Testing the Utility of Mapping Drones for Early Recovery in the **Philippines**

A project employing drones in the wake of Typhoon Haiyan explored how aerial imagery might support recovery and reconstruction activities. Ultimately, the imagery captured by drones became useful in both a tactical and strategic sense during the retrofitting of shelters, and helped not only to identify and verify the shelter sites, but also to help determine the placement of latrines. The mission provided a rich learning experience on the operational use of aerial robotics in a disaster recovery context.

Background

In November 2013, the Philippines experienced one of the strongest and deadliest tropical cyclones ever recorded. Typhoon Haiyan resulted in well over 6 000 deaths and devastated the city of Tacloban along with the islands of Leyte and Panaon, among other regions. The Category 5 super typhoon also displaced more than 6 million people and left almost 2 million more homeless. One of the first international humanitarian organizations to respond was Medair. They arrived in country just 48 hours after the typhoon to conduct their initial disaster damage and needs assessments, but their efforts were hampered by the lack of accurate and up-to-date maps of the region. In fact, in many instances Medair teams had to rely on hand drawn maps or outdated imagery provided by Google.

This lack of accurate geographic data explains why Medair teamed up with the Swiss-based Drone Adventures group in March 2014. Medair was keen to explore what role aerial imagery could play in providing better maps and believed that this imagery could also potentially support shelter construction and more specifically an element of disaster risk reduction (DRR) within shelter construction. To this end, over the course of six days, Drone Adventures used fixed-wing UAVs called eBees to carry out aerial surveys of Tacloban, Dulag and Julita municipalities and of the east coast of Leyte to assess the disaster damage and to support shelter reconstruction activities. The use of drones did not take place within the emergency phase but was rather carried out to explore how aerial imagery might support the recovery and reconstruction activities.

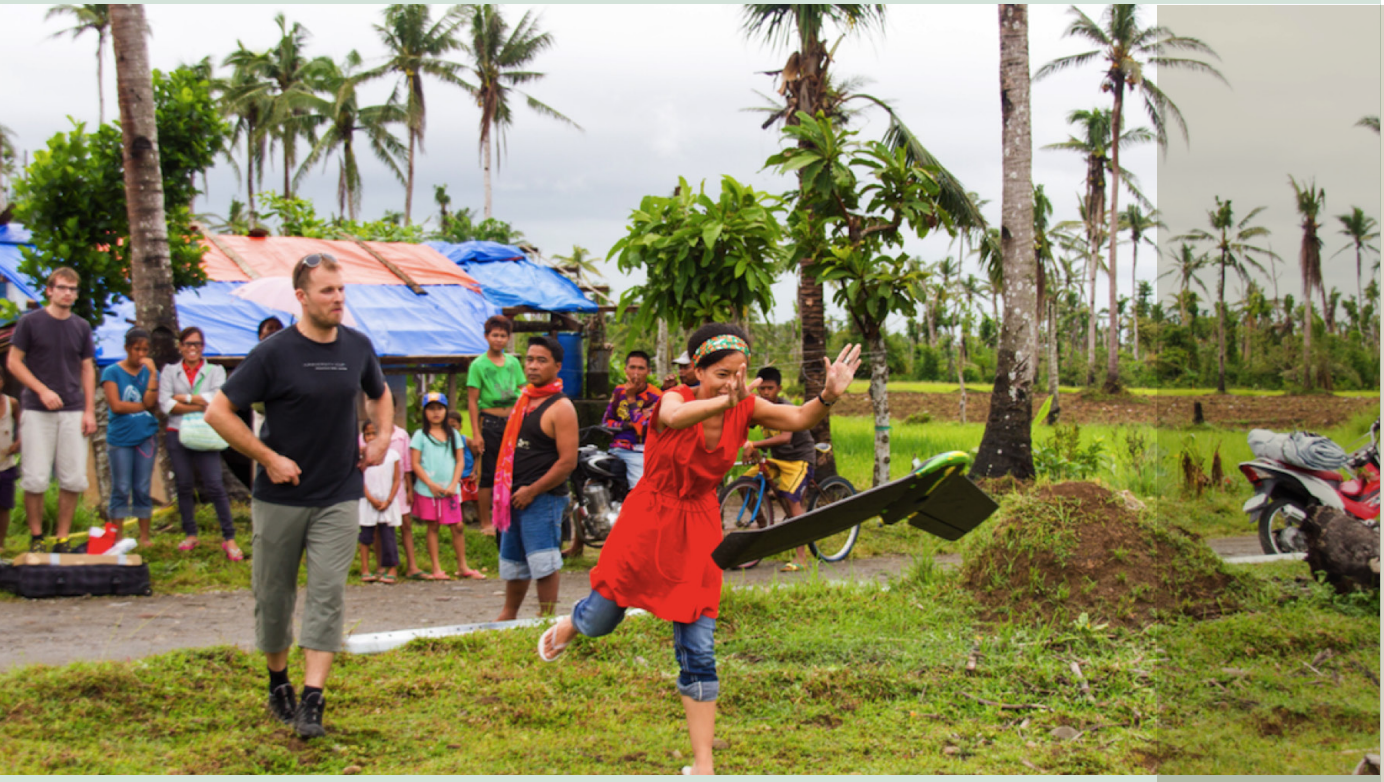

Figure 1 A Medair Team Member hand-launches an eBee UAV. @ Drone Adventures.

Implementation

Obtaining Permits

To obtain regulatory approval, Medair first met with the Civil Aviation Authority (CAA) at Tacloban Airport to request permission to fly in and around Tacloban. Next, Medair submitted an official letter to the CAA representative at the airport and a second letter to a representative of the Armed Forces of the Philippines Disaster Response Task Force, asking for specific permissions from them. This process took three weeks and was ultimately approved. In the meantime, Medair and Drone Adventures obtained permission to fly from local authorities in each barangay[1] and from the mayor of Tacloban. Under these permissions they proceeded to carry out the UAV mission. These local authorities also played a key role in the UAV mission by escorting the UAV team to safe areas to operate and/or by meeting with the UAV team after the flights to discuss the use of the maps. Local authorities were also instrumental in communicating with local populations regarding the purpose of UAV flights.

Area Selection

In addition to the normal housing, land and property issues related to shelter construction, Medair was concerned about no-build zones and local hazards such as flooding. The organization speculated that aerial imagery would help to inform their shelter team's efforts regarding these issues. The key locations that Medair and Drone Adventures focused on for the aerial surveys were the barangays south of Tacloban and those surrounding Dulag.

Flights

A two-person team from Drone Adventures carried out a total of 29 UAV flights with a combined flight time of 11.6 hours. The total surface area surveyed was 48.6 km^2, generating 5 139 very high-resolution aerial images[2]. Imagery for the larger areas (such as fields) was captured at 8 cm resolution to reduce processing time, while imagery for smaller areas such as villages was captured at 5 cm resolution to increase the quality and detail in more urban areas. Before

1 A barangay is the smallest administrative division in the Philippines

2 See resource section for the ortho-mosaics

surveying any new area, the team first contacted the local barangay captain – effectively the village mayor – to explain the purpose of the UAV flights and to ask what data they could offer to the village leaders. These local mayors were reportedly always excited by the opportunity to gain access to more accurate maps, and according to the Drone Adventures staff, they all understood "how much value up-to-date, highly accurate geographic information can bring and the transformative effect proper maps could have on their work."[3] As one barangay captain noted, "Before, we had an overview of our barangay with a large data sheet from 1999 but it was destroyed by the typhoon. Now we can better plan and show which households need help."[4]

The digital imagery was processed using Pix4D and hosted on MapBox. The data were shared with the mayor's office in Tacloban and the individual barangay offices. In addition, Medair and Drone Adventures printed out the maps on small banners in order to share hard copies of the resulting data.

3 http://blog.droneadventures.org/post/85863359885/mapping-the-philippines-after-typhoon-haiyan

4 http://relief.medair.org/en/stories/drones-used-for-good-relief-organisation-uses-drones-to-map-typhoon-haiyan/

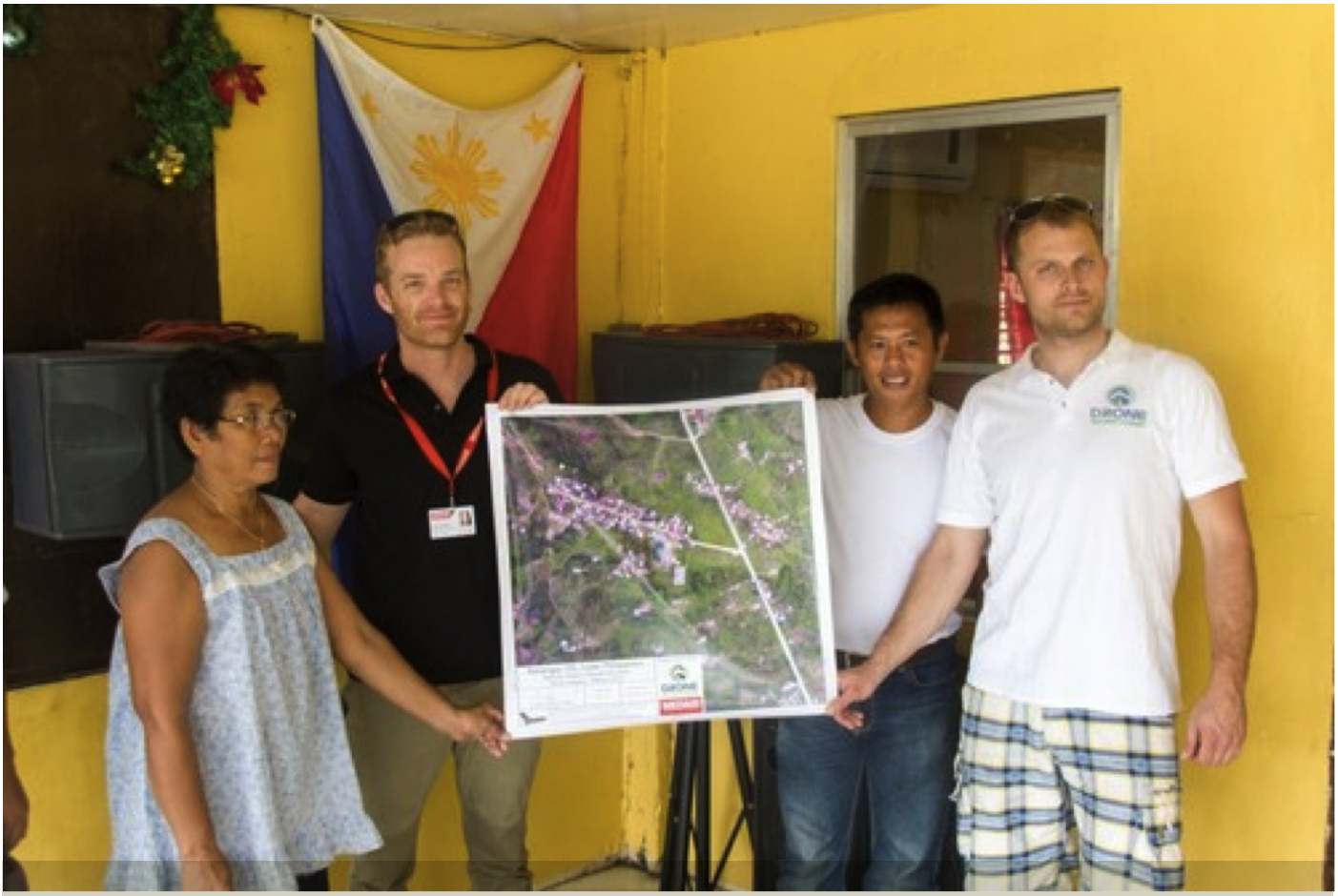

Figure 2 Presenting an aerial map of Barangay 105 to local leaders. The map was printed on a roll-able banner at a local shop. @ Drone Adventures.

Evaluation

Use of Outputs

A Medair international staff member and the Deputy Country Director for the Philippines together with Drone Adventures made follow-up visits to the mayor's office and to each local barangay. The first visit was to ascertain how the information products were being used, and showed a nearly even split in "actively being used" and "available but not actively used". The second visit was from a disaster risk reduction expert who was working on a specific project with a local partner in those barangays. This project thus utilized the printed maps more formally to demonstrate to community members how they can assess the risk of hazards in their communities. More specifically, the barangay council used the printed maps and markers to indicate areas where local hazards, such as flooding, were an issue, and where new shelters were to be constructed in relation to these local hazards. In one case the barangay council used the maps to advocate to municipal authorities regarding needed infrastructure in their community. In these instances the maps provided the council with an improved spatial understanding of their community, and a hands-on, low-tech means to analyze it. Medair judged the impact of the project to be moderate due to a lack of follow-up on the DRR issues identified. Medair was already fully occupied with building shelters before the results could have been integrated.

The resulting imagery did not inform the decisions of Medair's shelter teams at the tactical level. A Medair staff member reported that, "Our shelter teams likely did not make any significant project changes based upon aerial imagery."[5] At the strategic level, the aerial imagery did attract positive media attention and instill donor confidence. Donors were able to view digital imagery of the newly constructed shelters at each site, overlaid with the beneficiary data, providing a new level of project coordination and accountability. Finally, when Medair made a decision at a later date to retrofit all shelters with latrines, the imagery became useful in both a tactical and strategic sense during that project—not only to identify and verify the shelter sites, but also to help determine placement of latrines. The total cost of the UAV mission was about US $9 000. Drone Adventures carried out this mission pro bono as a volunteer-based initiative.

The overall impact of the UAV mission is difficult to measure independently since no formal assessment was carried out, but the mission provided a rich learning experience vis-à-vis the operational use of aerial robotics in a disaster recovery context. Medair's professional opinion is that "at least half of the value is in that regard: the capacity to learn from and improve future UAV missions in support of disaster response."

5 Personal correspondence with Joel Kaiser, Medair.

Plans for Adaptation

Medair is committed to continue using UAVs in future projects. A representative of Medair has been directly involved in development of the UAViators Humanitarian UAV Code of Conduct. Since then Medair has had numerous conversations with both Drone Adventures and UAViators on future collaboration opportunities involving the use of UAVs.

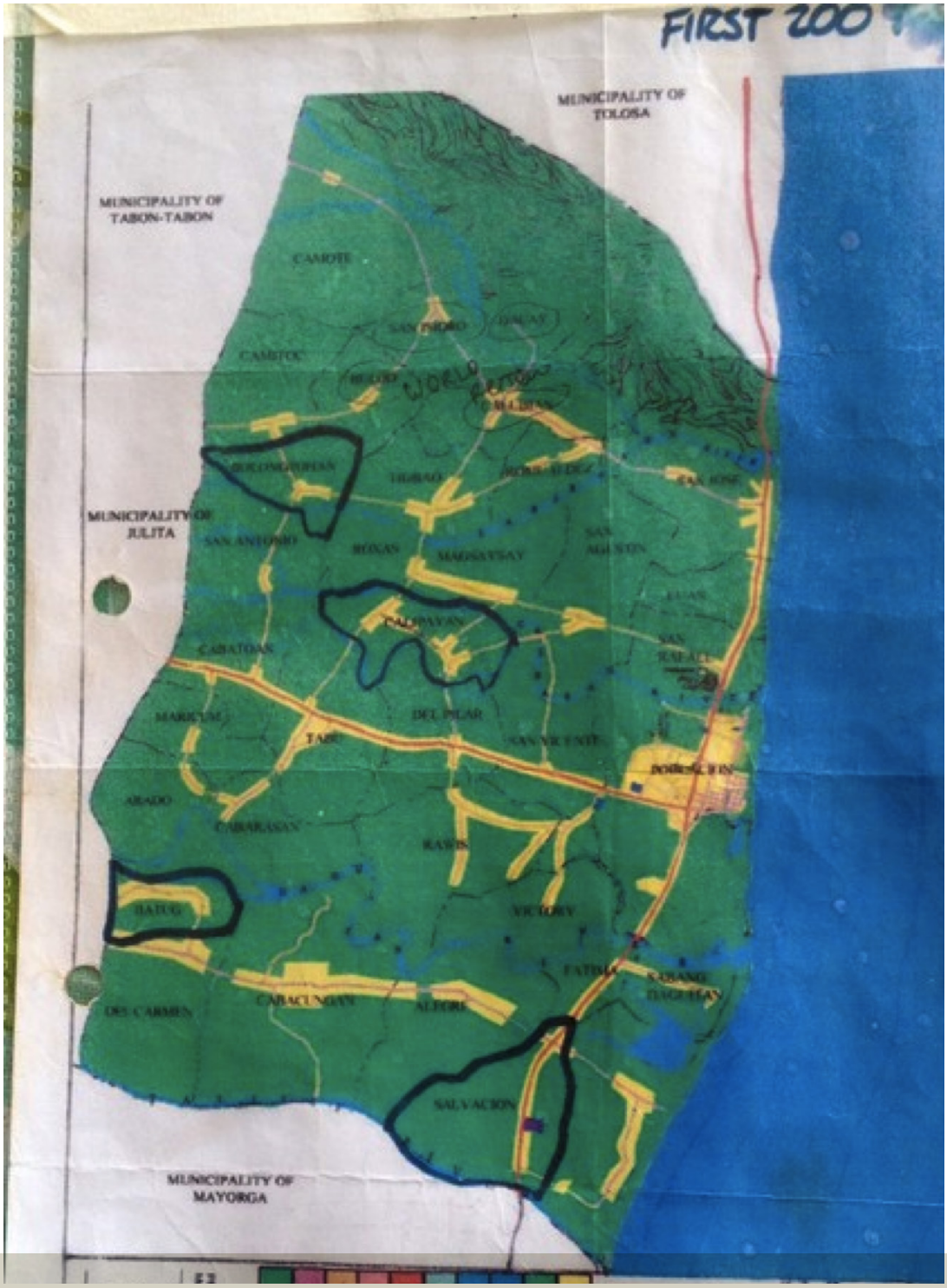

Figure 3 An existing map of Dulag municipality. © Drone Adventures.

Resources

The collected imagery is available on MapBox
http://a.tiles.mapbox.com/v3/droneadv.i4khp3b1.html?secure#14/10.9539/124.9906

Write-up from Drone Adventures
http://blog.droneadventures.org/post/85863359885/mapping-the-philippines-after-typhoon-haiyan

Write-up from Medair
http://relief.medair.org/en/stories/drones-used-for-good-relief-organisation-uses-drones-to-map-typhoon-haiyan

Acronyms

CAA	Civil Aviation Authority
DRR	Disaster Risk Reduction
UAV	Unmanned Aerial Vehicle

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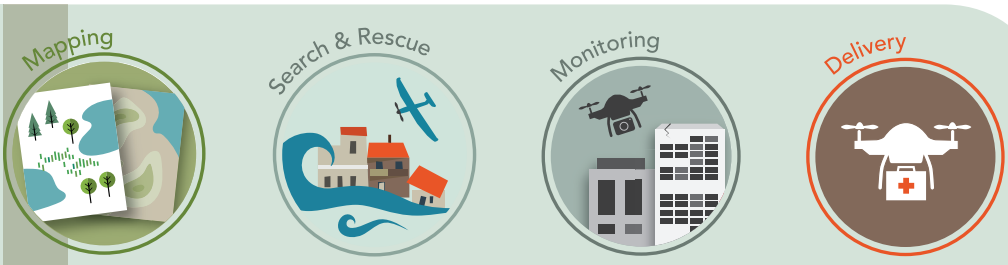
Technical Specifications & Credits

Type of system: eBee fixed-wing microdrone
Deploying Agency: Medair
Piloting Agency: Drone Adventures
Dates of Deployment: March 2014
Author: Patrick Meier, ed. Denise Soesilo

With special thanks to:
Joel Kaiser (Medair) for his input and comments.



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