

HOIS – advancing NDT in the energy industry: highlights of the technical programme

Dr Mark Jones
HOIS Symposium
Houston, January 2024



HOIS – who are we?



JIP established in 1982 on good practice for in-service NDT/NDE in the energy industry, managed by ESR Technology.

Annual budget > \$900k USD



Chairs: Shell & Equinor

HOIS – who are we?



Nearly 40 members.

In addition to asset owner/operators:

- NDT service companies
- NDT equipment vendors and technology developers
- The Net Zero Technology Centre, NZTC (who have provided matched funding for some projects)
- Notified/appointed bodies
- A regulatory authority (UK HSE)



HOIS - What do we do?



HOIS mission: independent guidance for asset integrity management in the energy industry on the capabilities and effectiveness of different non-destructive testing (NDT) methods.



Developing good practice documents for specific inspection applications.



Rigorously controlled blind trials: Independent assessment of the performance of current and developing inspection techniques.



Industry forum for latest developments: what's new and what works.

HOIS Team at ESR Technology



Dr Steve Burch

- Technical review
- Digital ultrasonics
- Principal UK expert on ISO radiography standards committee

Dr Helen Peramatzis

- HOIS Programme Manager
- NDT inspection trials
- Inspector validation

Dr Mark Jones

- Deputy HOIS Programme Manager
- Failure analysis
- Metallurgy
- Wear and corrosion

Breadth of knowledge in the team.

Wealth of experience.

Dr Mike Laws

- Advanced ultrasonics and emerging technologies
- Defence, nuclear, aerospace
- Technology transfer and adoption

Dr Trish Conder

- Data analysis
- Inspection statistics
- Asset integrity

Dr Martin Wall

- NDE reliability
- Failure mechanisms
- Composites, advanced materials
- NDE 4.0, digitalisation

firstname.lastname@esrtechnology.com

Dr Zubeir Saib

- Consultant
- PhD in non-linear ultrasonics
- Data science
- Digital ultrasonic NDT

Mr Neil Collett

- Senior Technician
- Test facility manager
- Digital ultrasonic NDT

Ms Julia Nojek

- Junior Technician

HOIS programme development

Project approval process:

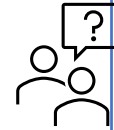
July - October

- HOIS members develop outline proposals aligned with their own inspection challenges



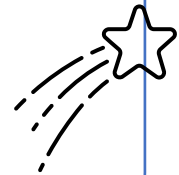
December – February

- ESR and project champions formulate detailed proposal with milestones, timescales, estimated costs
- Proposals issues to all members for consideration & voting



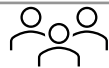
April

- New projects start



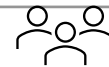
3 HOIS meetings per year

November



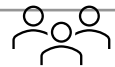
- **Strategy meeting:** Asset owner/operator members/HSE/NZTC consider which first stage proposals should be developed to second stage
- **Project review meeting**

March



- **Management meeting:** New projects approved based on all member votes (weighted by membership type – asset owner/operator votes 3x weight of other members) and available budget
- **Project review meeting**

June



- **Project review meeting**

Examples of Key Technical Activities



Remote Internal Inspection

Digitalisation

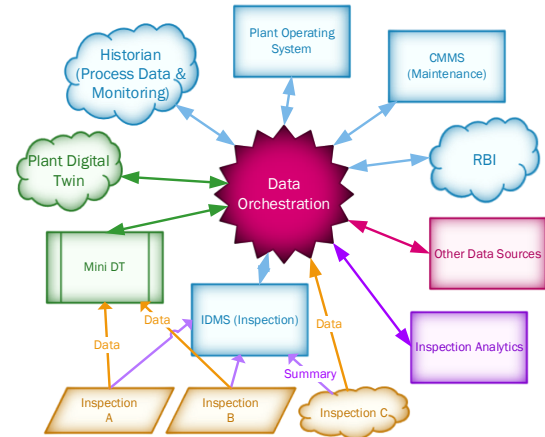


Image quality for UAV based inspection



Integrity challenges of energy transition



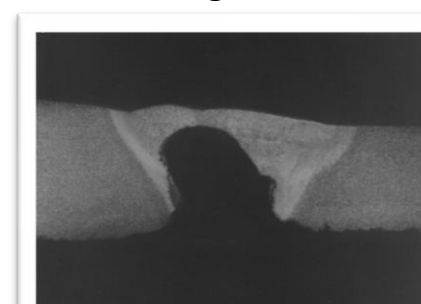
CUI



Flange face



External

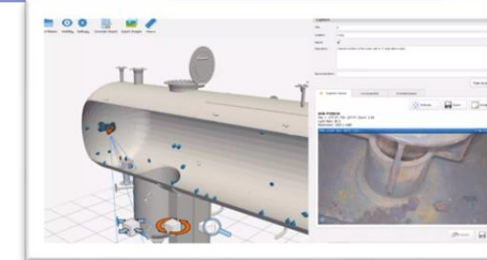


Weld root

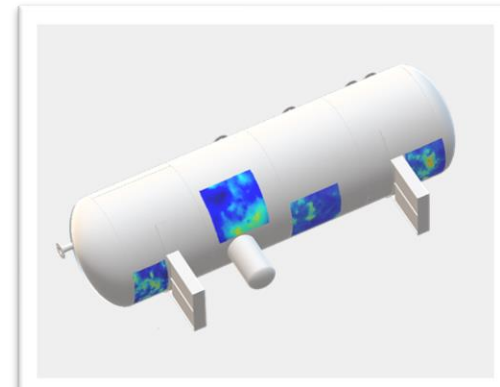
Inspection of contact point corrosion at pipe supports and trunnions



Heat exchanger tube inspection



Non-Intrusive Inspection (NII): Guidance for vessel inspection NII at elevated temperatures



HOIS key theme: Heat Exchanger Tube Inspection

Heat exchanger tube inspection is a major requirement for operators, but the performance of tube inspection techniques has not been widely qualified.

HOIS project to determine the most effective NDT methods for detecting and characterising indications present in heat exchanger tubes.

Test samples comprise five bundles containing a mixture of 22 ex-service tubes and 30 tubes with manufactured defects.

Techniques:

- Remote Field Testing (RFT)
- Remote Field Array (RFA)
- Magnetic Flux Leakage (MFL)
- Internal Rotary Inspection System (IRIS)
- Partially Saturated Eddy Current (PSEC)
- Near Field Array (NFA)
- Borescopy



HOIS key theme: CUI

Corrosion under insulation (CUI) is a major challenge for industry worldwide – costs of management are in the \$tn's per annum.

Failures associated with CUI can have severe consequences, e.g. rupture and fire.

- Personnel safety implications.
- Expensive remediation.
- Costly loss of production.

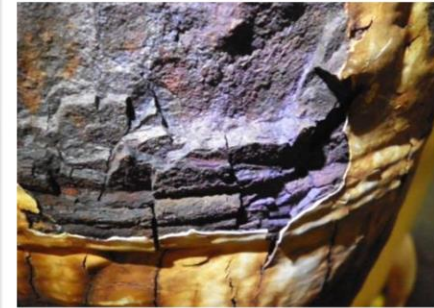
Estimated that 60% of piping failures due to CUI (source: OGA).

CUI is difficult to manage - unpredictable “finds us before we find it”.

For one UK facility alone, the annual maintenance cost is more than \$10 million.

HOIS activity:

- Design and manufacture of test pieces
- Extensive trial programme with global participation
- Development of publicly available guidance (<https://esrtechnology.com/hois/publications/>)



HOIS key theme: External Corrosion Scabs

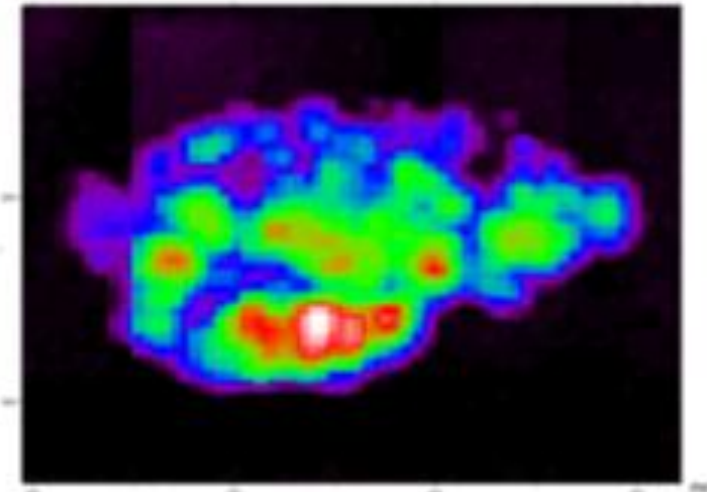
External corrosion is one of the biggest maintenance costs in the industry.

A number of HOIS projects have assessed the capability of techniques to size the remaining ligament under uninsulated corrosion scabs

Assumed need to make measurement with scab in-situ (hazardous to remove on live lines)

Previous work has shown that many areas of wall loss contain localised, isolated pitting which are very challenging to accurately size and can result in undersizing of the wall loss.

DWSI radiography as a screening tool for determining the possible presence of isolated fine pitting in the pipe wall under external corrosion scabs when the pipes were empty.



Example of Previous DWSI Work

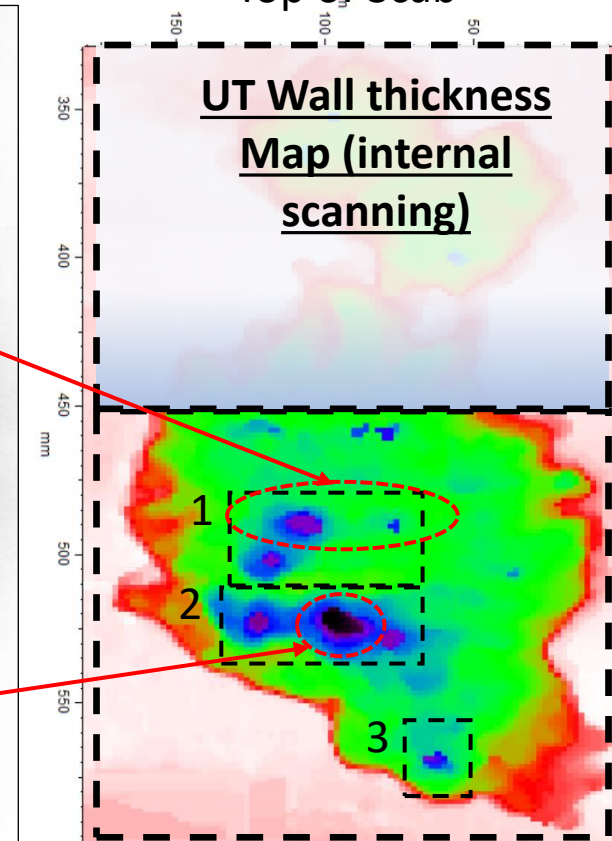
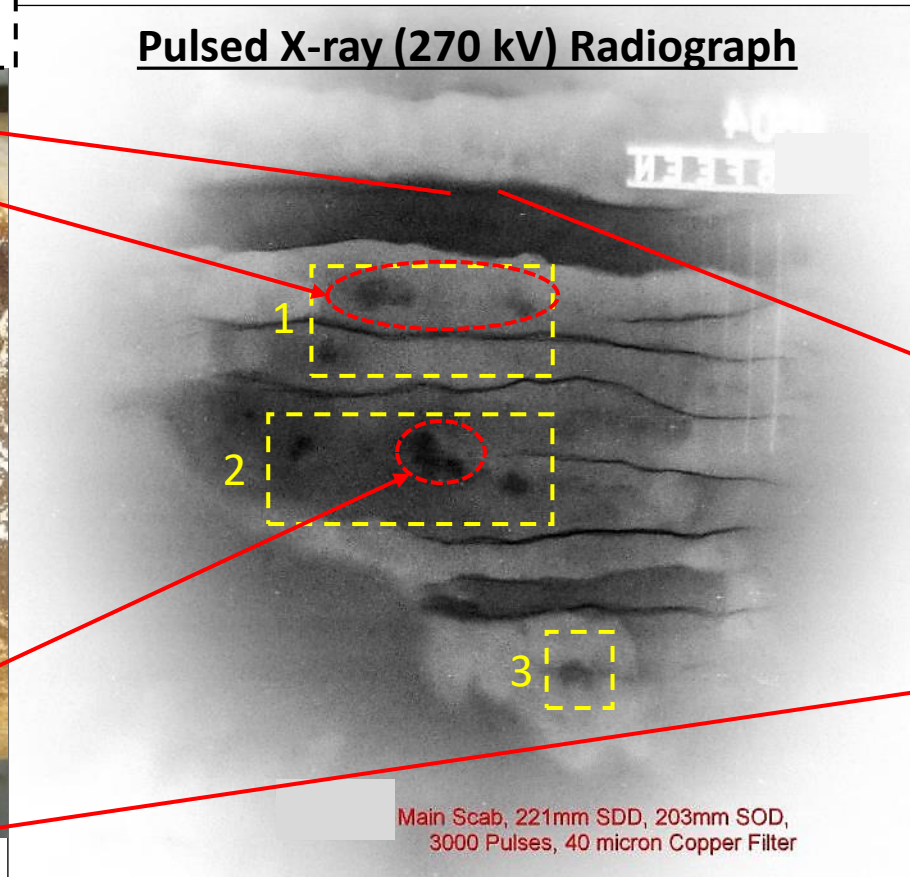
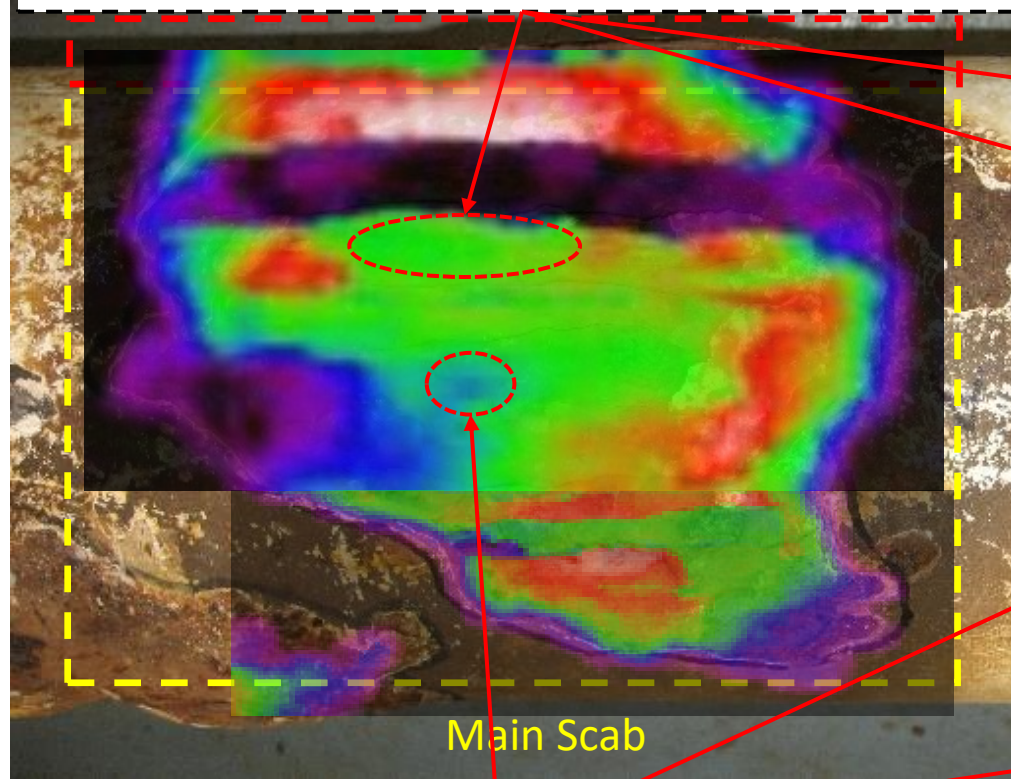
Main Scab

Top of Scab

Black spots not evident on Creaform scan of scab

Pulsed X-ray (270 kV) Radiograph

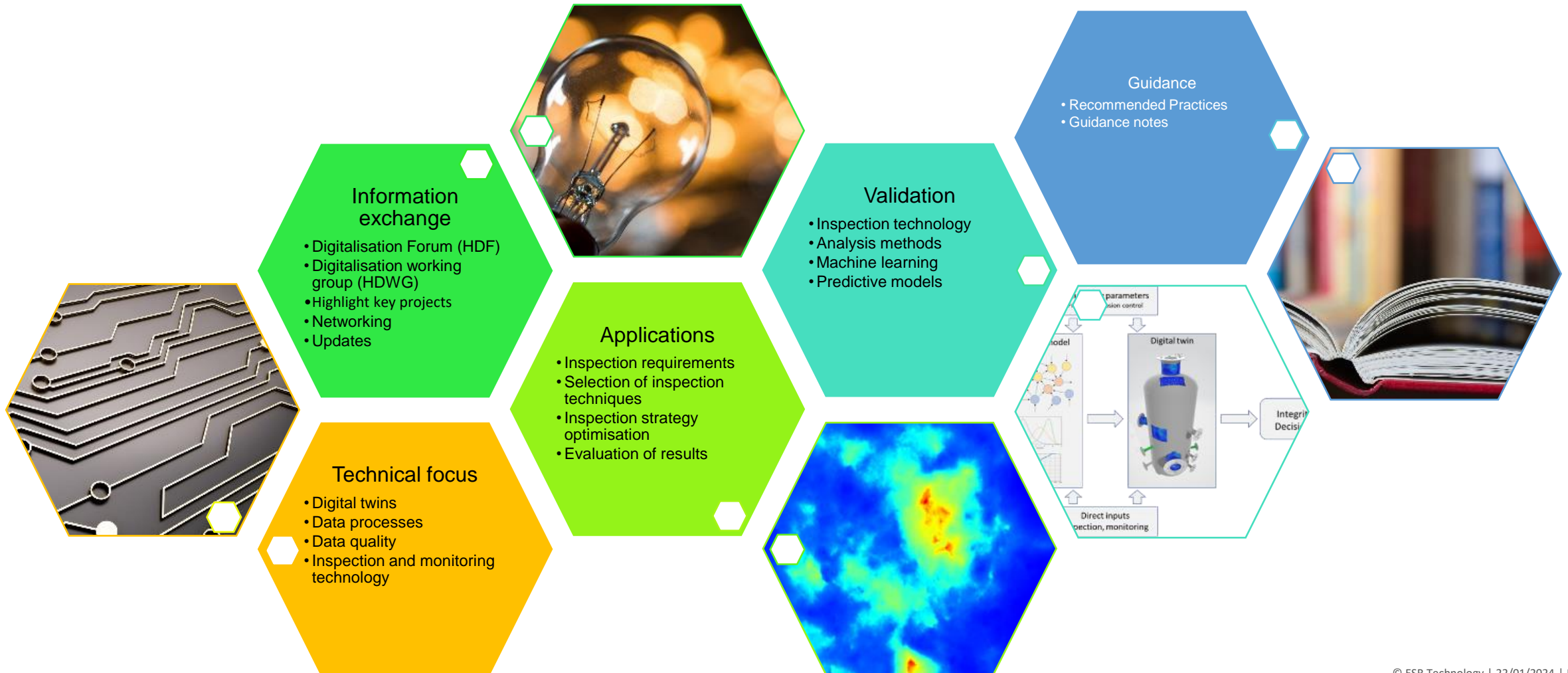
**UT Wall thickness
Map (internal
scanning)**



It appears that the deepest point in the UT scan was located in an area of scab spallation.

Shot horizontally with the scab at the rear – Source housing in contact with pipe
3000 Pulse Exposure / 40 μ m Cu filter

HOIS Digital Roadmap



HOIS Digitalisation Forum (HDF)

Virtual bi-monthly forum

- Launched in May 2020
- Open event

“To promote engagement with NDE 4.0 and digitalisation stakeholders worldwide and across industry sectors.”

NDE 4.0 solution providers often very different to traditional NDE providers in the Energy sector

Range of topics so far include;

- Digitalisation of inspection, digital twins, NDE data processes, NDE 4.0, integrity management and cloud solutions

International audience up to 100+.

Some talks available on YouTube

For info, replay links or to register for future events:

Email info@hois.co.uk



www.abysssolutions.com.au

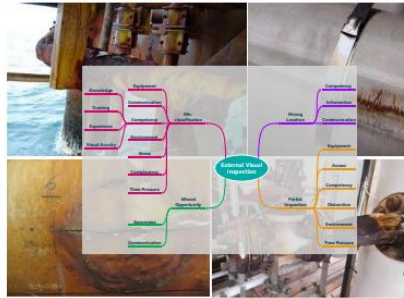


<https://quasnet.com/hologrid/>



www.guided-ultrasonics.com PAGE 13

Human Factors Activities & Deliverables



Issued recently:

- HOIS-G-055 – Guidance for reporting of in-service visual inspection
- HOIS-G-057 – Graphical guidance on external visual inspection
- HOIS-G-066 – Inspector portfolio for in-service visual inspection

Aim to raise awareness and encourage take-up of the HOIS human factors in NDT guidance

M10 Human Factors working group (HFWG)

- Interest in human factors in NDT (HF-NDT) within HOIS maintained in new strategic project M10 Human Factors Working Group with 2 meetings per year.

C21-05 HUMAN FACTORS Graphical Guidance on Human Factors Affecting External Visual Inspection

Human Factors Checklist for External Visual Reporting.
Reporting template
Integrity and Corrosion Engineer (IE, CE)

Fields

1. Free text fields for general observations and observations on anomalies found?
2. Consider digital entry with drop down and checklists.
3. Fields for information IE must have?
4. Observations encouraged?
5. Consider system specific form with checkboxes (e.g. for component types).
6. Space to report what inspected, what not inspected and observations outside scope of support info.
7. Ability to input drawings, photo, video support info.
8. Fields for anomaly IDs, grading, location defined datum and coordinate system, support info?

Characterisation

1. Does the template provide advice and guidance on characterisation and grading of anomalies found (and space for detail observations)?
2. Smart aids provided to assist reporting?
3. Facilitates the reporting of issues of concern to IE or CE?

Consistency

1. Consistent template across end user assets and to prior inspections.
2. Does the template guide but not limit reporting?
3. Consistent guidance and system on characterisation and grading of anomalies found?
4. Template encourages common language terms to describe the findings?
5. Consider system specific checklists to encourage consistency in inspection and reporting.
6. Is the template consistent with electronic templates and the data fields in the PD?
7. Does the template meet reporting requirements?
8. Is there standardisation of terminology?
9. Are the classification categories clear?

Human Factors Checklist for External Visual Planning

Competency

Training

Quality Assurance

Access

Location

Time Pressure

Challenging Anomaly

Reporting Template

Competency

Training

Quality Assurance

Access

Location

Time Pressure

Challenging Anomaly

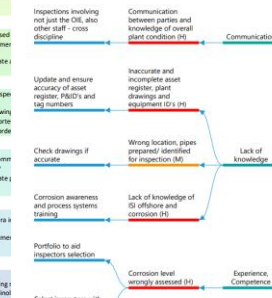
Reporting Template

HOIS-G-057 Issue 1
Patricia Conder
Julia Nojek
Martin Wall

April 2022

HOIS-G-007 Visual inspection for external corrosion Human factors in NDT (HF-NDT) Mindmap

Mindmap of planning as per original table construct



HOIS PROJECT C21-05 HUMAN FACTORS IN NDT

Human factors guidance for reporting of in-service visual inspection (CVI, GVI) or survey for external corrosion or wall loss

HOIS-G-055 Issue 1

Martin Wall

June 2023

HOIS C21-05 HUMAN FACTORS IN NDT Inspector portfolio for in-service visual inspection

HOIS-G-066 Issue 1

Martin Wall

June 2023

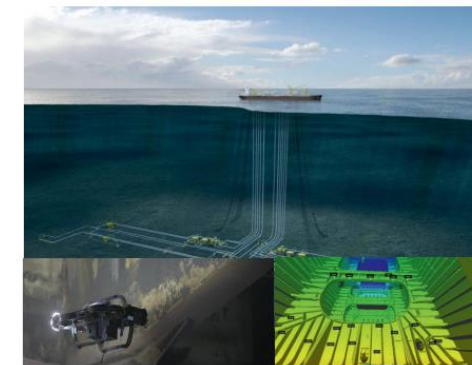


FPSO Working Group

Active working group on subsea inspection

With special focus topics each year.

2024/25 topic: 'Inspection Challenges for Life Extension of Subsea Infrastructure'



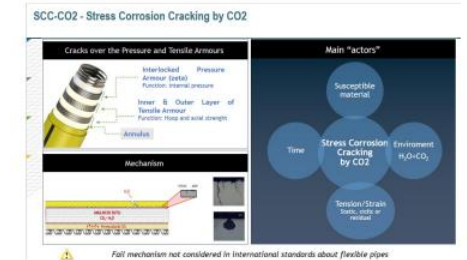
M9 HOIS FPSO flexibles & subsea working group - Special focus study 2020/21

FPSO tank inspection (including unmanned entry)

HOIS-R-043 Issue 1

Dr Martin Wall

December 2021



HOIS M9 FPSO, Flexibles and Subsea Working Group (FSWG). Report on special focus topic

NDE methods for annulus flooding and SCC-CO₂ in flexibles

HOIS-R-030 Issue 2

Dr Martin Wall

June 2021

Low Carbon and Emission Reduction

Hydrogen & CCUS

Information Exchange Documents



Two “Live” Information Exchanges:

- The Impact of Hydrogen Fuel Sector on NDT
- The Impact of CCUS Sector on NDT

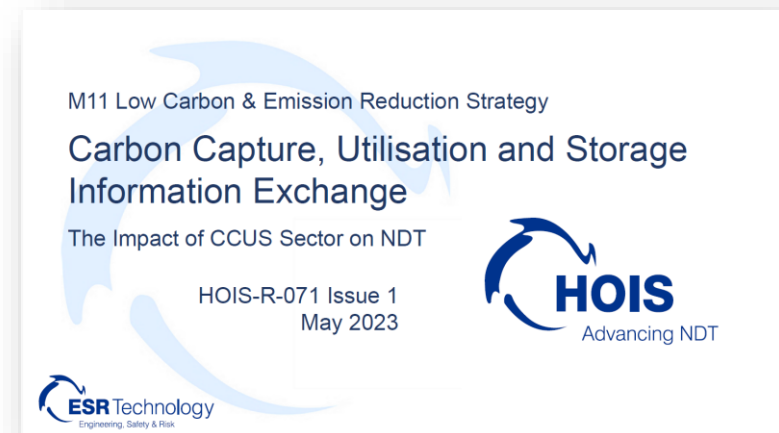
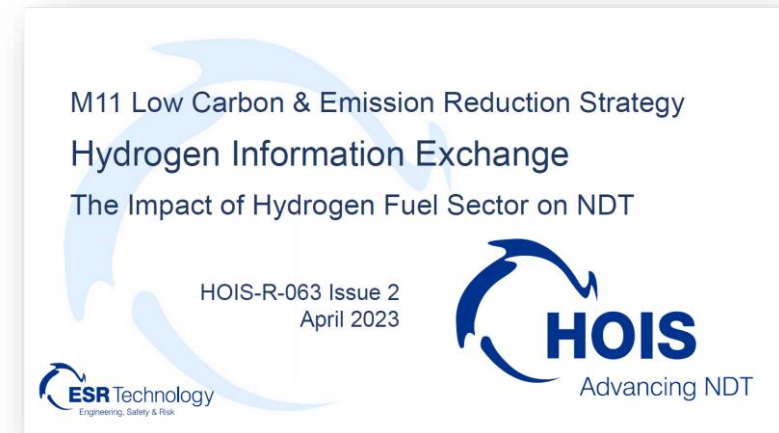
Aim

- To provide members with a one-stop **starting point** to build understanding of the **NDT issues** related to the use of **hydrogen in the fuel sector and carbon capture, transportation and storage**
 - Sign posting to best information sources not assimilating information

Scope

- Focussed on “Where is the NDT challenge?”
- Currently does not include process safety, applications such as fuel cells etc. but looking for membership steer

Actively encouraging membership input



Collaboration with other organisations



BINDT – HOIS deliverables available from BINDT store, ongoing representation at HOIS meetings and presentation of HOIS papers at BINDT conference.

RCNDE – invitation to research exchange meeting



EI – participation in CUI forum raising awareness of HOIS work on this topic.



KINT – keen to formalise relationship, MOU drafted by Casper Wassink, invitation to present at symposium in February.



NZTC – HOIS member and additional support of projects aligning with their strategic objectives.



SPRINT – collaboration on RII project. Closer connection with Quasset joining HOIS and ESR joining SPRINT

North Sea Transition Authority – potential opportunity through the NIIFTA initiative.

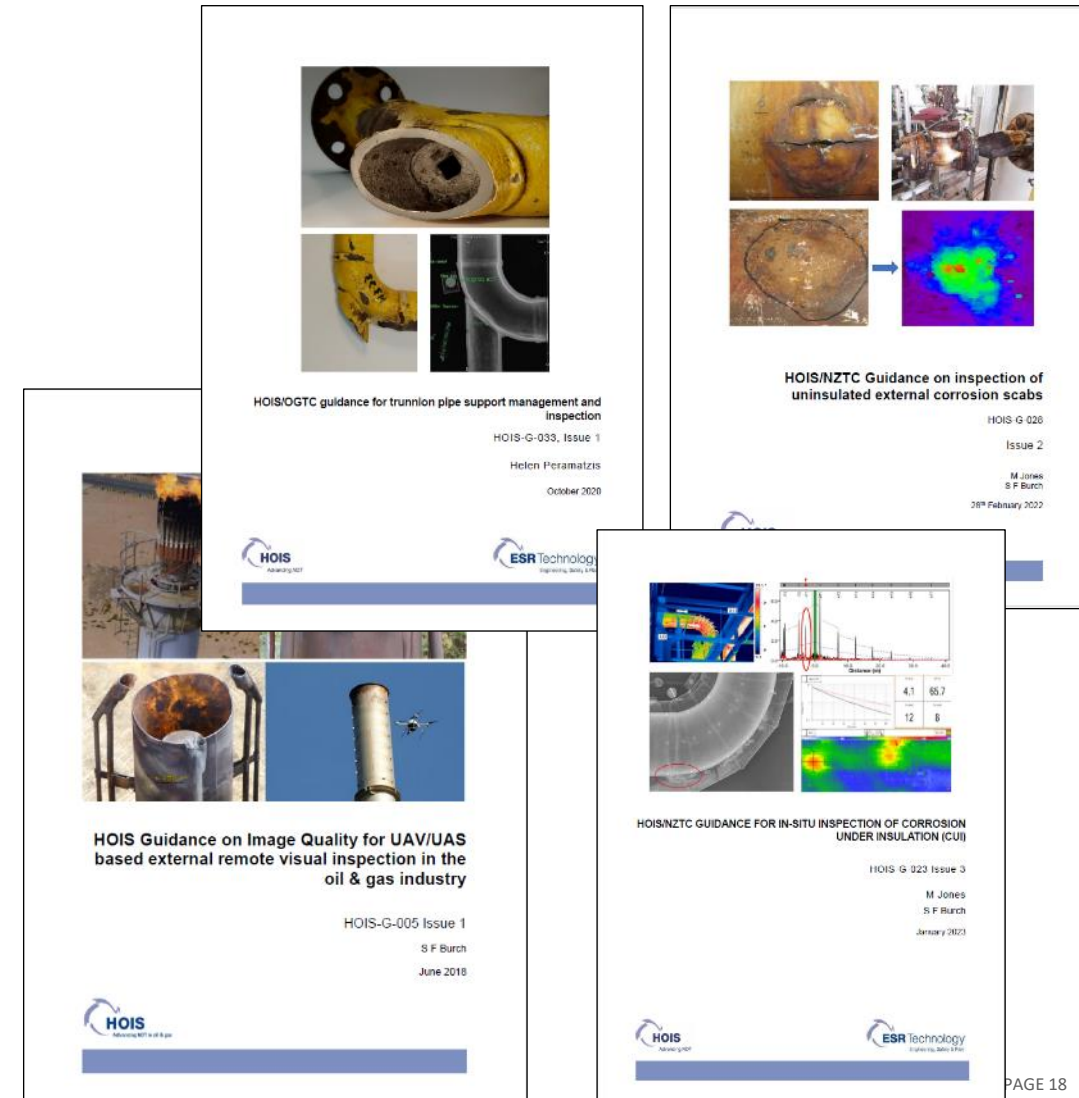
HOIS Publications

All trial reports are confidential to HOIS members.

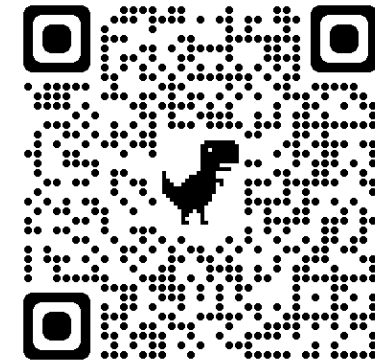
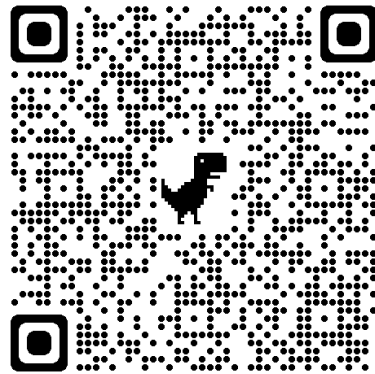
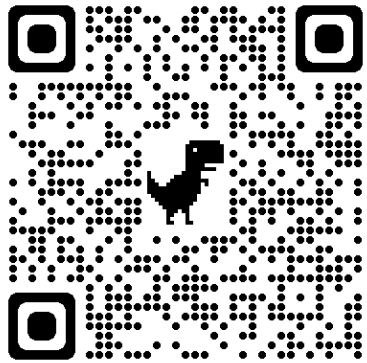
Select HOIS guidance documents are available for free or to purchase at the BINDT online store.



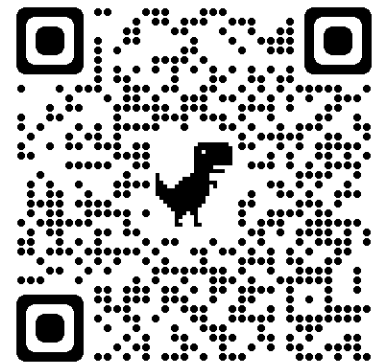
<https://esrtechnology.com/hois/publications/>



How to learn more



HOIS publications



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