A bird's eye view

The latest UAV (unmanned aerial vehicle) technology allows swift, thorough inspections to assess turbines. Drones can be used either as part of routine reporting or for detailed inspections in preparations for rope access teams. This has many significant health and safety benefits for the technical teams in terms of assuring all anchor points are secure and preparing in advance for any repair work that will need to be done at height. Here, UAVONIC Ltd, shares the fundamentals of a typical aerial inspection and how wind O&M teams can benefit.

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UAVONIC works closely with inspection engineers to give the UAV Operators a good understanding of the wind turbine's structure. So when on site with a client, pilots can understand the issues most commonly discovered upon inspection and what is required for the inspecting Engineer.

When doing an inspection on a wind farm usually an inspection Engineer from the site would be present with the UAVONIC UAV team. There may be specific issues he is already aware of that he will want the pilot and camera operator to focus on, but all project plans will look similar consisting of the following scope of work:

- Project Task List
- Clearance with Nearest ATC (air traffic control)
- Risk Assessment for the site
- Pre Site Survey of airspace for the site
- Plan Flight Paths
- Issue of Notams (notice to airmen) where needed
- Notification to local Police if necessary

On site the team will;

- Perform an On Site Survey
- Update the Risk Assessment
- Review media after capture
- Hand over to client and liaise with client and manager of the site on the day of flying

A typical team includes one UAV Pilot, one camera operator and one assistant to manage data and batteries. Obviously ensuring quality data capture on the day is of crucial importance. While UAV battery technology is constantly improving, in order to ensure optimal performance on site, the team allows up to 4 batteries per turbine to be sure all areas of concern can be completely documented.

The UAVONIC team works worldwide on multiple models of turbines of various ages. To prevent longer shut down time then necessary, it is crucial to plan ahead for any eventuality. For instance, when working on a field of older generation turbines, the blades' rotations can take a significant amount of time. Therefore the work flow is

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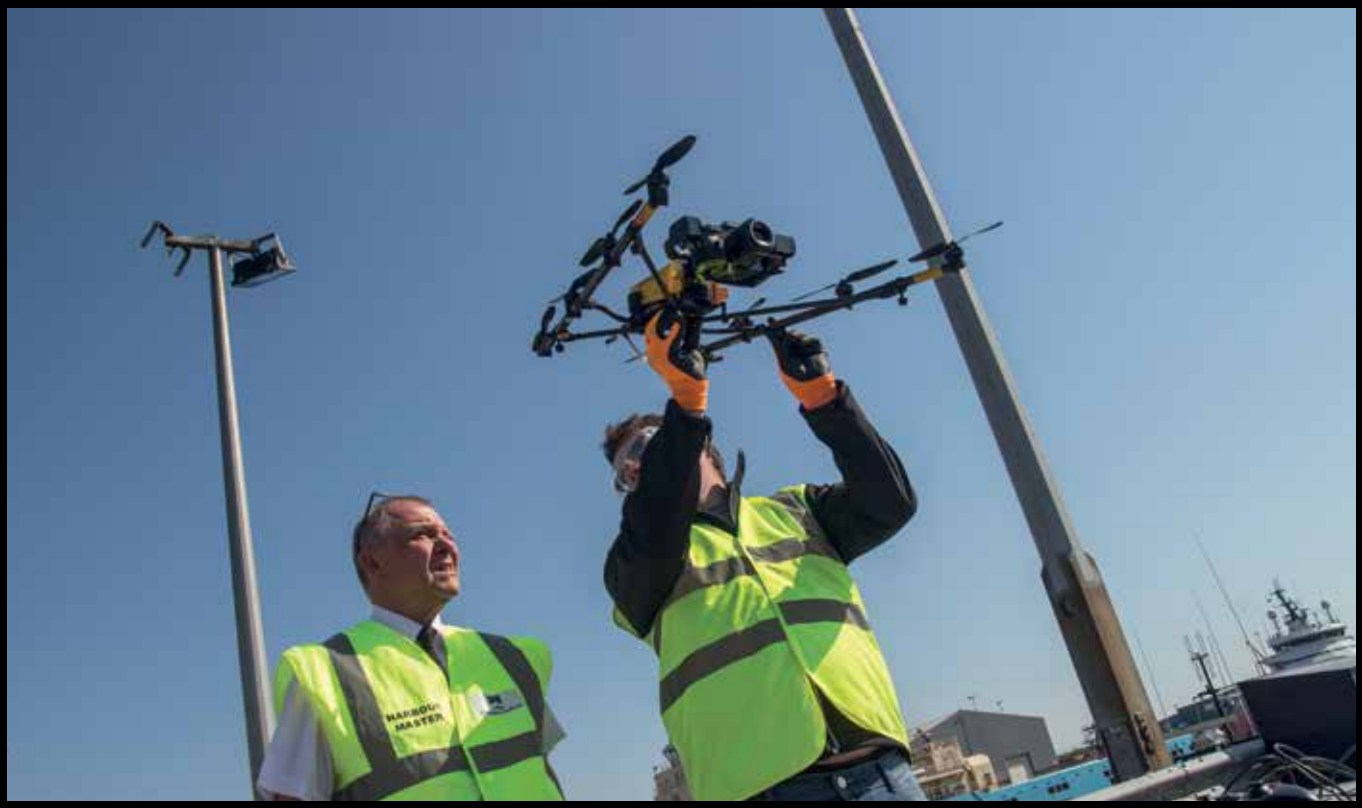
organised to allow for this extra time needed for the blades to rotate between each turbine. Depending on the layout of the site, flights can be planned for one turbine whilst another is rotating.

After each flight, while the blades are rotated, data is downloaded and reviewed by both the UAV team and the inspection engineer. This ensures each flight has captured all the data requested by the engineer and gives the opportunity to repeat the flight if any details are missing or unclear. All this can be done whilst preparing for the next flight. One of the cost saving benefits of UAV inspections is the ability to reduce downtime for the client, so flight plans always maintain maximum efficiency when shutting down the turbines.

A standard wind turbine is made up of over 8000 components. The rotors and the nacelle are the main subjects of UAV inspections, usually inspected with high resolution photographs and videography. Inspection with thermographic cameras is also currently proving useful to detect overheating.

Typically, the team will first look at the rotors, the assembly of three blades mounted on a hub that is connected via the main shaft to the gearbox. Varying in lengths of up to 60 meters, the blades are made up from fibreglass and epoxy resin. Some have design specifications where polyester is used instead of resin with carbon fibre added for strength. All blades are subject to wear from weather, bird-strike etc. Please see photo examples of typical issues spotted during UAV surveys. To take a closer look at the blade construction during inspection, it is important that the cameraman captures the full length of each side of the blade with good overlaps.

The UAV team takes care to document previous repairs and replacement of the blades edging tape. These areas are often the most important to capture, being especially significant for the inspection engineers. Also where the blade enters the nacelle, this is usually sealed with a rubber flange held in place with a metal gasket retainer. Inspecting a potential corrosion of this area is also important. And a UAV flight can often offer views not available from a ground photographic survey or even rope access teams.



Looking more closely at the nacelle, an all-around visual inspection is required of each nacelle. Clear high resolution imagery will give the engineers reassurance that there has been no weather damage, which may cause the nacelle to leak water causing further problems later on. The nacelle protects all of the internal components so is especially significant. This is usually constructed of fibreglass and can be subjected to fractures.

A UAV team can generally inspect 3 turbines with a 3 blade configuration in a day. Each turbine is given a unique ID, this is critical when labelling each set of imagery and videos. In addition, each blade on each turbine is also given an ID as the engineer needs to be able to identify the blades individually, the order in which the photos were taken and to which turbine they came from. All of this information will be detailed on the final report.

The engineer is then able to use the imagery to identify if any works need to be scheduled, and where roughly on the blade the technicians will need to go. The UAVONIC team's process is to download each data set after each flight, check, name and store before doing the next flight. This saves any confusion later on as all the blades do look identical. Great lengths are taken in the setup of the cameras to ensure the blade is always in the centre of the shot, and all photos are in focus.

Particular care must be taken with certain turbine models as the copper coil in the HUB to aid cooling can cause extreme interference with the video signal, it can also cause interference with some IMU's. UAVONIC have discovered a work-around and specify using custom VTX with a 7 turn directional helical antenna on the diversity monitor. All UAVONIC flights use the latest in both UAV and camera technology. The newest addition to the UAV fleet, the Falcon 8 drone is stable enough to reliably inspect offshore wind farms.

Once all the flight paths have been completed, the high res photographs have been downloaded and tagged and the client is satisfied with the output, all the data is presented in a report. The UAV inspection report is a key reference document for O&M teams and site owners/ asset managers alike. Maintaining a file of reports updated every 6 months to a year is best practice offering a visual record of the state of all repairs and informing schedules of required works. UAVs can offer high resolution data not available from the ground, that's quick, safe and cost effective. Understanding these basics of UAV operations will help you get the most out of your next aerial report. ■

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UAVONIC is a well established UAV Enterprise Services provider. Since the commencement of business in 2014, we have grown to become one of the most competitive service providers across Europe. Utilising the latest aircraft and payload sensors technology and in-house hardware/software development, UAVONIC is forging ahead to be at the forefront of our Enterprise Service market sectors.

Creating a UK base in Kettering in 2015, emphasis is placed on regulations compliance and Health and Safety being the key priority whenever and wherever we are operating.

Utilising proven, reliable platforms operated by professional, highly trained and experienced certified pilots, we ensure safe, time and cost effective services to our clients.