Aerial Drone Based Thermal Imaging to Detect Leakage from Sewage Lagoons

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KEYWORDS: Critical Infrastructure, Condition Assessment, Aerial Drone Surveys, Thermal Imaging Defect Identification

1 Introduction

TasWater's vision is to be a "trusted and respected provider of essential services that is making a positive difference to Tasmania". With over 500,000 maintainable assets in our infrastructure base, we are an asset-intensive organisation. Our infrastructure assets are core to the services we provide to our customers and stakeholders.

An essential activity for us to meet these goals is to undertake infrastructure condition assessment. In line with ISO 55000 guidelines, this allows us to better understand our asset health, condition and risk profiles; and informs/prioritises our capital renewals and maintenance program expenditure.

In common with other water businesses, our challenge is to identify methods and technologies that identify asset distress across a diverse range of infrastructure in a safe, cost-effective manner, while maintaining supply and provision of customer service. Since our formation, we have embedded recommended industry practices and guidelines for visual inspection and condition grading of our infrastructure assets. We have also adopted non-destructive testing for above and below-ground infrastructure to improve identification and early detection of defects.

As we continue to grow our infrastructure condition knowledge base, a clear challenge for us is posed by the quality and quantity of data required to inform our interventions. In the case of visual inspection methods, we are often relying on manual collection of data, often in hazardous environments and with restricted access. In some cases, the condition of assets remains unknown due to challenges inspecting large structures that are difficult to access. As a result of these limitations, our conventional inspections often produce observations and images taken from low-resolution cameras or from non-ideal vantage points. Consequently, the condition of the entire asset is difficult to establish or track over time with defects being missed.

To meet these challenges, our recent activities have focused on the use of aerial drones and Remotely Operated Vehicles (ROVs) to consistently acquire condition data to a higher quality and in a safe, cost-effective manner.

TasWater has engaged with a local robotics company to undertake technology trials using an industrial aerial drone. The objective being to capture relevant defect data on a sample set of our critical infrastructure. This presentation describes these trials, outcomes and value from applications including:

- Aerial visual surveys to rapidly locate defects in water storage roof/cover structures
- Aerial infra-red thermal surveys to:
    - Locate emerging leakage pathways from sewage lagoons and proximity to receiving waters

    - Provide early detection of cracking in the walls of critical water and sewage concrete structures
- Aerial photogrammetry to monitor critical infrastructure movement in landslip hazard areas

2 Methods

The premise is that an aerial drone specially equipped with high resolution optical and specially tuned thermal infra-red imaging cameras conducts an asset survey over the course of a day. The optical and thermal infra-red images are streamed back to a nearby base station for analysis. The resultant data can identify cracks and other defects that are both visible and not visible to the naked eye, but can also distinguish between areas that have not been affected by shadow over the course of the drone survey. For these shadow-free areas, analysis of the thermal images can reveal localised regions in the structure that did not heat up or cool down as rapidly as their surroundings over the duration of the survey. Further analysis is conducted to pinpoint a relationship between impairments in the structure and localised regions of differing temperature. These are considered to be potential leakage pathways from the asset. To monitor movement, the

3 Conclusions

This paper presents a case study of aerial drone-based surveys for condition assessment of some of our critical infrastructure. Results from the surveys are compared to alternative data sources, indicating that thermal anomalies correlate with the presence of defects and leakage pathways that are not clearly observed from visual inspection. The aerial drone-based survey is considered a useful new technique for cost-effectively locating defects and informing subsequent monitoring and identifying capital refurbishment projects.

These trials have demonstrated the benefits from drone-based inspection.

4 References