RISK

Onboard Tools for Planning and Optimizing SIMOPS

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Dynamic Positioning Committee
Marine Technology Society

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Overview of Presentation

- Background
- Onboard planning tool
  - Onboard SIMOPS simulation
  - Onboard simulator inputs
  - Operator interface
- Example application
- Conclusion

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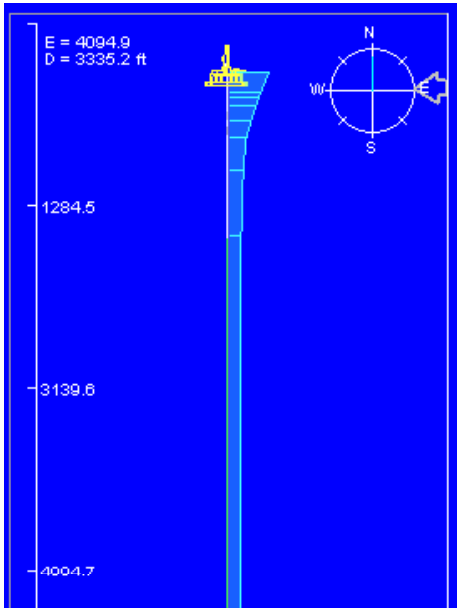
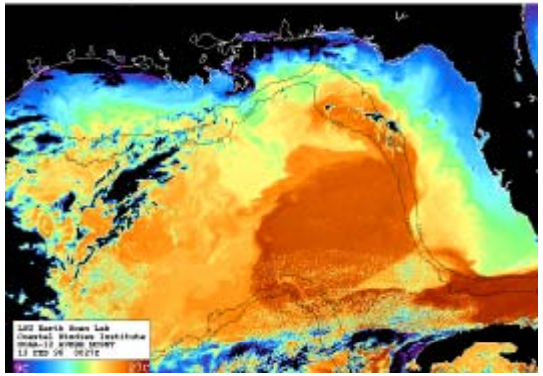
Drilling Riser SIMOPS – Background

- High drilling rig day rates
  - Driving need to maximize efficiency
- Dual activity rigs:
  - Dual derrick
  - High-capacity subsea cranes & winches
- SIMultaneous OPerationS:
  - Subsea operations carried out with drilling riser deployed:
    - Running casing
    - Subsea equipment installation (X-mas trees, manifolds, etc.)

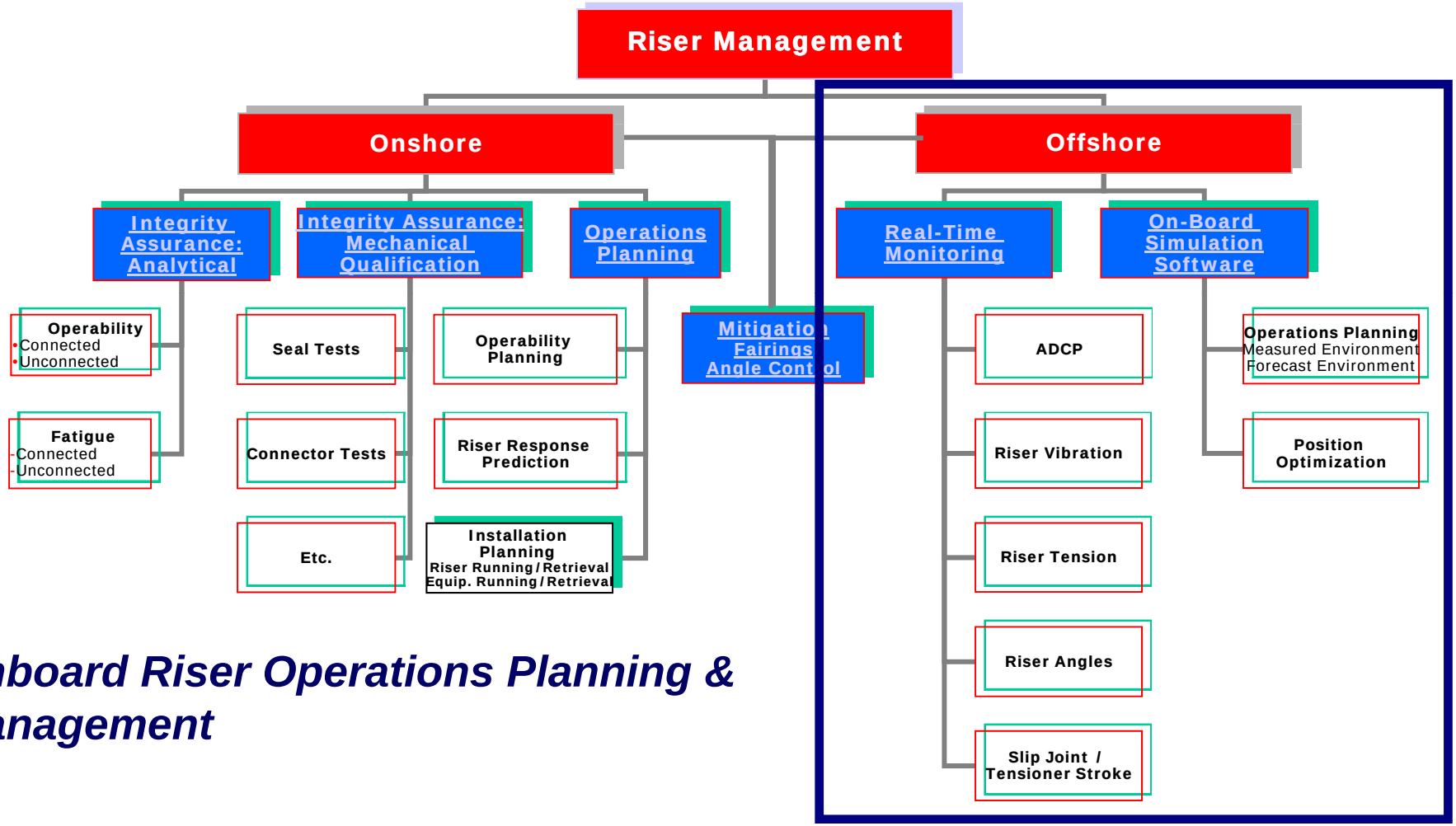
Onboard SIMOPS Planning

- Problem:
  - Feasibility of SIMOPS dependent on metocean conditions
  - Operations in high current areas
  - Planning essential to minimize risk
- Solution:
  - Advanced on-board software used to plan SIMOPS
  - Plan operations using *prevailing* or *forecast* data
  - Removes conservatism associated with assumed metocean conditions





SIMOPS Planning & Riser Management



Onboard Riser Operations Planning & Management

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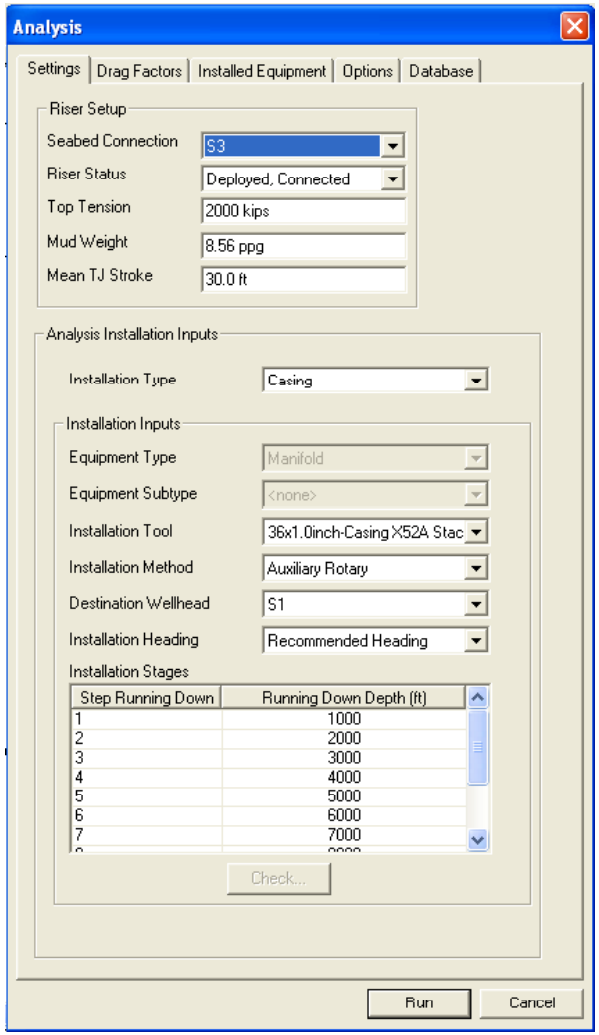
Onboard SIMOPS Simulation

- Intuitive, easy to use, simple to interpret
- Core analysis engine from MCS **Flexcom**/**DeepRiser**
- Models established onshore
- Operates in “online” or “offline” modes:
  - Online – data acquired from other vessel systems
  - Offline – all inputs specified by operator

Onboard Simulator Inputs

- Vessel data:
  - Position & heading
- Riser data:
  - State (connected/hung-off)
  - Top tension
  - Mud weight
  - No. of joints deployed
- Metocean data:
  - Ocean current profile
- SIMOPS operation details:
  - Nature of operation
  - No. of stages to be examined



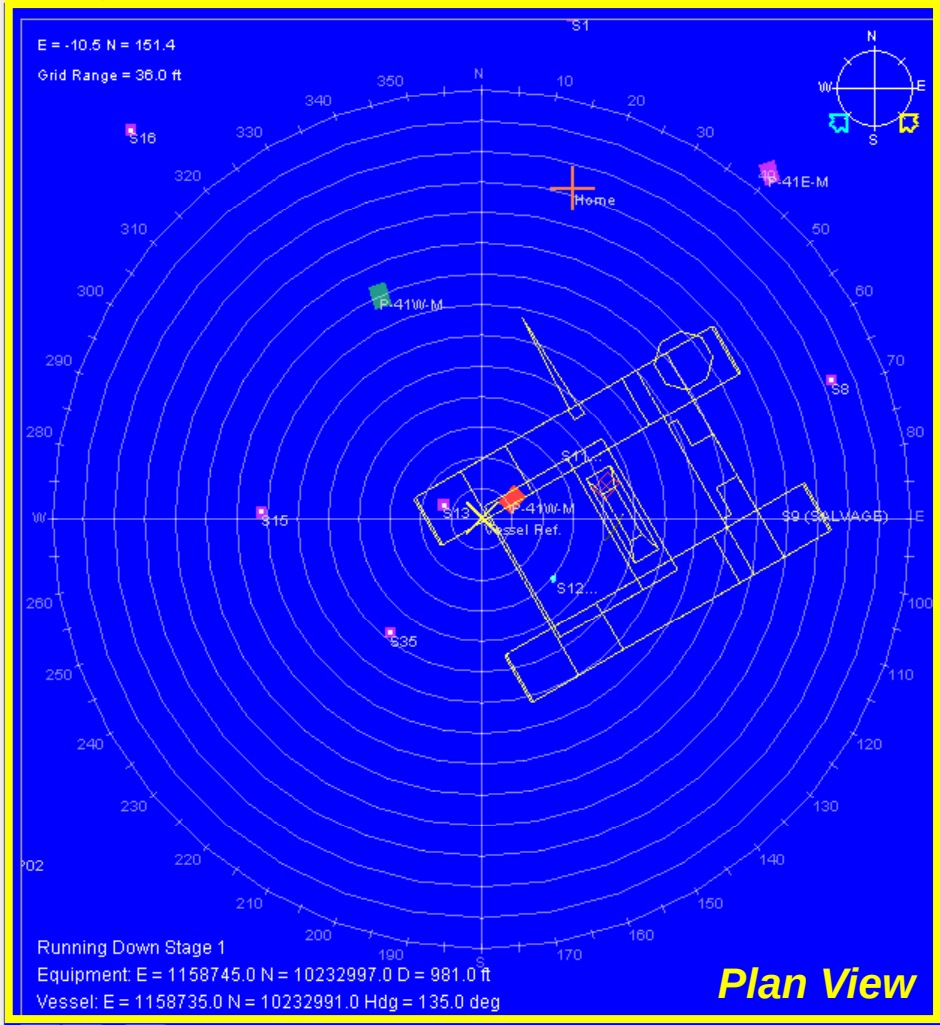
Operating Mode: Set

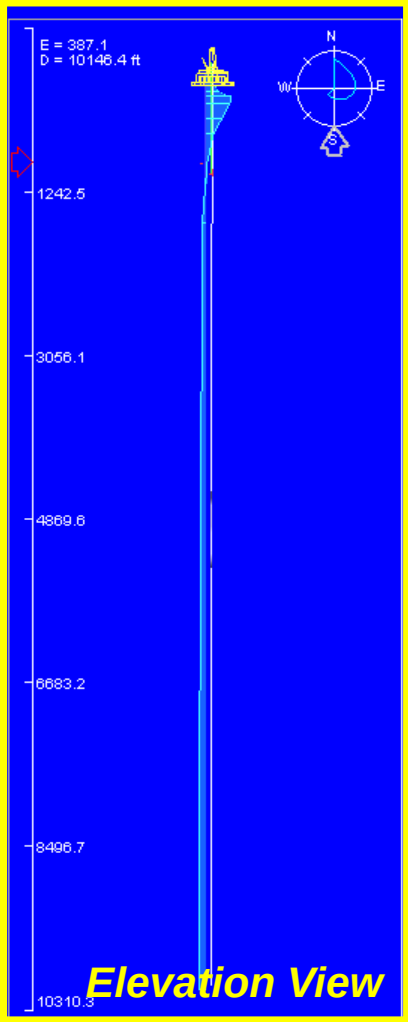
Analysis Type: Installation

Launch RIM

Dynamic Display

Schematics | Detailed Results | Progress





Current: 45.0 deg, 1.5 knots Wind: 135.0 deg, 15.0 knots Wave: 135.0 deg, 0.0 ft

Displayed Results for Installation Analysis of Manifold - P-41W-M, last run on Thursday, January 31, 2008 12:34:04.

Riser Setup | Vessel Setup | Environment | Equipment Database | Display Settings | Analysis

Installation Results Summary

Analysis Riser State: Deployed, Connected

Recommended Vessel Position and Heading to Land Subsea Equipment at Target Location:

Easting:	1158733
Northing:	10232986
Heading:	119.151 deg
Offset:	101.335 ft
Bearing:	299.055 deg

Connected Riser Results at Recommended Vessel Position:

UFJ Angle:	3.571 deg
LFJ Angle:	0.079 deg
Telescopic Joint Stroke:	50.377 ft

Minimum Clearance Parameters:

Heading for : All Headings

Maximum Clearance Parameters for Selected Heading:

Stage	60.0	75.0	90.0	105.0	120.0	135.0	150.0	165
1	70.8	78.0	84.1	88.7	91.8	93.3	93.4	91
2	102.2	110.6	117.9	123.8	128.1	130.6	131.5	130
3	70.1	77.8	84.3	89.4	93.0	95.1	95.6	94
4	81.2	80.3	77.9	74.0	68.8	62.2	54.5	46
5	130.8	128.6	124.6	118.9	111.8	103.4	94.2	84

Results Summary

Limits and Timings

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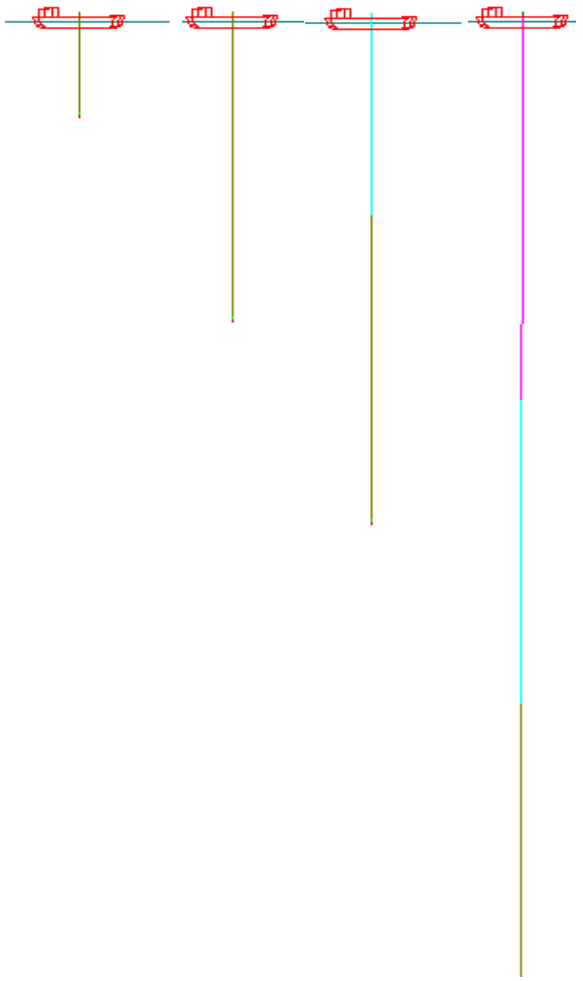
Example – Running Casing

- Installation of 36” casing
- Drilling riser deployed
- 10,000 ft water depth
- 10 installation stages examined
  - User specifies length of casing run for each stage
- At each stage:
  - Clearance between riser and casing examined
  - Recommended heading to maximize clearance calculated by tool

Casing Running Example – Overview

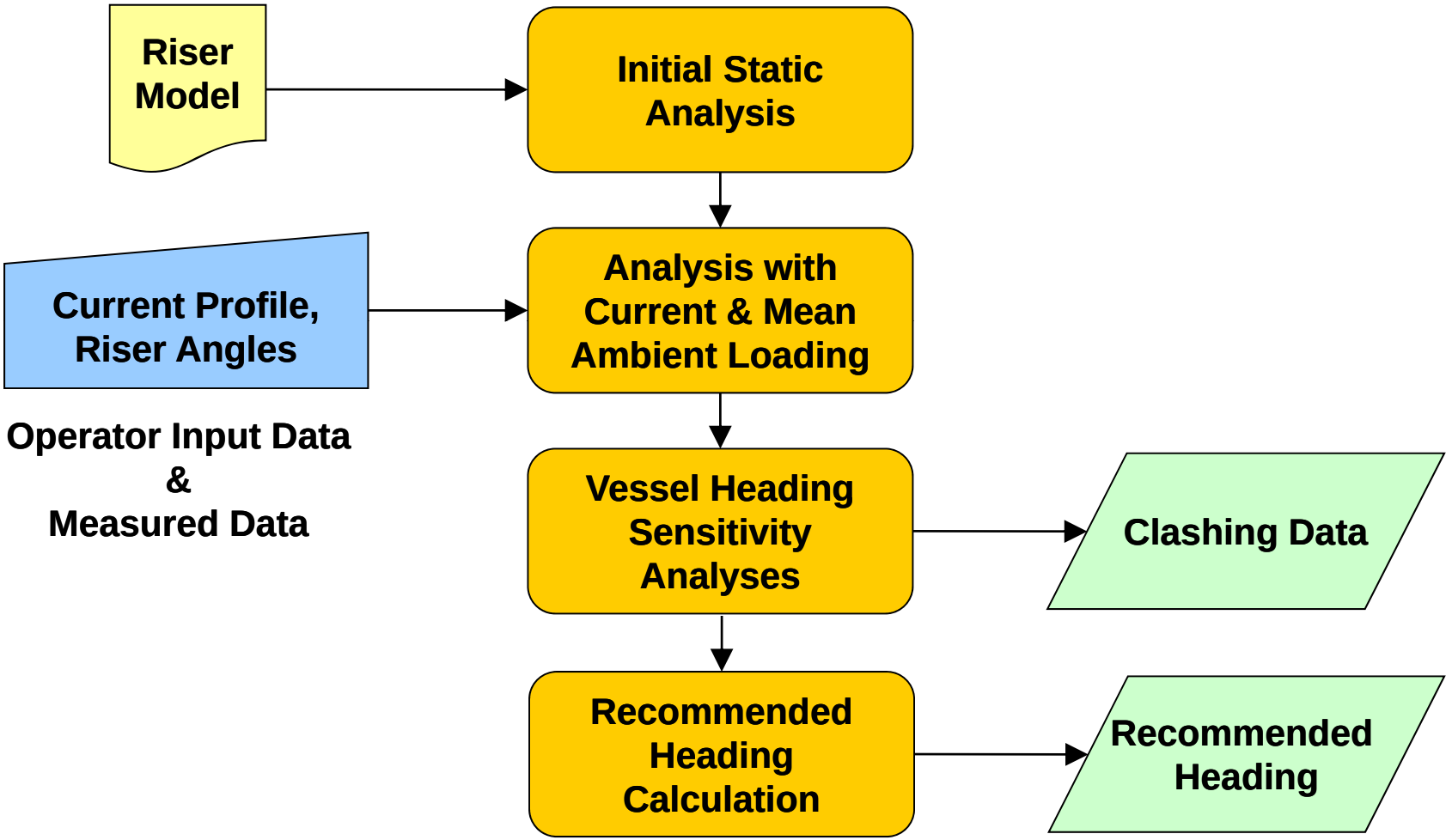
- Numerical (FE) model of riser & casing
- Range of casing running depths analyzed
  - Models for each configuration automatically generated
- Input data – combination of measured and operator specified data used
  - Current profile – ADCP
  - Riser profile – riser angle data



Casing Running Example – Input Data

Input	Source
Vessel Data:	
Vessel Position & Heading	DP System / DGPS & Gyrocompass
Riser Data:	
Top Tension	Tensioner System
Mud Weight	BOP Mux
Telescopic Joint Stroke	Tensioner System
Casing Data:	
Casing Running Down Depths	Operator Input
Clearance Tolerance with Riser	Operator Input
Environmental Data:	
Riser Angle Data	ERA System
Current Profile	ADCP

Casing Running Example – Procedure

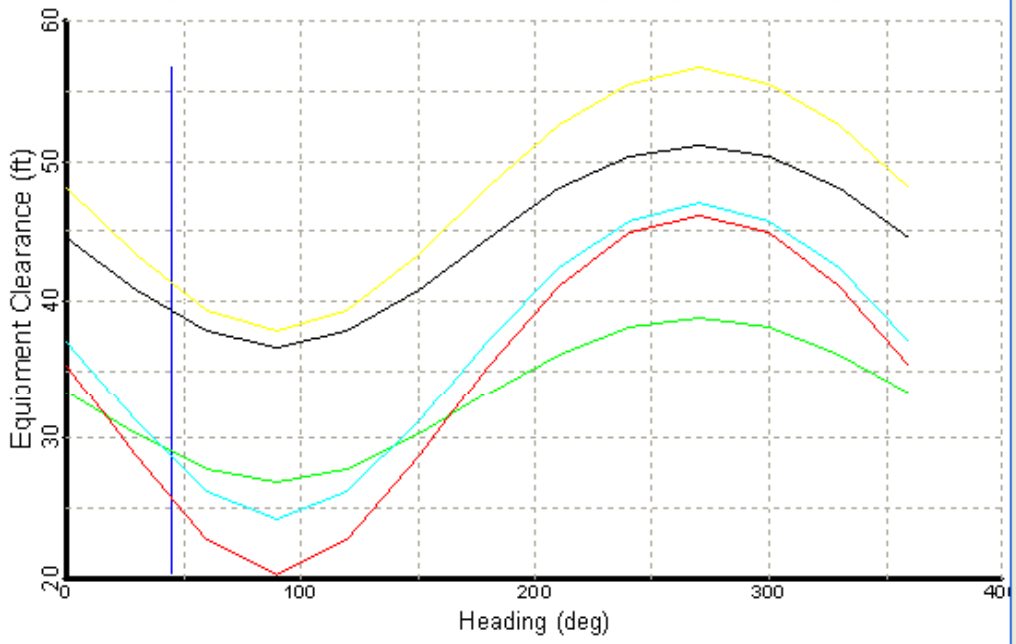


Schematics | Detailed Results | Progress

Recommended Headings at each Installation Stage

	Heading (deg)	Max Clearance (ft)
Stage 1	270.0	38.9
Stage 2	270.0	51.3
Stage 3	270.0	47.0
Stage 4	270.0	46.2
Stage 5	270.0	56.7

Fig. 1: Equipment Clearance v Heading, Stage No. 1 - Stage No. 5



--- True Vessel Heading = 45.0 deg
--- Stage No. 1, Depth = 1000.0 ft
--- Stage No. 2, Depth = 2000.0 ft
--- Stage No. 3, Depth = 3000.0 ft
--- Stage No. 4, Depth = 4000.0 ft
--- Stage No. 5, Depth = 5000.0 ft

Analysis

Settings | Drag Factors | Installed Equipment | Options | Database

Riser Setup

Seabed Connection	S3
Riser Status	Deployed, Connected
Top Tension	2000 kips
Mud Weight	8.56 ppg
Mean TJ Stroke	30.0 ft

Analysis Installation Inputs

Installation Type	Casing

Installation Inputs

Equipment Type	Manifold
Equipment Subtype	<none>
Installation Tool	36x1.0inch-Casing X52A Stac
Installation Method	Auxiliary Rotary
Destination Wellhead	S1
Installation Heading	Recommended Heading

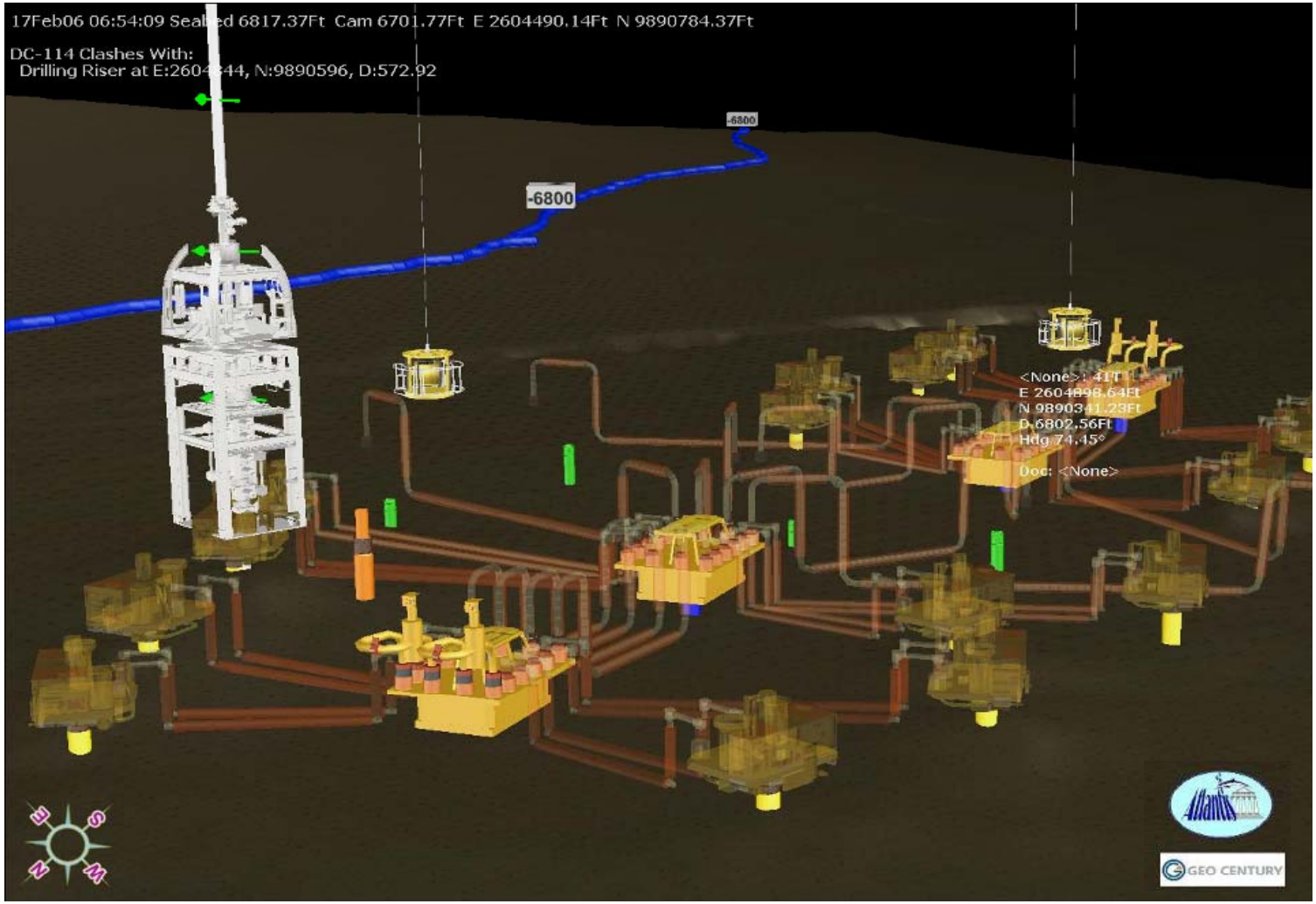
Installation Stages

Step Running Down	Running Down Depth (ft)
1	1000
2	2000
3	3000
4	4000
5	5000
6	6000
7	7000

Check...

Run | Cancel

Export for Visualization



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Conclusion

- **Onboard simulator** provides capability to plan SIMOPS in prevailing/forecast environment
- **Minimizes risk** of operations through planning
- **Maximizes operating window** – through use of actual metocean conditions
- **Deployed** on 6 vessels to date

Authors & Acknowledgements

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