Subsea Pipeline Design Automation

Colin McKinnon - Technical Director - Subsea and Export Systems
Digital & Technology Accelerator
Digital & Technology accelerator

Connected design
Knowledge Management
Spatial & GIS
Artificial Intelligence & Machine Learning
Connected operations
Connected build

Connected Design
IPIMS
GIS
PODS
VR
Concept Dev
Automated Design
Costs
Doc & Tag database

A presentation by Wood.
Digital & Technology accelerator

Connected Build

IPIMS
GIS
PODS
VR
Materials Tracking
Constrcut Tracking
Doc & Tag database
Sim Ops
Hand Over

Spatial & GIS

Knowledge Management

Connected Design

Artificial Intelligence & Machine Learning

Connected Operations

Connected Build

A presentation by Wood.
Digital & Technology accelerator

Connected Operations

- IPIMS
- PODS
- VR
- IMR
- IM / FFP
- Data Analytics
- Doc & Tag database
- GIS

Knowledge Management

Spatial & GIS

Connected design

Artificial Intelligence & Machine Learning

Connected operations

Connected build

A presentation by Wood.
• Where have we come from...
NEXUS GIS – Subsea Digital Twin

- Project life-cycle solution
- Developed over 10yrs
- Field proven
- Web based
- 100’s of users at once
- Pipeline Open Data Standard (PODS)
- Established process for data management and quality control.

Innovative and holistic ‘single source of truth’ information management solution developed by Wood

Improve efficiency | Improve safety | Improve decisions

EXISTING DATA
- DOC
- PDF
- Scans
- Video
- CAD
- Bathymetry
- Vessel
- Weather
NEXUS GIS – Field Proven

Benefits

**Design Engineering**
- Survey support and processing of survey data
- Route engineering & terrain analysis
- Generation of terrain profiles
- Development of chart / drawing deliverables

**Fabrication**
- Store coating, material testing and welding data.
- Materials tracking & management
- Procurement support and reporting

**Construction**
- Near real-time field layout & equipment installation
- Live vessel / asset tracking
- Real-time valve status management (track & report)
- SimOPs Planning Tool
- Weather tracking
- Survey video – online streaming of video with location tracking.

**Key Projects**
- Quad 204 - BP
- Shah Deniz 2 - BP
- Mad Dog 2 - BP
- In Salah Gas - Petrofac
Detailed Asset Location and Status Information
Detailed Asset Location and Status Information

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### Structures Design (1)

#### Structures Current (36)

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Detailed Asset Location and Status Information
Vessel Tracking, SIMOPS Planning and Monitoring
Anomaly Assessment (e.g. Spans)
• Where are we today...
Pipeline design automation

Automated GIS toolkit
- Terrain analysis
- Side slope analysis
- Trenching/burial volumes
- Soil assessment
- Routing (incl. auto bend fitting)
- Profiling (longitudinal & cross)
- Alignment sheet generation

Pipeline design tool
- Front end (GIS enabled)
  - Input and manage engineering data
  - View digital pipeline
  - Run calculations & view results
  - Produce design data
  - MTOs & reporting
  - Cost estimation
- Calculation library
  - Standalone calculations
  - Mathcad calculations
  - FE models

Data management
- Data models
  - PODS
  - SSDM
  - CFIHOS
  - Onshore survey data (remote sensing)
- Data QA/QC
- Document control
  - DocPro

Database
- Geospatial data
- Design data
- Asset data
- 3D models
- Documents
- Tags

A presentation by Wood.
Offshore Route Identification
Routing Tool linked to GIS

- Live manipulation of IP and bend radii against all background layers.
- Also minimum distance to next bend, departure angles.
- Add/remove shift IP points and define bend radii
- Longitudinal profile tool
- Front and Side Slope analysis tool
- Cross Profile analysis tool
- Proximity analysis
- Rock dump/Trench footprint analysis
New Pipeline Data Model linked to GIS and NEXUS GIS
New Wood Pipeline Design Apps

- DNVGL, ASME and API code checks
- Burst, collapse, buckling, spanning, stability checks
- Links to client data or NEXUS GIS
- Automated output
- Optimisation and probabilistic functions
- Thru life application
Links to Advanced Pipeline Analysis Models

- Buckling (upheaval / lateral)
- Walking
- Crossings / Protection
- Large Spans
- Pipe soil interaction
- Reeling
- Arctic
Automated Field Development

- A GIS-based dynamic costing and optimization system (ACE$)
- Manage and compare multiple development scenarios – optimising Drilling vs Subsea vs Surface costs
- Develop field architecture accurately using GIS mapping capability and survey data
- Check configuration against project specific rules & automatically calculate quantities
- Dynamic reports & charts from database for ease of interpreting results
- Provides reference repository for design & cost information throughout project lifecycle
Automated Pipeline Fitness Assessment
• Where are we going...
Simulating Operations

3D Asset Data Management

Autonomous Structure & Anomaly Detection