

Marc Jeroense, ABB AB High Voltage Cables, 2010-03-23

Energizing the Gjøa Oil and Gas Platform with a Dynamic Power Cable

Contents

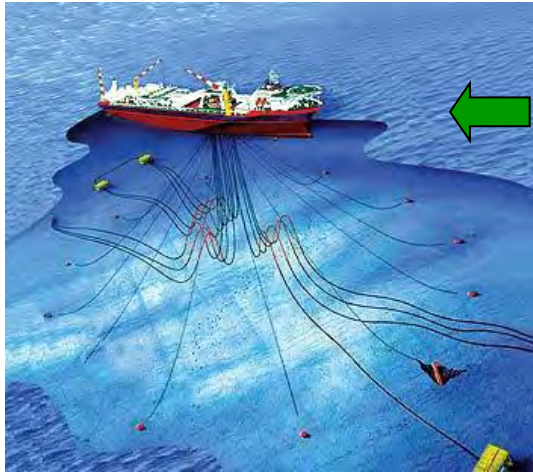
- Examples on applications
- Commercial project Gjøa
- Technology – floating platforms
- Technology – cable system specifically
 - Cable design
 - Joint design
- Development
- Qualification
- Future

Examples on applications

- ← PFS – Power From Shore
- PTS – Power To Shore



SEMI*



FPSO*



Floating wind power

*SEMI – Semi Submersible
FPSO – Floating Production , Storage and Offloading

Commercial project Gjøa

- **Customer**

- StatoilHydro ASA

- **Scope**

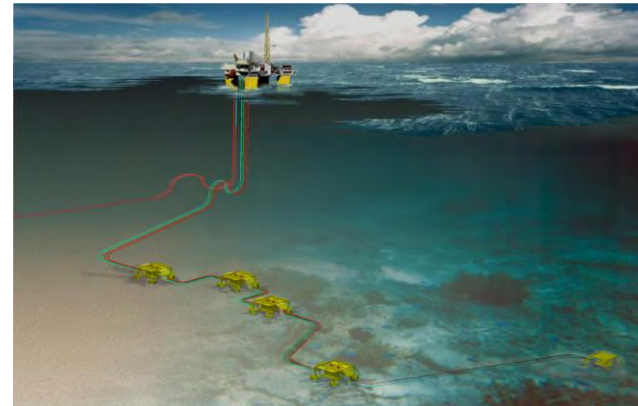
- Cable from Norway (north of Bergen) to new built production platform, Gjøa
- 100.5 km 115/123 kV subsea cable, Turnkey
- 99 km 3x240 mm² static cable +
1.5 km 3x300 mm² dynamic cable to floating platform

- **Time schedule**

- Contract Award June 2007
- Delivery schedule:
 - Cable laying: Spring 2010
 - Hook up to platform Spring 2010

- **Other facts**

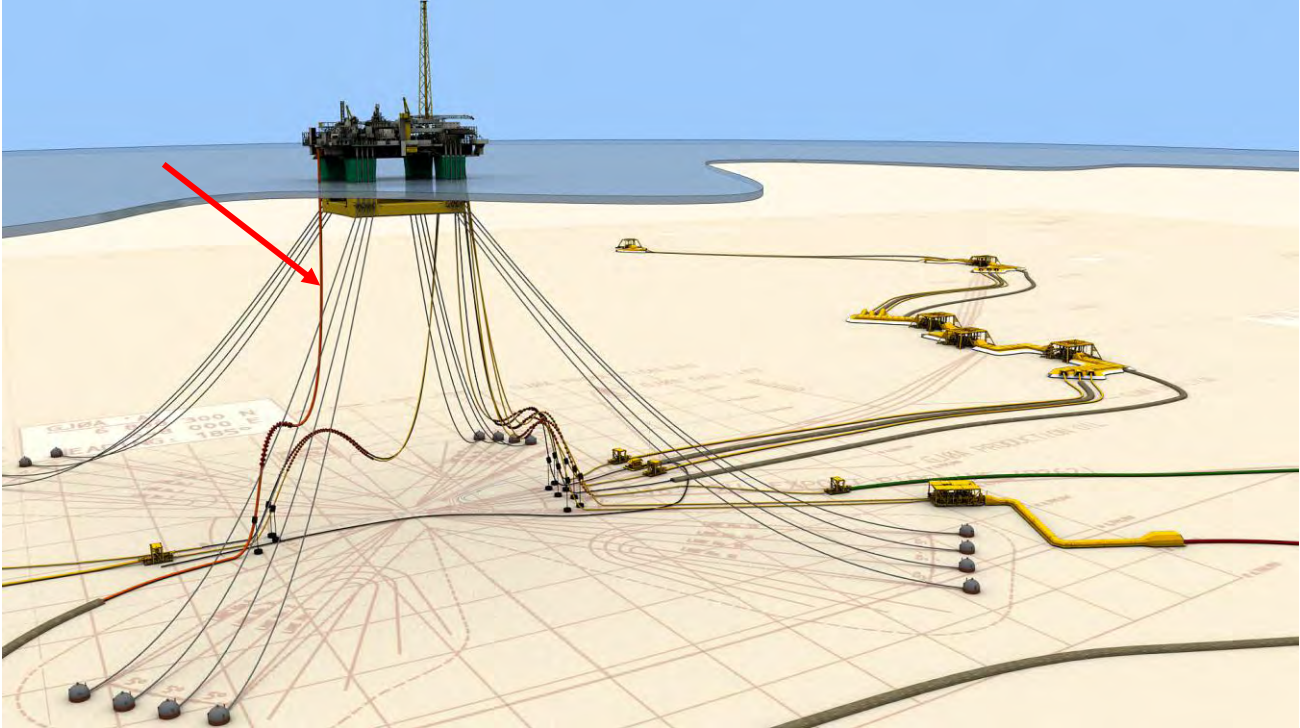
- 40 MW peak consumption
- CO₂ reduction
 - A line of cars from Oslo to Stavanger (300 km – 188 miles)
 - Bumper to bumper
 - Always driving



Commercial project Gjøa

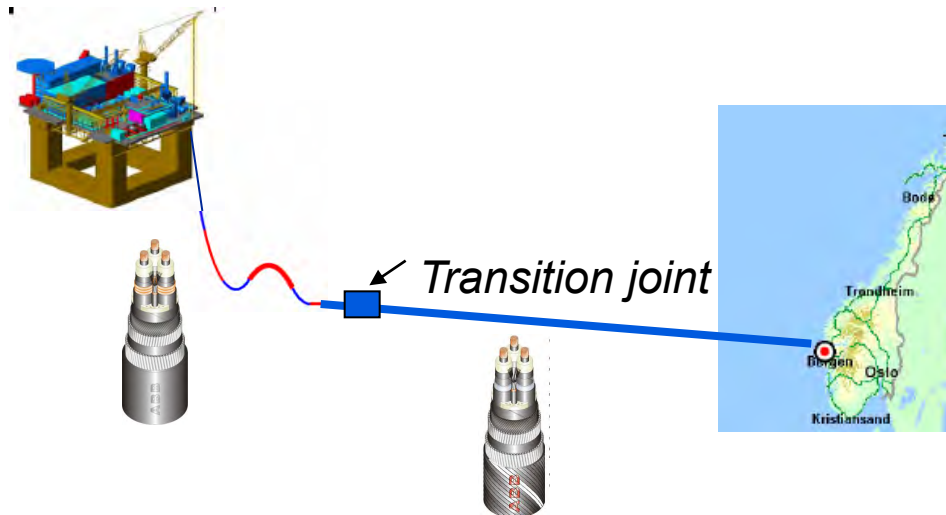


Commercial project Gjøa



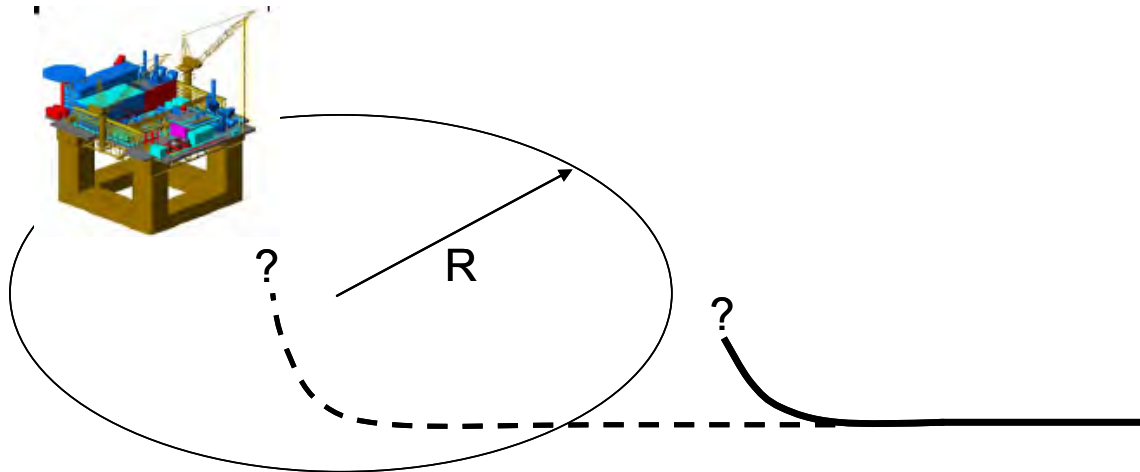
Technology – general

- Example from PFS
 - Long static cable
 - Short dynamic cable
 - Transition joint
 - Dynamic cable in a **configuration**

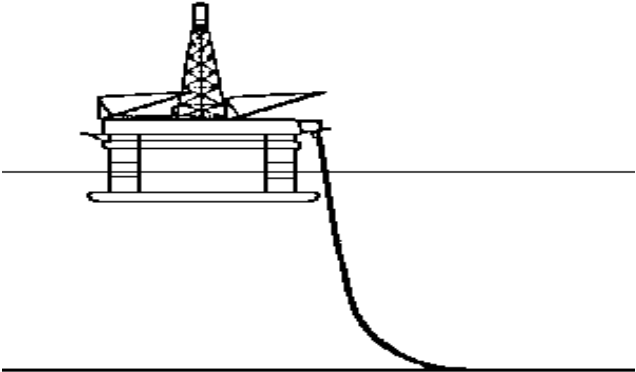


Technology – general: configuration

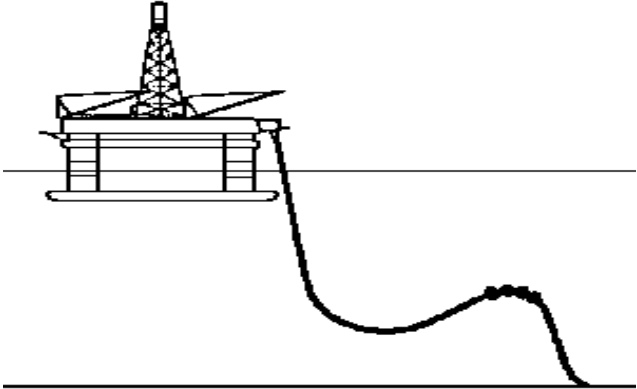
- Why do we need a "configuration"?
 - Platform floating around its mid-point center with radius R
 - Cable has to "follow"



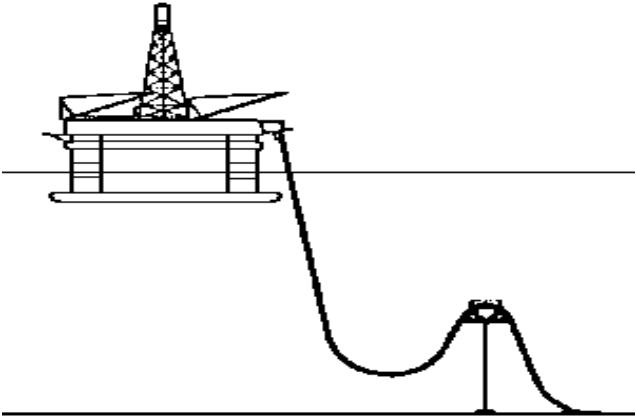
Technology – general: configuration



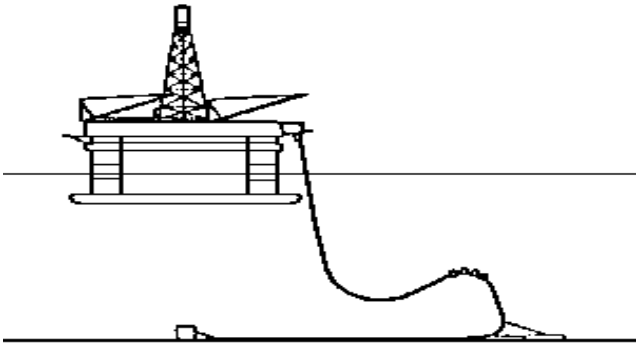
Free hanging



Lazy wave

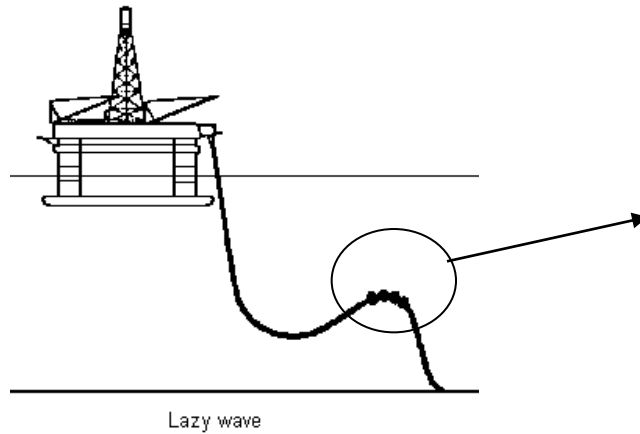


Lazy S



Pliant wave

Technology – general: buoyancy modules



- Buoyancy modules come in all sizes
 - Typical for the Gjøa project
 - 420 kgf lifting force per module
 - 70 modules
 - 1 kN/m lifting force over 250 meters

Technology – general: bending stiffener

- The stiffener increases the bending stiffness of the cable locally
 - Defines minimum bending radius at top location during
 - extreme weather conditions
 - Recurrent wave motions

- Large dimensions
 - Gjøa stiffener
 - 8 m length
 - 1 m base diameter



Technology – cable system specifically: cable design

- Static cable

- Lead sheath
- Weight/Diameter ratio not important
- Polypropylene yarn



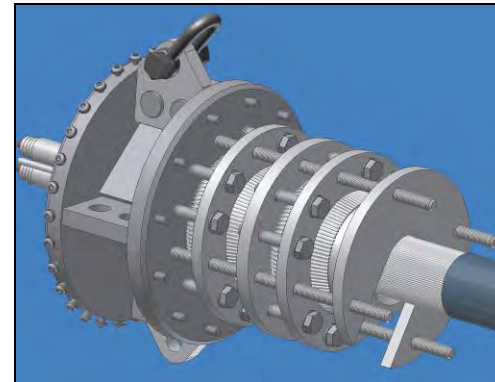
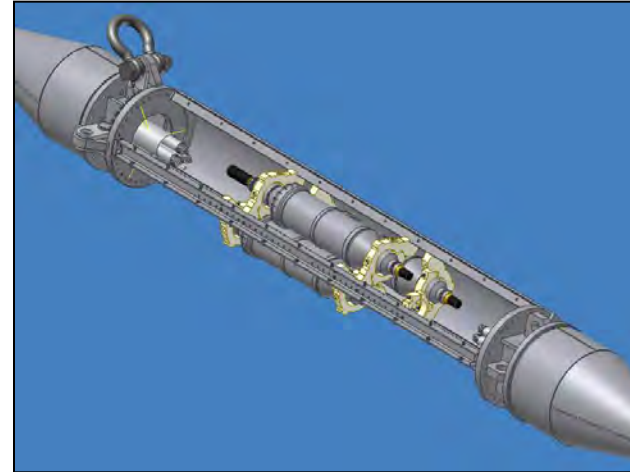
- Dynamic cable

- Corrugated welded copper sheath
- Weight/Diameter ratio important: high
- Polymer outer sheath



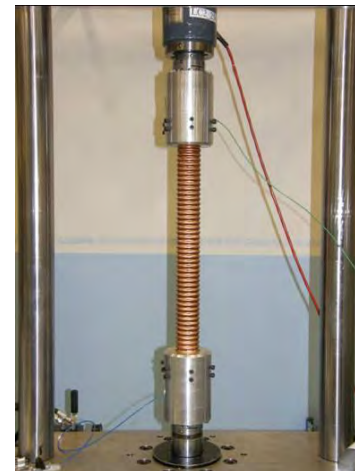
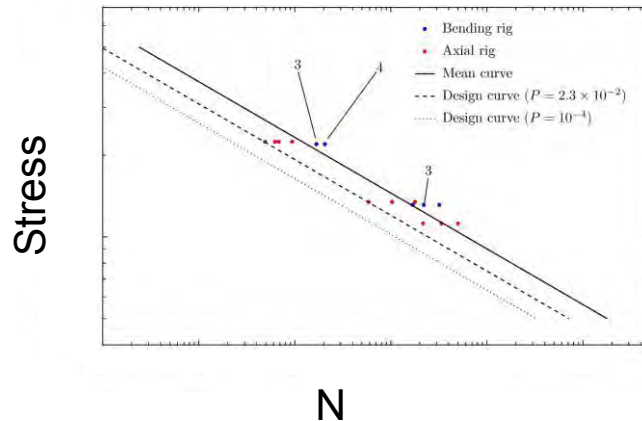
Technology – cable system specifically: joint design

- Three phase joint.
- Every phase electrically jointed with standard joint
- Every phase water tighted by means of welded stainless steel case
- Cable double armouring terminated on outer case



Development – cable

- Focus on fatigue properties of welded sheath
- Specially designed test rigs
- Results in a S/N design curve
 - Mechanical stress versus number of movements

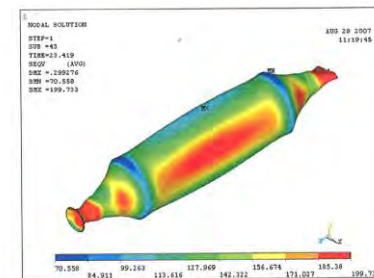


Development – joint

- Design depth 600 m
- Pressure withstand tests of the cable cores
- Water tight up to at least 90 Bar



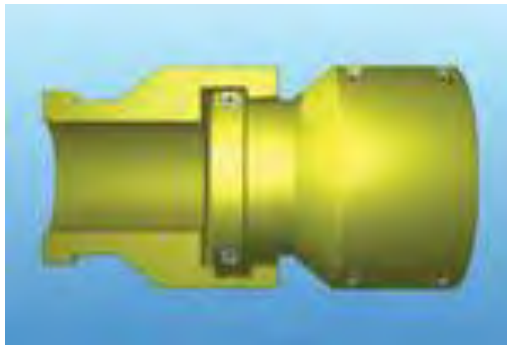
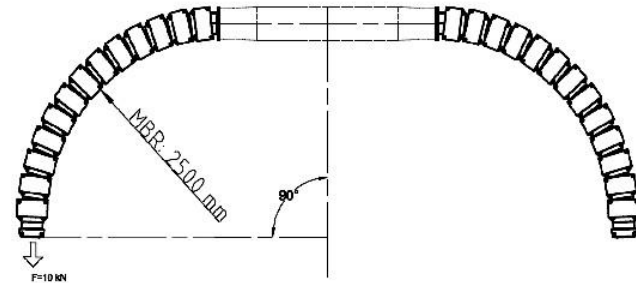
- Pressure withstand tests of the cable joint
- Water tight up to at least 90 Bar



Figur 5, Spänningsfördelning (VM) vid kollapslast 234 bar.

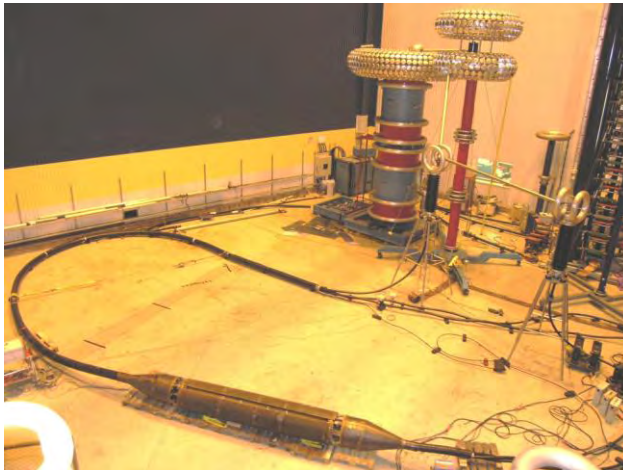
Development – joint

- Bending restrictors
- Limit the bending radius of the cable ends next to the joint during handling and installation



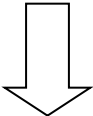
Qualification

- Mechanical type test
 - CIGRE Recommendations
- Electrical type test
 - IEC 60840
- Flex test
 - API 17J

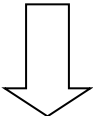


Future

- Larger depths



- More floating structures



- More dynamic cables

