

Protecting Humanitarian Workers: The Strategic Use of UAV Technology in Conflict Zones Sabrina Clumeck

Executive Summary

UAVs are becoming increasingly crucial as a means of protecting humanitarian workers exposed to violence. That allows for the location and identification of threats, safe access to areas of conflict, and delivery of assistance without the risk of exposing those involved in that assistance. Their employment presents challenges with considerable cybersecurity risks, high operational costs, legal uncertainties, and possible threats to the trust of local populations. For UAVs to realize their potential of protecting humanitarian missions without impinging on neutrality or trust, clear ethical guidelines, specialized design features, and transparent community engagement are required.

Introduction

Today's humanitarian workers are facing unprecedented violence — including kidnappings, targeted killings, and attacks on aid missions. Protecting humanitarian workers has become a critical challenge for international organizations working in conflict zones. In this context, Unmanned Aerial Vehicles (UAVs) constitute a promising technology for improving safety without losing humanitarian neutrality. This brief discusses how UAVs can help reduce threats to aid workers, the constraints under which their use presents risks, and the circumstances under which their use can support humanitarian action while not increasing the risks.

Humanitarian Neutrality Under Threat

Violence against humanitarian workers, in that sense, is a reflection of the deep failure of state systems during armed conflict. When accountability declines, and parties to the conflict politicize aid, it is deliberately targeted by attack, kidnapping, and harassment. Often, these assaults are strategic rather than accidental casualties that result from conflict dynamics — in an attempt to disrupt the operations of aid delivery, erode trust, and manipulate power structures.

“Such environments strip humanitarian action of international law-protected status and cast aid workers as political actors rather than neutral intermediaries.”

This issue is heavily relevant to peacebuilding and post-conflict recovery. Humanitarian access, in particular, directly makes for higher stability by meeting people's basic needs, supporting opportunities for long-term recovery, and reinforcing community strength. Violence disrupts the delivery of aid, increases grievances, undermines humanitarian principles, and creates new cycles of instability. Attacks against humanitarian workers sap not only



Patrick Brown. Burmese Aid Workers Head into Delta Regions to Hand out One Kg of Rice and Cooking Oil to Each Family. The Aid Was Supplied by Private Donors. Acts of Private Altruism Such as This Have Been Common in Reaction to the Ruling Junta's Lack of an Organised Response. Cyclone Nargis Hit Burma on 02/05/2008. 2001. <https://jstor.org/stable/community.12127469>.

Biography

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the ability to provide immediate relief but also the capacity to lead to political settlement and social reconstruction in the long run. It is, therefore, imperative to understand the forces and consequences of such violence if technologies and strategies are to protect humanitarian space and truly assist in the pursuit of peace.

The Dynamics of Violence Against Humanitarian Workers:

The direct source of violence against humanitarian workers is the breakdown of state structures in conflict zones, leading to weakened governance and the collapse of accountability, resulting in the normalization of the act of kidnapping₁. In these areas, humanitarian action is becoming increasingly politicized and weaponized and thus typically no longer protected under international humanitarian law that provides principles such as distinction and protection from harassment₂.

Armed groups often strategically attack aid workers in ways that follow the logic of the conflict and serve their specific aims₃. These attacks have two destabilizing effects. Violence indirectly disrupts aid delivery, making grievances among the affected populations grow. In Ukraine, unmet needs are aggravated by disrupted humanitarian efforts, which have helped fuel conflict escalation₄. There are disruptions in ac-

cess to food, shelter, and health, and when compounded by a lack of logistics and perennial security risks, the operational capacity of humanitarian organizations goes down.

Debates continue over whether aid provision increases risks₅, but there is wholehearted agreement that interruptions in humanitarian service make for war vulnerabilities. The reduction of trust between humanitarian organizations and the communities that they are serving also increases instability. In many sites where organizations deliver aid, humanitarian actors' public faith is key to civilian resilience in conflict. However, this trust disappears when attacks occur, undermining the view of the neutrality of aid providers. When trust goes away, people are less willing to cooperate with humanitarian assistance because, by extension, they are less willing to cooperate with broader stabilization initiatives₆, which prolongs insecurity.

The direct attacks take conflict dynamics further. Armed groups make humanitarian workers participants in the conflict by deliberately targeting them₇. Attacks on aid workers in Iraq made life-saving assistance there impossible, inflaming tensions and increasing civilian suffering. The removal of critical lifelines, which humanitarian organizations have to withdraw under threat and which are essential for

1 Hoelscher, Kristian, and Jason Miklian. "Conflict, Peacekeeping, and Humanitarian Security: Understanding Violent Attacks against Aid Workers." *International Peacekeeping*, November 29, 2024. https://www.academia.edu/33067556/Conflict_Peacekeeping_and_Humanitarian_Security_Understanding_Violent_Attacks_Against_Aid_Workers.

2 International Committee of the Red Cross (ICRC). "Rule 31. Humanitarian Relief Personnel Must Be Respected and Protected." *International Humanitarian Law Database*. Accessed February 26, 2025.

3 Aid Worker Security Database. "Aid Worker Security Database." Accessed February 26, 2025. <https://www.aidworkersecurity.org/>

4 Nesterenko, H. I., et al. "Analysis of Organizing the Delivery of Humanitarian Aid in Crisis Situations." *Systems and Technologies*. Accessed February 26, 2025. <https://st.umsf.in.ua/index.php/journal/article/view/167>.

5 Donini, Antonio, and Daniel Maxwell. "Remote Management, Effectiveness and Accountability Of ..." *International Review of the Red Cross*, 1 May 2014, [international-review.icrc.org/sites/default/files/irrc-890-donini-maxwell.pdf](https://www.international-review.icrc.org/sites/default/files/irrc-890-donini-maxwell.pdf).

6 Milliken, Jennifer, and Keith Krause. "State Failure, State Collapse, and State Reconstruction: ..." *Wiley Online Library*, 16 Dec. 2002, onlinelibrary.wiley.com/doi/10.1111/1467-7660.t01-1-00247.

7 de Torrente, Nicolas. "Humanitarian Action under Attack: Reflections on the Iraq Experience." *Harvard Human Rights Journal* 17 (May 2004): 1–30. <https://journals.law.harvard.edu/hrj/wp-content/uploads/sites/83/2020/06/17HHRJ1-Torrente.pdf>.



both short- and long-term peacebuilding and humanitarian crises, are threatened₈.

When aid organizations were strategically targeted in Afghanistan, their operational effectiveness and the perception of their remaining neutral decreased, making the conflict landscape worse₉. These are not random but planned out in the game of asymmetric warfare. They destroy government legitimacy to bolster their influence over desperate populations by disrupting aid delivery₁₀.

This rising exposure of humanitarian workers is also an overall increase in humanitarian workers in conflict zones. From 1997 to 2014, the number of aid workers operating in volatile locations increased, leading to more chances of attack₁₁. While the attack rate per capita has remained relatively stable over time, some countries of high risk, such as Afghanistan and Syria, have experienced drastic spikes₁₂.

Another key factor fueling the violence relates to the politicization of aid. While traditionally viewed as neutral, humanitarian organizations are often now seen as the arms of Western governments and their security interests₁₃. For example, in Ethiopia₁₄, any aid workers seen as supporting forces opposing the government came under fire. In Sudan, the same pattern happened: In the beginning, the rebel groups welcomed aid but later restricted it as suspicions grew that political actors were using humanitarian missions for infiltration. Conflict dynamics, such as in the contested areas, as the

power structures shift, also heightened the risk. One becomes believable after the disassociation with humanitarian organizations, as rebel groups that were previously cooperative turned hostile in Darfur as the threat to their authority grew₁₅. Humanitarian presence in such environments becomes wrapped up in local power conflicts in supportive or conflictive ways, as aid flows are interpreted as supporting certain factions or undermining others.

Security failures further aggravate the risk for humanitarian workers. The 2016 Juba attack, when UN peacekeeping and embassies refused to respond to emergency calls, shows how massive the gaps in the protection systems are. Organizations often consider international staff safer than national employees, even though evidence shows that national workers face equal—or even greater—risk₁₆. Further alienating local communities and threatening future humanitarian involvement, these disparities

Case Study: UAVs and Aid Worker Attacks in South Sudan

In July 2016, armed groups stormed the Terrain Hotel compound in Juba, South Sudan, where the humanitarian workers were assaulted. UN peacekeepers made no effort to intervene after being called repeatedly on emergency. Operations failed, and aid staff were assaulted. It laid bare the gross security weaknesses of humanitarian workers and showed how an early notice of a threat could lead to heightened violence. With these, UAVs could act as perimeter monitoring and real-time alerts in volatile contexts such as South Sudan to prevent such tragedies by giving early warning signals and facilitating safer evacuations.

Source: Hoelscher, Kristian, and Jason Miklian. "Conflict, Peacekeeping, and Humanitarian Security: Understanding Violent Attacks against Aid Workers." *International Peacekeeping*, November 29, 2024. https://www.academia.edu/33067556/Conflict_Peacekeeping_and_Humanitarian_Security_Understanding_Violent_Attacks_Against_Aid_Workers

in protection shield the environmental pillars of the military, but the little protection given to the residents is inadequate.

Violence against humanitarian workers is closely related to the patterns of violence and the dynamics of governance and politics. This perpetuates cycles of insecurity and reflects upon them, compromising not just the bit delivery of aid but the chance at peace as a whole. There is, thankfully, academic evidence overwhelmingly supporting this connection, this being that protecting

8 Blomster, Amanda Jenc. *The Western Savior: Making Aid the Enemy*. Accessed February 26, 2025. <https://www.diva-portal.org/smash/get/diva2:1518683/FULLTEXT02.pdf>.

9 Narang, Vipin, and Jessica Stanton. "The Strategic Logic of Attacking Aid Workers: Evidence from Violence in Afghanistan." *International Studies Quarterly* 61, no. 1 (2017): 38–51. <https://academic.oup.com/isq/article-abstract/61/1/38/3821185>.

10 Sellers, Hatti. "Harming Those Doing Good? The 10. Role of Anti-Aid Rhetoric in Explaining Worker Attacks." *Journal of Human Rights* 23, no. 5 (2024). <https://www.tandfonline.com/doi/full/10.1080/14754835.2024.2380702>

11 Wille, Christina, and Larissa Fast. "Security Patterns and Secure Systems Design: Shifting Patterns in Security Incidents Affecting Humanitarian Aid Workers and Agencies." Accessed February 26, 2025. https://www.researchgate.net/publication/220996345_Security_Patterns_and_Secure_Systems_Design

12 Hoelscher, Kristian, and Jason Miklian. "Conflict, Peacekeeping, and Humanitarian Security: Understanding Violent Attacks against Aid Workers." *International Peacekeeping*, November 29, 2024. https://www.academia.edu/33067556/Conflict_Peacekeeping_and_Humanitarian_Security_Understanding_Violent_Attacks_Against_Aid_Workers.

13 Ibid, p-44

14 Halperin, Eran, and James J Gross. "Emotion Regulation in Violent Conflict: Reappraisal, Hope, and Support for Humanitarian Aid to the Opponent in Wartime." *Cognition & Emotion*, U.S. National Library of Medicine, 25 Nov. 2011, <pubmed.ncbi.nlm.nih.gov/22017615/>.

15 Augustine, Joseph. "Exploring the Dynamics of Rebel Territorial Control and Its Impact on Violence Against Aid Workers." Accessed November 1, 2017. <https://www.diva-portal.org/smash/get/diva2:1921658/FULLTEXT01.pdf>.

16 Scott, Emily K. M. "Compromising Aid to Protect International Staff: The Politics of Humanitarian Threat Perception after the Arab Uprisings." *Journal of Global Security Studies* 7, no. 1 (2022).

humanitarian personnel is not simply a moral obligation but a strategic matter, too; it helps with conflict resolution and post-crisis recovery.

Protecting Humanitarian Workers through UAV Technology

Advantages

Attacks against humanitarian workers are increasing, and, in these circumstances, UAVs (Unmanned Aerial Vehicles) are proving to be an essential part of protecting aid operations. UAV refers to pilotless aerial systems capable of navigating remotely or autonomously, with high-resolution imaging, autonomous flight, and real-time data to monitor conflict zones and minimize human exposure¹⁷. UAVs provide safer access and group situational awareness essential in maintaining humanitarian space in very hostile environments where human aid workers face killings, kidnappings, and targeted ambushes.

UAVs were created for military use. However, their use has expanded to civilian and humanitarian works such as surveillance, supply delivery, and monitoring easier to spot threats early and plan safer routes—giving aid convoys a better chance of avoiding danger¹⁸. In border regions characterized by rough terrain and high threat levels—such as the Turkey-Iraq border—UAVs have proven instrumental. Simulations showed that UAVs with the right sensors and flight settings made it easier to spot threats early and plan safer routes—giving aid convoys a better chance of avoid-

ing danger¹⁹. In addition to safe routing, UAVs enable the enhancement of emergency logistics²⁰. Small and medium-sized UAVs have successfully delivered critical medical and food supplies to isolated areas where similar staff have been exposed to a direct risk²¹. In places where traditional access is impossible in highly volatile contexts, drones ensure that life-saving support

Case Study: UAV Deployment Along the Turkey-Iraq Border

A simulation study explored how UAVs could be used to detect hostile actors across the rugged Turkey-Iraq border, an area known for terrorist infiltration and harsh terrain. Researchers tested over 100,000 scenarios using MANA simulation software to evaluate UAV performance under varying conditions. They found that classification range, sensor strength, and flight speed were critical. UAVs flying slower than 250 km/h and equipped with high-resolution sensors were more effective in identifying threats. The analysis also showed that deploying at least three UAVs improved coverage and reduced detection variance. Civilian communication with hostile actors negatively impacted UAV success, suggesting that ISR strategies should be paired with electronic warfare tools. The case highlights how tailored UAV deployment can significantly enhance situational awareness in conflict zones.

Source: Ozcan, Begum Y. "Effectiveness of Unmanned Aerial Vehicles in Helping Secure a Border Characterized by Rough Terrain and Active Terrorists." Calhoun: The NPS Institutional Archive DSpace Repository, June 2013. https://calhoun.nps.edu/bitstream/handle/10945/34717/13Jun_Ozcan_Begum.pdf

continues as they reinforce the humanitarian need to reach vulnerable communities.

Site monitoring and camp protection are becoming more and more important for UAVs. The live video and perimeter surveillance capabilities of UAVs help aid organizations detect incursions, unusual movements, or early signs of attacks without endangerment of personnel²². Aerial surveillance in real-time makes the camps more secure while also being a deterrent against opportunist violence. Additionally, drones can facilitate automatic sight of emerging dangers and notify staff to evacuate or deliver aid deliveries around them when integrated with AI-assisted threat detection²³.

15 Mohsan, Syed Agha Hassnain, et al. "Towards the Unmanned Aerial Vehicles (Uavs): A Comprehensive Review." MDPI, Multidisciplinary Digital Publishing Institute, 15 June 2022, www.mdpi.com/2504-446X/6/6/147.

18 Laghari, Asif Ali, et al. "Unmanned Aerial Vehicles: A Review." Cognitive Robotics, Elsevier, 30 Dec, 2022. <https://www.sciencedirect.com/science/article/pii/S2667241322000258>

19 Ozcan, Begum Y. "Effectiveness of Unmanned Aerial Vehicles in Helping Secure a Border Characterized by Rough Terrain and Active Terrorists." Calhoun: The NPS Institutional Archive DSpace Repository, June 2013. https://calhoun.nps.edu/bitstream/handle/10945/34717/13Jun_Ozcan_Begum.pdf

20 Coiffman, Benjamin. "Ugpti." Surface Transportation Surveillance from Unmanned Aerial Vehicles, 2004, www.ugpti.org/smartse/research/citations/downloads/Coiffman-Surface_Transport_Surveillance_from_UAV-2004.pdf.

21 Borthakur, Anwasha, and Pardeep Singh. "Drones: New Tools for Natural Risk Mitigation and Disaster Response ." Calhoun NPS, May 2013, <https://bit.ly/3Z7e4w9>

22 Nintanavongsa, Prusayon. (PDF) Performance Analysis of Unmanned Aerial Vehicles (UAV) for Improved Aerial Surveillance, www.researchgate.net/publication/370549671_Performance_Analysis_of_Unmanned_Aerial_Vehicles_UAV_for_Improved_Aerial_Surveillance. Accessed 18 Mar. 2025.

23 Luo, Hao, et al. "Traffic Collisions Early Warning Aided by Small Unmanned Aerial Vehicle Companion - Telecommunication Systems." SpringerLink, Springer US, 3 Mar. 2016, 1

Disadvantages

However, UAV capabilities remain limited. Operations of drones are restricted by dense forests, urban slums, and heavy infrastructure²⁴ that interrupts the GPS signal and presents navigation hazards. These, by nature, are environments in which maintaining stability is difficult for drones, and they lack the human negotiation²⁵, trust-building, and local relationship management to replace ground-based humanitarian engagement. These are tools to support—not substitute—the human presence.

Another barrier is cost. Because of the expense of UAVs, training, and maintenance, drone benefits are implemented by larger organizations with logistical support²⁶. Cybersecurity vulnerabilities further complicate matters. UAVs are still prone to hacking, GPS spoofing, and signal jamming, and their lightweight designs can hardly support robust encryption onboard. This sensitive data about humanitarian positions or operations can compromise workers and beneficiaries if UAVs are captured.

Backfires

The challenge is also legal and ethical. Many countries do not have clear regulations on which civilian UAVs can be differentiated from military-grade systems, thus leaving the question of law in humanitarian drones unanswered²⁷. In addition, UAVs have often been linked to war, airstrikes, or surveillance and might occasionally be feared as a threat rather than a tool for assistance²⁸. Since surveys favor using unarmed drones to deliver aid instead of armed military convoys²⁹, confusion between humanitarian and military UAVs could lead to losing neutrality and access.

There have also been ethical considerations related to privacy. Unauthorized aerial surveillance with UAVs may intrude with the dignity and privacy of displaced populations if UAVs are viewed as devices of foreign intelligence, particularly in humanitarian contexts³⁰. For such life-saving missions, transparency, consent,

and data protection are all important factors for public acceptance of UAVs.

However, much about UAV integration in humanitarian settings remains unknown. The long-term effect of drones in those communities is increased psychological stress in already traumatized communities. It also features operational risk in sophisticated, electronically aware environments, i.e., signal jamming and drone takeovers, as of yet unknown³¹ (Ahmed et al., 2022). These vulnerabilities question the reliance on UAV technology in conflict recovery operations.

Although these are all uncertainties, UAVs are a revolutionary step in protecting humanitarian workers and aid delivery in violent contexts. They help strengthen the principles of impartiality and access by providing logistics support, lowering physical risks, and enabling threat detection. However, their use must be done with care, thought, and understanding of the systems' technical capabilities and the social realities of the groups the systems are meant to benefit.

Recommendations:

• *Deploy Only Unarmed, Clearly Marked UAVs*

To ensure the UAV parties are not misidentified with military assets, UAVs used for humanitarian purposes must be marked and strictly unarmed. These clear markings will help maintain the humanitarian principle of neutrality and reduce tensions among populations affected by conflict.

• *Minimize Data Collection and Integrate Auto-Delete Features*

Only essential operational data should be collected by UAVs. If UAVs are lost or hacked; and data protection is to be maintained; they must have automatic built in data deletion protocols to prevent otherwise sensitive data from being captured for misused by hostile actors.

24 Silva, Lucas, et al. "Photo-Realistic and Labeled Synthetic UAV Flight Data Generation Using ROS and Gazebo." IEEE, May 2024, <https://ieeexplore.ieee.org/document/10786455>.

25 Zieliński, Tadeusz. "Challenges for Employing Drones in the Urban Transport Systems." Safety & Defense, 15 Dec. 2022, <https://sd-magazine.eu/index.php/sd/article/view/179>.

26 Shafik, Wasswa, et al. "Cybersecurity in Unmanned Aerial Vehicles: A Review." Sciendo, Sciendo, 18 Oct. 2023, sciendo.com/article/10.2478/ijssis-2023-0012.

27 Rejeb, Abderahman, et al. "Humanitarian Drones: A Review and Research Agenda." Internet of Things, Elsevier, 22 July 2021, www.sciencedirect.com/science/article/pii/S2542660521000780.

28 "Hovering Threats: The Challenges of Armed Drones in Humanitarian Contexts, January 2025 - Myanmar." ReliefWeb, 14 Jan. 2025, reliefweb.int/report/myanmar/hovering-threats-challenges-armed-drones-humanitarian-contexts-january-2025.

29 Soesilo, Denise, and Kristin Bergtora Sandvik. "Drones in Humanitarian Action – A Survey on Perceptions and Applications." FSD, 9 Sept. 2016, blog.werobotics.org/wp-content/uploads/2016/09/Drones-in-Humanitarian-Ac-ion-Survey-Analysis-FINAL21.pdf.

30 Finn, Rachel L., and David Wright. "Privacy, Data Protection and Ethics for Civil Drone Practice: A Survey of Industry, Regulators and Civil Society Organisations." Computer Law & Security Review, Elsevier Advanced Technology, 2 June 2016, www.sciencedirect.com/science/article/abs/pii/S0267364916300887.

31 Ahmed, Faiyaz, et al. "Recent Advances in Unmanned Aerial Vehicles: A Review - Arabian Journal for Science and Engineering." SpringerLink, Springer Berlin Heidelberg, 25 Apr. 2022, link.springer.com/article/10.1007/s13369-022-06738-0.

- *Prioritize Community Transparency and Engagement*

Before drone deployment, humanitarian organizations should interact with local communities to inform them about the purposes of drones, schedules of drone flights, and protective measures they take to safeguard the privacy of people. Transparency breeds trust, removes the fear of drones, and guarantees consent of the community to drone activities.

- *Advocate for Global Standards for Humanitarian Drone Use*

International frameworks regulating the use of UAVs for aid missions have to be established involving humanitarian actors to clearly distinguish humanitarian UAVs from military drones. These frameworks should be promoted at global forums to protect humanitarian space.

- *Adapt UAV Technologies Specifically for Aid Worker Protection*

Drone designs for today are centered on logistics and surveillance. Features such as real time threat alerts, geofencing to no fly areas, secure communications and lighter frames affordable to small NGOs need to be built in such dedicated models.

- *Expand UAV Access for Smaller Humanitarian Organizations*

Support initiatives should fund the development and distribution of low-priced, easy-to-use UAV models for smaller humanitarian groups to take up without enormous financial or technological burdens to ensure equitable protection for all organizations.

- *Conduct Further Research on UAV Impacts in Conflict Settings*

The long-term effects of UAV presence on community psychology, the trust of humanitarian actors, and operational risks in electronic warfare will have to be investigated in future studies. The evidence-based adjustments will guarantee safe and ethical drone integration.