
Aid from the air: A review of drone use in the RCRC global network

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Aug 14, 2020

Contents

Introduction	1
Background	3
What is a drone?	3
How drones are used in disaster response today	4
Regulatory considerations	7
Ethical considerations	8
Summary of findings	10
Timeline of drone use	12
2013	12
2014	12
2015	13
2016	14
2017	15
2018	16
2019	17
2020	18
Drone activities in the network	20
American Red Cross	20
Australian Red Cross	22
Austrian Red Cross	22
Belize Red Cross Society	22
Brazilian Red Cross	23
The Canadian Red Cross Society	24
Colombian Red Cross Society	24
Ecuadorian Red Cross	24
Fiji Red Cross Society	26
German Red Cross	26
Indonesian Red Cross Society	26
International Committee of the Red Cross (ICRC)	27
Italian Red Cross	29
Kenya Red Cross Society	29
Korean Red Cross	30
Lesotho Red Cross Society	31
Malawi Red Cross Society	31
Mexican Red Cross	33
The Netherlands Red Cross	33
New Zealand Red Cross	34

Philippine Red Cross	34
Salvadorean Red Cross Society	35
Senegalese Red Cross Society	36
Spanish Red Cross	37
The Sri Lanka Red Cross Society	37
Tanzania Red Cross National Society	39
The Uganda Red Cross Society	39
Benefits and costs of drone use for disaster response	41
The benefits	41
The challenges	48
What should happen next?	57
Connecting Red Cross Red Crescent drone users	57
Creating trainings and materials	57
Promotion of open source technologies for drone operations	58
Developing organizational standards for drone use	60
Supporting further research into humanitarian drone use	60
Sharing airspace (and information) safely	61
Developing drone logistics	62
Developing methodologies for effective data use	63
Supporting development of humanitarian-friendly drone regulations	63
Conclusion	64
About the Authors	65
Faine Greenwood	65
Dan Joseph	65
Methods	66

Introduction

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<https://americanredcross.github.io/rcrc-drones/>

Unmanned aerial vehicles, or drones, have become an increasingly common sight in disaster response operations around the world. Small, inexpensive consumer drones equipped with cameras can capture high quality photographs and video, create geographically accurate maps, and livestream footage to multiple locations on the ground.

Like many disaster response organizations, National Red Cross and Red Crescent (RCRC) Societies around the world have begun to experiment with using civilian drones to support and streamline their activities and operations. However, up until now, little information existed that attempted to describe or quantify how many RCRC Societies were using drones, or what they were using drones for.

This research project is intended to address this knowledge gap. Our research was carried out using a mixed methods approach, including inquiry within the RCRC network, search engine queries using specific search strings, and 16 telephone or written interviews with RCRC drone users.

The following report is intended to summarize our findings: it is our hope that it will function as a useful source of information that will inform future drone strategy within the RCRC network. The report first provides a brief overview of what drones are and what they are used for in the disaster response sector. It will then list all uses of drone technology by National Red Cross and Red Crescent Societies, the International Federation of Red Cross and Red Crescent Societies (IFRC), and the International Committee of the Red Cross (ICRC) that we were able to identify, alongside brief summaries of their activities and intentions. The discussion portion of this paper, drawing primarily from interview sources, describes some of the benefits and some of the costs of using drone technology for RCRC network activities. Finally, we will put forth suggestions for how the RCRC network might provide support for current or aspiring drone users amongst their members.



Fig. 1: The view from a drone taking off to map in Canaan, Haiti. | Credit: Dan Joseph, American Red Cross.

Background

- *What is a drone?*
- *How drones are used in disaster response today*
- *Regulatory considerations*
- *Ethical considerations*

What is a drone?

The word “drone” is a colloquial term that refers generally to a pilotless aircraft, often controlled remotely and with the assistance of small computers and sensors. The vast majority of drones used in aid and development contexts are very small and inexpensive aircraft, designed specifically for hobby and generally non-military purposes. These small drones usually weigh under 55 pounds (with many popular models weighing under 10 lbs) and can easily be purchased from a variety of retailers around the world. Drones within this small, civilian category fall broadly into two categories: “multirotor” style drones that resemble helicopters, and “fixed wing” drones that resemble remote-controlled airplanes.

The vast majority of the drones used by the National Societies described in this study are small, consumer-focused “quadcopter” style drones (multirotor drones with 4 propellars); these devices are largely manufactured by Chinese drone-maker DJI, which sells its products around the world. These consumer drones are inexpensive (often retailing for less than \$2,000), require little specialized skill to fly, and are generally reliable, making them a popular choice amongst users with less technical experience with model aviation. They carry high-resolution cameras that are capable of collecting both photographs and video. The drones are equipped with GPS receivers that allow the drone to know where it is in space and follow predefined flight paths drawn by the user. Modern multirotor drones use GPS to assign geographic coordinates to each aerial photograph that they take. These aerial photographs can then be combined using specialized software to create highly accurate maps (orthomosaics) and 3D models.

While “delivery drones” are a hot topic in the tech world today, they remain largely experimental for a number of technical and regulatory reasons. This was reflected in our report findings. No National Society described in this study reported using drones for delivery purposes, although some individuals interviewed expressed interest in the future prospect of doing so.



Fig. 2: PMI team prepares a DJI Phantom for launch. | Credit: PMI.

How drones are used in disaster response today

Small, civilian drones have been used to collect data for humanitarian and development purposes since at least April of 2000, when Japanese government researchers used a sensor-equipped Yamaha RMAX helicopter drone to collect information on the volcanic eruption of Mt. Usu.¹ In September 2005, the Center for Robot-Assisted Search and Rescue (CRASAR) used both a fixed-wing drone and a miniature helicopter-style drone to search for survivors in the U.S. South after Hurricane Katrina, in one of the earliest examples of operational drone use during a disaster.²

While drones demonstrated considerable promise in these early disaster response deployments of the technology, they would not become truly easy to use, widely available, or legal to use in most countries until the late 2010s. The 2013 introduction of the DJI Phantom drone and the growing popularity of the DIY drone building hobby combined to launch drones into the mainstream around the world. Drone footage shot by disaster responders after Typhoon Haiyan struck the Philippines in November 2013 sparked considerable international interest in the technology's potential for post-disaster surveying and information gathering.³ Soon, both small and large NGOs began to experiment with flying drones and processing drone-collected data.

The 2015 Nepal earthquake saw what was likely the first wide-scale deployment of drone technology for aid purposes, as numerous small organizations captured images and maps of the destruction. While this response indisputably made drones more visible, the lack of organization amidst pilots at the scene raised questions about how drones should be smoothly integrated into existing humanitarian structures - questions that remain relevant as we write this report in 2020.⁴

¹ Akira Sato. "The RMAX Helicopter UAV." Yamaha Motor Company. September 2, 2003.

<https://pdfs.semanticscholar.org/5d80/faae7d1ffd27422df3ad6e3d08dc6bdb1920.pdf>

² National Science Foundation. "Small, Unmanned Aircraft Search for Survivors in Katrina Wreckage." September 14, 2005.

https://www.nsf.gov/news/news_summ.jsp?cntn_id=104453

³ Friederike Alschner, Jessica DuPlessis, Denise Soesilo, ed. "Case Study No 9: Using Drone Imagery for real-time information after Typhoon Haiyan in The Philippines." FSD. 2016. <https://europa.eu/capacity4dev/innov-aid/blog/case-study-no-9-using-drone-imagery-real-time-information-after-typhoon-haiyan-philippines>

⁴ Patrick Meier. "Humanitarian UAV Missions in Nepal: Early Observations (Updated)." iRevolutions. May 3, 2015. <https://irevolutions.org/2015/05/03/humanitarian-uav-missions-nepal/>

Today, many humanitarian response groups around the world are actively experimenting with drone technology. They are using drones for many different purposes, including post-disaster mapping, creating maps for pre-disaster planning, generating videos and photographs for public relations campaigns, acquiring an “eye in the sky” for situational awareness during chaotic situations, generating 3D models for post-disaster structural analysis, and using high-resolution maps created with drone imagery to monitor swiftly-growing refugee camps.



Fig. 3: Matthew Gibb prepares an Event 38 E384 fixed-wing mapping drone for launch. | Credit: Dan Joseph, American Red Cross.

United Nations agencies have worked with drone technology since at least 2012, when the GIS unit of the International Organization for Migration (IOM) and the National Statistics Office of Haiti used drones to capture high-resolution imagery of slum areas in Haiti, in support of the post-earthquake census there.⁵ Since 2017, IOM has used fixed-wing Sensefly eBee drones to make regular maps of the enormous Kutapalong Refugee Camp in Bangladesh, in an effort to ensure that their understanding of the constantly changing camp environment is up-to-date. IOM regularly uploads the resulting drone data to the Humanitarian Data Exchange website and to the OpenAerialMap imagery repository, where it is publicly available and free to use.⁶,⁷

In 2017, the United Nations World Food Programme (WFP) and the Government of Belgium announced a new initiative exploring drone use in humanitarian aid, with funding provided by the Belgian Development Cooperation: in 2018, Belgium committed \$2.33 million more in funding for WFP’s drone and blockchain programs.⁸⁹ WFP has used drones in a number of real-world projects in the recent past. During the 2017 response to Hurricanes Irma and Maria, WFP’s Panama regional office used a drone to assess housing

⁵ Audrey Lessard-Fontaine, Friederike Alschner, Denise Soesilo, ed. “Case Study No 7: Using High-resolution Imagery to Support the Post-earthquake Census in Port-au-Prince, Haiti.” FSD. 2016. <https://drones.fsd.ch/3615/>

⁶ Pix4D. “Reducing risk: mapping the world’s largest refugee camp.” April 10, 2019. <https://www.pix4d.com/blog/drone-map-refugee-camp>

⁷ “IOM Bangladesh - Needs and Population Monitoring (NPM) Drone imagery and GIS package by camp (September/October 2018).” Humanitarian Data Exchange. 2018. <https://data.humdata.org/dataset/iom-bangladesh-npm-drone-imagery-and-gis-package-by-camp-sept-oct-2018>

⁸ Amy Lieberman. “Q&A: WFP IT director on the role of drones in delivering aid.” Devex. May 28, 2018. <https://www.devex.com/news/q-a-wfp-it-director-on-the-role-of-drones-in-delivering-aid-92812>

⁹ World Food Programme. “WFP And Belgium Start Efforts To Deploy Drones In Humanitarian Emergencies.” February 3, 2017. <https://www.wfp.org/news/wfp-and-belgium-start-efforts-deploy-drones-humanitarian-emergencies>

damage and to gain situational awareness.¹⁰ Since 2017, WFP has used drones to support climate-change mitigation mapping in Colombia, to assess flood vulnerability risk in Mozambique, and has conducted drone workshops and capacity-building exercises in the Dominican Republic, Mozambique, Madagascar, Myanmar, Peru, Colombia, Nepal, Niger, and Bolivia.¹¹¹²¹³

The United Nations Children's Fund (UNICEF) has also committed itself to exploring drone technology in humanitarian aid. As of this writing in 2020, the agency has launched special drone testing corridors, in conjunction with the governments of Malawi,¹⁴ Vanuatu, and Sierra Leone; a fourth is planned in Namibia.¹⁵ In December 2018 in Vanuatu, UNICEF and two commercial drone company partners carried out a successful trial of a vaccine drone-delivery system.¹⁶ UNICEF's innovation fund provides support to drone start-up companies based in developing economies around the world.¹⁷

The Humanitarian OpenStreetMap (HOT) Team is a not-for-profit organization and global community dedicated to humanitarian action and community development through open mapping, helping bring humanitarians into the OpenStreetMap community. HOT has embraced the use of drone imagery in its operations, viewing it as a valuable new source of spatial information. In 2015, HOT relaunched the OpenAerialMap project, an open source platform for hosting openly licensed aerial imagery that permits drone users to easily share and use their aerial imagery; today, it is widely used by disaster response drone pilots. HOT's volunteer mapping efforts during disaster now use both drone imagery and satellite imagery as "base layers" from which online mapmakers can work. Some local HOT teams also build and fly their own drones for data collection, such as HOT Tanzania.¹⁸ A number of National Societies profiled in this study, such as the Indonesian Red Cross Society and the American Red Cross GIS team, regularly use OpenStreetMap and OpenAerialMap as key components of their mapping activities with drones.

The World Bank has been another relatively early-adopter of drone technology in the humanitarian and development sector. In 2015, the World Bank partnered with Swiss drone-NGO Drone Adventures and the Ramani Huria community flood-mapping project¹⁹ to fly drones over flood-prone areas of Dar Es Salaam, Tanzania.²⁰ Analysts used the drone data to update outdated maps of city settlements, and then used those maps to simulate the effects of future floods - affording them a much clearer picture of

¹⁰ Angel Buitrago. "Angel and the drones." World Food Programme Insight. Feb 26, 2018.
<https://insight.wfp.org/angel-and-the-drones-9df0fd407a00>

¹¹ Katarzyna Chojnacka. "Drone technology for community-driven change." World Food Programme Insight. January 8, 2019.
<https://insight.wfp.org/technology-and-community-driven-change-how-innovation-complements-humanitarian-response-in-1e6ba338e976>

¹² Tej Rae. "Drones to the rescue as Cyclone Desmond storms Mozambique." World Food Programme Insight. January 24, 2019.
<https://insight.wfp.org/drones-to-the-rescue-as-cyclone-desmond-storms-mozambique-d7f501e40b0f>

¹³ Katarzyna Chojnacka. "Now all the boats have washed away... to Madagascar." World Food Programme Insight. May 8, 2019.
<https://insight.wfp.org/now-all-the-boats-have-washed-away-to-madagascar-ff93480124f6>

¹⁴ "Drone mapping takes off in Malawi with Pix4D & UNICEF." Pix4D. November 27, 2019.
<https://www.pix4d.com/blog/drone-mapping-training-malawi>

¹⁵ "UNICEF expands network of drone testing corridors." UNICEF. April 25, 2019.
<https://www.unicef.org/press-releases/unicef-expands-network-drone-testing-corridors>

¹⁶ "Child given world's first drone-delivered vaccine in Vanuatu - UNICEF." UNICEF. December 18, 2018.
<https://www.unicef.org/press-releases/child-given-worlds-first-drone-delivered-vaccine-vanuatu-unicef>

¹⁷ "UNICEF Innovation Fund welcomes six drone startups to help solve global challenges." UNICEF. December 6, 2019.
<https://www.unicef.org/innovation/venturefund/dronescohort>

¹⁸ "Local graduate using drones for mapping." The Citizen. February 5, 2019.
<https://www.thecitizen.co.tz/magazine/success-/Local-graduate-using-drones-for-mapping/1843788-4967500-c6pj0rz/index.html>

¹⁹ Dar Ramani Huria. "About us." <https://ramanihuria.org/en/about-us/>

²⁰ GFDRR. "Taking Disaster Risk Management to New Heights." September, 2016.
<https://www.gfdrr.org/en/feature-story/taking-disaster-risk-management-new-heights>

which areas are most at risk. The ongoing Ramani Huria project now regularly uses drones as part of its mapping strategy, through a workflow that consists of uploading the imagery to OpenAerialMap, updating OpenStreetMap accordingly, and then for analysis and processing leveraging InaSAFE, a free software that produces realistic natural hazard impact scenarios.²¹ The World Bank has also used drones for post-disaster mapping in Vanuatu²² and in Tonga,²³ for updating and improving cadastral maps in Kosovo,²⁴ and for supervising the development of water infrastructure projects in the Democratic Republic of the Congo,²⁵ amongst other initiatives.

Some non-governmental organizations are specifically oriented around using drone technology and robotics for disaster response and aid. The largest of these is WeRobotics, a not-for-profit organization whose stated mission is to foster the use of drone technology for humanitarian aid and development purposes around the world. WeRobotics works with public and private partners to launch networked “Flying Labs” in each country that it operates in. These Flying Labs are meant to function as centers of expertise and experience with drone (and other robotics) technology, and are intended to provide training and support to other stakeholders who wish to use drones to support public good. WeRobotics has also recently begun to offer delivery/cargo drone solutions for its customers.²⁶ A number of the National Societies profiled in this study have received training from or otherwise worked with these Flying Labs on drone-related projects.

Regulatory considerations

Aspiring humanitarian drone users must contend with a complex regulatory environment, in which the only true constant is constant change. Some countries have elaborate and fully-developed drone regulations, while others have no specific laws regarding the technology at all. Some countries ban drone use entirely, some only permit certain licensed users to operate them, and others have very loose restrictions.²⁷

National regulations have an enormous impact on what is practically possible for aspiring National Society drone users. A number of the drone users interviewed for this study have only been able to deploy drones in very limited ways due to restrictive national laws regarding where and when drones can be flown. Others have reported that they have found local regulations to be no impediment at all.

The transitional nature of drone laws presents humanitarian users with both opportunity and with risk. They can use their good reputations to influence the passage of new laws that facilitate or protect the humanitarian use of drone technology. In some countries, National Societies are doing just this, by actively working with civil aviation authorities to develop drone regulations that take humanitarian use cases into

²¹ InaSAFE. <http://inasafe.org/>

²² Michael Bonte-Grapentin, Patrick Meier, Keiko Saito. “Lessons From Mapping Geeks: How Aerial Technology is Helping Pacific Island Countries Recover From Natural Disasters.” World Bank Blogs. November 20, 2017.

²³ World Bank. “Tonga: World Bank Drone-Led Damage Assessments Underway.” February 22, 2018.

<https://www.worldbank.org/en/news/press-release/2018/02/22/tonga-world-bank-drone-led-damage-assessments-underway>

²⁴ World Bank. “Drones Offer Innovative Solution for Local Mapping.” January 7, 2016.

<https://www.worldbank.org/en/news/feature/2016/01/07/drones-offer-innovative-solution-for-local-mapping>

²⁵ Pierre Francois-Xavier Boulenger. “A bird’s eye view: supervising water infrastructure works with drones.” World Bank Blogs. December, 2018. <https://blogs.worldbank.org/water/bird-s-eye-view-supervising-water-infrastructure-works-drones>

²⁶ “WeRobotics Now Offers Cargo Drone Solutions.” WeRobotics. September 11, 2019.

<https://blog.werobotics.org/2019/09/11/werobotics-now-offers-cargo-drone-solutions/>

²⁷ Global Drone Regulations Database. <https://www.droneregulations.info/>

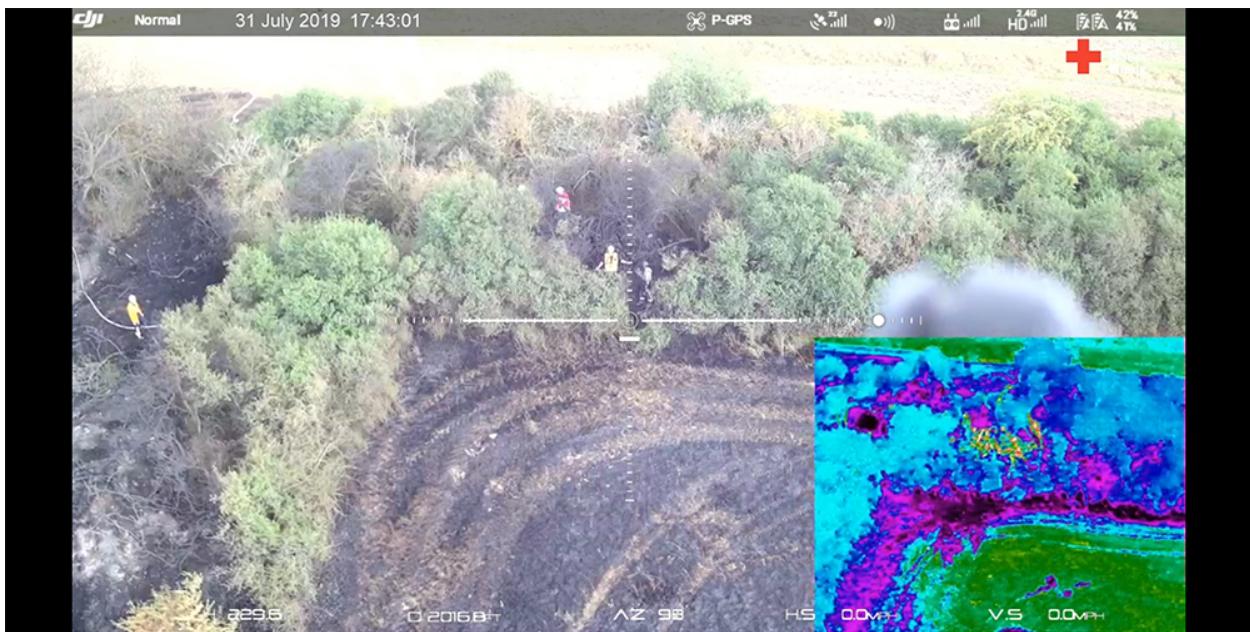


Fig. 4: Investigation with FLIR thermal camera for fire department. 32 acre burning field within a protected landscape in Mensfelden, Germany, 2019. | Credit: Kai Brunner, German Red Cross - Kreisverband Limburg e.V..

account. Still, the reputational advantage that comes from aid worker's usually-good reputations goes both ways. If humanitarians use drones in risky, irresponsible, or unethical ways, the overall public reputation of their organization may suffer - and regulators may decide to pass stricter laws that make it very hard for disaster responders to use drones in the field.

Ethical considerations

The use of drones in humanitarian aid remains controversial, and the technology remains somewhat poorly understood by the public at large. Small civilian drones are often conflated with or associated with the large, weaponized drones used by militaries around the world. In recent years, armed groups have occasionally equipped small drones with explosive weapons as well.

At the time of writing, there is still no reliable way for an observer on the ground to identify or communicate with a drone in the air, or to tell one drone apart from another in airspace.²⁸ There is currently no particularly effective or widely-agreed upon way to distinguish a small, commercial drone operated by a National Society for disaster work from a small, commercial drone that is being operated by another group in the same area. This creates great potential for confusion, as drones become ever more popular and widespread around the world.

The ethical issues that surround drones are closely linked to the information that they collect. Small

²⁸ Many countries and companies around the world are developing "UTM" or "unmanned traffic management" systems and regulations that will attempt to tackle this problem. However, as of February 2020, these systems remain largely experimental or theoretical in the vast majority of nations.

civilian drones lack the vast range or ability to loiter of large militarized drones, but they are still capable of collecting extremely high resolution imagery of objects on the ground. While drone-collected data can be very helpful for disaster responders, the same imagery can prove extremely useful for armed groups, militaries, and other non-neutral actors. It cannot be assumed that publicly-available drone data will only be used by individuals or organizations with goals aligned with those of National Societies.

Drones are a new technology, and many outstanding questions remain about how they might best be integrated into existing disaster response organizations and systems. There is still considerable uncertainty over how best drone-using volunteers should be integrated into disaster responses (or if they should be integrated at all). One example of this dynamic took place during the aforementioned response to the 2015 Nepal Earthquake: in the immediate aftermath of the disaster, a number of organizations and individuals arrived on the scene with drones and began collecting imagery, ostensibly to support the disaster response effort. Some of these drone pilots failed to adequately communicate with or coordinate with other actors or with the Nepalese government, fostering confusion and uncertainty over their intentions.²⁹ The Nepalese government eventually issued a blanket ban on unauthorized drone use, citing concerns over security. In a more recent example of this issue, disaster responders during Hurricanes Harvey and Irma in 2017 struggled to decide how best to use drone imagery for decision-making purposes, as well as with how to coordinate drone-using volunteers who appeared on the scene, wanting to help.³⁰

Local involvement in drone use is another important and often controversial issue. Disaster responders reliant upon new technologies have garnered a not-undeserved reputation for failing to consider local needs and preferences before testing new methods in disaster situations. While the small sample size of RCRC drone pilots interviewed in this study reported almost exclusively positive community responses to their drones, it should not be assumed that this will always be the case. Drones are a particularly visible and particularly controversial new technology, and those who wish to use them must take public trust into serious consideration before they begin a project.

Drone users who simply show up and begin to fly run the risk of being viewed as "data colonists," who capture information and conduct experiments without explaining what they are doing or why the information they collect will benefit the community they are operating in.³¹ Drone pilots who do not adequately explain their intentions may be prevented from entering an area to fly, may be verbally threatened, or may even be subject to physical threats against their equipment and themselves.

²⁹ Hannan Lewisley. "Eye in the sky." Nepali Times. December 4th, 2015.

<https://archive.nepalitimes.com/article/nation/nepal-government-crack-down-on-drones,2716>

³⁰ Faine Greenwood, Erica L. Nelson, P. Gregg Greenough. "Flying into the hurricane: A case study of UAV use in damage assessment during the 2017 hurricanes in Texas and Florida." PLOS One. 2020.

<https://journals.plos.org/plosone/article/comments?id=10.1371/journal.pone.0227808>

³¹ Sean Martin McDonald, Kristin Bergtora Sandvik, Katja Lindskov Jacobsen. "From Principle to Practice: Humanitarian Innovation and Experimentation." Stanford Social Innovation Review. Dec 21, 2017.

https://ssir.org/articles/entry/humanitarian_innovation_and_experimentation

Summary of findings

All in all, we were able to identify 26 National Societies around the world who had used drone technology or data in some capacity, or are intentionally working towards using drone technology. We also confirmed that the International Committee of the Red Cross (ICRC) is developing policy strategies around drone use.

Of the identified National Societies, we conducted approximately hour-long telephone interviews with representatives from 12, using a set of predetermined questions. Four National Societies responded to the same set of predetermined questions via email. We draw upon this combination of desk research and interviews to present these initial conclusions.

- Of the 26 National Societies identified, six were in Africa, five in Europe, seven in Asia Pacific, eight in the Americas (following IFRC region designations).
- The majority of identified National Society drone users work primarily with hardware produced by Chinese drone-maker DJI, the world's largest consumer drone company. The foldable DJI Mavic Pro and the DJI Phantom 3 Professional were the two most popular DJI models used.
- Some identified National Societies do not yet have their own internal drone capacity, but have collaborated with other organizations on mapping projects that incorporate drone data. One such example is the 2015 Tanzania flood mapping collaboration between the World Bank, Tanzanian mapping organization Ramia Huria, Humanitarian OpenStreetMap Team (HOT), and the Tanzanian Red Cross.
- A minority of National Societies reviewed for this research have not yet used drone data in their operations and do not operate drones themselves, but have expressed a clear interest in doing so in the future, and are actively exploring means of working with the technology. The Australian Red Cross and the Senegalese Red Cross Society are two examples within this category.
- The majority of RCRC National Societies reviewed for this research have developed their own, internal drone capacity: they are able to independently operate drones and collect data as needed. A smaller number currently use drones or drone data with support from other private or public sector groups (such as individual, private drone companies, or WeRobotics).
- Active drone operations carried out by National Societies remain relatively small. Most organizations reviewed for this research only have one or two pilots, and only own one or two aircraft. Often, a National Society's involvement with drones is driven largely by one or two individual members who have an existing interest in the technology, and then endeavor to find ways to use it within the organization. These projects run the risk of being abandoned or failing if these individuals leave the organization.
- The most widely-reported use (or intended use) of drone technology amongst National Societies was post-disaster data collection and mapping. Search and rescue operations, disaster resilience building, overall situational awareness, and information gathering for communications and public relations were also widely-cited use cases.

- RCRC drone users largely use their drones to collect spatial data (geographically-identified aerial photographs); information which is then turned into maps. National Societies that use drones for mapping often collect data both before disasters (for community mapping and resiliency projects) and in the immediate aftermath of disaster (to document and describe the destructive impact of an event). A smaller number of RCRC drone users also use the technology to: capture photographs and video for PR and public awareness purposes, capture photographs and video for overall situational awareness during crisis, and to assist in search and rescue operations.
- No identified RCRC drone users currently appear to use drones for delivery projects, although some National Societies are interested in doing so in the near future.

Timeline of drone use

The following is an incomplete timeline of UAS use by Red Cross and Red Crescent Societies since 2013. We apologize for any usage or events we missed in our research. We would like to hear from you so that we can update this timeline. Please contact daniel.joseph@redcross.org regarding any omissions.

2013

September

The IFRC and ICRC participates in a workshop entitled “Unmanned Aerial Systems for Rapid Mapping UASRapidMap 2013,” organized by the European Commission Joint Research Centre and United Nations UNITAR - UNOSAT.¹

November

In the aftermath of Typhoon Haiyan, Philippines-based Danoffice IT uses a drone to support disaster response activities: it helps support the Canadian Red Cross Society (amongst other organizations).²

2014

November

The first UN advisory round table on humanitarian UAVs meets in New York City: the American Red Cross attends, alongside UN-OCHA, UNHCR, UNICEF, the UAViators network, Humanitarian OpenStreetMap, DanOfficeIT, Google Project Wing and others.

¹ Markus Reuster et al. “Unmanned Aerial Systems for Rapid Mapping UASRapidMap 2013.” 4th JRC ECML Crisis Management Technology Workshop, JRC Scientific and Policy Reports. European Commission Joint Research Centre. 2013. <http://unosat.web.cern.ch/unosat/unitar/publications/unmannedAerialSystemsRapidMapping.pdf>

² “Case Study No 9: Using Drone Imagery for real-time information after Typhoon Haiyan in The Philippines.” FSD. August 26, 2016. <https://drones.fsd.ch/en/3642/>

2015

February

The International Federation of Red Cross and Red Crescent Societies and the American Red Cross publish "A Vision for the Humanitarian Use of Emerging Technology for Emerging Needs," a report that summarizes the results of the Global Dialogue on Emerging Technology for Emerging Needs.³ The report selects drones as one of four technologies that address "actual barriers to resilience" and it calls upon disaster responders to further invest in the technology.

March

The International Red Cross participates in a Norwegian disaster simulation that includes use of a search-and-rescue drone, made by Aerialtronics.⁴

April

The American Red Cross and Measure release a joint study describing how drones "can help first responders and improve disaster relief efforts."⁵

May

Abi Weaver of the Red Cross Global Technology project describes the progress of her organization's global UAV strategy.⁶

³ International Federation of Red Cross and Red Crescent Societies; American Red Cross. "A Vision for the Humanitarian Use of Emerging Technology for Emerging Needs." ALNAP. February 1, 2015.

<https://www.alnap.org/help-library/a-vision-for-the-humanitarian-use-of-emerging-technology-for-emerging-needs>.

⁴ Aerialtronics. "Drones can save lives in search and rescue mission after avalanche." March 30, 2015.

<https://www.aerialtronics.com/2015/03/drones-can-save-lives-in-search-and-rescue-mission-after-avalanche>

⁵ Measure. "American Red Cross And Measure Study Shows Drones Can Save Lives And Help Rebuild Communities #dronesforgood #droneasaservice." PR News Wire. April 21, 2015. <https://www.prnewswire.com/news-releases/american-red-cross-and-measure-study-shows-drones-can-save-lives-and-help-rebuild-communities-dronesforgood-droneasaservice-300069410.html>

⁶ Emma Schwartz. "Global Strategies with Community Value: The Red Cross Experiment with UAVs." NetHope Solutions Center. May 4, 2015.

<https://solutionscenter.nethope.org/resources/global-strategies-with-community-value-the-red-cross-experiment-with-uavs>

August

The Tanzania Red Cross National Society collaborates with the World Bank, Drone Adventures, COSTECH, the Swedish International Development Agency and the Global Facility for Disaster Risk Reduction to evaluate UAV use for disaster risk reduction.⁷

September

The RCRC holds its second global summit on emerging technologies in the Netherlands. Drones are part of the dialogue.⁸

October

The Humanitarian UAV Network holds a meeting at MIT, bringing together representatives from the Red Cross, GlobalMedic, DJI, Skycatch, the UN, and others.⁹

November

The Italian Red Cross participates in a joint exercise with university researchers and city officials in Turin to test the performance of UAVs for search and rescue missions.¹⁰

The IFRC and scientists from Airbus Group meet at Airbus Space Labs to discuss humanitarian technology.¹¹

2016

June

The American Red Cross participates in a “Drone Do Tank” activity with UN agencies, drone companies, and local government.¹³

⁷ “World Bank Using UAVs for Disaster Risk Reduction in Tanzania.” OpenDRI. August 19, 2015.

<https://opendri.org/world-bank-using-uavs-for-disaster-risk-reduction-in-tanzania/>

⁸ Climate Centre. “A high-tech future for humanitarians one step closer after Red Cross Red Crescent summit in NL.”

September 1, 2015. <https://www.climatecentre.org/news/572/>

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⁹ Mapbox. “Humanitarian Drone Mapping with UAViators.” Points of Interest. October 12, 2015.

<https://blog.mapbox.com/humanitarian-drone-mapping-with-uaviators-13c455ae1bd2>

¹⁰ Laura Novaro Mascarello, Fulvia Quagliotti, Mario Bertini. “An unmanned search and rescue mission.” EGU General Assembly 2016, held 17-22 April, 2016 in Vienna Austria, id. EPSC2016-7124.

<https://ui.adsabs.harvard.edu/abs/2016EGUGA..18.7124N/abstract>

¹¹ Shaun Hazeldine. “To boldly go..” Thomson Reuters Foundation News. May 23, 2016.
<http://news.trust.org/item/20160523120933-7pc5y>

¹³ “Disaster Relief Drones Provide Life-Saving Aid.” UNICEF Innovation. July 7, 2016.
<https://www.unicef.org/innovation/stories/disaster-relief-drones-provide-life-saving-aid>

September

Nigerien drone maker Aziz Kountche uses his DIY camera drone to take photographs of a Red Cross Luxembourg project in Gaya, Niger.¹²

The Uganda Red Cross Society deploys a drone to monitor the situation at a refugee camp on the border with South Sudan.¹⁴

2017

March

The IFRC, the Austrian Red Cross, and Land Rover announce “Project Hero,” a Land Rover Discovery customized with a “tailor-made communications drone and other specialist technology.”¹⁵

May

The Philippine and American Red Cross collaborates to collect UAV imagery for mapping in the Philippines, as part of the recovery project from Typhoon Haiyan.¹⁷

June

The Kenya Red Cross captures footage of the severe drought in the Ewaso Nigro river basin using a DJI Phantom 4 drone which was supplied by the Red Cross Red Crescent Climate Centre.¹⁶

¹² Katie Drew. “Taking to the skies: displacement, drones, and maps.” UNHCR Innovation Service. September 27, 2016. <https://www.unhcr.org/innovation/taking-to-the-skies-displacement-drones-and-maps/>

¹⁴ Red Cross Red Crescent Climate Centre. “First use of a drone by Red Cross in Africa highlights scale of humanitarian situation at Uganda’s border with South Sudan.” September 16, 2016. <https://www.ifrc.org/en/news-and-media/news-stories/africa/uganda/first-use-of-a-drone-by-red-cross-72516/>

¹⁵ IFRC. “Land Rover unveils drone-fitted search and rescue vehicle to support Red Cross Red Crescent disaster response.” March 7, 2017. <https://media.ifrc.org/ifrc/press-release/land-rover-ifrc-drones/>

¹⁷ “Detailed drone and street-level imagery for mapping in the Philippines,” Missing Maps, July 27, 2017. <https://www.missingmaps.org/blog/2017/07/27/drone-and-street-level-imagery-in-philippines/>

¹⁶ IFRC. “The struggle for water in Kenya: Red Cross drone video shows grip of drought as global appeal raised to \$25m.” ReliefWeb. April 10, 2017. <https://reliefweb.int/report/kenya/struggle-water-kenya-red-cross-drone-video-shows-grip-drought-global-appeal-raised-25m>

September

The Australian Red Cross collaborates with the Australian Government, the IFRC, and WeRobotics to understand how UAVs might be used for disaster risk management in the South Pacific: the year-long project ends in Sept 2017.¹⁸

The American Red Cross announces that it will collaborate with now-defunct tethered drone maker CyPhy Works to conduct drone-data collection in support of relief efforts after Hurricane Harvey. The project is funded with a charitable donation from UPS.¹⁹

December

The Malawi Red Cross Society participates in a workshop coordinated by UNICEF Malawi and WeRobotics regarding drone technology.²⁰

The American Red Cross collects drone imagery of Canaan, Haiti.²¹

2018

February

UNICEF collaborates with LUANAR University and the Malawi Red Cross Society in an anti-cholera mapping exercise using drone imagery.²²

May

The American Red Cross is named as a partner in Reno's successful bid to participate in the U.S. FAA's Unmanned Aircraft Systems Integration Pilot Program.²³

¹⁸ "Red Cross Robotics in the South Pacific." WeRobotics. September 18, 2017. <https://blog.werobotics.org/2017/09/18/red-cross-robotics-in-the-south-pacific/>

¹⁹ Eric M. Johnson. "Red Cross Launches First U.S. Drone Program for Disasters." Reuters. September 7, 2017. <https://www.reuters.com/article/us-storm-harvey-redcross-drones/red-cross-launches-first-u-s-drone-program-for-disasters-idUSKCN1BI2X9>

²⁰ "Building Expertise in Humanitarian Drone Coordination in Malawi." WeRobotics. December 14, 2017. <https://blog.werobotics.org/2017/12/14/humanitarian-drone-coordination-malawi/>

²¹ "Drones over Canaan, Haiti." Missing Maps. April 9, 2018. <https://www.missingmaps.org/blog/2018/04/09/canaan-drones/>

²² Rebecca Phwitiko. "Drones for cholera response: innovating for children in Malawi." UNICEF Malawi. February 26, 2018. https://medium.com/@unicef_malawi/drones-for-cholera-response-innovating-for-children-in-malawi-6dcab2c4de53

²³ "Reno picked for national drone pilot program." Kolo8 NewsNow. May 9, 2018. <https://www.kolotv.com/content/news/Reno-picked-for-national-drone-pilot-program-482204101.html>

June

The Sri Lanka Red Cross Society launches a drone to assess monsoon disasters from the air as part of a response effort supported by the IFRC.²⁴

August

Canadian Red Cross Society communications officer Luc Alary uses a drone to take photographs and video at refugee camps in Bangladesh.²⁵

October

Uganda Flying Labs works with the Uganda Red Cross Society, MapUganda, and Drone Nerds Africa to use drones to assess landslide damage in the Bududa district.²⁶

The Kenyan Red Cross announced a collaboration with Canadian drone company DAC Aviation, as part of an effort to launch its own drone program.²⁷

November

The Philippine Red Cross announces a collaboration with Nokia and Smart Communications to “bring innovative technology like LTE-connected drones and a portable network into areas struck by disaster.”²⁸

2019

January

German Red Cross unit Kreisverband Limburg e.V. begins to use UgCS software and a drone for search and rescue operations.²⁹

²⁴ “Sri Lanka Red Cross drone assesses monsoon disaster from the air.” Climate Centre. May 6, 2018.

<https://www.climatecentre.org/news/1003/sri-lanka-red-cross-drone-assesses-monsoon-disaster-from-the-air>

²⁵ Fanni Barocsi. “Drones: A helpful eye in the sky.” Canadian Red Cross. August 14, 2018.

<https://www.redcross.ca/blog/2018/8/drones-a-helpful-eye-in-the-sky>

²⁶ “Uganda Flying Labs Deploys Drone Expertise to Assess Landslides in Bududa District.” WeRobotics. October 31, 2018.

<https://blog.werobotics.org/2018/10/31/uganda-flying-labs-deploys-drone-expertise-to-assess-landslides-in-bududa-district/>

²⁷ DAC Aviation. Twitter. <https://twitter.com/DACAviation/status/1057586158266392576>

²⁸ Nokia. “Philippine Red Cross to employ Nokia Drone Networks solution to aid disaster response.” November 27, 2018.

<https://www.nokia.com/about-us/news/releases/2018/11/27/>

philippine-red-cross-to-employ-nokia-drone-networks-solution-to-aid-disaster-response/

²⁹ UGCS. “German Red Cross strengthens its search and rescue capability with UGCS.” January 23, 2019.

<https://www.ugcs.com/news-entry/german-red-cross-strengthens-its-search-and-rescue-capability-with-ugcs>

The American Red Cross leads a community mapping for risk reduction training in Belize, which includes a drone component.³⁰

March

The IFRC uses a drone to document devastation in Mozambique after Cyclone Idai.³¹

August

The American Red Cross funds improvements to OpenDroneMap (ODM) that allows users of the open source software to process large datasets on a cluster of machines faster by distributing the dataset over multiple nodes.³²

2020

March

As part of the COVID-19 response, the Korean Red Cross uses a drone to disinfect high-risk spots at the Red Cross Hospital in Gyeongsang-do.³³

³⁰ American Red Cross. "Mapping for disaster risk reduction in Belize." January 22, 2019. <https://americanredcross.github.io/2019/01/22/belize-mapping/>

³¹ Chris Mills Rodrigo. "Drone footage shows devastation from cyclone in Mozambique." The Hill. March 19, 2019. <https://thehill.com/policy/international/434734-drone-coverage-shows-devastation-from-cyclone-in-mozambique>

³² Dan Joseph, Seth Fitzsimmons. "POSM 0.9 - Passel of POSMs." American Red Cross. August 7, 2019. <https://americanredcross.github.io/2019/08/07/posm-9-release/>

³³ IFRC Asia Pacific. Twitter. <https://twitter.com/IFRCAsiaPacific/status/1235852877119160322>

July

The Italian Red Cross RPAS training centre in Bologna, which first opened in 2017, is recognized as “state flight” by the national civil aviation authority (ENAC). The Italian Red Cross aims to standardize training and capacities for all personnel to support search and rescue activities.³⁴

August

The British Red Cross uses drone footage for media communications to show the devastation in Beirut caused by the explosion at the port.⁶⁸

³⁴ Centro Addestramento Nazionale SAPR (Sistemi di Aeromobile a Pilotaggio Remoto).

<https://www.cri.it/centroaddestramentodroni>

⁶⁸ British Red Cross. Twitter. <https://twitter.com/BritishRedCross/status/1293561021974675462>

Drone activities in the network

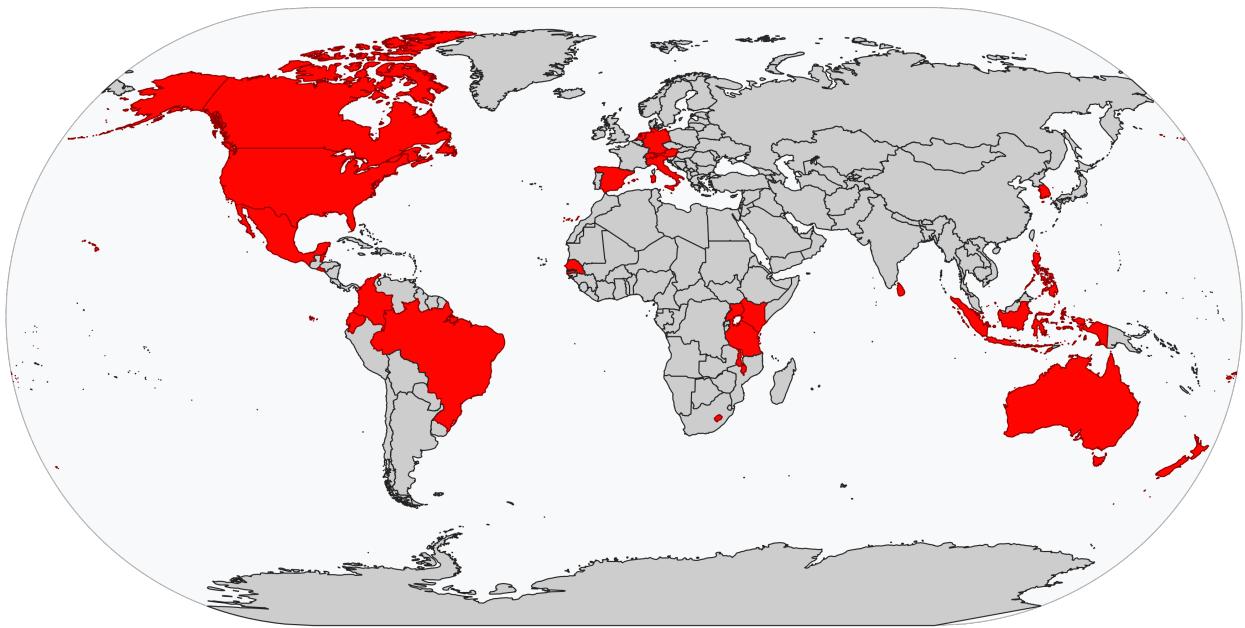


Fig. 5: Countries where the National Society has undertaken activities with drones.

American Red Cross

Drones used for: Initial research into drone use, post-disaster situational awareness, mapping.

Operational examples: The American Red Cross used drones domestically for the first time during Hurricanes Harvey and Irma in September 2017. Since 2017, the American Red Cross International Services Department GIS/Data Team has used UAS for mapping activities in collaboration with other societies: these mapping projects have taken place in the Philippines, Haiti, and Belize.

Summary: In 2014, representatives of the American Red Cross attended the first United Nations Advisory Round Table on humanitarian UAV technology. In April 2015, the American Red Cross and UAS consulting firm Measure released a joint study entitled "Drones for Disaster Response and Relief Operations." The report described potential use cases for the technology, policy recommendations for the development of favorable UAS regulations, and technical information.¹

¹ Measure, American Red Cross. "Drones for Disaster Response and Relief Operations." April, 2015. <https://www.issuelab.org/resources/21683/21683.pdf>.

Since 2017, the International Services Department (ISD) GIS/Data Team has used UAS for several mapping activities in their work with other National Societies. At present, however, there is not an overall, organization-wide strategy for integrating UAS into American Red Cross activities domestically.

In May 2017, the ISD GIS/Data Team used UAS to map 23 barangays in Leyte, Philippines for creation of more detailed OpenStreetMap (OSM) data to be used for disaster management activities. In December 2017, the team used UAS to map 35 sq km of Canaan, Haiti to update the OSM data for the rapidly urbanizing landscape. In January 2019, the team led a community mapping training with Belize Red Cross that included sessions on the use of UAS for mapping.

The first real-world deployment of a drone by the American Red Cross domestically took place in September 2017, as part of the response to Hurricane Harvey in the US state of Texas. In a project funded by the United Parcel Service's charitable wing, Red Cross workers collaborated with drone-makers CyPhy Works to use their tethered UAS to gain situational awareness and capture photographs of hurricane damage.



Fig. 6: Dan Joseph from American Red Cross shows members of the Haitian Red Cross how to pilot a drone. | Credit: Matthew Gibb, American Red Cross.

Australian Red Cross

Drones used for: Initial policy research into drone use.

Operational examples: None reported.

Summary: In 2016, the Australian Red Cross, the Australian Government and the International Federation of the Red Cross sponsored drone organization WeRobotics to study the suitability of UAS technology for disaster response operations in the South Pacific. The final report, released in June 2018, noted the importance of “integrating data into decision making processes” and the importance of “evidence-based decision making” when assessing UAV performance: the report also stressed the importance of considering location-specific and contextual factors when considering the use of UAVs in disaster response.

Austrian Red Cross

Drones used for: Search and rescue, situational awareness.

Operational examples: Public demonstrations of UAS capabilities, in collaboration with Austrian K9 search and rescue units.

Summary: The Austrian Red Cross UAS project was initiated in January 2017, after the Austrian Red Cross won a Land Rover competition with a UAV-focused car design. Vehicle and proprietary UK-made drone were delivered soon afterwards under auspices of “Project Hero”, launching a still-continuing 2 year experimental phase. The Austrian Red Cross now uses both the Land Rover UAS and multiple other consumer UAS (largely DJI products). The Austrian Red Cross has not yet deployed the UAS in real-world disaster and SAR settings, largely due to a lack of relevant disaster and SAR incidents as well as restrictive Austrian UAS regulations. The ARC has carried out regular trainings and demonstrations with the UAS, and currently have 10 certified drone pilots, as well as a standardized training system.

Belize Red Cross Society

Drones used for: Community mapping efforts, disaster resilience work.

Operational examples: Using drones to make maps of multiple communities around Belize City, in support of community mapping efforts for disaster resilience.

Summary: The Belize Red Cross Society uses drones primarily for community mapping exercises and for community disaster resilience preparation. In its first operational use of drones, the Belize Red Cross initially planned to use drones to map 16 communities in the vicinity of Belize City. The Red Cross drone pilots worked with other Belizean organizations to conduct mapping exercises, including the Belizean Ministry of Natural Resources, the Lands and Geology Department, and the National Emergency Management Organization. Drone data was used to augment out-of-date Google maps, and to help communities develop disaster risk awareness and planning strategies, giving them a “big picture” view of their homes. The Belize Red Cross hopes that communities will use these maps and the training provided to them as a means of developing “sustainable” disaster response systems and strategies: they also hope that the

UAS-created maps will be shared throughout the Belize emergency management community when the next disaster hits.



Fig. 7: Terence Woodye of the Belize Red Cross practices flying a DJI Phantom drone. | Credit: Dan Joseph, American Red Cross.

Brazilian Red Cross

Drones used for: Post-disaster mapping, public relations photographs.

Operational examples: In 2017, the Brazilian Red Cross used drones to search for potential mosquito breeding locations, as part of efforts to fight Dengue fever and Zika virus in urban areas.²

Summary: The Brazilian Red Cross currently uses drones to support post-disaster mapping operations, as well as for general situational awareness efforts. Drones are also used to take photographs for promotional materials.

² "Technology in the hand and in the sky helps prevent the spread of Zika," IFRC.org. 2016. <https://www.ifrc.org/ar/news-and-media/news-stories/americas/brazil/technology-in-the-hand-and-in-the-sky-helps-prevent-the-spread-of-zika-72080/?print=true>.

The Canadian Red Cross Society

Drones used for: Video and photographs for public relations and communications, situational awareness, post-disaster mapping.

Operational examples: Collecting video footage of the scale of the Kutapalong Refugee Camp in Bangladesh, for use in the "Safe for Humanity" informational campaigns.

Summary: The Canadian Red Cross Society has shot drone photos and video in many countries around the world, including Bangladesh, Mozambique, Haiti, South Sudan, Uganda, Congo, Nepal. This aerial imagery is largely used to support public messaging and communications campaigns. Drone imagery was also used to facilitate overall operational awareness during the Mozambique flood response in 2019.

Colombian Red Cross Society

Drones used for: Post-disaster mapping, search and rescue.

Operational examples: Mapping for emergency response operations after the Mocoa landslide in 2017.

Summary: The Colombian Red Cross Society began integrating drones into their operations in 2016. Initially it was thought to use drones to support search and rescue activities. The National Society has leveraged staff and volunteers who have been trained and certified personally and voluntarily by their own means. In 2017, drones were used in support of emergency response operations after the Mocoa landslide by mapping the area, helping to assess the magnitude of the tragedy and allowing a contextual analysis to ensure staff safety. In 2018, the Colombian Red Cross team participated in a drone training coordinated by WFP. In 2020, the Cundinamarca Branch plans to participate in a training that focuses on the use of drones for risk management, emergency response, and search and rescue operations.

Ecuadorian Red Cross

Drones used for: Post-disaster mapping, community mapping.

Operational examples: Post-disaster mapping after Quito landslide.

Summary: The Ecuadorian Red Cross acquired its first drone in November 2018, with funding from a disaster forecasting financing project. The DJI Mavic Pro was then used for VCA risk assessment work and community mapping. Risk maps are combined with hand-drawn maps to give a comprehensive view of possible disaster. Drone imagery was also collected for disaster assessment purposes during the Quito landslide.



Fig. 8: Drone deployment for mapping vulnerable communities in Cotopaxi Province, Ecuador. | Credit: Ecuadorian Red Cross National Disaster Risk Reduction Program.

Fiji Red Cross Society

Drones used for: Damage-assessment mapping, post-disaster photography and video.

Operational examples: Pacific Flying Labs, in coordination with the Fiji Red Cross Society, attempted to use a Phantom 4 Professional drone to document damage from Tropical Cyclone Keni in the Kadavu Region in April 2018. Ultimately, high winds prevented the drone from being flown safely in the area.

Summary: Tropical Cyclone Keni hit Fiji on April 10th 2018, causing widespread damage across the island. The Fiji Red Cross Society and Pacific Flying Labs worked together to collect images of the village of Manuana, combining on-foot surveys and aerial mapping techniques.³

German Red Cross

Drones used for: Search and rescue, situational awareness.

Operational examples: The German Red Cross Kreisverband Limburg (a district association of the German Red Cross) has used its DJI Matrice 200 drone during four SAR operations at the time of writing. On one occasion, the drone was used to search for signs of a sinkhole in an area where an explosion attributed to unexploded ordnance took place. The drone was used to look at the area to evaluate risk to fire teams. On a second occasion, the drone was used to assess an ongoing 11 acre-wide fire in a national park area. Additionally, the drone was used to assist with searching for missing people on two different occasions.

Summary: The German Red Cross Kreisverband Limburg is actively experimenting with UAS technology at this time to support SAR operations with dogs, facilitate fire department situational awareness, create maps of disaster areas, and to provide lighting for search teams on dark nights. The organization hopes to use UAS equipped with thermal sensors to enhance visual searches for missing people. Additionally, the organization is working with UgCS specialized software for drone search and rescue operations, which facilitates extensive, comprehensive searches using drones over wide areas.⁴

Indonesian Red Cross Society

Drones used for: Disaster resilience mapping, IDP camp planning, vulnerability and capacity assessment support.

Operational examples: The Indonesian Red Cross Society (Palang Merah Indonesia - PMI) has used its DJI Phantom 4 Professional drone on a number of real-world missions. These include mapping a displaced person's camp in Sulawesi, creating orthomosaic maps of Maluku, supporting earthquake readiness projects in Java, and more.

³ Amrita Lal. "Pacific Flying Labs Deploys with Fiji Red Cross After Major Cyclone." WeRobotics. May 24, 2018. <https://blog.werobotics.org/2018/05/24/pacific-labs-deploys-red-cross/>

⁴ "German Red Cross Strengthens Search and Rescue Capability with UgCS Drone Software." DroneBelow. January 23, 2019. <https://dronebelow.com/2019/01/23/german-red-cross-strengthens-search-and-rescue-capability-with-ugcs-drone-software/>



Fig. 9: Drone take off in Ahlbach, Germany, 2019. | Credit: Kai Brunner, German Red Cross - Kreisverband Limburg e.V..

Summary: The Indonesian Red Cross (PMI) acquired its first drone in early 2017, hoping to use it to create high-quality and up-to-date photographic maps, or orthomosaics. The organization has since flown its DJI Phantom 4 Professional drone throughout the country, largely in support of disaster risk resilience (DRR) and Vulnerability and Capacity Assessment (VCA) activities. The high-quality drone imagery they collect helps PMI and community leaders to better identify potential disaster risks and dangers before they take place.

PMI uses open platforms OpenStreetMap (OSM) and OpenAerialMap (OAM) to create community maps and to ensure that the drone data they collect is available for public use. Its first project used drones to create orthomosaic maps of areas of the island of Maluku for disaster risk reduction purposes: these maps were uploaded to OpenAerialMap and used for OpenStreetMap mapping activities. Drone imagery enables PMI to help communities create better, more up-to-date and accurate maps than they might otherwise have access to, giving them a more accurate “big picture” view of their communities and the potential disaster risks they face.

International Committee of the Red Cross (ICRC)

Drones used for: Mapping, infrastructure planning.

Operational examples: None at this time.

Summary: The ICRC has developed a number of policy documents related to drone technology in recent years. The 2017 ICRC Data Protection Handbook included specific guidance related to the ethical use of drone data. In 2019 in Mozambique, the ICRC conducted limited, non-operational testing of drone technology. The ICRC plans to conduct proof-of-concept drone technology tests in 2020. One such test is planned in Juba, South Sudan: drones will be used to map and plan water infrastructure. The ICRC hopes to build a small air operations team: from there, it hopes to train “all the units to have their own pilot



Fig. 10: Team picture taken using the drone. | Credit: PMI.

certified by Air Operations."

Eventually, the ICRC may operate regional drone "hubs" which will enable units to quickly access drone technology when they need it, without requiring that they purchase a drone themselves. The ICRC is also interested in potentially working with outside partners to collect drone data, such as Flying Labs. In its experiments going forward, the ICRC will be emphasizing data security and data protection, and will pay special attention to how it might ethically operate UAS in conflict areas and in complex emergencies.

Italian Red Cross

Drones used for: Search and rescue.

Operational examples: 2015 experimental joint exercise in Turin area.

Summary: Desk research indicates that the Italian Red Cross used a drone with Red Cross insignia on it in 2015.⁵ This appears to be linked to a November 2015 joint exercise between the Italian Red Cross and the Politecnico of Turin, in which medical teams and engineers used a thermal-camera equipped drone to assist with a simulated search and rescue operation.⁶ In 2016, the Italian Red Cross in Bologna announced a collaboration with the UK-based telematics provider Octo on a "drone intelligence service" for emergency rescue operations.⁷ In 2017, the Italian Red Cross opened an RPAS training centre in Bologna. In 2020, the training centre was recognized as "state flight" by the national civil aviation authority (ENAC).²³

Kenya Red Cross Society

Drones used for: Mapping, agricultural monitoring, risk mapping, disaster response.

Operational examples: Recent Kenyan Red Cross drone missions (with mentorship from Canadian companies DAC and Altohelix) include: creating drone maps of the Dadab refugee camp, documenting shelter reconstruction efforts and crop health monitoring in Kilifi, flood response and documentation in Moyale, flood search and rescue in West Pokot, and flood risk mapping in Narok County.

Summary: In June 2017, the Kenyan Red Cross used drone footage provided by the Red Cross Red Crescent Climate Centre to convey the scale of flooding in the Ewaso Ng'iro river basin.⁸ The Kenyan Red Cross began its own drone program in early 2019, working closely with Canada-based companies DAC Aviation

⁵ "Roma Drone 2015, Rome Urbe Airport. Drone of the Italian Red Cross in flight." Alamy. May 28, 2015. <https://www.alamy.com/rome-roma-drone-2015-rome-urbe-airport-drone-of-the-italian-red-cross-in-flight-italy-image179247631.html>

⁶ Laura Novaro Mascarello, Fulvia Quagliotti, Mario Bertini. "An unmanned search and rescue mission." EGU General Assembly 2016, held 17-22 April, 2016 in Vienna Austria, id. EPSC2016-7124.

<https://ui.adsabs.harvard.edu/abs/2016EGUGA..18.7124N/abstract>

⁷ William Payne. "Octo drone telematics for emergency rescue." IoT M2M Council. November 8, 2016. <https://www.iotm2mcouncil.org/octoteleer>

²³ Centro Addestramento Nazionale SAPR (Sistemi di Aeromobile a Pilotaggio Remoto). <https://www.cri.it/centroaddestramentodroni>

⁸ "Drone footage highlights severity of drought in Kenya's Ewaso Ng'iro river basin." IFRC. June 4, 2017. <https://www.ifrcnewsroom.org/story/en/237/drone-footage-highlights-severity-of-drought-in-kenya-s-ewaso-n-giro-river-basin/792>

and Altohelix. The drone program's goal is to build in-house drone-piloting and drone data-analysis capacity amongst Kenyan Red Cross staff both at headquarters and amongst regional teams. Ultimately, it hopes to be able to provide drone services to the broader humanitarian community, including UNHCR: it also hopes to work with drone-delivery technology (dependent upon the loosening of Kenya's current, strict, drone regulations). Currently, the program works with 2 drone models: the DJI Mavic 2 Enterprise and the Mavic Pro 2, as well as the ArcGIS, Pix4D, and OpenDroneMap software packages.



Fig. 11: Kenya Red Cross Society Initial Pilot Training for the RPAS unit with DJI Mavic drones in April 2019 with DAC Aviation, Altohelix corporation, and Kenya Civil Aviation Authority. | Credit: Kenya Red Cross Society.

Korean Red Cross

Drones used for: Health.

Operational examples: Used a drone to disinfect high-risk spots when combating COVID-19.⁹

Summary: In March 2020 when combating COVID-19, the Korean Red Cross used a drone to disinfect high-risk spots at the Red Cross Hospital in Gyeongsang-do.

⁹ IFRC Asia Pacific. Twitter. <https://twitter.com/IFRCApaciaPacific/status/1235852877119160322>



Fig. 12: Drone launch. | Credit: Korean Red Cross.

Lesotho Red Cross Society

Drones used for: Mapping, pre-disaster mapping.

Operational examples: Participation in a 2018 training conducted by Tanzania Flying Labs and WeRobotics, with support from World Vision International.¹⁰

Summary: The Lesotho Red Cross Society (LRCS) and World Vision International took part in a 3-day Tanzania Flying Labs/WeRobotics training focused on using drones to acquire and analyze aerial imagery. The training emphasized the creation of drone maps of disaster areas for use in Community Disaster Preparedness Plan (CDPP) development, as well as drone use for rapidly mapping disaster areas for assessment purposes.

Malawi Red Cross Society

Drones used for: Pre-disaster mapping.

Operational examples: Participation in cholera response mapping exercise using drones with UNICEF and LUANAR University. Drones used as part of assessment efforts in response to 2019 flooding. Drone mapping and flood risk assessment work in collaboration with the Netherlands Red Cross in 2018.

¹⁰ "Creating Community Disaster Preparedness Plans in Lesotho." WeRobotics. December 7, 2018. <https://blog.werobotics.org/2018/12/07/creating-community-disaster-preparedness-plans-in-lesotho/>

Summary: The Malawi Red Cross Society participated in a UNICEF cholera risk mapping project using drones in early 2018, in conjunction with LUANAR university.¹¹ In 2019, Malawi experienced extensive flooding: as part of the disaster response process, the Malawi Red Cross Society, the Malawi Department of Disaster Management Affairs (DODMA), and UNICEF used drones to capture assessment data in inaccessible areas.¹²¹³¹⁴ In 2018, the Malawi Red Cross Society worked with the Netherlands Red Cross Society to secure permission to fly from Malawi's Civil Aviation Authority (CAA): later in 2018, the two Societies collaborated on flood mapping efforts using drone data in the Chikwawa area. In 2017, the Malawi Red Cross Society was one of a group of national and local stakeholders who attended a WeRobotics training on the integration of UAV technology into disaster response efforts.¹⁵



Fig. 13: Launch of the Freya drone. | Credit: Malawi Red Cross Society.

¹¹ Rebecca Phwitiko. "Drones for cholera response: innovating for children in Malawi." UNICEF Malawi. Feb 26, 2018. https://medium.com/@unicef_malawi/drones-for-cholera-response-innovating-for-children-in-malawi-6dcab2c4de53

¹² International Federation of Red Cross And Red Crescent Societies. "Malawi Floods: Emergency Plan of Action (EPoA) - DREF: MDRMW014 (11 February 2019)." ReliefWeb. Feb 11th, 2019. <https://reliefweb.int/report/malawi/malawi-floods-emergency-plan-action-epoa-dref-mdrmw014-11-february-2019>

¹³ Tautvydas Juskauskas. "Flying a drone in Malawi: My first emergency deployment." UNICEF Connect. April 10, 2019. <https://blogs.unicef.org/blog/flying-drone-malawi-my-first-emergency-deployment/>

¹⁴ International Federation of Red Cross And Red Crescent Societies. "Emergency Appeal. Malawi: Floods". ReliefWeb. April, 2019. https://reliefweb.int/sites/reliefweb.int/files/resources/EA-Malawi%20floods_210421_final.pdf

¹⁵ "Building Expertise in Humanitarian Drone Coordination in Malawi." WeRobotics. December 14, 2017. <https://blog.werobotics.org/2017/12/14/humanitarian-drone-coordination-malawi/>

Mexican Red Cross

Drones used for: Damage assessment and search and rescue, with particular emphasis on supporting staff safety and facilitating better decision-making.

Operational examples: Search and rescue and damage assessment work during the 2016 Ecuador earthquake. Damage assessment work during response to Hurricane Matthew in Haiti in 2016. Search and rescue and assessment work during the 2017 Mexico City earthquake. Damage assessment work during the response to the 2018 Guatemalan volcanic eruption.

Summary: The Mexican Red Cross has worked with drones since 2014, when it acquired its first Phantom 2. Since then, the Mexican Red Cross has used drones on multiple occasions during real-world disaster response incidents, including the 2016 Ecuador earthquake, during Hurricane Matthew in 2016 in Haiti, as part of the response to the 2017 Mexican earthquake, and during the response to the 2018 Guatemalan volcano. The Mexican Red Cross uses drones primarily for post-disaster damage assessment and for search and rescue purposes.

The Netherlands Red Cross

Drones used for: Post-disaster mapping and damage assessment, flood risk assessment for disaster resilience.

Operational examples: Damage assessment and mapping in St Maarten following Hurricanes Irma and Maria in 2017. Flood risk mapping and assessment in collaboration with the Malawi Red Cross in 2018. Drone pilot training participation in Sweden in 2018.

Summary: In 2016, the Netherland's Red Cross humanitarian data-focused 510 Initiative began to experiment with drone technology: 510 team members began to learn to fly drones and to process drone data. In September 2017, the Netherlands Red Cross used a Phantom 4 Professional drone to take photographs of hurricane damage on St Maarten, following Hurricanes Irma and Maria. Drone data was used to conduct damage assessment of buildings, identify roof types and materials, and to better inform the building of shelters.

In early 2018, the Netherlands Red Cross worked with the Malawi Red Cross to assist that organization with securing permission to fly from Malawi's Civil Aviation Authority.

Later in 2018, the Netherlands Red Cross worked with the Malawi Red Cross to conduct a 10-day mapping mission in Malawi's Chikwawa area. The organizations used drone data to conduct flood analysis, and to analyze potential risk from future flooding. Also in 2018, the Netherlands Red Cross participated in a 5-day drone pilot training in Sweden.

The Netherlands Red Cross is currently planning drone mapping missions in the Philippines, in coordination with Philippines Flying Labs.

New Zealand Red Cross

Drones used for: The NZRC hopes to use drones for sea-based search and rescue and disaster assessment.

Operational examples: None yet.

Summary: The New Zealand Red Cross began to explore drone technology in 2018, with the intention of using drones to get better data into the hands of disaster managers. Currently, the NZRC is working towards developing a drone mapping and search and rescue program capable of operating throughout the Pacific region. It hopes to work with engineers and university researchers to develop sophisticated machine-learning supported data collection and analysis pipelines, better methodologies for aerial disaster response assessment, and more sophisticated hardware adapted to the watery Pacific environment, like drones capable of conducting long-range mapping and search and rescue missions from water-based "lily pads." The program is currently working with Pacific airway administrators and officials to secure permission to operate on a cross-Pacific basis. The NZRC has acquired DJI Mavic drones, and is working towards acquiring funding for a staff training program.

Philippine Red Cross

Drones used for: Community mapping, disaster preparedness mapping.

Operational examples: Community mapping efforts in May 2017 in support of a recovery project.

Summary: In response to the devastation caused by Typhoon Haiyan in 2013, the Philippine Red Cross and the American Red Cross partnered on Tindog Tabang Leyteño, a 3-year recovery project dedicated to building safer, more resilient communities. In May 2017, the project used drones (an Event 38 E384, a Tuffwing UAV Mapper, and a DJI Mavic Pro) to create updated, high-resolution maps of project focus areas.¹⁶

In November 2018, the Nokia company announced that it would be supplying the Philippine Red Cross with "portable LTE networks, and artificial intelligence (AI) and analytics tools" to "help with disaster recovery" as part of Nokia's Nokia Saving Lives (NSL) initiative.¹⁷ In December 2019, the Philippine Red Cross announced a new collaboration with US-based drone delivery company Zipline: the project intends to use the Philippines as a base for the "the largest drone delivery operation for blood and medical supplies in the Asia-Pacific region through Zipline," and is slated to launch in the summer of 2020.¹⁸

¹⁶ "Detailed drone and street-level imagery for mapping in the Philippines," Missing Maps, July 27, 2017, <https://www.missingmaps.org/blog/2017/07/27/drone-and-street-level-imagery-in-philippines/>

¹⁷ James Blackman. "Nokia supplies UAVs, LTE, AI for disaster recovery in the Philippines," Enterprise IOT Insights, November 27, 2018, <https://enterpriseiotinsights.com/20181127/channels/news/nokia-supplies-disaster-recovery-in-philippines>

¹⁸ Scott Garceau. "Bono teams up with Red Cross to deliver blood using drones." The Philippine Star. December 11, 2019. <https://www.philstar.com/headlines/2019/12/11/1976087/bono-teams-red-cross-deliver-blood-using-drones>



Fig. 14: Barangay officials refer to drone imagery during a disaster planning exercise. | Credit: Ylla De Ocampo, Philippine Red Cross.

Salvadorean Red Cross Society

Drones used for: Communications and PR, training.

Operational examples: Limited use of two drones for capture of photographs and video of field operations and events for communications, as well as training exercises.

Summary: The Salvadorean Red Cross is in the early stages of incorporating drone technology into its damage assessment operations: it is “interested in working to have these devices that help to carry out risk mapping and to support emergency operations, especially in search and rescue.”

Salvadorean Red Cross members are learning more about the uses of new technology in disaster mapping, and have run simulations of damage assessment procedures and protocol. In 2019, the Swiss Red Cross visited El Salvador and conducted a presentation and demonstration of risk-mapping drone technology.

The El Salvador Red Cross currently owns two drones: one is used by communications staff to document field visits and events with photographs and video, while the other is used exclusively for training.

Senegalese Red Cross Society

Drones used for: Training.

Operational examples: None yet.

Summary: Senegal Flying Labs/We Robotics is currently working with the Senegalese Red Cross Society to provide initial training and support for future drone operations. They hope to use UAS to produce pre-disaster and post disaster maps. They do not currently have their own drones, but hope to acquire them in the future with Senegal Flying Labs assistance.



Fig. 15: Senegalese Red Cross and Flying Labs briefing with volunteers before assessment. | Credit: Mamadou Gueye, Senegalese Red Cross.

Spanish Red Cross

Drones used for: Search and rescue, situational awareness, mapping.

Operational examples: In October 2017, the Spanish Red Cross used drones in a search and rescue pilot project at a beach in Tenerife. This initial pilot project has been followed by a number of other search and rescue pilots in different environments, including lakes, mountains, and more sea rescues. Some Spanish Red Cross branches currently use drones to record simulated emergency exercises.

In 2018, during the response to the Indonesian earthquakes, the Spanish Red Cross deployed an information management field assessment coordination team (IM FACT) to map IDP camps in Sulawesi: the Spanish Red Cross worked with teams from the Indonesian Red Cross Society and the IFRC to use a Phantom 4 Pro drone to collect map data.

Summary: The Spanish Red Cross first used drones in October 2017, as part of a search and rescue pilot project: the drone was used to deliver a RFD (rescue floatability device) to a distressed person in the ocean. In June 2018, the Spanish Red Cross created a working group to “assess [the technology], define the drone requirements, and create procedures.” In 2018, the Spanish Red Cross was involved with drone mapping efforts at IDP camps in Sulawesi, as part of the response to the Indonesian earthquakes. Currently, the working group consists of 4 volunteer drone pilots and 3 disaster management officers. As of this writing, the Spanish Red Cross has carried out multiple pilot projects involving drones, primarily using the aircraft to assist in search and rescue operations. The SPRC is involved in a 5G pilot project with assistance from Vodafone and Altran: search and rescue teams are testing an app that enables their drones to more effectively stream video, night video, and thermal imagery.

The Sri Lanka Red Cross Society

Drones used for: Flood mapping, pre-disaster mapping, disaster planning, climate change planning.

Operational examples: Drone used to assess damage from monsoon flooding in 2018.

Summary: The Sri Lanka Red Cross Society is currently using UAV mapping as part of a risk-reduction strategy for climate change, as highlighted in a IPCC report from 2018.¹⁹ In May 2018, the Sri Lankan Red Cross announced that the Colombo branch had used a waterproof Swell Pro quadcopter-style drone to assess damage from monsoon flooding.²⁰

¹⁹ “Sri Lanka Red Cross drone assesses monsoon disaster from the air.” Climate Centre. May 6, 2018. <https://www.climatecentre.org/news/1003/sri-lanka-red-cross-drone-assesses-monsoon-disaster-from-the-air>

²⁰ “Disaster Response Units of Red Cross standing by to assist in case weather worsens.” Sri Lanka Red Cross Society. May 18, 2018. <http://www.redcross.lk/main-news/disaster-response-units-of-red-cross-standing-by-to-assist-in-case-weather-worsens/>

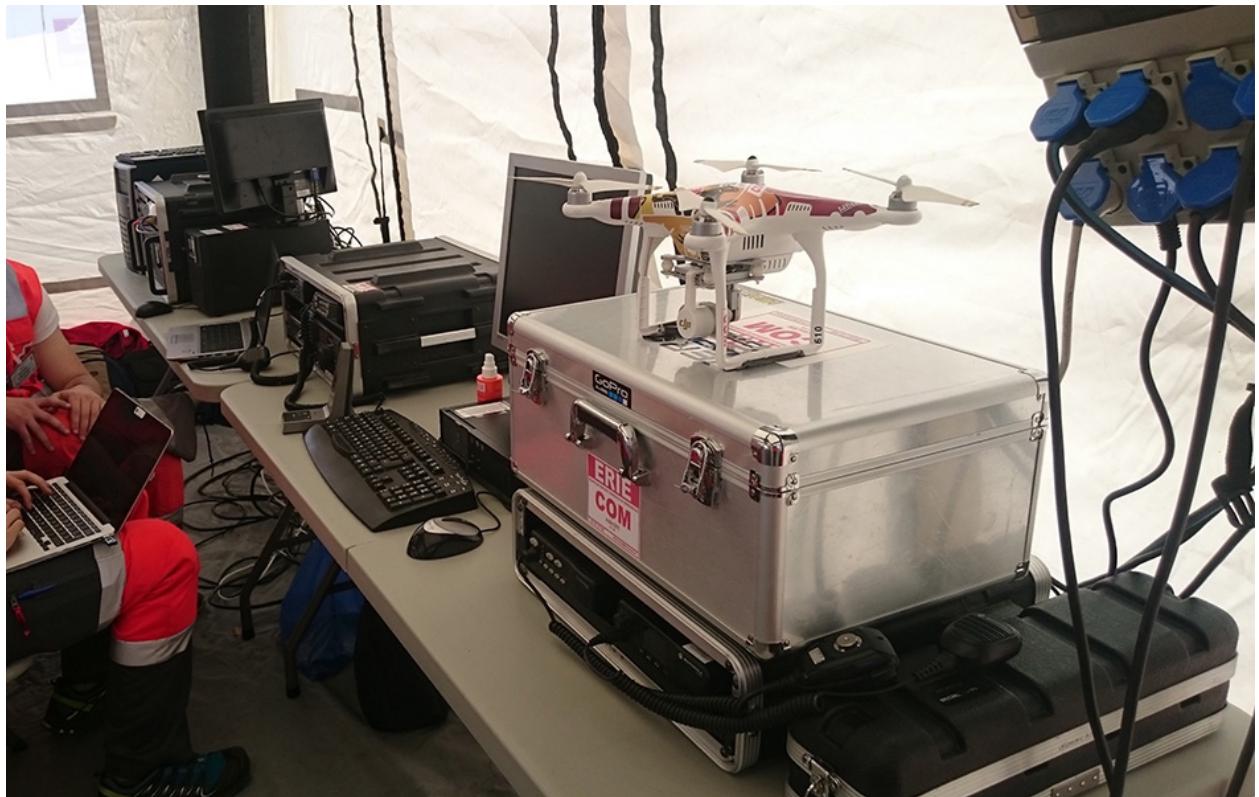


Fig. 16: Albacete's IT & Telecom Domestic Emergency Response Team Equipment at the Spanish Red Cross Advanced Control Post, during the SIMEX with the Military Emergency Unit in Torrelavega, April 2017. | Credit: Spanish Red Cross.

Tanzania Red Cross National Society

Drones used for: Pre-disaster mapping, disaster planning, flood mapping.

Operational examples: 2015 participation in flood-risk reduction mapping exercises.

Summary: In 2015, the World Bank and Drone Adventures used UAVs to capture imagery of flood-prone areas in Dar es Salaam, in a consortium flood risk-reduction project²¹ with the Tanzania Red Cross National Society, the Commission for Science and Technology (COSTECH), the Swedish Development Agency, and the Global Facility for Disaster Risk Reduction.²²

The Uganda Red Cross Society

Drones used for: Post-disaster mapping and situational awareness, as well as limited use for monitoring population movement.

Operational examples: Drone mapping of October 2018 landslide, aiding disaster assessment efforts. Drone video of refugee movement across border collected in 2016.

Summary: In September 2016, the Uganda Red Cross Society used drone footage to document the scale of the humanitarian response at the Bidibidi refugee reception centre, in what was widely heralded as the first use of a drone by the Red Cross Red Crescent on the African continent. In October 2018 in response to the Bududa landslides, the Uganda Red Cross Society worked with Uganda Flying Labs to use drones to collect data for situational awareness and mapping. The Uganda Red Cross Society was pleased with the resulting data, and hopes to build its own internal drone capacity in the near future. However, Ugandan UAS policies are restrictive: the Uganda Red Cross Society hopes to obtain official permission from aviation authorities to fly more often.

²¹ Julie Arrighi. "Dar es Salaam workshop charts future of inter-agency programme for flood resilience in Tanzanian commercial capital." Climate Centre. November 14, 2016. <https://www.climatecentre.org/news/799/dar-es-salaam-workshop-charts-future-of-inter-agency-programme-for-flood-resilience-in-tanzanian-commercial-capital>

²² "World Bank Using UAVs for Disaster Risk Reduction in Tanzania." OpenDRI. August 19, 2015. <https://opendri.org/world-bank-using-uavs-for-disaster-risk-reduction-in-tanzania/>



Fig. 17: Uganda Flying Labs, Uganda Red Cross, and community members. | Credit: Uganda Flying Labs.

Benefits and costs of drone use for disaster response

Drones, like any new technology, invite new benefits and costs. We present the following summary of costs and benefits for drone use by Red Cross/Red Crescent members, derived from telephone interviews, email correspondence, and desk review of relevant documents.

The benefits

Collecting low-cost, high quality geospatial data

Drones generally offer a low-cost and easy to use means of collecting high-quality geospatial data after disaster. In many countries and scenarios, drones represent the only realistic or affordable means of collecting aerial imagery: manned aircraft and usable satellite images are not options. Drones permit disaster responders to quickly create usable, actionable maps, and to rapidly impact a disaster's effects on the community.

Pre-disaster planning

During the last 3 or 4 years, there was trouble in Gambia, and a lot of people coming to Senegal. So we can use the drone to see or find a good area for their reception, so we can identify a good place to put a camp. Because we can also know the level of the ground. If the area is not accessible, we can use a drone to find a good way to go there.

- Mamadou Gueye, Senegalese Red Cross Society

Drone-collected data makes it easier and cheaper for organizations to plan future construction and infrastructure projects. With drone data, organizations can identify better places for IDP camps, assess flood risk in a given area, predict and plan for climate change impacts, and more. In this way, drones have just as much utility for "pre-disaster" operations as they do for "post-disaster" operations.

Situational awareness during disaster

We have a lot of old bombs from WWII lying around. There was an explosion in this field... The police thought it might lead to a sinkhole, or an old mining path. We went up with the drone and looked at what was there, to minimize the risk for the police or fire department.

- Kai Brunner, German Red Cross

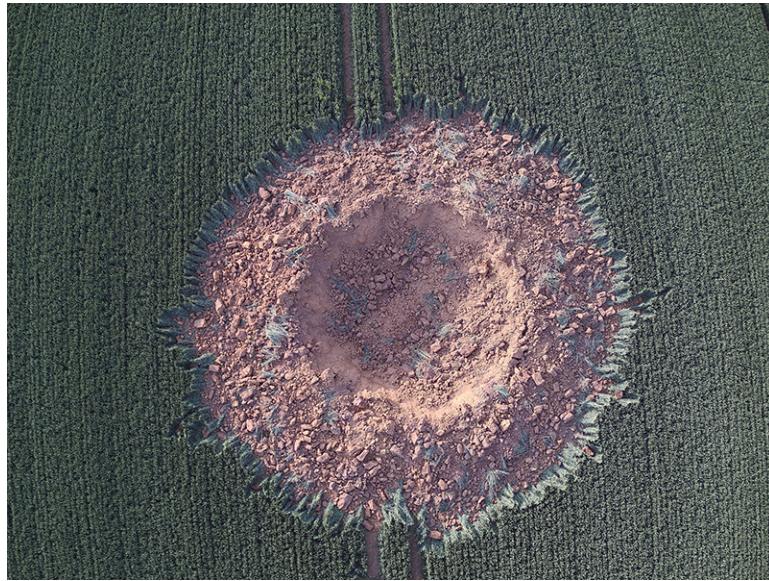


Fig. 18: Investigation for Police. Self explosion of a 250 kg. WWII aircraft bomb in Ahlbach, Germany, 2019. | Credit: Kai Brunner, German Red Cross - Kreisverband Limburg e.V..

Drones are an “eye in the sky,” a means of gaining a birds-eye view of a given scenario or situation. Humanitarians can use drones to gain a quick, overview idea of what they are responding to, and to make quicker decisions about which areas they should attempt to reach first, and how they might best get there. This type of situational awareness information does not require computationally demanding processing. Using this information simply requires a functioning drone that is capable of instantly outputting images to a connected mobile device, which most modern consumer drones are capable of doing.

After the [landslide] disaster, we wanted to know what the situation was visually, and that was impossible without drones. The ground team was moving, but it was very soggy, very wet, and continuously raining - they weren't able to reach the site. The drone imagery helped us do that kind of mapping, where we were looking at the before situation and the after situation. We were able to count how many houses were affected, how many bridges were washed away, what roads were cut off.

- Joel Kitutu, Uganda Red Cross Society

Interviewees for this report described using drones in this way in a number of occasions and contexts, such as searching for safe entry ways into disaster areas, gaining a sense of the overall scale of flooding events, and conducting an initial overview of areas with potential unexploded ordnance. These initial, overview images can also be used to quickly identify areas that should be mapped in more detail. Search and Rescue Operations



Fig. 19: Flooding in Karonga, Malawi. | Credit: Malawi Red Cross Society.

In combination, drones and dogs are very powerful. The dogs search in the forest and the drones search in the meadows, mostly where the dogs aren't searching - in places where it's dangerous for them, for example fields with wild pigs, quarries or along stream courses.

- Kai Brunner, German Red Cross

Search and rescue operations often rely upon aircraft to search for missing people over large geographic areas. Manned aircraft may not always be available and are expensive to operate. With this in mind, a number of search and rescue-focused Red Cross societies have begun to experiment with using drone technology to assist both land and water-based rescues. The German Red Cross is working to combine both drone-assisted searches and searches carried out with dogs: the drones search areas that are not heavily forested, while dogs are sent to areas that are too dense with foliage for the drones to "see" effectively. The New Zealand Red Cross intends to work with academic researchers to develop drone hardware and software for off-shore search and rescue operation, which could then be deployed throughout the Pacific region. A number of private companies are also beginning to develop specialized software for drone-assisted search and rescue operations.

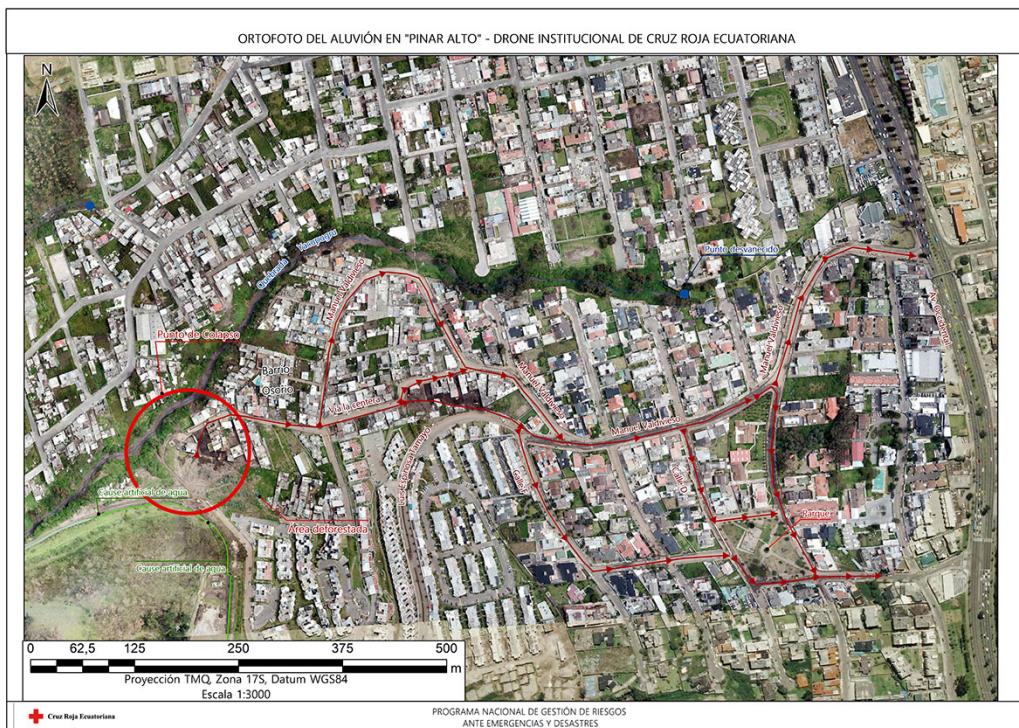


Fig. 20: Orthophoto of the Pinar Alto alluvium emergency response. | Credit: Ecuadorian Red Cross National Disaster Risk Reduction Program.

Striking, compelling imagery for PR and communications

We had that Faces of Humanity campaign centered around the Bangladesh Myanmar Crisis, and a lot of people came to us with feedback that they hadn't fully grasped the scale of the disaster until they saw the drone images of an endless sea of tents, stretching far beyond the horizon.

- Luc Alary, Canadian Red Cross Society

Drone imagery presents a compelling, aerial view of the world, and a number of Red Cross societies are incorporating drone photos and video into their PR and communication strategies. Before the rise of inexpensive consumer drones, capturing these striking "big picture" views of disaster areas and operations was often prohibitively expensive for humanitarians.

Today's drones are capable of collecting high-resolution photographs and video at a lower price point than is possible via manned aerial photography, making it easier for humanitarians to quickly collect and disseminate imagery to the public. Drone images are particularly valuable for giving the public a sense of the size and scale of a given disaster, such as aerial photographs of a vast flooded area, or videos depicting the enormous size of a camp for people displaced by disaster.



Fig. 21: Aerial view of a community infrastructure construction site in Canaan, Haiti. | Credit: Matthew Gibb, American Red Cross.

Positive community responses

Internationally, people are really intrigued. It's almost difficult to deploy the drone in Bangladesh due to massive interest and curiosity from people.

- Luc Alary, Canadian Red Cross Society

Drones are a controversial technology, and humanitarians often assume that the public will respond negatively to their presence. However, this was not the experience of the RCRC drone users that were interviewed for this report.

The vast majority of interviewees reported that local community members had positive responses to the presence of their drone: the overarching theme of these interactions was public curiosity, instead of public distrust. No interviewees reported an outright negative or hostile experience with community members regarding their use of drones.

While some reported that community members were curious and wanted to ask questions, they noted that these interactions all ended on a positive note, after the RCRC members explained what they were doing with the drone and why. Their experiences are an encouraging indicator that drones may be a less polarizing technology than they are often thought to be.

Perhaps the fact that the drones are flown by the RCRC is a relevant factor in the technology's positive reception. Recent research from the US¹ found that the public holds considerably more positive views of drones that are used for public safety than they hold of drones used for other purposes.² RCRC societies may want to ensure that their drones are clearly marked with RCRC insignia. They should also ensure that communities are notified of drones activities as widely as possible, and that communities are (when possible) given access to the data that drones collect.

Community mapping work

When we get... requests from the village administration office, we mostly work with them in the community, so they have very detailed mapping for development proposals.... It can be useful for them to plan their community and village.

- Husni Mubarok, Indonesian Red Cross Society

Drones are becoming an increasingly common sight during community mapping projects, where disaster responders draw upon the first-hand knowledge and insight of community members to craft maps that better reflect reality on the ground. The high-quality, high-resolution images that drones capture give people who participate in community mapping exercises a clearer visual overview of where they live: they can this supplement this information with their own local knowledge and expertise.

We are testing risk mapping, community mapping - these methodologies where you go and talk with people. They make a hand-drawn map, and all of these go on the computer. And with the photos from the drone, you can mix these two sources of info: what the community sees, and what you see in the orthophoto. The final product will be a risk map.

¹ Audrey Fraizer. "Sky's the Limit." The Journal of Emergency Dispatch. October 22, 2019. <https://iaedjournal.org/skys-the-limit/>

² Joel D. Liberman et al. "Aerial Drones, Domestic Surveillance, and Public Opinion of Adults in the United States." University of Nevada, Las Vegas. July 2014. https://www.researchgate.net/publication/327474201_Aerial_Drones_Domestic_Surveillance_and_Public_Opinion_of_Adults_in_the_United_States



Fig. 22: A crowd of interested children observe the progress of a drone mapping mission in Leyte, Philippines. | Credit: Ylla De Ocampo, Philippine Red Cross.

- María Fernanda Ayala, Ecuadorian Red Cross

Drone mapping exercises also, ideally, leave communities with raw data that they can use for their own projects and purpose. Many interviewees described positive interactions and collaborations with community members around drone mapping projects.

In an interview, Husni Mubarok, IFRC Indonesia, IM Senior Officer described the typical workflow his team follows when they fly drones in the field. We provide it below as a representative example of how drone teams plan flights, capture data, and process that data for practical use.

First, we prepare the flight plan based on a request from the Disaster Management department at PMI (the Indonesian Red Cross). Once we get the location, then we do an initial remote survey of the area.

We create a flight path and plan, and prepare our technical kit. We meet with local authorities and get permission to fly first. We then go to the field and fly the drone.

Once the flight is done, the images are sorted, so we know that there is clean imagery to be processed into an orthomosaic (a map made from many drone photographs).

Once we get the mosaic imagery, we upload it to Open Aerial Map. Then, we contact Open-StreetMap Indonesia, so they can update their tasking manager with the latest TMS (Tile Map Service). Then once we update all those things, we conduct a small mapathon with the local volunteers [using the drone map], so that we have full digitization of the area. We map out roads, building footprints, waterways, and more.

Once that's done, we continue to create the final basemap: if it's required, we create an atlas. Then, we distribute the map to the Vulnerability and Capacity Assessment Team." Once it is done we will continue with the work of creating the basemap. If it is required... we will create an atlas. Then, we will distribute the map to the Vulnerability and Capacity Assessment (VCA) team.

The challenges

Regulatory restrictions

If you look over all of Europe, Austria has one of the strictest rules and regulations around drones. And at the moment, the laws and regulations are making no difference between a private person, a commercial drone user like a photographer or a video company, or rescue organizations. At the moment that's our biggest challenge.

- Markus Glanzer, Austrian Red Cross

It's a very bureaucratic process, getting permission to fly. That's one of the biggest challenges we're having - to secure a drone and use it here.

- Joel Kitutu, Uganda Red Cross Society



Fig. 23: Preparing for a drone mission to do displaced persons camp mapping during the 2018 recovery assessment in Indonesia. | Credit: Husni Mubarok, IFRC & Laura Ruiz, FACT IM.

Due to a lack of regulation, it's very often a situation where we cannot exactly know in advance about what regulations we have to comply with in a country... is it possible to fly, is it forbidden, or is it something in the middle? We often need ad hoc acceptance from regulators in each country. And it's very often a case of uncertainty about how we obtain the flight permit.

- Alexis Cléré, ICRC

Drone laws differ around the world, and are constantly changing. As mentioned above, some countries have essentially no regulations at all, while others have exceedingly strict restrictions regarding drone use. RCRC drone users often find themselves confronted with significant regulatory impediments to the wider use of drone technology in real-world operations. Drone users who operate in countries outside of their home country must contend with extremely different drone laws, and may face restrictions on bringing drones into (or out) of the country.

While a Society may own a drone capable of flying at night or operating beyond visual line of sight of the user - both functions that are useful during search and rescue operations - national regulations may bar them from using their drone in this way. Some regulators require that drone pilots give advance notice of flights well in advance, making it all but impossible to secure permission to fly during an active disaster response.

Lack of clarity around how drone data influences decision-making

How do we get the data from a drone - this data intensive, high resolution imagery - and how do we put it through a pipeline? What does a disaster manager actually need, to get the situational awareness picture? And then, how do we send them the minimum amount of data needed to satisfy these requirements?

- Andrew Bate, New Zealand Red Cross.

Collecting drone data means little if there is no clear plan in place for using it. The drone data to decision making pipeline remains poorly-defined within the humanitarian sector. Too often, drone data is collected during humanitarian projects and then goes unused, or is used in ways that are confusing and unsystematic. Building drone piloting-capacity means little in the absence of drone-data processing capacity.

Very few methodologies exist that attempt to use drone data in a systematic way for activities such as post-disaster damage assessment, pre-disaster resiliency mapping, and more. Drone users often are forced to come up with their own methodologies and systems for using drone data, in the absence of clear guidelines or best practices. Often, disaster responders find themselves adapting drone data tools, methodologies and best practices that were initially designed for non-disaster applications for their own purposes, with varying results. The open-source mapping tools provided by the Humanitarian Open-StreetMap Team (HOT) are one example of a more systematic means of putting drone-collected data to work. More research, guidance, and effort in this area is needed.

Lack of institutional buy-in or support

Often, drone operations start within National Societies because of the efforts of one or two interested and motivated people: they largely do not originate as top-down initiatives of their organizations. Some interviewees reported challenges with securing institutional buy-in or support within their Red Cross organizations for drone use. They felt pressured to demonstrate the value of drone technology to skeptics within the larger organization. Drone pilots within RCRC societies must also find ways of securing funding and permission to operate from within their organizations, if they wish to continue using the technology.

Cost of acquiring drones or hiring drone services

For this kind of product, it was flying one time or 2 times a month. But it requires a budget to go to the field, and you know this... expenses of hotels, eating, everything like that.

- María Fernanda Ayala, Ecuadorian Red Cross.

Drones are generally a lower-cost means of collecting aerial imagery, as compared to manned aerial photography or satellite imagery analysis, but this does not mean that they are cheap. Drones remain a novel technology, and funding streams for humanitarian aid may not specifically include support for purchasing drone hardware or software. Small drones that are usable for mapping and for disaster response vary widely in price, but generally range from \$1,000 to \$10,000 USD. The popularly-used DJI Mavic Pro drone, which a number of interviewees reported using, retails for around \$1,000 in the United States. The software and hardware used to analyze and process drone-collected data, such as images and video, can also be expensive.

While individual photographs from a drone are available almost instantly, these photographs are often of limited value for many drone users during disasters, who wish to create geographically-accurate maps and overviews of the areas they work in. Creating a geographically correct photograph (or orthophoto) from drone images requires access both to the requisite software (such as Pix4D or DroneDeploy), and a computer capable of running the software. While some drone data processing services, such as DroneDeploy, process data using cloud computing and not directly on a user's laptop, these services require high-speed Internet access. A number of interviewees reported that they found it very difficult to upload their photos to these services, as they lacked fast enough or reliable enough Internet connections.

Cloud-based data processing software may also be unusable during operations that take place in remote areas without access to either Internet connections or to mobile data. Under these conditions, an adequately-powerful laptop or computer will be needed to create geographically accurate products like orthomosaics or 3D maps.

Finally, drones come with logistical costs. Field work with drones requires expense-incurring travel. Regular practice with drones is essential, but requires access to a safe practice space and regular personnel time and effort.

Technical expertise and availability of trained personnel

This is something I had underestimated a little bit, how many details you have to document. We have checklists for takeoff, landing, monthly maintenance, weekly maintenance, also the accumulated management, and so on. So a drone is really technical, you have to do updates, test the updates...

- Kai Brunner, German Red Cross

Safely and effectively flying and maintaining drones requires both technical expertise and organization. Adhering to national drone regulations requires attention to detail. While drones have a lower barrier to entry than manned aerial photography or satellite imagery analysis, they still require specialist expertise to be useful. Without training, drone users are more likely to fly in unsafe ways, putting people on the ground at risk: they are also more likely to crash or badly damage their drones.

Poorly trained drone pilots may be unaware of the importance of protecting the privacy and security of communities whose data may be collected during drone flights - creating the potential for scenarios where data is used in unsafe or unethical ways, putting people at risk and damaging public trust. Inadequately trained drone users may also lack confidence in their ability to fly drones and to process drone data, meaning that expensive equipment goes unused.

While adequate training in both piloting and data processing is essential, locating people who have expertise in these areas can be a challenge. Limited access to funding and organizational resources often make it difficult for Societies to attract or to build a cadre of trained, experienced drone pilots. Currently, most societies appear to have only one or two trained drone pilots: this creates problems when these pilots move, leave the organization, or are otherwise unavailable.

While some interviewees within Societies currently rely upon drones operated by partners for drone-data collection, many expressed interest in building their own, internal drone capacity in the future: a model where they have control over when they fly, where they fly, and how much it will cost.

Technical and environmental constraints

Small UAVs have some limitations. The flight time is about 30 minutes, but really it's only about 20 minutes for a flight. So that's the kind of limitation. We can't extend the battery life: we need to get more batteries. For our flights today, we needed a total of 5 batteries, which let the drone fly for 20 minutes each.

- Husni Mubarok, Indonesian Red Cross

The drone is not waterproof... there was one day when we were mapping, and at the end of the mapping exercise, when we were about to finish taking the photos, it started to rain. So we had to return the drone and continue the mission on another day. We didn't want to risk the safety of the drone.

- Feliciana Vernon, Belize Red Cross

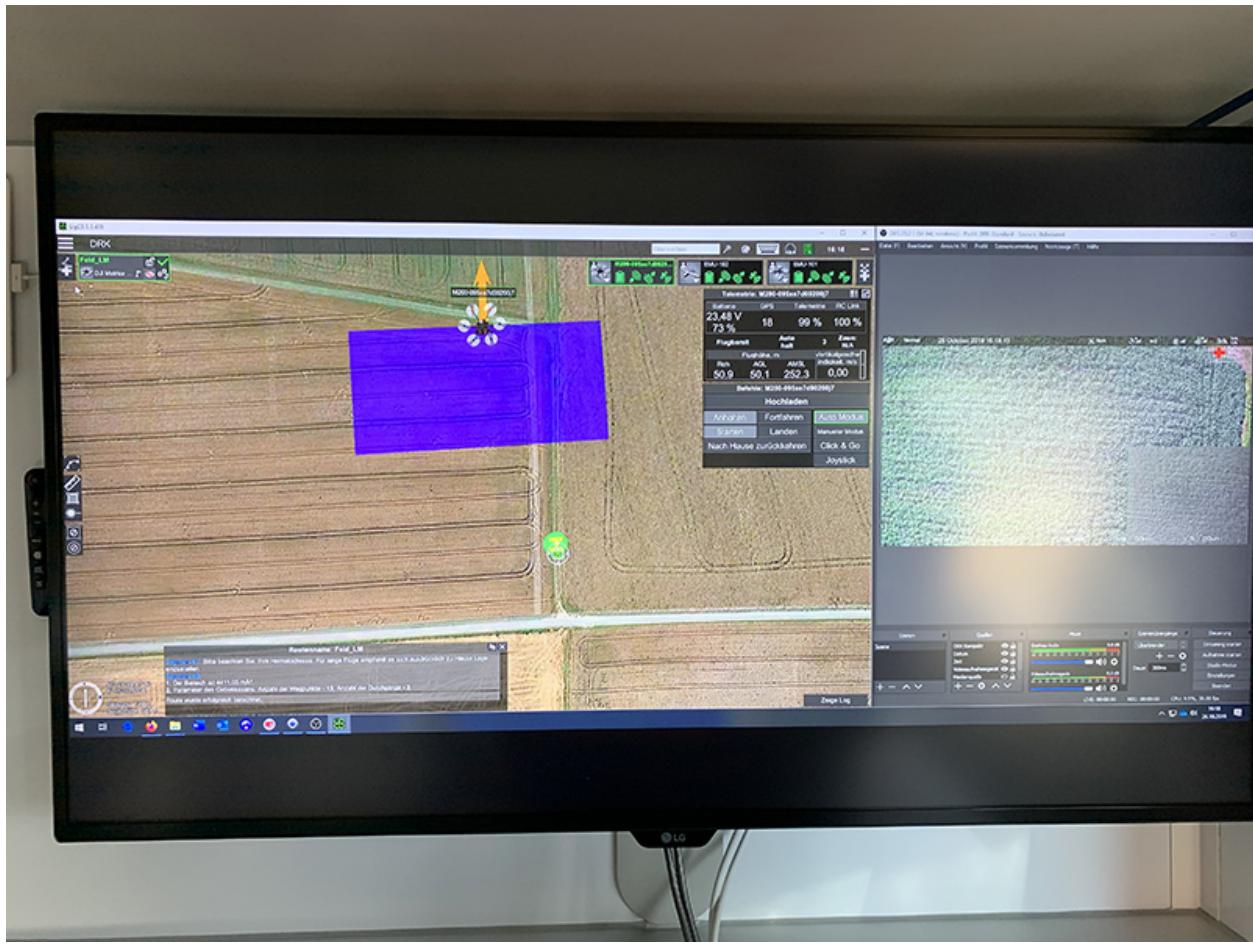


Fig. 24: Ground station software and drone live stream. | Credit: Kai Brunner, German Red Cross - Kreisverband Limburg e.V..

Small, consumer drones are surprisingly sturdy, but they still suffer from a number of technical and environmental limitations. Most drone models available to consumers are unable to operate safely under certain weather conditions, such as heavy rain, snow storms, and strong winds. During search and rescue operations, drones may be grounded under conditions where manned aircraft will not be.

Drones also require a certain amount of open space to take off and land safely in. While multirotor drones can take off and land in smaller spaces than fixed wing drones are capable of, they still require unobstructed areas to operate in. Some countries drone laws mandate that a drone remain within “visual line of sight” of a drone pilot at all times, further restricting their ability to operate at a distance. Drone operations can be particularly challenging in heavily forested or mountainous areas: many crashes occur after collisions with trees and power lines.

Connectivity is another major concern for RCRC drone users. A drone’s radio and data link to the pilot and the ground may be compromised by environmental factors, such as interference from other radio stations, large nearby buildings, metal objects, bodies of water, and other features. Unfortunately, it can be difficult to identify these obstacles in advance.

Drones also require an adequate number of batteries to operate. Generally, each 20 to 30 minute long flight will use up one battery: larger mapping or reconnaissance missions may require many batteries to complete. Purchasing multiple drone batteries - or operating a generator for long enough to charge them - can be expensive. Drone batteries may also fail or experience technical challenges, which can slow down or halt drone operations.

Finally, drone pilots must take into account how local communities will respond to drones. Sometimes these responses are hostile: drone pilots in the United States, including those working in disaster response operations, have reported being shot at or physically threatened.

Even well-meaning community members may unintentionally interfere with drone operations.. One interviewee reported an incident where a large, curious crowd gathered around the drone pilot during a search and rescue operation, making it difficult for the flight team to fly safely and to communicate with one another. In some situations, teams may want to consider assigning one team member to community relations: this person can answer questions, describe the data that's being collected, and can keep people safely away from where the drone is flying.

Bad reputation of drone technology

In some conflict zones where we operate, there are military drone operations - so the acceptance of drones, even civil ones, is very low. We have to work on this in some countries.

- Alexis Cléré, ICRC

While all of the Red Cross drone users described in this report are using consumer-focused, civilian-produced drones in their work, the word “drone” itself is often linked with much larger unmanned aircraft that are used for offensive, military purposes. While none of the Red Cross drone users interviewed for this report described experiencing pushback or criticism from the public, they were still conscious of the potential for this to take place, and were aware of the necessity of acting as good “ambassadors” for the technology.

While the interviewees contacted for this report uniformly reported positive public responses to their

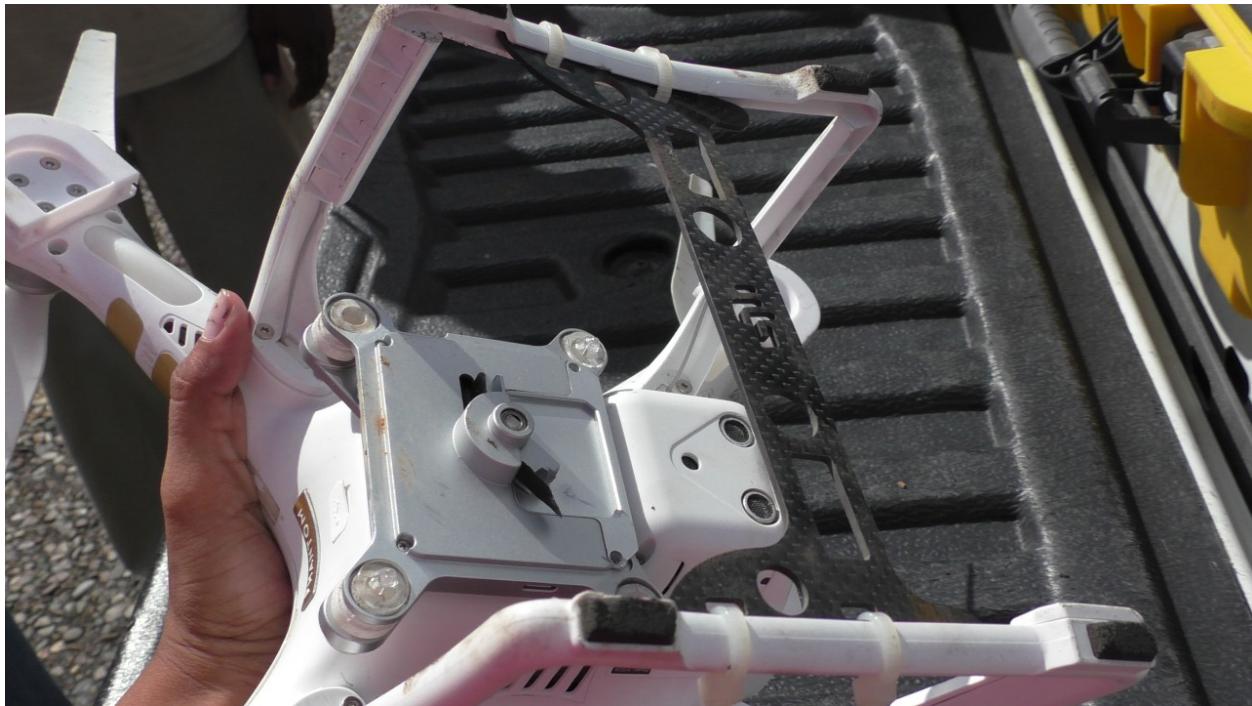


Fig. 25: Examining damage to a drone after a rough landing. | Credit: Feliciana Vernon, Belize Red Cross.

drones, it should not be assumed that this will always be the case. Ultimately, little is known about how regional, cultural, and demographic differences impact public perception of drones. While some research around these topics exists, it is almost exclusively focused on the United States and Europe. More non-US and Europe-centric research, like this 2018 study on attitudes towards small drones in Rwanda and Tanzania, should be undertaken in the near future.

Some interviewees reported seeing other drone users - who were not affiliated with the Red Cross - using drones irresponsibly around them. One interviewee recalled seeing non-Red Cross drone users flying irresponsibly low over a group of people around a food distribution center at an IDP camp: he described this as the "only instance" where he had seen people "threatened by drones."

Concern around data privacy and security

We are allowed to fly almost everywhere and to take pictures of everything and persons, but after the emergency phase, the disaster phase, we are more or less not allowed to use the pictures or data in public. What we are not allowed to do is if we take a video stream or video from an area - that we just put the video on YouTube, that's strictly forbidden. We can use it internally, but we need to protect the data and the rights of each person in Austria and the EU.

- Markus Glanzer, Austria Red Cross

Data privacy is both a regulatory and an ethical concern. Some places, like the European Union, mandate that drone pilots adhere to strict data privacy laws: Societies who use drones in these places must ensure that they are adhering to these rules in their operations.

Other countries may lack clear guidance on data privacy and security, placing responsibility for data protection on the shoulders of Society drone pilots themselves. Drone pilots must take into account the possibility of the drone data that they collect making its way into the wrong hands. They must also weigh the costs versus the benefits of making the drone data that they collect publicly available via platforms like OpenDroneMap and the Humanitarian Data Exchange. While some valuable resources exist that help drone users make these ethical calls, such as the ICRC's Handbook on Data Protection in Humanitarian Aid, there is still not enough practical guidance or operational information available.³



Fig. 26: Senegal Flying Labs pilots communicating with community members during a Senegalese Red Cross assessment. | Credit: Mamadou Gueye, Senegalese Red Cross.

³ ICRC. "Handbook on Data Protection in Humanitarian Action." 2017. <https://shop.icrc.org/e-books/handbook-on-data-protection-in-humanitarian-action.html>

What should happen next?

Connecting Red Cross Red Crescent drone users

It's good sometimes to see what others are doing, how they are using the drones, in which situations they're using the drones. Maybe we can do the same here, and it could really help us.

- Mamadou Gueye, Senegalese Red Cross Society

Multiple Red Cross Society interviewees expressed a desire to connect with other drone users, via the Red Cross network. They felt that sharing knowledge and advice amongst one another would be of great value: this was particularly important to Societies that were only just beginning to use drones in their work.

With this in mind, the Red Cross should consider the development of means of connecting the Red Cross drone users identified in this research with one another. Initially, it may be most realistic to form these connections via the use of an online group or via an email list. Users could be encouraged to introduce themselves, describe how they currently use drones and how they intend to use drones in the future, and to list any questions, concerns, or thoughts they might have regarding drones and drone use.

If resources allow, it would be valuable to coordinate regional drone meetings or meet-ups, in which members of different national Societies can meet in person, conduct workshops and trainings, and experiment with drone technology in a real-world setting.

Creating trainings and materials

In our partnership with Senegal Flying Labs, first, we want to identify how to use the drones, and in what operations or on what occasion we should use them, like doing assessments, or finding areas where there's migration happening. After that, we want them to train us on using drones, about tracking data and using it. And after that, they can advise us on finding a drone that's good for each operation.

- Mamadou Gueye, Senegalese Red Cross Society

Drone technology is complex and ever-changing, and it can be difficult for interested Societies to know where to start. They need information on how to pick out a suitable drone for their operations, how to maintain that drone, how to train pilots, how to work with drone data, and more. Our call for increased dialogue and collaboration between Societies should be accompanied by the development of training materials, references, and other information that can be shared within the movement, helping those with an interest in drones learn more. Real-world meetups, workshops, and trainings should culminate with the release of widely-available materials, which ideally should be translated into multiple languages.

Promotion of open source technologies for drone operations

We mostly use drone imagery to enhance the quality of our maps. We release our final imagery to the public domain with OpenAerialMap, and to the OpenStreetMap tasking manager. The map that volunteers use and discuss with the community during capacity assessment is the final product of a lot of different documents. | - Husni Mubarok, Indonesian Red Cross Society

Drone data processing software is expensive. Multiple societies interviewed for this report reported that they are forced to rely upon demo or free trial versions of popular UAS data processing software packages like Pix4D and Drone Deploy, as they are not currently able to afford to purchase the software outright.

Open source and free software for drone data processing, analysis and sharing is widely available, but few societies contacted for this report said that they currently use it. This may be due to awareness: organizations may not know that free options exist. This may also be related to ease of use: open source and free software can be more difficult to use and more technically complicated to install than paid software packages.



Fig. 27: Intel NUCs running open source POSM and OpenDroneMap software to process drone imagery.
| Credit: PMI.

There are other benefits to uploading drone data to public platforms like OpenAerialMap (although the possibility of that data being used in unethical ways should always be considered). A number of drone-using organizations can work together to create high-resolution base maps of the areas that they operate in, reducing the need for each unit or organization to collect their own drone data. Some organizations, like the Indonesian Red Cross, regularly re-use the drone imagery that they collect for other projects and mapping activities.

Informations sharing about free and open source software should be a key component of RCRC wide

information sharing regarding drone technology. Red Cross drone users that are comfortable with using open source software should work to raise awareness of this software's existence among other Societies. They should consider developing quick-start guidelines for using this software that can be disseminated in multiple languages. They might also consider offering personalized advice and technical support to organizations who wish to begin to use free and open source software (as their availability allows).

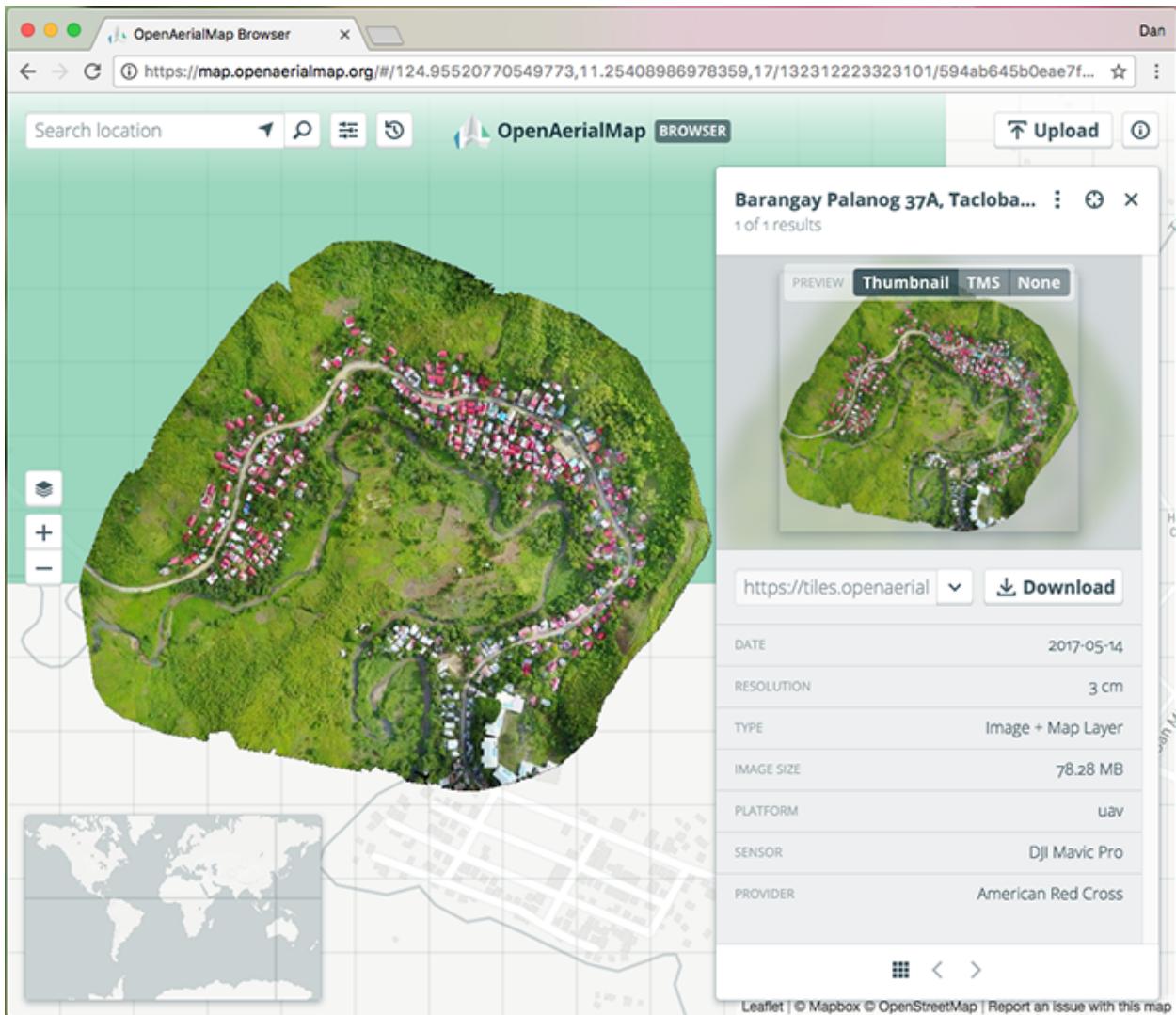


Fig. 28: Imagery of a barangay in the Philippines uploaded to OpenAerialMap.

Developing organizational standards for drone use

We have to know how we are going to standardize the operation and maintain the competency of our drone pilots. We need to define the standard of regulation they are going to follow, what will be the organizational framework with which we will work? Because flying the drone is the easiest part, we have to make sure how we do flight planning, prepare the mission, assess the safety, how we manage for data control, for data privacy...

- Alexis Cléré, ICRC.

The humanitarian drone sector still lacks a centralized set of best practices, technical guidelines, or ethical standards for the use of drones. The Humanitarian UAV Network “UAViator’s Code of Conduct” is the most well-known effort to craft a set of universal best practices and ethical guidelines for drone use in humanitarian contexts. However, these guidelines have not yet been formally adopted across the humanitarian sector: humanitarian organizations are largely developing their own, internal standards at this time. As one example, the ICRC’s Data Protection Handbook, released in 2017, describes best practices for securing drone data and ensuring the privacy of drone users.

The RCRC global network should build an initial strategy for developing and disseminating a set of general ethical guidelines and best practices regarding drone use. These guidelines will provide new drone users with a clear starting point as they consider how best to use the technology: they will also help ensure that all RCRC drone users are operating the technology in ethical, safe ways. These guidelines should include guidance around a variety of topics, including best practices for public interaction, the ethical use and collection of aerial data and images, procedures for crashes and accidents, guidance for assessing drone pilot competency, and more. These guidelines should also take into account current research - both academic and other sources - around drone use in disaster response and humanitarian aid.

Once initially released, these centrally-developed guidelines could then be expanded upon, modified, or localized by individual National Societies. These guidelines could be regularly updated, discussed, and improved upon by means of regular convenings or meetings. They should also be informed by ongoing research work into humanitarian drone use over time, as well as work by other NGOs in the sector. Ongoing drone-related activities by RCRC societies should be regularly reviewed, ensuring that both successes and failures are documented and taken into account so that best practices may be updated over time.

Supporting further research into humanitarian drone use

At the time of writing, little academic or non-academic research work exists on the operational use of drones in humanitarian and disaster response settings. This lack of objective information makes it difficult for organizations to develop well-informed sets of best practices and ethical guidelines around drone use. The RCRC global network should consider prioritizing supporting research work by National Societies or resource centers to add to the overall body of knowledge around humanitarian drones. National Societies who use drones should be encouraged and supported in writing up their experiences and disseminating these documents across the wider network.

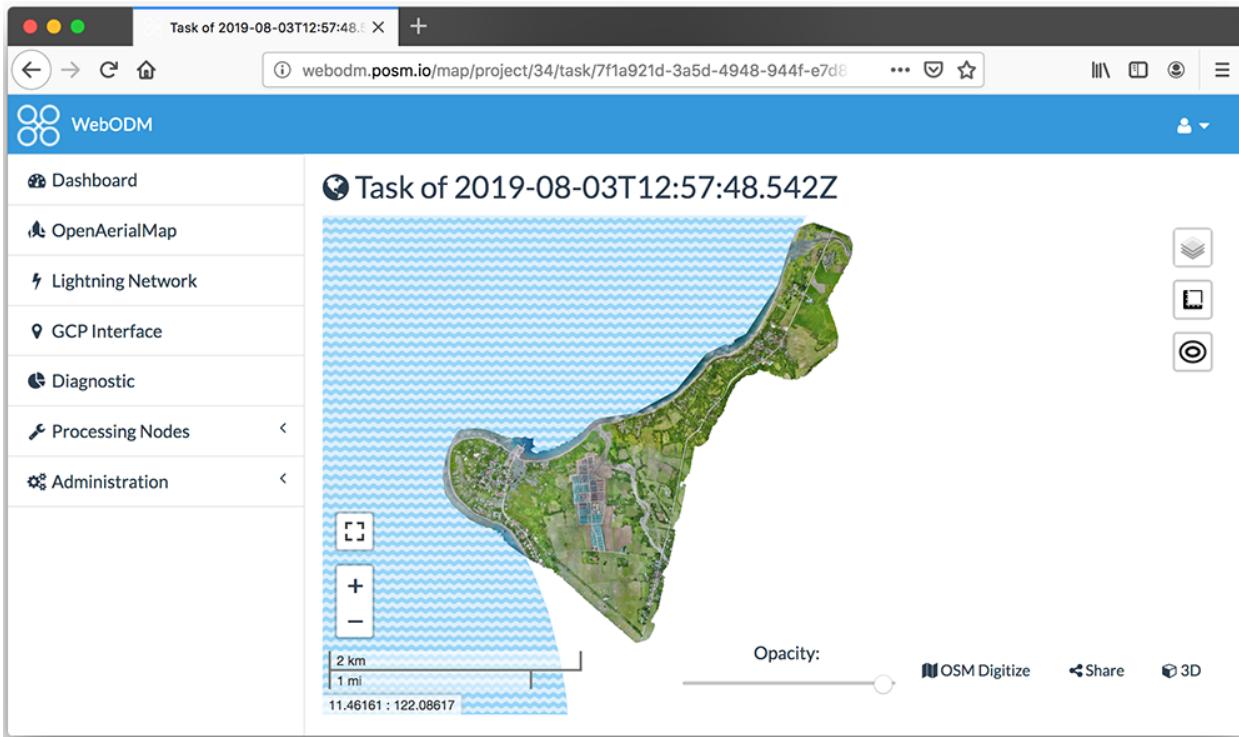


Fig. 29: A processed scene viewed in the WebODM interface for OpenDroneMap.

Sharing airspace (and information) safely

Sharing the skies safely is of essential importance for humanitarian drone users. The ICAO and a number of nations around the world are currently developing strategies for UTM (unmanned traffic management) systems, which will integrate small UAS into the broader airspace. These systems will likely use different technical and operational techniques to make UAS visible to manned aircraft, air traffic monitors, and other users of public airspace. Red Cross drone users should keep up with these upcoming developments in national and international UTM systems, and should take them into account when developing internal best practices and procedures.

Red Cross drone users should also consider their own strategies for sharing flight plans and drone-collected data with governments, other aid organizations, and with the public. Some of the societies interviewed for this report have already developed information-sharing agreements or strategies with other organizations, giving them access to the drone data that they collect.

Internal ethical guidelines and best practices should include guidance on information sharing with other organizations and with flight regulators. Training for Red Cross drone pilots should include comprehensive information on how to work with flight regulators, manned aircraft pilots, other humanitarian organizations, and others. Systems should be developed that permit Red Cross drone pilots to log flight plans with flight regulators and with other aid organizations.

Developing drone logistics

First, we want to build capacity internally, to have an in-house group of pilots we could deploy at any time, and the drones and equipment to process data and share data and the final product. An entire unit, that's the end-game, that can be used for drone deployment. Hopefully, not just a unit that serves Kenya Red Cross, but one that can serve all humanitarian actors, to be kind of a champion in that.

- Safia Verjee, Kenya Red Cross

If each field unit buys a drone and uses it 3 times a year at maximum, it will then just sit in a box until the next mission. So with different logistics hubs equipped with drones, we can more efficiently disseminate drones according to the needs.

- Alexis Cléré, ICRC

RCRC National Societies need to find ways to use drones efficiently, and that may mean that not all RCRC units or organizations need to own and operate their own drones and their own teams of drone pilots. Efficiency may mean finding ways to share drone hardware and drone capabilities across different units within a country, and even outside of it.

Some organizations, including the New Zealand Red Cross, the Kenya Red Cross, and the ICRC, are considering developing drone programs that can operate both outside of the RCRC global network and outside of their home countries. Some are also considering the benefits of partnering with other organizations, such as WeRobotics Flying Labs, to collect data on their behalf.



Fig. 30: Drone DJI Matrice 200 with FLIR XT2 thermal Camera. | Credit: Kai Brunner, German Red Cross - Kreisverband Limburg e.V..

Developing methodologies for effective data use

In the context of our national society, we need more capacity, more capabilities with people with this knowledge and more tech, more computers. Most of all, I think we have to explore how the capacities and methodologies already being used [by the Red Cross] can be transformed, into the new era.

- María Fernanda Ayala, Ecuadorian Red Cross

The act of collecting data with a drone is merely the first step in a much more comprehensive and complex process of data processing, data analysis, and decision-making. RCRC societies need information that clearly links drone data with better outcomes.

One of the seven transformations that are part of IFRC's Strategy 2030 is digital transformation; it calls for integration of digital and emerging technology to enable the organization to, among other things, democratize access to information. The IFRC should review existing methodologies, such as Vulnerability and Capacity Assessment (VCA) and Community Based Surveillance (CBS), and consider how drone data might be best integrated within these and other mapping and assessment activities. In some cases, new methodologies may be needed. In others, it may be possible to adapt existing methodologies to accommodate drone data.

Supporting development of humanitarian-friendly drone regulations

We want to work closely with the government to see if legislation can be passed, maybe to allow regulation on flying drones, so that it's clear, when we acquire drones we can fly them in a democratic process.

- Joel Kitutu, Uganda Red Cross Society

As the Kenya Red Cross, we work as an auxiliary to county and national governments. We have a very good working relationship with them, and they're aware of the nature of our work... It took a little bit of advocacy from our senior management, our secretary general, to say to the government: 'We have an opportunity to try drones, and here's how it will benefit regulators and the defense forces. You'd be involved in training too, so we'd all build our capacity. As a country, we'll be better prepared and ready to respond at any time- and it will help us save lives, our main mandate.

- Safia Verjee, Kenya Red Cross

Drone laws can be difficult to navigate, but RCRC National Societies often enjoy excellent reputations with regulators in their own countries. Multiple interviewees reported that they or their Societies were actively engaged with efforts to create or alter the drone laws in their countries, to develop regulations that balance the ethical concerns that surround drone technology with disaster responders needs.

Conclusion

We have plentiful evidence that drones are a useful - and increasingly widely used - technology for collecting spatial and operational data in support of humanitarian operations. The IFRC should seek to support National Societies as they integrate drones into their day-to-day operations.

Twenty-six National Societies are using or plan to use drones, in a variety of ways. These use-cases include monitoring IDP camp construction; community mapping for resiliency projects; conducting search and rescue operations; post-disaster mapping after landslides and earthquakes; and capturing photographs and video for communications purposes. More use cases are likely to be added in the near future, as Societies grow more comfortable with drones and find new applications for the technology.

We found that these 26 National Societies are largely not collaborating with one another on drone projects, or currently speaking with one another about the use of drone technology. A number of interviewees expressed interest in connecting and collaborating with other drone users at other National Societies in the future.

Currently, the IFRC has no centralized source of contextualized information on drone technology. The IFRC does not currently promote or organize experience-sharing opportunities around drone technology.

Our research demonstrates that there is considerable demand amongst National Societies for methods of collaboration and communication with one another on drone technology and its uses. As a first priority, the IFRC needs to find ways to connect drone users with one another across the movement, so that they can share information and learn from one another. This initial act of international connection will facilitate the later development of movement-wide drone knowledge, standards, training mechanisms, and research.

The IFRC should find ways to collect, organize, and disseminate the knowledge that these drone users possess across the entire Movement. This may take the form of formal research, reports, convenings, manuals, social networking websites or groups, and other resources that can be made widely available to everyone.

The IFRC should also encourage and facilitate the development of Movement-wide technical and ethical standards for drone use. This will provide National Societies with a clear framework for setting up their own drone programs and operations. These standards will provide new and existing National Society drone programs with information that they need to assess the competency of their own pilots and the competency of vendors, ensuring that the IFRC does not inadvertently associate itself with dangerous or unethical activities.

About the Authors

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Faine Greenwood is a humanitarian technology researcher and writer, with a particular focus on drone technology, remote sensing, and spatial data ethics. Greenwood has previously conducted research into operational uses for drone technology at the Harvard Humanitarian Initiative's Signal Program, New America, the World Economic Forum, the World Bank, and the Massachusetts Department of Transportation.

Dan Joseph

Dan is a Solutions Engineer with the American Red Cross International Services Department. As part of the Quality, Data, and Learning (QDL) unit he provides a variety of support related to information management and humanitarian tech. He provides direct implementation support for improved analysis, information dissemination, and data collection. He also engages in technology R&D for continuous improvement and competency development for Red Cross staff and volunteers.

Methods

The initial research was conducted September 2019 to February 2020. Specific search terms were used to identify press releases, reports, and other sources describing RCRC drone uses. Various networks such as Surge Information Management Support (SIMS) were queried about any knowledge of drone uses. Identified National Society staff and volunteers were asked about any drone use cases that they were themselves aware of.

We conducted a total of 17 written and telephone interviews with RCRC or ICRC staff and volunteers. After we confirmed that drones had been used by a National Society in some capacity, we attempted to reach out to representatives of that National Society to identify the individuals who had piloted or otherwise worked closely with the technology. With the consent of the interviewee, all interviews were recorded.

RCRC drone uses were sorted and categorized using a data extraction tool, drawing from both desk research and interview data. Variables of interest included what purpose the drones were used for, what type of drone was used, what type of software was used, reported technical challenges, and reported regulatory challenges, among others. We identified overarching or repeating themes and issues using this data extraction tool.

We apologize for any usage or events we missed in our research. We would like to hear from you so that we can then include your experience with drone technology in future research and written reports. Please contact daniel.joseph@redcross.org regarding any omissions.