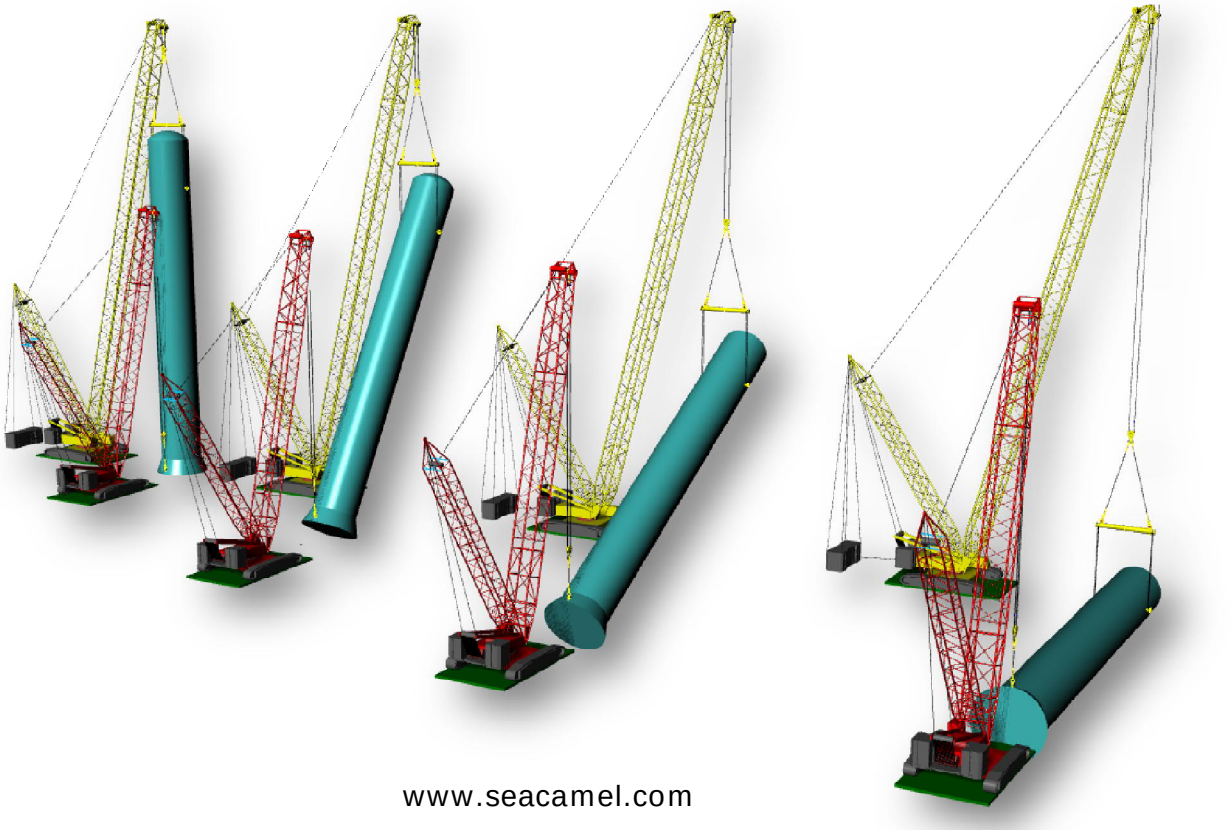
# Principles of heavy lifting, transport, shipping and Offshore construction.

## Overview

From seller to site, heavy transportation and lifting involves a variety of specialized load handling equipment and qualified people. From contract signing to project execution all aspects of heavy transport and lifting affect the overall project.

This course is designed to train personnel and organizations involved with heavy lifting and transports to work more efficient, effective and safer.



## WHO SHOULD ATTEND

- Crane & Transport Contractors
- Freight Forwarders
- HSE Managers
- Heavy lift supervisors and specialists
- Offshore superintendents
- Marine Warranty Surveyors.
- Construction and Installation managers
- Project cargo engineers and Vessel design engineers
- Naval architects
- Sales engineers
- Heavy lift vessel managers and Project cargo coordinators and managers
- Project cargo companies
- Heavy lifting components manufacturers
- Representatives from offshore oil & gas and renewables
- HVL fleet owners
- Heavy lift project management personnel
- Maritime transport and logistics professionals
- Freight consultancies and technical authorities
- Freight forwarders, break-bulk shipping
- Personnel involved in lifting operations interested in enhancing their knowledge
- Companies entering the heavy lifting market
- Heavy lifting companies enlarging their portfolio with offshore operations

## THE TRAINER

Rob Hoekstra

SEACAMEL FOUNDER

Rob Hoekstra is the founder of SEACAMEL Maritime Engineering a company providing services and training for the maritime industries since 2009. He has wide experience with other fortune companies such as Dockwise, Boskalis, Subsea 7, “Heerema Fabrication Group Engineering”, Mammoet, ALE Heavy Lifting, etc. Heavy lifting and transportation, maritime, offshore and insurance industries are fields that he's specialized in.

With over 25 years of industrial experience, many organizations have benefited from Rob Hoekstra, such as: salvage companies, companies involved in design, offshore installation, construction and operation of ships, barges and offshore structures, cargo owners, warranty surveyors and legal firms.

## OVERVIEW

Characteristic for heavy lifting is the absence of standardization, which requires unique transport planning and multidiscipline preparation for each project Oversized and impossible to split over different scheduled services they need to be transported from one place to another and then lifted or installed into place. Such undertaking requires:

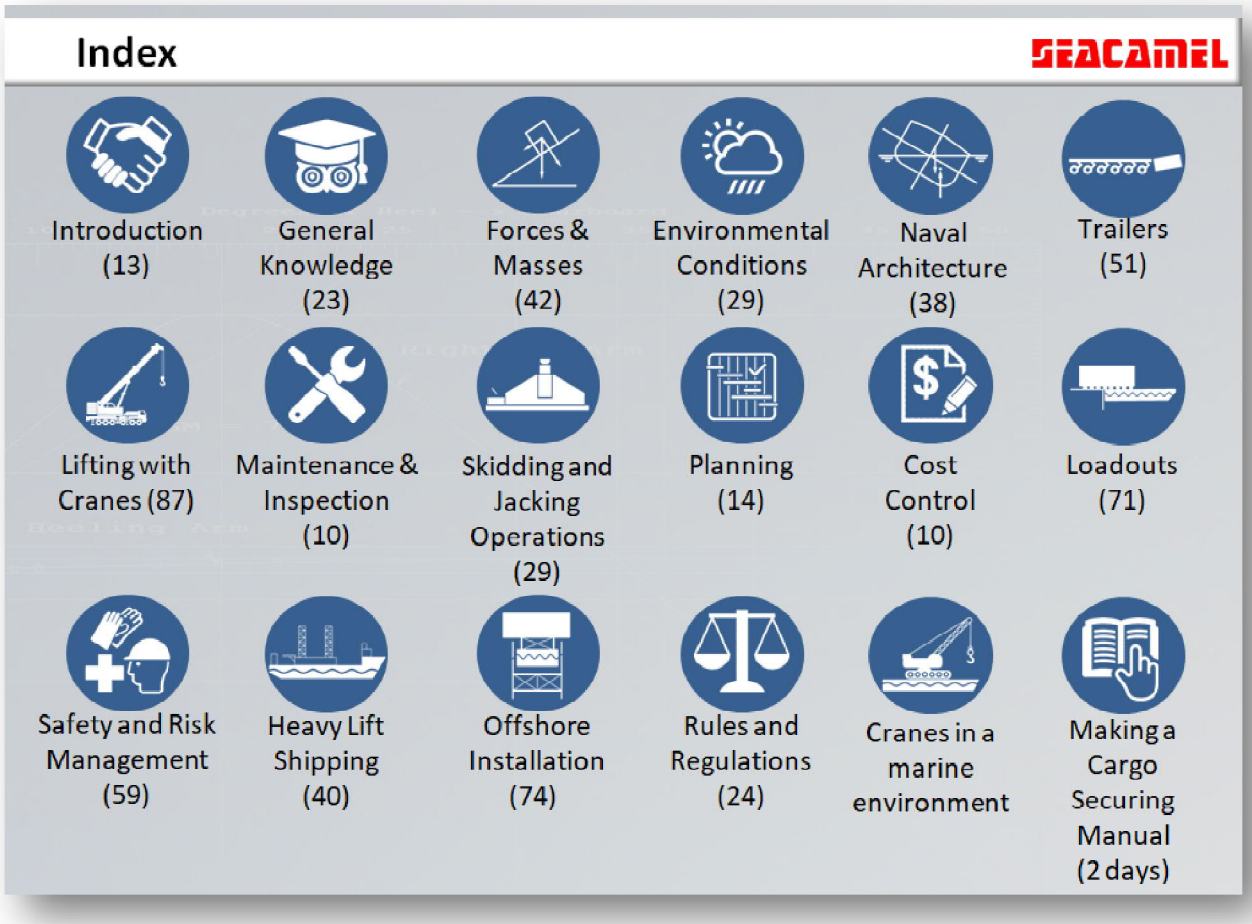
- Planning
- The procedure and techniques of handling heavy lifting
- Teamwork and team coordination
- Investigation and preparation of the infrastructure
- Equipment selection and preparation
- Awareness of safety, rules, regulations and legislation

Excellent engineering and dedicated project management are truly indispensable elements in preparing, planning and executing projects of this nature. Special sets of skills and knowledge are required to undertake such projects. From engineers who want to broaden and elevate their knowledge to project managers who are overall responsible, this workshop equips and furnishes participants with the necessary tools, skills and understanding to undertake such projects.

## SETUP

The seminar is divided in modules which are all related to the preparation and safe execution of heavy lifting, transport and shipping.

For in-company trainings, you may decide that a one- or two-day training would be more applicable. Just handpick the modules of interest to create the training suitable for your organization.



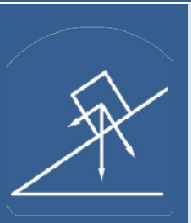
## DESCRIPTION OF THE MODULES

### MODULES

#### General Knowledge

A brief overview of the topics that will be discussed.

#### Forces, Masses and Center of Gravity



A true engineering refresher and important to assure that we speak the same language. Learn about Newton's laws, linear and angular accelerations, forces and moments.

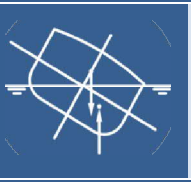
How to calculate the centre of gravity of an object? What will happen with the C.o.G. when you add another mass to it or shift a mass within it?

For those who had problems with trigonometry, we will make it fully clear to you within 10 minutes.

#### Environmental Conditions

What are environmental conditions, how do they affect our work and how to deal with it?

#### Naval Architectural and Maritime Basics



Learn the basics of naval architecture. After this module you understand how to calculate the stability of a barge or vessel and how much a barge will list when you add or shift a cargo on a barge or vessel.

#### Trailers

What types of trailers are around? What is the difference between an SPMT and a pull type trailer? How do they work? How many do you need for a transport? Will that transport be stabile? What truck do you need? All these questions will be addressed during this module.

## Lifting with Cranes

Lifting is an essential part of the work we do. The various types of lifting will be discussed and you will learn how to select a crane suitable for the job. You will learn:

- about the stability of a load,
- how designing a lifting plan,
- the use of spreader bars and,
- how to organize a lift.

## Maintenance and Inspection

Inspection of material and equipment can in many countries only be done by authorized inspectors. While this master class will not train you for being an authorized inspector, it is good to know what to look for when we visit the site.

## Skidding and Jacking

When objects become too big to lift or move by trailers, skidding becomes the preferred option for moving. You will learn about the various skidding & moving techniques and the mayor companies active in this field.

## Making a Project Planning

Plan your work and work your plan.

Delivering projects on time and within budget is only possible with a decent planning. Learn the basics for making a planning and monitor the progress during the execution of the project.

## Preparation of Cost Estimate

A subject closely related to the planning and part of the 4d training.

## Loadouts of Extreme Heavy Lifts

Many heavy loads are transported via water. Although most cargoes leave the quay eventually, the costs can be enormous if the loading of a cargo has not been part of the entire project scope.

## Safety and Risk Analysis

Either we do the job safe or we do not do the job at all. Safety is an attitude and a value we all share but how do we know if we are working safely? What are risks and what methods are available to measure safety?

Both the risk matrix and the bowtie method, which are both part of ISO 17776, will be explained.

## Heavy Lift Shipping

What types of vessels are around and what is important when loading, sailing or discharging these vessels?

You will learn how to seafasten the cargo and determine the required amount of seafastenings.

## Offshore Lifting and Installation

A topic which is part of the 4d training. Introduction to the offshore world with respect to exploration, production and installation of offshore structures.

This section contains a case study for a jacket transport and installation.

## Rules and Regulations

What certifying bodies do exist and what do they stand for? Learn what is applicable for us and how to find your way in the overwhelming variety of rules, regulations, legislation etc.

## Cranes in a marine environment

In-shore and off-shore, cranes are used on barges and vessel. This gives additional dynamics to the operation and not all cranes are suitable. Learn the differences and understand how to access and deal with these differences.

## TRAINING SCHEME

The standard open training takes 2, 3 or 4 days. Most people experience the 3 day training as intensive. The 4 day training, which in addition includes the modules Cost control, Planning and Offshore Installation, allows for going deeper into the subjects and questions raised by the attendees.

For the 2d training, most subjects related to shipping and offshore are skipped and the modules are at a more basic level. Engineering skills enhancements is still a mayor topic.

| 2 Days<br>Module | Slides | 9.00 | 10.00 | 10.30 | 11.00 | 12.00 | 12.30 | 13.30 | 14.00 | 15.15 | 15.45 | 16.00 | 17.00 | Time |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Introduction | 13 | | | Coffee brake | | | Lunch | | | Coffee brake | | | | Day 1 |
| General knowledge | 23 | | | | | | | | | | | | | |
| Forces and Masses | 42 | | | | | | | | | | | | | |
| Environmental Conditions | 29 | | | | | | | | | | | | | |
| Safety | 59 | | | | | | | | | | | | | |
| Naval Architecture | 38 | | | | | | | | | | | | | |
| Trailers | 51 | | | | | | | | | | | | | |
| Lifting with Cranes | 87 | | | | | | | | | | | | | Day 2 |
| Cranes in a marine environment | 36 | | | | | | | | | | | | | |
| Maintenance & Inspection | 22 | | | | | | | | | | | | | |
| Skidding Operations | 29 | | | | | | | | | | | | | |
| Cost Control | 10 | | | | | | | | | | | | | |
| Loadouts of extremely heavy cargoes | 71 | | | | | | | | | | | | | |
| Planning | 14 | | | | | | | | | | | | | |
| Heavy Lift shipping | 40 | | | | | | | | | | | | | |
| Offshore Lifting and Installations | 74 | | | | | | | | | | | | | |
| Rules and Regulations | 24 | | | | | | | | | | | | | |
| Evaluation and test | - | | | | | | | | | | | | | |

| 3 Days<br>Module | Slides | 9.00 | 10.00 | 10.30 | 11.00 | 12.00 | 12.30 | 13.30 | 14.00 | 15.15 | 15.45 | 16.00 | 17.00 | Time |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Introduction | 13 | | | Coffee brake | | | Lunch | | | Coffee brake | | | | Day 1 |
| General knowledge | 23 | | | | | | | | | | | | | |
| Forces and Masses | 42 | | | | | | | | | | | | | |
| Environmental Conditions | 29 | | | | | | | | | | | | | |
| Safety | 59 | | | | | | | | | | | | | |
| Naval Architecture | 38 | | | | | | | | | | | | | Day 2 |
| Trailers | 51 | | | | | | | | | | | | | |
| Lifting with Cranes | 87 | | | | | | | | | | | | | |
| Cranes in a marine environment | 36 | | | | | | | | | | | | | |
| Maintenance & Inspection | 10 | | | | | | | | | | | | | |
| Skidding Operations | 29 | | | | | | | | | | | | | |
| Cost Control | 10 | | | | | | | | | | | | | Day 3 |
| Loadouts of extremely heavy cargoes | 71 | | | | | | | | | | | | | |
| Planning | 14 | | | | | | | | | | | | | |
| Heavy Lift shipping | 40 | | | | | | | | | | | | | |
| Offshore Lifting and Installations | 74 | | | | | | | | | | | | | |
| Rules and Regulations | 24 | | | | | | | | | | | | | |
| Evaluation and test | - | | | | | | | | | | | | | |

| 4 Days<br>Module | Slides | 9.00 | 10.00 | 10.30 | 11.00 | 12.00 | 12.30 | 13.30 | 14.00 | 15.15 | 15.45 | 16.00 | 17.00 | Time |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Introduction | 13 | | | Coffee brake | | | Lunch | | | Coffee break | | | | Day 1 |
| General knowledge | 23 | | | | | | | | | | | | | |
| Forces and Masses | 42 | | | | | | | | | | | | | |
| Environmental Conditions | 29 | | | | | | | | | | | | | |
| Naval Architecture | 59 | | | | | | | | | | | | | Day 2 |
| Trailers | 38 | | | | | | | | | | | | | |
| Lifting with Cranes | 51 | | | | | | | | | | | | | |
| Cranes in a marine environment | 36 | | | | | | | | | | | | | |
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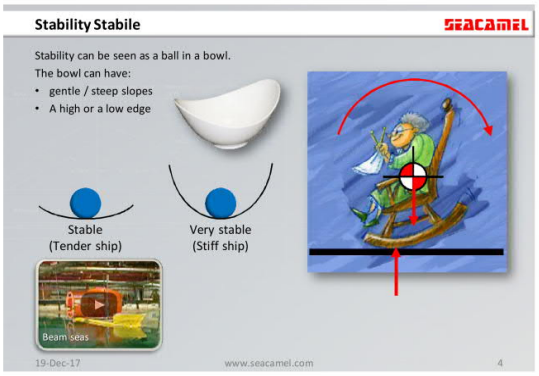
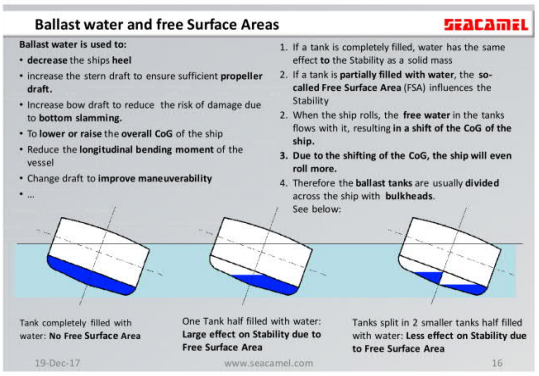
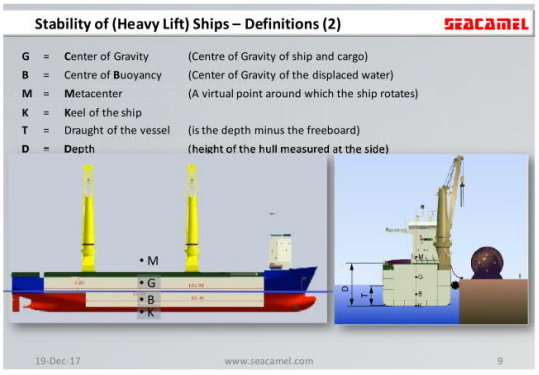
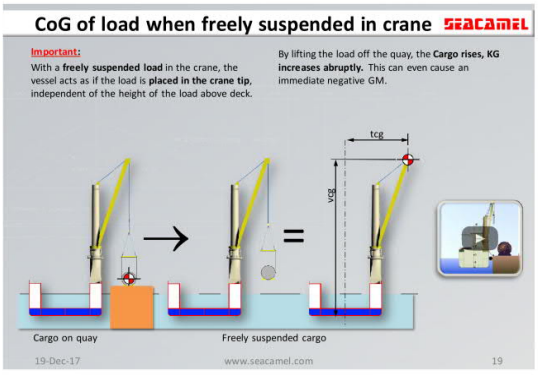
| Skidding Operations | 10 | | | | | | | | | | | | | Day 3 |
| Planning | 29 | | | | | | | | | | | | | |
| Cost Control | 10 | | | | | | | | | | | | | |
| Loadouts | 71 | | | | | | | | | | | | | |
| Safety | 14 | | | | | | | | | | | | | |
| Heavy Lift shipping | 40 | | | | | | | | | | | | | Day 4 |
| Offshore Lifting and Installations | 74 | | | | | | | | | | | | | |
| Cranes in a marine environment | 24 | | | | | | | | | | | | | |
| Rules and Regulations | 24 | | | | | | | | | | | | | |
| Evaluation and test | - | | | | | | | | | | | | | |

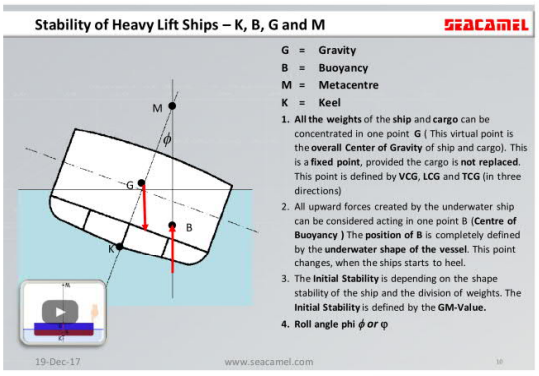
## EXAMPLES OF SLIDES

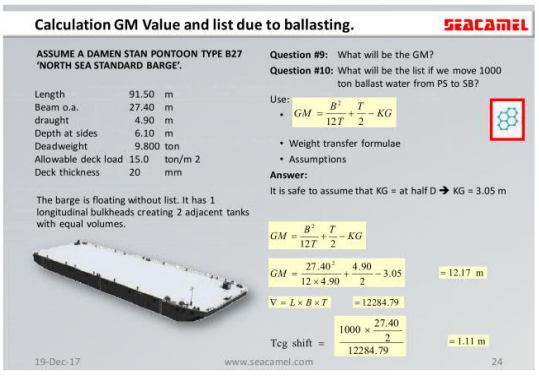


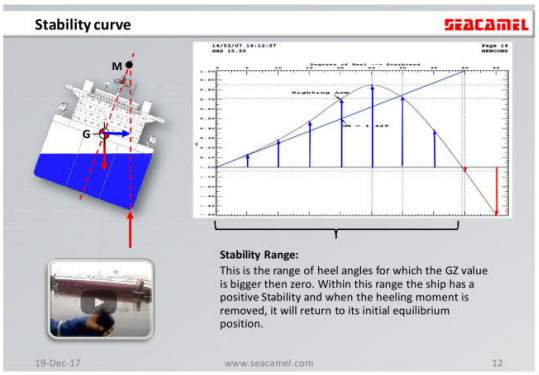



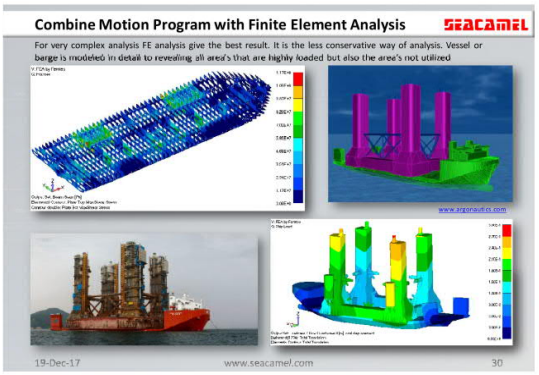



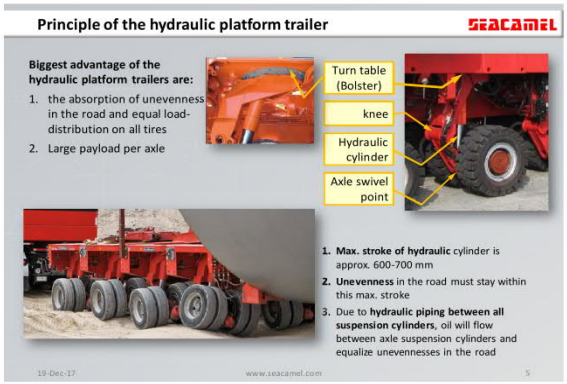



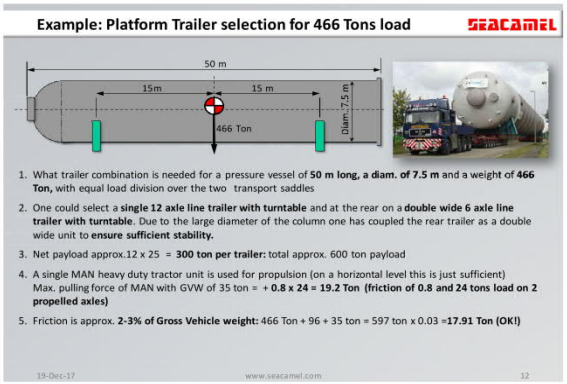



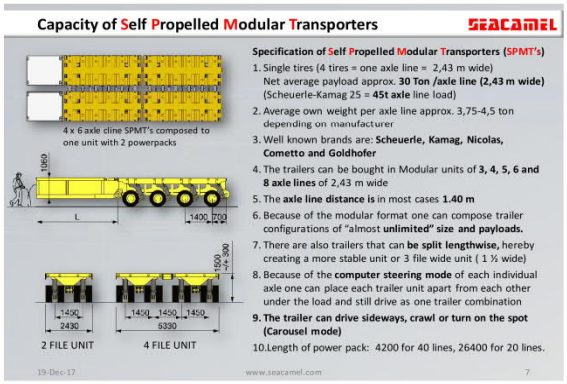



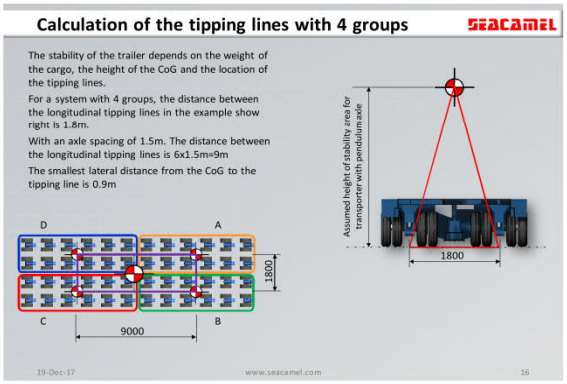



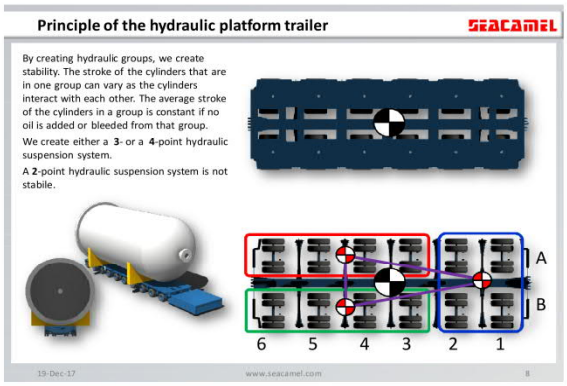

Naval architecture

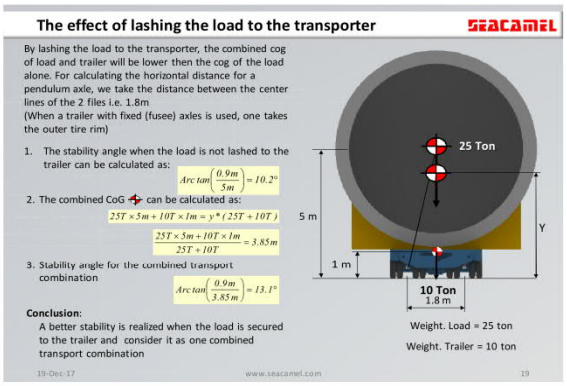

Principle of the hydraulic platform trailer
Biggest advantage of the hydraulic platform trailers are:
1. the absorption of unevenness in the road and equal load-distribution on all tires
2. Large payload per axle
Turn table (Bolster)
knee
Hydraulic cylinder
Axle swivel point
1. Max. stroke of hydraulic cylinder is approx. 600-700 mm
2. Unevenness in the road must stay within this max. stroke
3. Due to hydraulic piping between all suspension cylinders, oil will flow between axle suspension cylinders and equalize unevennesses in the road

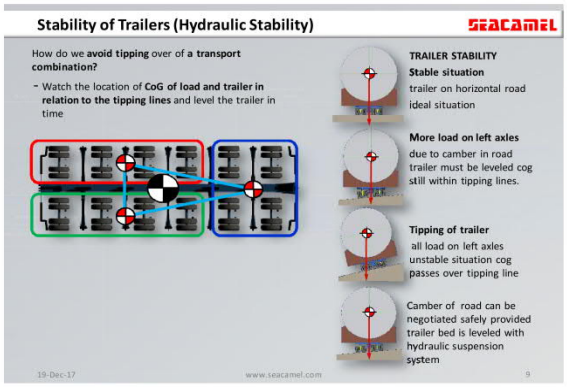

Example: Platform Trailer selection for 466 Tons load
50 m
15m
15 m
466 Ton
Diam.:7.5 m
1. What trailer combination is needed for a pressure vessel of 50 m long, a diam. of 7.5 m and a weight of 466 Ton, with equal load division over the two transport saddles
2. One could select a single 12 axle line trailer with turntable and at the rear on a double wide 6 axle line trailer with turntable. Due to the large diameter of the column one has coupled the rear trailer as a double wide unit to ensure sufficient stability.
3. Net payload approx.12 x 25 = 300 ton per trailer: total approx. 600 ton payload
4. A single MAN heavy duty tractor unit is used for propulsion (on a horizontal level this is just sufficient) Max. pulling force of MAN with GVW of 35 ton = + 0.8 x 24 = 19.2 Ton (friction of 0.8 and 24 tons load on 2 propelled axles)
5. Friction is approx. 2-3% of Gross Vehicle weight: 466 Ton + 96 + 35 ton = 597 ton x 0.03 =17.91 Ton (OK!)

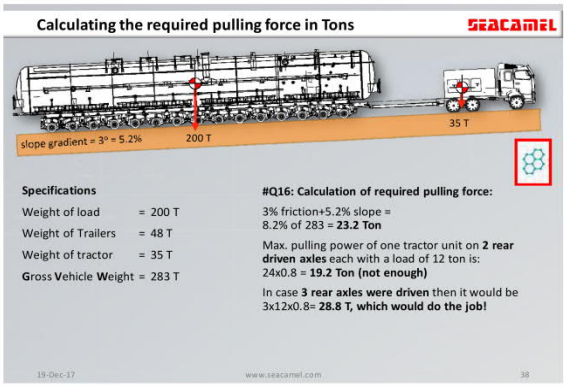

Capacity of Self Propelled Modular Transporters
4 x 6 axle cline SPMT's composed to one unit with 2 powerpacks
2 FILE UNIT
4 FILE UNIT
Specification of Self Propelled Modular Transporters (SPMT's)
1. Single tires (4 tires = one axle line = 2,43 m wide) Net average payload approx. 30 Ton /axle line (2,43 m wide) (Scheuerle-Kamag 25 = 45t axle line load)
2. Average own weight per axle line approx. 3,75-4,5 ton depending on manufacturer
3. Well known brands are: Scheuerle, Kamag, Nicolas, Cometto and Goldhofer
4. The trailers can be bought in Modular units of 3, 4, 5, 6 and 8 axle lines of 2,43 m wide
5. The axle line distance is in most cases 1.40 m
6. Because of the modular format one can compose trailer configurations of "almost unlimited" size and payloads.
7. There are also trailers that can be split lengthwise, hereby creating a more stable unit or 3 file wide unit ( 1 ½ wide)
8. Because of the computer steering mode of each individual axle one can place each trailer unit apart from each other under the load and still drive as one trailer combination
9. The trailer can drive sideways, crawl or turn on the spot (Carousel mode)
10.Length of power pack: 4200 for 40 lines, 26400 for 20 lines.


Calculation of the tipping lines with 4 groups
The stability of the trailer depends on the weight of the cargo, the height of the CoG and the location of the tipping lines.
For a system with 4 groups, the distance between the longitudinal tipping lines in the example show right is 1.8m.
With an axle spacing of 1.5m. The distance between the longitudinal tipping lines is 6x1.5m=9m
The smallest lateral distance from the CoG to the tipping line is 0.9m
Assumed height of stability area for transporter with pendulum axle
1800
D
A
C
B
9000
1800

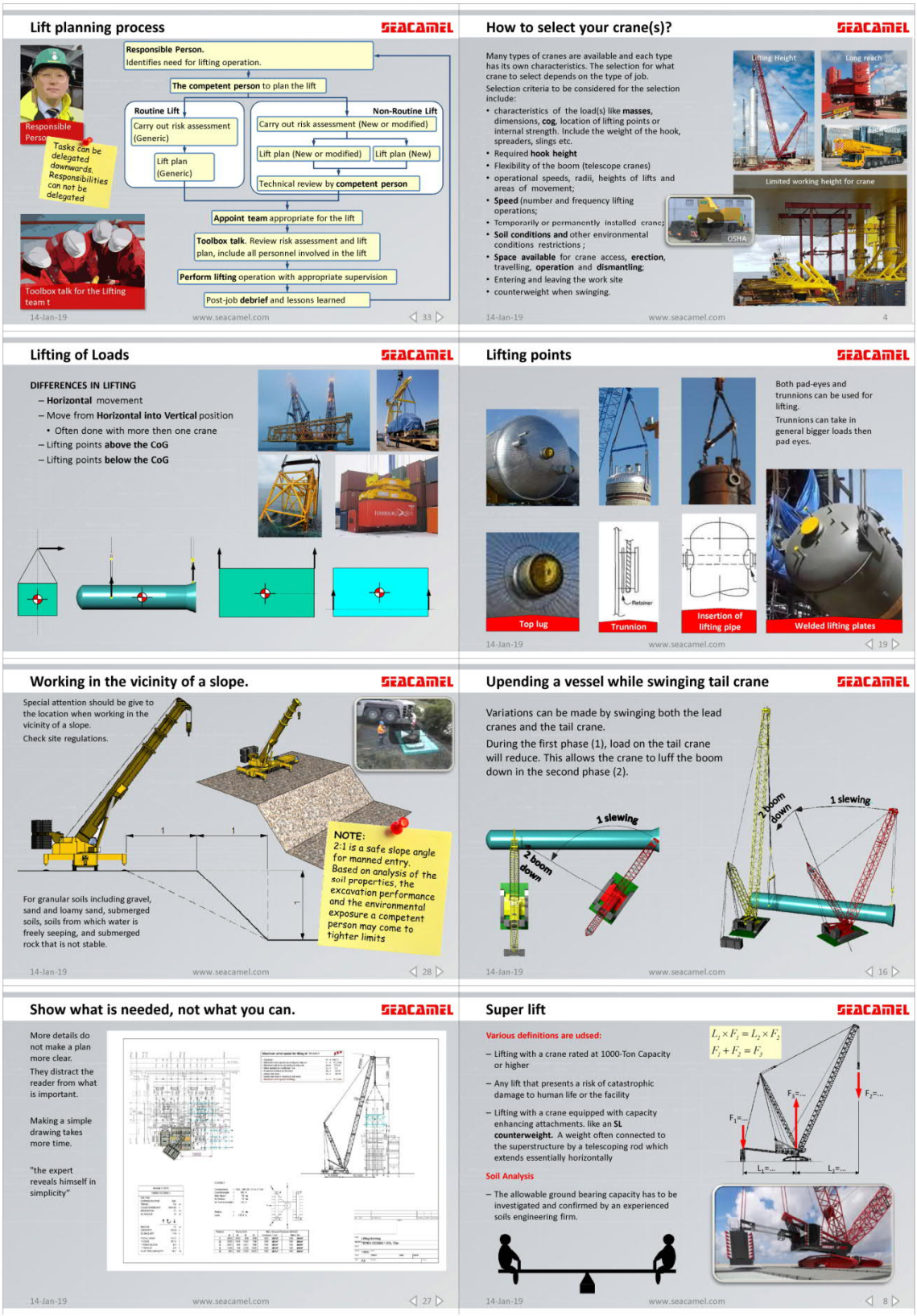

Principle of the hydraulic platform trailer
By creating hydraulic groups, we create stability. The stroke of the cylinders that are in one group can vary as the cylinders interact with each other. The average stroke of the cylinders in a group is constant if no oil is added or bleeded from that group.
We create either a 3- or a 4-point hydraulic suspension system.
A 2-point hydraulic suspension system is not stabile.
A
B
6 5 4 3 2 1


The effect of lashing the load to the transporter
By lashing the load to the transporter, the combined cog of load and trailer will be lower then the cog of the load alone. For calculating the horizontal distance for a pendulum axle, we take the distance between the center lines of the 2 files i.e. 1.8m
(When a trailer with fixed (fusee) axles is used, one takes the outer tire rim)
1. The stability angle when the load is not lashed to the trailer can be calculated as:
Arc tan (0.9m / 5m) = 10.2°
2. The combined CoG can be calculated as:
25T × 5m + 10T × 1m = y * (25T + 10T)
(25T × 5m + 10T × 1m) / (25T + 10T) = 3.85m
3. Stability angle for the combined transport combination
Arc tan (0.9m / 3.85m) = 13.1°
Conclusion:
A better stability is realized when the load is secured to the trailer and consider it as one combined transport combination
25 Ton
5 m
1 m
Y
10 Ton
1.8 m
Weight. Load = 25 ton
Weight. Trailer = 10 ton

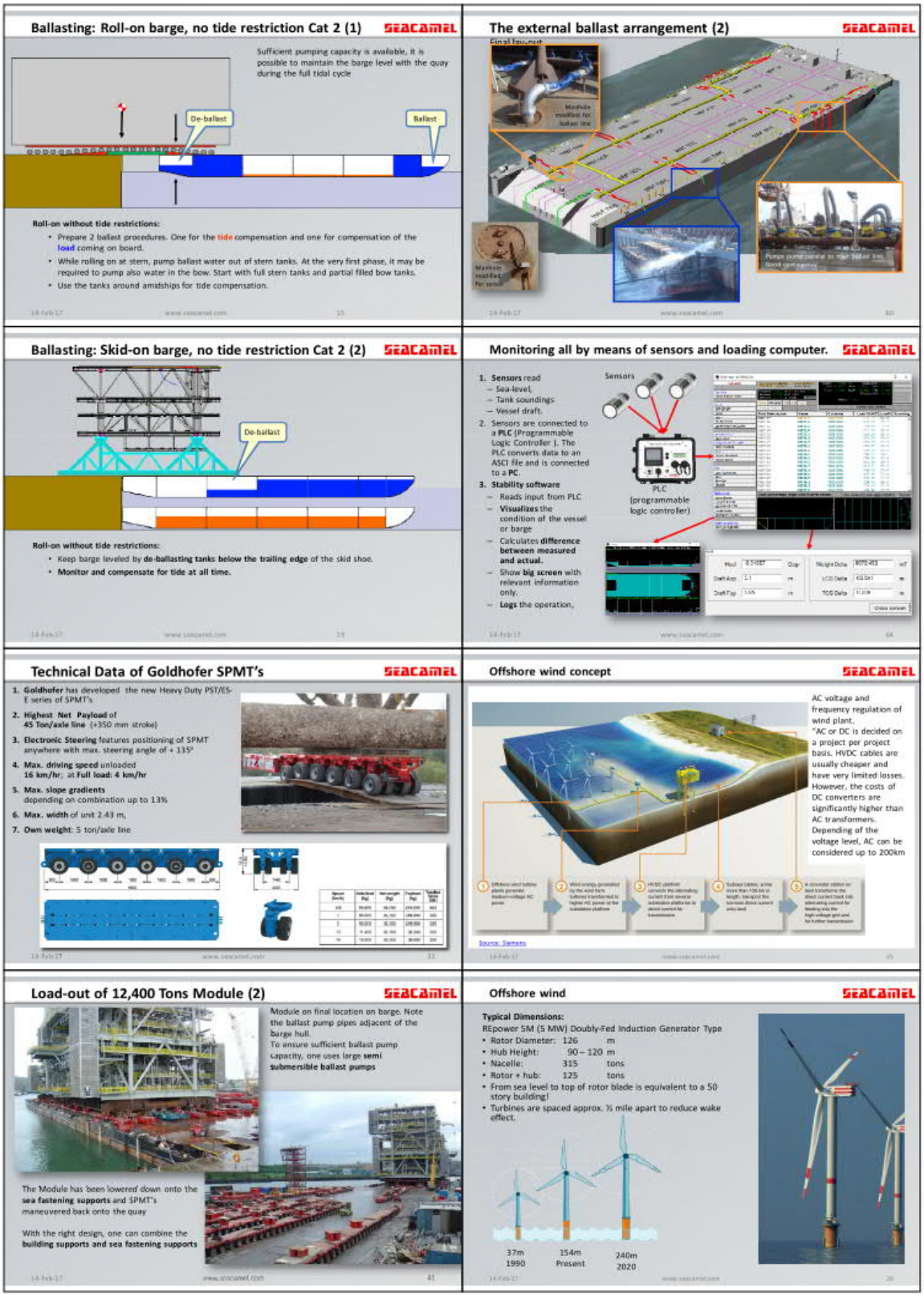

Stability of Trailers (Hydraulic Stability)
How do we avoid tipping over of a transport combination?
- Watch the location of CoG of load and trailer in relation to the tipping lines and level the trailer in time
TRAILER STABILITY
Stable situation
trailer on horizontal road
ideal situation
More load on left axles
due to camber in road trailer must be leveled cog still within tipping lines.
Tipping of trailer
all load on left axles unstable situation cog passes over tipping line
Camber of road can be negotiated safely provided trailer bed is leveled with hydraulic suspension system


Calculating the required pulling force in Tons
slope gradient = 3° = 5.2%
200 T
35 T
Specifications
Weight of load = 200 T
Weight of Trailers = 48 T
Weight of tractor = 35 T
Gross Vehicle Weight = 283 T
#Q16: Calculation of required pulling force:
3% friction+5.2% slope = 8.2% of 283 = 23.2 Ton
Max. pulling power of one tractor unit on 2 rear driven axles each with a load of 12 ton is: 24x0.8 = 19.2 Ton (not enough)
In case 3 rear axles were driven then it would be 3x12x0.8= 28.8 T, which would do the job!

Trailers




Lifting with Cranes




Loadouts of Extreme Heavy Cargoes and offshore installation

## DETAILED CONTENT OF THE SEMINAR

Overview of all slide titles.

### General Knowledge

- Different LIFTING and TRANSPORT types
- Heavy load trailers
- Land Cranes
- Terminology (EN13000)
- Terminology (EN13000)
- Terminology (EN13000)
- Terminology (EN13000)
- Largest Mobile Land Cranes available
- Various cap. Charts and applications of Mammoet PTC-DS-140 and PTC-DS-200
- Floating (Seagoing) Cranes
- Various moving techniques in one project
- Conventional Trailers
- Platform Trailers
- Different Vessel Crane types
- Different Land Crane types
- Heavy Lift Transport Vessels
- Offshore Installation Vessels
- Offshore Support Vessels
- Terms & Abbreviations
- Some Definitions

### Forces, Masses and Center of Gravity

- What is exactly a Force?
- Newton's Three Laws of Motion
- 1st Law of Newton (Law of inertia)
- 2nd + 3rd law, force changes motion
- Difference between Mass, Weight and Force
- Forces and Moments
- Newton's Third Law and Archimedes law of lever
- Composing of Forces using the Head-Tail Method
- Composing of Forces with a parallelogram
- Forces acting on a body
- Main formulas to calculate forces
- Example
- Answer
- Calculation of Centrifugal Forces
- Standard triangles and Pythagoras ($a^2+b^2=c^2$)
- Understanding trigonometry within 5 minutes
- Something about Forces
- No Control of Forces
- Summary of composing of forces
- Calculating the CoG by means of the moment equation
- Principle of Center of Gravity
- Calculating Combined CoG of barge with crane (1)
- Calculating Combined CoG of barge with crane (2)
- Calculating Combined CoG of barge with crane (3)
- Calculating Combined CoG of barge with crane (4)
- CoG shift due to shifting or adding a mass
- Calculating Outrigger loads of a crane
- Wind force
- Possible effect of wind
- Wind force on crane load according EN13000
- Accelerations and Decelerations (Stability)
- Calculating if something will slide
- Friction Forces when sliding (2)
- Friction Forces (Dynamic + Static)
- Forces on vessels
- Free useful study material.
- Calculation of weights
- Estimation of Weights of Loads (2)
- Same can be done for barges
- Essential information for Transport & lifting

## Environmental Conditions

- Wind Conditions
- Wind force (Scale of Beaufort)
- Wind force (Scale of Beaufort)
- Wind force (Scale of Beaufort)
- Wind pressure and wind load
- Wind gradient.
- Finding the allowable wind speed for cranes using a diagram
- Calculating the allowable speed (1)
- Calculating the allowable speed (2)
- Waves and swell
- Significant wave
- Longitudinal bending moments
- Current
- Loop Currents (Eddy Currents)
- Check the weather yourself (www.zygrib.org)
- Location, heading and speed of a vessel.
- Tide, what is causing it?
- Tide Tables and Tides
- Tide Tables and Tides
- Simple method to calculate the tide
- Weather restricted operations (DNV)
- Tropical storm avoidance flow chart (float-over).
- Weather restricted operations. The α-factor (DNV)
- OPLIM Operational environmental limiting criteria.
- Water force (slamming, tide, current)
- Storm at Borgholm Dolphin, North Sea Jan 10, 2015

## Naval Architectural and Maritime Basics

- Engineering is Not BLACK or WHITE
- The difference between stability and balance.
- Unstable
- Indifferent stability
- Stability of Heavy Lift Ships - Introduction
- Stability of (Heavy Lift) Ships – Definitions (1)
- Stability of (Heavy Lift) Ships – Definitions (2)
- Anatomy of a barge
- Stability of Heavy Lift Ships – K, B, G and M
- Why do ships stay upright?
- Stability curve
- Calculation of Metacenter of a ship
- Moment of inertia of the water plane area and BM.
- Calculation of GM Value
- Ballast water and free Surface Areas
- Stability Requirements of IMO for ships
- How can the Stability of a Ship be influenced?
- CoG of load when freely suspended in crane
- Stability example
- Advanced stability, orthogonal tipping: 1
- Advanced stability, orthogonal tipping: 2
- Advanced stability, orthogonal tipping: 3
- Calculation GM Value and list due to ballasting.
- Calculation using GM Value Cont'd
- Sea fastening of Cargo on Heavy Lift Ships
- Motion Analysis of vessel
- "20 deg 10 Barge" DNVGL-ST-N001 Marine operations and marine warranty.
- "20 deg 10 Rule", simple rule and in general conservative.
- Combine Motion Program with Finite Element Analysis

## Trailers

- Platform trailers and standard flatbed trailers
- Pros and cons of the hydraulic platform trailer

- Principle of the hydraulic platform trailer
- Capacity of Platform trailers (pull type)
- Capacity of Self Propelled Modular Transporters
- Principle of the hydraulic platform trailer
- Stability of Trailers (Hydraulic Stability)
- Stability of Trailers (Tipping lines)
- Stability of Trailers (Hydraulic)
- Example: Platform Trailer selection for 466 Tons load
- Example: Platform Trailer selection for 810 Tons load
- SPMT Animation by ALE
- Stability: 3- and 4- points hydraulic suspension
- Calculation of the tipping lines with 4 groups
- Calculation for the tipping lines with 3 groups symmetrical
- Calculation for the tipping lines with 3 groups (a-symmetrical)
- The effect of lashing the load to the transporter
- Stability: 3- and 4- points hydraulic suspension
- Critical Stability of a single SPMT used in dolly configuration with turntables
- Software for trailers
- Tipped Over Transport Combination (1)
- Tipped Over Transport Combination (2)
- Conventional Platform trailer with load tipped over
- Stability of a Conventional Hydraulic Platform trailer
- Axle loads (A-symmetrical suspension point)
- Calculation of axle loads
- Calc. of aver. ground load (This is not a scientific approach) (1)
- Realistic ground pressure profile
- Calc. of aver. ground load (This is not a scientific approach) (2)
- Section 2 BS 8004:1986
- Load on ground surface or steel deck
- Principle of steering (Conventional)
- Principle of steering (SPMT's)
- Heavy Duty Tractors versus required pulling force
- Estimation of pulling force of HD Tractor
- Calculating the required pulling force in Tons
- Determining the Lashing loads
- Determining the Lashing loads
- Standard Cargo Securement Rules
- Example: Choice of Trailer configuration for 520 t load (1)
- Example: Choice of Trailer configuration for 520 t load (2)
- Job site preparation
- Choice of Trailer configuration for a 16 m Sphere
- The Transport Plan
- BEST PRACTICE GUIDE "Europaische Schwertransport Automobilkran" (ESTA)
- BEST PRACTICE GUIDE "Europaische Schwertransport Automobilkran" (ESTA)
- BEST PRACTICE GUIDE "Europäische Schwertransport Automobilkran" (ESTA)
- BEST PRACTICE GUIDE "Europaische Schwertransport Automobilkran" (ESTA)
- Recommendations

## Lifting with Cranes

- Lifting of Loads
- How to select your crane(s)
- Comparison; Crawler versus Tyre
- Comparison; Telescopic versus Lattice (1)
- Comparison; Telescopic versus Lattice (2)

- Pros and cons of the various crane types
- Lift versus Heavy duty
- Comparison; Lift versus Heavy duty
- Rated Crane capacity and Load moment
- Quick Reference capacity Chart for Hydraulic cranes
- Upending a vessel with 2 cranes, one crane moving
- Upending a vessel with 3 cranes
- Upending a vessel while swinging tail crane
- Upending a vessel using a tailing frame
- Upending using a lift System
- Lifting points
- Tailing lugs
- Tailing lugs
- Lift Plan
- Setting up of a Lift Plan
- Set-up of a lift plan for the erection of a reactor
- Set-up of a lift plan for the erection of a reactor (some details)
- Set-up of a Lift plan
- Lift data sheet: the basics
- Lift data sheet: the basics
- Video: Lifting of 950Tons reactor
- Organizing the lift
- Lift planning process
- Type of lifts
- The Moment equation
- The load in each crane depends on the location of CoG and the angle with the horizon
- Location of CoG in relation to the lift points
- The 10 Golden Rules for Lifting a load
- Checklist for lifting (Subsea 7)
- Mobile Crane Hand Signals
- Radio Communication
- Tail crane and distribution of load between tail crane and main lift crane (1)
- Tail crane and distribution of load between tail crane and main lift crane (2)
- Tail crane and distribution of load between tail crane and main lift crane (3)
- Tail crane and distribution of load between tail crane and main lift crane (4)
- Distribution of Tail load and Main lift crane (In Excel program)
- Lifting of a Load with 2 cranes (position of Cranes) (1)
- Lifting of a Load with 2 cranes (position of Cranes) (2)
- The lifting of two large columns with 3 cranes (1)
- The lifting of two large columns with 3 cranes (2)
- The lifting of two large columns with 3 cranes (3)
- The lifting of two large columns with 3 cranes (4)
- The Inclino meter
- The lifting of two large columns with 3 cranes (1)
- The lifting of two large columns with 3 cranes (2)
- Drawing the lifting plan using CAD blocks.
- Sling plan and forces in lifting slings (1)
- Sling plan and forces in lifting slings (2)
- The CoG is always suspended straight under the hook
- Forces in slings of unequal lengths
- Define the sling length and force with the graphical method
- Define the forces in each sling
- Calculate the forces in the spreader beam
- Calculate the forces in slings and spreader beam
- The Stability criteria of a crane
- Play time!
- Spreader beam configurations

- The Stability of a load to be lifted (1)
- The Stability of a load to be lifted (2)
- The Stability Range
- The Stability Moment of the load to be lifted (1)
- The Stability Moment of the load to be lifted (2)
- The Stability of the load to be lifted (1)
- The Stability of the load to be lifted (2)
- How to rig a Trafo to a Lifting Beam
- The Stability of the load with 3 lift points below CoG
- Lifting if a container crane
- Examples of Stability of the Load
- The Stability of the load to be lifted
- Use of lifting beams and spreaders
- Lifting beam (800 Tons) and Spreader beams (1000 Tons)
- Use of lift beams and spreader beams (1)
- Use of lift beams and spreader beams (2)
- Use of lift beams and spreader beams (3)
- Use of various Lifting beams
- Rigging arrangement
- Use of shackles and pad-eyes
- 52% FAILED The Basic Rigging Quiz?
- Work factors (Safety Factor)
- OS-H205_2014-04 Nominal safety factor
- Certification (Europe).
- Sling Capacities in various applications
- Grommet Capacities in various applications
- Applying slings to a load
- Calculate the loads in this example
- Lifting with more than 2 cranes
-

## Maintenance & Inspection

- Baldwins guilty of corporate manslaughter
- Inspection Criteria for Lifting Equipment
- Maintain, Inspect, Check and Test
- Inspection Criteria for Lifting Equipment
- Excessive wear on Crane sheaves
- Synthetic web slings
- Shackles
- Shackles do and don'ts
- Loading directions of lifting points and Checking!
- Discarding Slings (U.S. Department of Labor )
- Discarding wire ropes
- Checklist for Mobile / Crawler Crane
- Wire Rope Clips – Not for lifting
- Maintenance recommendations for Transport Equipment
- Work factors (Safety Factor)
- Identification and CE Marks
-

## Skidding and Jacking

- Various Skidding & Moving techniques
- Skidding Techniques
- Example skidding system
- Stainless Steel on P.T.F.E. Blocks (Teflon). Lubricated with backing oil
- Self propelled skidbeam system (1)
- Self propelled skidbeam system (2)
- Hydra-Slide skidding systems
- Using winches
- Skid system for extreme heavy loads
- Load-out of 17700 mT deck
- Skidding of 830 Tons Container cranes
- Skidding float pads of 200 Tons cap. each
- Working Principle of Strand jacks
- Using Strand jacks as lifting devices

- ALE's Super Crane SK-190/SK-350 using strand jacks (1)
- ALE's Super Crane SK-190/SK-350 using strand jacks (2)
- ALE's Super Crane SK-190/SK-350 using strand jacks (3)
- ALE's Super Crane SK-190/SK-350 using strand jacks (4)
- Jacking methods
- Jacking Towers and Gantries
- ALE's Mega Jack System (40,000T) and Mammoet Push-Up System
- ALE's Mega Jack System (40 - 60,000 T Cap.)
- Alternatives moving method: Airbags
- Airbags Procedure
- Air pressure in bags and stability
- Rules for loading operations for loadouts. Friction

## Making a Project Planning

- Making a Project Planning
- Project Execution:
- Front End Planning
- Typical Project Organisation Chart:
- CTR's, Cost Time Recourse
- Gantt Chart or Bar Chart Planning (1)
- Gantt Chart or Bar Chart Planning (2)
- Example: Project Planning
- Critical path in a Planning Schedule
- Example for a lifting operation
- Measuring Progress.
- Keeping track of the progress
- How to make a Gantt table using Excel Bar chart.

## Preparation of Cost Estimate

- Preparation of a Cost Estimate
- Why a Cost estimate?
- Essential to cost estimates
- Make a Lift- or Transport. What is needed?
- On basis of plans make a Planning Schedule
- Prepare cost estimate on basis of Planning Schedule
- Example of Cost Estimate
- Recommendations

## Loadouts of Extreme Heavy Lifts

- Various Ro-Ro Operations
- Necessary information for RoRo operation
- Categories of loadout. ISO versus DNVGL
- Ballasting the barges
- Ballasting when loading via the stern.
- Barge ballasting.
- Making use of the tidal conditions
- Ballasting: Roll-on barge, tide restricted Cat.1 (1)
- Ballasting: Roll-on barge, tide restricted Cat.1 (2)
- Ballasting: Roll-on barge, tide restricted Cat.1 (3)
- Ballasting: Roll-on barge, tide restricted Cat.1 (4)
- Ballasting: Roll-on barge, tide restricted Cat.1 (5)
- Ballasting: Roll-on barge, no tide restriction Cat 2 (1)
- Ballasting: Roll-on barge, no tide restriction Cat 2 (2)
- Ballasting: Roll-on barge, no tide restriction Cat 2 (3)
- Ballasting: Skid-on barge, no tide restriction Cat 2 (1)
- Ballasting: Skid-on barge, no tide restriction Cat 2 (2)
- Ballasting: Skid-on barge, no tide restriction Cat 2 (3)
- Roll-on to grounded barge (1)
- Roll-on to grounded barge (2)
- Roll-on to grounded barge (3)
- Beach Landing on grounded barge (1)

- Beach Landing on grounded barge (2)
- Beach Landing on grounded barge (3)
- Beach Landing on grounded barge (4)
- Examples of a beach landings (1)
- Examples of a beach landings (2)
- Examples of a beach landings (3)
- Positioning of SPMT's under the load
- Technical Data of Scheuerle SPMT's
- Technical Data of Goldhofer SPMT's
- Roll-off with a 2400 Tons HRSG Module
- Ro-Ro ramps or steel plates
- Confi gure right Transport Combination (1)
- Configure right Transport Combination (2)
- Configure right Transport combination
- Transp. beams, Supports & Sea fastening combined
- Load-out of 12,400 Tons Module (1)
- Load-out of 12,400 Tons Module (2)
- Load-out of a Special Structures (1)
- Load-out of a Special Structures (2)
- Transport & Load-out of a large Modules
- Loadout of a 4500 jacket. Helwin Beta
- Site moves of a Heavy Loads
- Load diagrams of Platform Trailers
- Moving various Heavy Loads (1)
- Moving various Heavy Loads (2)
- Moving various Heavy Loads (3)
- Increased support area.
- Skidshoes when it is too heavy for trailers
- Weighing of the cargo to determine weight and Cog
- load-out of the 47,830t Arkutun Dagi topside
- Load Distribution
- Redistributing the loads.
- Load concentrations for jacket transport.
- Load (re-) distribution
- The external ballast arrangement (1)
- The external ballast arrangement (2)
- Barge mooring: stern to quay
- Barge elevation and tide control.
- Monitoring systems.
- Monitoring all by means of sensors and loading computer.
- Linkbeams (1)
- Linkbeams (2)
- Linkbeams (3)
- Rules for loading operations for loadouts.
- Rules for loading operations for loadouts
- Recommendations

## Safety and Risk Analysis

- Why important?
- BP Golden Rules of Safety.
- Shell 12 Life Saving Rules
- Heerema Fabrication
- House Rules for Visitors & PPE
- History of Jumbo's Safety Policy
- Part of Jumbo's QHSE POLICY STATEMENT
- What is right and what is wrong in these pictures?
- Safety Awareness Culture Ladder
- Safety to be generative. What does it mean?
- Safety Awareness Culture Ladder Explanation
- How do we Record & Analyze?
- Some Definitions/Abbreviated terms
- Some Definitions
- What are our Goals?
- Safety Culture and Awareness
- How?
- What do we see?
- Use proper PPE = Personal Protective Equipment
- Reduce 20% of causes and you reduce 80% of all accidents

- Keep Welding and Cutting equipment in Good condition (1)
- Keep Welding and Cutting equipment in Good condition (2)
- Use proper PPE = Personal Protective Equipment (1)
- Use proper PPE = Personal Protective Equipment (2)
- PPE and good accessible lifting points
- Accident & Incident Reporting and Analysis
- Card Systems
- Stay Focused
- Safety Requirements & Procedures
- RISKS (ISO/Guide 73:2009)
- Events - Consequence – Likelihood
- Use a Risk Matrix
- Risk Matrix; Frequency x Consequence = RISK
- Risk Register
- Useful Guide Words for the Risk Assessment (TECHNIP)
- What prevents the hazards being realised?
- What mitigates the consequences?
- A shared picture of how the hazard is managed
- The bow-tie
- Diagrammatic representation of a hazardous event (EN ISO 17776)
- Design Safely
- Guide Line Job Hazard Analysis
- Job Hazard Analysis (JHA)
- Safety Awareness Posters
- Is it all OK?
- Identification of Hazards
- Identification of Hazards
- Why, When and How a “Toolbox Meeting”
- Last Minute Risk Analysis (LMRA)
- Exercise and Communication
- Radio Communication
- Co-operation with Client is essential
- Examples of well secured Transport saddles
- Examples of badly secured Transport saddles (1)
- Examples of badly secured Transport saddles (2)
- Conclusion

## Heavy Lift Shipping

- Various Types of Heavy Lift Ships: Lo-Lo
- Various Types of Heavy Lift Ships: Flo-Flo
- Various Types of Heavy Lift Ships: Ro-Ro
- Heavy Lift Ships, Crane Types: Lift-on / Lift-Off
- Difference between Pedestal crane and Mast crane
- Heavy Lift Mast Cranes: 900 tons on J-Type Jumbo
- Cargo Types: Petrochemical, Offshore, Floating Equipment
- Cargo Types: Pressure vessels, Modules, Gasturbines
- How to prepare a Lift-on Lift-off (Lo-Lo) Lift Plan
- How to prepare a Lift-on Lift-off (Lo-Lo) Lift Plan (2)
- Lifting cargo from the quay by ballasting and hoisting (1)
- Lifting cargo from the quay by ballasting and hoisting (2)
- Lifting cargo from the quay by ballasting and hoisting (3)
- Lifting cargo from the quay by ballasting and hoisting (4)
- Lifting 3 Bullet tanks over PS on board
- Motion Analysis of vessel
- Checklist for Lashing and Securing
- Examples of Sea fastenings (Jumbo) (Lashing wires + Stoppers) (1)
- Examples of Sea fastenings (Jumbo) (Lashing wires + Stoppers) (2)
- Examples of Sea fastenings (Jumbo + SAL) (Lashing wires)

- How to lash a Harbor Crane (Lashing wires + Stoppers)
- Lashing examples SAL: 1100 Tons Shiploader
- Cribbing, seafastenings, guideposts (Boskalis/Cosco/OHT)
- Calculation of Sea fastening Forces
- Code of Safe Practice for Cargo Stowage and Securing 2011
- How to calculate the required number of lashings?
- Examples of Sea fastenings (Jumbo) (Lashing wires + Stoppers)
- Lashing & Securing Methods
- Seafastening of a jacket
- Recommendations

## Offshore Lifting and Installation

- Introduction to the Offshore World: Exploration and Production
- Offshore Production Platform types (1)
- Offshore Production Platform types (2)
- Seabed Topography
- Seabed Preparations
- Subsea Structures general (1)
- Subsea Structures general (2)
- Subsea Structures general (3)
- Field Development (1)
- Field Development (2)
- Field Development (3)
- Field Development (4)
- Field Development (6)
- Field Development (7)
- Field Development (8)
- Subsea Installation Techniques
- The different phases of a subsea lift from an offsh. constr. vessel
- Types of Offshore Installation Vessels
- Largest Offshore Construction Vessel in the World: „Pioneering Spirit" (Allseas)
- Overview of the world Largest Crane Vessels
- Overview of the world Largest Crane Vessels
- Largest Crane Vessel in the World: SSCV "Thialf" (HMC)
- SSCV "Saipem 7000" Crane Vessel
- Mono Hull Crane Vessel "Oleg Strashnov" (Seaway Heavy Lifting)
- Offshore wind concept
- Offshore wind
- Foundations (1)
- Foundations (2)
- Floating "foundations"
- Jack-up Wind Turbine Installation vessels Crane Cap. 300-1500 Ton
- Installation Methods Wind Turbines
- Jack-up & Platform Supply Vessel (PSV)
- Offshore Construction Vessel (OCV) with X-Bow
- Spud-cans and set down of a jack-up rig / vessel.
- Overview of jack-up foundation design/assessment process
- Mono Hull Crane Vessel + Pipe laying "Subsea 7 Borealis" (1)
- Mono Hull Crane Vessel + Pipe laying "Subsea 7 Borealis" (2)
- Mono Hull Crane Vessel + Pipe laying "Subsea 7 Borealis" (3)
- Mono Hull Pipe-ay/Construction Vessel „Aegir" (Heerema)
- Catamaran Crane Vessel "Svanen" (van Oord)
- Catamaran Crane Vessel "Rambiz" (Scaldis) used in Wind farm construction
- Pipe Lay Installation Methods
- S-Lay Pipe laying vessel Solitaire (Allseas)
- Reel Lay Spool base (Subsea 7)
- Reel Lay Pipe lay Vessel Deep Blue (Technip)
- Global 1201 S-Lay Pipe laying vessel Global Industries (Technip)
- Largest Semi-Submersible Transport Vessel (Boskalis Vanguard)

- Float-over Technique for extremely heavy topsides
- Float Over Operation North Rankin Field (Australia)
- Do not be reluctant making wooden scale models
- LMU principle.
- CASE STUDY: Installation of Risers in 2700 m Deep Water in GOM
- Deepwater traction winches
- Video of installing Free Standing Hybrid Riser (FSHR)
- Work class ROV
- Lay out for ROV
- CASE STUDY: Gina Krog jacket installation
- CASE STUDY: Gina Krog Jacket Project location
- CASE STUDY: Gina Krog Jacket Field Lay-out
- CASE STUDY: Gina Krog Jacket Construction and loadout.
- Pile sleeves and leveling
- CASE STUDY: Gina Krog Jacket Installation

## Rules and Regulations

- Applicability, all countries are different
- What type of rules do we have?
- Contracts
- Outline of standards (Norsok)
- Which rules are relevant or useful for us? (1)
- Which rules are relevant or useful for us? (2)
- Which rules are relevant or useful for us? (3)
- Which rules are relevant or useful for us? (4)
- Which rules are relevant or useful for us? (5)
- When working with barges or vessels from safety perspective
- Singapore, Ministry Of Manpower and WSH
- LOLER (Lifting Operations and Lifting Equipment Regulations 1998) (1)
- LOLER (Lifting Operations and Lifting Equipment Regulations 1998) (2)
- LOLER (Lifting Operations and Lifting Equipment Regulations 1998) (3)
- What is a 'competent person'?
- Specific requirements applicable to floating equipment
- ISO 12480-1 Cranes safe use part 1
- Associations
- ASME; The American Society of Mechanical Engineers. (1)
- ASME; The American Society of Mechanical Engineers. (2)
- IACS; the International Association of Classification Societies
- The Role of the Marine Warranty Surveyor (MWS)
- Guidelines for offshore marine operations (G-OMO)
- The International Association of Oil & Gas Producers (IOGP)
- Document hierarchy
- LSD or LRFD and WSD or ASD
- Load and Resistance Factor Design
- How to deal with the variety of regulations?

## Cranes in a marine environment

- Juliana Bridge, Alphen aan den Rijn, August 2015
- Juliana Bridge, The lift plan step 1
- Juliana Bridge, The lift plan step 2
- Juliana Bridge, how it was executed.
- Juliana Bridge, conclusions from the Dutch Safety Board
- Differences between land and marine and offshore cranes.
- Dynamic Amplification Factors (DAF) in air
- DAF in water lifting through the splash zone
- Lifting through the splash zone
- Lifting through the splash zone, slamming.

- Lifting through the splash zone; varying buoyancy
- Lifting through the splash zone; inertia force
- Lifting through the splash zone; drag and friction.
- Lifting through the splash zone
- Lifting through the splash zone
- Lifting through the splash zone
- Lifting through the splash zone
- Lifting through the splash zone
- Lifting through the splash zone; what method to use?
- Do we need a lift plan?
- Lifting of personnel.
- LOLER lifting operations and lifting equipment regulations
- IMCA Guidelines for Lifting Operation
- Equipment Selection
- Possible safety measures to be considered
- Lifting of personnel
- Degrading lifting curves
- Down graded lifting curves depending on Hs
- Barge limitations:
- Local deck strength
- Environmental limitations
- Limitations on the workability:
- Risk assessment (1)
- Risk assessment (2)

As the training is updated continuously, small deviations with the list shown above may occur.