



# Internal Riser Inspections

*Getting it right first time, every time!!!!*

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# Introduction



- We must do everything possible to ensure no accidents or harm to anyone. Getting it right first time, every time, is crucial for a safer execution
- Getting a pipeline inspection tool (PIG) stuck inside a pipeline/riser is very bad for business, it can either permanently restrict or completely stop production
- Every effort should be taken onshore to ensure a PIG can successfully pass internally through a pipeline without any concerns prior to going offshore
- We wanted to find ways to safely and accurately test the pigging equipment before going offshore, where risks of inclement weather, risks to personnel carrying out the work and challenges are much greater
- BP decided to invest in the fabrication of full-scale replicas of critical sections of the Andrew oil and gas export risers and the Cyrus gas lift riser and carry out onshore intelligent pigging trials



- Obtaining inspection data from the riser / pipeline allows us to:
  - Confirm the presence of any defects on the riser / pipeline
  - Understand the remaining pipe wall thickness of any defects
  - Allows us to calculate the remaining life of the riser / pipeline based on remaining pipe wall thickness and corrosion rates
  - Confirms the integrity of the riser allowing us to extend the remaining life beyond its cessation of production date

# The Challenge

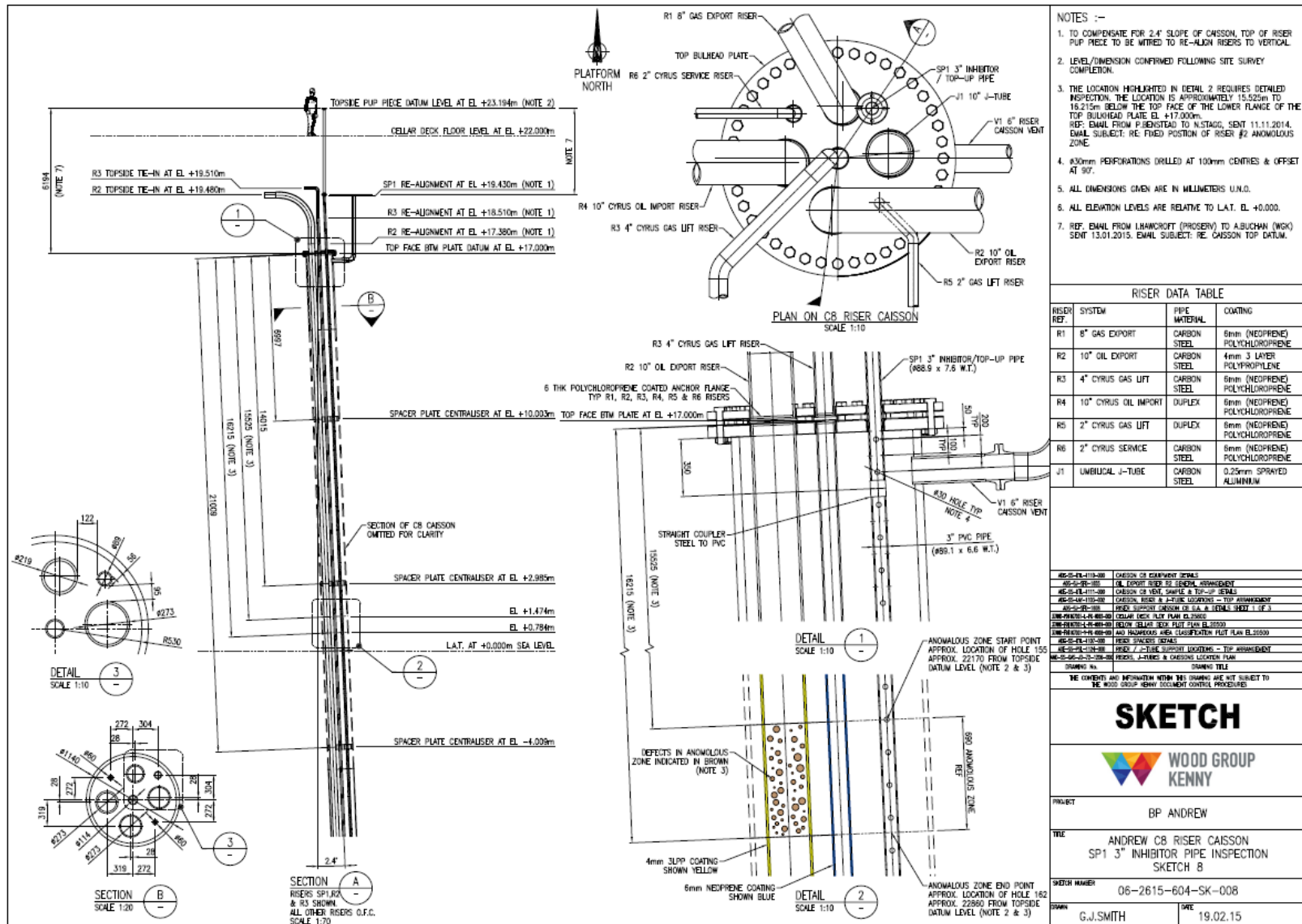


- The Andrew C8 caisson encapsulates all the risers, therefore it is not possible to gain access to the risers to undertake an external inspection, all inspections need to be undertaken internally within the riser.
- With complex riser configurations, non piggable bends, and pipework with restricted bores, conventional pigging tools and execution methodologies cannot be used and a novel approach to internally inspect the risers with bespoke pigging solutions was required

# Andrew C8 Caisson



# Andrew C8 Caisson

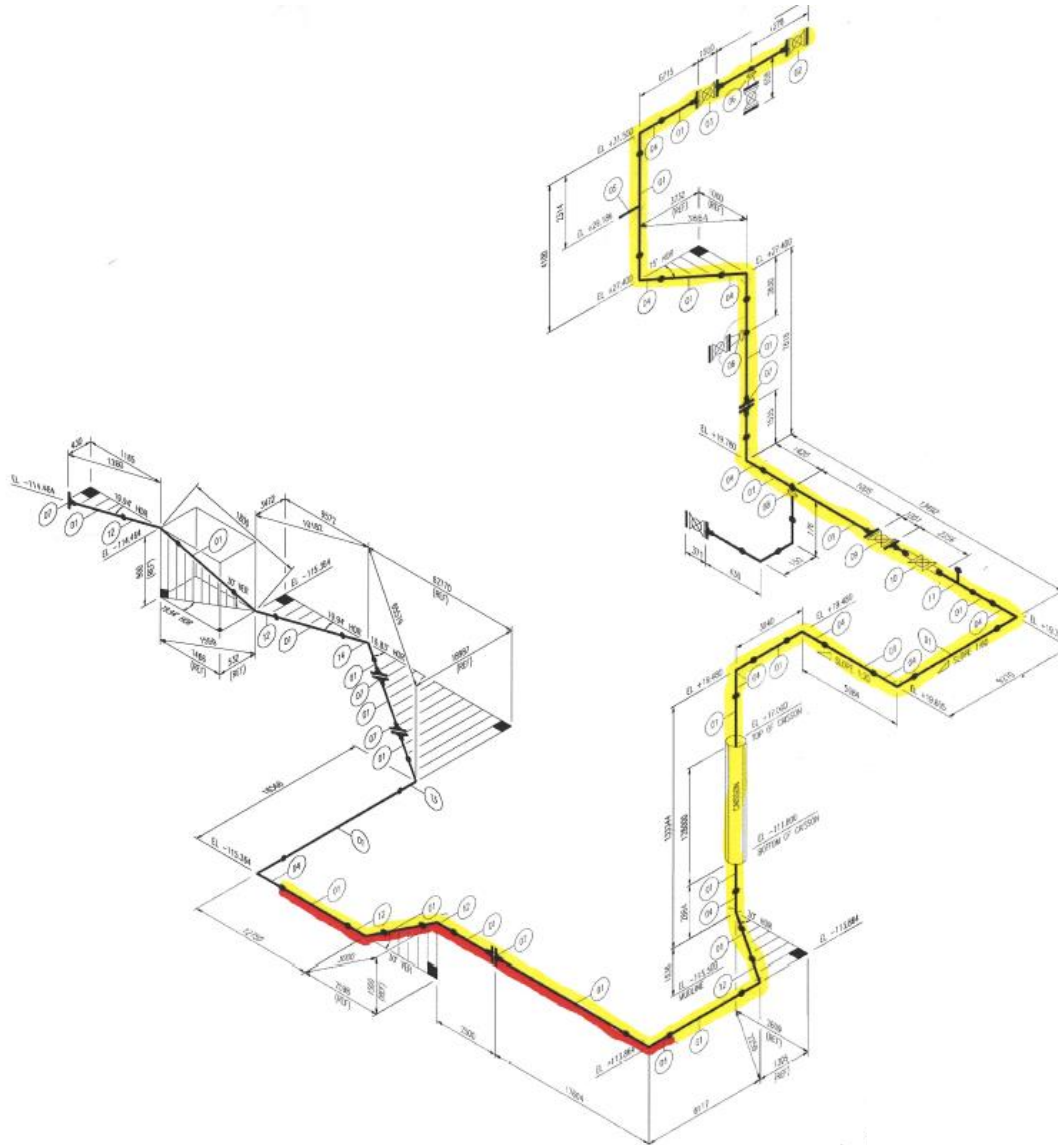


# Onshore Trials



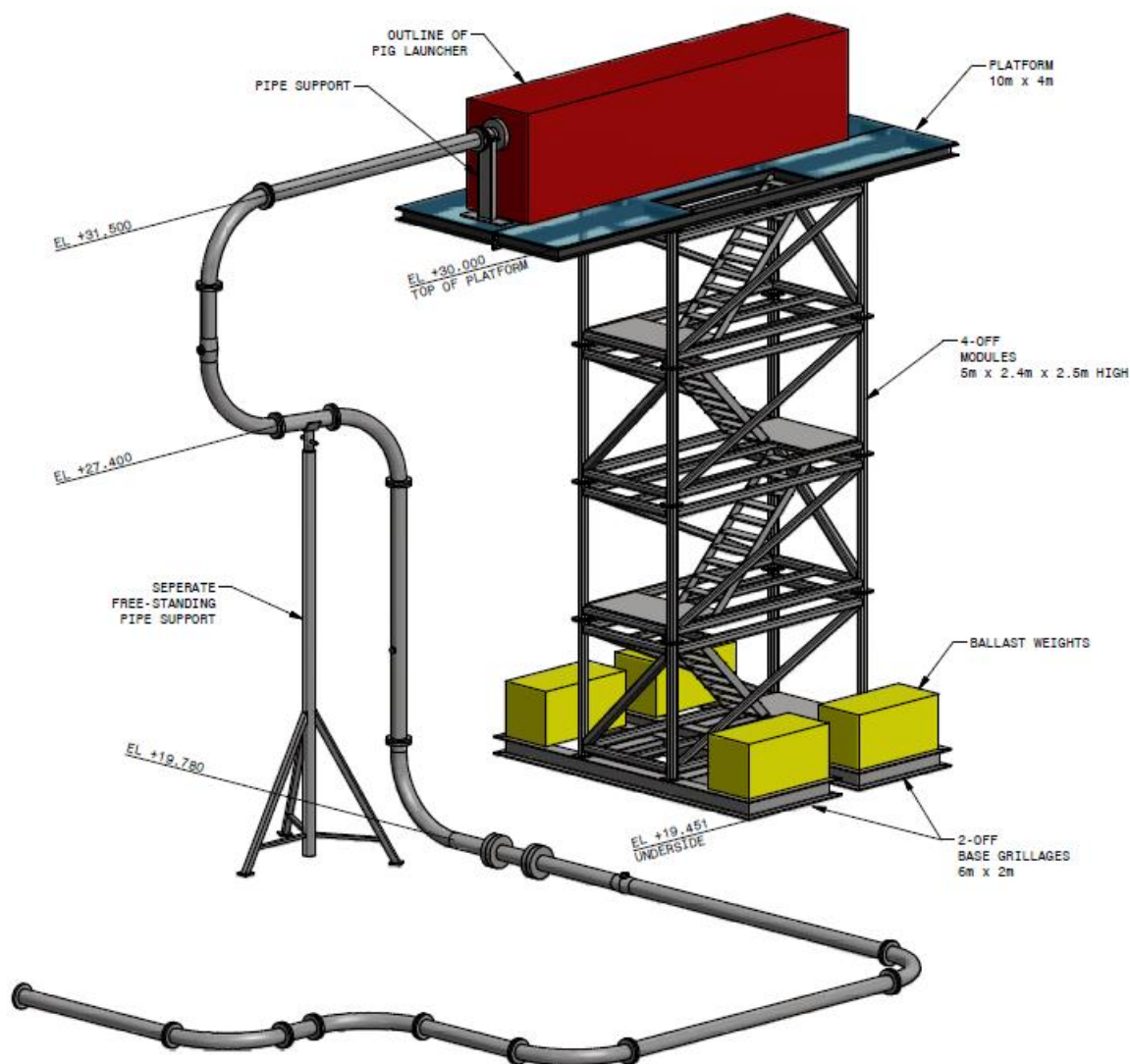
- Collaboration with specialists to design bespoke tooling
- Undertaking onshore trials with a purpose made test rigs allows us to:
  - Confirm execution methodology and make any changes to procedures prior to going offshore (right first time offshore execution)
  - Validate and records the performance of the tooling, allowing us to precisely predict the expected bore passing capability and inspection durations offshore
  - Removes any testing offshore prior to execute, therefore reducing the impact of POB offshore and production deferrals
- Advanced external inspection techniques of the topsides pipework (out with the caisson) were undertaken to create 3D models of all the critical features of the riser
- State of the art 3D metal printing was undertaken to convert the 3D models into physical components for inclusion into the test rig

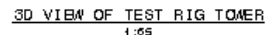
# Andrew 10" Oil Export Riser Trials



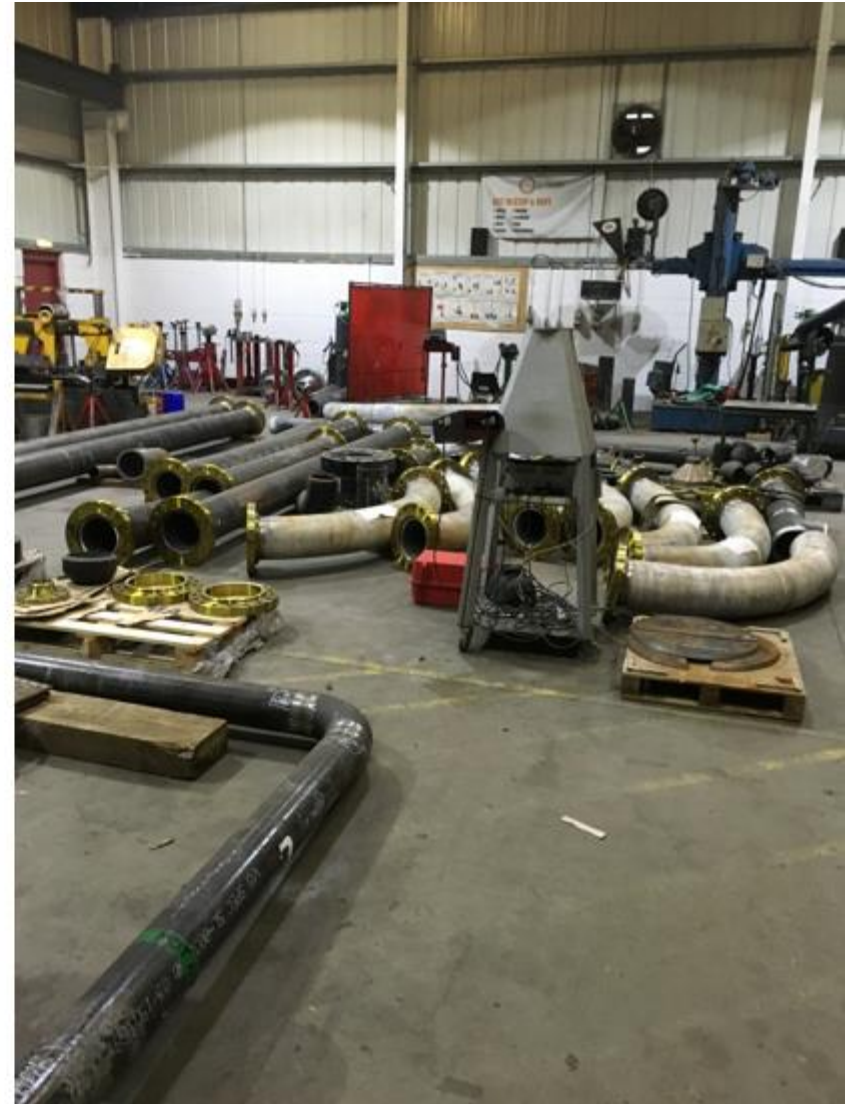


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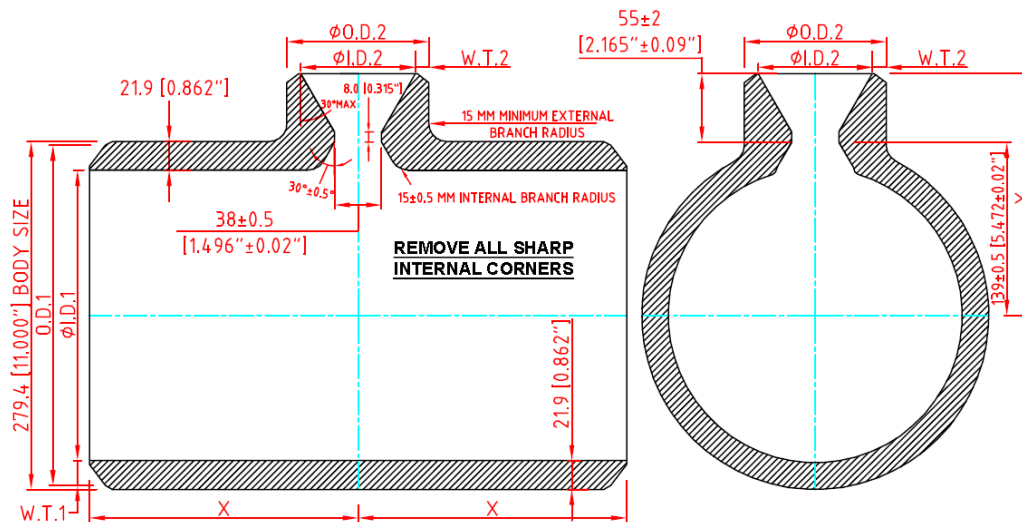
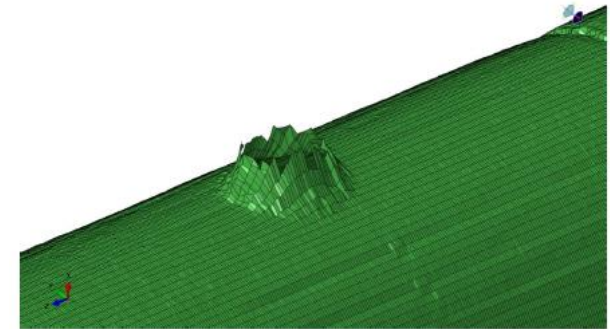
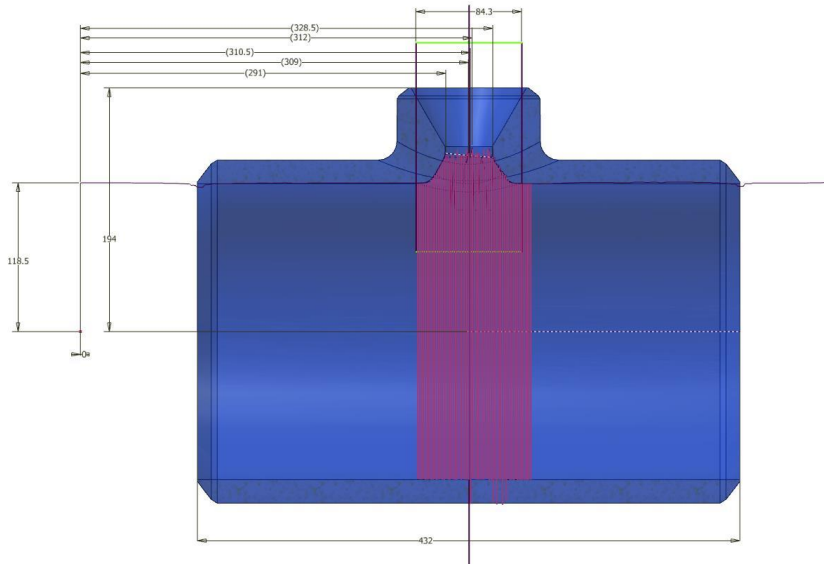


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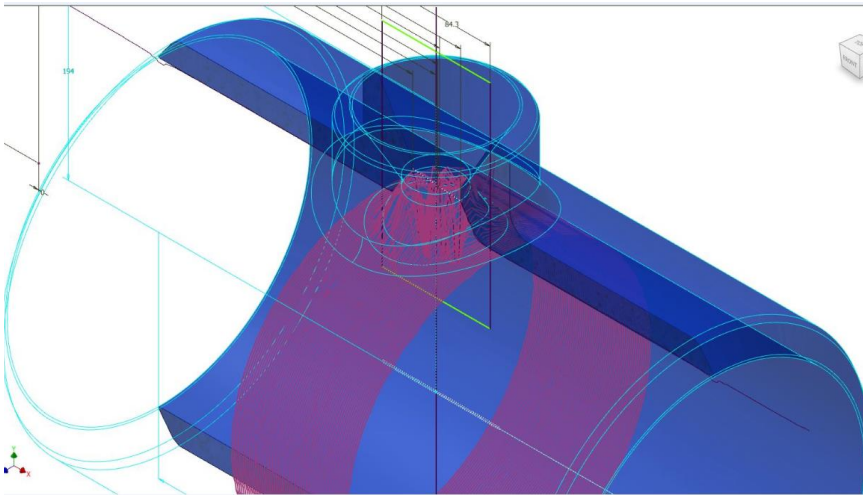




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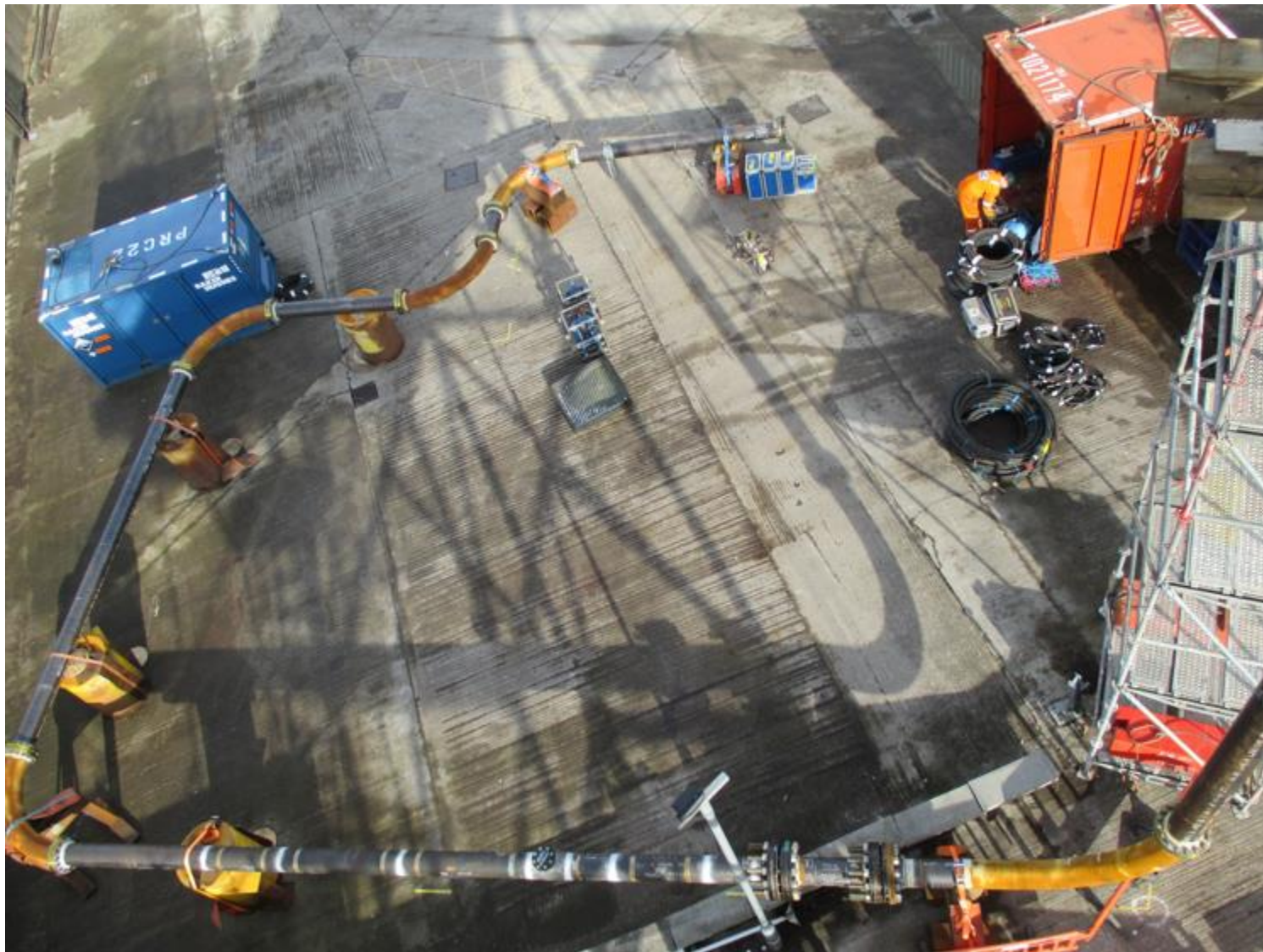


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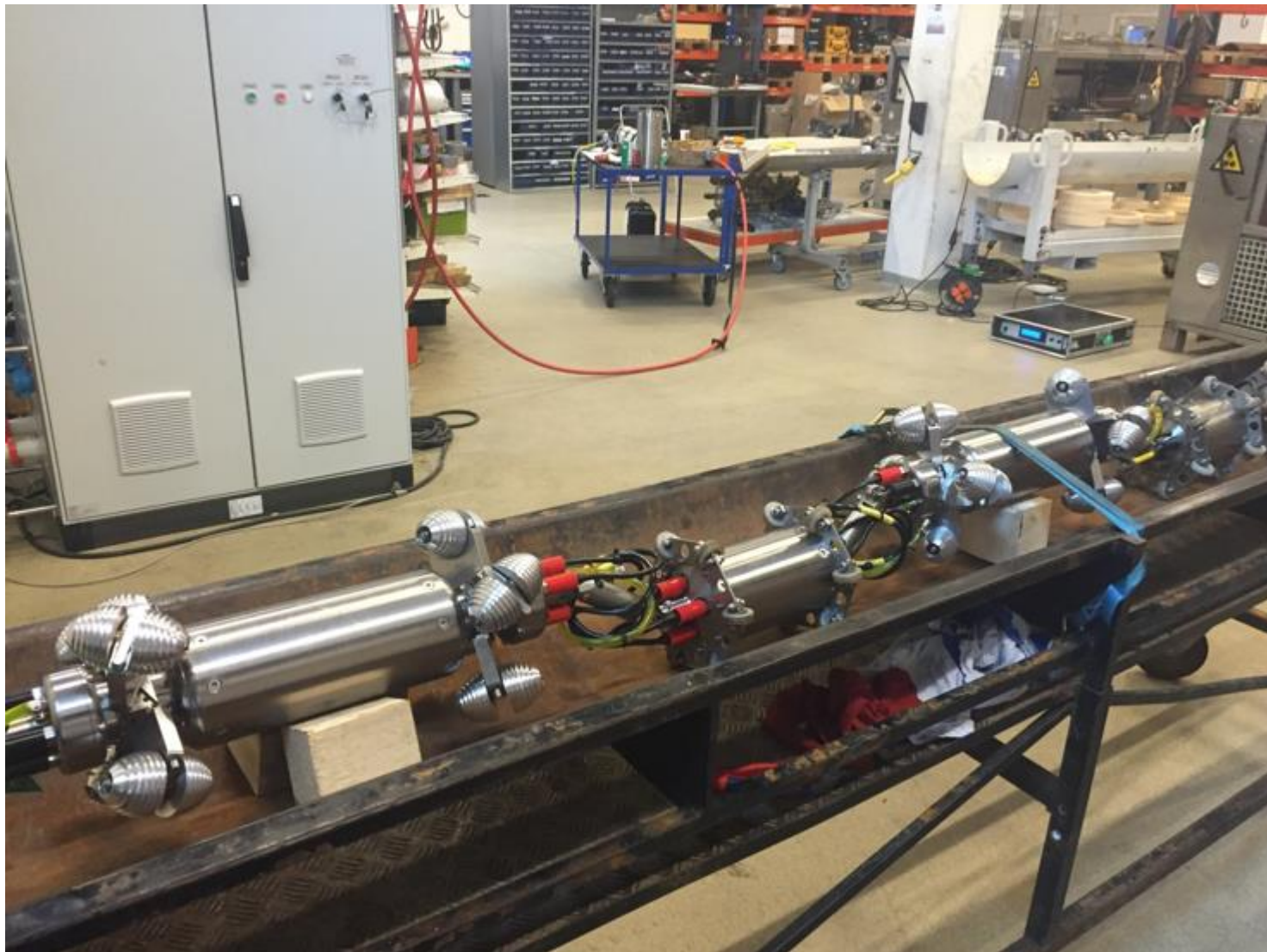


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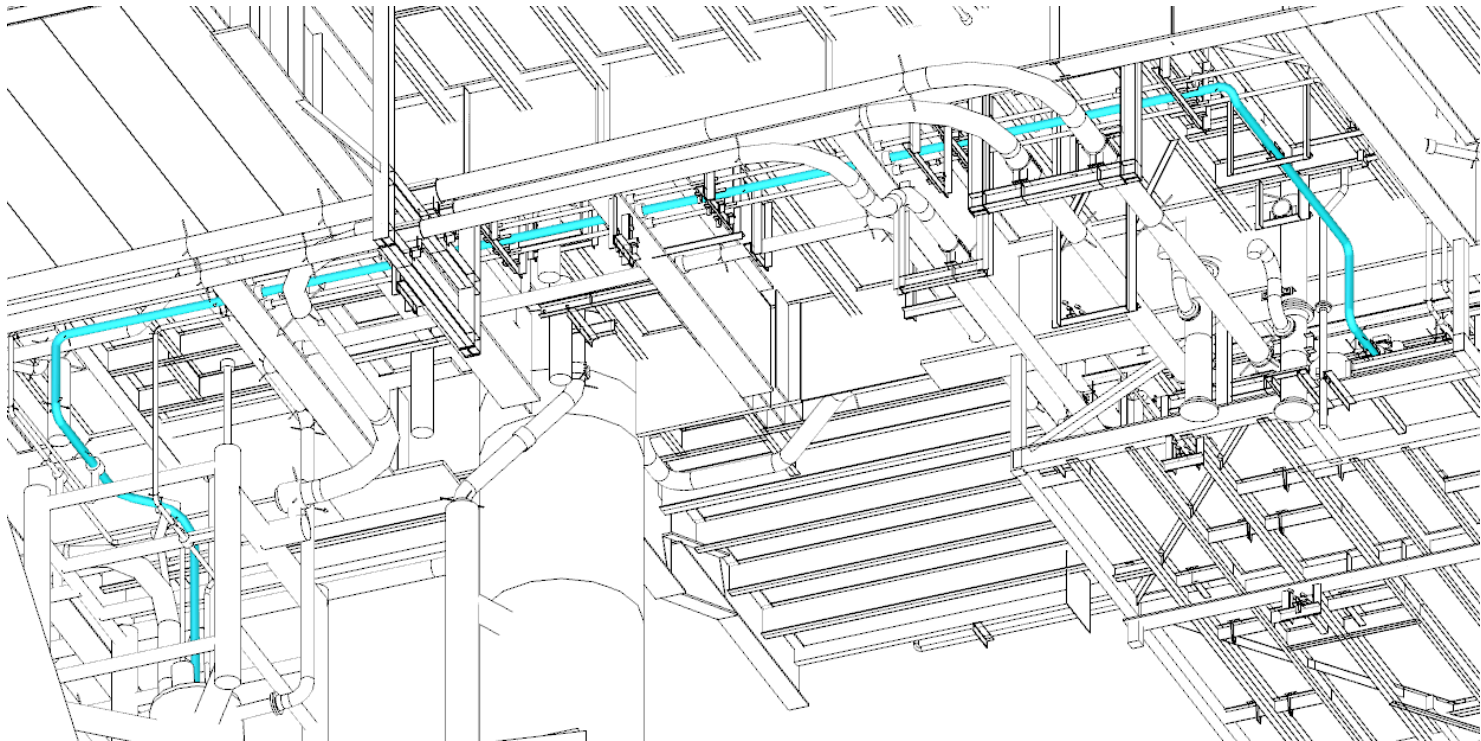




# Cyrus 4" Gas Lift Riser Inspection



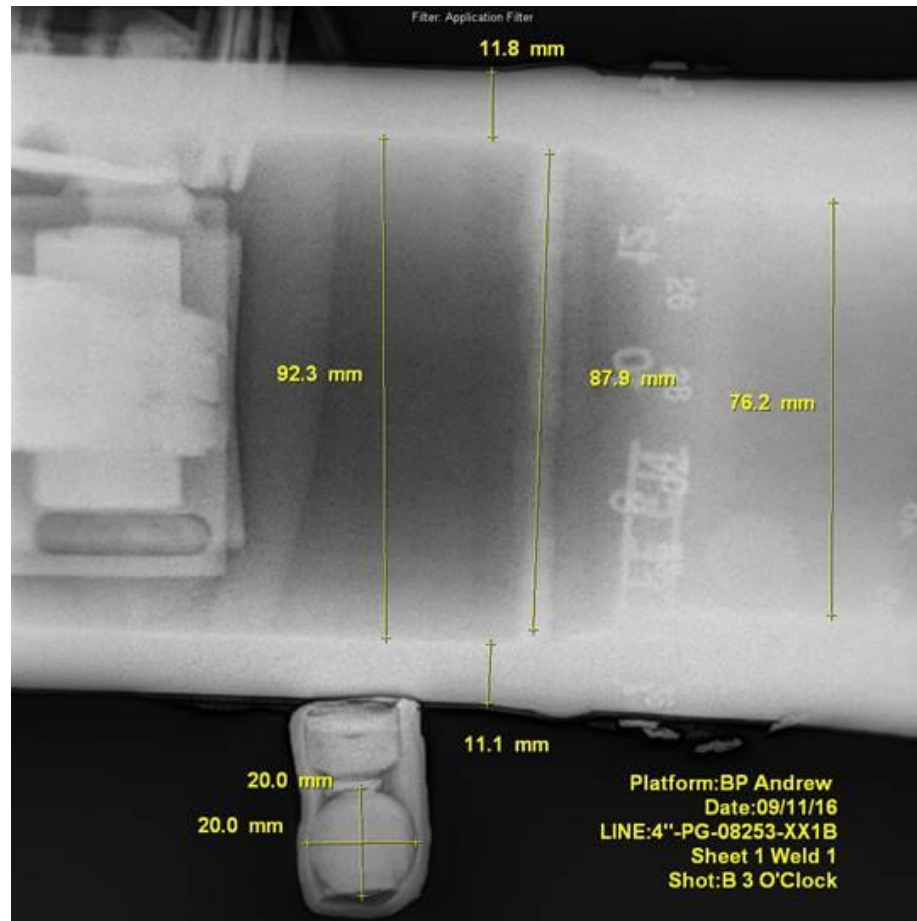
- An internal inspection the Cyrus 4" gas lift riser on the Andrew platform from the topsides ESDV to the subsea pipeline was required to validate its integrity
- Bore checks of the topsides pipework (in blue below) was undertaken as part of a project risk mitigation action plan



# Cyrus 4" Gas Lift Riser Inspection



- Restricted bore identified in the bend of the Cyrus 4" gas lift riser at the top of the riser

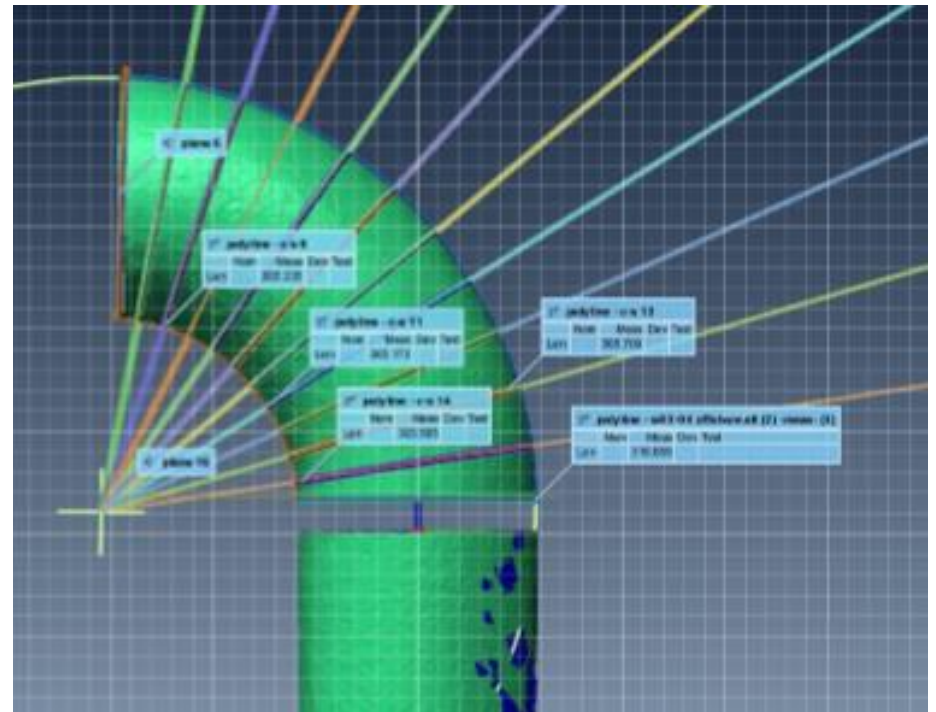




# Cyrus 4" Gas Lift Riser Inspection



- Innovation in Safety



# Cyrus 4" Gas Lift Riser Onshore Trials



# Cyrus 4" Gas Lift Riser Onshore Trials





# Cyrus 4" Gas Lift Riser Onshore Trials



# Andrew 8" Gas Export Riser Onshore Trials



# Andrew 8" Gas Export Riser Onshore Trials





# Andrew 8" Gas Export Riser Onshore Trials



# Benefits



- Safer operations
- Cost savings
- The onshore trials and offshore execution was completed successfully and safely and provided the following benefits:
  - Provided the required inspection data to validate the integrity of the subsea systems
  - Improved efficiency of offshore execution, all scopes completed ahead of schedule
  - The successful execution of this pigging methodology and equipment has been communicated throughout the global organisation so that any of BPs operating asset with similar inspection challenges can benefit from this innovative and proven inspection techniques
- These successful outcomes are helping BP to secure the future of our riser and pipeline systems. It demonstrates BP commitment to safe, reliable and compliant operations and is making innovative steps to improve the likelihood of success in key integrity inspections



# Q&A Session



- Many thanks