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2022 TECHNICAL AWARDS ENTRY FORM

Entry Deadline: Friday 29th April 2022

Please tick which categories you are entering (entries may be submitted in multiple categories)

Landbased Pipeline Project Award	☐
Landbased Pipeline Technology Award	☑
Utility Pipeline Project Award	☐
Utility Pipeline Technology Award	☑
Subsea Pipeline Project Award	☐
Subsea Pipeline Technology Award	☐
iICE Award	☐

1. **Brief title of entry:** **The Machines are Taking Over! Adapting Drones for Advanced, Safer Sewer Surveys .....**
2. **Company name:** **Environmental Techniques .....**
3. **Signed:** S. Herron .....
4. **Date:** **29th April 2022 .....**
5. **Company contact name:** **Shauna Herron .....**
6. **Telephone:** **02892 677500 .....**
7. **Email:** **sherron@aegion.com .....**

8. **Precis of your entry (50 words):**

Adapting unmanned aerial vehicles to survey critical underground infrastructure which are too difficult to survey using CCTV crawlers and unsafe conditions make them high risk for man entry surveys. In addition to undertaking video surveys, LiDAR 3D mapping and Artificial Intelligence software are being developed for use with the drone.

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9. Summary of entry:

A significant number of highly critical sewers have not been able to be surveyed using traditional CCTV crawler and float methods and, as a result, our Clients have little to no information on their current condition. This may be large diameter sewers where the pipe invert is too uneven or narrow for a traditional CCTV crawler unit to travel, where there is too little flow to undertake a float survey and where conditions are too hazardous for a man-entry walkthrough. Detailed programmes of work to find the condition of these assets can often be extremely costly and logistically difficult.

ET partnered with Good Friday Robotics (GFR) to adapt drone technology that could fulfil this purpose and include additional technologies that could improve the data we collect during a survey. The Proof of Concept (POC) requirements were high quality footage (4k resolution achievable) and adequate lighting for large diameter sewers (up to 3m). In addition, we also included a LiDAR module for the capability of 3D mapping out the sewers and implemented Artificial Intelligence (AI) software to digitally code the condition of the sewer based on the information from the survey. We collaborated with Clients on our current frameworks to test and develop the new technologies. There are a number of aspects to the development and approval stages. The first was testing the drones in the sewer and understanding the capabilities and limitations of the system, for example what distances we could cover using current battery technologies. The next is ensuring that footage meets the specifications and that matches, or exceeds, what current CCTV systems can provide. By increasing the speed of travel through the sewer, the drone can survey longer lengths of sewers on the same battery charge. Existing specifications dictate speeds for traditional CCTV crawler systems which can often miss defects or bounce around if the speed is too fast. We are confident that all defects are visible on the drone surveys due to the strong lighting, high resolution footage, stable flight, and high frame rate, and that specifications may need to be reevaluated for these newer technologies.

In a large diameter sewer, even a relatively small amount of debris is enough to prevent a CCTV crawler from progressing down the line. In these cases, we would need to use a JetVac to clean the line and reattempt the survey. The cost of fuel and labour for the Jetter can be significant and it can take hours, and often days, to fully remove silt and debris from large diameter sewers for a CCTV crawler survey to be undertaken. A drone survey can be undertaken to condition assess without needing to remove all the silt and debris in the line, and the visual assessment of the pipe can determine if cleaning is required to improve the hydraulic performance of the line. If not, the client can reduce costs by scheduling cleaning at a planned date in the future as part of a desilt programme.

Where CCTV crawlers are not suitable, man-entry walkthroughs are often undertaken to visually assess culverts and large sewers. In order to be carried out safely, these can often involve 9 person crews, including specially trained rescue team members. The cost of a crew that size, as well as breathing apparatus and other safety gear, results in walkthroughs being extremely costly for the Water Company. A drone survey, in comparison, can be done safely with a 2- or 3-person crew depending on access into the sewer, providing potential cost savings to the client. The reduced number of operatives and vehicles required on site also makes the drone survey have a much smaller carbon footprint which will assist Water Companies in meeting their Carbon Net Zero Targets.

The significant benefit of a drone survey compared with a Man-Entry Walkthrough is the improvement of health and safety. Whilst we ventilate sewers, monitor gases in the sewer and provide the survey crew with breathing apparatus and escape sets, there remains inherent risks with operatives being in a confined space. The drone survey removes the need for operatives to be in a confined space or travel along the sewers and therefore the survey can be undertaken with a higher certainty of safety for all employees. As we continue to develop the AI coding, we are confident this will be able to replace the need for an operator to undertake the coding. This is a repetitive task and by removing that responsibility from the operator, they can focus their attention on completing the job safely. The benefit to the Water Company is they will receive consistent, repeatable results that is not reliant on the skill of the CCTV operator. An added benefit to this is that Water Companies can validate data much quicker, without having to assign people to many months of reviewing footage and reports.

We are still at the nascent stages with regards to the development of our drones and software but already it is returning breathtaking, quantifiable deliverables. In addition to the internal excitement over this technology, our Clients and many within our parent company, Aegion, are actively observing how the drone technology is improving. We have written about our developmental findings in internal communication in our parent company and delivered a presentation on the potential. We have also put the technology forward for ‘Innovation of the Year’ with our parent company that oversees critical infrastructure projects worldwide.

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Ancillary Entry Information

(Entry restricted to normal type face and font size on this form plus no more than 3 pages of A4 drawings or photographs)

Example of a cascading sewer that can't be surveyed using float/crawler surveys and would be treacherous to survey with a man-entry walkthrough. These larger, more intricately designed sewers are found in busy city centres where access can be difficult.

The drone entering into the manhole from ground level. This negates the need for man entry into sewers and greatly reduces the health and safety risks that are encountered when working in confined spaces.

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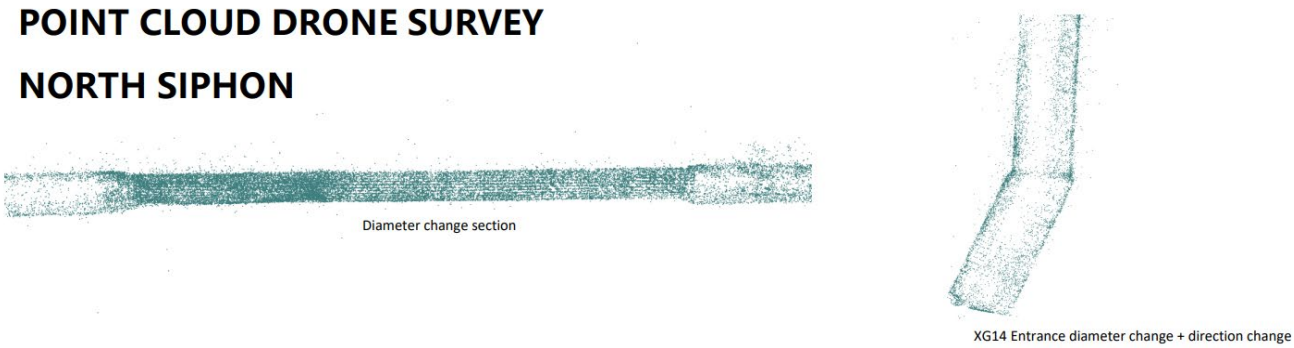
Example of a 3D point cloud (obtained from LiDAR data) and video footage from drone. The uneven invert, due to bricks and debris, would have prevented a crawler survey from being completed and the size of the sewer is not suitable for man entry.



As well as allowing access into difficult sewers, the 3D information picked up by the drone can pick up detailed information for possible rehabilitation works such as the measurements of a diameter change (required for CIPP lining designs) or accurate measurements of the angles of bends in the sewer. The information can also be used for informing civils repair works by locating the exact location of a defect.

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