Welcome to the FER Forum

Agenda

Agenda FER forum June 5th, 2024

Time	Activity	Presenter	Company
8:00 - 8:30	Registration and coffe/tea		
8:30 - 10:15	**North Sea perspectives**		
	Opening of Forum	Vegar Johansen	SINTEF
	A Norwegian perpective on the energy future of the North Sea	Simen Moxnes	Equinor
	Technical challenges for floating energy systems in the North Sea	Jan van Kessel	Shell
	Offshore energy outlook	Mahnaz Hadizadeh	DNV
	Panel discussion	SO, DNV, EQ	
10:15 - 10:40	Break		
10:40 - 12:00	**From innovation to industrialization**		
	Capacity challenges in developing large scale floating wind	Helena Nielsen	Aker
	From one-off FPSO design to mass production of FOWT	Otto Skjåstad	Sevan
	Motivations to use composites for Floating Offshore Units	Stephane Paboeuf	BV
12:00 - 13:00	Lunch		
13:00 - 14:30	**Electrification of offshore installations**		
	O&G Electrification – a Pathway for Industrial Floating Wind	Tim Hunter	Flotation Energy
	Electrification case studies: from offshore charging buoy to FPSO emission reduction	Amir Izadparast	SOFEC
	Hywind Tampen experiences	Herbjørn Haslum	Equinor
	SwitchH2/BWO Green Ammonia FPSO	Bob Rietveld + Fredrik Savio/Morten Hova-Forsberg	SwitchH2 & BWO
14:30 - 15:05	**New JIP pitches**		
15:05 - 15:30	Break		
15:30 - 18:00	**Technical visit to Sintef Ocean wet laboratories**	The visit will include a demonstration of cyber-physical testing in the ocean basin and a presentation of the new Norwegian Ocean Technology Centre.	
19.00 - ..	Dinner		

New JIP Pitches

Floating Energy Research Forum

New JIP pitches

	JIP Pitches		
14:30	SheathFlex	Delphine Rigaud	BV
14:35	HoliMoor JIP	Alexandre Kane	Sintef/NTNU/Equinor
14:40	Riser retrofit sensor network for lifetime extension	Karsten Husby	Sintef
14:45	DROPS JIP Phase III	Egil Giertsen	Sintef
14:50	LWR JIP Phase III	Jie Wu	Sintef
14:55	MAPLES JIP	Jie Wu	Sintef
15:00	LEAP JIP	Jule Scharnke / Erik Jan de Ridder	MARIN
15:05	end		

JIP

QUALIFICATION METHOD OF PRESSURE SHEATH AND OUTER SHEATH MATERIAL IN UNBONDED FLEXIBLE PIPE

5 JUNE 2024

SheathFlex

QUALIFICATION OF PRESSURE AND OUTER SHEATH MATERIALS

CONTEXT

Several standards available for qualification of materials for pressure sheath and outer sheath:

API 17J:

List of required small scale tests but not representative of actual conditions

API 17B:

List of recommended full-scale tests but without a clear link with respect to those needed for pressure sheath and outer sheath material qualification

IOGP 645:

Recommendations for five full-scale tests to qualify an internal pressure sheath issued by operators and rejected by the three flexible pipe manufacturers

Lack of guidance/inconsistent requirements to qualify materials for pressure sheath and outer sheath (new materials or known material with extended ranges)

QUALIFICATION OF PRESSURE AND OUTER SHEATH MATERIALS

BV REFERENCES

FLEXIBLE PIPE PROJECTS REVIEWED BY BV

- Petrobras LAPA SW, MERO3, Pre-salt qualification, Iracema Sul, Reliance, Totalenergies CLOV jumpers, KAOMBO, EGINA, BP QUAD 204…
- API 17J Type Approval Certificates for TechnipFMC and NOV Flexibles.
- Involvement in projects for Pressure Sheath material qualification.

PUBLICATIONS

- **BV NI 364 Rev.1 2022**

Verification scheme of Unbonded flexible pipes

- **OTC 2022-31811**

Assessment of new materials in unbonded flexible pipes

BUREAU VERITAS PROPOSAL

JIP OBJECTIVES

Develop a guideline defining the requirements to qualify pressure sheath and outer sheath material for unbonded flexible pipe considering:

- **Pipe body**
- **end-fitting sealing system**

BUREAU VERITAS PROPOSAL

STUDY AND WORKSHOP SESSIONS

WP1

Methodology to qualify pressure sheath and outer sheath materials:

- Functional analysis
- Basis: Known/New material, fluids /applications,….
- Qualification-FMECA
- Qualification plan/test methods

⇒ Report WP1 with failure modes and tests associated

WP2

Test requirements and procedures

- Gap analysis between the API 17J/B and IOGP 645 proposed methods
- Minimum requirements and criteria for all tests and each material family and applications

⇒ Report WP2 : Tests procedure principles

WP3

Guideline for reliable unbonded flexible pipes pressure sheath and outer sheath material qualification

PLANNING BUDGET

Planned start by end of 2024 / beginning of 2025

- WPI – 2/3 worskhops
- WPII – 2 workshops
- WPIII ~ 6 months

Estimated budget 200 000 €

Fees equally shared

Fees depending on number of participants, manufacturers/operators

CONTACT

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New JIP pitches

	JIP Pitches		
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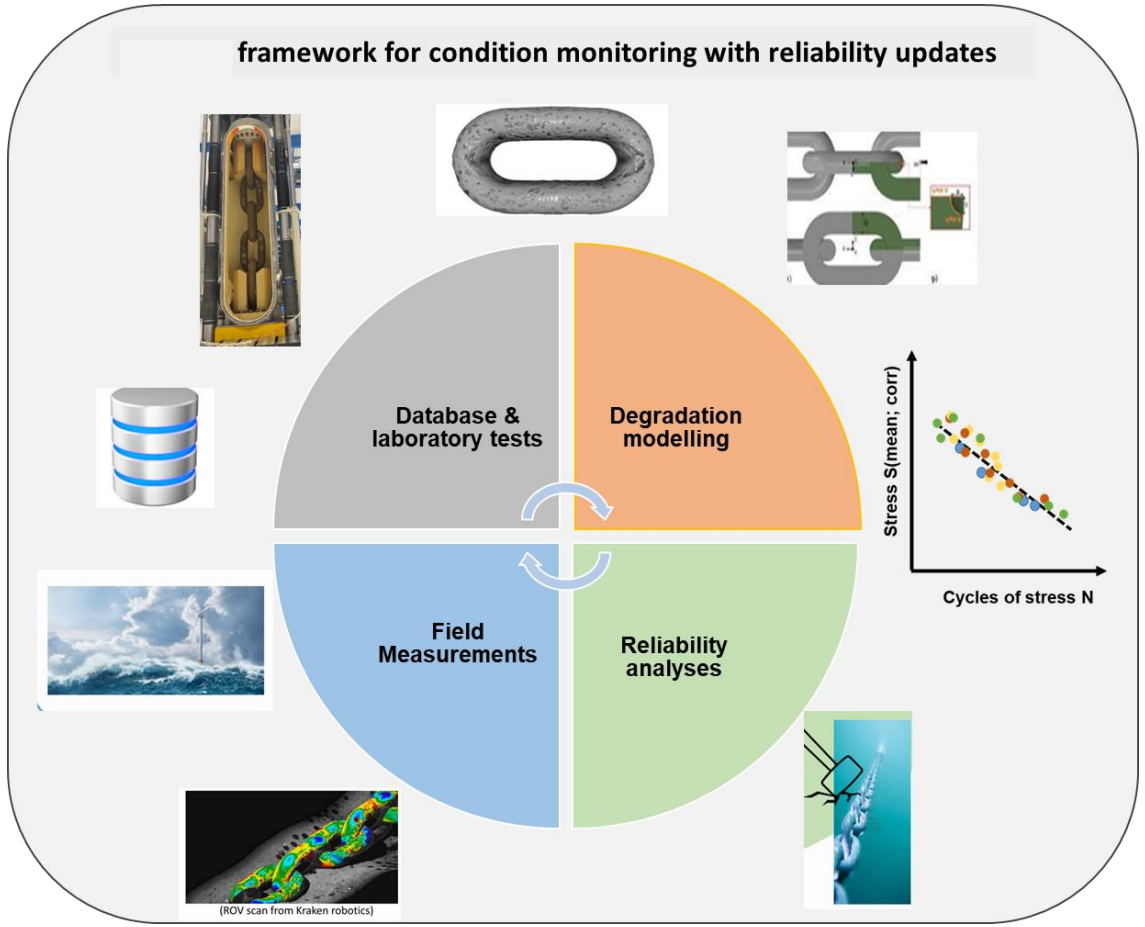
15:05	end		

JIP: holistic framework for fatigue and corrosion condition monitoring of mooring chains

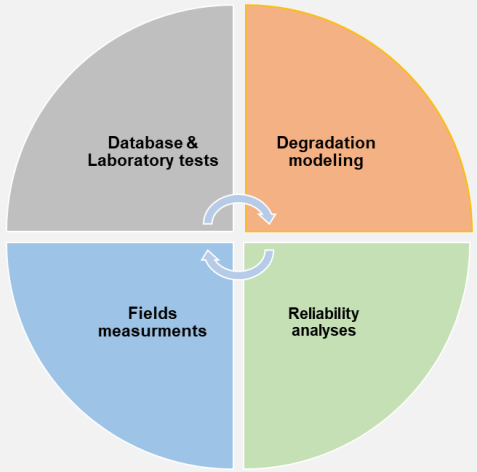


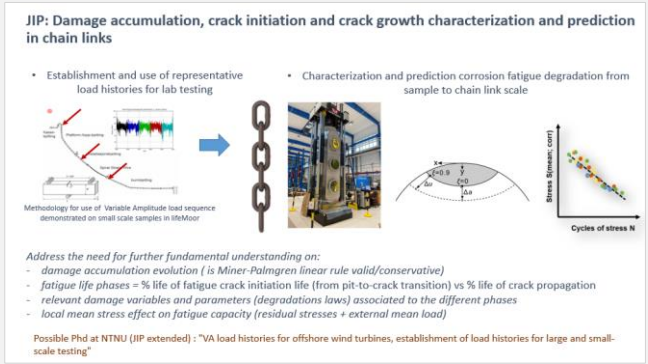
Research partners:

- SINTEF
- NTNU

Industry partners: Value chain industrials: from mooring chain manufacturers, suppliers to end-users e.q. energy companies

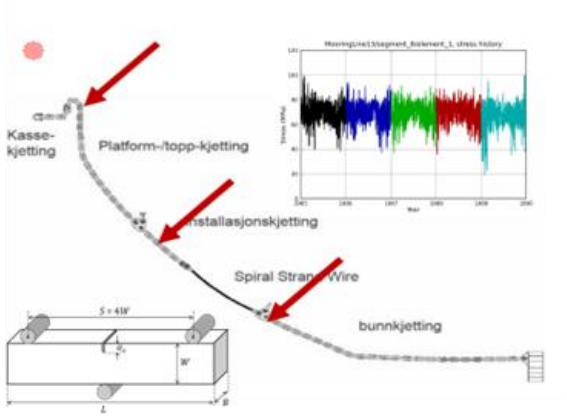
WP1: Damage accumulation, crack initiation and crack growth in chain links





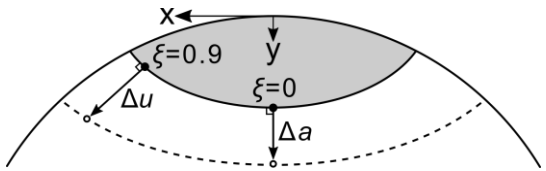
JIP: Damage accumulation, crack initiation and crack growth characterization and prediction in chain links

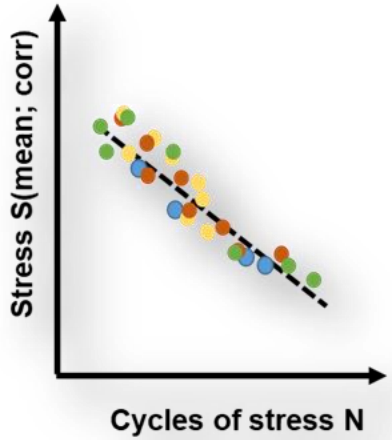
- Establishment and use of representative load histories for lab testing



Methodology for use of Variable Amplitude load sequence demonstrated on small scale samples in lifeMoor

- Characterization and prediction corrosion fatigue degradation from sample to chain link scale



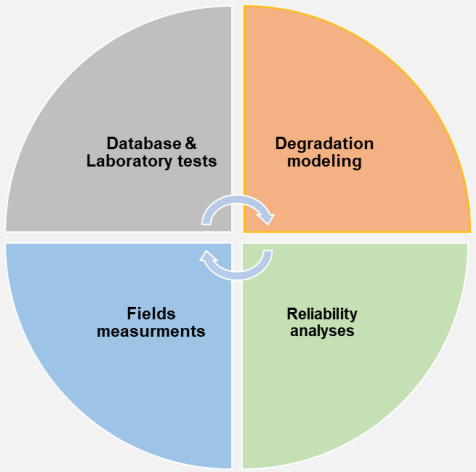


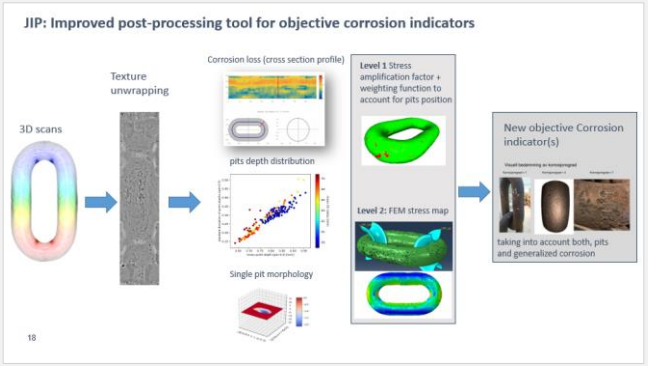
Address the need for further fundamental understanding on:

- *damage accumulation evolution (is Miner-Palmgren linear rule valid/conservative)*
- *fatigue life phases* = % life of fatigue crack initiation life (from pit-to-crack transition) vs % life of crack propagation
- *relevant damage variables and parameters (degradations laws) associated to the different phases*
- *local mean stress effect on fatigue capacity (residual stresses + external mean load)*

Possible Phd at NTNU (JIP extended) : "VA load histories for offshore wind turbines, establishment of load histories for large and small-scale testing"

WP2: Corrosion condition monitoring (objective corrosion indicator tool, an assessment with two levels of criteria)

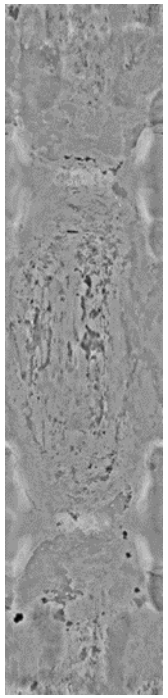




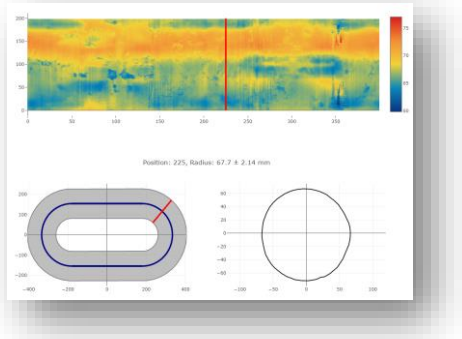
JIP: Improved post-processing tool for objective corrosion indicators

3D scans

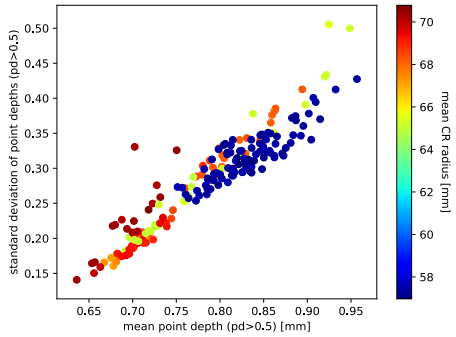
Texture unwrapping



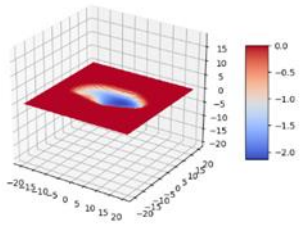
Corrosion loss (cross section profile)



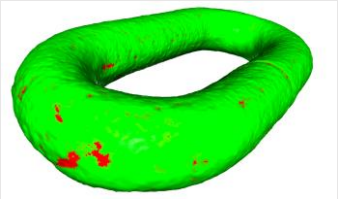
pits depth distribution



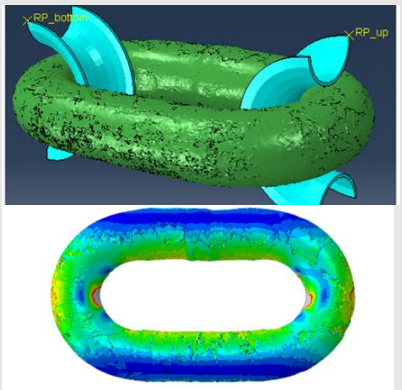
Single pit morphology



Level 1 Stress amplification factor + weighting function to account for pits position



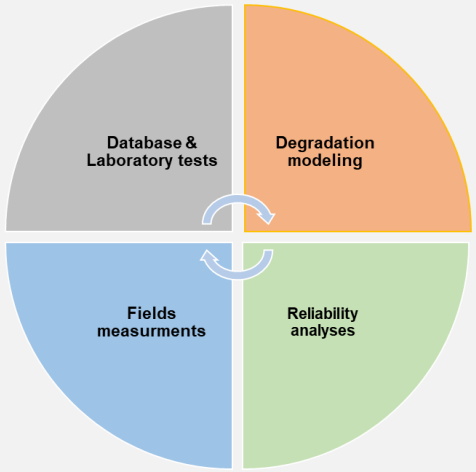
Level 2: FEM stress map



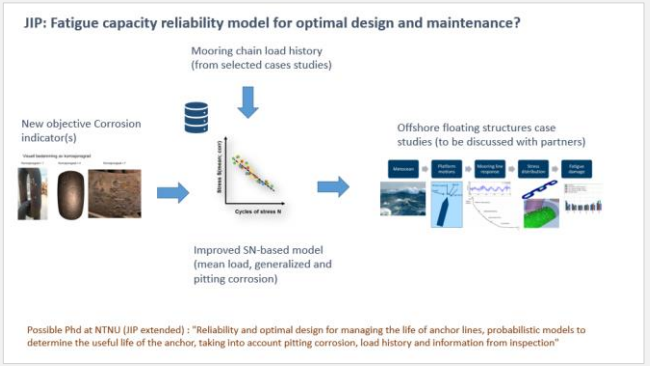
New objective Corrosion indicator(s)

taking into account both, pits and generalized corrosion

Fatigue capacity reliability model for optimal design and maintenance



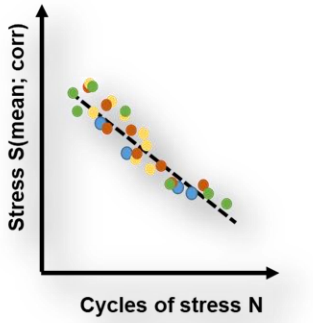
WP3-WP4: Improved SN-based probabilistic model & Case studies



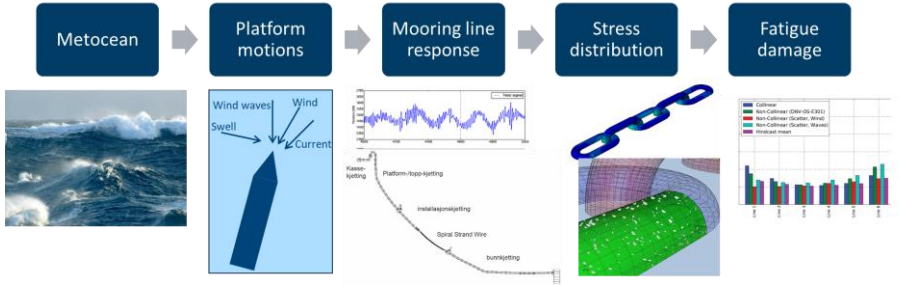
JIP: Fatigue capacity reliability model for optimal design and maintenance?

Mooring chain load history
(from selected cases studies)

New objective Corrosion indicator(s)



Offshore floating structures case studies (to be discussed with partners)

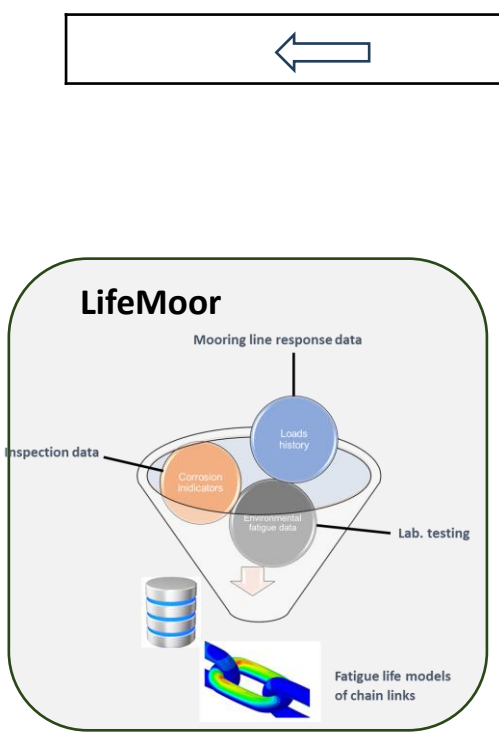


Improved SN-based model
(mean load, generalized and pitting corrosion)

Possible Phd at NTNU (JIP extended) : "Reliability and optimal design for managing the life of anchor lines, probabilistic models to determine the useful life of the anchor, taking into account pitting corrosion, load history and information from inspection"

Status of JIP proposal

- The JIP proposal phase 1 (2 years) is expected to start Q3 2024
- The JIP proposal phase 2 (2 years) is expected to start Q3 2026 (where an extension of the framework will be done enable the use of in-situ inspection data)
- A KSP proposal (4 years) will be submitted March 2025 to the RCN, to apply for 14MNOK extra funding



Status of JIP : proposal for JIP phase 1 (2 years)

- **Discussions with some potential industrial partners have been initiated (proposed activities are under adjustment based on industrial partners priorities).**
- **Today, the key deliverables planned in the JIP phase 1 are (scaled according to the project budget):**

✓ Report on the sequential loading effect (damage accumulation, crack initiation and crack growth in chain links).

✓ Report on the methodology and post-processing results for assessing of the corrosion degradation of chain links.

✓ Report on the new SN-based model (accounting for the mean load and corrosion influences).

✓ Report on case studies of practical lifetime assessment of mooring lines (to be further defined with partners).

✓ Access, during the project, to the web-service database framework and post-processing tools to structure and analyze their respective scans and fatigue data (at project termination, maintenance and support fee to be discussed with the interested partners).

- **Participation fee -** Energy companies: 1200kNOK (600kNOK per year). Others : 400kNOK (200kNOK per year)
- **Status:** 1600kNOK indicated (+5MNOK for full scale testing), minimum remaining for project go 800kNOK.
- **A proposal will be sent end of June 2024 to all interested partners. Contact: alexandre.kane@sintef.no**
- **Industrials interested by the possibility to include additional full-scale fatigue tests, please contact bjorn.skallerud@ntnu.no**

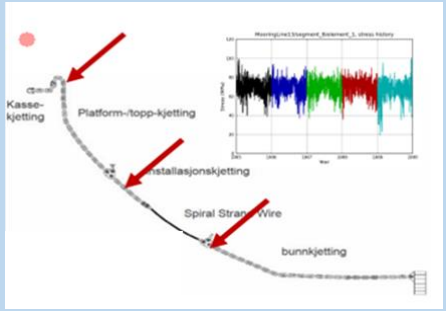
Status of JIP : JIP phase 2, Field monitoring

JIP phase 1

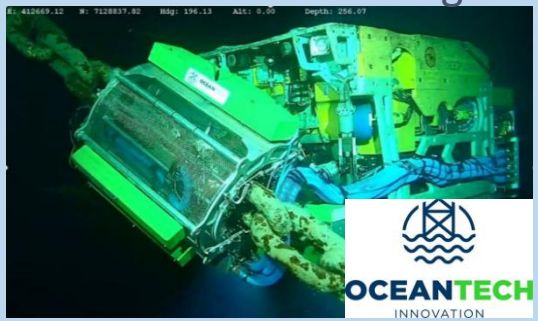
+

IPN project SeeMoor

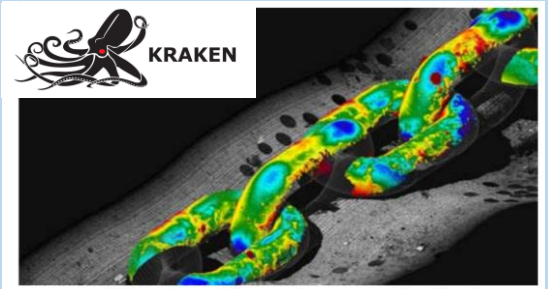
Representative load histories



ROV for In-situ cleaning

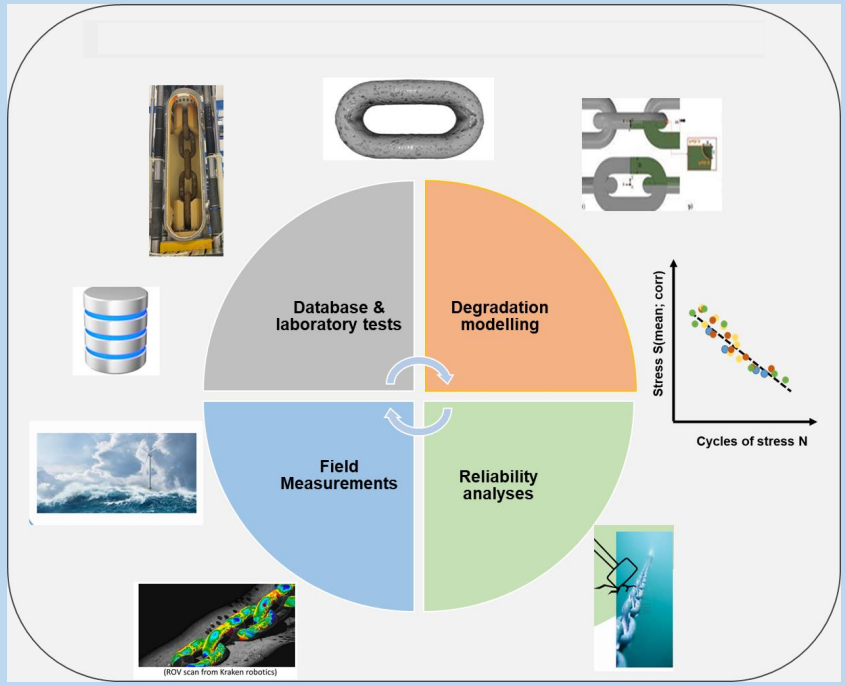


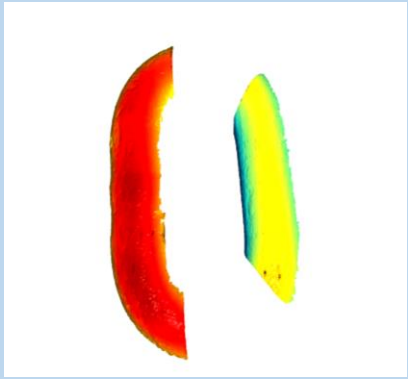
ROV for In-situ scanning



(ROV scan from Kraken robotics)

Framework for field monitoring





Status of JIP : KSP proposal (JIP extended with 14 MNOK RCN funding (4 years))

- **Currently setting-up a potential value chain industrial consortium.**
- **The extension of activities, and in particular the definition of PhDs topics, are under discussions (and will take into account industrial partners feedback).**
- **A proposal is expected to be submitted to the Research Council of Norway in March 2025 (feedback from the RCN expected in June 2025).**
- **Participation fee -** Energy companies: 2400kNOK (600kNOK per year). Others : 800kNOK (200kNOK per year)
- **For interested partners. Contact: alexandre.kane@sintef.no**

New JIP pitches

	JIP Pitches		
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14:35	HoliMoor JIP	Alexandre Kane	Sintef/NTNU/Equinor
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15:05	end		

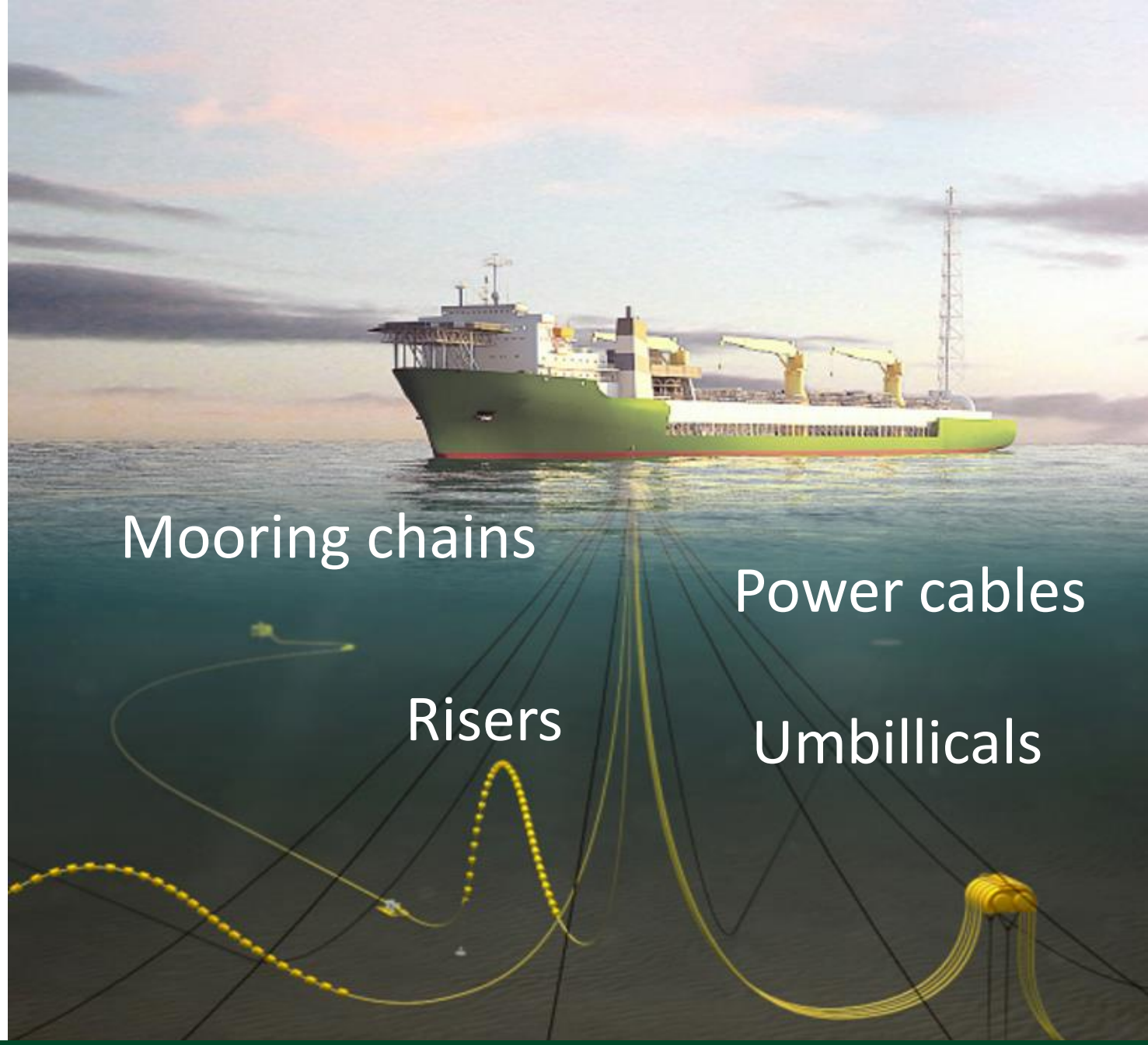
JIP proposal:
Retrofit subsea sensor nodes for continuous monitoring using battery less and wireless technology

karsten.husby@sintef.no

Challenges

Lack of information about ongoing:

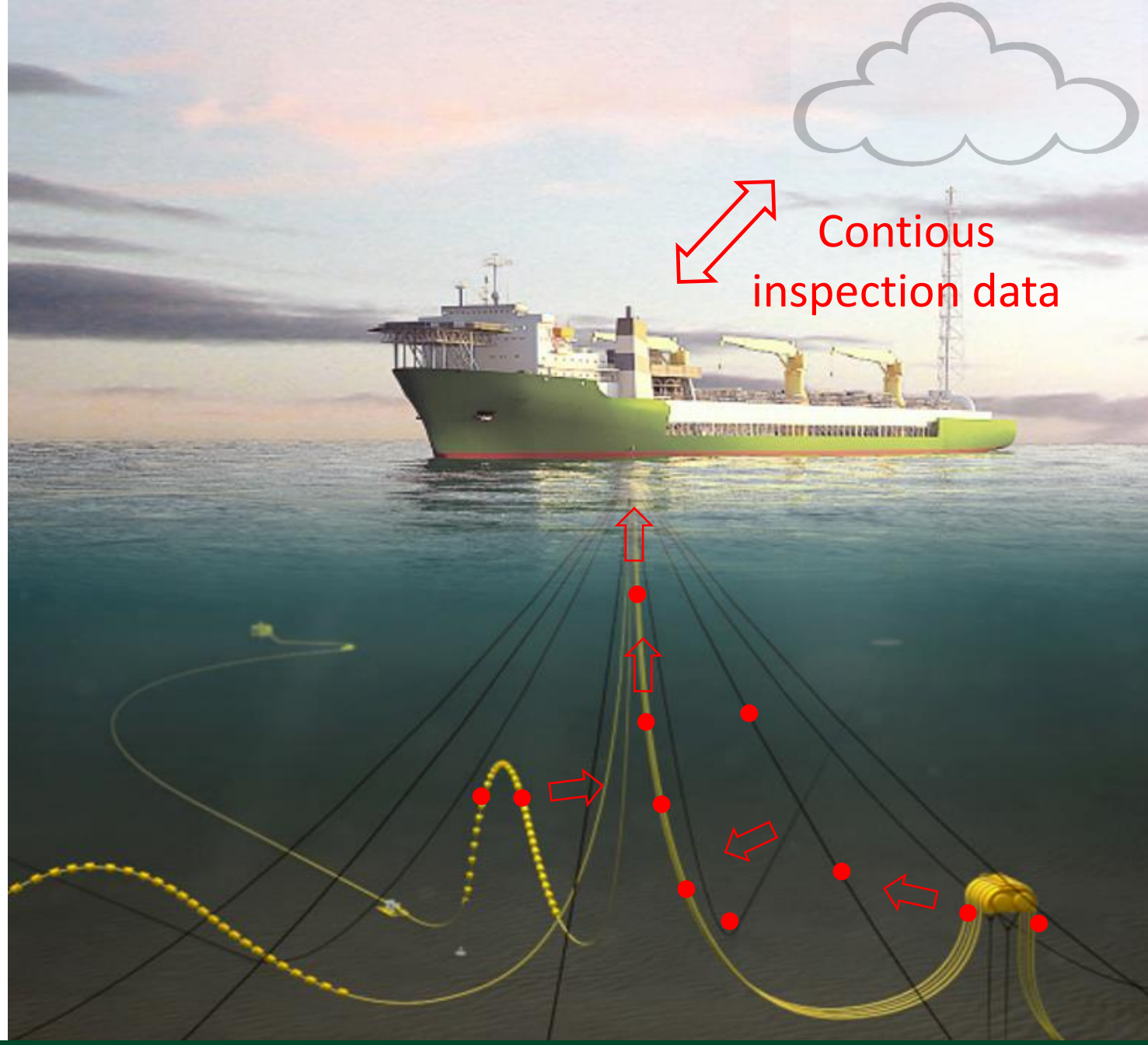
- Corrosion
- Fatigue
- Strain levels



Picture from: HANDBOOK on DESIGN and OPERATION of FLEXIBLE PIPES: NTNU 4subsea SINTEF

Sensor nodes operator benefit

- Improved integrity management
- Reduced risk of failure
- Reduced service cost
- Early warning alarms
- Cloud storage
- Digital twins / ML
- Lifetime extension



Tasks


SINTEF Background: SmartPipe 2013 Orkanger

- Wireless underwater communication
- Low power embedded design
- Energy harvesting
- Failure modes assessment
- Sensor edge prosessing and ML
- Information management system integration

SINTEF

Technology for a better society

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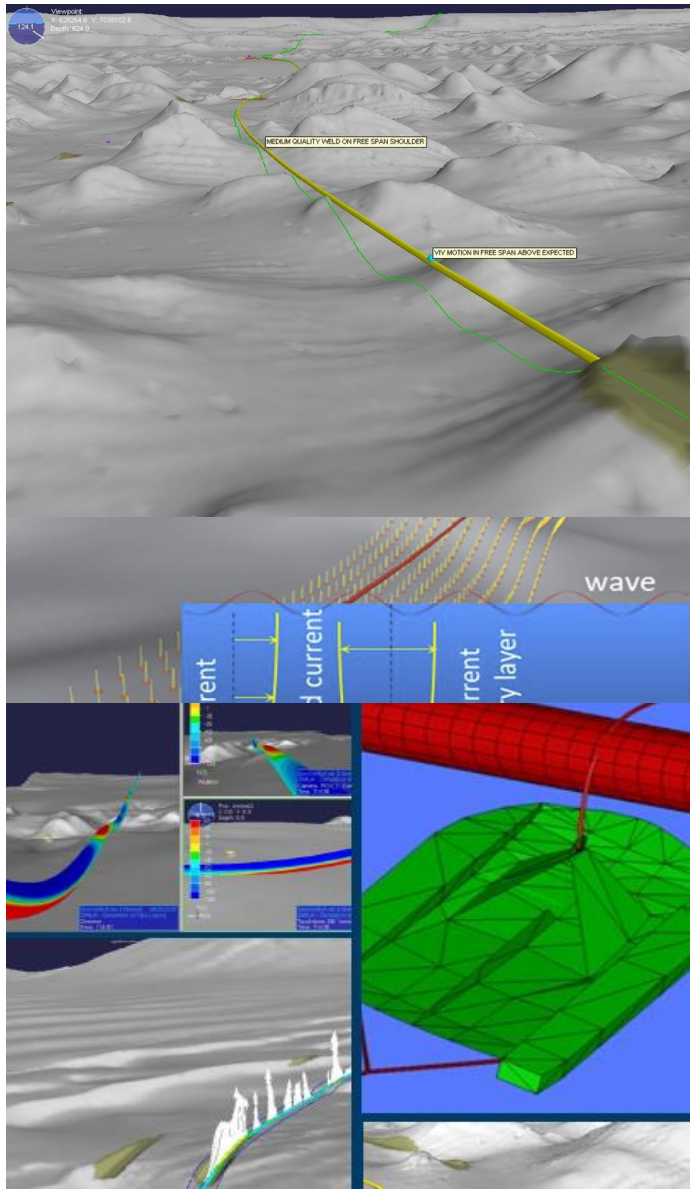
DROPS JIP PHASE III (DP3)

FER Forum 2024 - PITCH

Trondheim, 5th June 2024

Introduction



DROPS - Dynamic Response of Offshore Pipelines on the Seabed

- **DROPS JIP Phase III (2024-2026)**
- DROPS JIP Phase II (2021-2024)
  - To solve some of the engineering challenges in on-bottom stability assessment of small diameter pipelines and cables on 3D seabed also considering the influence of intermediate/shallow water depth
  - The activity «Interaction of pipes/cables with 'soft' sediment seabeds» on pipe-soil interaction (PSI) was sub-contracted to NGI 10th September 2022
- DROPS JIP Phase I (2017-2021)
  - Through DROPS JIP Phase I SIMLA has become a full-featured engineering tool for dynamic on-bottom stability (OBS) analysis of subsea pipelines considering real 3D seabed topography

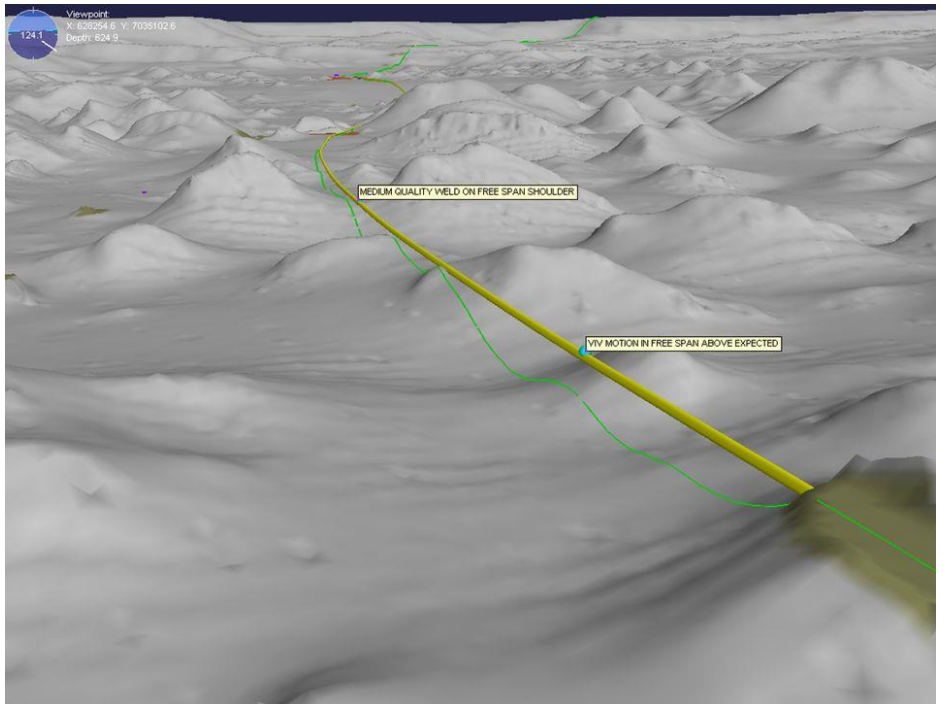
The SIMLA Software

- The development started about 23 years ago (2001)
- The main objective at that time was to be able to simulate a pipeline installation operation on a 3D seabed as physically correct as possible (ref. the Ormen Lange gas field)
- Over the years a lot of new functionality and application areas have been added (pipeline routing, on-bottom roughness, lateral/upheaval buckling, overtrawling, etc)

SINTEF

Motivation

Global response of subsea pipelines and cables in the operational phase is a complex and integrated process where different effects (operational conditions, waves, current, seabed interaction, etc.) all work together, hence affecting the global response of the product, and thereby its integrity, in a lifecycle perspective.



Solving engineering challenges in global response analysis of subsea pipelines and cables by including 3D non-linear time domain VIV analysis of free spans.

SINTEF

Objectives

WP1: Hydrodynamic load model for near-seabed scenarios

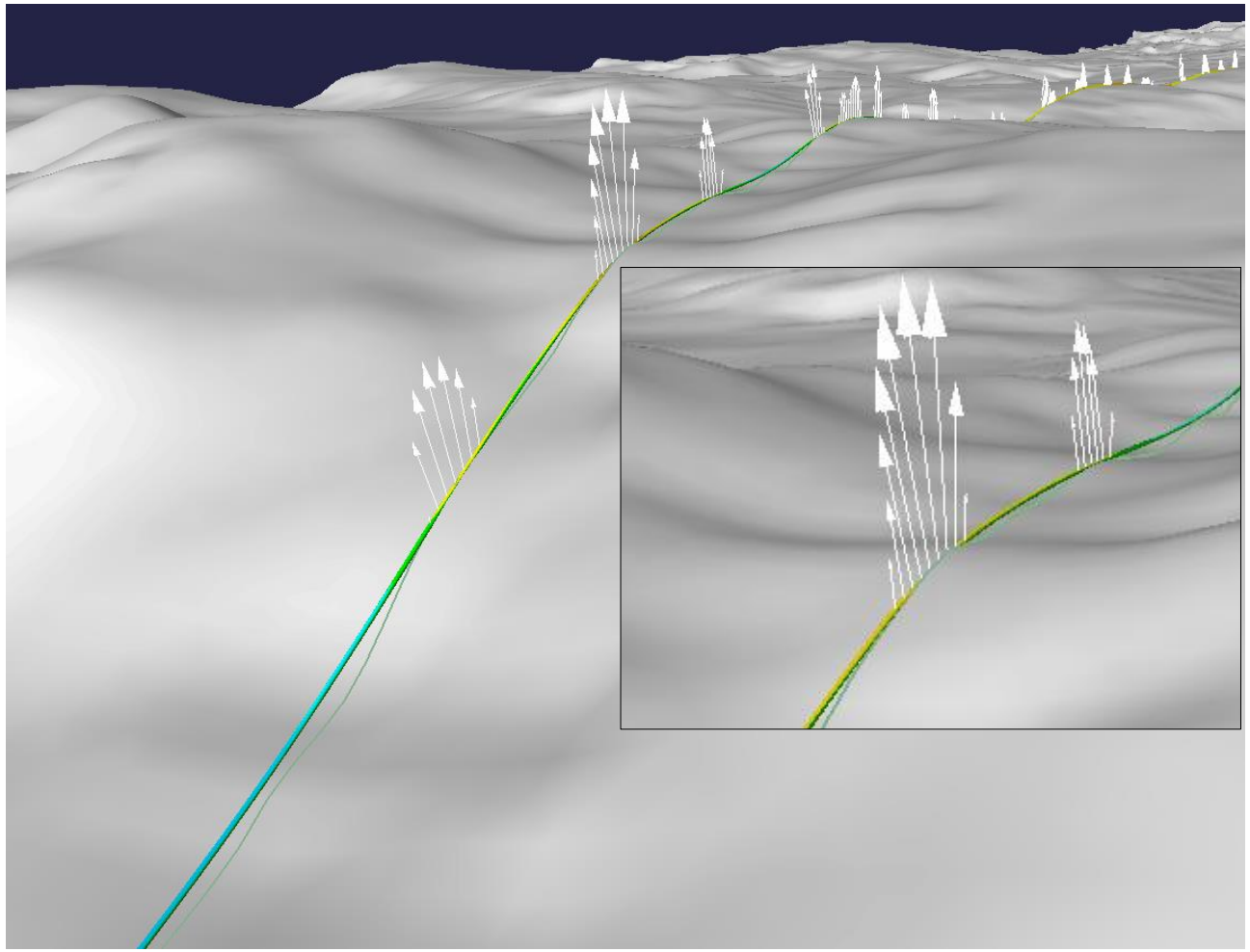
- Improve the combined wave-current boundary layer model, and to improve the existing hydrodynamic load model with respect to gap effects, hence taking the research efforts from Phase II the required steps forward for use in engineering design.

WP2: 3D non-linear time domain VIV analysis of free spans

- Enhance the ability of SIMLA to correctly simulate the physical behaviour of subsea pipelines and cables in the operational phase by including functionality to perform 3D non-linear time domain VIV (Vortex-Induced Vibrations) analysis of free spans.

Goals

- VIV fatigue from combined steady current and wave-induced oscillatory flow calculated without questionable simplifications. Internal slug flow conditions may also be included.
- Single- or multispans on 3D seabed terrain, including curves if relevant.
- Detailed design and fatigue assessment of free spanning pipelines and cables.
- All load contributions included in the same 3D non-linear time domain analysis, i.e. on-bottom stability and VIV in free spans can be assessed simultaneously.
- All non-linear structural effects (tension variation, contact, etc.) included in the same simulation.



Interested in more details?
Please join the combined DROPS + LWR session after lunch tomorrow!

Contact:

SINTEF

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14:55	MAPLES JIP	Jie Wu	Sintef
15:00	LEAP JIP	Jule Scharnke / Erik Jan de Ridder	MARIN
15:05	end		

Lazy Wave Riser JIP – Phase III

FER forum 2024 – Pitch

5th June, 2024 Trondheim

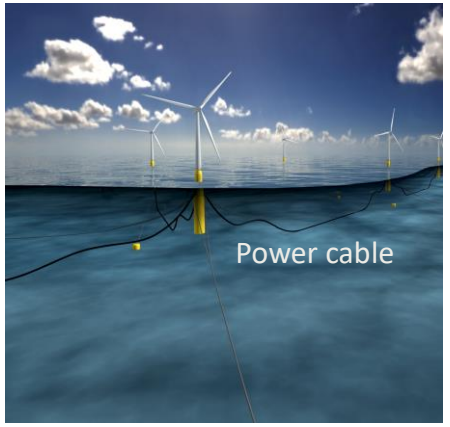
Introduction

- Vortex induced vibrations (VIV) to the slender marine structures can lead to fast accumulation of fatigue damage and amplified drag loads

- Present industry design practice based on frequency domain VIV prediction tool has its limitations:
  - Stationary current
  - Linear structures
  - Response/fatigue due to VIV and wave loads calculated separately

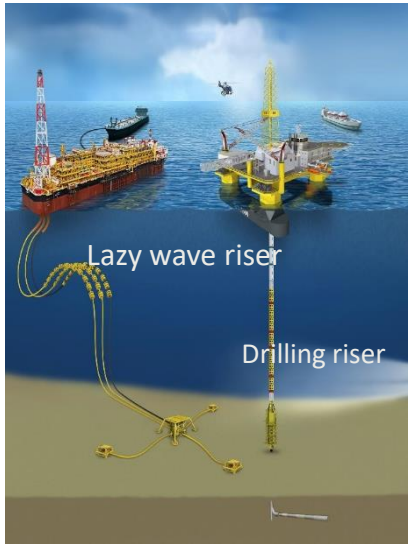
- High safety factor and over-conservative designs

Overall Objective of Lazy Wave Riser JIP



Close the gaps and reduce uncertainties in the existing VIV design practice:

- Steady/oscillatory flow
- Non-linear structural behavior, e.g., hysteresis damping, soil-pipe interaction
- Combination of other load effects, e.g., wave loads, slugging loads



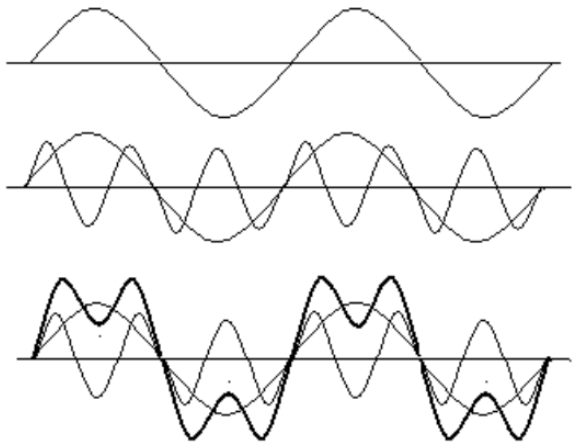
Provide industry a time domain VIV prediction tool:

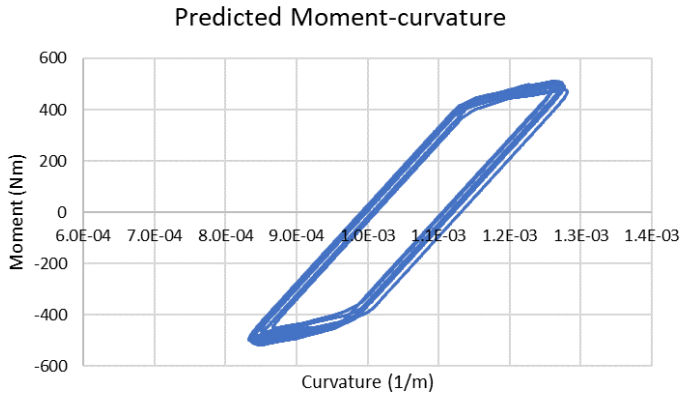
- Increase safety and cost-effective design of slender marine structures, e.g., power cables, umbilical, risers/pipelines, mooring lines etc.

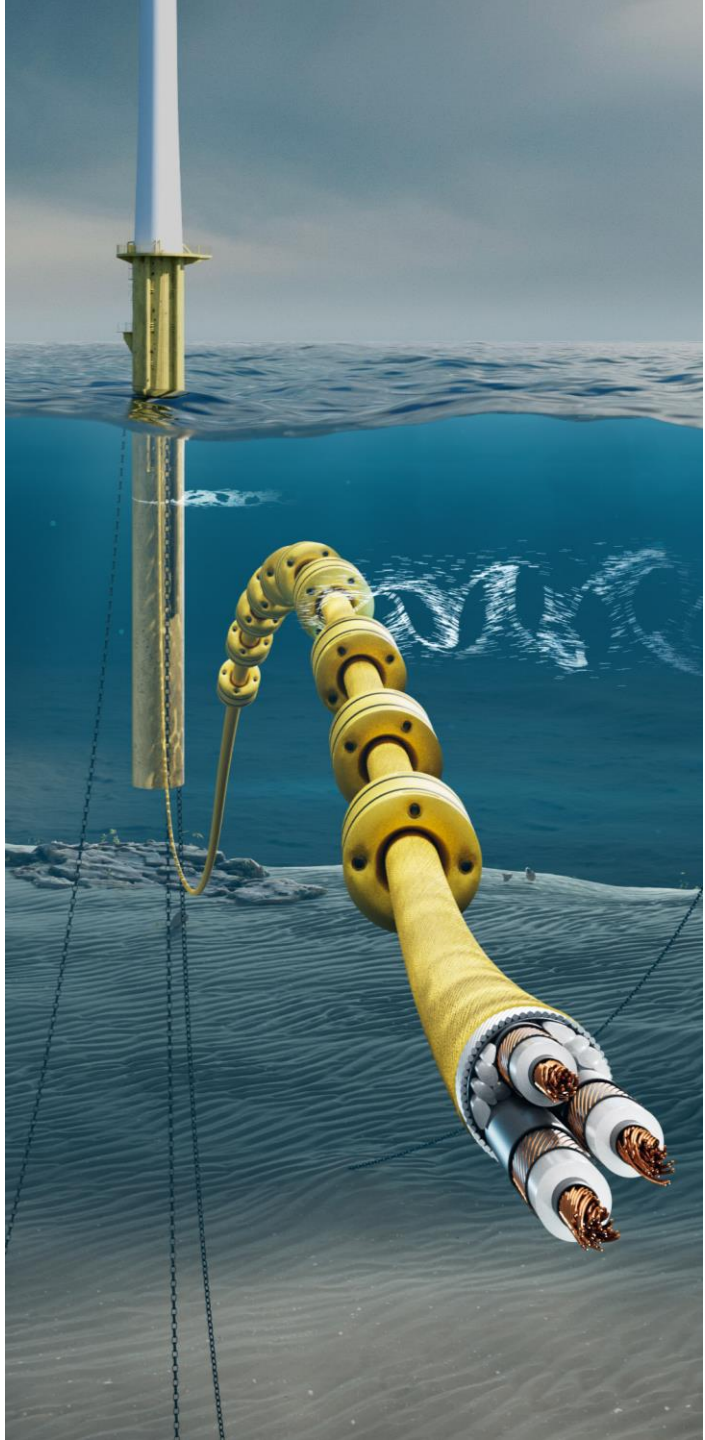
Figures from internet

Phase III objective

- Validation of tool for response prediction under simultaneously acting current and waves
- Validation of the newly implemented hysteresis stiffness and damping model for umbilical/power cables
- Improvement of design practice







SINTEF

Interested in more details?
Please join the combined DROPS + LWR session (Room Munkholmen) after lunch tomorrow!

Contact:

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SINTEF

Teknologi for et bedre samfunn

New JIP pitches

	JIP Pitches		
14:30	SheathFlex	Delphine Rigaud	BV
14:35	HoliMoor JIP	Alexandre Kane	Sintef/NTNU/Equinor
14:40	Riser retrofit sensor network for lifetime extension	Karsten Husby	Sintef
14:45	DROPS JIP Phase III	Egil Giertsen	Sintef
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Multi-fidelity and Probablistic Lifetime Estimation of Slender Marine Structures (MAPLES)

FER forum 2024 – Pitch

5th June, 2024 Trondheim

Introduction

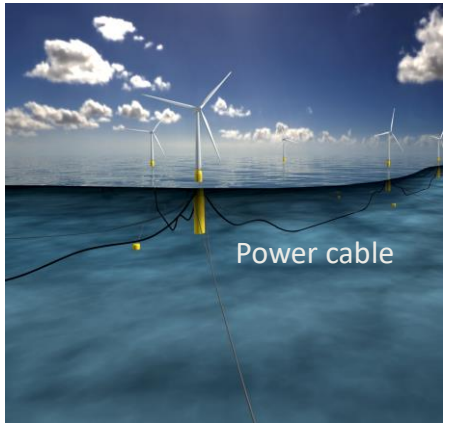
- The development of time domain VIV prediction model overcomes limitations in present industry design practice based on frequency domain VIV tools:
  - Non-linear structures/contacts
  - Response/fatigue due to simultaenoulsy acting VIV and wave loads

- There is lack of established design practice and calibrated safety factors to meet the target failure probability levels when applying the time domain VIV prediction model during both engineering and operation stages.

- Laboratory test and field measurements typically come with various levels of uncertainty in a high dimensional parameter space, which requires advanced machine learning methods to reveal more efficiently the underlying physics from data and evaluate the uncertainties.

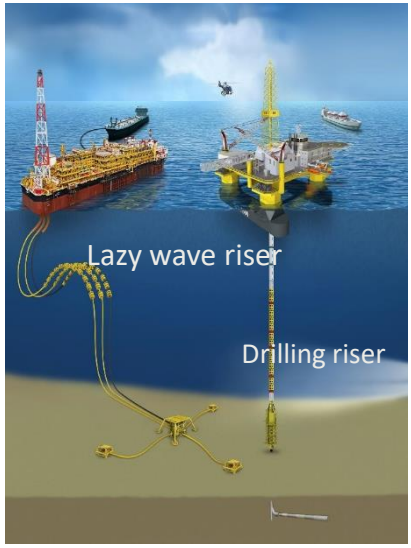
Objective of MAPLES

The **primary objective** is to model and reduce the uncertainties in lifetime prediction of marine risers based on targeted probability levels using **probabilistic** and **multi-fidelity** modelling relying on measurement data.



The **secondary objectives** are:

- Improve present time-domain prediction model by learning more about the underlying physics from data.
- Improve design practice and input parameters for simultaneously acting loads, including waves, VIV and floater motions.
- Starting from defining the inherent safety level of today's practice, reduce uncertainty in the safety factor for target reliability levels benefitting from the inclusion of simultaneous acting loads.
- Improve lifetime prediction with updated uncertainty estimations based on monitored data.



Figures from internet

Interested in more details?
Please join the MAPLES session (Room Ravnkloa)
kl 9:00 on Friday!

Contact:

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Jie.Wu@sintef.no

SINTEF

Teknologi for et bedre samfunn

New JIP pitches

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MARIN

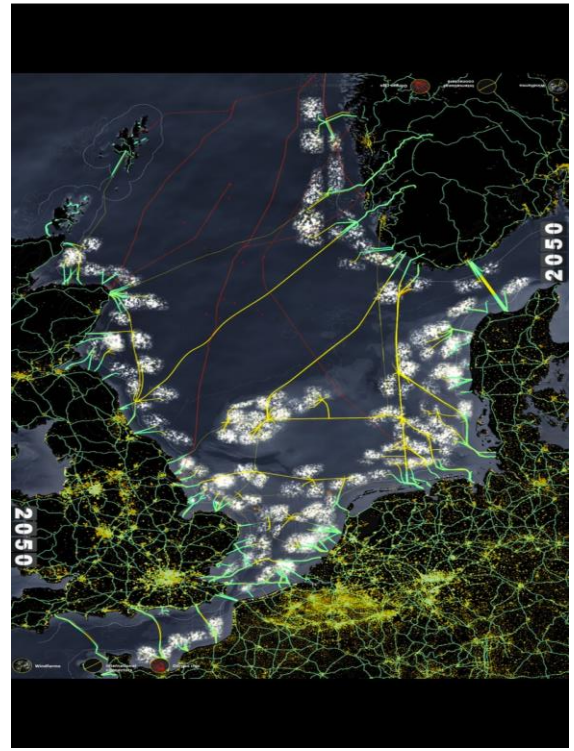
BETTER SHIPS, BLUE OCEANS

LEAP JIP

LiablE Access for Personnel

Motivation and background

- Offshore wind maintenance
  - Wind turbines require regular maintenance including crew transfer
  - For large offshore wind park > 1000 crew transfers per year
  - Number of wind parks are increasing continuously
    - → requires new and inexperienced technicians
    - → increasing risks of incidents

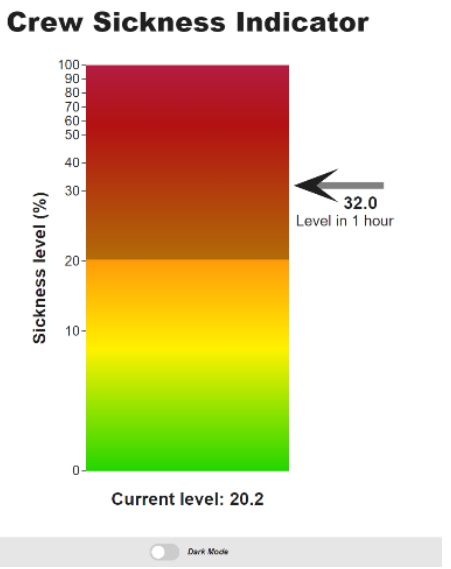


- Access methods:
  - CTV: step over to fixed and floating wind turbines
  - SOV: gangway access to fixed and floating wind turbines
  - Ship-to-ship transfer

SPOWTT JIP: Project goals

- Primary goal: On-shore decision support tool
- Secondary goal: On-board advice system

Can we show and predict chance of motion sickness based on vessel motions



Objective

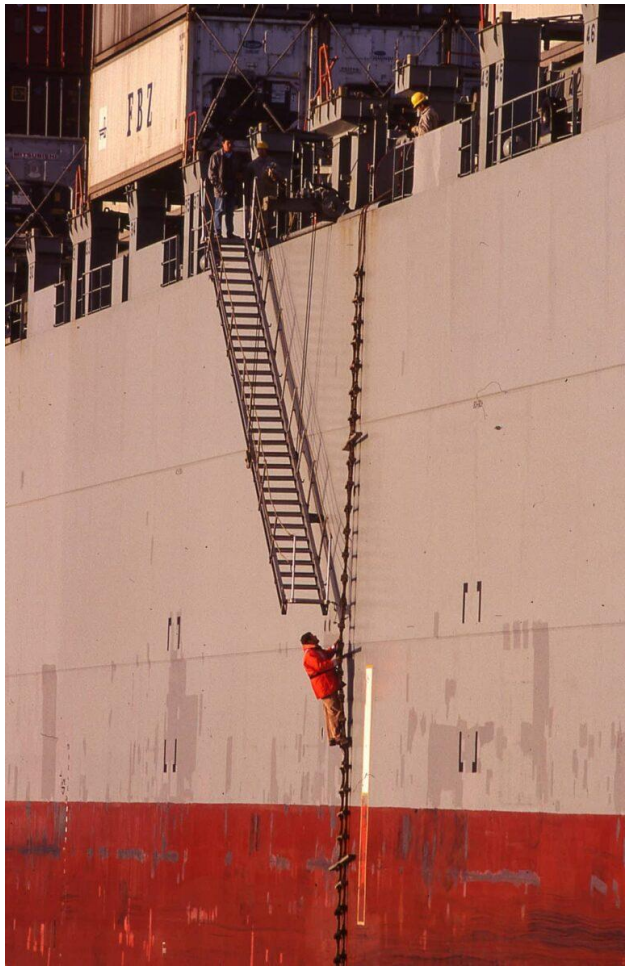
The objective of the LEAP JIP is to assess and reduce risk involved in crew transfers offshore.

Scope of work overview

1. Evaluation industry standard
2. Assess global risk of incident
3. Means to reduce risk/increase safety

airbus.com

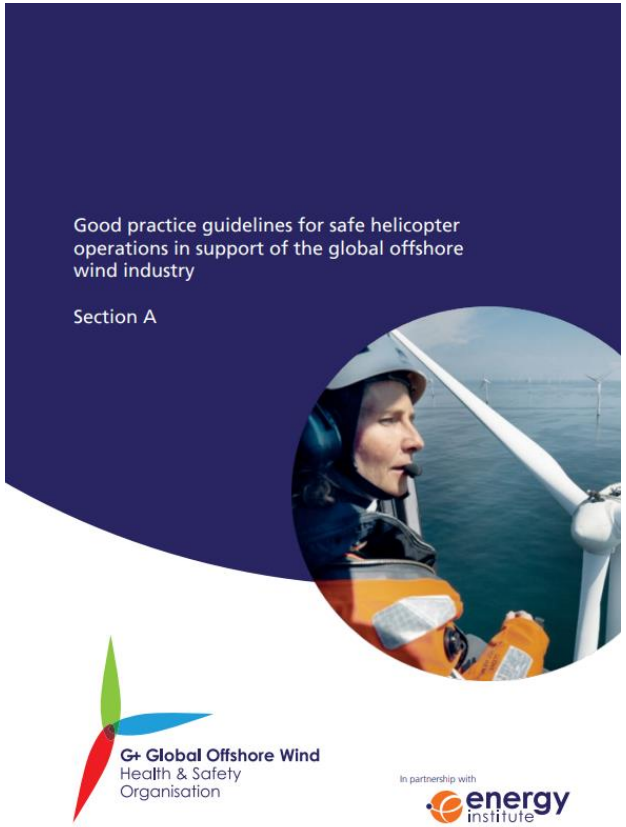
www.gplusoffshorewind.com



pilotladdersafety.com

Scope of work - Evaluation industry standard

1. Evaluation industry standard
   - What are the rules and regulations?
   - Review of existing incident reports
   - Common practice, decision points



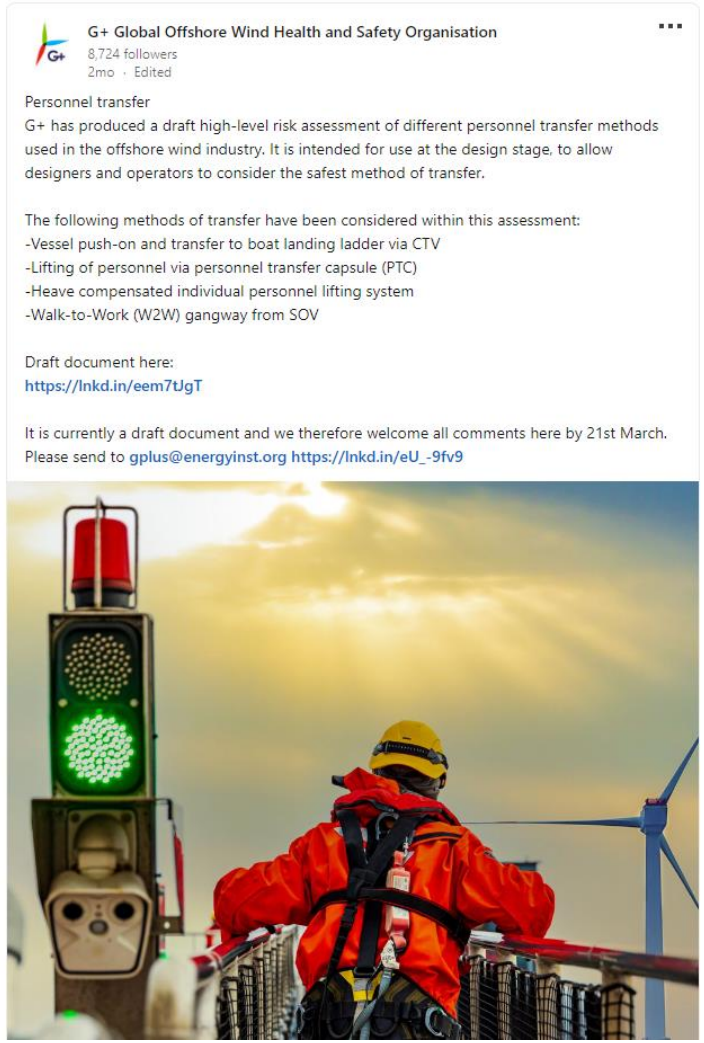
Sources:
G+ Global Offshore Wind Health & Safety Organisation
ICS-shipping.org

Scope of work - Assess global risk of incident

2. Assess global risk of incident

- Risk based (risk for incident) vs workability based (cost-based availability) assessment:
  - What is the risk of injury within workability range?
  - Include human factor aspects (e.g. effects of sea sickness, experience)
- Risk analysis for different types of transfers (walk-to-work, helicopter transfer, etc.)
- Typical number of transfers per year, including unexpected maintenance moments due to failure
- Influence on risk due to specific location aspects: environmental conditions, accessibility (e.g. additional ship-to-ship transfer required)

G+ Global Offshore Wind Health and Safety Organisation's Post



Scope of work - Means to reduce risk/increase safety

3. Means to reduce risk/increase safety
   - Improve procedures
   - Improve transfer technology
   - Training:
     - Are there specific training requirements?
     - Training need analysis
     - Effect of training on risk?

Best practices

Maritime eXperience Lab

For advanced Virtual, Augmented and Mixed Reality applications, including the Fast Small Ship Simulator (FSSS), smaller motion platforms, treadmills, motion capturing and a cable robot. With the 8 cables of the cable robot moving objects (such as a crane hook) can be simulated above a moving platform or the FSSS for advanced interactive Mixed Reality simulations, both above and below water.

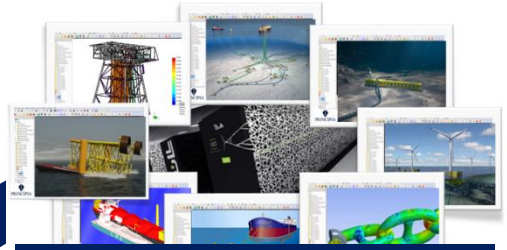
Announcement of next FER week

Cédric Le Cunff

PRINCIPIA

COMPANY PROFILE

About 140 people



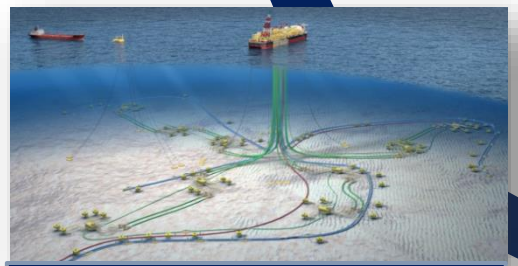
SOFTWARE

DEEPLINES WIND

DTA m Monitoring

OFFSHORE RENEWABLE ENERGY

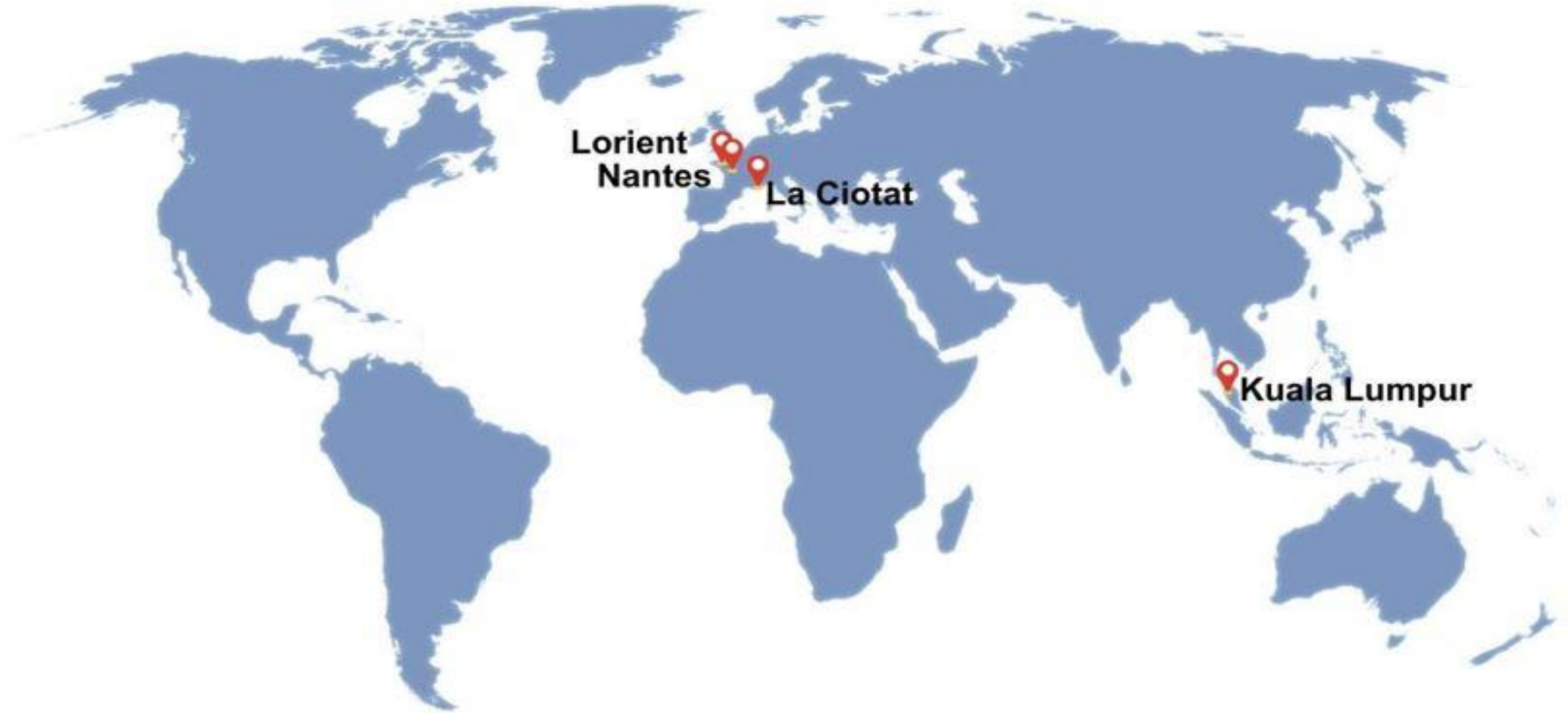
NAVAL / DEFENSE



OFFSHORE CONVENTIONAL ENERGY

NUCLEAR

COMPANY PROFILE



PRINCIPIA

PREVIOUS JIP Weeks

Bandol, France

November 2006

St Cyr Sur Mer

October 2016

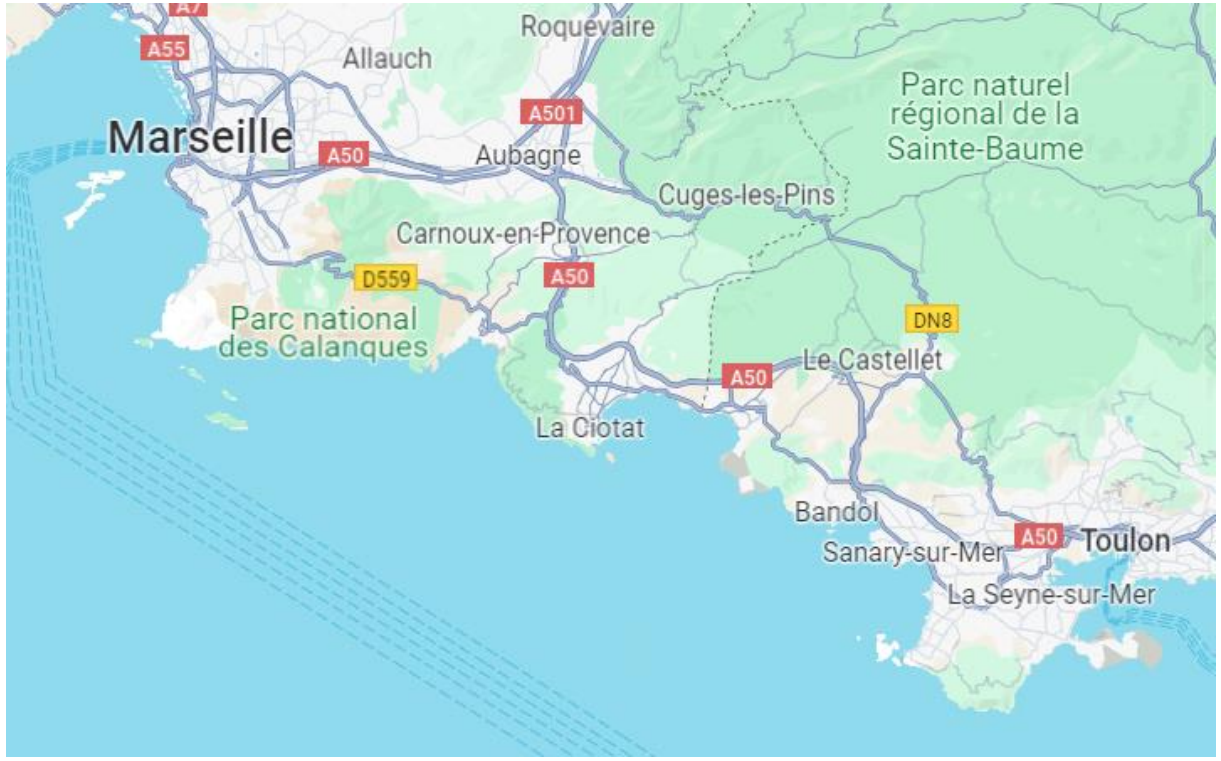
PRINCIPIA

NEXT
FER Week

Work In progress!

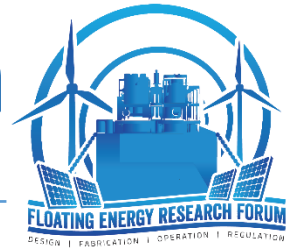
What we know:

- 18-22 November 2024
- Close to Marseille



PRINCIPIA

Thank you to the SINTEF local organizing team



Practical matters for Technical visit/dinner

Thank you for joining us!