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AVOIDING TERRAIN AND OBSTACLE COLLISIONS

DRONE EDUCATIONAL & SAFETY ARTICLES

03.

INTRODUCTION

A recent analysis of Mandatory Occurrence Reports (MORs) from drone operators has revealed a four-fold increase in incidents involving a collision with terrain, obstacles, or persons since 2018. While commercial drone pilots operating under the Specific category will be well aware of the MOR process, most incidents involving non-commercial operators flying in the Open category will not have been reported.

Collisions with objects or the ground are likely to be the incidents that pose the most significant risk of serious injury or damage to property.

In this article, we'll look at the primary causes of such collisions and examine what steps you can take to mitigate the risk of it happening to you.



SITUATIONAL AWARENESS

Of course, when flying, you must always keep your aircraft within visual line of sight (VLOS). But to reduce collision risks, it's equally important to familiarise yourself with the area where you will be operating. Before taking off, survey your flying area in all directions, including what's directly overhead.

In one incident reported to the AAIB in 2021, an enterprise-grade drone struck a cable directly overhead during its takeoff manoeuvre, causing it to drop to the ground and incur extensive damage.

Note the wind direction and strength and plan your flight accordingly. Ascertain the height and distance of any obstacles, moving to get a closer look if necessary. Make a comprehensive scan for hard-to-see risks such as wires and cables, netting, and fencing.

In many cases, using a spotter to help you will always be safer. Our ability to judge the relative distance of objects (depth perception) is limited when those objects are relatively small or quite far away - a combination often found when flying drones. Once your drone is more than a few metres away, be cautious about approaching trees or bushes without first moving yourself to assess the accurate distance if you are not using a spotter. As well as reducing risk, spotters can also allow you to get closer to objects than if operating solo, often improving the outcomes for inspection or photographic/video sorties.

Almost 40% of all MORs reporting collisions mention hitting trees, branches, leaves, or bushes. It's an old joke in the community that all trees contain "drone magnets" - and the incident reports appear to bear this out!

While flying into a leaf or two might result only in some green-tinged props and a lucky escape, there's a real risk of inflicting enough damage to the drone to cause a total loss of lift and control. As well as damage to the aircraft itself in any subsequent impact, this also increases the risk of the falling drone hitting anyone and causing injury.

In-built collision avoidance technology is not infallible, and small twigs and branches that are big enough to do severe damage to a propeller may well be small enough to go unnoticed by sensors or cameras.

Similarly, relying on the video downlink for situational awareness is risky. As well as putting you in an "eyes down" position with your aircraft, the limited peripheral vision given by on-board video cameras won't be enough to avoid leaves and branches that could be within the prop arcs but not the view of the camera - usually mounted below the level of the props. The video feed quality is unlikely to be high enough to show fine wires or similar objects until it's too late.

EXTERNAL FACTORS

Flying anything involves dealing with a highly dynamic medium - the air. Some collision reports highlight sudden changes in wind speed and direction as factors in the incident. Strong thermal activity, gust fronts, and the funnel effect of terrain or ground features where you fly can all lead to the wind doing things you hadn't expected.

Knowing your aircraft's performance limits and accurately assessing your abilities can reduce the likelihood of situations that end in unwanted contact. In stronger, gusting, or swirling wind conditions, allow a greater margin of safety and fly further away from any obstacles.

You're often not the only thing in the air when you're flying, and reports have shown that

collisions have occurred when taking avoiding action to escape the unwanted attention of birds. It's usually safer to descend than to manoeuvre laterally to avoid a curious or aggressive bird, particularly if operating in an area with multiple object hazards.

It's not just airborne hazards that can cause distractions. In one MOR report, a pilot who was hours-building in a local open space became distracted when an off-lead dog decided to jump up at him repeatedly. Instead of putting the aircraft into a hover or initiating an automatic landing, the pilot continued to try to control his drone, and it subsequently collided with a pole, writing off the aircraft.

SYSTEMS KNOWLEDGE AND UNDERSTANDING

Many drones use some form of "object detection" to minimise collision risk. These can be optical and infrared sensors, ultrasonic sensors, or a combination. Like all electronic systems, they have their limitations and are not infallible. You must understand how such systems on your aircraft work and - crucially - when they might not.

For example, some object detection systems can't easily detect moving obstructions, such as tree branches swaying in the wind. Others will only react to objects smaller than a specific size within the detection area. Such systems might automatically stop a collision with a pole, for example, but not a large brick wall.

Thoroughly familiarise yourself with any collision-avoidance systems your aircraft may have, and understand the situations in which they may not prevent an impact. You should not fly when you need to rely entirely on automatic systems to avoid a collision.



TECHNICAL ISSUES

The second most common root cause of collisions is technical failure. While the overall reliability of the hardware and systems of the current generation of drones is excellent, component failure can and does occur.

By adopting a thorough pre-flight inspection regime before every take-off, pilots can catch some issues on the ground before they develop into in-flight failures. Verifying the secure attachment and condition of props is particularly important, as is ensuring batteries are correctly seated and secured to the aircraft.

Ensure your aircraft, flight controller, and companion apps or software are updated with the manufacturer's latest versions. Sign up to receive notifications from the manufacturer about safety critical issues, bug fixes, or recall notices.

Pay close attention to the status indicators on the drone or controller. Don't take off without a full GPS lock; never ignore any warnings regarding compass calibration; do not push battery life beyond a safe margin.

HUMAN FACTORS

By far the most common root cause of collisions identified from MORs, human factors account for over 50% of collision incidents reported.

Incorrect control inputs are a common theme. Under stress or in an unexpected situation, mistaking the aircraft's orientation and pushing the sticks the wrong way could easily happen when under pressure. Ensure you are always aware of your aircraft's direction and the correct control inputs required to manoeuvre away from obstructions.

Practice your manual flying skills regularly. Familiarity with "hands-on" control will build muscle memory to help you respond correctly to unplanned situations.

The pressures of "getting the job done" can sometimes lead to overlooking essential checks or operations. Use written checklists to ensure you don't forget any safety-critical checks or procedures before every flight.

Are you fit to fly? Feeling ill, tired, or highly stressed can impact your decision-making ability and hamper your reactions and responses to tricky situations, increasing the chance of collisions.



