

How Drones Are Being Used for Inspection In Industrial Environments

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Contents

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- UAV Operations in Industrial Environments
- Case Studies
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 - Construction & Decommissioning
- Takeaways



Takeaways

- Inspection in industrial environments is not easy. Pilots need additional training, experience & mature operating procedures
 - You need engineers with industry knowledge to know what you are looking at
 - Use as a screening tool. You may need to change your inspection philosophy
 - The drone doesn't matter, the key is the report
 - Drone inspection generates huge volumes of data, digital reporting systems are required



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Global Experience







CYBER**HAWK** Team

>60 Members of Staff

- Pilots >30,000 commercial flights

Inspection Engineers

Mechanical, structural & civil engineers ASME & CSWIP plant inspectors Blade engineers OHL engineers

> - Surveyors >25 years experience

- Software Developers

iHawk cloud based digital reporting solution



Drones, UAV, UAS, ROAV, RPAS...



UAVs – Operations

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UAVs - Pilot Training



LEVEL 1

AERIAL PHOTOGRAPHY & SURVEY

UK CAA qualification (or equivalent) In-house ground instruction In-house flight training Site training



LEVEL 3

ADVANCED INDUSTRIAL INSPECTION

Full manual flying In-house advanced inspection training In-house confined space inspection training Min. 500 flights to move to next level



LEVEL 2

BASIC INDUSTRIAL INSPECTION

Flying close to structures In-house inspection training In-house industrial risk awareness training Min. 250 flights to move to next level Full manual flying



LEVEL 4

OFFSHORE INDUSTRIAL INSPECTION

Elevated levels of airmanship and risk awareness High level of flying competency In-house working from vessels training In-house and external offshore training Full manual flying

UAVs – When It Goes Wrong



UAVs – When It Goes Wrong



Oil, Gas & Petrochemical



Flare Stack Inspection









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Inspection Report

Client: Supermajor North Sea Asset: Platform Description: HP/LP Flare Inspection Inspection Date: 28-29/04/17 Report Ref:XYZ170702_HPLPFLR_MHV1

Inspection Summary:

Sonajet HP/LP & Sour Gas Flare Tip + Flare Structure was inspected between the 28th and the 29th of April 2017. The 14" HP tip was found with a possible

hairline crack at the tip periphery.

The LP tip was found to be in poor condition. Deformation of the upper shell has resulted in a moderate sized tear on the East El. lifting lug weld. The deformation of the tip has also affected the overall cross section of the tip. Heavy liquid carry over was also found to be occurring on the low pressure flare. The sour gas flare was found to be in good condition.

The windstrake was found to be in poor condition. Multiple potential dropped objects found on flare deck. Access stairs handrails/backscratcher noted to have heavy corrosion/material loss – caution advised if used.

The overall flare structure appeared in good mechanical condition.

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Sonajet HP/LP & Sour Gas Flare Tip + Flare Structure Findings:

HP Flare Tip

The 14" HP tip was found to be in satisfactory condition with the exception of a possible hairline crack at the tip periphery, further inspection is required to confirm this. The 8" nozzles were found to be in good condition with light carbon build noted.

LP Flare Tip

The LP tip was found to be in poor condition. Considerable deformation was noted since the last Cyberhawk inspection in 2013. The deformation of the upper shell has resulted in a moderate sized tear on the East El. lifting lug weld. The deformation of the tip has also affected the overall cross section of the tip, which can cause an undesired burning effect, accelerating the deterioration of the tip itself and the components surrounding it. Heavy liquid carry over was also found to be occurring on the low pressure flare, more than likely related the separation process in the LP KOD, this appeared to cause a light smoke which can be observed in various stand off images.

Sour Gas Tip

The sour gas flare was found to be in good condition with no visible anomalies.

Windstrake

The windstrake was found to be in poor condition, further deterioration noted since the previous Cyberhawk inspection in 2013.

Flare Deck and Access Stairs

Multiple potential dropped objects found on flare deck. Loose and detached handrail clamps were also noted. Access stairs handrails/backscratcher found to have heavy corrosion/material loss - caution advised.

Structure

Overall, the structure appeared in good mechanical condition. Few areas of isolated coating breakdown with surface corrosion present were highlighted. PFP coating integrity appeared to be in overall good condition, one isolated area was found to have deteriorated PFP.



Anomaly No.	Description	Location	Elevation	Page
1	Damaged Windstrake	Windstrake	N/A	15,25,26
2	Deformed LP	LP Tip	North El.	16-23
3	Missing Pilot Burner	LP Tip	South El.	17
4	Tear	LP Tip Lifting Lug Weld	East El	19,20
5	Damaged Windstrake Support	Windstrake Bracket	East El.	23
6	Possible Crack	НР Тір	West El.	24
7	Dropped Object Hazard	Flare Deck	N/A	28-30
8	Detached Handrail Clamps	Flare Deck Handrails	N/A	31,32
9	Corroded Handrails	Access Stairs	North El.	35-45



Flare Tip Findings



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Small crack-like-indication found on HP upper shell, adjacent to the flame retention segments. Propagation likely under normal operating conditions and shutdown/start up (cooling).

DSC00476.jpg

iHawk Visual Asset Management - Flares



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Anomaly table with remedial work priorities

1-high 2-medium 3-low 4-null

Defect Nr	Location	Priority	Description	Link to Image
1	Top platform	2	Melted aviation light.	
2	Top platform	2	Dislodged grating near the platform penetration point of the LP flare	
3	Top platform	1	Debris/ loose item on the top platform (SW corner) Potential dropped object (PDO)	
4	Top platform	1	Metal sheet lying near the LP tip platform penetration point (PDO)	
5	Top platform	3	Coating degradation and rust staining to the deck plate and gratings	
6	Top platform	3	Wire hanging loose	
7	Top platform	3	Radiation shield underside - general coating breakdown and rusting	
8	Top platform	3	Melted fall arrest gate and chain	
9	LP flare	4	Misaligned guard	
10	HP riser	2	Isolated areas of coating breakdown and rusting to the main HP riser	
11	HP Riser	4	Impact damage to the HP riser guard at the bottom section	
12	LP/HP supports	4	Fluid accumulation ponding at all slider support brackets	
13	Access platform	1	Top access platform fall arrest gate damaged and lying on the gratings (PDO)	6
14	Flare boom	2	NE side of the flare boom top section showing isolated areas of coating breakdown and corrosion	







Flare Inspection Case Study

- Oil and Gas Supermajor, Nigeria
- 5 flares inspected in <1 week while fully operational
- Alternative methods of inspection, such as rope access, would have required a shutdown of the facility
- Saved the client >\$US11 million

Underdeck Inspection














Underdeck Inspection Saving



Oil and Gas Supermajor, UK North Sea

- Cyberhawk underdeck inspection in 3 days
- Previous method of inspection was a 6man rope access team over 14 weeks
- Saved the client >£1 million



Internal Crude Oil Tank (COT) Inspection



iHawk COT Visualisation





COT Inspection Saving



Oil and Gas Supermajor, West Coast USA

- 14 COTs inspected in 12 days
- Inspection approved by American Bureau of Shipping (ABS) to Class code
- No scaffolding or RATs used
- Client saved \$750,000 attributed to no scaffolding costs & efficiency of the inspection allowing for quick turnaround



Storage Tank Inspection

857





NT N905F Tank – Internal - Findings



thecyberhawk.com info@thecyberhawk.com + 44 (0) 1506 592187 Another example of scoring marks found. Do not appear to penetrate surface of internal wall excessively. A more tactile inspection would be recommended to determine actual depth.

DSC05244.jpg





A Screening Tool

- Save Money
 - Increase uptime
 - Reduce cost of traditional access techniques
 Periodic condition monitoring to keep ageing assets running safely
 - Improve Safety
 - Reduction or elimination of working at height
 - Maintain stand-off from operating asset
 - Increase Efficiency
 - Shorter setup and faster inspection
 - Gain 100% visual evidence of asset condition
 - Better planning of maintenance and turnarounds



Thermal Power Generation

Internationals)

-

Chimney & Cooling Tower Inspection







-



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Thermal Inspection



Electricity Transmission & Distribution



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>> Transmission



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High Risk Sites

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Show Distance To Fault

Maintenance Module



>> Transmission >> 132kV >> TAN/TAS

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>> Transmission >> 132kV >> TAN/TAS >> 27

Search



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...after selecting a tower, components can be viewed by clicking a parts list or schematic

Inspection Date: 2015-10-01 OVERVIEW - Left Side Trees interfering with conductors? -No - 1

All Images

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All Images

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Inspection Date: 2015-10-01 OVERVIEW - Left Side Trees interfering with conductors? -No - 1

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Tower: 27 Inspection Date: 01 Oct 2015 Left - TAN ; Right - TAS

Parts / Schematic ID PLATES STUBS AND MUFFS ACD SAFETY SIGN FLAG SOCKET SPAN OVERVIEW PEAK/EARTHWIRE EARTHWIRE X-ARM OBLIQUE X-ARM ACROSS **FITTINGS S FITTINGS T** INSULATOR OVERVIEW S INSULATOR OVERVIEW T INSULATOR TOWER END S INSULATOR TOWER END T INSULATOR LIVE END S INSULATOR LIVE END T STEELWORK/BRACING LEGS MISC

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All Images

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...component of interest can then be investigated

Search

Inspection Date: 2015-10-01 INSULATOR TOWER END S - Right CCT Lower Arcing Horns - Rusty/Slack - 3

3

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Tower: 27 Inspection Date: 01 Oct 2015 Left - TAN ; Right - TAS

Parts / Schematic ID PLATES STUBS AND MUFFS ACD SAFETY SIGN FLAG SOCKET SPAN OVERVIEW PEAK/EARTHWIRE EARTHWIRE X-ARM OBLIQUE X-ARM ACROSS **FITTINGS S FITTINGS T** INSULATOR OVERVIEW S INSULATOR OVERVIEW T INSULATOR TOWER END S INSULATOR TOWER END T INSULATOR LIVE END S INSULATOR LIVE END T STEELWORK/BRACING LEGS MISC

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Wind Inspection

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significant scaling and corrosion.





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Bridge & Viaduct Inspection







XXXXXX

Viaduct - XXXXXX



Cyberhawk Innovations Ltd Innovation Centre, Alba Campus, Livingston, EH54 7GA Tel: +44 (0) 1506 592187 E: info@thecyberhawk.com P127 Condition deteriorated, brick loss on face ring: 1.7m L x 0.2m D, additional spalling, 0.7x0.6m with 0.1m D.

Photo:DSC00023.jpg









Construction & Decommissioning













3D Models & Asset Visualisation







Electricity Substation Construction Progress - 3D Pointcloud





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Orthophoto

Survey: 17-03-2018

Orthophot

🖾 Panotour

(3D) Mode

Ortho Comparison

	3D Model

Video 30/07/2017

Spherical

One save

MW All 20180318 -

3D Mesh Model



Gaadle

Bentley:

Takeaways

- Inspection in industrial environments is not easy. Pilots need additional training, experience & mature operating procedures
 - You need engineers with industry knowledge to know what you are looking at
 - Use as a screening tool. You may need to change your inspection philosophy
 - The drone doesn't matter, the key is the report
 - Drone inspection generates huge volumes of data, digital reporting systems are required





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