

Humanitarian UAV Network – Experts Meeting

UN Secretariat, New York City, USA
November 6, 2014



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Introduction

The United Nations Office for the Coordination of Humanitarian Affairs ([OCHA](#)) and the Humanitarian UAV Network (See Annex 1 or the [Humanitarian UAV Network website](#)) recently organized a full-day strategy session on the use of UAVs in humanitarian settings. The meeting was held at the UN Secretariat in New York on November 6, 2014. The Experts Meeting was co-sponsored by the ICT for Peace Foundation ([ICT4Peace](#)) and the Qatar Computing Research Institute ([QCRI](#)). It was intended to build on OCHA's recent Occasional Policy Paper "Unmanned Aerial Vehicles in Humanitarian Response" ([PDF](#)) that was released in August 2014.

The purpose of this meeting was to bring key UAV experts and select members of the *UAViators Advisory Board* together with humanitarian professionals (from OCHA, UNICEF, WFP, American Red Cross, etc) who are beginning to use UAVs or have a strong interest in leveraging this technology in the near future. The strategy session provided an opportunity for information sharing with the aim of catalyzing collaboration on the operation of UAVs in humanitarian settings. UAV experts sought to better understand humanitarian information needs while humanitarians sought to better understand the challenges and opportunities around deploying UAVs.

In sum, the meeting was intended to serve as a "spring board" for future action, collaboration and information sharing. The summary below outlines the key issues that were covered in the meeting and the suggestions for next steps. Please see the annex for a copy of the agenda, thank you.

Daniel Gilman (OCHA) & Patrick Meier (QCRI)

November 20, 2014

Overview of Humanitarian UAV Network

The Humanitarian UAV Network (UAViators) was founded in April 2014 to promote the safe, responsible and effective use of UAVs in a wide range of humanitarian settings. The Network has some 700 members in over 70 countries around the world. UAViators is composed of self-organized teams dedicated to 8 core topics or themes: Humanitarian Professionals; Researchers; Technologists; Imagery Analysts; Data Capture; Pilots; Policy Makers; and Lawyers. These teams, together with the Advisory Board, serve to support the Network's 4 key strategic goals or pillars. These are: Policy, Operations, Education and Research. See Appendix for detailed overview.

UAViators seeks to promote enlightened policy making to support the safe, responsible and effective use of UAVs in a wide range of humanitarian settings. UAViators has drafted (and continues to revise) a Code of Conduct and an Operational Check-List in order to inform international policies and regulations on the use of UAVs for humanitarian purposes.

UAViators serves to connect UAV operators responding to the same disaster so that they can share their missions, flight plans and potentially data, and to connect professional UAV pilots around the world with humanitarian organizations. UAViators also seeks to support collaboration around the analysis of aerial imagery by collaborating with key partners and experts in imagery analysis, such as Humanitarian OpenStreetMap, MicroMappers and MapBox. In the Philippines, UAViators is working with SkyEye to create workflows for the rapid analysis of aerial imagery using the MicroMappers platforms. UAViators is also partnering with Kathmandu Living Labs (KLL) to train a local team of UAV operators in Kathmandu for disaster risk reduction, preparedness and response missions.

As UAVs become both much easier and cheaper to use, more and more individuals will be using UAVs and capturing aerial imagery, which poses some serious risks as well as important new opportunities for humanitarian response. To this end, the Network's focus on education serves to raise awareness and make members of the public part of the solution rather than part of the problem. This includes a number of tools including a "Crowdsourced Crisis Map" (UAViators.org/map) of aerial videos and photographs of disaster areas; and a Wiki on laws & regulation (UAViators.org/travel-laws), including a travel section to crowdsource UAV pilots' experiences. The Network has also reviewed over 170 UAVs for humanitarian use and compiled a very comprehensive list of UAV software and imagery analysis software.

Ignite Talks

The Experts Meeting featured a series of short presentations (5 minutes each). The purpose of these talks was to provide humanitarian organizations with a quick and broad overview on the current use of UAVs in humanitarian settings. Participants from Drone Adventures, DanOffice, Humanitarian OpenStreetMap, EU Commission, RP Flight Systems, Linking the World and Usense.

Drone Adventures

Drone Adventure, an NGO affiliated with UAV producer senseFly, promotes the civilian use of drones for humanitarian uses and has deployed their team around the world. Most recently they were deployed in the Philippines where they performed a community assessment in partnership with Medair. During their deployment they visited several towns on the island of Leyte that only had access to out-of-date and inaccurate hand-drawn maps for reconstruction and town planning. Using their senseFly eBee mapping drones the team was able to collect hundreds of aerial images in the matter of a few hours, process them to create geo-accurate maps within a few hours and print hard-copy maps by the next day. Among other deployments, they have created 3D models of river valleys for hydrological analysis and flood protection in Haiti, and detailed digital maps of the area around Fukushima to help reconstruction work in radiation-affected areas as close as 10km from the reactor.

Danoffice

Danoffice Inc. provided a description of their Hugin X1 quadcopter drone. With a range of 2.5km, the quickly deployable drone compared to traditional fixed wing mapping drones. The company had gone to Tacloban in the Philippines to test out their drones in a humanitarian context in collaboration with NGO Direct Relief. They assisted in structural damage assessment, road evaluations and in identifying locations to set up camps and other facilities. The Hugin X1 provided a range of potential benefits including the use of special sensors, e.g. thermal cameras, and the ability to act as data platforms, sending out info while still in the air. Looking to the future, Danoffice stressed the future of the field and emphasized the importance of the code of conduct. They saw another of issues including the challenges of dealing with export/import controls, which could be an issue even beyond the UAVs themselves, with controls on laptops,

batteries or other equipment. Other challenges mentioned were around the need for insurance and certification, and balancing data security with open data sharing.

Humanitarian OpenStreetMap Team

Humanitarian OpenStreetMap Team (HOT) emphasized the difficulty in obtaining high-resolution imaging, noting that imagery from Haiyan was one of the first major releases of openly available satellite imagery since the Haiti earthquake in 2010. UAVs, which were cheaper than satellites, provided a viable alternative in some contexts and were less expensive and therefore a better option for NGOs. However, compiling and analyzing data from multiple UAVs flights was a major barrier to using them as an effective tool in humanitarian response. For example, in the Philippines after Typhoon Haiyan, a number of people had brought UAVs and created imagery, but this was largely not shared or compiled in a way that was useful for the wider humanitarian community. To address this problem, HOT, building on the existing OpenStreetMap (OSM), was now working on a new tool - OpenAerialMap. This was an idea that had been around since 2006, and which had now received funding from the Humanitarian Innovation Fund (HIF). OpenAerialMap (OAM) will essentially be an open solution for hosting, editing, and distributing UAV imagery, using a distributed hosting system to reduce overall costs and improve robustness. Once the tool was fully operational it would allow for data collected from any number of UAV flights to be compiled and shared among the humanitarian community.

EU Commission

A representative of the EU Commission presented the Copernicus Emergency Management Service, which provided a number of mapping services in support of disaster response. Products included Rapid Mapping, which was standardized, 12-hour satellite mapping, and Risk and Recovery Mapping, which was on demand request based imagery. He emphasised that there were issues with satellite imagery however, specifically in regards to flood detection in urban areas, earthquake damage assessments or on cloudy days and other areas where satellite imagery often wasn't useful. From next year Copernicus will begin to support UAV or manned flight imagery, with imagery released without license restrictions. The focus was to develop systems for the mapping to be autonomous and software driven, so they were looking at fixed wing UAVs rather than rotor UAVs. He emphasized the need for all inclusive guidelines to be developed for using UAVs in humanitarian contexts.

RP Flight Systems

A representative from RPFlightSystems, Inc. introduced RP Search Services is the non-for-profit side of the company that provided search and rescue services. In 2005 the company entered this field and had worked on 1000's of fire and search/rescue missions. They had performed search/rescue in 32 states and 4 countries, working on high profile cases such as Kaley Anthony in Florida and Chelsey King in California, and have been accredited with successfully recovering 12 people. The team used many different payloads in their missions, such as aerial photography, infrared imagery, thermal imagery, and false color imagery. He spoke about his company's desire to create guidelines for insertion into disaster scenes. These would need to answer such question as "What can you carry in?", "What are minimum qualifications of aircrews?", "How do you interface with the people running the disaster scene?", "What tools do you need to create these images?", and "How much equipment do you need?".

Linking the World

A representative of Linking the World and HALO outlined their work in providing mapping services and imagery analysis with UAVs. He introduced the notion of "expendable UAVs", that is, low-cost, rugged UAVs. He spoke about the simplicity and cost effectiveness of the platforms he used and the importance of collaboration. He provided an overview of the software and hardware being used by his organization, namely: 3DR platforms and Pix4D software, to Skywalker 1900 and Agisoft respectively. He had used UAVs in a number of applications including conservation, geomorphology, vegetation mapping, cultural site mapping, erosion mapping, lake management, structural damage assessment, elevation data generation, and volumetrics. He had also been to Tacloban, where in one flight the group was able to take 785 images and in 2-3 hours processed a 5 centimeter resolution map. This representative was also working at Lake Palakpakin, in the Philippines, where they were mapping all of the fish traps and fish pods to help manage fishing resources by preventing disputes among fish farmers and supporting analysis that the lake is 20-30% over carrying capacity. At the Alkan River, also in the Philippines, they were able to determine the amount of sediment being displaced and what effect this would have on the local mangrove trees. The group also did work in Hawaii using SfM (Structure From Motion) to develop digital surface models to help predict the effects of sea level rise in high risk areas.

Usense

A representative of small UAV manufacturing company Usense, as well as Vito, a remote sensing institute based in Belgium, outlined their work focused on small fixed UAVs, built using open source and off the shelf components, and teaching people how to build and fly such drones. Usense's UAV of choice employed the X8 frame, Ardu:Plane software, and a commercially available camera. The organization had found a range of applications for their equipment, from Pre-Colombian archeological digs in Peru to mapping Potato fields at 4,500m altitudes in the Andes Mountains. He emphasized their work in capacity building, in terms of teaching basic remote control, mission planning, and UAV flying skills. He stressed the challenges of data analysis, saying that high resolutions (5cm, 6cm, and 7cm) offered too much data to handle. The solution was data reduction, in particular a super-pixel algorithm from Vito, a software that allowed you to join pixels which are aligned in order to create land classification to facilitate mapping. In any case, it was critical to think about image processing before you start taking photos. He stressed that open source technology was ready to be used in professional UAV work and humanitarian response. In addition, training local people is imperative since they will remain as the first responders of the area.

Humanitarian Use of UAVs

The meeting included a robust discussion of the potential uses of UAVs in humanitarian settings. Three major areas of use were discussed - general issues around integrating UAVs in humanitarian response and several specific use-cases - mapping and information collection, community capacity building, the potential for using UAVs for delivery and to support logistics and the challenges of using UAVs in conflict settings.

Mapping and Information Gathering

The technical experts emphasized that the capability for UAVs to produce maps and provide high-resolution aerial imagery was well-developed, and a number of organizations in the room had already begun using this as part of disaster response or DRR programming.

However, a need was identified for more analytical tools, such as the ability to count the number of people in crowds or camps. This would speed up such a process over traditional verification processes and would make planning in refugee situations much easier for NGOs. It was noted that several groups including the Center for Disease Control (CDC) are actively exploring this space and seek to develop automated or semi-automated solutions to estimate population counts based on aerial imagery. Another group was looking at UAVs largely for damage assessments, such as bridges washed away or other damage to infrastructure.

Community engagement

A number of participants discussed projects where they trained local people or communities to use or even make UAVs, and many people emphasized that even with projects run by the international community community engagement was critical. This could include providing communities with the maps or other products of aerial imagery. Some representatives said that a goal of UAV projects should be to create autonomous national teams that could be sustainable. Others suggested that training and engagement with local communities was valuable simply to build a level of ownership and understanding over the tools, which would help facilitate acceptance of humanitarian action.

At the same time, there were concerns raised over the idea of training communities to use UAVs, with several people stressing the need to hear from community perspectives on what introducing the technology might mean. Several people also raised the risk of misuse, noting that communities wouldn't be bound by a Code of Conduct or other principles. Others noted that while basic flying of UAVs could be taught relatively easily (at least for some models), data analysis was often much more complex, potentially limiting the utility. In addition, with the trends toward requiring licensing and certification for UAV use, training communities might violate local regulations, or at least international standards. Still, UAVs were likely to become more common globally as prices drop, so some of these issues might become less over time, while the opportunities to use UAVs to strengthen resilience would increase.

Coordination, Preparedness and Training

One critical point raised by humanitarian organizations was the question of whether humanitarians could easily adopt the technology themselves, or would need to work with technical partners. Several participants noted that while basic uses, such as capturing HD video were fairly straightforward, the use of more complex UAVs or analytical tools would be harder to build capacity in. At the same time, it would be critical to develop a solid pool of partners and have stand-by agreements and arrangements for accessing the technology in emergencies.

Another major challenge was how to engage with other humanitarian actors in the absence of clear national or organization wide-policy. One organization had been substantially slowed by the need for permission from local affiliates and low community level support. There was therefore a need also for more awareness raising around the appropriate use of the technology. Effective sharing of UAV information with responders and how to integrate it into operational procedures was another issue. This would include the need to have appropriate contacts with civil authorities. Overall, it was critical to think how information would be acted on before it was collected.

Another critical issue was the importance of pre-planning and having existing capacity ahead of a disaster if possible. For example, already having maps or databases to provide baselines for comparison. One participant noted that there was an increasing use of UAVs in development, such as in agriculture, that could be used potentially as emergency response capacity. This also meant that there were an increasing number of organizations that could do specialized analysis of aerial imagery, which was an opportunity if humanitarian organizations could connect with them.

This also related to the opportunities to develop emergency uses for UAVs, with several participants underscoring that it wasn't always practical (or responsible) to refine techniques or try new approaches in the middle of a disaster. While some countries or contexts, such as the Philippines for natural disasters had a pro-humanitarian culture and were supportive of pilot projects in other cases it would be necessary to have done extensive testing before hand. Even in the most ideal circumstances, catastrophic failures, such as crashes into people, were a possibility so standards and safeguards needed to be in place before extensive use in the field.

Participants agreed that there was a need for simulations and emergency response drills and exercises for UAVs, that mirrored actual humanitarian functions. In practice, this meant less of a focus on buildings and more about supplementing assessments around human needs. Several organizations and events that already did disaster simulations, such as the Research and Experimentation for Local and International First Responders (RELIEF) or the EU Commission. It was therefore more a matter of the community engaging to develop appropriate training exercises.

Logistics and Transportation

There was substantial interest from humanitarian organizations in the potential for using UAVs to transport goods. One participant noted that the ability to transport small, high-value items such as blood samples, test results, vaccines or other medicines, water purification tablets, communication materials, and cellphones would be crucial in their organization deciding to adopt UAV technology.

While current technology certainly allowed for transporting objects there were a number of issues which meant that it was practically probably several years away from implementation at scale in the field. The largest were the regulatory challenges as there were quite reasonable concerns about safety, such as the risk of dropped objects. One participant noted that while blood and other medical samples were an obvious use case, transporting what were essentially bio-hazardous materials might raise concerns, justified or not.

Other technical issues included whether it was necessary for the UAV to land - in which case there needed to be safe spaces and protocols, since by definition the UAVs would be remotely controlled or on auto-pilot. One alternative being tested by Google Project Wing among others was the use of winches to lower goods to the ground, but this

meant that UAVS would need enough battery power to make a return trip. Either way it was likely that some training or experienced staff would be needed at the drop-off points.

The limitations on range and battery power were also seen as a major obstacle. There were a number of potential technological solutions, but they also had downsides, such as the use of petrol motors on fixed wings that could do automated take-off and landing. The idea of charging stations that could serve as waypoints for UAVs was raised, though it was noted that this infrastructure would require substantial advance investment.

Several participants noted that the practical and safety challenges of operating UAVs in urban settings meant that the focus should be more on delivery in rural areas, which is in any case where the biggest logistical and access challenges were. One participant suggested that demand for delivery services had to come from people living in remote areas, so initial programs might be developed as resilience or DRR tools rather than strict emergency response.

Overall, it was agreed that the first priority was to identify specific use cases in terms of types of products, required range and carrying capacities and other details and to work with UAV experts to develop technical options. As with other UAV uses, there was a pressing need for more simulations and testing to ensure that any solutions were at a high-level of reliability. There was also a need for identifying the most pressing legal issues around look to advocate for clarifications or exemptions for disasters and humanitarian response. Due to these issues, it was unlikely that use of UAVs for delivery would be happening at scale anytime soon, but better mapping of existing pilots and experiments would help build an evidence base.

Conflict Settings

According to the World Humanitarian Summit (WHS), about 80% of humanitarian crises around the world are connected to violent conflict. There was thus a discussion of ways in which humanitarians or other NGOs could responsibly use UAVs. In fact, a number of projects by NGOs were already under consideration. An example of this is the Syria Airlift project that seeks to empower local NGOs to build and fly their own UAVs to transport medical supplies and other small items to affected communities within Syria. This project raised a number of concerns among participants, who noted the risk of quality control and potential crashes around the UAVs, that this violated state

sovereignty, and other issues. Nonetheless, it was indicative that it would be difficult to strictly restrict the use of UAVs only to natural disasters.

In addition, The use of UAVs by UN Department of Peacekeeping Operations (DPKO) is already raising a number of complicated issues; more recently in the Democratic Republic of the Congo (DRC) where a consortium of leading NGOs issued a formal letter of complaint against DPKO's use of surveillance UAVs.

If DPKO collects aerial imagery that can be used by humanitarian actors, is there an obligation to share this imagery? Is there an obligation on the part of humanitarian organizations to use this imagery even though this may undermine their role as impartial actors? How does one prevent the misuse of data collected? What if local populations began actively asking for imagery? The goal should be to do the most good possible in such areas while avoiding accusations of collecting info, taking sides, etc.

One key question that came up was the possibility of marking or differentiating UAVs, in the same way that humanitarian vehicles were often clearly marked with logos. Participants noted the difficulty of seeing smaller vehicles at higher altitudes, but suggested that LED lighting systems or other technologies could work potentially. While some questioned the practicality of this as it would be easy to fake, it was acknowledged that it was likely unavoidable to have to deploy humanitarian UAVs into the same airspace as intelligence gathering UAVs, so some form of differentiation would be important.

There was also a discussion on the challenges of getting consent or doing meaningful community engagement or even notification in a conflict zone, which was likely to be an ongoing challenge.

Legal and regulatory issues

A presentation and discussion was had on legal and regulatory issues. It was emphasized that one of the biggest challenges was around the unclear regulatory environment that persists in many countries. More specifically, what happens in the United States may have an impact on UAV use around the world by humanitarians. For example, in the Haiti earthquake, organizers wanting to use UAVs to do thermal scans for people under rubble called the FAA regarding such of UAVs, and the FAA indicated that the lack of regulatory framework (in the United States) precluded their use elsewhere. The potentially life saving operation was stopped.

Only a few countries, such as Australia, have commercial UAV regulations, although many other countries are developing standards. Emerging regulations may require pilot certification and training, or certified equipment, which would create challenges for community training or use by volunteers.

There are also significant public concerns about privacy, even though existing privacy laws (e.g. “peeping toms” or unlawful surveillance) would seem to cover most circumstances and would be unlikely to apply in emergency situations. However, participants noted that the spread of UAVs and the stigma around “drones” meant that people were much more sensitive to their use anywhere. There are also issues around what information or data might be demanded by law enforcement or other officials once it is gathered (e.g. evidence of crimes or civil unrest) and other legal implications even for information that was inadvertently collected. In short, it will be important to remain aware of regulatory developments and for humanitarians to remain proactive about the emerging regulatory framework, so as to counter public misconception about the technology and to advocate for a less restrictive ability to use UAVs in humanitarian contexts.

Ethical issues

Three key issues were identified around ethics - professionalism, human rights and the “ethics of the practical”.

On professionalism, there was a need for different guidelines for humanitarian groups and drone groups. Organizations would need to contact local authorities before proceeding with projects and be mindful of local laws and customs. There needs to be

thought regarding the ability to make money and the types of services that can be rendered.

On human rights and privacy, there was a distinct difference between surveillance and community empowerment, however the question need to be asked: “when does one become the other?” What should the regulations behind selling information look like, especially if it is sensitive data. Use of data should be determined before the missions take place.

Other practical ethical issues, included ensuring comprehensive insurance that would cover liability for injuries or damage.

Another form of practical accountability that was discussed at length was data security and privacy. It was emphasized that the issues around data security were not unique to UAVs, but in fact simply reflected general best practices although these were as yet not widely adopted by humanitarian organizations (see the OCHA Occasional Policy Paper “Humanitarianism in the Age of Cyber-Warfare” for more information). One issue was the question around how long data should be retained. Some participants emphasized that maps and other aerial data remained valuable in the long-term, while others saying that destroying data after search and rescue missions for example was an important way to ease concerns over privacy. Overall, having clear privacy and cybersecurity policies would be critical for organizations using UAVs.

There was broad consensus that the humanitarian UAV space needs a solid policy or code of conduct soon or else other less qualified individuals will be creating it. A few negative incidents could result in a longer-term stigma against UAVs, particularly in countries sensitive about sovereignty.

Training and Certification

The purpose of this session was to introduce the 3-day course being organized by UAViators in partnership with Vives in Belgium. The introductory course was specifically designed for international humanitarian organizations (syllabus available at UAViators.org/docs). Participants reviewed the syllabus and provided valuable feedback. The main concern expressed was that 3 days is not enough to properly train new UAV pilots or to learn how to use mission planning software proficiently. A strong recommendation was made that the course be framed as an introductory course that

provides participants with a basic understanding of how to operate UAVs and how to use UAV planning and imagery analysis software. In other words, the purpose of the course should be to enable humanitarian professionals to converse and partner intelligently with UAV pilots during disasters. Participants also recommended the use of flight simulators as this can be done remotely before and after the course. Maintenance and repair training is something which many people are interested in as well. The ability to troubleshoot problems with a gimbal for example are needed.

Interestingly, UAV experts at the meeting expressed a strong interest in taking a course to learn more about the use of UAVs specifically in humanitarian settings. They articulated a strong need for UAV/technical experts to familiarize themselves with humanitarian principles and standard operating procedures.

Overall the recommendation of the group was the need in the future for two types of specialized training - familiarization courses for humanitarian professionals on UAVs, and training in specific needs of humanitarian responses for UAV pilots.

Other Technical Issues Around UAVs

Costs and types of micro-UAVs

The workshop went over the range of smaller UAVs Mapping frones are high end versions of simple imaging drones. \$500-1000 for a consumer grade drone and \$10,000 - 20,000+ for a professional mapping drone. Fixed wings are harder to deploy that rotor UAVs. Participants spoke a bit about DJI platforms which were easy to use and although often considered toys by many had the ability to quickly get into the air after a disaster and provide high-quality video for public information purposes. Participants agreed that you ideally would want a toolbox full of drones, for different uses.

Open Source Software

Open-source software for UAV flight planning and monitoring is quite good for basic mission profiles, though requires some parameterization to adapt it to a specific platform. Some advanced functionalities, such as adaptation to 3D terrain and multi-drone support, are still lacking but are being worked on. Commercially-available

drones are usually packaged with closed-source software which is adapted to the particular platform.

Comparative Advantages of Fixed Wing Versus Rotor UAVs

Both fixed-wing and rotary-wing drones have their advantages and limitations, and so it's important to choose the right platform for the required task.

Fixed-wing drones are typically used for mapping. For a given weight they can fly 3-4x longer than a rotary wing, and fly several times faster, and can thus cover much more area in a single flight. Practical fixed-wing mapping drones can be found at weights down to 500g, and tend to be safe (can glide if engine fails) and quick to deploy. However, they need some open space to land so are not always suitable for dense urban environments.

Rotary-wing drones are typically used for live-streamed video. Rotary-wing drones can take-off and land vertically, making them very practical for urban spaces and to see what's around a corner or behind rubble. They can hover in place for fixed surveillance, and can fly closer to the ground, and thus map at higher resolutions. However, they have a much reduced flight time and range (around 15-25min for <2kg platforms), and are thus less practical for mapping areas of more than 1km².

Flying Elevation and Range

The appropriate elevation for a UAV missions depended largely on the purpose of the flight, and for imagery, on the desired resolution. For 11cm you would fly at 300m, but for 4cm you would fly anywhere from 100-130m. For 1cm resolution or below, which allowed an extremely high-level of detail, it would be done better with rotor UAVs and that everything bigger should be done with fixed wing UAVs. Several participants emphasized that for many uses high resolution was not always better, as it created more data without necessarily strengthening the analytical capacity.

The elevation of flights also had legal implications. In the USA for example lower elevations were considered part of the property of the landowner, while over a certain level it became regulated space. These boundaries were often not clear however, and

currently around 400-500 ft was considered unsettled space, which was essentially claimed by both the FAA and Landowners.

One participant noted that access to remote locations, which were otherwise inaccessible by truck would be extremely helpful for humanitarian purposes. However, the smaller UAVs that would be cost-effective for most humanitarian organizations did not yet have the kind of range, perhaps up to several hundred kilometers, that would allow this. In practice, smaller UAVs were limited by battery capacity to 20 minutes to an hour of flying time, which allowed an effective range of 10-20 km on average.

Collision Avoidance and Deconfliction

One of the issues for humanitarian organizations was the possibility of large number of UAVs or other manned flights working in the same area, which meant that collision protection and avoidance was critical. Automated avoidance technology was fairly far along in development and would likely be available with in 1-3 years, but systems would need to be implemented into manned aircraft as well to provide any real value, which would take longer. In the meantime, it was possible to manually coordinate through air traffic control or other systems when these were available.

Next Steps

How do we build the community? There are many different organizations involved, each of which can offer unique means to assist the group as a whole. The key next steps identified at the meeting were:

- The need for standards (standardized processes, standardized equipment, privacy standards, etc.). In this regard, a key priorities are:
 - the further development of the Code of Conduct and Operational Check-list
 - to work with ICAO and other national regulators on the on our needs vis-a-vis regulations,
 - to explore the potential around international agreements to facilitate the import/export and use of UAVs.
- The need to develop more case studies, including evidence of impact. This included the need to develop clear use-cases around delivery, search and rescue and other areas beyond mapping.

- More media engagement, based on positive real-life examples was needed.
- Better awareness of resources and tools available to support humanitarian activities.
 - Participants agreed to develop a resource list of organizations able to provide technical support and capacity in support of humanitarian missions.
 - UAViators will offer a dedicated training and certification course on humanitarian UAVs specifically geared towards international humanitarian organizations.
- The need for simulation and training exercises.
 - UAViators has pledged to support the organization of a disaster response exercise using UAVs and other participants. Note that this need not be a new simulation but likely a partnership with existing exercises.
 - The UN Humanitarian Response Depot (UNHRD) Lab is also working to develop a Basic Training for the use of UAVs in humanitarian settings.

UAViators will also convene a number of policy meetings (described below) and has the group created a dedicated email list-serve to continue facilitating information sharing and collaboration. In addition, UAViators will produce edited videos of select presentations and make the slides for these presentations available.

Upcoming Events and Opportunities

Meetings

- As one of the next steps, the Humanitarian UAV Network will be organizing a high-level, 3-day experts meeting in July 2015, supported by the Rockefeller Foundation Center in Bellagio, Italy. The purpose of this meeting will be to build on the UN meeting and fill the identified policy gaps.
- UAViators is also working with Advisory Board members Nethope and the Norwegian Center for Humanitarian Studies to organize a panel on humanitarian UAVs at the 2015 Interaction Consortium Conference and one on the use of non-lethal UAVs in conflict zones (also slated for 2015).
- Finally, in terms of convenings, UAViators will be organizing an annual Experts Meeting to follow this first one in New York. The next meeting will be held at

Harvard University (in collaboration with the International CrisisMappers Network and the Harvard Humanitarian Initiative) in 2015

Trainings

- Humanitarian UAV Training Course in Belgium on May 28-31, 2015

Annex 1 - Detailed Overview of Humanitarian UAV Network

The Humanitarian UAV Network (UAViators) was founded in April 2014 to promote the safe, responsible and effective use of UAVs in a wide range of humanitarian settings. The Humanitarian UAV Network (UAViators) has an active and cross-disciplinary Advisory Board. Members of the Board represent humanitarian and development organizations (e.g. United Nations, Red Cross, Nethope, World Bank); International policy organizations (e.g. European Commission); NGOs (ICT4Peace Foundation, Linking the World); UAV groups and experts (e.g. DJI, 3DRobotics, Google Project Wing, senseFly, SkyEye, uSense, RPFlightSystems, Drone Adventures, ShadowView Foundation, Small UAV Coalition); Researchers (e.g. Norwegian Center for Humanitarian Studies, University of Maryland); and Law firms (GeoLaw, Kraver & Kremin).

The Network has some 700 members in over 70 countries around the world. In addition, thanks to the Network's official partnership with AirVid, UAViators has access to over 700 vetted, professional UAV pilots in more than 60 countries worldwide. Given that partnerships are key to the Network's mission, UAViators is also exploring partnership opportunities with Aerial Photos for Disaster Emergencies and Recovery (APDER), Rescue Global and Measure 32. The latter recently announced an important partnership with the American Red Cross to pave the way forward for the use of humanitarian UAVs in the United States.

UAViators is composed of self-organized teams dedicated to 8 core topics or themes: Humanitarian Professionals; Researchers; Technologists; Imagery Analysts; Data Capture; Pilots; Policy Makers; and Lawyers. Each of these teams is described in more detail on the UAViators.org website. These teams, together with the Advisory Board, serve to support the Network's 4 key strategic goals or pillars. These are: Policy, Operations, Education and Research.

Policy

UAViators seeks to promote enlightened policy making to support the safe, responsible and effective use of UAVs in a wide range of humanitarian settings. As such, the Network convenes policy meetings and advocates on behalf of humanitarian organizations by bringing together leading experts to address major policy gaps. In addition the meeting at the UN Secretariat, UAViators is organizing a high-level, 3-day experts meeting supported by the Rockefeller Foundation's Bellagio Center in Italy. The

purpose of this meeting, to be held in July 2015, will be to build on the UN meeting and fill the identified policy gaps. UAViators is also working with Advisory Board members Nethope and the Norwegian Center for Humanitarian Studies to organize a panel on humanitarian UAVs at the 2015 Interaction Consortium Conference and one on the use of non-lethal UAVs in conflict zones (also slated for 2015). Finally, in terms of convenings, UAViators will be organizing an annual Experts Meeting to follow this first one in New York. The next meeting will be held at Harvard University (in collaboration with the International CrisisMappers Network and the Harvard Humanitarian Initiative).

The Network also advocates for appropriate policies through regular policy speeches. These have included talks at RPAS 2014 in Brussels, Belgium; Triple UAV Summit in Melbourne, Australia; Federal Emergency Management Agency (FEMA) Headquarters in Washington, DC; and soon at the American Red Cross Headquarters, also in DC.

Lastly, UAViators has drafted (and continues to revise) a Code of Conduct in order to inform international policies and regulations on the use of UAVs for humanitarian purposes. Instrumental to the Network's focus on education is the Code of Conduct and the accompany Operational Check-List (both available at UAViators.org/docs website). The purpose of these documents is to let members of the public know what steps they need to take in order to safely, responsibly and effectively use UAVs in humanitarian settings. UAViators actively promotes the Code of Conduct at expert meetings, keynote presentations and online via social media and mainstream media.

Operations

One of the main motivating factors behind the foundation of the Humanitarian UAV Network is the provision of coordination support to ensure safe, responsible, efficient and effective humanitarian UAV missions. UAViators serves to connect UAV operators responding to the same disaster so that they can share their missions, flight plans and potentially data. The Network's coordination role also serves to connect professional UAV pilots around the world with humanitarian organizations. This service has already been used by a number of humanitarian partners to identify reliable UAV pilots in Liberia, Uganda and Indonesia. In addition to the partnership with AirVid, the Humanitarian UAV Network has access to professional UAV pilots thanks to the UAV manufacturers who sit on the Network's Advisory Board. These manufacturers have global networks of professional UAV pilots thanks to their international resellers.

In addition to supporting the coordination of UAV missions, UAViators seeks to support collaboration around the analysis of aerial imagery by collaborating with key partners and experts in imagery analysis. In terms of operational data analysis platforms for aerial imagery, the Network promotes the use of Humanitarian OpenStreetMap, MicroMappers and MapBox. The first two platforms are crowdsourcing solutions that humanitarian organizations have already used for disaster response. The latter is a platform used to host and share aerial imagery.

Given the Network's strong focus on community engagement and community-centered approaches to humanitarian UAVs, UAViators is also directly involved in the operational use of UAVs. In the Philippines, UAViators is working with SkyEye to create workflows for the rapid analysis of aerial imagery using the MicroMappers platforms. The partners will be testing this workflow through a pilot project in December 2014. UAViators is also partnering with Kathmandu Living Labs (KLL). Nepal is one of the most disaster-prone countries in the world, and the focus on the KLL partnership is to train a local team of UAV operators in Kathmandu for disaster risk reduction, preparedness and response missions. The project, which will also include the NGO Linking the World (Advisory Board member), is set to launch in early 2015 with on-site trainings slated for September 2015.

Lastly on Operations, the Humanitarian UAV Network is partnering with Vives in Belgium to offer the first ever specialized training and certification course specifically geared towards international humanitarian organizations. The first iteration of the course will take place in Belgium on May 28-31, 2015.

Education

The purpose of the Network's focus on education is to inform the general public on the important opportunities that UAVs provide in humanitarian settings. As UAVs become both much easier and cheaper to use, the aerial perspective will become increasingly "democratized". This means more and more individuals will be using UAVs and capturing aerial imagery, which poses some serious risks as well as important new opportunities for humanitarian response. To this end, the Network's focus on education serves to raise awareness about the do's and don'ts vis-a-vis the use of this new technology. As such, UAViators seeks to make members of the public part of the solution rather than part of the problem.

In addition, the Network maintains a “Crowdsourced Crisis Map” (UAViators.org/map) of aerial videos and photographs of disaster areas. The purpose of this map is to further promote the Code of Conduct since anyone wishing to post content to the map is asked to first review the Code of Conduct. Naturally the crisis map also serves to augment situational awareness for disaster response by offering another data source for disaster damage and needs assessments.

The Network also offers a Wiki on laws & regulation (UAViators.org/travel-laws) surrounding the use of UAVs across the world. This country director seeks to make existing laws more easily accessible to humanitarian organizations and members of the public. The Wiki also includes a travel section to crowdsource UAV pilots’ experiences in traveling with their UAVs across borders. This travel section thus serves as a “Trip Advisor” for UAVs.

Still on education, UAViators is collaborating with the Omidyar Network on a handbook for NGOs who wish to use UAVs. UAViators will be authoring the handbook’s chapter on humanitarian response. In addition, the Network has given a number of webinar presentations on humanitarian UAVs as well presentations to several high schools. In March 2015, UAViators will be on a panel at SXSW to further educate and raise awareness about the use of UAVs in humanitarian settings.

Lastly, the Network engages in media outreach to further educate and spread the word on the opportunities (and challenges) of using humanitarian UAVs. To date, UAViators has been featured in the UK Guardian, Los Angeles Times, Bloomberg News, Global Post and Virgin Unite. UAViators will be working closely with the Small UAV Coalition to continue these important media outreach efforts.

Research

The purpose of the Network’s research arm (UAViators.org/docs) is to support and feature research on humanitarian UAV Policy, Operations and Education efforts. As such, UAViators has carried out research on humanitarian UAV missions, reviewed over 170 UAVs for humanitarian use. The Network has also compiled a very comprehensive list of UAV software and imagery analysis software. In addition, UAViators research focuses on ethics, privacy and rights. Finally, research activities focus on future developments in the UAV space.

Annex 2 - List of Participants

1. Daniel Gilman (UN Office for the Coordination of Humanitarian Affairs, OCHA)
2. Patrick Meier (QCRI / Humanitarian UAV Network)
3. Andrej Verity (UN/OCHA)
4. Jose Odi (World Food Program Logistics, WFP)
5. Nicolas Messmer (WFP Logistics)
6. Martin Kristensson (WFP IT)
7. Kate Chapman (Humanitarian OpenStreetMap)
8. Andrew Schroeder (DirectRelief / NetHope)
9. Adam Klaptocz (Drone Adventures/senseFly)
10. Charles Devaney (Grassroots UAVs / LTW)
11. Mina Chang (Linking the World)
12. Dries Raymaekers (USENSE)
13. Steve Roest (ShadowView)
14. Gene Robinson (RPFlightSystems)
15. Jacob Petersen (Anthea Technologies)
16. Sanjana Hattotuwa (ICT4Peace)
17. Brendan Schulman (Drone Lawyer)
18. Dirk Gorissen (World Bank)
19. Peter Spruyt (European Commission-JRC)
20. Kristen Sandvik (Peace Research Institute, Oslo)
21. Peter Mosur (QCRI RA)
22. Melanie Goggins (Small UAV Coalition)*
23. Michele Lynch (American Red Cross)
24. Tony Ngo (Intelligent UAS)
25. Mohammad Fayyazi (UNICEF)
26. Matthew Irwin (Mapbox)
27. Michael Perry (DJI)
28. Timothy Reuter (Google X Project Wing)
29. Sebastian Ancavil (IOM)
30. Stacy McDougal (DPKO)
31. Diego Batista (UNHCR)

Annex 3 - Meeting Agenda

18:00-20:00 *Informal Dinner on Wednesday, November 5th.*

8:30 - 8:45 Go through UN security

9:00 - 9:05 Welcome remarks by OCHA

9:05 - 9:15 Self-introductions of participants

9:15 - 9:45 Introduction to Humanitarian UAV Network by Patrick Meier

9:45 - 10:45 Individual ignite talks (5 minutes each) on current and/or planned uses of UAVs by users of UAVs and by humanitarian professionals

Ignite Talks:

1. Adam Klaptocz (Drone Adventures/senseFly)
2. Jacob Peterson (DanOffice)
3. Kate Chapman (Humanitarian OpenStreetMap)
4. Peter Spruyt (European Commission-JRC)
5. Gene Robinson (RPFlightSystems)
6. Charles Devaney (Linking the World)
7. Dries Raymakers (Usense)

10:45-11:00 *Break*

11:00-12:00 Open Discussion on humanitarian applications of UAVs [D. Gilman]

12:00-14:00 *Lunch (informal) - UN Cafeteria*

14:00-15:00 Legal, privacy and ethical issues related to the use of UAVs and review of Humanitarian UAV Network Code of Conduct [Brendan Schulman & Kristin Sandvik]

15:00-15:45 Self-organized break-out sessions to address individual topics.

Such as (suggestions only):

- Community Engagement
- Imagery Processing & Analysis
- Non-lethal UAVs in Conflict Zones
- Role of Insurance

15:45-16:00 Report back on Self-Organized Sessions

16:00-16:15 *Break*

16:15-17:00 Certification and Training [P. Meier / D. Gilman]

17:00-17:30 Explore areas for direct collaboration/partnership between participants; Wrap up & Next Steps [P. Meier / D. Gilman]