Role of Air Power in Humanitarian Assistance and Disaster Relief Operations

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"The best way to find yourself is to lose yourself in service of others."
—Mahatma Gandhi

INTRODUCTION

The world has seen natural disasters from time immemorial, however, the recent increase in frequency and intensity of disasters and conflicts have shown us the paramount importance of the Armed forces—Army, Navy and Air Force, Non-Governmental Organisations and other institutions and organisations that can carry out humanitarian assistance and disaster relief (HADR) operations. HADR operations have a long history that dates back to ancient civilisations. While the concept of providing aid during disasters has existed for centuries, organised and structured HADR efforts have evolved over time.

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Due to its unique geo-climatic and socio-economic conditions, India is vulnerable, in varying degrees, to floods, droughts, cyclones, tsunamis, earthquakes, urban flooding, landslides, avalanches and forest fires. Out of 36 States and Union Territories (UTs) in the country, 27 are disaster prone. 58.6 per cent landmass is prone to earthquakes of moderate to very high intensity; 12 per cent land is prone to flood and river erosion; out of 7,516 km coastline, 5,700 km is prone to cyclones and tsunamis.[1]

Humanitarian assistance is aid to an affected population that seeks, as its primary purpose, to save lives and alleviate suffering of a crisis-affected population. Humanitarian assistance must be provided in accordance with the fundamental humanitarian principles of humanity, impartiality and neutrality.[2] The Indian government uses "humanitarian assistance" or "disaster relief" to describe initiatives that relieve suffering caused by cyclones, droughts, earthquakes, or floods, among other natural catastrophes. This description is more specific than Western strategists' understanding of humanitarian aid, which often entails aiding affected civilians by conflicts.[3]

In an ever-changing world marked by unpredictable natural disasters, aftermath of fatal conflicts, and humanitarian crises, the need for effective and efficient responses in HADR operations has become paramount. Air power stands out as a critical asset among the various tools available to respond swiftly and provide aid in such situations. Air power utilisation, including both fixed-wing aircraft and helicopters, has proven

1. National Disaster and Management Authority, NDMA Annual Report 2021, p. 1, at https://ndma.gov.in/sites/default/files/PDF/Reports/NDMA-Annual-Report_20-21.pdf
2. Oslo Guidelines, OSLO Guidelines Revision 1.1, November 2007, p. 7, at https://www.unocha.org. Accessed on June 21, 2023.
3. Claudia Meier and C. S. R. Murthy, "India's Growing Involvement in Humanitarian Assistance", *Global Public Policy Institute,* Research Paper 13, 2011, p. 6, at https://www.india_humanitarian-aid_2011.indd+jnu.ac.in. Accessed on June 21, 2023.

to be instrumental in overcoming geographical barriers, facilitating rapid response, and delivering vital supplies and assistance to affected areas.

To give a historical perspective: in ancient times, communities would assist each other during disasters, such as floods or earthquakes, through local mutual support systems. This often involved providing affected individuals shelter, food, and basic supplies. The modern history of organised humanitarian relief began with the establishment of the Red Cross in 1863 by Henry Dunant.[4] The Red Cross aimed to provide medical aid, support, and care to wounded soldiers during armed conflicts and natural disasters. This marked a significant step in formalising HADR efforts and establishing international humanitarian principles. The devastation caused by the two World Wars led to the formalisation and expansion of HADR operations. Organisations like the Red Cross and the United Nations Disaster Relief Organisation (UNDRO) played crucial roles in coordinating relief efforts, providing aid, and facilitating reconstruction in war-torn regions.

Over time, international agreements and conventions were established to guide HADR operations. Notable examples include the Geneva Conventions (1949), which defined the humanitarian rules of war,[5] and the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) established in 1991 to coordinate global disaster response.[6]

4. British Red Cross, "About us", at https://www.redcross.org.uk/about-us/our-history/the-beginning-of-the-red-cross. Accessed on June 22, 2023.
5. International Committee of the Red Cross, "The Geneva Convention of 1949", at https://www.icrc.org/en/doc/war-and-law/treaties-customary-law/geneva-conventions/overview-geneva-conventions.htm. Accessed on June 22, 2023.
6. OCHA, "History of OCHA", at https://www.unocha.org/about-ocha/history-ocha. Accessed on June 22, 2023.

EVOLUTION OF HADR

The evolution of HADR has further improved the efficiency and effectiveness of HADR operations. With advancements in technology, such as satellite imagery, telecommunications, and transportation, HADR operations became more efficient and effective in terms of search and rescue with saving precious lives during cyclones and floods.[7] These developments enabled quicker response, better coordination, and improved aid distribution during disasters.

Countries and regional organisations also developed their own HADR frameworks. For instance, the Association of Southeast Asian Nations (ASEAN) established the ASEAN Agreement on Disaster Management and Emergency Response (AADMER) in 2005 to enhance cooperation in disaster management among member states.[8] Last year, the Quadrilateral security dialogue including the USA, Australia, Japan and India, pushed a constructive agenda by signing into operation guidelines for the HADR in the Indo-Pacific.[9]

The involvement of military forces (their primary objective being to safeguard the borders) in HADR operations gained prominence. Armed forces have the resources, logistics capabilities, and specialised skills necessary for rapid response and rescue operations during disasters. Military organisations now often collaborate with civilian agencies and international partners in

7. Marcin Frackiewicz, "The Use of Satellites in Emergency Response and Search and Rescue", *TS2 Space*, April 2023, at https://ts2.space/en/the-use-of-satellites-in-emergency-response-and-search-and-rescue/. Accessed on June 24, 2023.
8. Association of Southeast Asian Nations, "Overview", at https://asean.org/our-communities/asean-socio-cultural-community/disaster-management-humanitarian-assistance/. Accessed on June 22, 2023.
9. Dipanjan Roy Chaudhary, "Quad Foreign Ministers sign into operation HADR Partnership", *The Economic Times*, September 24, 2022; "Partnership: Quad Foreign Ministers sign into operation HADR Partnership", *The Economic Times* (indiatimes.com). Accessed on June 25, 2023.

HADR efforts. This has increased the civil-military cooperation which enhances the country's capacity building.

CRITICALITY OF AIR POWER IN HADR OPERATIONS

How is Air Power critical in HADR operations? Air power plays a vital role in HADR operations, offering invaluable capabilities that significantly enhance the effectiveness and efficiency of relief efforts.

First and foremost, air power provides rapid response and swift deployment capabilities. In the aftermath of a disaster, time is of the essence in saving lives and mitigating further damage. Air assets, such as transport aircraft and helicopters, enable the rapid transportation of essential personnel, equipment, and relief supplies to the affected areas.[10] By bypassing damaged infrastructure, congested roadways, and inaccessible terrain, air power ensures that aid reaches disaster-stricken areas quickly, thereby increasing the chances of survival and minimising human suffering.

Another critical aspect of air power is its ability to access remote and inaccessible areas. Disasters often strike regions with limited or damaged infrastructure, making ground-based operations challenging or impossible. Air assets, especially helicopters, can access disaster zones that are otherwise unreachable by road or sea. They can land in confined spaces, evacuate stranded individuals, deliver supplies, and provide medical assistance in areas where traditional modes of transportation are impractical.[11] This capability is particularly crucial in reaching isolated communities,

10. RK Yadav, "Facilitating IAF capabilities for HADR operations in the IOR", *Defstrat Magazine*, March 2021, p. 40, Facilitating IAF Capabilities for HADR Operations in the IOR – Defstrat. Accessed on June 22, 2023.
11. Mayank Singh, "Indian Air Force Sets Record with 1910 km helicopter sortie from Chandigarh to Jorhat", *The New Indian Express*, April 12, 2022, Indian Air Force sets record with 1910 km helicopter sortie from Chandigarh to Jorhat. *The New Indian Express*. Accessed on June 23, 2023.

mountainous regions, or flood-ravaged areas, where time is of the essence in providing aid and support.

Air power also enables practical and comprehensive situational awareness. Aerial surveillance and reconnaissance platforms equipped with advanced sensors, imaging systems, and radars provide real-time information on the extent of damage, critical infrastructure, and population concentrations.[12] This valuable data helps decision-makers assess the scale of the disaster, identify priority areas for assistance, and allocate resources effectively. The teams of the Garud para commandos of the IAF and their equivalents from the Navy and the Army might be airdropped at various areas to assess the kind of assistance that the affected people need. They can also locate helipads and even evaluate potential sites for new helipad construction.[13] By obtaining a bird's-eye view of the affected area, air power enhances situational awareness, thereby enabling better coordination, informed decision-making, and optimised resource allocation.

Furthermore, the versatility of air power is unparalleled in HADR operations. Helicopters, with their vertical take-off and landing capabilities, can perform a wide range of tasks, including search and rescue missions, medical evacuations, delivery of supplies, and infrastructure assessment. They can operate in diverse environments, such as densely populated urban areas, rugged terrains, or waterlogged regions, adapting to the specific needs of each situation. Transport aircraft such as Boeing C-17 Globemaster, Ilyushin Il-76, C-130J Super Hercules, Antonov An-32, and Dornier Do-228, on the other hand, provide large payload capacities (up to 77,519 kg of C-17 Globemaster), enabling the swift delivery of bulk relief supplies, such as food, water, medicine, and shelter materials. The ability to conduct multiple

12. Raghu Rajan, "IAF's Humanitarian Missions", *SP's aviation*, December 2013, IAF's Humanitarian Missions (sps-aviation.com). Accessed on June 22, 2023.
13. Ibid.

tasks simultaneously and adapt to evolving circumstances makes air power an indispensable asset in HADR operations.

Moreover, air power offers a unique advantage in reaching international disaster zones. When a catastrophe occurs in a neighbouring country or region, air power allows for rapid deployment of assistance beyond national borders. The ability to transport relief supplies, deploy medical teams, and support evacuation efforts across long distances makes air power crucial in international HADR missions. The IAF, for instance, has played a significant role in providing assistance to neighbouring countries during times of crisis, leveraging its air assets and capabilities to deliver aid and support to those in need. Operation Maitri (2015) in Nepal, Raahat (2015) in Yemen, Sankat Mochan (2016) in Sudan, Vande Bharat (2020), Devi Shakti (2021) in Afghanistan, Ganga (2022) in Ukraine and lastly Operation Dost (2023) in Turkey and Syria are just a few instances of recent years where India has conducted humanitarian operations for either its own citizens or those of other countries, or both, in response to crises caused by civil/military unrest or natural disasters.[14]

Finally, air power brings efficiency and logistical advantages to HADR operations. Airlift operations allow for the transportation of large quantities of relief supplies in a single mission, reducing the overall time and effort required to deliver aid. This efficiency is particularly valuable in situations where ground transportation infrastructure is damaged or when time is critical. Additionally, air power can establish temporary airfields or landing zones and enabling the continuous flow of aid and personnel into disaster-

14. Pradeep Kumar Jena, "India's mature diplomacy in offering humanitarian aid to Dost countries in times of crisis", ET Government.com, February 19, 2023, National Disaster Response Force: India's mature diplomacy in offering humanitarian aid to Dost countries in times of crisis, ET Government (indiatimes.com). Accessed on June 24, 2023.

stricken areas, even in the absence of operational airports or seaports.

ROLE OF INDIAN AIR FORCE IN HADR

The Indian Air Force (IAF) possesses unique capabilities and advantages that set it apart from other armed forces when it comes to HADR operations. One of its key strengths lies in its airlift capabilities, which are supported by a robust fleet of transport aircraft, including the C-17 Globemaster III, C-130J Super Hercules, and IL-76.[15] These aircraft allow the IAF to rapidly transport large quantities of relief supplies, equipment, and personnel to disaster-affected areas, even in remote or inaccessible locations with limited resources.

In addition to its airlift capabilities, the IAF operates a diverse range of helicopters, such as the Mi-17, Mi-26, Dhruv, and Chinook which are well-suited for HADR operations.[16] Helicopters offer the advantage of vertical take-off and landing, enabling them to access disaster-affected areas with limited or damaged infrastructure. Their versatility allows them to perform various tasks like search and rescue operations, medical evacuations, and the transportation of relief personnel and supplies.

The IAF has extensive experience and expertise in conducting search and rescue missions, which are crucial in HADR operations. Equipped with advanced sensors, communication systems, and trained aircrews, the IAF can swiftly locate and extract survivors in disaster-stricken areas. The ability to deploy helicopters and specialised search and rescue teams enables the IAF to save lives and provide immediate assistance during emergencies.

15. Dinakar Peri, "IAF to procure new transport aircraft to replace AN-32", *The Hindu*, February 4, 2023, India section, New Delhi edition. Accessed on June 24, 2023.
16. Mayank Singh, n. 11.

Furthermore, the IAF's airborne surveillance and reconnaissance capabilities play a vital role in gathering real-time situational awareness during HADR operations. Equipped with aircraft carrying advanced sensors, imaging systems, and radars, the IAF can assess the extent of damage, identify critical infrastructure, locate survivors, and monitor the progress of relief operations. This airborne surveillance capability facilitates informed decision-making and efficient resource allocation.

The IAF's readiness and ability to respond swiftly to disasters provide a significant advantage in HADR operations. With strategically located airbases and forward operating locations, the IAF can quickly deploy aircraft and personnel to affected areas. This rapid response capability ensures that relief efforts can be initiated promptly, minimising the response time and maximising the impact of assistance.

Moreover, the IAF's long-range capabilities enable it to undertake HADR operations both within India and in the region. With aircraft capable of long-range flights, such as the C-17 Globemaster III and IL-76, the IAF can deliver aid to distant locations and support international HADR missions such as the recent Operation Dost. This capability is particularly valuable when neighbouring countries require assistance or when India extends support beyond its borders during regional disasters.

Lastly, the IAF's extensive training and operational experience in various environments and scenarios contribute to its effectiveness in HADR operations. Regular exercises such as joint HADR exercise—Samanvay,[17] simulations, and joint training with national and international agencies equip IAF personnel with the necessary skills to operate efficiently in dynamic and challenging situations. The IAF's experience in responding to numerous

17. Press Information Bureau, "Joint HADR Exercise Samanvay-2022", Press Information Bureau (pib.gov.in). Accessed on June 25, 2023.

disasters within India and abroad has helped refine its strategies and approaches in HADR missions.

USE OF TECHNOLOGY IN HADR OPERATIONS

Technological advancements have revolutionised the field of HADR, providing crucial tools and capabilities which enhance the effectiveness and efficiency of the HADR operations.

Technological innovations have led to the development and implementation of early warning systems capable of detecting and forecasting natural disasters such as hurricanes, earthquakes, tsunamis, and floods. By utilising sensors, satellites, and data analysis, these systems provide authorities with crucial time to prepare and issue timely warnings to at-risk populations. Furthermore, remote sensing technologies, including satellite imagery, aerial photography, and drones, have become invaluable for assessing the extent of damage caused by disasters.[18] Geographic Information Systems (GIS) complement these technologies by mapping and analysing affected areas, identifying critical infrastructure, and facilitating effective response planning.[19] GIS also allows for rapid damage assessment by comparing pre-disaster and post-disaster imagery.

In HADR operations, efficient communication and information management play a vital role. Mobile communication networks, satellite phones, and internet connectivity enable real-time communication between relief agencies, responders, and affected communities. Additionally, information management systems are employed to track and coordinate relief efforts, manage logistics,

18. ANM Muniruzzaman, "The Digital Age of HADR: Harnessing Technology for Relief Operations", RSIS Publication, April 2017, at CO17061.pdf (rsis.edu.sg). Accessed on June 25, 2023.
19. Varatharajaperumal T., "Role of GIS in Disaster Management", *Scanpoint Geomatics Limited*, April 2022, at https://www.sgligis.com/gis-in-disaster-management/. Accessed on June 26, 2023.

and share critical information among stakeholders, facilitating a more coordinated response.

Drone technologies/Unmanned Aerial Vehicles (UAVs) have proven to be an indispensable tool in the battlefield and can play a vital role in HADR operations as well. Their aerial surveillance, imagery, and mapping capabilities enable rapid damage assessment, search and rescue operations, and aid delivery planning. UAVs can access hard-to-reach areas, collect real-time data, and assist in identifying the most effective response strategies.[20]

Satellite-based technologies provide valuable data for disaster monitoring, early warning systems, and mapping affected areas.[21] Earth observation satellites provide high-resolution imagery for damage assessment, identifying critical infrastructure, and planning response efforts. Satellite communication systems enable reliable and real-time communication between relief agencies, responders, and affected communities in remote or disrupted areas. Space services and applications provide critical information, communication, and navigation capabilities, improving the effectiveness and coordination of HADR operations, particularly in challenging and inaccessible environments.

Space-based technology can contribute in the prevention, preparation, and early warning, response, and reconstruction phases of the disaster. Remotely sensed data gives information for models and systems that can forecast disasters and give early warnings before they occur. When ground-based infrastructure is disrupted, satellites become even more critical to relief and recovery efforts as they are dependable, quick, and efficient instruments for communication and observation.[22]

20. Marcin Frackiewicz, n. 7.
21. United Nations Office for Outer Space Affairs, "Benefits of Space: Disaster Management", at https://www.unoosa.org/oosa/en/benefits-of-space/disasters.html. Accessed on June 25, 2023.
22. Ibid.

LIMITATIONS AND CHALLENGES IN HADR OPERATIONS

The role of air power in HADR operations is crucial, but it has its limitations and challenges. During HADR operations, a multitude of challenges arise, each presenting unique obstacles that need to be overcome.

Adverse weather conditions, like strong winds and heavy rainfall, restrict air asset usability, making aerial surveys and supply deliveries difficult. Limited availability of air assets during large-scale disasters causes delays in resource allocation and prioritisation. Accessibility issues in remote areas hinder aircraft deployment, although helicopters with vertical take-off and landing capabilities are an option. Safety risks, such as debris and contaminated areas, must be carefully evaluated to protect aircraft and personnel.

Coordination and communication challenges arise when communication infrastructure is damaged, hindering seamless coordination between air assets, ground teams, and relief agencies. The limited payload and airlift capacity of aircraft further complicate operations, restricting the quantity of relief supplies delivered in a single mission.

Airspace management and prioritisation are vital in HADR operations, requiring effective planning and cooperation to avoid congestion among various aircraft. Coordinating with civil administration presents challenges due to communication breakdown and diverse decision-making processes. Establishing protocols and conducting joint training can enhance coordination during high-pressure disaster situations.

CONCLUSION

In conclusion, the role of air power in HADR operations is paramount. Air power provides unique capabilities that enable rapid response, swift deployment, and efficient delivery of relief supplies to disaster-affected areas. The versatility and agility of

aircraft and helicopters allow access to remote and inaccessible locations, reaching those in need when traditional transportation methods are hindered.

Moreover, air power brings invaluable situational awareness through aerial surveillance and reconnaissance, providing real-time information on the extent of damage, critical infrastructure, and population concentrations. This data enables effective decision-making, resource allocation, and coordination among relief agencies, leading to more targeted and efficient relief operations.

The IAF plays a crucial role in HADR operations, leveraging its airlift capabilities and diverse fleet of aircraft. The IAF's extensive experience, expertise, and readiness in conducting search and rescue missions further enhance its effectiveness in saving lives and mitigating the impact of disasters. The IAF's long-range capabilities also allow for international assistance, extending support beyond national borders when required.

However, challenges such as adverse weather conditions and limited availability of air assets need to be addressed to optimise the role of air power in HADR operations. Effective coordination, prioritisation, and investment in infrastructure are essential to overcome these challenges and ensure the efficient utilisation of air power in future relief efforts.

Overall, the role of air power in HADR operations cannot be overstated. Its swift response, ability to access remote areas, situational awareness, and support in search and rescue missions make it a vital component of disaster response and recovery, ultimately saving lives and alleviating suffering.

Appendix: Chronology of HADR Operations by IAF

Ser. No.	Dates	Event	IAF code name for relief operation	Achievements
1.	December 27, 2004	Tsunami	Operation Sea Wave	More than 5,000 people were airlifted. IAF has also airlifted more than 5,000 tonnes of relief material.
2.	June 17, 2013	Flood	Operation Rahat	During these operations, remarkably in 65 days, IAF undertook 3,536 missions airlifted 23,892 civilians and carried 797.589 tonnes of valuable relief material, a Herculean effort by any standards.
3.	June 19, 2013	Flood	Operation Surya Hope	Relief material was extended to 60,000 people who were affected by the flood.
4.	September 10, 2014	Flood	Operation Megh Rahat	Relief and medical assistance to the affected people of Jammu and Kashmir.
5.	April 3, 2015	Yemen crisis	Operation Raahat	More than 2,900 people were evacuated by air from 18 flights including the domestic airlines.
6.	April 25, 2015	Earthquake	Operation Maitri	More than 11,200 people were evacuated and IAF had dropped about 1,700 tonnes of relief material.
7.	July 14, 2016	Civil war	Operation Sankat Mochan	IAF's C-17 Globemaster evacuated 156 people from Sudan.

8.	September 14, 2017	Refugee crisis	Operation Insaniyat	Relief material was given to refugees in Bangladesh and these materials were transported through IAF's transport carrier.
9.	April 3, 2020	Epidemic	Operation Sanjeevani	IAF airlifted 6.2 tonnes of vital medications and medical supplies to the Maldives.
10.	May 8, 2020	Pandemic	Operation Vande Bharat	One of the most significant evacuation operations in the history of HADR operations in India. Vande Bharat mission has facilitated 1.83 cr. passengers.
11.	August 23, 2021	Taliban overtaking the Afghanistan government	Operation Devi Shakti	Around 800 people were evacuated from Afghanistan.
12.	February 26, 2022	War between Russia and Ukraine	Operation Ganga	India has successfully evacuated its 20,000 citizens from Ukraine, which is a big achievement for the Indian Air Force.
13.	February 7, 2023	Earthquake	Operation Dost	India has sent over 135 tons of relief material to Turkey on 5 C-17 IAF aircraft.