

APRIL 2023



PREVENTING TECHNICAL FAILURES

DRONE EDUCATIONAL & SAFETY ARTICLES

02.

INTRODUCTION

Drones used for commercial activity combine advanced electronics with robust hardware. Batteries, motors, and props are designed to handle high loads, and onboard and remote flight control systems process enormous amounts of data to mitigate flight risks.

Inevitably, failures will eventually occur in all complex systems. However, a recent analysis of Mandatory Occurrence Reports (MORs) submitted by drone operators has shown an increase in avoidable technical failures caused by human error.

Commercial drone operators are well-trained, skilled professionals with excellent knowledge of their equipment and its capabilities. However, none of us is immune to the human factors affecting all aviators - including stress, time pressure, overload, and task-completion focus.

Most of the incidents reported resulted in either total loss of the equipment or extensive damage. This could have a serious impact on your business, resulting in loss of work and additional costs.

We want to highlight three areas of drone operation from recent MORs where human error contributes to equipment failure: pre-flight checking, battery and power management, and situational awareness.



PRE-FLIGHT CHECKS

You must perform thorough pre-flight checks before every flight, not just the first of the day. Be wary of distractions when setting up and pre-flying - it's easier to miss a vital step if you're not giving checks 100% of your attention. Always double-check safety-critical items.

Incident: *One propeller incorrectly attached. No issues noticed at launch. Prop later detached mid-flight. Equipment destroyed.*

Drone hardware has to cope with a high-vibration environment. Anything designed to be removable should be checked particularly carefully. Attachment mechanisms should be positively confirmed as correctly seated to avoid partial connections, crossed threads, or similar.

Incident: *The battery was not fully latched. During the flight, the battery worked loose and all power was disconnected. Equipment destroyed.*

Any safety-critical component should be checked not only visually but also physically. Err on the side of caution and never assume any latching or locking mechanism has engaged - give it a tug!

Incident: *Pilot took off prematurely before the aircraft had achieved a GPS connection. Drone began to move in an unexpected way. Over-control by pilot in an attempt to recover led to ground impact. Major damage.*

Before you power up the motors, ensure that all the conditions required for your intended flight have been met. Follow the manufacturer's instructions on calibrating electronic compasses. Consider moving if you cannot receive sufficient GPS lock in your intended launch area. Don't overestimate your ability and currency in maintaining manual or attitude mode flight until the signal improves.

BATTERY AND POWER MANAGEMENT

If there's one thing most drone pilots aren't short of, it's batteries. We know they are consumable and gradually lose capacity with use, even with careful handling. Many drones display remaining battery power as a percentage. This calculation can be inaccurate, and the shown value may decrease in a non-linear way depending on how the aircraft is being flown and the chemistry in the battery. Sometimes, the communication between the battery circuitry and the aircraft can fail. Don't take any risks with batteries.

Incident: *The drone controller suddenly showed a low battery warning. The pilot did not land immediately. The aircraft then suddenly lost power. Equipment destroyed.*

Any unexpected battery warning should never be ignored. Don't rely on any low-power automatic landing mode your aircraft may have. In the case of a sudden battery failure, or battery communication error, this mode may not have time to engage. Any power warning should be treated as an emergency. It's better to troubleshoot the battery issue on the ground.

Incident: *Pilot noticed a battery warning error early in the flight and landed the drone. After rebooting the aircraft, the battery percentage seemed back at expected levels. Pilot continued the mission with the same battery. The aircraft suddenly lost all power while still showing 30% battery available. Equipment destroyed.*

If a battery appears to be giving unusual or unexpected power readings, treat it as suspect and immediately replace it with another unit. Assume it is about to fail and mark it to avoid being used again until it has been thoroughly ground tested. Always ensure the manufacturer's instructions are followed for charging, storing, and discharging batteries.

SITUATIONAL AWARENESS

Most commercial drone missions are flown with a single operator controlling the drone and the images or sensor data it collects. The ability of drones to hover in place without operator input can sometimes lead to pilots “flying the screen” and not keeping a good overview of their aircraft’s position and any potential hazards outside the camera’s field of view. Some pilots overestimate the capability of any obstacle detection systems their aircraft may have - particularly in detecting objects with a smaller cross-section or in challenging conditions.

Incident: *A lack of pilot situational awareness led to the drone clipping a power line. Equipment destroyed.*

Incident: *A lack of pilot situational awareness during a flight near trees led to the drone clipping branches. Equipment severely damaged.*

These incidents reflect the risk involved when flying with reference to the camera view. In both cases, the pilots were aware of the hazards as part of their flight planning but became focused on their filming/scanning. When flying, move your controlling position to a location where you can clearly see your aircraft and its position relative to anything that could be a collision risk. Keep “heads up, eyes on” as much as possible. Consider using an observer to mitigate the risk of collision when operating close to any obstacles.

We want operators to minimise the risks to their equipment and to the safety of others on the ground or in the air. The MORs submitted by drone operators allow us to highlight areas where human factors have caused failures that could otherwise have been avoided.

By being conscious of these particular scenarios - thorough pre-flight inspections before every take-off, immediate action after battery warnings, and avoiding loss of spatial awareness - we hope commercial drone operators can reduce their exposure to risk and increase flight safety.



