Checklists for sUAS Flight Operations

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The following issues are very important for safe and sustainable small UAS operations.

Pre-Flight Drone Setup

DON'Ts:

- Do not power on the drone before you power on the controller, the drone could fly away with no way to bring it back if the controller does not connect.
- Do not fly the drone without checking weather conditions (rain, humid, high winds, etc.)
- Do not turn off the controller while flying the drone.
- Do not fly without properly checking that the drone is in good working order.
- Do not fly if there are any GPS, or electrical problems that prevents the drone from functioning smoothly.
- Do not fly on low battery no matter how far the distance.
- Don't power up the battery without being attached to the drone.

DO's:

- Be sure to have all equipment needed for the intended flight, this includes batteries, controllers, cameras, generators, etc.
- Check the weather and report to Air Traffic Control or airport if needed; this is in the case you are within 5 miles of an airport
- Have a flat surface for takeoff, free of debris and other obstacles.
- Always perform a preflight inspection of the drone, the engines, battery power, and all equipment attached to ensure a safe flight.
- Place the props on the drone and ensure they are ready for flight.
- Always turn on the controller prior to powering up the drone, this will ensure that the drone does not take off by itself with no control.
- Perform all compass, and sensor calibrations to prepare for flight.
- Create an appropriate flight plan that follows all FAA guidelines, and is safe for the public surroundings.
- Do keep accurate logs for every flight which includes flying time, location/study area, sensor and flight characteristics. Have a separate log for battery usage

Drone Flight

DON'Ts:

- If there are any compass, or calibration problems at all do not proceed until a maintenance check is performed!
- Upon take off ensure the drone functions as it should, do not fly if there are any unwarranted movements, this could mean that there is a problem; land the drone and run software diagnostics and inspect the drone closely
- Never continue flying if a plane or a bird seems to be in a direct line towards the drone, evasive maneuvers must be taken in order to protect the public, and wildlife.
- Do Not fly in poor weather, this could damage the drone or lead to a malfunction that could injure others if the drone were to fall.
- Do not fly on cloudy days, the images are best with no clouds when collecting data.

- Don’t fly with insufficient battery power, this could lead to an immediate loss in power.
- Don’t fly in high wind speeds if possible, flights will be shorter, and the drone will work harder to stay level.
- Do not land in an unleveled area that could damage the drone. Landing in high grass can smear the lens and impact image quality
- Never land the drone without the legs being down to protect the equipment.

DO’s:

- Make sure the drone takes off and functions as it should, Straight flight path upwards with little variance in movement is normal.
- Always keep line of sight, for most this will be for birds, buildings, and wires, but for some near airports small airplanes CAN fly near to the drone and pose a serious threat.
- If needed take immediate action to avoid a Collison, even if it means to crash the drone.
- Be aware of FAA law regarding, distance from the ground, distance from wires, and distance from clouds, although in many cases the cloud ceiling is much higher than the allowed 400 ft. for flying.
- Pay close attention to the battery required for a return to home if a battery swap is needed. Always bring the drone back with sufficient power for the return.
- When performing a battery swap be sure to perform a check of the equipment once again before resuming the flight.
- When landing the drone, it should be automated, however as the drone gets closer to the ground manual control should be taken if there are any unleveled surfaces, or obstacles in the way.
- If the legs do not come down perform a manual landing gear deployment.
- Fly in clear weather in the middle portion of the day for best results.
- If the weather changes quickly make sure to call the drone back home until the weather is safe to fly again.
- If you are in a public area, be sure to fly in times where it is least likely for someone to get injured if an accident does occur.
- Report any accidents or damage according to the FAA rules regarding drones (part 107)
- ALWAYS follow FAA regulations and rules regarding drones (part 107)
- Be sure to fill out a drone log and a battery log after the flight

<u>Data Processing</u>

DON’Ts:

- Don’t do any processing on a machines with processing lower than an i7 core.
- Don’t mix datasets from different dates without careful thought as this might cause errors in processing.
- Don’t use ambiguous names for data that can be easily confused with other data, dates, or tables; proper data indexing is very important
- Don’t store data from the same flights in different folders, each plan should have its own set of folders and sub folders.
- Never delete original data from the flights, this could cause missing data that will corrupt the entire process stage.
- Don’t use GPS with large error for ground control points; survey grade GPS is the best choice if available

DO’s:

- Be sure you have the proper CPU for processing and software you will be using.
- If possible to speed up data processing use cloud based services.

- Allow proper planning for processing time based off of your available resources (weeks for large data, or days if cloud based).
- Ensure you use at least 70% overlap in photogrammetry for good results for ortoimages and 3D models
- Chose the appropriate pixel size and ground sample distance for your flight.
- Flight speed will directly impact the data you are collecting; slower speeds can be more desirable in precision mapping operations
- Decide the level of accuracy you need for the project (Internal accuracy for one particular project or, absolute accuracy for comparisons of multiple data sets across time.)
- Run smaller sections of processing at one time so that if you are experimenting with new data processing approaches
- Properly label the data specifically to the day, and equipment for proper organization.
- Specify pixel radiometric in UAS imagery exports; 32 bit imagery can be difficult to work with and only most recent software versions can handle this type of data properly. (ArcPro is easier to change things like this than ArcMap).
- Always check server restrictions when working with ArcMap/ArcPro, and be sure when saving/ exporting data your server allows processing to run smoothly.
- Make all data in your set the same pixel size, and depth, this will ensure a smooth processing.
- Use ArcPro as much as possible as it is easier to control the data, and export data as needed;
- Always use ground control points when processing data for accurate imagery products.