

## Humanitarian UAV/Drone Missions: Towards Best Practices

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### Introduction

The purpose of this handbook is to promote the safe, coordinated and effective use of UAVs in a wide range of humanitarian settings. The handbook draws directly on recent humanitarian UAV missions in Vanuatu (March-April 2015) and Nepal (April-May 2015) as well as earlier UAV missions in both Haiti and the Philippines. The handbook takes the form of an operational checklist divided into Pre-flight, In-flight and Post-flight sections. The best practices documented in each section are meant to serve as a *minimum* set of guidelines only. As such, this document is *not* the final word on best practices, which explains why the handbook is available as an open, editable Google Doc. We invite the humanitarian, UAV and research communities to improve this handbook and to keep our collective best practices current by inserting comments (click on “Insert” in the toolbar above) directly to the Google Doc. Note that future versions of this handbook will need to incorporate best practices for the use of UAVs for the transportation payloads. In the meantime, both hardcopies and digital copies of this handbook are available for free and may not in part or in whole be used for commercial purposes.

### Acknowledgements

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### Disclaimer

It is your responsibility to ensure that you operate safely, legally and responsibly. The guidelines below should be considered as *minimum* measures only. *UAViators* is no way responsible or legally liable for any negative consequences caused or faced by anyone following or affected by these proposed guidelines.

# Pre-Flight Checklist

## Join the Network

- Join the Humanitarian UAV Network at [UAViators.org](http://UAViators.org). Check the Operations Page (<http://uaviators.org/ops>). Please create a new discussion on the Ops Page if none of the existing discussions are relevant to your mission. Be sure to use the following format for the title of any new discussions: [Country] – [Event] – [Year]. Briefly summarize your UAV mission in the discussion and pose any question you may have. This will allow members of *UAViators* to connect with you and provide support. Coordinators with *UAViators* will also let you know whether other UAV teams are operating nearby and will offer to connect you with *local* UAV networks, operators and experts.

## Staying Legal

- Review UAV regulations for the country you will be operating in. These can be found at <http://uaviators.org/laws>. If you are not already in country, be sure to review any import/export restrictions before you travel vis-à-vis UAVs and any VHF, UHF, HF radios you plan to take with you. (Note that countries regard radio spectrum as sovereign territory and closely manage who is using what frequency, it is very important to only use permitted frequencies. In addition, poorly manufactured radio equipment can interfere with other users, consequently type approval for each type of hardware may also be required). It is important that you obtain the necessary legal permits to operate. If the country you plan to operate in does not have any UAV regulations or you are not clear on the country's existing regulations, it is fully your responsibility to ensure you get clarity before you fly. The lack of regulations does *not* give you *carte blanche* to operate. *UAViators* may be able to assist in gaining clarity on regulations, which is another reason why joining the Network is highly advisable.
- Once you've received official permission to operate UAVs, make several copies of your permit(s) as you may need to leave individual copies with various local authorities in areas where you are looking to fly. Note that some countries may require an additional permit to use recording devices on your UAVs. Be sure to seek out local authorities regardless before operating. This can include the local Mayor's office, police station, hospital, etc. It is your responsibility to inform local authorities that you have received permission to operate UAVs. It is also in your interest to collaborate directly with local authorities; take the time to explain what you want to do, how the technology works and be sure to capture aerial imagery they also need.

- If you are operating in partnership or on behalf of a formal humanitarian organization, be sure to obtain a letter from them confirming that you are carrying out your UAV mission in collaboration with said organization. Again, make multiple copies of this official letter, as you may need to provide a number of local authorities with a copy.
- When you arrive in country, be sure to identify the appropriate coordination body for UAV flights. During major disasters, this may be the UNDAC (UN Disaster Assessment and Coordination) Team and/or Civil-Military Coordination Teams with the UN Office for the Coordination of Humanitarian Affairs (OCHA). These entities typically serve as a liaison with the country's military and aviation authority. It is particularly important that you establish a professional relationship with the military authorities in charge. To this end, having experience in Civ-Mil coordination is a definite advantage. If these coordinating bodies are not present, be sure to approach the country's military and civil aviation authority yourself to ensure you have permission to operate. Once you have obtained written permission, you will typically need to submit your individual flight plans 24 to 48 hours before your flights. These will need to be approved prior to flying and once approved you may not deviate from the flight paths submitted. Please communicate your flight plans with UAViators as well to ensure that other UAV Teams are aware of your operations. The section below on *Safety Measures* includes guidelines on how to carry out individual UAV flight both safely and legally. Double check that your flight plan has been added to the [NOTAM system](#) and ensure it does not conflict with other flight plans.<sup>1</sup> See also [this link](#).
- In some situations, especially in areas with a complex airspace, you will need to communicate directly with the nearest airport's Air Traffic Control (ATC) before *and* after every UAV flight even if your flight plans have already been approved. This means you will need to meet with them when you arrive, obtain their contact information (be sure to get several phone numbers for the purposes of redundancy) and agree on an appropriate communication protocol to receive final clearance before every flight and to confirm when said flight is completed.
- Bring business cards to easily share your contact information. Consider wearing an appropriate uniform that designates who you are; such as a shirt with the name, logo and link of your organization. This enables government

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<sup>1</sup> Note: You can only issue a NOTAM when you've had a dedicated training. This training is given by ANSP (Air Navigation Service Provider) or CAA (Civil aviation authority). If you don't have a training: request a permit to fly to CAA (as normal). CAA will determine if a NOTAM is required. If so, CAA will ask ANSP to prepare one. The pilot has to ask (call to) ANSP to activate-deactivate the NOTAM at the beginning/end of his flight. Note: not all countries have a separate CAA-ANSP. Some country have only a CAA who will manage everything.

official and/or local authorities to recognize who you are and which organization you are with. Providing this level of legibility is also important for transparency and accountability. As such, be sure to that your UAVs also have your organization's name, logo and contact information; in the form of a sticker, for example.

### **Insurance, Travel and Customs**

- Always obtain insurance before any UAV mission. It is your responsibility to do the necessary research to identify the appropriate insurance.
- It is also your responsibility to research any customs restrictions ahead of time before bringing any UAV into a country. Some countries will have strict regulations on what types of UAV can be imported.
- Airlines are increasingly regulating the types of Lithium battery allowed in carry on luggage. Be sure to research this before your flight. Any Lithium batteries you carry with you on board should be placed in a fire safety pouch.

### **Staying Ethical**

- Identify whether any *local* UAV networks, operators, experts, etc., exist in the country you are deploying to. Do not circumvent these local actors but rather seek to engage and partner directly with local groups.
- Once you have been granted official, legal permission to operate, this does not mean you can ignore the local communities you fly over. It is particularly important to engage local communities and involve them in your mission. Be sure to take the necessary time to explain what you want to do and why. Clearly demonstrate the added value that you expect your mission will yield and let communities know who you will be sharing your imagery with, how and for what purpose. It is also good practice to train local communities and to share your imagery with them in a timely manner. Your imagery may need to be shared in a “low tech way” such as hard-copy printing. In sum, while you may have *legal* permission to fly from the government, you’ll want to build trust and get buy-in from local communities directly as well from an *ethical* perspective. For example, if you’re looking to fly over someone’s land, be sure to ask them for permission if practical and/or legally required. This is a matter of respect and common decency.
- Be sure to spread the word locally about your scheduled UAV flights. A public information campaign is ideal. This can be done using simple flyers or posters that include information on your project along with a contact number

for those wanting more information. Consider approaching local community radio stations to get the word out and get in touch with other local outlets like newspapers to suggest that local journalists write an article about your project before you start flying. This may not always be possible due to time constraints, but it is nevertheless your responsibility to get the word out in one way or another.

- Be sure to ask local communities whether another UAV team has already flown over their town or village recently. If so, you should first try to contact said team to ask if they are willing to share their imagery before attempting to collect the same imagery yourself. To this end, be sure to provide your contact information to local community representatives before you start your UAV mission.
- Do not practice discrimination when using UAVs for humanitarian aid. For example, do not ignore marginal communities. Only collect aerial data that has a clear, compelling or expected value for specific humanitarian purposes as other data could be used in discriminatory or other negative ways, or could be exploited by third parties such as to harm local communities.
- Once deployed, keep in mind that you may not have the opportunity to operate a drone in the disaster affected areas. This could be due to weather, logistics, changing regulatory requirements, etc. It is your responsibility that you plan accordingly and still have the opportunity to contribute meaningfully to the humanitarian efforts rather than be in the way or acting as dead weight. Previously, humanitarian UAV pilots have provided this kind of support by using their GoPro cameras to provide high resolution field based photos of disaster damage, for example.

## **Define the Mission**

- Clearly define your upcoming mission. What exactly will you be using UAVs for? Data collection? Payload transportation? Either way, are UAVs the most appropriate technology available to complete the mission? If so, be sure to select the appropriate UAVs for the task at hand. Larger UAVs will enable you to cover more ground but are more challenging to transport once on site. Fixed-wing UAVs will cover more ground than multi-rotors but are not advisable when operating in complex airspace.
- If the plan is to use UAVs for data collection, exactly what locations need to be surveyed, by when and at what resolution? Is that resolution *really* the most appropriate resolution? The answer to this question will in part inform your decision on what UAV model is most appropriate for the mission. What kind of imagery will need to be collected? Nadir only? Or also oblique

images? Is 12 MegaPixels sufficient? What level of geo-referencing accuracy is required? Be sure to determine upfront whether you'll need to produce orthorectified mosaics and 3D point clouds. Also ensure that you identify the most appropriate sensors (cameras) for the data collection, e.g., MSI camera, Infrared camera, etc. Note that Sectoral Clusters usually maintain an assessment registry and could potentially help UAV teams ensure that their missions adds the most value.

- Be sure to create flight plans (maps) for each proposed sortie. Each flight plan should include the date and time of the flight in question, the takeoff and landing locations, the area surveyed, the type of imagery collected, the file and folder names where this imagery can be found and the corresponding URLs. Keeping these flight logs is essential. Consider using or drawing from the CASA templates/forms.
- If using UAVs for payload transportation, have you already created your transportation map with takeoff and landing sites? Have you carried out your logistics calculations to determine how much load you'll be able to deliver, where and when?
- Ensure that all budget questions have been addressed prior to deployment. Quickly approximating local costs before getting on site can be challenging during rapid deployments. Consider suggesting a "floating fund" to cover unknown or uncertain costs with your client or funder.
- It is your responsibility to have concrete answers for the above mission-related questions before you deploy. Consider using the freely available [UAViators Operations Template](#). Note that a UAViators smartphone app is under development to further facilitate coordination.

### **Data Resolutions, Formats and Sharing**

- Only collect aerial data if there is a clear or compelling humanitarian need for this data and only if said data cannot be obtained practically and in a timely manner through other means.
- Humanitarian organizations will typically request as high a resolution as possible for the aerial images and resulting orthorectified mosaics. This is a mistake. Aid and development organizations rarely need spatial resolutions below 5 centimeters given the types of features they're interested in for decision-making purposes.. In fact, one UN organization that has long term agreements with drone companies requests imagery at a standard 7cm resolution, while the World Bank's requests will range from 5cm-10cm. The higher the resolution the imagery is collected at, the longer it takes to

complete the survey of the area of interest and the longer it takes to process all the resulting imagery.

- Speed is one of the most important comparative advantages of using UAVs for disaster response. But humanitarian UAV missions do take time to plan and implement. Humanitarian organizations and politicians will be under great pressure after sudden onset disasters to demonstrate that they are responding quickly and effectively. To this end, a good practice with UAV missions is to carry a short aerial survey (10 minutes max flight time) in the priority areas and to process this imagery right away. This will enable data teams (GIS analysts) to get started on the analysis of the imagery and will enable aid organizations and politicians to show that imagery has already been collected and is being analyzed. In contrast, carrying out large scale surveys from the start will mean longer flight times and much longer processing times (several hours). In the meantime, data teams will have nothing to do and aid organizations and politicians will look ineffective. So a quick 10-minute aerial survey is highly recommended to begin with. Naturally, if several UAVs are available, than one can be used for this initial survey while the others are used to cover the larger survey areas.
- Before you start collecting any data, determine what format the imagery should be shared in and what software will be used to view, share and analyze this data. Also decide what imagery will be prioritized for data sharing. In addition, be sure that you fully understand what the resulting imagery will be used for. Ask for examples of previous information products that drew on aerial imagery to ensure you understand what the final product is expected to look like.
- Agree on the naming protocol you will use to name each image and folder. Keep in mind that you may end up collecting hundreds of aerial images and videos using multiple sensors; so consistent naming of files and folders from day one is imperative.
- Uploading and processing aerial imagery can take a long time depending on software and Internet connectivity. More on this in the *Communication Needs* section below.
- Consider having someone on your team dedicated exclusively to ensure that the data is processed, hosted and shared in the right formats. This person must have a background in GIS and experience in handling and processing aerial data.
- Open data sharing is one form of sharing and other forms may be appropriate (such as sharing with a limited group of organisations) depending on what data is captured (e.g., imagery of people may be

sensitive). For open data specifically there is help on licensing etc at <http://www.opendefinition.org> and <https://okfn.org/opendata>.

## **Pre-Mission Meeting and Logistics**

- If you plan to operate in collaboration with multiple UAV teams, do not wait until you are on site to hold that first cross-team meeting. An official pre-mission meeting should be carried out immediately prior to departure to consolidate all available information along with any updates on mission objectives and logistics. This is also the time to make final decisions on workflows and data sharing.
- The meeting should also serve to confirm appropriate lodging and local transportation options. If you are not able to move around with your UAV assets while in country, then your mission will fail or be significantly hampered. So do not underestimate transportation challenges, especially after major disasters and if you're considering on using larger/heavier UAV assets. Note that while some foreign militaries may allow you to "piggy back" on their planes and/or helicopters, these militaries eventually complete their missions and leave after the initial search and rescue and early recovery phase. So keep in mind that you may need to arrange alternative aerial transport during the reconstruction phase.
- Consider hiring a local driver and/or guide once on site. But try to identify a local transportation company before arriving to the country in question in order to ensure you'll be fully mobile once you land at the airport. Note that you may at times need to camp and be fully self-sufficient in terms of food and water. This will require advanced preparation. Consider having one person on your team dedicated exclusively to providing logistics support.
- Do your homework on the expected weather and wind patterns in the area you plan to operate in. Consult wind & weather charts. This will have implications on where, when and how you fly. The weather may also influence the choice of UAV assets. If you're heading to an area that is particularly windy (say due to recent Cyclone), then you'll want to prioritize a heavier drone and fly lower using shorter flights. If the area of interest is expected to be humid, or a rainy season is around the corner, then ensure that the UAVs you select (and their carrying cases) are waterproof, for example. Sensors like wind-speed sensor can also be affected by moisture and sand.
- Be sure to clearly define the chain of command and operational roles, especially when deploying with multiple teams.

## Communication Needs and Protocols

- UAVs operate within an ecosystem of technologies. If this ecosystem is not robust or not integrated, then this will degrade the value added of UAV assets. For example, be sure to find out whether you will need satellite phones, BGANs, walkie-talkies, electric generators, etc. Communication is key throughout UAV operations. The inability to communicate with your UAV pilots and other team members can significantly delay your missions. Establish internal communication protocols to ensure regular updates between the Field Team and Headquarters.
- Uploading aerial imagery to the Cloud whilst in the field can be particularly challenging given that aerial data can easily run into the Gigabytes range. If BGANs or other high-speed Internet solutions are not available, consider flying to neighboring city/country with a hard disk for upload there. This may ultimately be the only solution in areas hardest hit by a disaster.
- Clearly define the formal communication protocols you will follow when communicating with the media and other external actors. These protocols need to be agreed on before launching the mission. Ensure that all UAV teams get the full and fair public credit they deserve throughout the mission. This will also boost the morale of the teams on the ground. Consider having one point person as a point of contact for the media.

## Safety Measures and Flight Planning

- Do not operate UAVs in humanitarian settings unless you have already logged 20 hours *minimum* of flight time with the UAV you plan to use (50+ hours is preferred). If you have logged sufficient hours but have not operated the UAV in more than a month, be sure to refresh your skills (including programming flight plans) before the start of your UAV mission.
- Lighter UAV models (e.g., 500-1,500 grams) are inherently safer than heavier (5kg+) models. Be sure that you only use heavier UAVs when absolutely necessary.
- Take the time you need to calibrate all your UAVs and carry out test flights before launching your humanitarian UAV flights. Ensure that all the fail-safe mechanisms of your UAVs are operational. Do not rush or skip this process.
- Ensure that you know which Airspace Class you are operating in along with any additional specialized classes in your area. Consult Visual Flight Routes (VFR) Low Air Charts for consultation ([see link](#)).

- Getting formal permission to operating UAVs from official authorities in no way implies that any flight you conduct will be legal or safe. It is your responsibility to inform yourself of the country's aviation and UAV laws. For example, you may not be allowed to operate a UAV within 3 to 5 kilometers of an active airport or airfield. In addition, there are frequently restrictions on the altitude you can fly a UAV at and some regulations don't allow UAV flights over urban or heavily populated areas. Some UAV laws only allow the operation of UAVs by Visual Line of Sight (LOS) and *not* by Beyond Line of Sight (BLOS) or Extended Line of Sight (ELOS). See also: How to get UAV operators qualification ([link](#)).
- Do not operate UAVs during the first 72 hours after a disaster unless these are being used as part of formal Search and Rescue missions. Be aware that manned aircraft are likely to be operating in country after major disasters. These may include low-flying Search and Rescue helicopters and larger military cargo aircraft carrying relief aid. Helicopters pose more of a danger since they tend to fly at lower altitudes. Do not under any circumstance operate a UAV in such a complex airspace without prior written approval from the national Civil Aviation Authority, Air Traffic Control and/or the military. If such approval is granted, you must follow all Standard Operating Procedures designated by the authorities and be in constant contact with Air Traffic Control. Failure to follow the above guidelines has in the past resulted in Search and Rescue and cargo aircraft being grounded for hours when unauthorized UAVs are spotted.
- Carry out a risk assessment and risk mitigation strategy before operating your UAVs. Your use of UAVs must uphold the principle of *Do No Harm* and seek to minimize any and all risks. Safety is always the number one priority of any UAV mission. If the risks/costs of carrying out your UAV operation outweigh the expected benefits, then reconsider your UAV mission. Naturally, operating UAVs in conflict zones or former conflict zones carries additional risks, which need to be carefully weighed before any humanitarian UAV flights. Additional risk assessment parameters below.
- When preparing to operate a UAV flight, the primary takeoff and landing areas need to be identified early on in the flight planning process. It is good practice to identify an alternative landing site in case your primary site is no longer useable when you are preparing to land. This could be due to individuals obstructing the landing site, for example. To be sure, crowd control can be a major challenge in some cases. UAV pilots should not be the ones having to do crowd control. Instead, local police or other relevant authorities should be consulted for support on crowd control. A third landing site should also be identified in the event that a controlled crash landing is necessary. Naturally, these takeoff and landing sites should be well clear of buildings, trees, people, power lines, telephone lines, busy roads, etc. Note

that power lines, antennas, WiFi routers, mobile phones etc., can also create problems vis-à-vis possible radio interference with your UAV controller. Be sure to also identify the safest lowest altitude to operate your UAV in case you need to quickly lower your UAV due to other aircraft in the sky.

- UAV missions often attract crowds of onlookers. This can be an opportunity to explain your mission. At the same time, having crowds nearby can add to the risks. If onlookers don't give you a safe space to operate then do not fly your UAV. Consider bringing pictures with you of UAV accidents and injuries to show onlookers so they understand the physical risks. It may also be beneficial to install [drone operational signage](#), alerting pedestrians to the activity overhead.
- Do not operate UAVs in complex (non-segregated) airspace without prior permission from the appropriate authorities. It is your responsibility to determine whether other manned humanitarian aircraft are operating in your area of interest and under no circumstances should you fly your UAVs if other said aircraft are operating. You must first get clearance from Air Traffic Control and/or military.
- Consult the latest weather forecasts on the day of to determine whether your humanitarian UAV mission can be carried out safely and responsibly. See [UAVForecast](#) and also [this resource link](#). Be aware that wind speeds and direction may be different at higher altitudes. Note also that operating in high-altitude countries like Nepal has implications for battery-life (shorter life at higher altitudes). Keep in mind that LiPo battery performance will change depending on exterior temperature. When operating in sub-zero temperatures, keep your batteries indoors (e.g., in a car with the heat on) until you are ready to fly. As per standard practice, always take off & land into the wind. When programming your flight paths, it is advisable to fly perpendicular to the wind to ensure relatively constant speed for higher quality aerial imagery. It is also advisable that you look up [solar flare conditions](#) and forecasts. Large solar flare activity may disrupt GPS. Lastly, operating in high and low temperature environments will affect LiPo batteries. Keep your batteries cool and out of the sun.
- Launching and operating UAVs from mountains may change the performance of UAVs. Working in complex terrains such as mountains will impact any pre-planned flight paths. Experience suggests that fixed-wing flights "stair stepping" along a hill or mountain may be preferable to covering the entire area at one altitude. Indeed, programmed percentage overlaps between images will change if the topology on the ground changes (valleys and hills, for example). Moreover, flying at one altitude only may violate any flight altitude restrictions.

- Film all takeoffs (and landings). If a technical failure occurs then you'll have proof/footage to share with the manufacturer/client.
- Always have at least one spotter for UAV flights. The responsibility of the spotter is to keep an eye on the airborne UAV and surrounding airspace at all times. Ideally, 2-3 spotters can be positioned across the flight area and connected via cell phone or walkie-talkie. Consider adding a tracker to your UAV in case it goes missing. Here are two examples ([1](#)) and ([2](#)) of trackers. You can find more information in the tracker section of the [Comprehensive review of UAV](#).
- Consult the safety sections in Australia's official Civil Aviation Safety Authority UAV Operations Manual: [http://www.casa.gov.au/wcmswr/\\_assets/main/download/example\\_rpas\\_gen\\_man\\_v5mar14.pdf](http://www.casa.gov.au/wcmswr/_assets/main/download/example_rpas_gen_man_v5mar14.pdf). Do consider using the forms provided in the Appendix.

### **Other Sensitivities**

- Do not operate UAVs near or over military installations like military bases, airstrips, ships, etc. Likewise, do not operate UAVs near or over intelligence or security-related installations or over critical infrastructure.
- Carrying out aerial surveys of or over tourist attractions including religious sites may prove particularly sensitive. This is especially true if these sites have been destroyed, which means that a country's tourism industry may be severely impacted as a result. Religious and heritage sites are rightly a source of pride for locals, please be sensitive to this and do not publish aerial imagery without prior permission.
- Stay clear of "Drone Journalists" regardless of whether these are professional or citizen journalists. There has recently been a backlash against "disaster tourists" who now show up with UAVs after major disasters. These individuals have proven to be particularly careless and reckless.
- Remain calm, polite and cooperative if local or national police arrests you. Even if you have formal, written permission, they may not have received formal notice that your UAV operations are legitimate. Police officers have been known to confiscate UAVs in recent missions; some of these UAVs have not been returned. If you do get arrested, do *not* contact the United Nations or other humanitarian organization. Doing so may result in humanitarian groups distancing themselves from you both publicly and privately. Getting arrested may also hurt your professional reputation.

## In-Flight Checklist

- Do *not* deviate from your flight plans especially when you are operating in a complex (non-segregated airspace) and when the authorities have approved your flight plans. They will expect you not to deviate from your flight plans. Failure to follow your agreed plans may lead to serious accidents with manned aircraft.
- Ensure that your designated spotters are continually scanning the airspace for any interference/dangers. Scan across the sky and not only the airspace around the airborne UAV. If you see or hear what could potentially be another aircraft (manned or unmanned), then immediately lower your UAV to a safe altitude. The latter should be determined prior to operating your UAV as per the Pre-Flight Checklist above.
- If you plan to carry out aerial surveys for structural damage inspection missions, you may need to fly relatively close to the surveyed structures. Be aware that this creates wind effects and can interfere with GPS and wireless connectivity.
- Things still go wrong even with extensive planning and preparation. Strive to keep a positive and can-do attitude. This is important for overall morale.
- Film all landings (and takeoffs). If a technical failure occurs then you'll have proof/footage to share with the manufacturer/client.

## Post-Flight Checklist

- If you are liaising with the local Air Traffic Control Tower, inform the Tower that your UAV flight has been completed and that your UAV assets are therefore no longer airborne.
- Carry out an inspection of your UAV to ensure it is airworthy for your next flight. Be sure to log all your flights as well. This includes logging any incidents or accidents that may have occurred on takeoff or landing or during the flight itself. A number of smartphone and tablet apps exist to log UAV flights, such as Drone LogBook. Minimum log parameters: Date, Weather Conditions, Name of Pilot and Observer, Flight Type, Flight time (takeoff/landing), Battery Status/Condition and any other relevant Remarks.
- Save the collected imagery/videos to your computer(s) using a consistent and standard labeling format for naming the imagery files and folders. Consider using this same format when uploading your imagery to the Cloud (e.g., when using DropBox, Box, MapBox, etc). Suggested labeling format: ProvinceName\_AeriaName\_Date\_TakeOffTime\_Flight#\_Oblique/Nadir/Video. Suggested structure for folders: Province, Area, Date, Oblique/Nadir/Video. Make sure that access to your imagery is password protected and that you take care when sharing any imagery publicly vis-à-vis data privacy, etc. Make sure to make multiple backups for your imagery.
- Data privacy guidelines are still being developed for aerial imagery. Consider reducing the resolution of images that contain sensitive information before making those images public. Another approach that has been used is to simply not provide any GPS or location information for the image in an effort to keep said image more “anonymous” (although this tactic has some obvious limitations). Most of the time, humanitarian organizations do not need (and do not necessarily want) the raw aerial images. Their interest is in the analysis of said images and in the results of this analysis. These results tend to be integrated and aggregated with other datasets in order to produce information products that are useful for decision-making. In other words, sharing the meta-data derived from the imagery analysis and aggregating this metadata typically presents future data privacy issues. In any event, every image that is publicly shared should include contact information should someone request that the imagery be kept private.
- Do not retain data collected using UAVs for more than 180 days unless deemed absolutely necessary. Data collected by UAVs that is retained must be secured and safeguarded.
- Do not release any of your imagery to the media. The latter may end up using your imagery as a media asset, thus “sensationalizing” the disaster. This

could brand you as insensitive and as a disaster tourist, which could have serious repercussions on both your humanitarian operations and those of other legitimate groups operating in country. Note that “Drone Journalism” even when carried out by professional journalists can create a significant backlash against any and all UAV use after a major disaster.

- Prioritize your data for processing and analysis. Do not upload all the data you have collected to the Cloud especially when Internet connectivity is an issue. Be sure to pre-filter and pre-process the imagery and prioritize accordingly for upload. Consider using graphics file formats that use a lot of compression (eg, JPG 2000) and .Zip or .Rar in order to further reduce the size of the data that needs to be uploaded.
- Be sure to share the imagery you have collected with local authorities *and* local communities at every opportunity. This includes sharing both the aerial data and the resulting maps. Consider printing your aerial maps on rollable, waterproof banners and/or bringing a mini-projector to project the imagery.