



**Innovative
maintenance using
unmanned aerial
vehicles.**

Innovative maintenance using unmanned aerial vehicles.

We're reducing health and safety risks, saving time and maintenance costs, and reducing operational downtime by using unmanned aerial vehicles (UAVs), commonly known as drones, to inspect equipment and infrastructure such as cranes, digesters and slow sand filters.

Background.

Unmanned aerial vehicles (UAVs) come in a variety of shapes and sizes, ranging from small handheld types up to large aircraft. Their usage is rapidly increasing thanks to a variety of applications, including taking still images or video footage using conventional, zoom and even thermal imaging cameras.

Benefits of UAVs.

UAVs offer solutions to many of the daily challenges and risks in our business including:

- Health and safety.
- Reducing costs.
- Saving time and improving productivity.
- Providing data and information with imagery.
- Reducing operational downtime.

Health and safety is an important reason for using UAVs, giving us safer access to confined or hard to reach places like roofs, towers and watercourses. Using them for inspections can significantly reduce the cost of traditional forms of access such as scaffolding, cherry pickers and scissor lifts, and the time taken to set them up. UAVs can also be used to gather information about the condition of our sites and assets, which helps us with maintenance and investment decisions. A wide range of information can be safely and accurately recorded.

We've carried out a successful trial to test whether the images from UAVs were sufficient and of an acceptable quality to satisfy insurance inspectors and the Health and Safety Executive. Although human inspections are needed and can't be ruled out completely, UAVs can be used for most inspections, for example in three out of every four years.

- **We saved around £1.3 million last year by using UAVs.**
- **UAVs help to reduce health and safety risks, costs and time taken by our daily activities.**



Examples of our UAV fleet.

How we use them.

Last year, we carried out a statutory inspection of a gantry crane track at Mogden sewage works. If we'd taken the conventional approach of putting up scaffolding and taking the asset out of service for inspection, it would have taken over a week to complete and cost us more than £100,000.

Now, with the latest UAV technology, we were able to carry out the inspection in three hours by photographing the gantry crane track using a high definition camera with a powerful optical zoom. The UAV eliminated the need for anyone to work at height, and the all the health and safety risks usually associated with this task.

Last year, we saved over £1 million thanks to using UAVs, and we expect to save even more by adding an anti-collision UAV to our fleet, which is specially designed for confined spaces like shafts and sewers.

We're now in the process of trialling this technology which will mean that our people won't have to work in confined spaces, and could save us around £250,000 per inspection.

Other UAV uses.

We use our UAVs with a variety of capabilities including taking high resolution images and thermal imaging. This technology can help us in all sorts of scenarios, improving the speed, accuracy and safety of many of our activities.

Enhanced access.

Across our business, we have hundreds of structures like cranes, digesters, shafts and tunnels that need regular internal and external inspections. This usually requires scaffolding, and most accidents are caused by falls, misuse or by objects falling from the scaffolding.

Our fleet of UAVs now enables us to inspect these and other equipment without putting our people into potentially hazardous situations.



Inspection of a gantry crane.

Asset inspections.

UAVs help us to quickly capture vast amounts of information over large areas, and let us identify and resolve issues fast before any risks emerge. By viewing our sites and processes from above, we're able to assess the health of these assets. For example, we can look for discoloration in our slow sand filter beds. To inspect our aerators, we can use a powerful optical camera lens to zoom in and look for bubbles.

Thermal imaging.

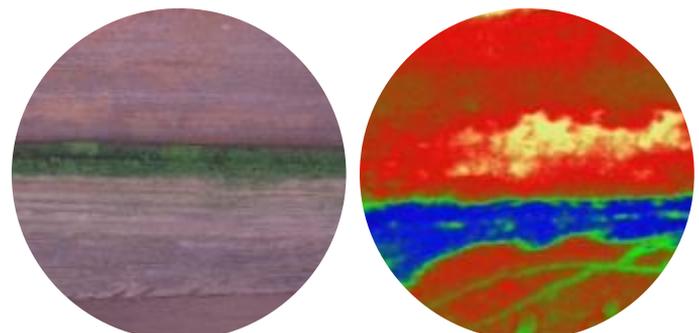
We also use thermal imaging cameras on our UAVs to detect leakage. Alongside accurate, real time aerial views of the ground, we can see the scale of leaks and pinpoint the source. We can also monitor temperatures in our network, carry out asset health inspections, and identify intruders on our sites.



Structural inspection of digesters.



Using optical camera to zoom in on our aerators.



Using thermal imagery to identify a leak in a field.

"It's fascinating what has been achieved. UAVs can drastically reduce safety risks by enabling us to inspect cranes and other equipment at height without putting people into potentially hazardous situations, as well as save on maintenance costs and time."

- Karl Simons, Head of Health, Safety, Security and Wellbeing.

