

Our Journey - *From the Eye to the Lens*

RVI: Remote Visual Inspection



Timeline

**NII Established
(2010 – present)**

Full man-entry scope
to support NII

Reporting increasingly
comprehensive

Large number of
images

**RVI + NII
The Future?**

**Early Years
(pre-2010)**

Full man-entry
scope (Intrusive
Visual Inspection –
IVI)

Very basic reporting

Few images

Reduced man-entry

Inspection & Reporting
tailored to each vessel /
tank

360° video & laser
scanning potential

**Digital
Reporting**

Repeatability

Inspection Planning



— Preparation is key to a successful inspection

- NII only able to give equivalent integrity assurance to IVI if you can demonstrate that you can find what you're looking for.

— Review RBI information

- Knowledge of the vessel history
- Understand the potential damage mechanisms
- Taking into account access restrictions as well as damage mechanisms
- Supplement RVI with NII if required to achieve appropriate inspection coverage

RVI can be used to bridge the gap between IVI and NII.

Test Separator RVI



Details	
Height	5m
Diameter	1.2m

Workscope – Test Separator



VESSEL INSPECTION INFORMATION SHEET									
ASSET / PLATFORM		Lomond		Vessel	LOM-V-0202 Test Separator			Sheet Status	B1
INSPECTION SCOPE					Summary Info				
Inspection Type	Internal Visual Inspection	WA- 70	WA- 1837399	Design Code :	BS 5500 Cat 1	Construction Date :	1991		
& Inspection Type	FF - M1 and K2A	TA- 70	TA- 1837399	Manufacturer :	Motherwell Bridge	Vessel Shell Material :	BS 1501-224-490B LT50		
& Inspection Type	Borescope	TA- 11	TA- 1838971	Design/Op Pr. :	73 Barg / One 63.8 Barg	Vessel Shell Thickness :	34mm		
& Inspection Type	Manway Door Camera	TA- 60	TA- 1837398	Design Temp. :	-10 / 125	Head Thickness :	27.8mm		
From Location	16. INI - Process (Siding)	Vessel	2	Operating Temp	93/55 C	Internal Lining/Clad/ele	Yes - (3mm) 904L SS		
PMR Number		PM Number	14174	Size Vessel :	1343mm O/D x 4200mm T/T	Internal Materials :	316L		
Other Related WO	See Maximum			Corr. Allow	3 mm	Internal Bolting / Supp :	316L		
ONE	IQ-170-LOM-2013-PS (Isolated)			Insulated		System:	2		
Man entry	Not Required			Last Inspection	*20				
Scope Internal IVI					Borescope				
Activity :	IVI Inspection using RVI equipment				Required Optio				
Isolation and Entry	Vessel to be isolated and Nozzle/Manway opened. No man entry				Borescope Access :				
Inspection Prompt	See page two for inspection info	Complete	Complete	Comment	Camera Access :				
		Furniture	Welds						
		Nuts and Bolts	Nozzle edge & bore						
		Coating	Stand off Photos						
		Shell and Heads	COE						
Access & Service Requirements									
FF Inspection :	Yes - as per sheet 2				Scaffolding (ext	Hop Up Platform/Scaffold	Internals Removal	N/A	
Photo's & Video :	Photo's and Video required for each inspection activity				Rope Access :	Not Required	Internals Removal	N/A	
Scope External					Flange Faces :	As required	Internal Staging	N/A	
Last Inspection, Known Anomalies & Modifications					De-insulation :	N/A	Internal Access	N/A	
External CVI	Not part of this scope				*Last Inspection relates to last IVI or RVI				
External CVI	Not part of this scope				IVI 2005 - CVI -LOM-GVI-14-0237 Internal : Vessel shell , circ, longitudinal, nozzle and attachment welds were in good order as were all fittings. The vessel material is stainless steel lined.				
UT Inspection Supports	Not part of this scope				IVI - RBA states The next major inspection should be scheduled for the 2011 shutdown.				
External Bolting Check & Review	Not part of this scope				This vessel was subsequently reviewed on 23/03/2011 which concluded to defer the next IVI until the 2012 shut-down, unless an earlier inspection is driven following the bridge assessments. No inspection report could be found for this vessel.				
Nameplate	Photograph of nameplate								
Photo's & Video	As required								
Created by Calum O'Brien Checked by David Emery Approved by									

We were presented with an opportunity to complete an RVI within a Test Separator as part of its Return to Service – **significantly reduced isolation requirements for RVI vs IVI.**

A detailed Inspection Information Sheet was produced to assist with scoping the RVI

Equipment – Test Separator

DJI Osmo	Dekra VT360
	
Non ATEX Rated – Gas Test prior to inspection	
External Lighting System	Integrated Lighting System
Gimbal mounted	Integrated Pan / Tilt
No Optical Zoom	30x Optical Zoom
4k Video Capable	HD Video Capable

Execution - Test Separator



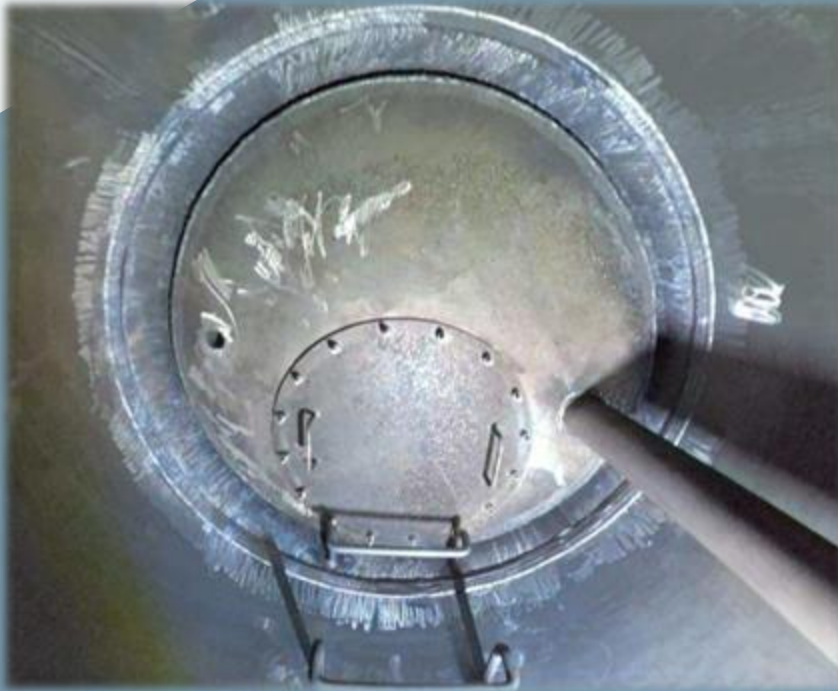
DJI Osmo inserted through 3" Nozzle above Baffle Plate

Dekra VT360 inserted through Manway below Baffle Plate

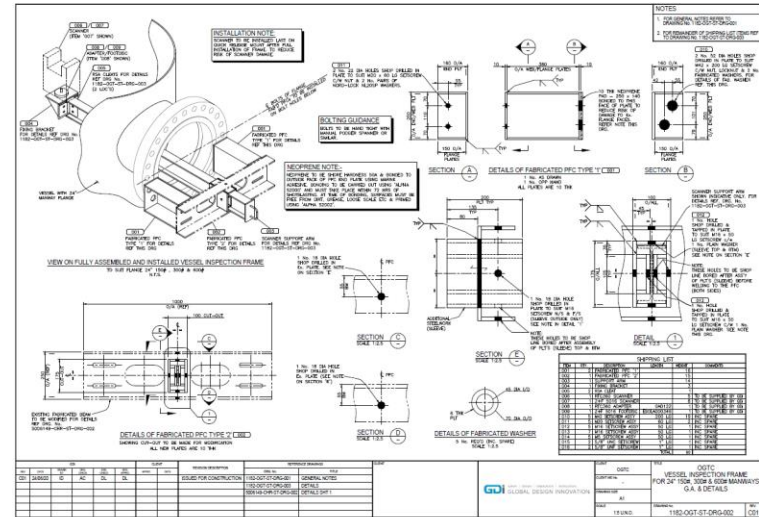
Results – above Baffle Plate



Results – below Baffle Plate

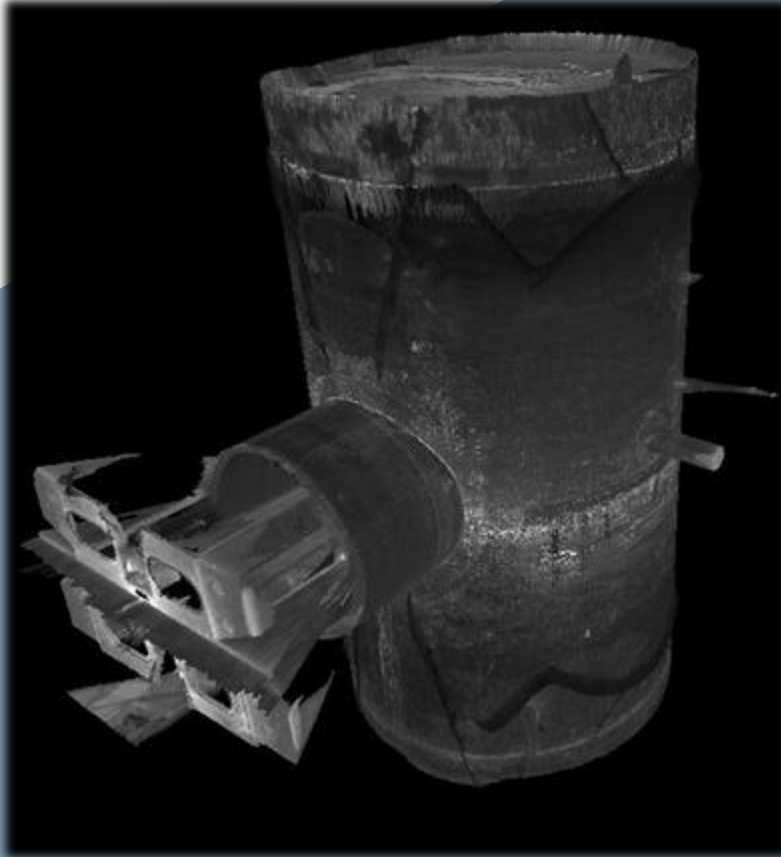


CHRYSAOR



In partnership with the OGTC and GDi a laser scanner was deployed within the Test Separator
The scanning was carried out by Matrix AI technicians

Laser Scan – 3D Model – Test Separator

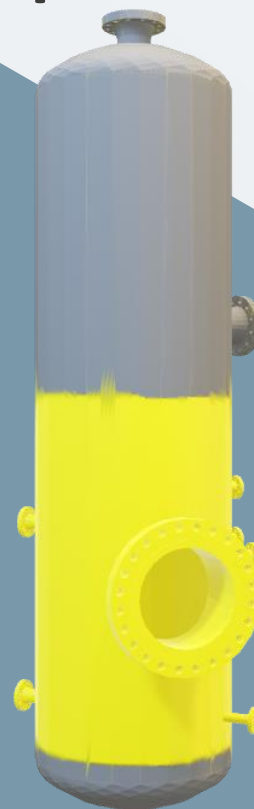


3D model of the vessel produced

High degree of noise due to stainless steel internals

[GDi Vision - Test Separator](#)

Laser Scan – Ovality – Test Separator



An attempt was made to determine the vessel ovality

Difficult to quantify with certainty due to noise

A vessel with a less reflective surface would have produced more favourable results

Summary – Test Separator

DJI Osmo stills were surprisingly clear given the cost of the camera

- Images comparable to close visual inspection
- Small size, low cost and easy to use.

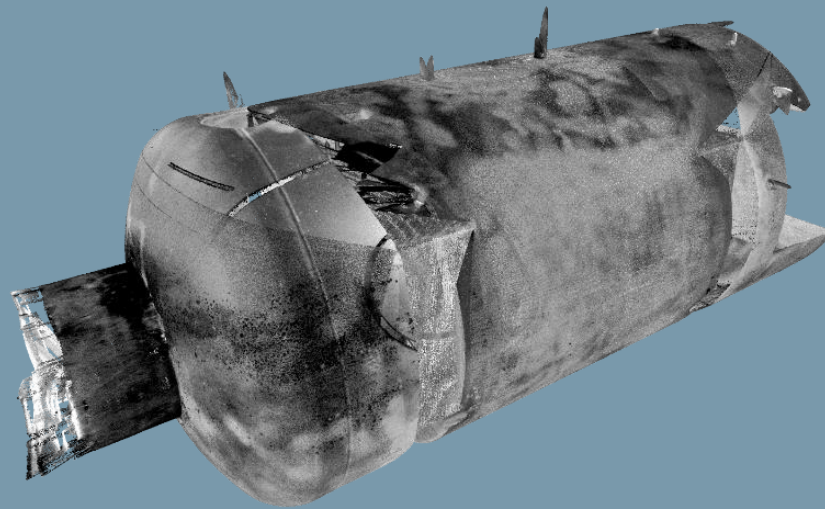
Dekra VT360 imagery not as clear, however this may be due to the small diameter of the vessel

- May be more useful in larger vessels

Laser scanning was not as successful as hoped with this vessel due to the internal surface.

Unfortunately, the return-to-service of this vessel was cancelled and therefore no NII was completed

Laser Scan – 3D Model – Tilted Plate Separator



Laser scanning more successful than the Test Separator with measurement of pitting possible

Potable Water Tanks RVI



Details	
Height	7.5m
Diameter	4m

Equipment – Potable Water Tank

GoPro



Non ATEX Rated

External Lighting System

No Optical Zoom - fisheye

4k Video Capable

through 6" Nozzle used for Hypochlorite

Telescopic pole required

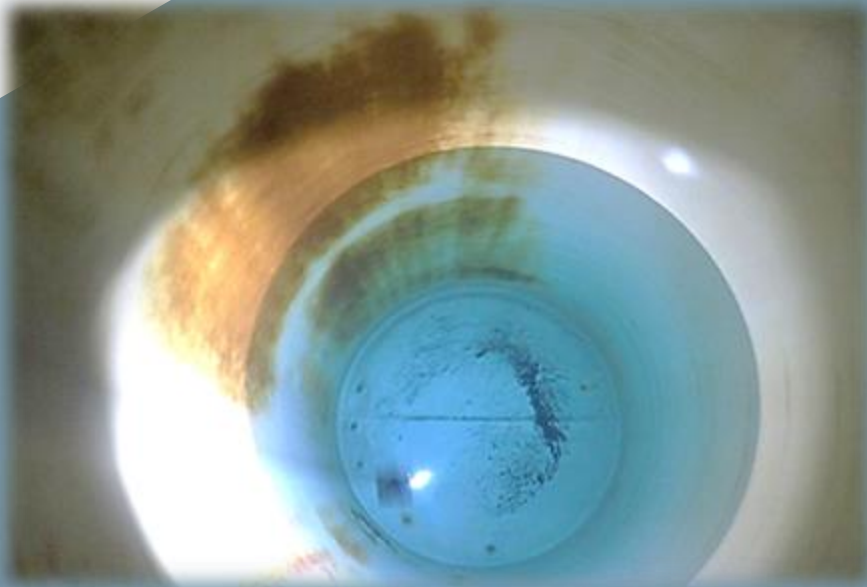
Execution – GoPro Inspection



Very simple method of inspection

Used for inspection of equipment throughout the platform

Results – Potable Water Tank



Summary – Potable Water Tank



Historically, this inspection would have required draining of the tank followed by entry through the manway

GoPro imagery was more than adequate

Imagery used to scope Fabric Maintenance scope

Use of GoPro has resulted in reduced labour and hours

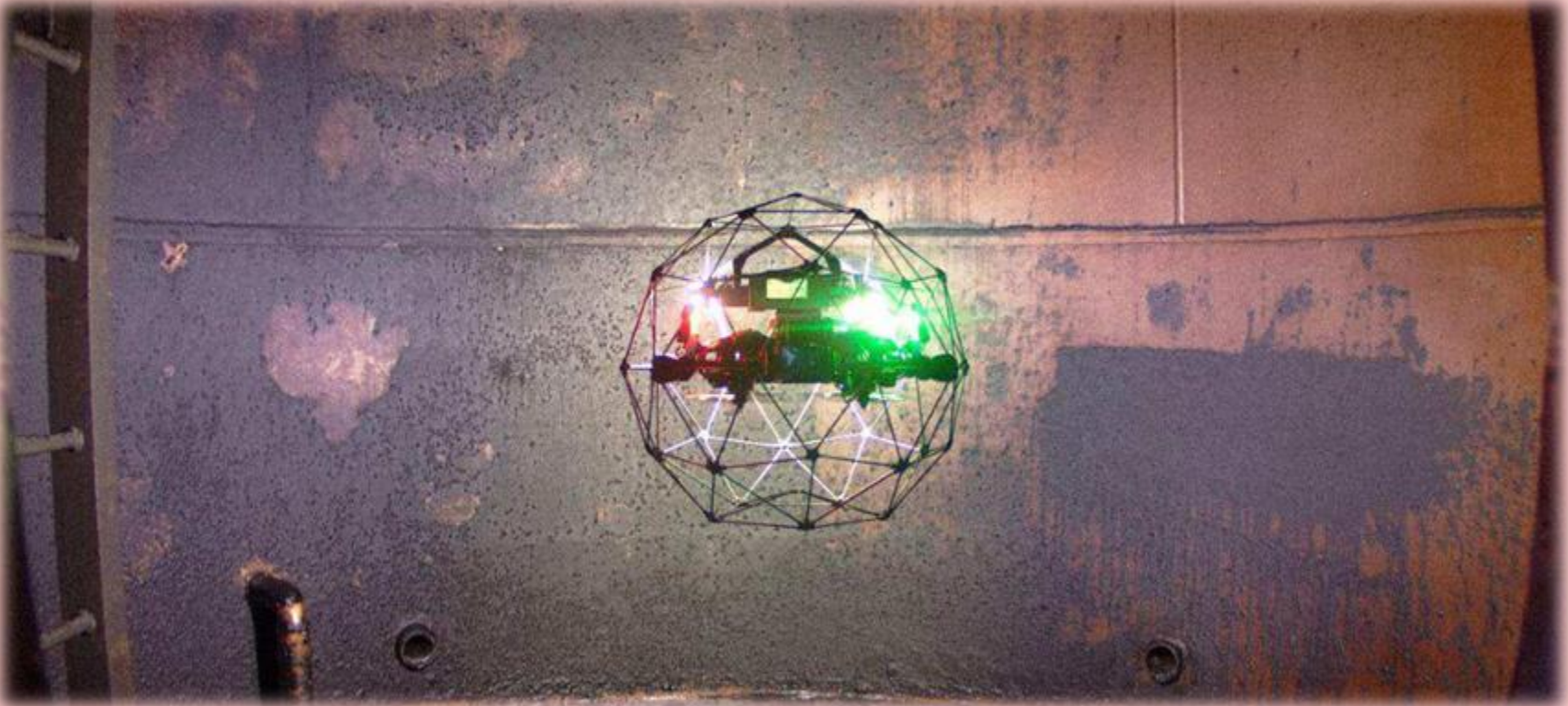
Diesel Tank UAV



Details	
Height	30m
Diameter	3m

Equipment – Diesel Tank

Elios 2



Non ATEX Rated

Integrated Lighting System

4k Video, FLIR Camera & Photogrammetry capable

Execution – Elios 2 Inspection



Elios 2 drone inserted through Manway at base of tank

Results – Diesel Tank



Summary – Diesel



Historically, this inspection would have required man-entry with either Rope Access or Scaffold

Rapid inspection when compared to traditional visual inspection

Clear imagery with ability to size defects

Thank you for listening

Any Questions?