“if you can fly it we can model it”

“Subsea Spool Metrology with an HD Camera”
Arnauld Dumont

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AECC, Aberdeen
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Summary:

- Introduction
- A brief history of Photogrammetry
- Spool Metrology Data Capture
- Spool Metrology Data Processing and CAD
- Case Studies
- The “AS-MAP” Concept
Introduction:

- Who are we? Dimensional Eye specializes in Subsea 3D Surveys
- What do we provide? Services and Software Development in the field of 3D Measurement by Optical Techniques into inaccessible/hazardous environments
- Tracking Records: more than 25 years of experience in the field, more than 20 spool metrology projects worldwide over the last 2 years
A (very) brief History of Photogrammetry

“The art, science and technology of obtaining reliable information about physical objects and the environment through processes of recording, measuring and interpreting photographic images and patterns of recorded radiant electromagnetic energy and other phenomena”

DiMEye has developed its own Photogrammetry software VLS™ (Video Laser Scan) integrating the use of a laser line for the high accuracy/density mapping of anomalies.
A (very) brief history of Photogrammetry

Photography: Niepce and Daguerre, France 1830
Photogrammetry: Aimé Laussedat, France 1849
Close-Range Photogrammetry: Duane Brown (GSI), USA 1985
Digital Cameras: Kodak, USA 1994
Video Laser System VLS™: DimEye and BP (USA) 2010
Applications

3D As-Built CAD Modeling
- Manifold, Pipes, Valves, Flanges, ...
- Spool Metrology

Periodical & One-time Inspections
- Flex Joints
- Mooring Chains & Lines
- Anodes
- Pipes
Spool Metrology
relative positions and orientations of
flanges in 3D space
Sensors

HD Camera (SUBC Imaging)

Diver HD Camera (Canon)

VLS™ Unit (diver & ROV)

Mini ROV & HD Camera (Ashtead)
Calibrations

Camera Self-Calibration : $c, (x_p; y_p), (K_1, K_2, K_3), (P_1, P_2), (A P_1, A P_2)$

Scale Bar Calibration : Brunson Bars calibrated by NIST, National Institute of Standards and Technology (+/- 10 μm)
Vehicles
Environment & Configuration

• On the Seabed, on Subsea installations or in Air
• With or without existing spool
Data Processing

Extraction of Images from video files

Photogrammetry Computation

3D Points & Geometrical Features
3D As-Built CAD Model
Digital Simulation
Case Studies

Flange-to-basket without pipe
Camera: SUBC 1CAM
Length: 10 m
Data Capture: 1h
Data Processing: 16h
CAD Modeling: 8h
Accuracy: +/- 2 mm

Flange-to-flange with pipe
Camera: SUBC 1CAM
Length: 8 m
Data Capture: 30 min
Data Processing: 8 hours
CAD Modeling: 4h
Accuracy: +/- 1 mm
Manufacturing Control

- Spools
- Flanges
- Connectors
- ...

[Image of manufacturing control components]
Benefits

• Speed: Efficient Data Capture resulting in less time on site + Potential Data Capture by Client (after Dimensional Eye Training & Qualification Session)

• Flexibility: Photogrammetry and VLS™ are very robust measurement tools allowing for many configurations

• Reliability: Redundancy of Data, Known Accuracy, Linked to NIST
The Future Holds...

The AS-MAP Concept
Automated Spool Metrology Application

Fast & Accurate 3D CAD Modeling
( Library of predefined objects, Artificial Neural Network, Optical Tracking, …)

Cloud Based Data Processing

Holograms & 3D Printing
Thanks for your attention!
Questions?