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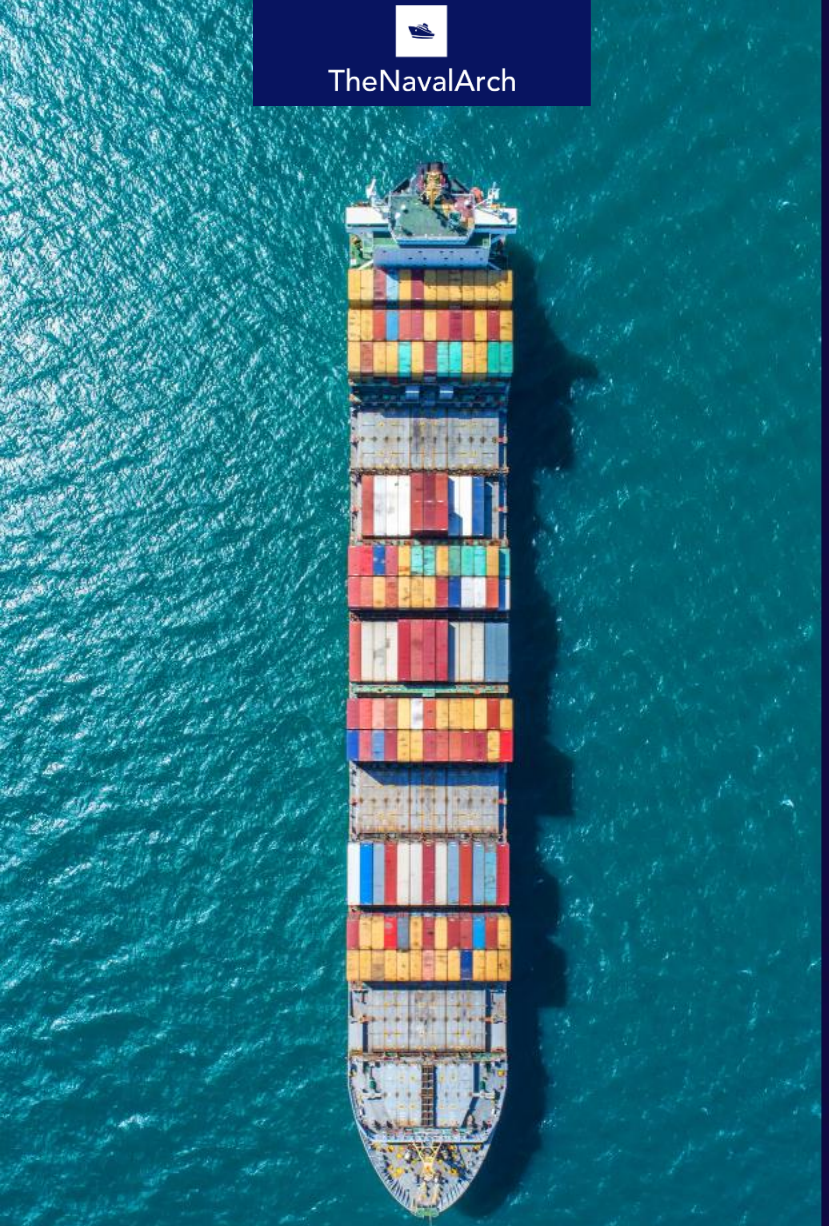


How to Generate Rapid Lift Rigging Designs

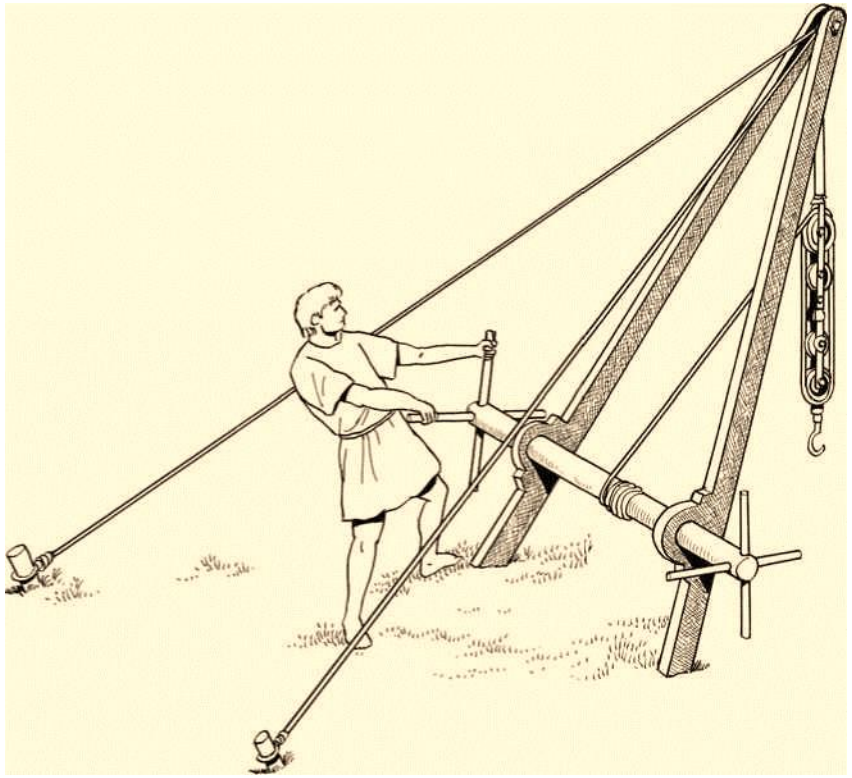
An example of design automation

Michael Harwood, 12-Aug-2020

Rapid Lift Rigging Designs

where "Rapid" means one hour or less

Presented by Michael Harwood, PE, PMP
In collaboration with TheNavalArch.com



Graphics courtesy of MCHTM Inc, Houston, TX, USA

Photo courtesy of Anthony Wilson on assignment with LOC

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Topics by Section

1. Welcome and webcast systems check
2. Problem statement
3. Observations on typical present practice
4. Proposed solutions
5. Solutions Implementation
6. Recap
7. Q&A & Acknowledgements

Note: Webcast has been pre-recorded and is made available to subscribed viewers along with the Presenter's Notes. Please participate in the survey following this presentation

Photo courtesy of Anthony Wilson on assignment with LOC

SECTION 2: PROBLEM STATEMENT

A. Need for early alignment of engineers and designers in Rigging layout design

B. Exploit opportunities for improved design workflow

Photo credited to Boss Crane & Lift, TX, USA on the WWW

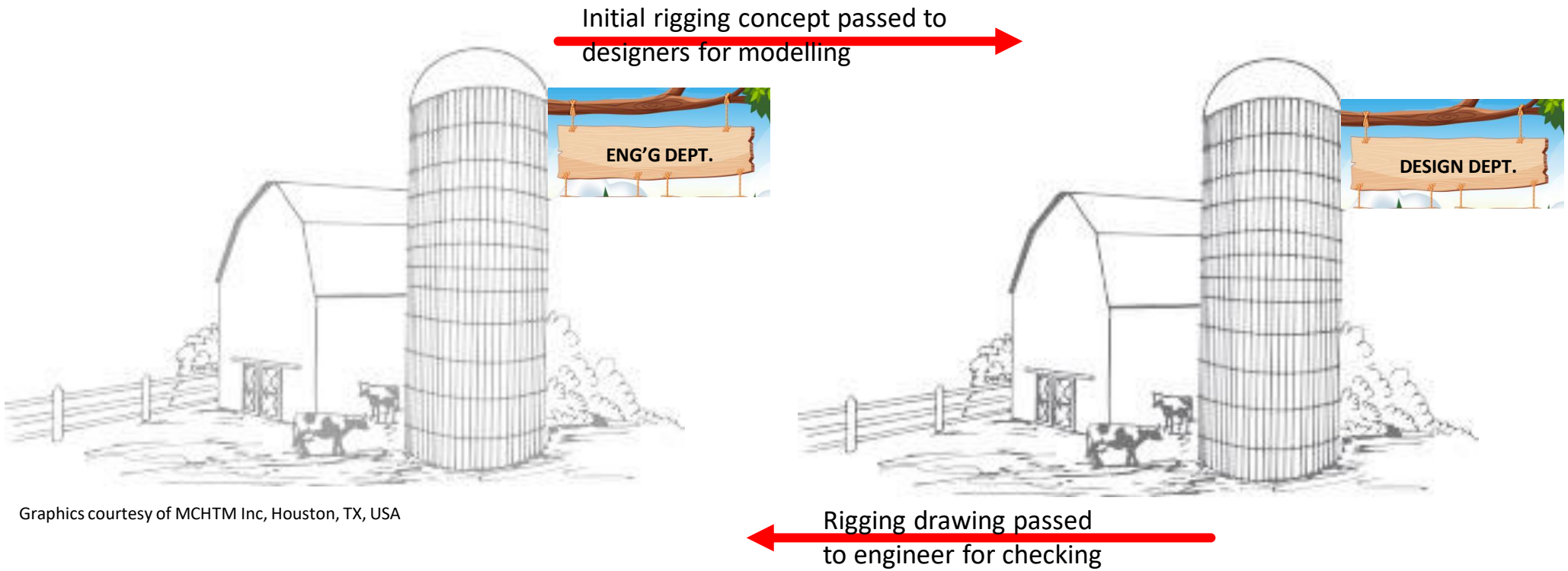
Attention is restricted here to single crane lifts of “Packages” having four lift points.

Photo courtesy of MCHTM Inc on assignment with OYO FPSO project

SECTION 3: TYPICAL CURRENT PRACTICE

Back & forth exchange of information:

engineers → designers → engineers → designers …..



Graphics courtesy of MCHTM Inc, Houston, TX, USA

… "silo-based" so review cycles can be many …..

SECTION 4: PROPOSED SOLUTIONS

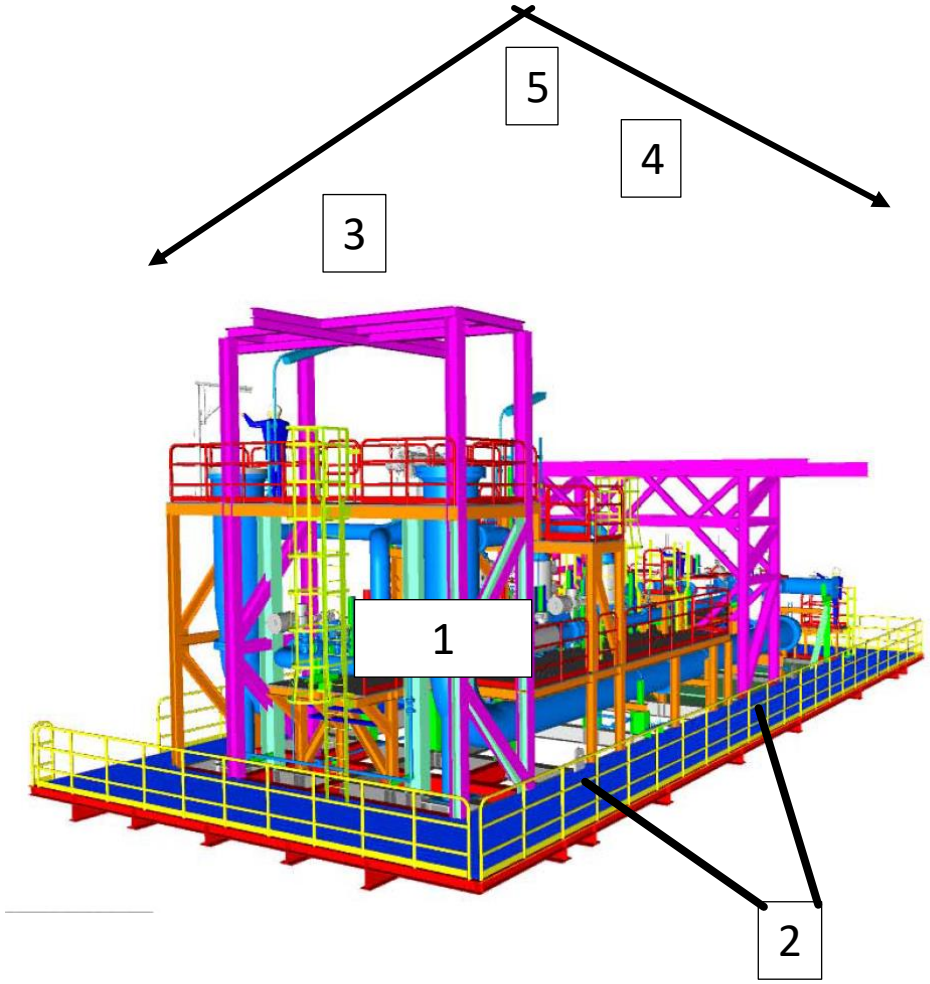
A. Calculate the key rigging system 3D work points

B. Standardize and automate the layout calculations involved

4A: Solutions Methodology Overview

Rigging arrg't design proceeds in 5 steps:

STEP	DESCRIPTION
1	Obtain the Package weight and CoG (and thus the ideal PP)
2	Establish the Package strong points
3	Work out the key setting-out work points
4	Estimate the sling forces
5	Adjust the arrangement (ie the PP) eg for sling matching



CoG – Centre-of-gravity

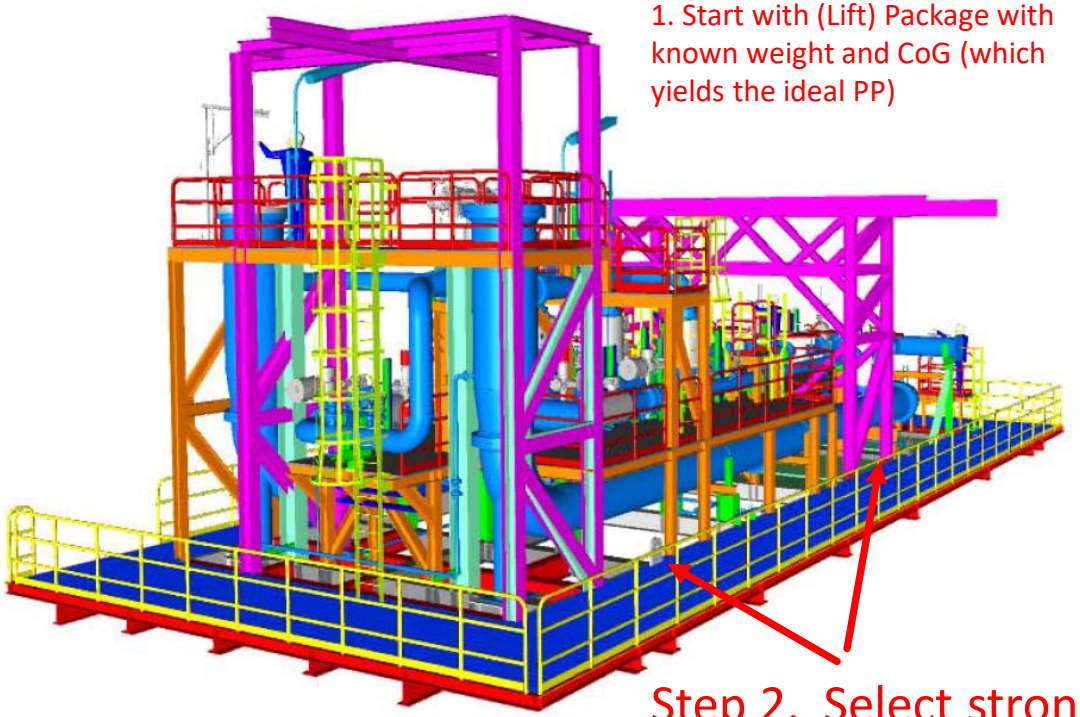
PP – Crane “pick” point

SECTION 4A: Solutions Methodology Details

Step 1. Start with (Lift) Package with known weight and CoG

Note: the IDEAL Hookpoint will be directly above the CoG)

1. Start with (Lift) Package with known weight and CoG (which yields the ideal PP)

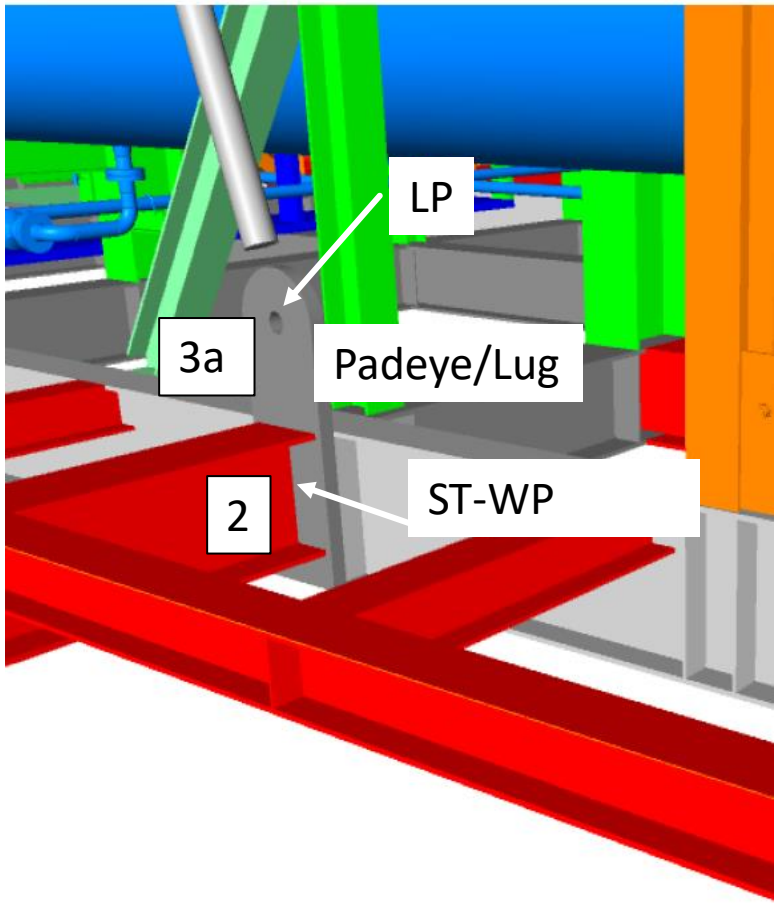


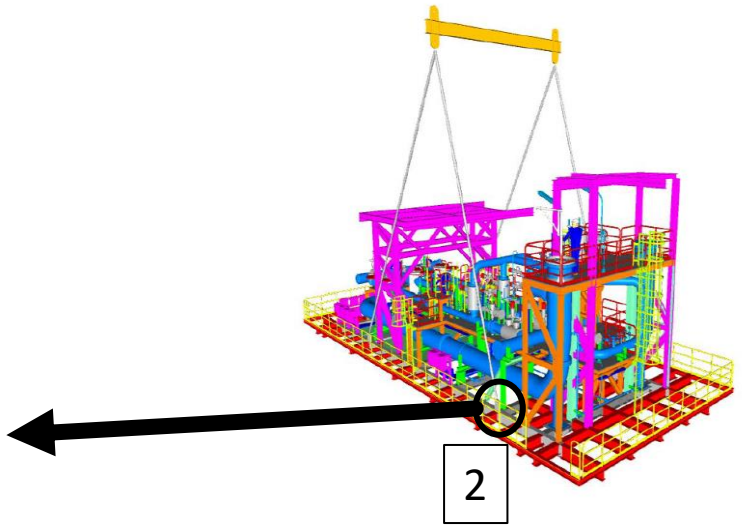
Step 2. Select strong points on the package to lift from

Steps 1 and 2 based on design input….

SECTION 4A : Solutions Methodology Details (con't)

DERIVATION: Step 2 -→ Step 3a: WPs iwo Strong Points/Lift Points



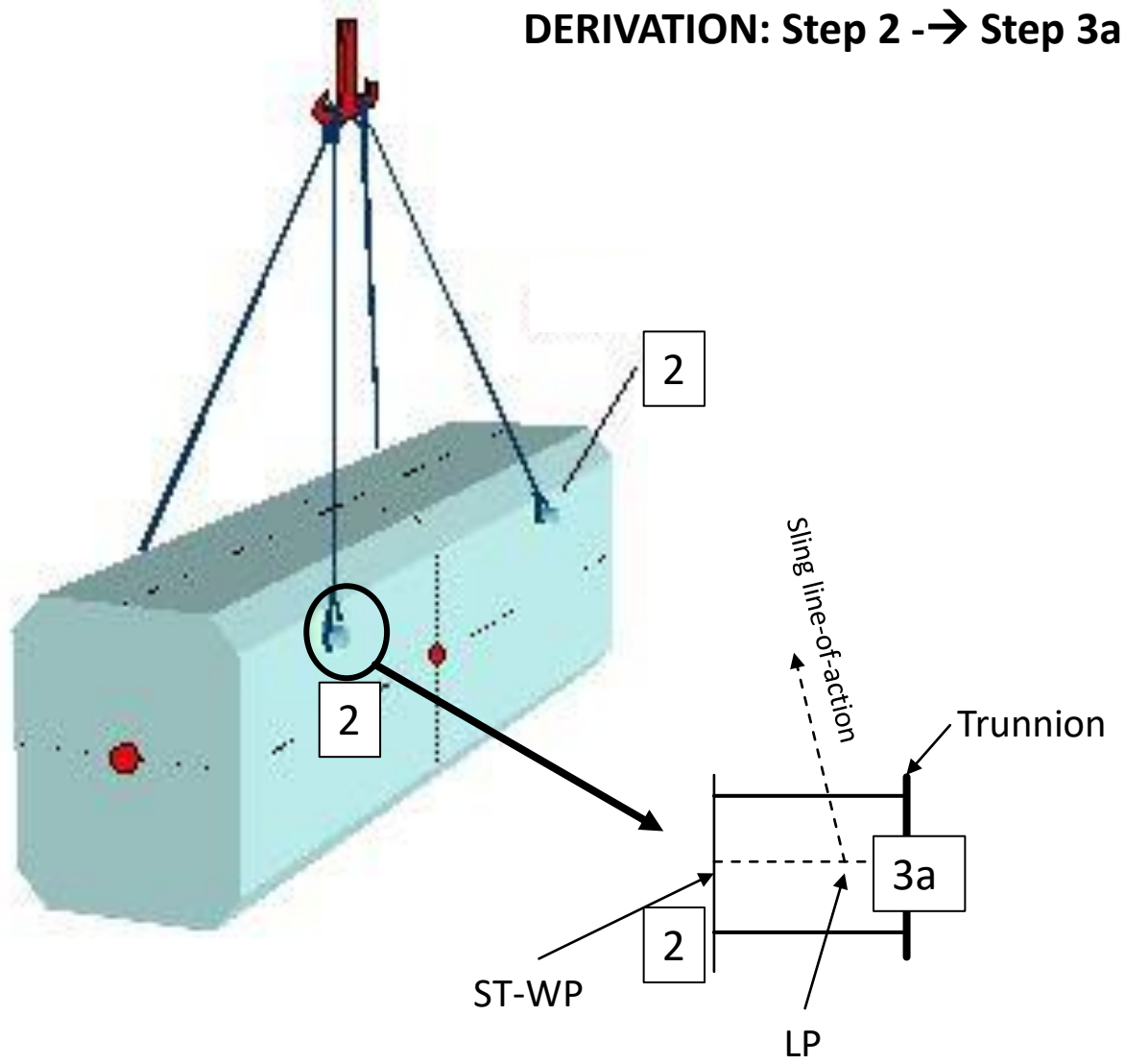


WP – Work point
LP –Lift Point
ST-WP – Package Strong Point

Padeye/Lug Case

SECTION 4A : Solutions Methodology Details (con't)

DERIVATION: Step 2 -→ Step 3a: WPs iwo Strong Points/Lift Points (cont.)

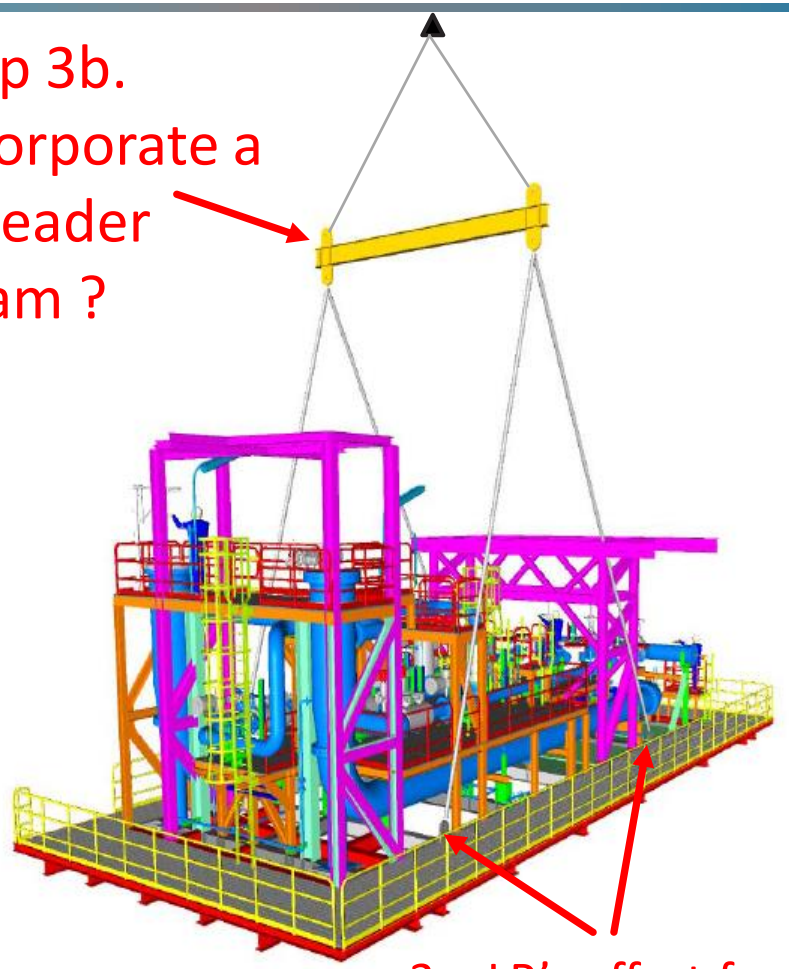


WP – Work point
LP –Lift Point
ST-WP – Package Strong Point

Trunnion Case

SECTION 4A : Solutions Methodology Details (con't)

… From Step 2 precede to Steps 3a & 3b by calculation



SECTION 4A : Solutions Methodology Details (con't)

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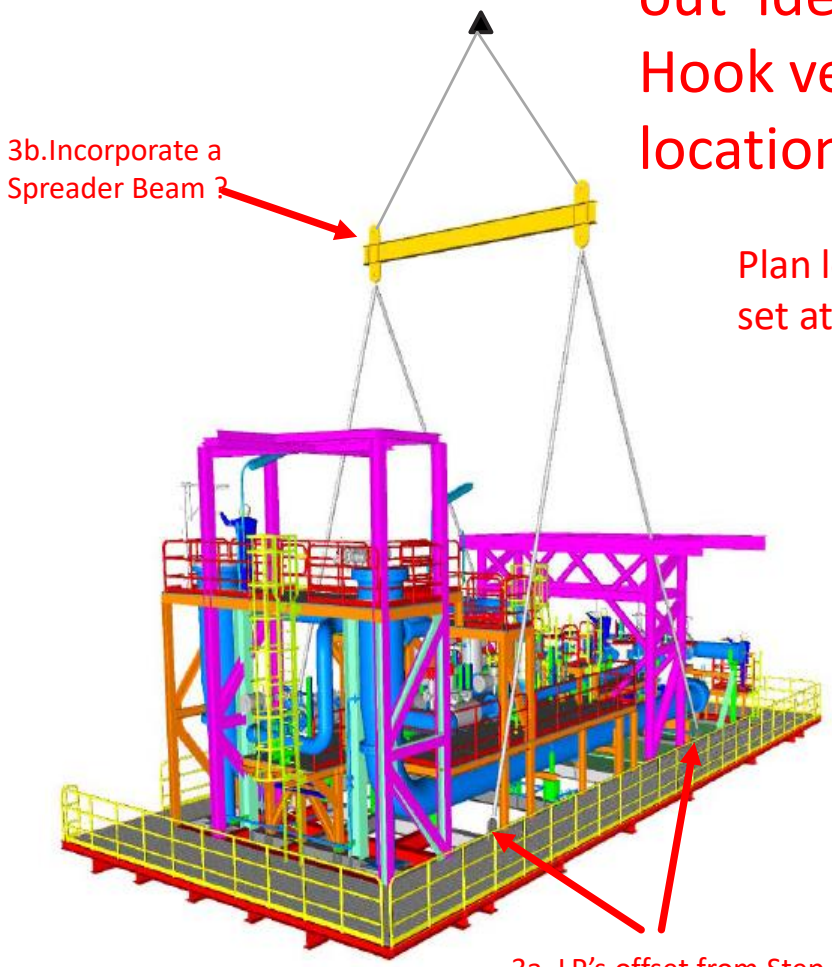
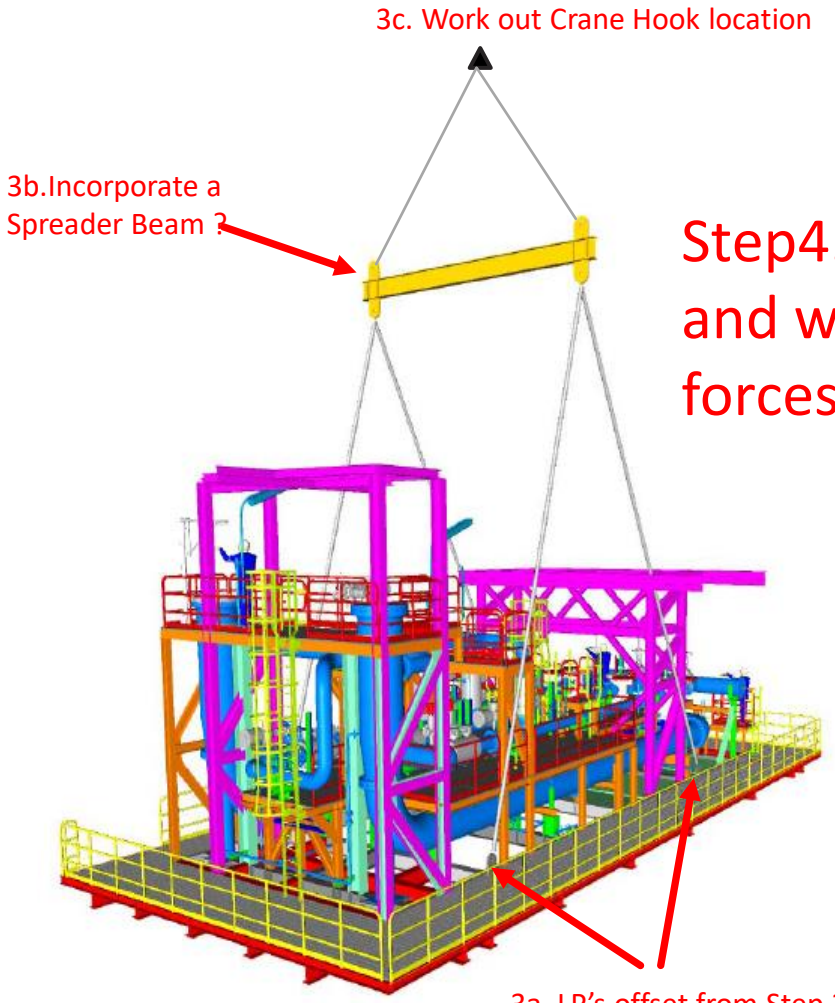
… From Step 3b precede to Step 3c by calculation

Step 3c. Work out"ideal" Crane Hook vertical location



SECTION 4A : Solutions Methodology Details (con't)

… From Step 3c precede to Step 4 by calculation

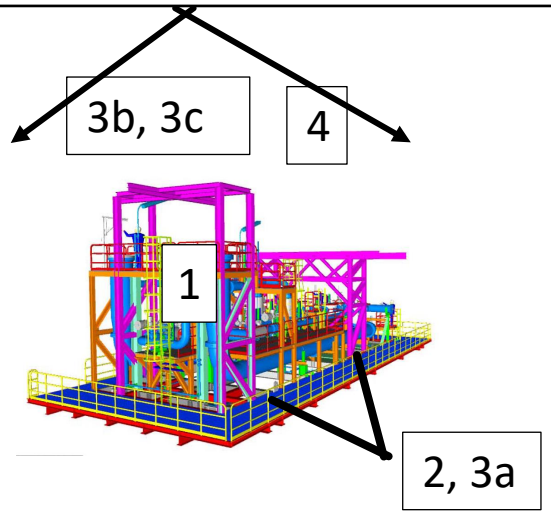


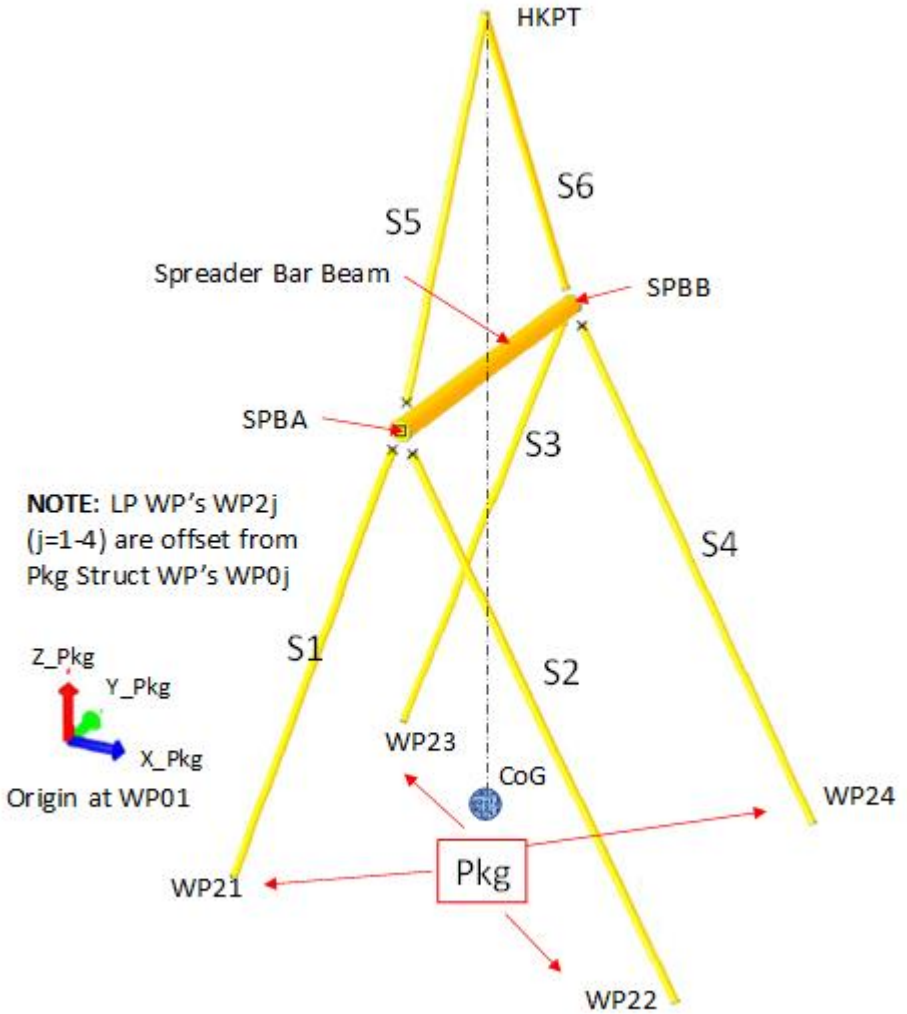
Step4. Add Slings and work out forces in them.

NOTE: Nominally this is a statically indeterminate problem but simplifying assumptions can be made.

SECTION 4A : Solutions Methodology Steps 1-4 Recap

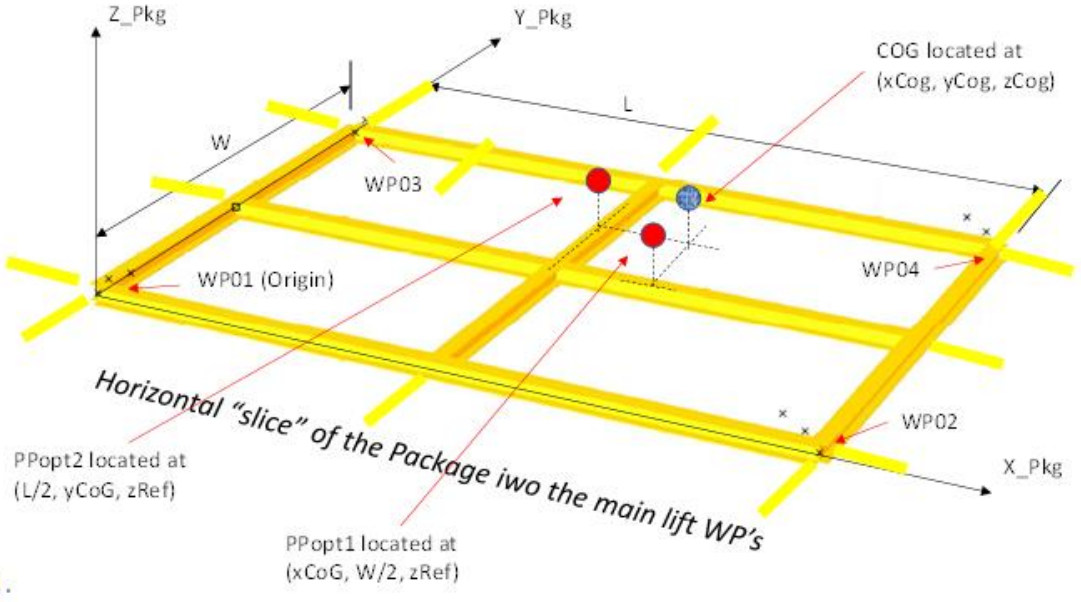
STEPS	INITIAL DESIGN PASS (ideal case – No Package Tilt)
1 &2	Weight & CoG input and Package strong points selection
3a, 3b & 3c	Key Rigging system work point locations calculation
4	Estimate sling loads
For more details, refer to following article posted on TheNavalArch.com: https://www.thenavalarch.com/preliminary-rigging-arrangement-design-of-4-point-single-hook-lifts-for-non-specialists/	

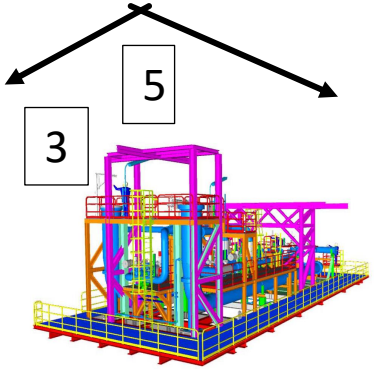


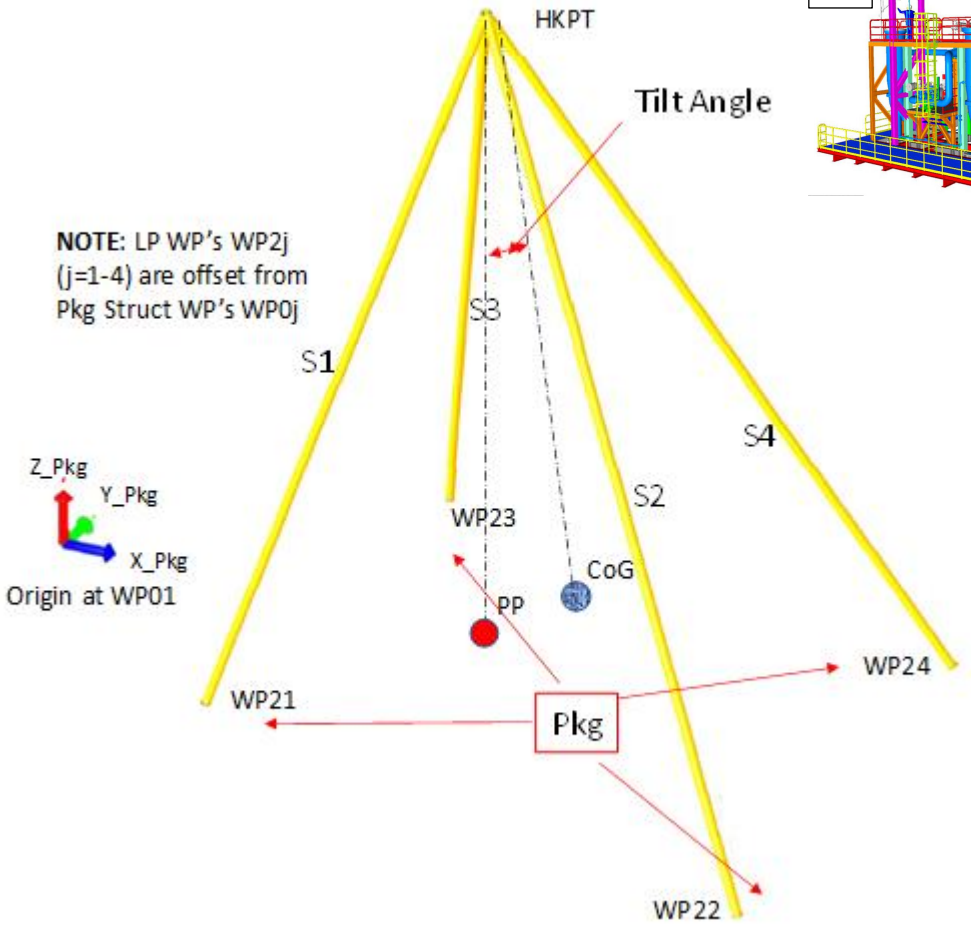


SECTION 4A : Solutions Methodology Step 5

STEPS	RIGGING ARRANGEMENT FINE-TUNING
5	Determine alternate hook point location based on a specified Package "Tilt" to achieve one or more pairs of slings with equal lengths ie matching slings



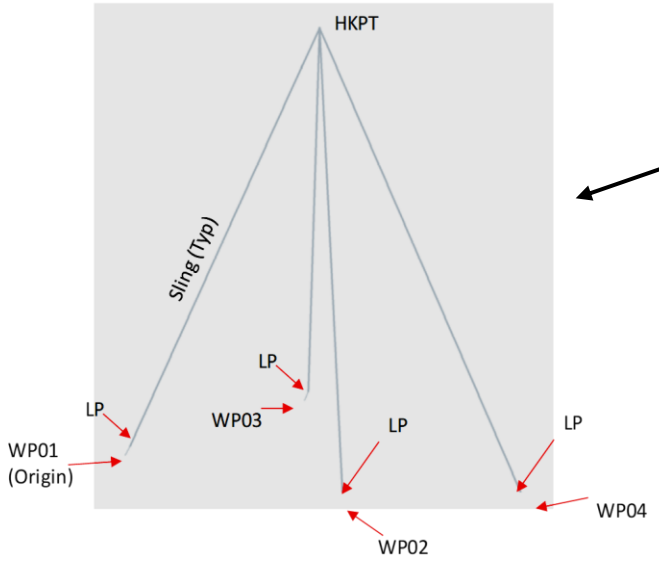




SECTION 4B: PROPOSED SOLUTIONS

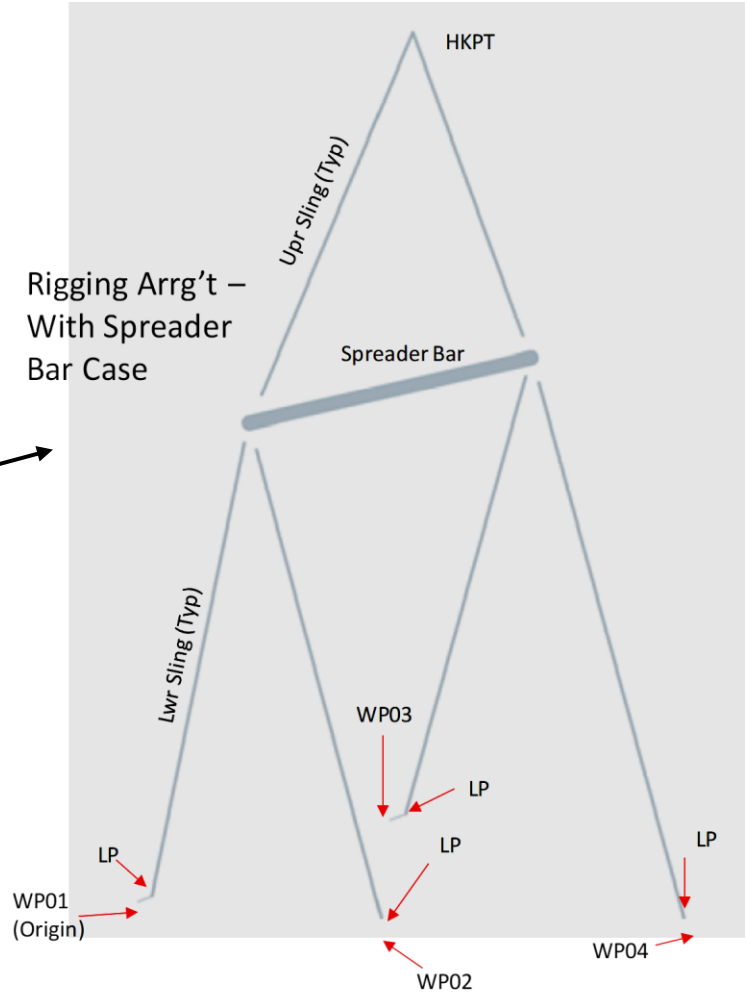
Generate input to other computer applications for further design development

SID	POST-PROCESSING OPERATIONS
1	Export WPs to a “starter model” built with AutoCAD 3D
2	Export Structural analysis program input files for Rigging System sub-model e.g StaadPro and SACS



Rigging Arrg’t – No Spreader Bar Case

SAMPLE Step 4b1 Outputs



SECTION 4B: SOLUTIONS IMPLEMENTATION

HELPFUL CALCULATION APPS AVAILABLE FROM TheNavalArch.com	NOTES
TNA_RiggingArrgtsGenerationV1basic.exe ("zero-tilt")	All three are supplied with auxiliary macro-enabled workbook GenerateAcadStarterRiggingModelV1.xlsm (for Solution 4B-1)
TNA_RiggingArrgtsGenerationV1plus.exe	
TNA_ControlledTiltRiggingArrgt_V1.exe ("specified tilt"	
https://www.thenavalarch.com/software/marine-operations/preliminary-rigging-arrangement-4-point/	All three are available from this web order page

Photo courtesy of Anthony Wilson on assignment with LOC

SECTION 6: PRESENTATION RECAP

1. Rigging design Problem statement – Early alignment of engineers & designers plus assess automation potential for their work processes

2. Typical present practice – Engineers → Designers → Engineers → Designers …..

3. Proposed solutions – Establish main 3D Rigging system work points and automate the calculations & 3D model(s) set-up

4. Calculation Apps are available from TheNavalArch.com to enable rapid development of preliminary rigging arrangement designs

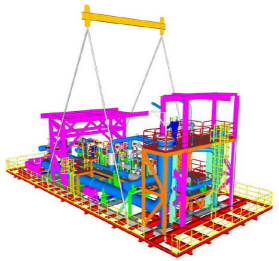


Photo courtesy of Anthony Wilson on assignment with LOC

SECTION 7: Q&A and ACKNOWLEDGEMENTS

1. Thanks for staying tuned until this point of the webcast
2. Please complete the survey and note any questions you might have.

ACKNOWLEDGEMENTS

1. The Presenter wishes to acknowledge the contributions of the following parties for
2. Permitting use of their rigging system photos, thanks goes to
   a. Mr Anthony Wilson on assignment with London Offshore Consultants, Houston, TX, USA.
   b. OYO FPSO Integration project
3. Apps development and testing assistance, thanks goes to Mr Ande Veera Mahesh.
4. Pushing me beyond my comfort zone to present this webcast, thanks goes to Mr Prem Shankar, TheNavalArch.com