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**2020 AWARD FOR SIGNIFICANT CONTRIBUTION TO
UTILITY PIPELINE TECHNOLOGY**
Entry Form
Entry Deadline: Friday, 17th April 2020

1. **Brief title of entry:** 'Telesto' 3D LiDAR Modelling of Tunnels in Semi-Turbulent Flow
2. **Company name:** Wessex Water / Headlight AI / Bright Innovations Group (*Joint Application*)
3. **Precis of your entry for inclusion in the Awards Lunch booklet (50 words):**

'Telesto' is a multi-sensor intelligent AI survey platform to model 3D underground assets in semi-turbulent flow, over long distances. It removes the necessity for personnel to enter underground sewers and river tunnels etc, improving H&S, and goes beyond the capabilities of CCTV and laser profiling solutions, at reduced cost.

4. **Summary of entry:**

Signed:

5. **Date:** 25 April 2020
6. **Company contact name:** Julian Britton Wessex Water, E & C Utilities Div.
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Detailed Description of Entry

Wessex Water's main focus in the management of its 35,000 km network of sewers, is safety. Until the late 1990's tunnels would often have access shafts located every 1000m. With the advent of the CDM Regulations, such distances are concerning, when planning operative entry and long-distance surveys. Consequently, Wessex Water want(ed) to avoid man access in live sewers and searched for a partner who could provide 3D modelling via an autonomous platform in an environment of semi-turbulent flow, found in sewers, and to map the sewers to a precision of millimetres in the X/Y/Z.

Headlight AI develops technology for the sensing and assessment of harsh environments, such as subterranean infrastructure (e.g. sewers). Headlight AI's multi-sensor system (Telesto) is deployed on a floating platform in a large critical sewer to conduct a high accuracy 3D survey of the asset in semi-turbulent flow, whilst avoiding man entry into the sewer. The data collected is processed to account for the motion of the system and utilises Artificial Intelligence (AI) to obtain insights into the sewer's condition, to identify defect locations faster and more accurately. To the best of our knowledge this is the first solution in the world of its type, with a scope to improve the health and safety of sewer inspections across the water and wastewater industry.

Development activities started in 2018 by Headlight AI with the build of the multi sensing scanning system. We formulated the device on a proven floating platform (supplied by Bright IG) with capabilities of transit of over 4000m at a time, controlled and manoeuvred by a winch and capstan. The system's first stage trials were undertaken in the Southern Foul Water Interceptor tunnel in Bristol, owned by Wessex Water, and later successfully mapped the Bournemouth 8Km Coastal Interceptor Tunnels. (See Fig 1 & 2)

The system generates excellent results allowing projection to the surface with a terrestrial survey, this allows 'brownfield redevelopment piling for foundations around the asset without concern (See Fig 2). The model can be rendered with a contiguous still 360-degree photographic overlay. The Telesto is self-contained and does not rely upon an umbilical for electrical power supply or data transmission back to the surface.

Why is Telesto different-? As stated previously there is no known device that can map and model the sewer tunnels in semi-turbulent flow, and if they were available, it is highly likely they would utilise a stability gimbal, which by its very nature, may cause the survey platform to 'ground' on mineral detritus or banks of other sediment commonly deposited in the inverts of sewers and river tunnels, due to periodic low flows. The Telesto system does not use a gimbal and verifies the accuracy of a model by mathematical algorithms, and unlike normal Dense Point Cloud tunnel surveys, does not require 'targets' placed along the line of the sewer (which would require man entry) for model control. Thus, the Telesto method provides a greater level of information at a lower cost (greater than 50% lower on average) than person entry solutions.

The innovation brought together several fields of science and engineering. It utilises computer science, electrical and electronic engineering, mechanical engineering, photophysics, material science, geospatial engineering, and other fields to solve the challenges involved. As part of the PR19 process, OFWAT want to encourage the engagement of external designers/innovators etc, to collaborate in AMP7 to drive innovation into the water industry, setting up a £200 million fund which will issue grants to the most deserving concepts. This is covered by their new strategy known as 'Time to Act, Together'.

Wessex Water and Headlight AI have additional concepts of using the extremely precise laser technologies such as crystalline microscopy, multi-sensor systems and AI, to scan the variable crystalline structures of concrete degradation to allow an understanding of the degree of tunnel lining deterioration. Still an early concept, it is one of a number of analytical tools we hope to explore through the OFWAT funding over the next 5 years.

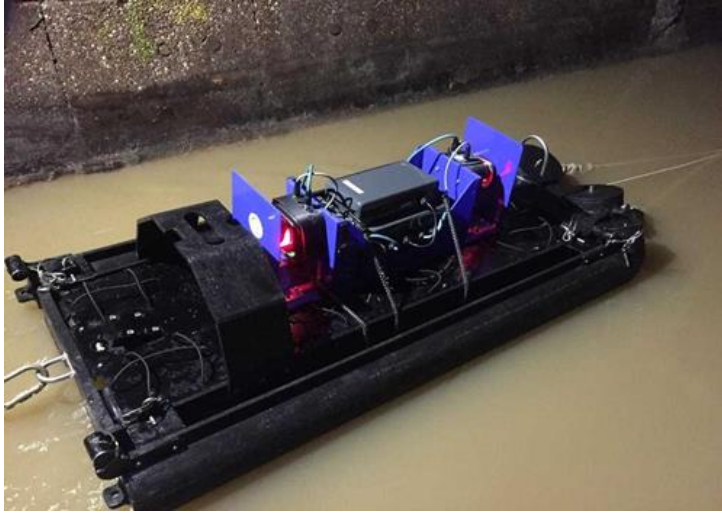


Fig 1 : The Telesto (above) Versions One an Two.



Fig 2 : Below model digitisation and rendering

