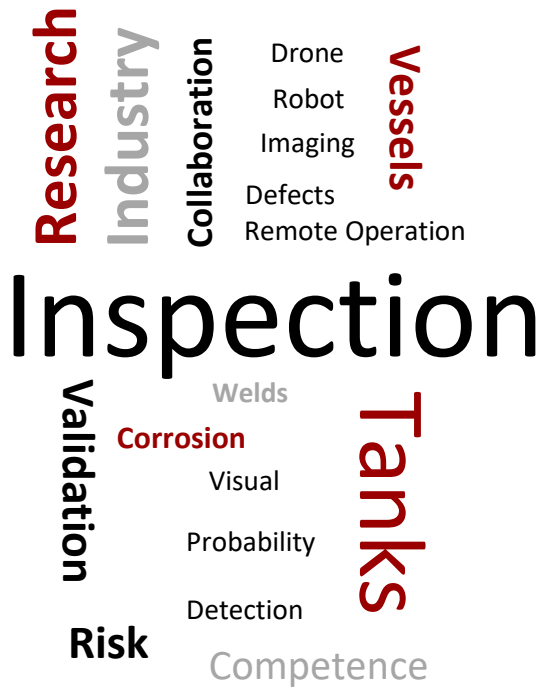
Shared Research Project

Remote Visual Inspection (RVI)



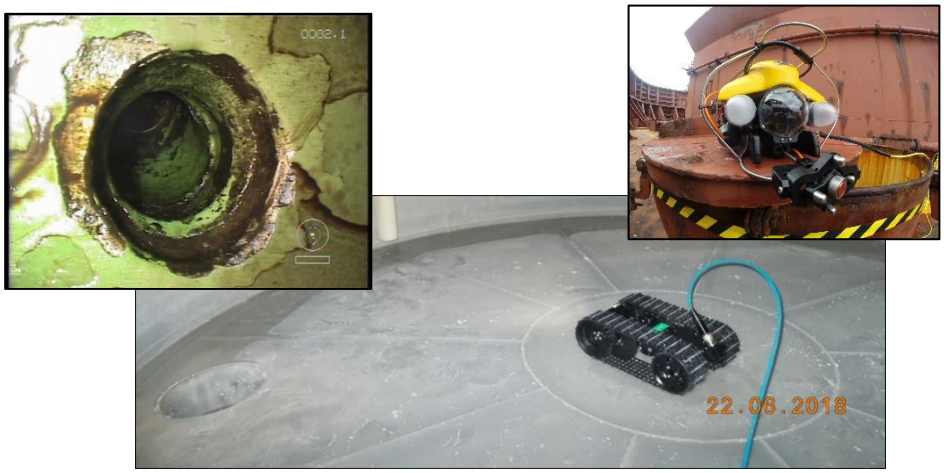
Visual inspection of tanks and vessels forms a cornerstone of integrity assurance and is often the primary means of detection and sizing of flaws and corrosion damage. Recent advances in access technologies such as unmanned aerial vehicles (UAVs) or drones and Remotely Operated Vehicles (ROVs) coupled with imaging technology has enabled increasing replacement of the human element of visual inspection. This can present significant benefits in avoidance of high-risk manned interventions such as in confined spaces, working at height or in hazardous environments.

However, the limitations of these remote inspection methods have yet to be systematically explored, while structured comparative studies are lacking. Variables such as lighting and surface quality can have a significant effect on image quality, the steps from image capture to damage recognition are not standardised and the influence of human factors is not well understood. In addition, the risk balance of avoiding manned interventions compared with that of a potentially reduced probability of detection, or incorrect sizing, arising from RVI must be understood from a goal-setting perspective.

This project seeks to develop an evidence base to underpin RVI related decisions with envisaged benefits taking the form of enhanced safety and operational efficiency.

HSE SHARED RESEARCH PROGRAMME

HSE has a longstanding history of supporting science and research to address a range of cross-sector safety issues. Building on this heritage, the HSE Shared Research Programme provides a platform to identify and co-fund applied research projects that are of interest to both industry and regulatory bodies.



Overview of Technical Work Packages

The work packages present a top level overview of the work to be completed and the proposed deliverables. The technical detail of each work package will be defined and agreed on a collaborative basis via the steering group which will be formed when the project commences. The group is expected to be a partnership of operators, inspection companies, technology providers and the regulator (HSE). The project comprises a range of activities covering reviews, workshops, practical inspection trials, data analysis, human factor studies and production of guidance on good practice.

APPROACH

To shape this Shared Research Project, HSE hosted a workshop attended by operators, inspection companies and regulatory bodies. Knowledge gaps were identified and following a prioritisation exercise, several key subject areas requiring further study were identified. These have been converted into a series of distinct but interrelated work packages for the current proposal.

Work package 1: Current Technologies and Practices

The aim of this work package is to establish the current state-of-the art, identify good practice within user-industries and to evaluate the decision-making processes used to underpin RVI activities.

A literature review of applicable RVI technologies and standards will be undertaken and any differences with conventional visual inspection highlighted. In conjunction with the project sponsors, existing good practice shall be identified and documented. A priority matrix of defect types and degradation modes typically targeted via conventional visual and RVI methods will be established. The decision processes used to establish the appropriateness of RVI from a net risk perspective will be examined. A workshop will take place to review the outcomes and steer the detail of the subsequent RVI trials.

Deliverables:

- State-of-the-art and current Good Practice review report
- Collation of case studies on risk-based approaches to RVI selection

Work package 2: RVI Trials for Probability of Detection

The aim of this work package is to design and conduct a series of inspection trials to benchmark current technologies, imaging methods and human performance.

Based on the output of the workshop in WP1, an inspection matrix will be agreed to ensure coverage of the necessary range of structures, access conditions, delivery technologies, defect types and inspection variables (light, surface condition, field of view etc). A series of RVI trials will be carried out to evaluate Probability of Detection (POD) and the effect of a range of variables on this. The precise extent of the trials, number of variables and rounds will depend on number of sponsors. Full evaluation of the results and comparison with actual defect dimensions will be carried out.

Deliverables:

- Results of RVI trials
- Report on RVI trials and key conclusions

Work package 3: Human Factors and Competence Assessment

The aim of this work package is to assess how human factors can impact on the quality and reliability of RVI results, particularly in comparison with conventional visual inspection, and to establish a route for competence assessment applicable across the range of RVI methodologies.

Outputs from existing studies on human factors in visual inspection will first be collated and existing schemes of competence and standards for such inspection will be reviewed. The key findings of these two studies will then be evaluated in the context of observations and results from the RVI trials in WP2. A competence framework for assessing RVI methods will be developed for subsequent trial.

Deliverables:

- Report on impact of human factors in RVI

Work package 4: Good Practice Guide for RVI and Methodology for Demonstrating Competence

The aim of this work package is to agree and draft good practice.

It is expected that the good practice guide will be underpinned by the outputs and experience gained from WP1, 2 and 3. As such it is likely to feature key topics such as the decision-making process, capabilities and limitations of inspection technologies, human factors considerations etc. A workshop will be held to share feedback and to finalise the guide.

Deliverables:

- Procedures for validating RVI approaches
- RVI Good Practice Guide

PRICE AND DURATION

The total funding required for this Shared Research Project, with the full range of RVI trials, is estimated to be £700k. It is therefore anticipated that with financial support from HSE, each project sponsor would need to contribute £50k. The project is anticipated to commence mid-2019 and will take 24 months to complete.

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