



Installation Methods and Analysis

Main Questions

- What do we need to install?
 - Flexible riser or an umbilical
 - Subsea packages (eg. Manifolds, PLETs, etc)
 - Flowlines, pipelines, rigid risers
 - Topsides
- What type of vessel is available?
- What is the most severe weather we can tolerate?
- How can we safely minimise the cost?



Installation Methods and Analysis

Typical Installation Operations

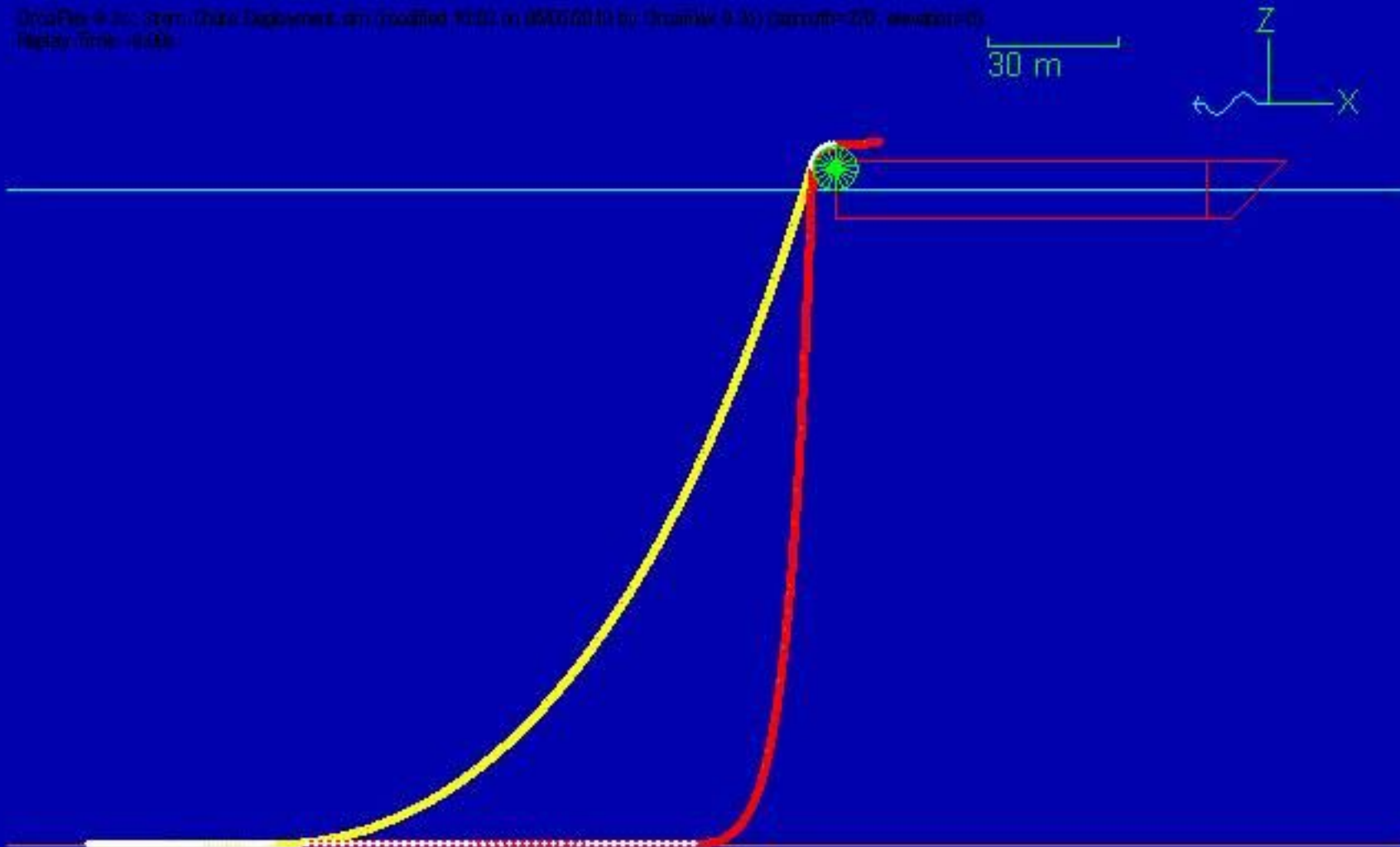
- Lowering a riser or umbilical over a stern chute
- Lowering a riser or umbilical through a moonpool
- Transfer of a riser/umbilical from an installation vessel to a floating platform
- Lowering a subsea package

Questions: What do we need to guard against?

What determines if a procedure is acceptable?

Installation Methods and Analysis

Lowering over a Stern Chute 1





Installation Methods and Analysis

Lowering over a Stern Chute 2

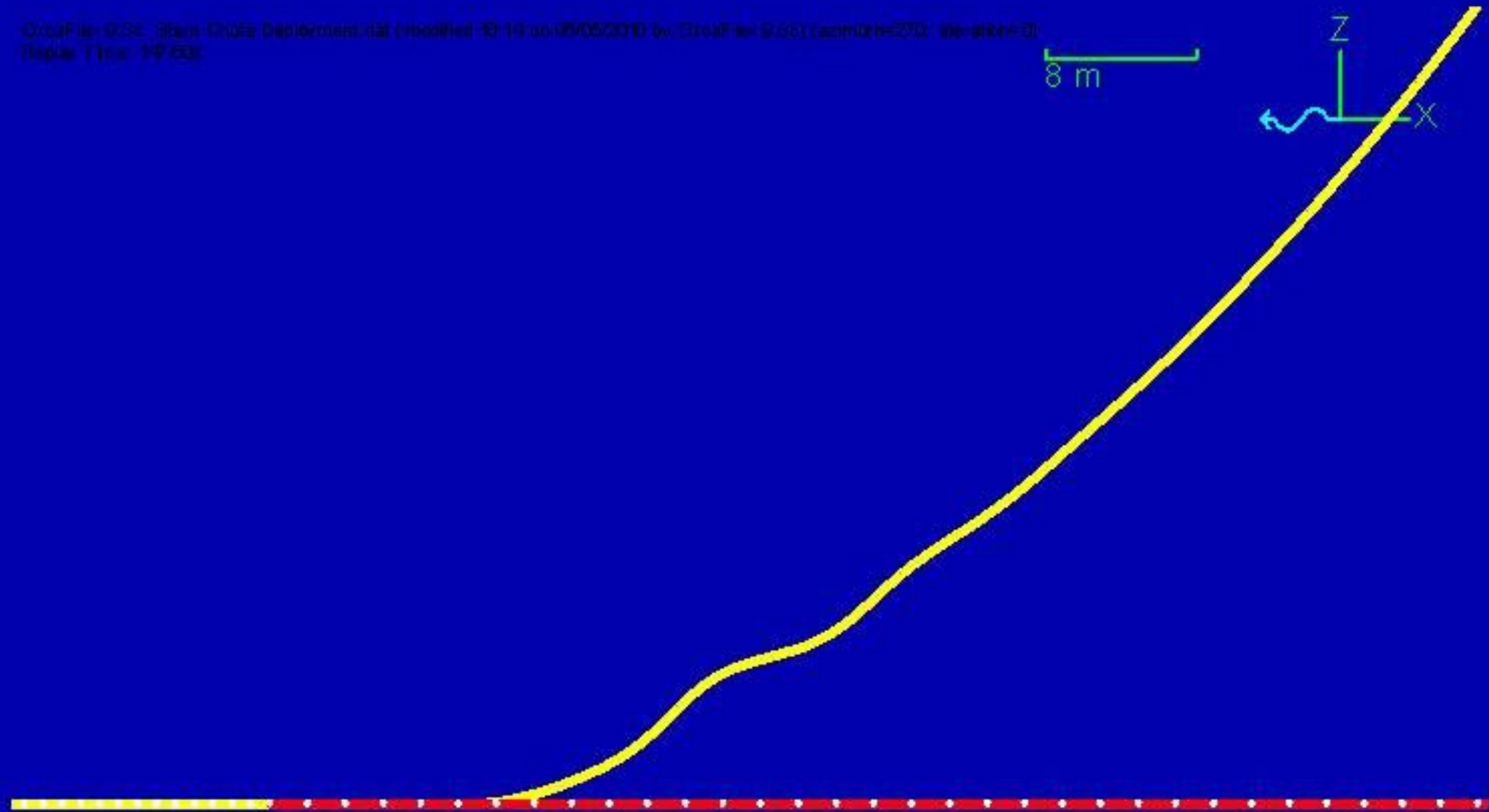
- Advantages: simplicity, vessel availability
- Problems: pitch-heave coupling, compression, vessel holding capacity
- Riser Limits: tension, curvature, compression
- Mitigation: adjust layback



Installation Methods and Analysis

Compression Wave at Touchdown

Orcina File: 024 - Base Study - Deployment (modified 10/11/00) (05000000) by Orcina File: 024 (modified 04/2001) - 06/06/01
Base Title: 14/03

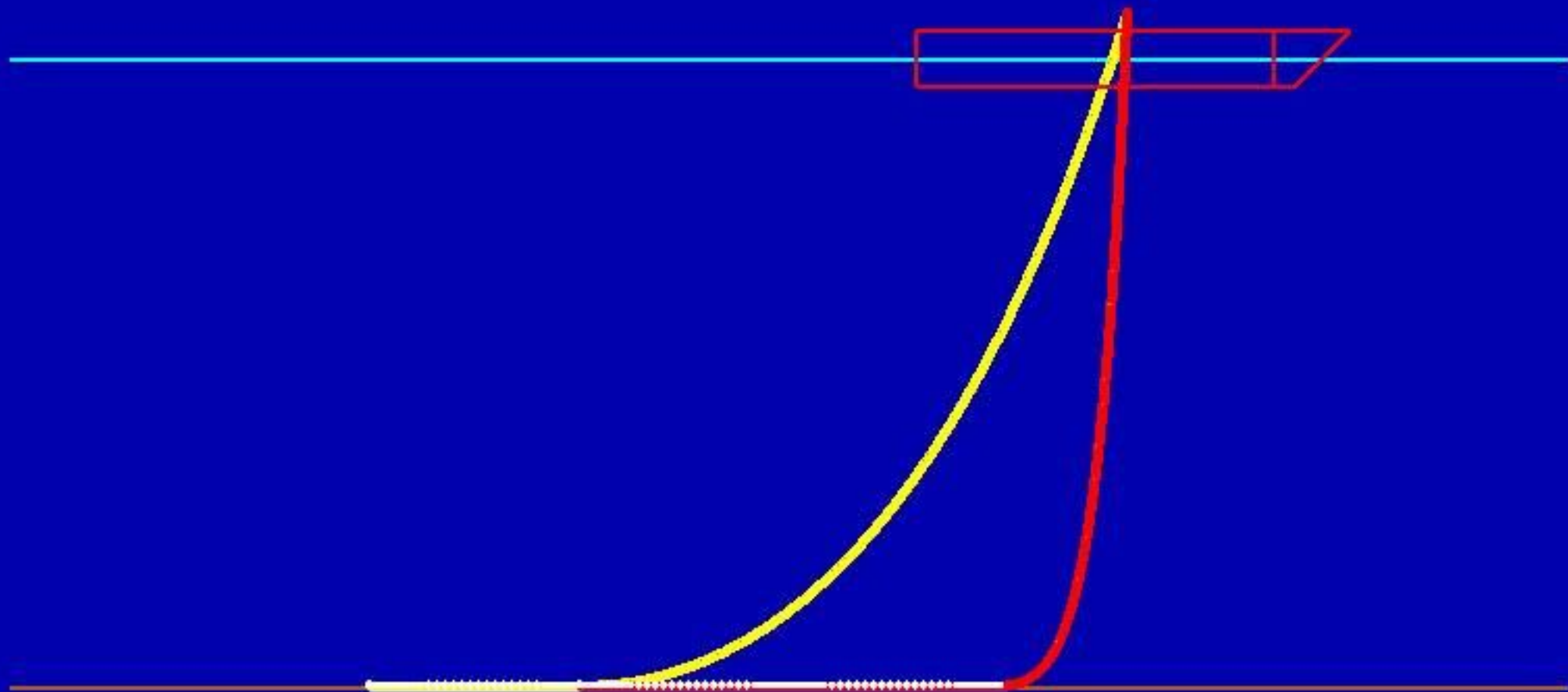




Installation Methods and Analysis

Lowering through a Moonpool 1

Created by: Moonpool Installation of (model) 1019 on 02/02/2010 by Orcina (version) 372 - revision 0
Status: Complete





Installation Methods and Analysis

Lowering through a Moonpool 2

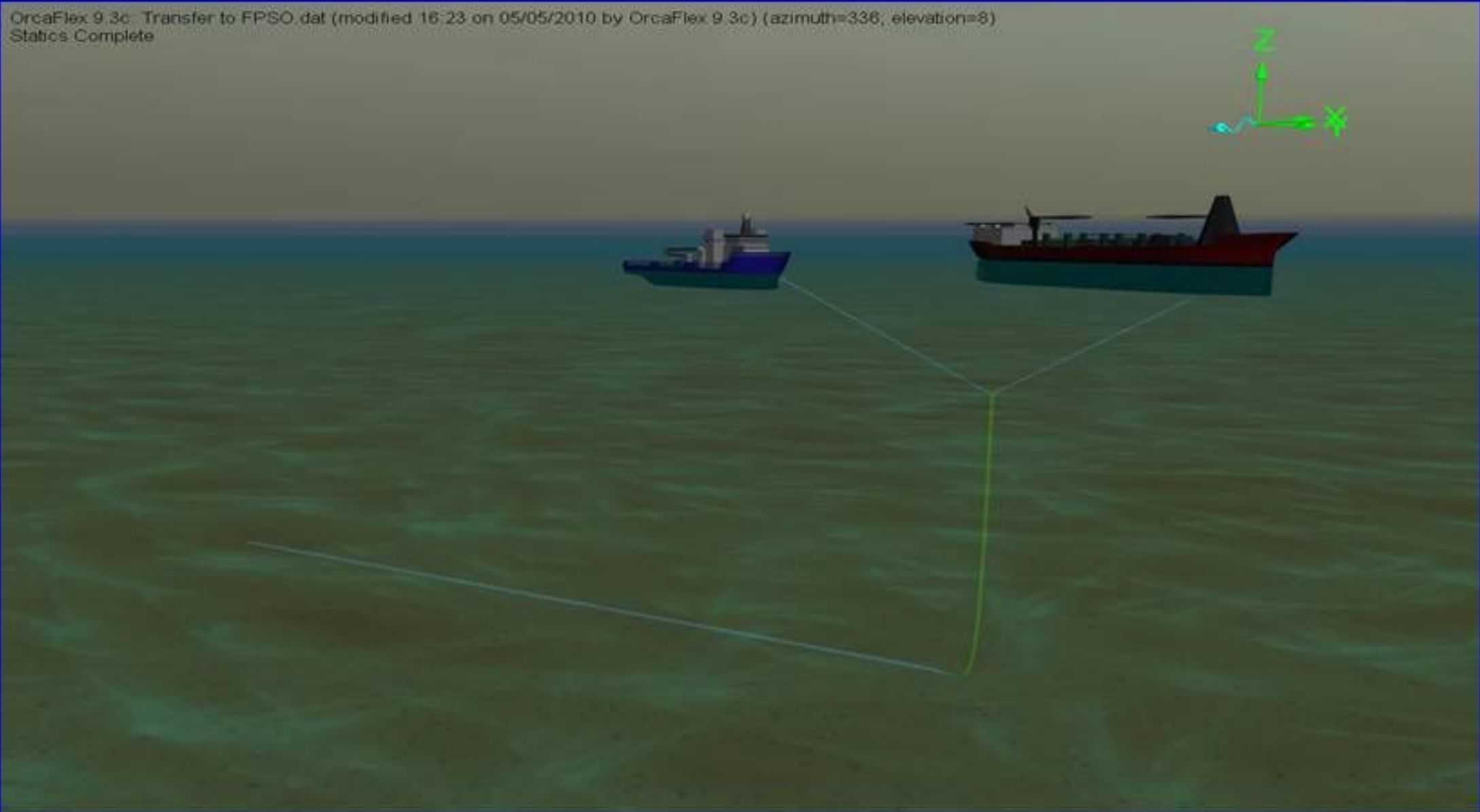
- Advantages: Lower top end motions
- Disadvantages: Reduced vessel availability and therefore higher cost

Controlling factors are the same as for lowering over a stern chute

Installation Methods and Analysis

Transfer from Installation Vessel to Platform/FPSO 1

OrcaFlex 9.3c: Transfer to FPSO.dat (modified 16:23 on 05/05/2010 by OrcaFlex 9.3c) (azimuth=336, elevation=8)
Statics Complete





Installation Methods and Analysis

Transfer from Installation Vessel to Platform/FPSO 2

Issues:

winch capacity,
contact with vessel hulls,
tension and curvature in riser,
compression at touchdown

for I-tube pull-in:

friction loads
possibility of pull head jamming



Installation Methods and Analysis

Lowering a Subsea Package 1

- For example: manifold, template, line end terminations, any heavy equipment
- Three main stages:
 1. splash zone
 2. lowering through water column
 3. Touchdown

Each with its own problems.



Installation Methods and Analysis

Typical Lowering Arrangement 2

Orcina v. 4.0 - Suspended Package (modified) (0.2) on 0.100m (0) by Orcina v. 4.0 (0.100m) (0.100m) (0.100m)
Date: 01/01/09





Installation Methods and Analysis

Package Lowering 2

- **Concerns**
 - Splash Zone: slamming loads, slack rigging
 - Lowering: resonance effects, slack rigging
 - Touchdown: excessive motion, contact loads
- **Mitigation**
 - Splash Zone: Use vessel as a shield, lower fairly quickly
 - Lowering: Heave compensation devices, irregular wave analysis
 - Touchdown: Heave compensation devices, additional buoyancy to slow fall



Installation Methods and Analysis

Pipelay

Graphic 4.44: Pipeline installation method (red line) at 07 Nov 10 by Orcina 4.0 (2010) (2010) (2010)
Reply Time: 4000s

50 m



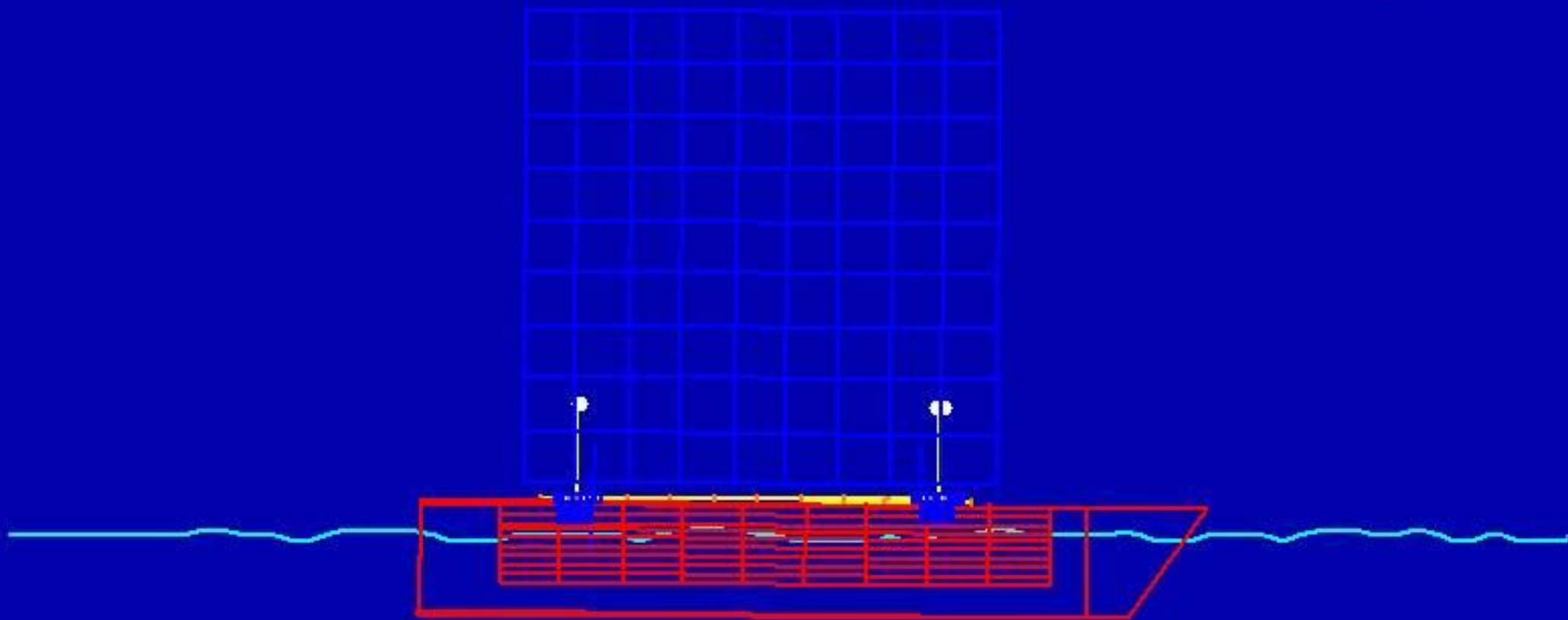


Installation Methods and Analysis

Floatover

Graphic 4-4-4: Floatover on gridded (107 m (349 ft) x 19 by 19) by Graphic 4 (c) (gridm170, wwidth10)
Time: 00:00:00

20 m





Installation Methods and Analysis

Conclusion

- Very brief review of a large subject
- Many types of operation have been omitted and details glossed over
- If you have questions please ask either:

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