to the aircraft were reconnaissance, artillery, observation, offensive action, resupply of ammunition and supplies, delivery and messaging duties. The turn of the century replicated the old scenario, with United States (US) replacing the Union of Soviet Socialist Republics as agent provocateur. The use of airpower triggered 'Operation Enduring Freedom' - the first instance of large-scale use of Special Operations Forces to direct airborne fire power. Transport aircraft like the AC-130 gunship were introduced due to their ability to sight ground targets, speed and manoeuvrability compared to hostile fast movers.<sup>28</sup> The close air support was provided to ground forces by AC-130 during 'Operation Anaconda'.<sup>29</sup>

Afghanistan operations drew a lot of lessons for the effective use of transport platforms in the mountainous regions. The transport aircraft with its long endurance, can successfully negotiate ground threats and rugged terrains to undertake close air support operations. Transport aircraft, if modified into gun-ship aided with a felicitous Self-protection Suite, could effectively neutralise enemy strongholds.

Rapid advancements in technology have resulted in the unprecedented use of the electronic spectrum in warfare. The ripples in the global order and attempts to usurp control of the battlespace have witnessed an increased acquisition and reliance on Anti-Access Area Denial systems. This poses a serious challenge to conventional methods of warfare. Remotely Piloted Aerial (RPA) platforms are among the harbingers of technology shaping modern warfare.<sup>30</sup> Micro RPAs, Medium Altitude Long Endurance RPAs, and Conventional RPAs can be air-dropped remotely by C-130J aircraft, avoiding enemy Air Defence (AD) radar<sup>31</sup> while circumventing the speed-range conundrum of RPAs. The profusion of RPAs attacking vital High Value Air Assets is truly alarming, given the simplicity and cost involved in offensive action. The destruction of four Russian IL-76 aircraft on the ground by the Ukrainian RPAs forces military commanders to rethink strategies and tactics due to the heightened vulnerability of air assets on the ground.<sup>32</sup>

While C-130s delivering Directed Energy Weapons through a turret known as the Advanced Tactical Laser<sup>33</sup> is already an operational reality, the US Defence Advanced Research Project Agency has demonstrated the ability to launch and recover lowcost gremlins (swarms of drones) from a C-130J.<sup>34</sup> Raytheon has recently deployed Miniature Air-Launched Decoy (MALD) and MALD-X decov/jammer missiles from C-130 to deceive missile defence systems<sup>35</sup>, displaying capability to counter the multi-mode, overlapping, multilayered network of seemingly impregnable electronic order of battle of adversary employing the 'humble', 'domesticated' transport platform.<sup>36</sup> From the traditional radarconfusing metal chaff, the MALD offers a small, inexpensive decov to counter AD measures, carrying electromagnetic transmitters capable of simulating virtually any aircraft. Along the northern borders, these decoys can be launched from their own territory, programmed to ingress into enemy territory and provoke the activation of enemy radars and Surface-To-Air Missiles (SAMs), thereby revealing vital Electronic Warfare (EW) data crucial to successfully waging an EW battle. These roles performed by transport platforms require minimal modification and yield exponential results, auguring new horizons for transport aircraft in combat and shattering the glass ceiling of a 'Combat Supportcentric' approach and the limited originality of commanders.

Additionally, transport platforms may also be employed to deliver cluster munitions or mines to stymie the adversarial ground movement along a particular axis or valley, especially when coupled with armoured/mobile elements. These tactics would provide a vital time-window for their own corps of engineers to undertake extensive mining, unhindered and outside the reach of enemy fire, as evidenced by operations in Afghanistan. In the Indian context, these tactics, would impede the progress of High-Mobility Combined Arms Battalions<sup>37</sup> in the mountainous regions, and thus, deny critical capability to adversary. Such tactics can effectively shape the battlefield to one's choosing and can have a strategic impact on the overall contest. The USAF has developed a method for rapidly converting a C-130J Super Hercules into a temporary bomber.<sup>38</sup> The method involves loading the C-130J with cruise missiles bundled onto cargo-type pallets. A similar system can also be employed on the C-17 giving an increased opportunity to deliver precision missiles on enemy targets. The system termed 'Rapid Dragon' was successfully tested with minor aircraft modifications.<sup>39</sup>

#### Challenges of Transport Operations in High Altitude

• **Terrain.** Despite the high-density radar network coupled with long range SAMs deployed by the PLA, the limited effectiveness in terms of detection and engagement due to high terrain and river valleys in the northern and eastern sectors regions renders the IAF an advantage.<sup>40</sup>



Map 7: General Terrain and valleys along Northern Sector<sup>41</sup>



Map 8: General Terrain and valleys along Sikkim Sector<sup>42</sup>





• **Reduced Engine Performance.** Aircraft engines produce less thrust at high altitudes due to lower air density. resulting in longer take-off and landing distances at high-altitude airfields.<sup>44</sup>

• **Weather.** High-altitude regions experience rapidly changing weather conditions, including turbulence, thunderstorms, and icing.<sup>45</sup>

• **Aeromedical aspects**. Acclimatisation is essential for the personnel operating in these areas; otherwise, they may become prone to altitude sickness and lack of oxygen.<sup>46</sup>

# Change in People Liberation Army Air Force (PLAAF) Tactics in High Altitude Areas

As stated in the 2015 Chinese White Paper on 'China's Military Strategy'47, China capitalised on the soaring economy to fund its defence modernisation program. Significant emphasis was placed on transforming the PLAAF into an integrated air-space force making it capable of undertaking both defensive and offensive operations across mediums. The PLAAF, taking cues from the network centric warfare of the US, has expanded both in numbers, sophistication and employment strategy significantly. In its southern boundaries with India, it has analysed its limitation regarding aircraft operations and dense network of multi-layered, multi-spectral AD network<sup>48</sup> has been its response. The Chinese disposition of AD systems in the northern sector are likely<sup>49</sup> to be Hong Qi (HQ)-6, HQ-17A, HQ-16, HQ-9B, HQ-7 and HQ-22. Additionally, China has also deployed an overwhelming network of radars.<sup>50</sup> Including but not limited to YLC-2/YLC-2A/YLC-2V, High Guard, JL3D-90A, JY-29, LLQ120, JYL-1, JY-27 and YLC-4.

#### Present Capability in IAF

The various transport platforms currently in the IAF inventory and their roles and capabilities including Air to Air Refuelling are depicted in the table below:

Aircraft	Airdrop	Airland AAR		EW/Airborne Warning and Control System	
AN-32 <sup>51</sup>	Yes	Yes	No	No	
C-130J <sup>52</sup>	Yes	Yes No		No	
IL-76 <sup>53</sup>	Yes	Yes No		No	
C-17 <sup>54</sup>	Yes	Yes	No	No	
IL-7855	No	No	Yes	No	
IL-76 AWACS⁵6	No	No	No	Yes	
HS-748⁵7	No	No	No	Yes	
DO-22858	Yes	Yes	No	No	
C-295 <sup>59</sup>	Yes	Yes	No	No	
EMB- 145 <sup>60</sup>	No	No	No	Yes	
A-32161	No	No	No	No	

 Table 2: Transport Aircraft of IAF<sup>62</sup>

Aircraft	C-130 J	AN-32	Do-228	IL-76	C-17	C-295
Maximum Take off Weight in tons	74	27	6.4	190	265	23
Payload in tons	19	6.7	1.2	43	74	8.8
Personnel	128	50	10	225	188	70
Troopers	75	40	15	126	102	49
Stretchers (patients)	97	24	02	80	90	24

Table 3: Comparison of Capability: IAF Transport Aircraft

From Table 2 it can be deduced that the tactical and strategic platforms capable of carrying out airborne assault and other tactical operations are Do-228, An-32, C-130J, IL-76 and C-17 and the newly acquired C-295. Table 3 enumerates operational capabilities of these aircraft.

#### **Mission Planning Considerations**

The challenging terrain and inhospitable regions along the northern borders present significant difficulties for transport operations. However, these conditions also offer a strategic advantage by creating natural barriers that enhance security and defensive capabilities. The operations of transport aircraft along the border are assessed to evaluate their vulnerabilities and survivability.

• **Vulnerabilities**. A typical transport aircraft possesses several vulnerabilities that must be acknowledged before determining the appropriate mission package. These vulnerabilities include:

- Low max speed.
- Large radar and visual signature.
- Limited manoeuvrability.
- Long trails.
- Limited self defence capability.

• Enhancing Survivability of Transport Aircraft. Given the inherent vulnerabilities faced by transport aircraft, several factors must be considered to enhance survivability and ensure mission accomplishment: • Unpredictable and fast developing weather phenomenon.

• Treacherous terrain with narrow and blind valleys with limited or no manoeuvring space.

• Limited radar coverage and communication with own forces.

• **Survivability.** With the inherent vulnerabilities that a transport aircraft is subjected to, following factors need to be considered for increasing the survivability and therefore, mission accomplishment.

- Degree of control of air.
- Accurate Intelligence.
- Tactical Navigation.
- Protector force and composite offensive aircraft package.
  - Radar cover.

• **Terrain.** While terrain can significantly impact the safety of aircraft, it can also present operational advantages. Flying below the crest level through valleys and evading enemy radar due to limited scanning capabilities can lead to delayed detection and create a shock effect on the adversary.

• Self-Contained Navigation System. Aircrafts like C-130J, C-17, C-295, Do-228 have 'State of Art' navigation system, sustainable even during Global Positioning System (GPS) jamming scenario, increasing mission accomplishment rate.

• **Survivability Enhancement**. The following capabilities can enhance the survival of transport platforms:

- Advanced identification friend or foe.
- Radar warning receiver.
- Missile approach warning system.
- Accurate autonomous navigational suite.
- Secure communication.
- Night vision devices.
- Electronic counter measure pods.
- Low radar cross section.

• Directed infra-red counter measure/Large aircraft infra-red counter measure.

- Multiband chaff.
- Cockpit armour.
- Force packaging.
- Route planning and launch bases.
- Timing of operations.
- Holding patterns, assembly areas and radio telephony procedures.
- Rapid Turnaround Operations.

**Operations Envisaged by IAF Transport Fleet.** The operations anticipated by the IAF transport fleet include:

- Air maintenance by air landed operations.63
- Proposed emergency landing fields operations.<sup>64</sup>





- Inter valley troop transfer.<sup>66</sup>
- ISR missions.<sup>67</sup>
- Combat search and rescue.68
- Tactical routine transport role.
- Special air operations.<sup>69</sup>
- Casualty evacuation.<sup>70</sup>

#### Outlook for Future

To reshape future tactical operations, certain employment philosophy adaptations may be affected in future CONOPS as follows:

• The evolving operational philosophy to employ transport fleet for roles other than conventional 'Support-centric' roles such as airlift of troops and equipment in and out of theatre of operation.<sup>71</sup>

• Mixed formations flying comprising of various transport platforms such as C-130J, An-32, Do-228 and C-295 should be prioritised. Such capabilities will aid in launching multiple missions exploiting complementarity of accurate navigational performance, high situational-awareness and achieve requisite mass over objective area.

• Retrofitting for NVD operations for IL-76, An-32 and Do-228. This will provide impetus for night operations

• Retrofitting navigation systems with Indian constellation receivers in IAF aircraft to forestall GPS jamming.<sup>72</sup>

• The use of transport platforms for the carriage of high power jammers to counter dense enemy EW environment in the roles of stand-off-jammer to accord crucial defence to other aerial platforms as well as the advancing surface forces.<sup>73</sup>

• Dedicated training on simulators, replete with accurate elevation modelling, is necessary to fully exploit operational capability inherent in modern transport platforms and undertake realistic mission preparation.

• One of the changes carried out by the PLAAF was realignment of Airborne corps. The PLAAF Airborne Corps<sup>74</sup>, which serves directly under the PLAAF Headquarters, cancelled its earlier designation of the 15<sup>th</sup> Corps that carried a strong imprint of the army to further reinforce the concept of an independent arm of service within the air force. The establishment and command of the new airborne troops also have been adjusted into three tiers, which includes corps, brigade and battalion.<sup>75</sup> This allows the PLAAF airborne corps to act as a principal force employed for independent campaign

missions and presumably used for pre-emptive attack on enemy airfields. Under the corps, the airborne division have various special units, including weapon controller, reconnaissance, infantry, artillery, communications, engineering, chemical defence and transportation of soldiers.<sup>76</sup>

• The use of C-130J as 'Take charge and move out' mission is already well documented.<sup>77</sup> Though study of such missions falls outside the scope of this paper, a related functionality that is airborne command and control support will provide for critical force-enabling especially if adversary has been able to severely impede information/communication systems of own forces. This functionality can be exploited on existing platforms of IAF like C-130J, which can act as an airborne command post using 'Jackpot System'<sup>78</sup> which is a roll-on roll-off communications package.

## Conclusion

The enduring India-China border dispute, rooted in historical complexities and territorial sensitivities, underscores the critical importance of air power in contemporary military strategy. The operational history of the IAF illustrates its evolution in response to the challenges posed by high-altitude warfare and the changing dynamics of regional security. From the airlift operations during the 1962 Sino-Indian War to modern advancements in transport capabilities, the IAF has demonstrated a remarkable ability to adapt and innovate.

The lessons gleaned from past conflicts and the integration of advanced technologies in transport aircraft have paved the way for a more versatile and responsive air mobility strategy. As the geopolitical landscape continues to shift, characterised by China's increasing assertiveness and the ongoing modernisation of its military capabilities, India must remain vigilant and proactive in enhancing its air operations. This includes rethinking traditional roles of transport aircraft, emphasising multi-domain operations, and leveraging new technologies to ensure operational effectiveness.

### Endnotes

<sup>1</sup> Joe Thomas Karackattu, 3 How Britain, Tibet and China actually chalked out claim lines at the 1914 Simla conference6, *The Economic Times*, 27 Mar 2014, accessed 21 Aug 2023. https://m.economictimes.com/opinion/ et-commentary/ <sup>2</sup> *Civil Aspirant* "Birth of McMahon line" 05 Jul 2020, accessed 21 Aug 2023.

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<sup>3</sup> Ministry of Home Affairs, *Management of Indo-China Border*, May 05, 2017, accessed 21 Aug 2023.

https://www.mha.gov.in/sites/default/files/INDO%20CHINA\_05052017.pdf

<sup>4</sup> "India-China clash: 20 Indian troops killed in Ladakh fighting" BBC News 16 Jun 2020, accessed on 21 Aug 2023. https://www.bbc.com/news/world-asia-53061476

<sup>5</sup> Josy Joseph, "What is the Doklam issue all about?" *The Hindu* 27 Jan 2018, accessed 22 Aug 2023.

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<sup>6</sup> The Gale Review. https://review.gale.com/wp-content/uploads/2021/08/Liping-McMahon-line-Map-768x541.png

<sup>7</sup> https://www.Kashmir.net/2020

<sup>8</sup> Sikkim Maps https://www.freeworldmaps.net/asia/india/sikkim

<sup>9</sup> DP Ramachandran, The Border war with China" Book Empire's first Soldiers (Indian Defence Review, 2018))

<sup>10</sup> Lt Gen Prakash Menon and Anirudh Kanseti, "China, India and Doklam in 2020", Takshashila Institution 2021.

<sup>11</sup> Prabhash K Dutta, "Graphical representation of Galwan clashes" in India Today, 2020

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<sup>12</sup> Dr. Rajeev Sachdeva, "The Versatile Transport Fleet of the IAF" *SP's Aviation* September 2022, accessed 09 Sep 2023.

https:/www.sps-aviation.com/story/?id+3185&h+The-Versatile-Transport-Fleet-of-the-IAF

"To save the airfield from imminent capture by advancing Lashkars from Pakistan. The Dakotas flew incessantly for three weeks without oxygen and de-icing equipment, both considered an absolute necessity for operations at high altitudes and cold weather. Poonch would have fallen by early 1948 had it not been for the timely action by the IAF's transport fleet."

<sup>13</sup> VK Ahluwalia, AN Jha, "Defence of the east lies in the west, Pakistan's miscalculations" *CLAWS*, accessed 09 Sep 2023. https://www.claws.in/assets/upload/WEB-ARTICLE-WAR50-YEARS.pdf

"To foil this attempt, Air Cmde Mehar Singh led the first air- landed task force into Leh as Dakotas from 12 Squadron opened an air-bridge to Leh by ferrying in two hundred and fifty soldiers and saved Leh."

<sup>14</sup> Manmohan Bahadur, "It's a myth IAF wasn't used in 1962 war" *The Print* October 23, 2022, accessed 09 Sep 2023.

https://theprint.in/opinion/its-a-myth-iaf-wasnt-used-in-1962-war-helicopterand-transport-fleets-were-deeply-involved/1179119/

"C-119 Packet aircraft operated to and from the unpaved strip situated at 17,000 feet; and these operations continued even in the face of enemy ground fire which caused 19 bullet holes in a Packet aircraft, the aircraft however recovered safely at Chandigarh."

<sup>15</sup> Prakhar Gupta, "This day in 1962: when India airlifted tanks to Ladakh's Chushul to halt the invading Chinese army" *Swarajya* 25 Oct 2018, accessed on 08 Sep 2023.

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<sup>16</sup> "On Republic Day, IAF to mark Tangail airdrop , Meghna Crossing of '71" *The Tribune*", 18 Jan 2022,

https://www.tribuneindia.com/news/nation/on-republic-day-iaf-to-marktangail-airdrop-meghna-crossing-of-71-362120, accessed September 9, 2023

<sup>17</sup> The Tangail Airdrop: A landmark operation in 1971 Indo-Pak war, Aviation and Defence Universe, accessed 09 Sep 2023.

https://www.aviation-defence-universe.com/tangail-airdrop-landmarkoperation-1971-indo-pak-war/

"The objective of the paradrop was to capture the Poongli Bridge on the Jamuna River to cut off the retreating 93 Brigade of the Pakistan Army that was moving back from Mymen Singh to reinforce the defences of Dhaka."

<sup>18</sup> Dr. Rajeev Sachdeva, "The Versatile Transport Fleet of the IAF" *SP's Aviation* Issue September 2022, accessed on 09 Sep 2023.

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"In the next wave, a Pakistani artillery concentration around the Haji Pir pass was attacked, and based on intelligence inputs, a Pakistani artillery brigade was wiped out." <sup>19</sup> Dr. K Chandradeva, "Operation Poomali" *Ilankai Tamil Sangam,* June 2007, accessed 09 Sep 2023.

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"In Sri Lanka on 04 Jun 987 in support of Tamil Tigers during the Sri Lankan Civil War. The operation involved five An-32s of the Para Training School in Agra, escorted by five M2000s."

<sup>20</sup> AK Tiwary, "No Use of Combat Air Power in 1962" *Indian Defence Review,* 02 May 2016, accessed 09 Sep 2023.

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"The IAF's transport fleet consisted of DC-3 Dakota, Ilyushin-14, C-119 Packet, Otter light transport and limited number of AN-12 medium lifters"

<sup>21</sup> James H. Donoho, "An Analysis of Tactical Military Airlift", (Captain, USAF 1997) October 08, 1997 p 1-2,

https://apps.dtic.mil/sti/tr/pdf/ada329935.pdf, accessed 09 Sep 2023.

"During World War I, an American unit, the 2nd Battalion of the 308t' infantry, was cut off and surrounded by the Germans. This unit, known as the "Lost Battalion," was supported by the 50th Aero Squadron for three days before it was rescued."

<sup>22</sup> Office of the Historian, Dept of State, USA, 09 Sep 2023. https://www.history.state.gov/milestones /1953/60/ dien-bien-phu

<sup>23</sup> Connor Fridersdorf, "Battle of Khe Sanh and its Retellings", The Atlantic,27 Jan 2018, accessed 10 Sep 2023

https://www.theatlantic.com/politics/archive/2018/01/the-battle-of-khe-sanhand-its-retellings/ 551315

<sup>24</sup> Avinash Chikte "How Paradrop Became A Game Changer At Tangail During The Bangaldesh Liberation war 1971" *India Times,* December 10, 2021, accessed August 24, 2023.

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<sup>25</sup> Suren Ratwatte "Operation Poomalai" *Medium*, March 12, 2022, accessed August 24, 2023.

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<sup>26</sup> Edgar O' Balance, *Afghan wars*, rev. ed. (London: Brassy's 2002), p 60.

<sup>27</sup> Lieutenant Colonel Andrew Roe, "Pink's War-Applying the Principles of Air Control to Waziristan 9 March to 1 May 1925," in *RAF Air Power Review*, Vol 13 No 3 Autumn/Winter 2010. p 102,

http://www.airpowerstudies.co.uk/, accessed August 31, 2023.

<sup>28</sup> Benjamin S Lambeth, Air Power Against Terror: America's Conduct of Operation Enduring Freedom, (Santa Monica, CA: RAND Corporation,2005), p.59.

<sup>29</sup> Headquarters United States Air Force, AF/XOL, Operation Anaconda: An airpower Perspective, (Headquarters United States Air Force, 7 February 2005), p.6,34 at http://www.af.mil/shared/media/document/AFD-060726-037.pdf, accessed August 30, 2023. "The fixed wing aircraft flew an average of 65 CAS sorties a day, dropping almost 3500 bombs, a majority of them precision weapons. The preplanned CAS eventually came to exceed the immediate CAS missions gradually. The important lesson derived from 'Operation Anaconda' was the under-utilisation of fixed wing assets initially due to insufficient and incorrect ISR. Post 'Operation Anaconda', the ISR facilities in the region improved, the AC-130 could get live video feed from RQ-1 Predator. Similar operations (Op Tidal Wave II) were carried out by AC-130 to carry out deliberate strikes on high impact targets in all elements of ISIS's oil supply chain, refineries, transportation and distribution in October 2015. The concept of Joint Precision Airdrop System (JPADS) which was evolved during this time, permitted the deliverables to land in limited areas. The fixed-aircraft could easily negotiate through MANPADs resulting in less fixed-wing being shot down."

<sup>30</sup> Eado Hecht, "Drones in the Nagorno-Karabakh War- Analysing the date" *Military Strategy Magazine* Vol 7 issue 4, 31-37 winter 2022. https://www.militarystrategymagazine.com/article /drones-in-the-nagornokarabakh-war-analysng-the-data, accessed September 8, 2023

<sup>31</sup> Erdemli, Mustafa Gokhan et al., (California: Naval Postgraduate School,2009), p.78.

<sup>32</sup> Erin Snodgrass, "Four Russian IL-76 Transport Planes Were Damaged in a fiery Blaze after a Ukrainian Drone Strike hit a Russian airfield more than 400 miles from the Border." *Business Insider India*, September 01, 2023,

https://www.businessinsider.in/international /news/four-russian-il-76transport-planes-were-damaged-in-a-fiery-blaze-after-a-ukrainian-drone strike-hit-a-russian-airfield-more-than-400-miles-from-the-border/ articleshow/103262821 accessed September 8, 2023.

<sup>33</sup> Erdemli. Mustafa Gokhan et al., (California: Naval Postgraduate School,2009), p.151.

<sup>34</sup> Defense Advanced Research Project Agency (DARPA)," Gremlins on Track for Demonstration Flights in 2019," (DARPA Outreach, 9 May 2019), https://www.darpa.mil/news-events, accessed September 8, 2023.

<sup>35</sup> "Raytheon Deploys MALD Airframe from C-130 Cargo aircraft" *Air force Technology,* May 30, 2011, at

http://airforce-technology.com, accessed September 6, 2023.

<sup>36</sup> "Miniature Air Launched Decoy" DARPA,

https:/www.darpa.mil/about-us/timeline/miniature-air-launched-decoy, accessed September 9, 2023.

<sup>37</sup> Joshua Arostegui, "An Introduction to China's High-Mobility Combined Arms Battalion Concept"

https://www.moore.army.mil/infantry/magazine/issues/2020/fall/pdf/ 5\_ARosteguiHIMOB\_txt.pdg

<sup>38</sup> Kyle Mizokami, "The Air Force Discovered how to turn cargo planes into bombers" *Popular Mechanics*, May 24 2021,

https://www.popularmechanics.com/military/aviation/a36492032/how-airforce-turns-cargo-planes-into-bombers/, accessed September 7, 2023

<sup>39</sup> George M Moore, "Rapid Dragon: the US military game-changer that could affect conventional and nuclear strategy and arms control negotiations". *Bulletin of the Atomic Scientists*, August 04, 2023, https://www.thebulletin.org/2023/08/ accessed September 8, 2023

<sup>40</sup> The mountain ranges from Ladakh to Arunachal include Karakoram, Ladakh, Zanskar, Dhaula Dhar, Shivalik in the North and Tiger, Dafla, Miri, Abor and Mishmi, Namcha Barwa and Saramati hills in the East. In the Northern sector, valleys of Shyok and Nubra via Saser La pass, Indus valley via Nyoma and Fukche, further in the South Spiti and Sutluj valley, Bhagirathi and Alaknanda valley in Uttarakhand region give an access to ingress into Aksai Chin region. Elevation of the valley floor in this region is approximately 11,000 feet and rising up to 13,000 feet. The mountain crest heights are ranging from 15,000 to 22,000 feet and peaks such as Saser Kangri up to 25,000 feet depicted in Map 7. In the Eastern sector, the terrain heights are relatively lower and starting from Chumbi valley; the hills ranging from 5000 feet to 7000 feet and rising high to 13000-15000 feet close to LAC depicted in Map 8. Further moving Eastwards in the Kamla valley and Subansiri valley, the crest heights at valley entry are from 5000-8000 feet and rising to 12,000-14000 feet towards North. Further eastwards towards Tuting, Dihang valley the crest heights are 7000-10000 feet rising up to 12000-14000 feet. East of Tuting are Mathun Valley, Enzon valley and Dri valley. Lastly in the Fish Tail I and Fish Tail II east of Tezu Delai and Lohit valleys, the crest heights are starting from 7000-10000 feet

and rising northwards up to 12000-14000 feet. The general terrain in Eastern sector is depicted in Map 9.

<sup>41</sup> Tessa DEM elevation Topographic Map, https://en-gb.topographic-map.commap42tf/india.

<sup>42</sup> Tessa DEM elevation Topographic Map, https://en-gb.topographic-map.com-map-42tf/india.

<sup>43</sup> Tessa DEM elevation Topographic Map, https://en-gb.topographic-map.com-map-42tf/india.

<sup>44</sup> Ashish Singh," Airpower in Mountains" (Graduation, School of Advanced Air and Space Studies Air University 2012), p4

<sup>45</sup> Ibid, p. 6.

<sup>46</sup> Ibid, p. 5.

<sup>47</sup> China's Military Strategy (2015) James Foundation, p 4

<sup>48</sup> Andrew S Erickson, interview by Greg Chaffin, Building an Active, Layered Defense, September 10, 2012

<sup>49</sup> John C. Wise et al, "PLA Air Defence Radars" *Air Power Australia*, https//www. ausairpower. net/APA-PLA-IADS-Radars.html#mozTocid 536320, accessed August 10, 2023

50 Ibid.

<sup>51</sup> Antonov 32, *Flugzeg info net*, https://www.flugzeuginfo.net/acdata\_an32, accessed August 24, 2023.

<sup>52</sup> https://www.lockheedmartin.com/en-us/products/c130/c-130j-30-superhercules.html accessed August 24, 2023.

<sup>53</sup> https:/www.britannica.com/technology/ilyushin-il-76 accessed August 24, 2023.

<sup>54</sup> https:/www.af.mil/about-us/fact-sheets/display/article/1529726/c-17-globemaster-iii/ accessed August 24, 2023.

<sup>55</sup> https://www.team-bhp.com/news/explained-tranposrt-tankerreconnaissance-aircrafts-iaf ,accessed August 31, 2023.

<sup>56</sup> Staff reporter, "IAF deploys AWACS in air exercise" *The Hindu* October 20, 2010 https://www.thehindu.com/news/national/IAF-deploys-AWACS-in-air-exercise/article15786745 .ece/amp, accessed August 24, 2023

<sup>57</sup> https://www.firstpost.com/explainers/glorious-history-of-iaf-avro-748-9948281.html/, accessed August 24, 2023. <sup>58</sup> https://hal-india.co.in/product\_detials.aspx?, accessed August 24, 2023.

<sup>59</sup> https://www.airbus.com/en/products-services/defence/military-aircraft/ c295, accessed August 24, 2023.

<sup>60</sup> https://www.sps-aviation.com/story/?id=, accessed August 24, 2023.

<sup>61</sup> https://www.100knots.com/air-india-transfers-4-airbus-a321s-to-drdoand-iaf-for-netra-mk2-aewcs-project, accessed August 24, 2023.

<sup>62</sup> Ananth Iyer, "Explained: Transport, Tanker, Reconnaissance Aircrafts of the IAF, https:// www. team-bhp.com/news/explained-tranposrt-tanker-reconnaissance-aircrafts-iaf, accessed August 24, 2023.

<sup>63</sup> Doctrine of the Indian Air Force (IAP2000-22), 62. "Air maintenance operations by the transport fleet of the IAF are undertaken in support of troops and civilian's population in far flung areas and inhospitable terrain conditions in the North and North Eastern part of the country."

<sup>64</sup> Ibid, p. 62. "Presently the government is planning to construct the Arunachal frontier highway that would cover the entire McMahon Line similar to Darbuk-Shyok-Daulat-Beg-Oldie (DSDBO) Road depicted in Map 10. ELF operations may be undertaken on these roads. These ELFs would provide desired flexibility and redundancy in terms of operating surfaces available. A similar study of identifying potential ELFs in enemy area and surveyed in near-real time during conflict may also facilitate utilisation of such ELFs for covert/clandestine insertion of SFs."

<sup>65</sup> Kuldip Singh, "DSDBO Road from Leh to DBO", China's Intrusion in Ladakh was not treachery but surprise, and it shouldn't have been one, https://m.thewire.in/article/secutrity/ladakh-china-intrusion-dsdbo-road-indian-army/amp.

<sup>66</sup> ibid p. 62. Helicopters and fixed wing aircraft can be combined to enable rapid insertion or transfer of troops into forward locations, ALGs and inter valley troop transfers (IVTT) in mountainous terrain enhancing the flexibility of surface operation for immediate change of sector during operations.

<sup>67</sup> Ibid p. 64. The C-130J ac is fitted with 'state of the art' Star Safire III Electro Optical Infra-Red (EO-IR) System. The EO-IR enhances external vision, offers an independent and more importantly, a passive means of surveillance.

<sup>68</sup> Ibid p. 63. C-130Js may be used towards search missions for downed aircrew using EO-IR pod. Such an operation will have to be carried out in coordination with Rescue Platforms (RESPLATs) such as helicopters. Depending on the position of downed aircrew, FAS may be a pre requisite for conduct of such ops due to the large radar signature of the platform

<sup>69</sup> Ibid p. 63. "Special air operations are conducted at any level of conflict to support clandestine and psychological operations. These operations include inserting agents or troops into the enemy occupied territory and may require specialist training such as low-level ingress and landings by using NVDs. Some of these operations may have to be carried out regardless of the total air situation and under conditions not normally considered suitable for air operations. The preferred platform for special air operations would be C-130J due NVD capabilities, advanced avionics and defensive system suite. The remarkable and dramatic aerial rescue by the IAF of 121 Indians from a small airstrip at Wadi Sayyidna about 40 km North of Khartoum in Sudan, with a degraded surface and no navigational approach aids, fuel or landing light stands testimony to the capabilities that IAF transport fleet possesses."

<sup>70</sup> Ibid p. 63. Transport aircraft by virtue of being large bodied, can be fitted with equipment to support large-scale medical evacuation from battle or crisis zones. Casualties are evacuated from the combat zone to a forward casualty clearing area and from there moved to the rear. Aircrafts equipped with Patient Transfer Units (PTU) would greatly enhance the survivability of the patient and would be morale booster for troops.

<sup>71</sup> J Micheal Dahm, "Special Mission Aircraft and Unmanned Systems", John Hopkins Applied Physics Laboratory October 20 P 4

<sup>72</sup> "IAF develops NaviC-based real time aircraft tracking system", 21 July 2023, https://www.thehitavada.com/Encyc/2023/7/21/IAF-develops-NaviC-based-real-time-aircrft-tracking-system.html, accessed September 7, 2023

<sup>73</sup> Akhil Kadidal, "Japan to use C-2 airlifter for stand-off EW aircraft" *Jane S*, 02 May 2022. https://www.janes.com/defence-news/news-detail/japan-to-use-c-2-airlifter-for-stand-off-ew-aircraft, accessed September 7, 2023

<sup>74</sup> Anil Chopra, "Growing Big- Know About Chinese Airborne Forces", *Air Power Asia*, https:// airpowerasia.com/2020/06/09growing-big-know-about-chinese-airborne-forces, June 09, 2020, accessed August 25, 2023.

75 Ibid.

76 Ibid.

<sup>77</sup> https://aviationweek.com/defense-space/aircraft-propulsion/lockheedstudy-if-C-130J-30-ready-tacamo-role, accessed September 9, 2023.

<sup>78</sup> "Unique C-130J unit gets roll on communication package" Air *& Space Forces Magazine,* August 15, 2006, https://www.airandspaceforces.com/ 1050package/, accessed September 9, 2023.