

DNV Consultancy Services in addition to traditional Class Services

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Topics

I. DNV – Det Norske Veritas

II. Selected DNV Consultancy Services

- a. Certification of Offshore Containers
- b. Engineering/Asset Risk Management (Structural and Stability Analyses)
- c. HSE Management System (ANP's SGSO)
- d. BowTie Analysis

III. Final Comments



I. DNV – Det Norske Veritas

DNV's core competence

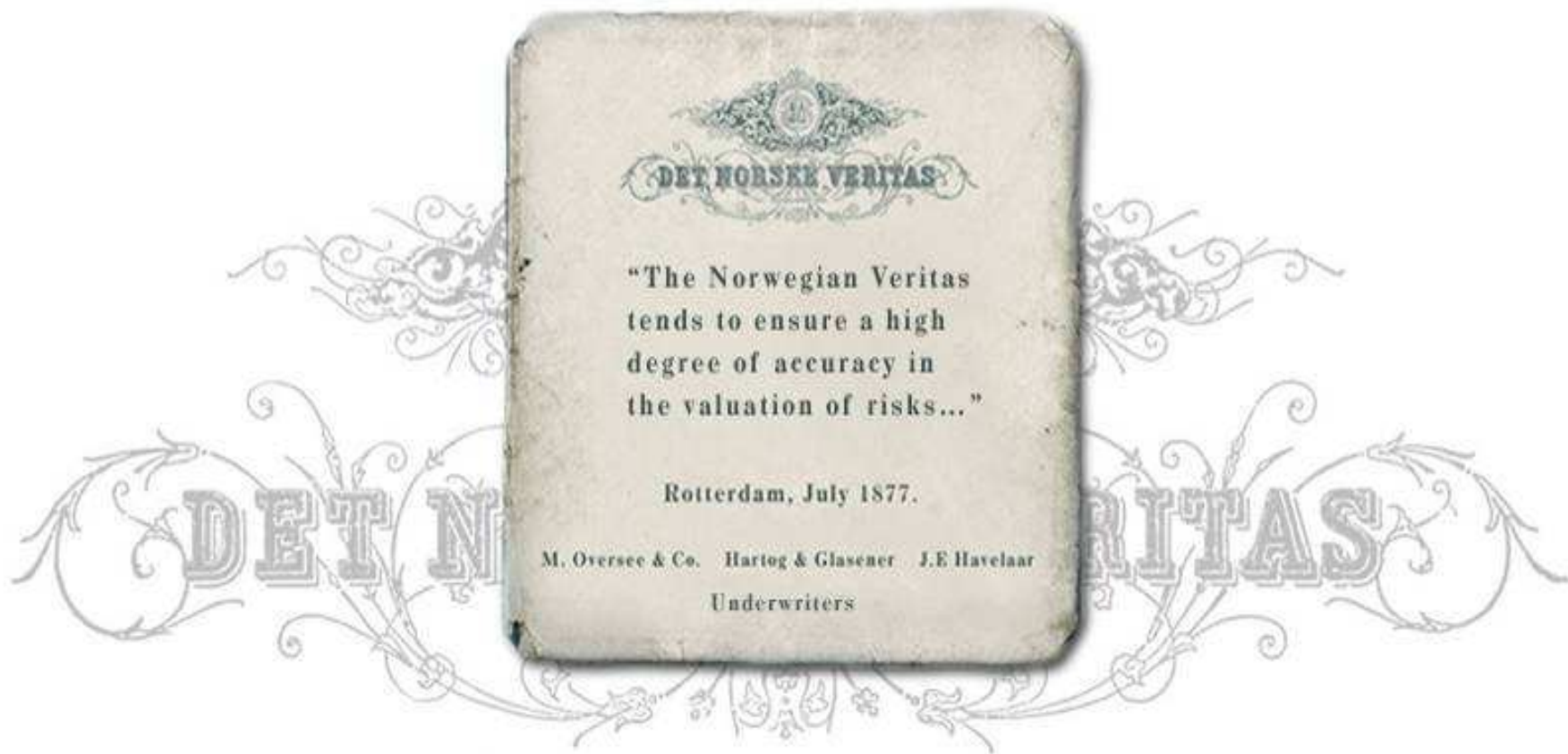
identify
assess
manage

risk



More than 145 years of **managing risk**

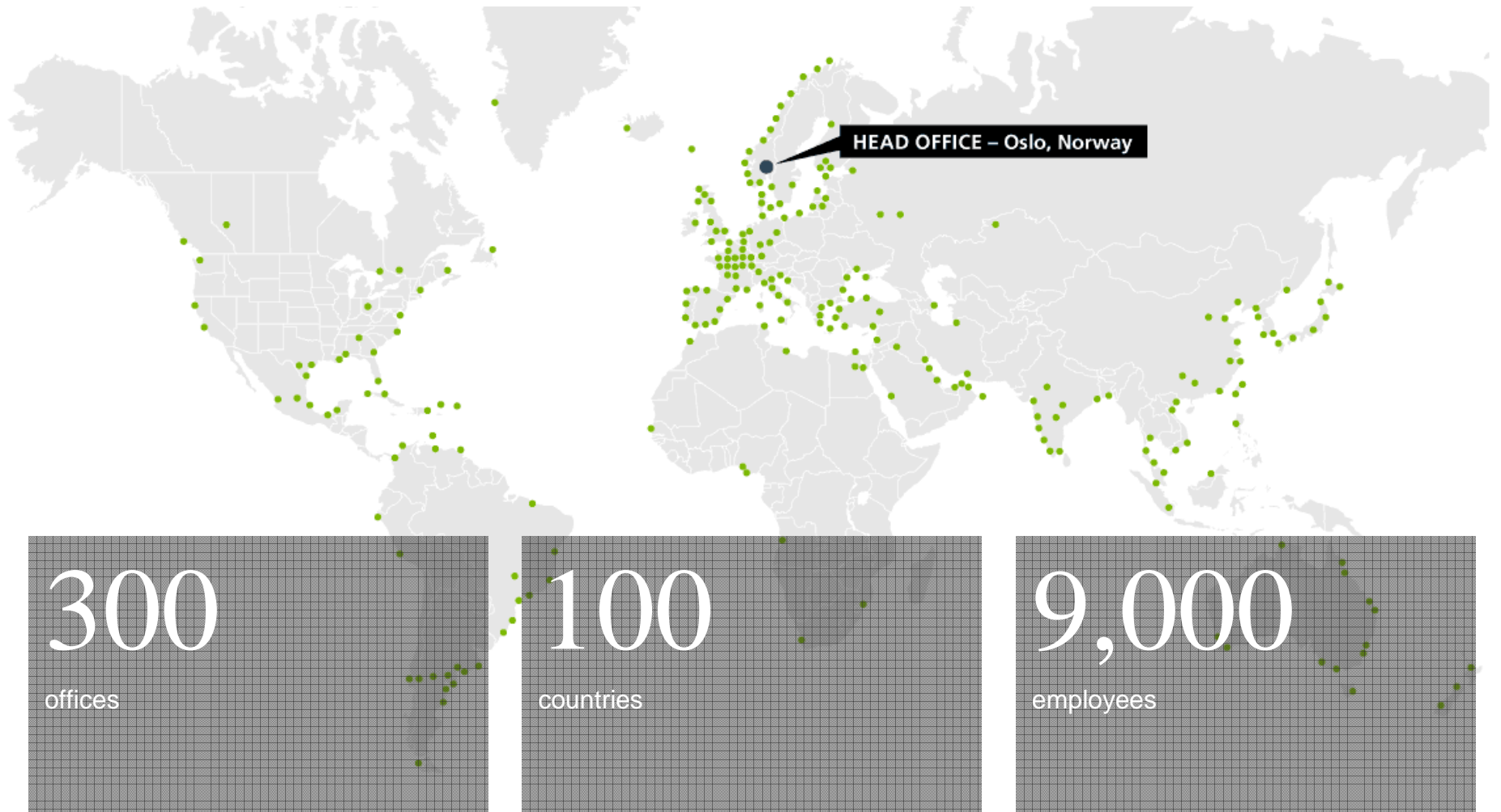
- DNV was established in 1864 in Norway
- DNV is a leading international provider of services for managing risk



Our main services



Strong network across the world



Our main service areas



We assist you to comply with classification and statutory requirements for MOUs and FPSOs

Offshore Classification



We develop, implement, maintain and continually improve best practices in SHE management

SHE Risk Management



We provide a complete view of your organisations total risk exposure and manage these risks in an integrated way

Enterprise Risk Management



We provide you with the confidence that technology will function reliably

Technical Analyses



We safeguard integrity and maintain optimal production safely and cost-efficiently

Asset Risk Management



We ensure your projects are properly managed through transparent risk based verification and certification

Field Services

II. Selected DNV Consultancy Services

Main Services from SHE Risk Management & Management System

SHE Risk Management

- Preliminary Hazard Analysis (PHA)
- Hazard and Operability analysis (HAZOP)
- Hazard Identification (HAZID)
- Failure Mod. Effects and Analysis (FMEA)
- Layer of Protection Analysis (LOPA)
- Emergency Planning
- BowTie Analysis
- Accident Investigation
- Quantitative Risk Analysis (QRA)
- Explosion Analysis
- Gas Dispersion Analysis
- Fire Analysis
- Smoke Analysis
- Fire escalation (propagation) analysis - pipe collapse
- Flare Radiation/Temperature Study
- Escape, Evacuation and Rescue analysis (EERA)
- Dropped Objects Analysis
- Ship Collision Analysis
- Safety Integrity Level (SIL)
- Environmental Analysis
- Training

Management System

- Development and Implem. of Mgm't System
- Integrated Management System (HSEQ)
- International Rating Safety System (ISRS 8)
- Audits of Management Systems
- Behavior Based Safety Program (BBS)
- Process Safety Management (PSM)
- Process Safety Audit
- Protection Barriers Audits
- Training



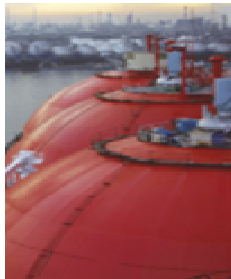
Main Services from Asset Risk Management & Enterprise Risk Management

Asset Risk Management

- Risk Based Inspection (RBI)
- Reliability, Availability and Maintainability (RAM)
- Reliability Centered Maintenance (RCM)
- Integrity Management Program
- Fault Tree Analysis (FTA)
- Event Tree Analysis (ETA)
- Markov Diagram
- Reliability Database
- Training

Enterprise Risk Management

- Value Chain Analysis (VCA)
- Due Diligence (DD)
- Enterprise Risk Mgm't Implementation (ERMI)
- Project Risk Management (PRM)
- Business Continuity
- Training



Main Services from Field Services



Field Services

VERIFICATION & CERTIFICATION

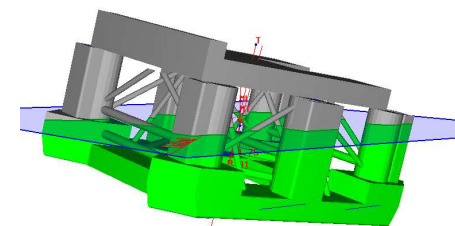
- Risk Based Verification (RBV)
- Verification and Certification of Products and Equipment
 - Manufacturer Product Quality Assessment (MPQA)
 - Certification of Subsea Equipment
 - Certification of Offshore Containers (DNV 2.7-1 Standard)
 - Certification of Lifting Appliances ILO 152
 - Certification of Pressure Vessels, Piping and Accessories
 - NR-13 – Compliance Verification
 - Certification of Drilling Risers
 - Fabrication Surveys
 - Qualification of Welding Procedures and Welders
 - Verification of Load and Hydrostatic Tests
- Marine Operations and Warranty
- Local Content Certification



Selected Services



- Certification of Offshore Containers – DNV 2.7-1
- Engineering/Asset Risk Management (Structural and Stability Analyses)
- HSE Management System (ANP's SGSO)
- BowTie Analysis



II-a. Certification of Offshore Containers

Certification of Offshore Containers - DNV 2.7-1

■ Approach

- The only fully comprehensive design code available
- Covers the requirements and regulations from IMO/MSC Circular No. 860 and EN12079 (Stated in the DNV Certificate for Offshore Container)
- Applicable for new and existing containers
- Experience as developer allows DNV to interpret the Standard and consider deviations

■ DNV 2.7-1 Scope

- Design approval, witness of fabrication, qualification tests, and final / periodical inspection

■ Deliverables

- Design Verification Report (DVR)
- Type Approval Certificate
- Certificate for Offshore Container



■ Processes & Tools

- Structural analysis using 3D Beam software
- Padeye calculation using OffCon® software
- Checklist included in OffCon® software
- Verification of manufacturing process
- Verification of tests
- Verification of final databook

DNV expertise

- There are about 150,000 offshore containers in the world, 100,000 were certified according to DNV SfC 2.7-1.
- DNV has been involved with offshore containers since 1986 and published the first edition of DNV SfC 2.7-1 in 1989, and later revisions in 1995 and 2006.
- Both IMO/MSC Circular No. 860 and EN 12079 refer to DNV's Standard 2.7-1.



II-b. Engineering/Asset Risk Management (Structural and Stability Analyses)

Accommodation Modules

■ Objective

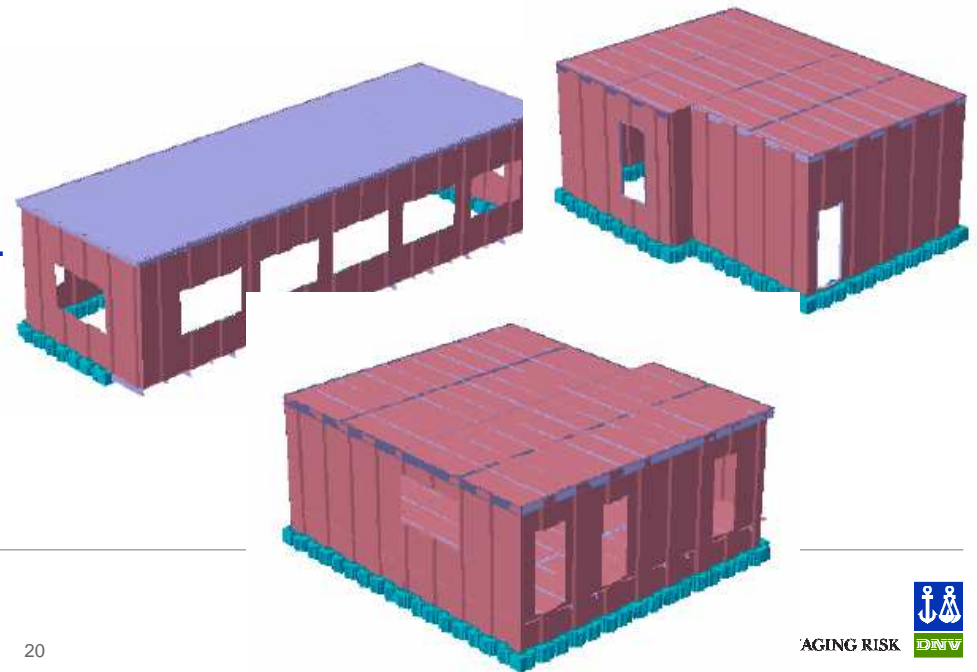
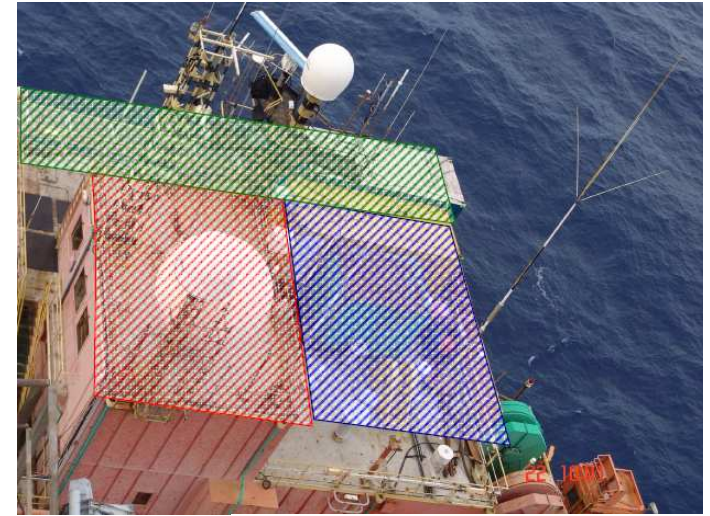
Increase number of accommodation modules

■ DNV approach

- Verification of interferences
- Elaboration of Basic Structural Design, including all calculations and impact on existing structures
- Calculation of temporary reinforcements for the lifting operation offshore

■ Value to customer

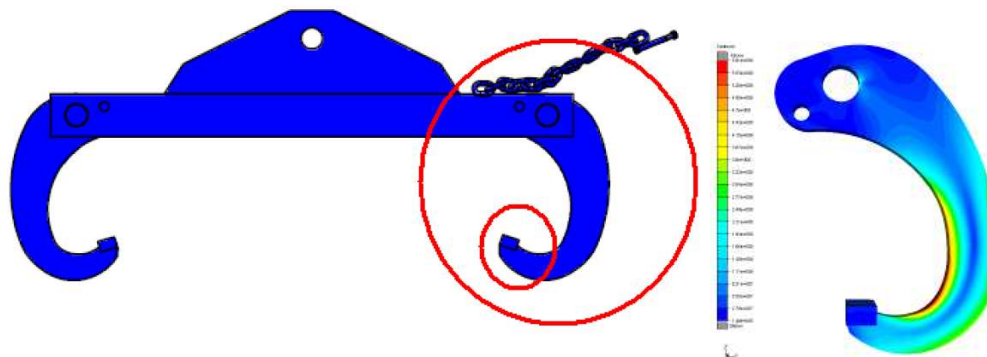
- Optimised modular design allowed the acc.
- Modules To be erected onshore and assembled offshore without interrupting operations



DNV Services

Technical Analyses

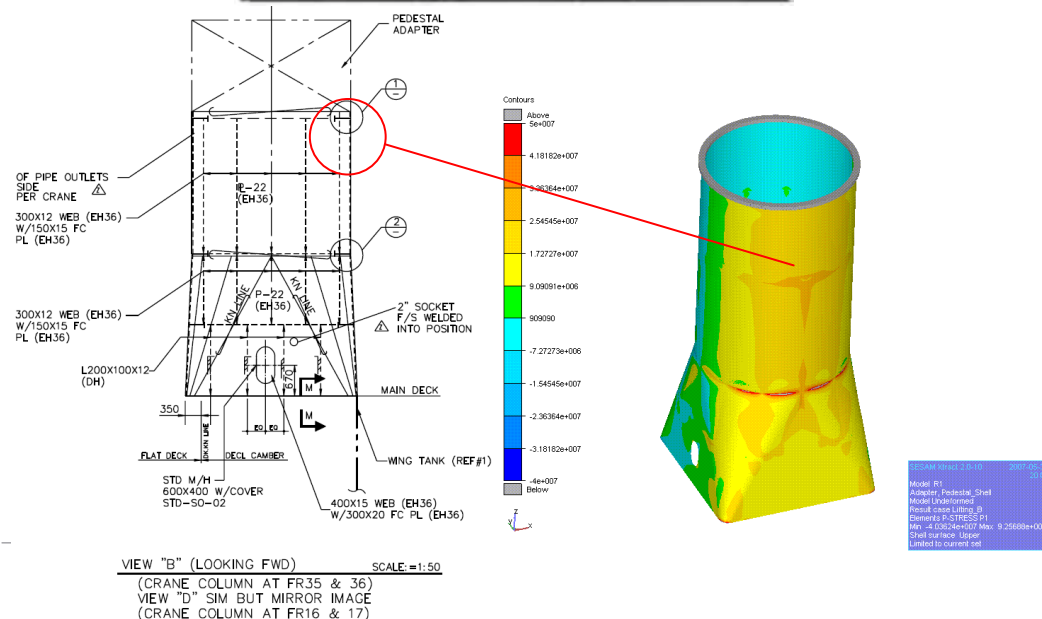
Equipment Structural Reassessment Steel Bobbins Handling Device – Reference Case



- Objective
 - Structural reassessment to verify compliance with technical design specification
- DNV approach
 - Structural solid FEM analysis to assess strength for maximum operating load and evaluation of mechanic components such as pins and padeyes;
 - Design proposal of additional reinforcement for higher operating loads
- Value to Customer
 - Decision support on optimum structural design

DNV Services Technical Analyses

Crane Foundation Verification and Design Offshore Crane Foundations – Reference Case



- Objective
 - To attest compliance with technical equipment design specification and applicable Rules including structural reassessment due to increase on crane capacity
- DNV approach
 - Structural FEM analysis to assess strength for operating loads and Units inertial loads due to sea motion under extreme condition including fatigue reassessment;
 - Design proposal of additional reinforcement
- Value to Customer
 - Decision support on optimum structural design reducing costs

Structural assessment – Cracks in Ballast Tank

▪ Objective

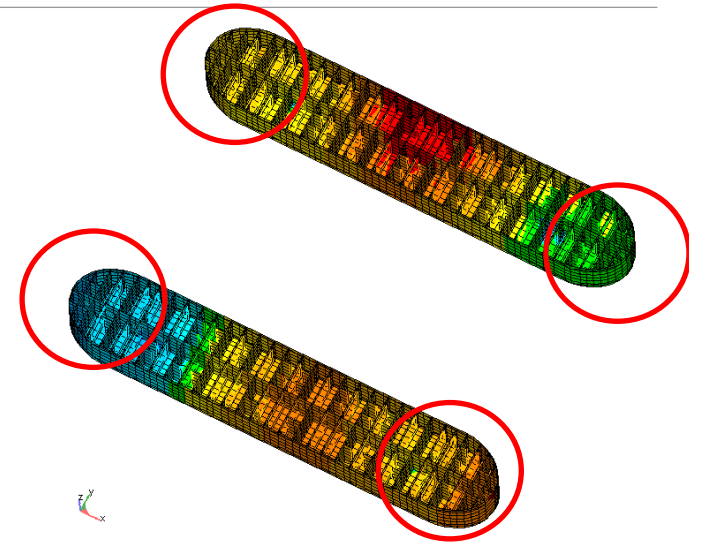
Assess cracks identified on the four ends of both pontoons

▪ DNV approach

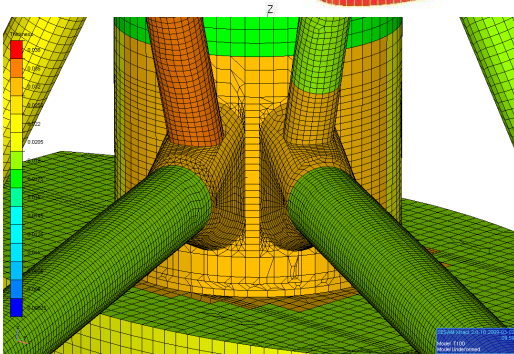
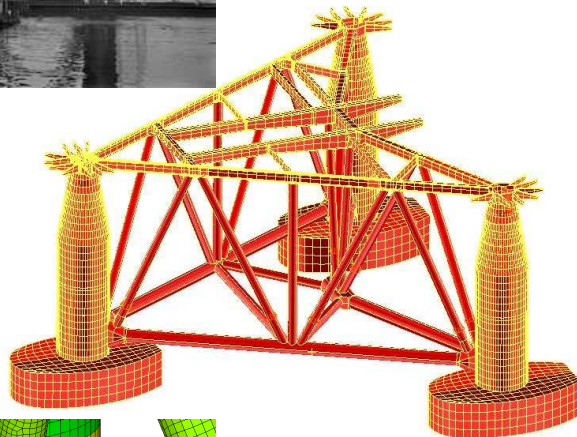
- Assessment of cracks' criticality and prioritization
- Define sequence of repair without compromising the structural integrity during operation / repair
- Submission for Class as means for postponing the CC

▪ Value to customer

- CC postponed and repair carried out without compromising the operational safety
- Repair carried out according to procedure, avoiding uncertainties and optimizing time



Structural Reassessment and Life Cycle Extension



■ Objective

- Structural reassessment of an ageing Unit (40 year old) intended to operate for more 10 years according to Client request

■ DNV approach

- Structural independent FEM analysis assessing ultimate strength and fatigue lives
- Condition surveys regarding hull, safety and electrical equipments
- DNV has offered a sample of RBI approach using DNV software ORBIT not part of original SoW

■ Value to Customer

- Advices for structural repairs and additional reinforcements and equipment replacements

II-c. HSE Management System (ANP's SGSO *)

SGSO* - Sistema de Gerenciamento da Segurança Operacional - Operational Safety Management System

HSE Management Systems (ANP's SGSO)



SGSO related services

- **Operational Safety Documentation (Documentação de Segurança Operacional - DSO);**
 - a) **Correlation Matrix (Matriz de Correlação - MC)**
 - b) **Maritime Unit Description (Descrição da Unidade Marítima - DUM); and**
 - c) **Field Operator Report (Relatório de Informações do Concessionário - RIC)**

DNV Services:

- **Gap Analysis:**
 - **SGSO Requirements Vs Drilling Operator Management Systems**
 - **SGSO Requirements Vs Operational Conditions – Audits**
- **Implementation of SGSO**
 - **Support on recommendations – advise and implementation**
 - **Accident Investigation, Risk Analysis, Integrity Management Programs, Emergency Planning, Assessment of Safety Culture, Audits, Safety Work Practices.**
 - **Training**

HSE – Accident Investigation

■ Description

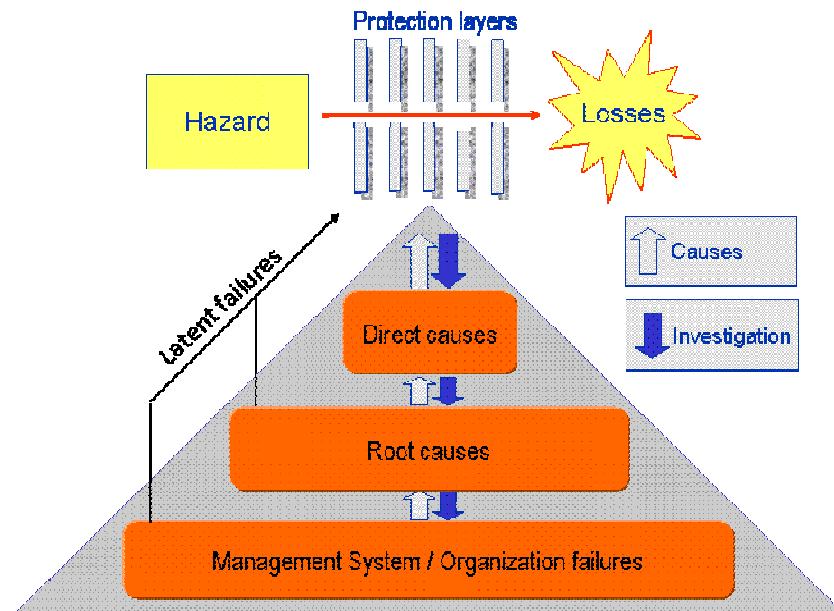
- Identification of root causes and management system improvements that are required.

■ Deliverables

- Root cause - block diagram
- Root causes description and analysis
- Management System failure analysis
- Recommendations

■ Approach

- Loss Causation Model (ILCI – Frank Bird)
- Human error analysis using Performance Shaping Factors



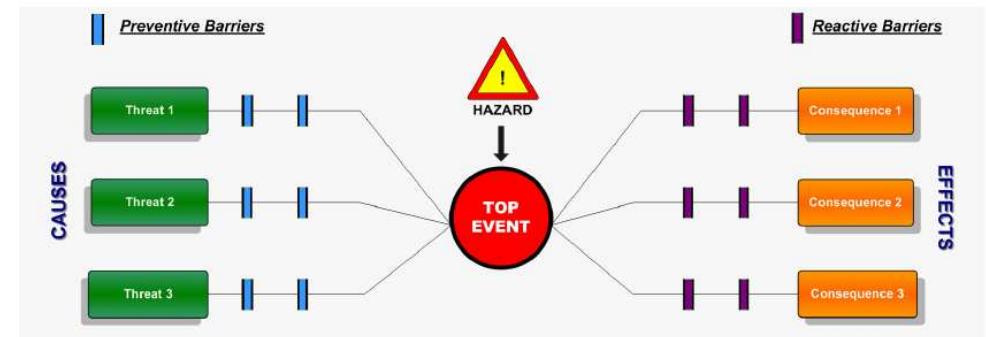
■ Methods/Tools

- SCAT – Systematic Cause Analysis Technique
- Fault Tree Analysis
- Event Tree Analysis
- Root Cause Analysis

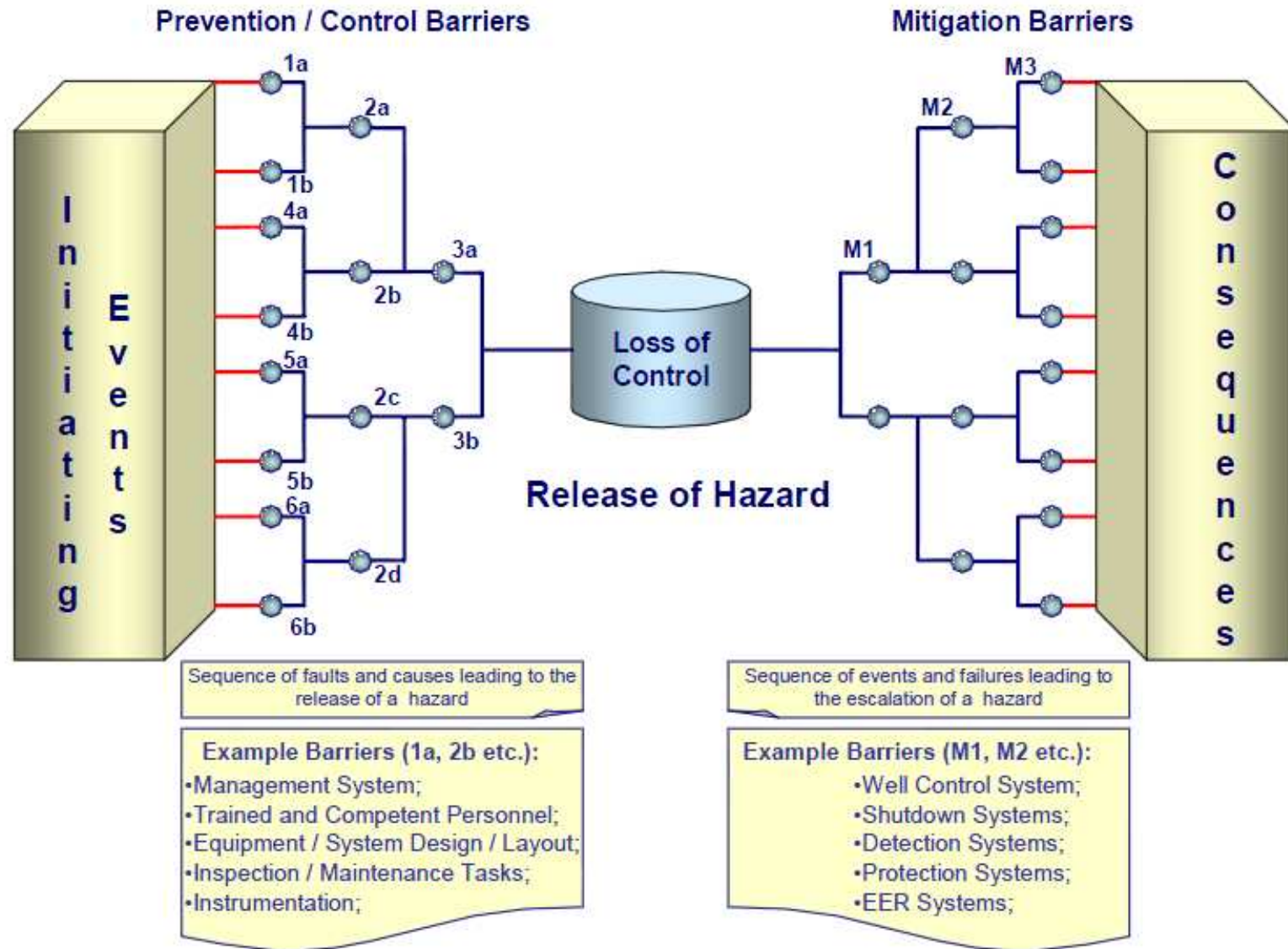
II-d. Bow-Tie

Bow Tie

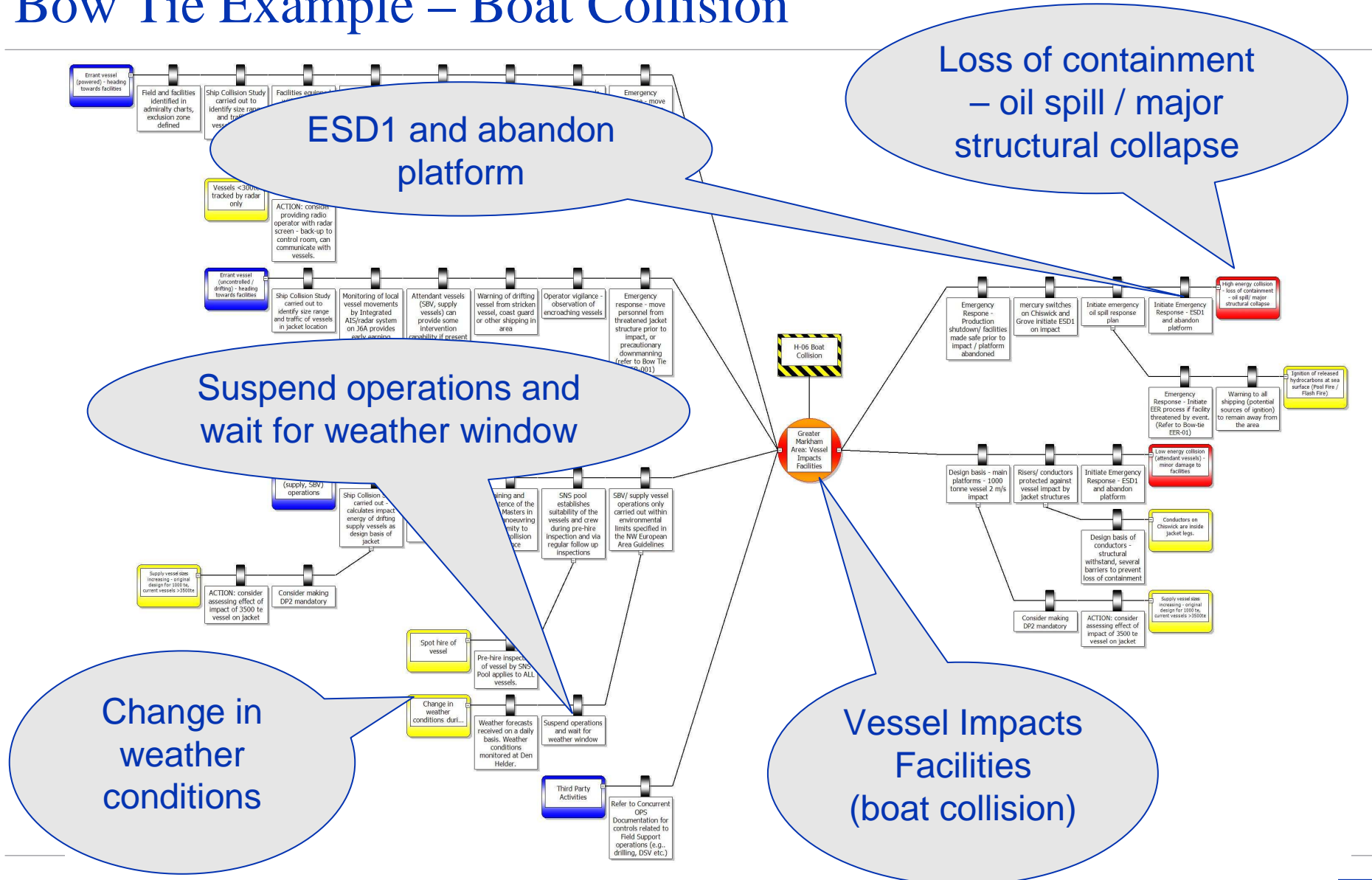
- The Bow Tie model serves as a critical risk management communication tool used to support Hazards and Effects Management Processes.
- It provides a highly visual demonstration of the anatomy of complex risk management structures and supporting operational systems.
- Bow Tie analysis helps you to:
 - Identify and document the “HSE” (control and/or mitigating) barriers that are in place;
 - Facilitate a qualitative gap assessment of any gap;
 - Help communicate an assessment of event likelihood;
 - Support in accident investigation.



Bow Tie Example – IADC HSE Case Guideline



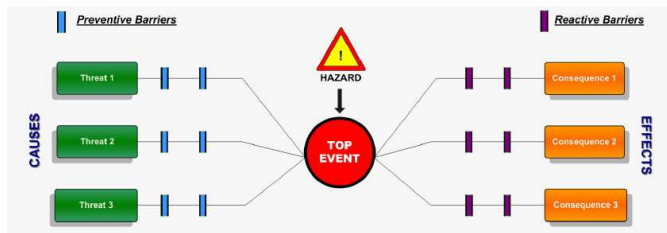
Bow Tie Example – Boat Collision



Bow-Tie

DNV can carry out:

- Assessment using Bow-Tie methodology
- Training



 BowTieXP



III. Final Comments



DNV

**Safeguarding life,
property, and
the environment**



Thank you !