



Mechanical and Electrical Engineering Services

Liftech

STS Crane Procurement



Other Container Cranes

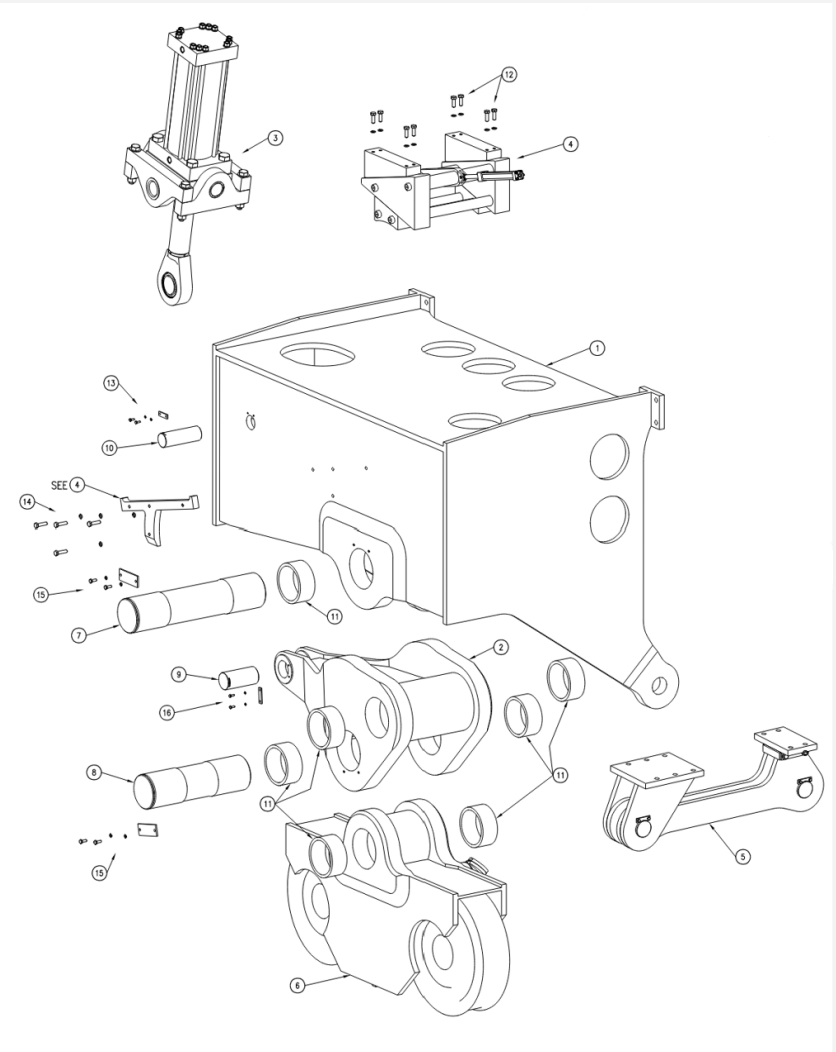
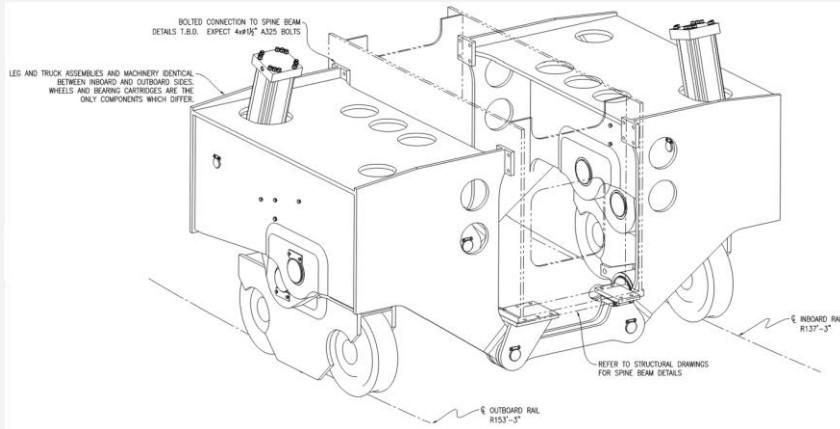
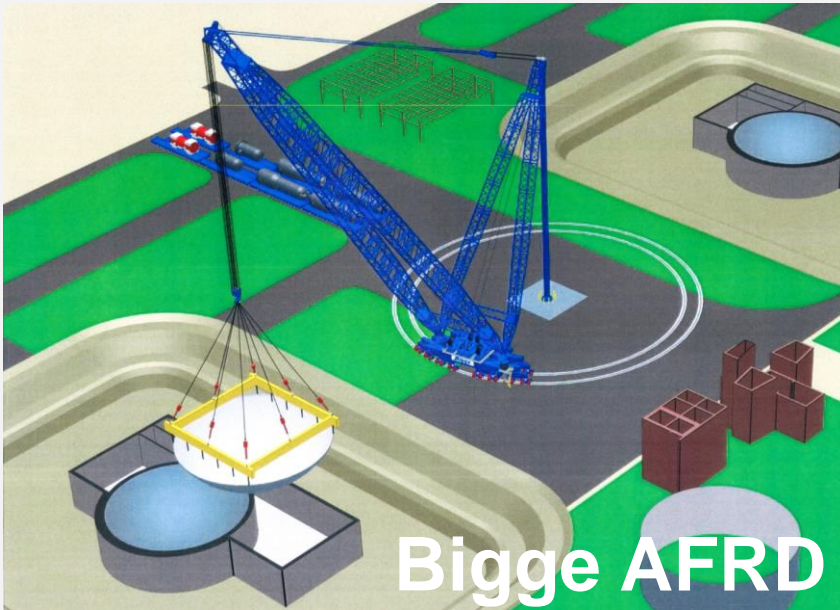


RTG
RMG
ASC

IYC
MHC

Liftech
LIFTECH CONSULTANTS INC.

Specialty Cranes



Floating Cranes



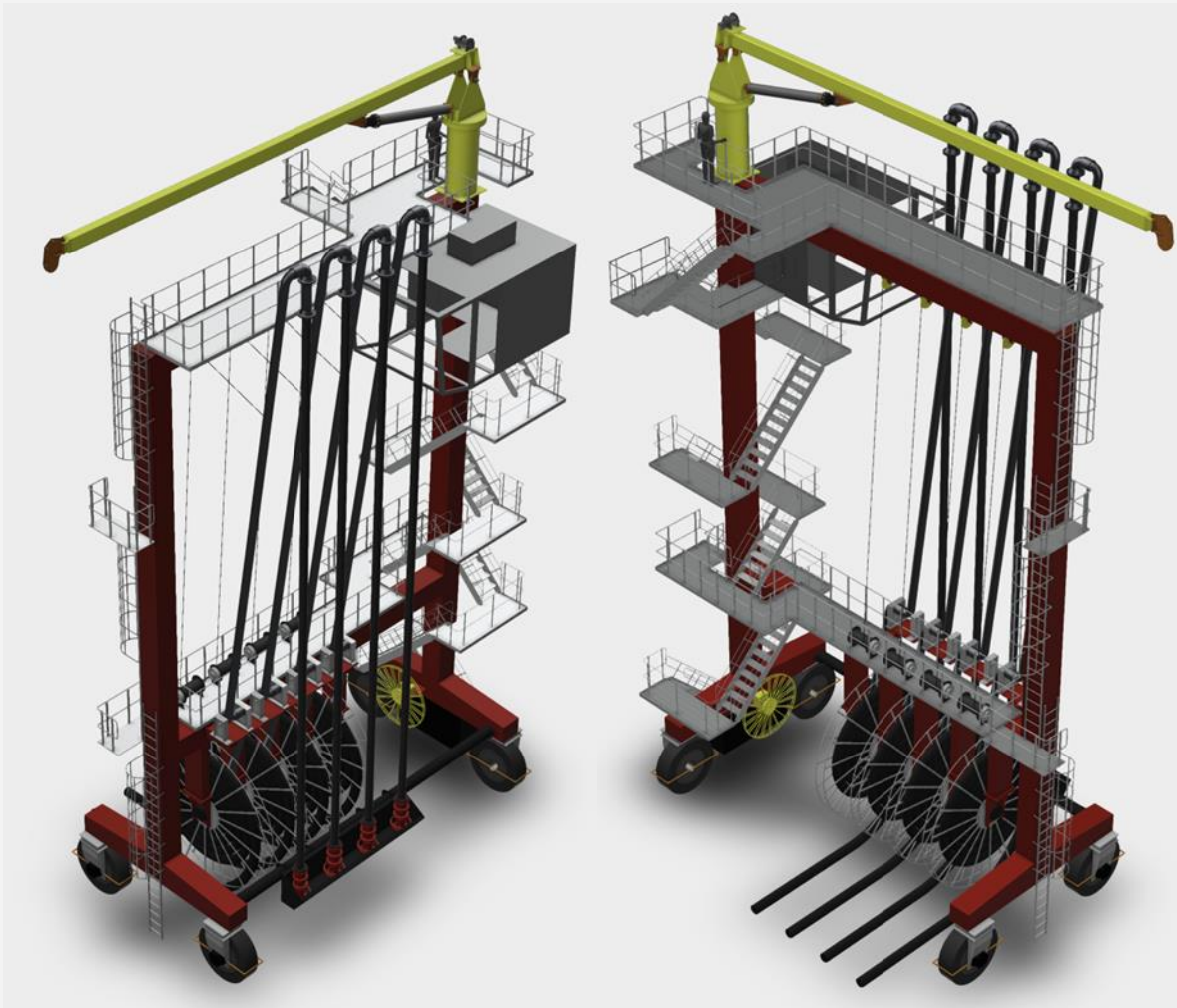
Left Coast Lifter

Dry Bulk Handling Equipment



Grab Bucket, Loaders, Unloaders, Stacker/Reclaimers

Liquid Bulk Equipment



**Hose
Towers**

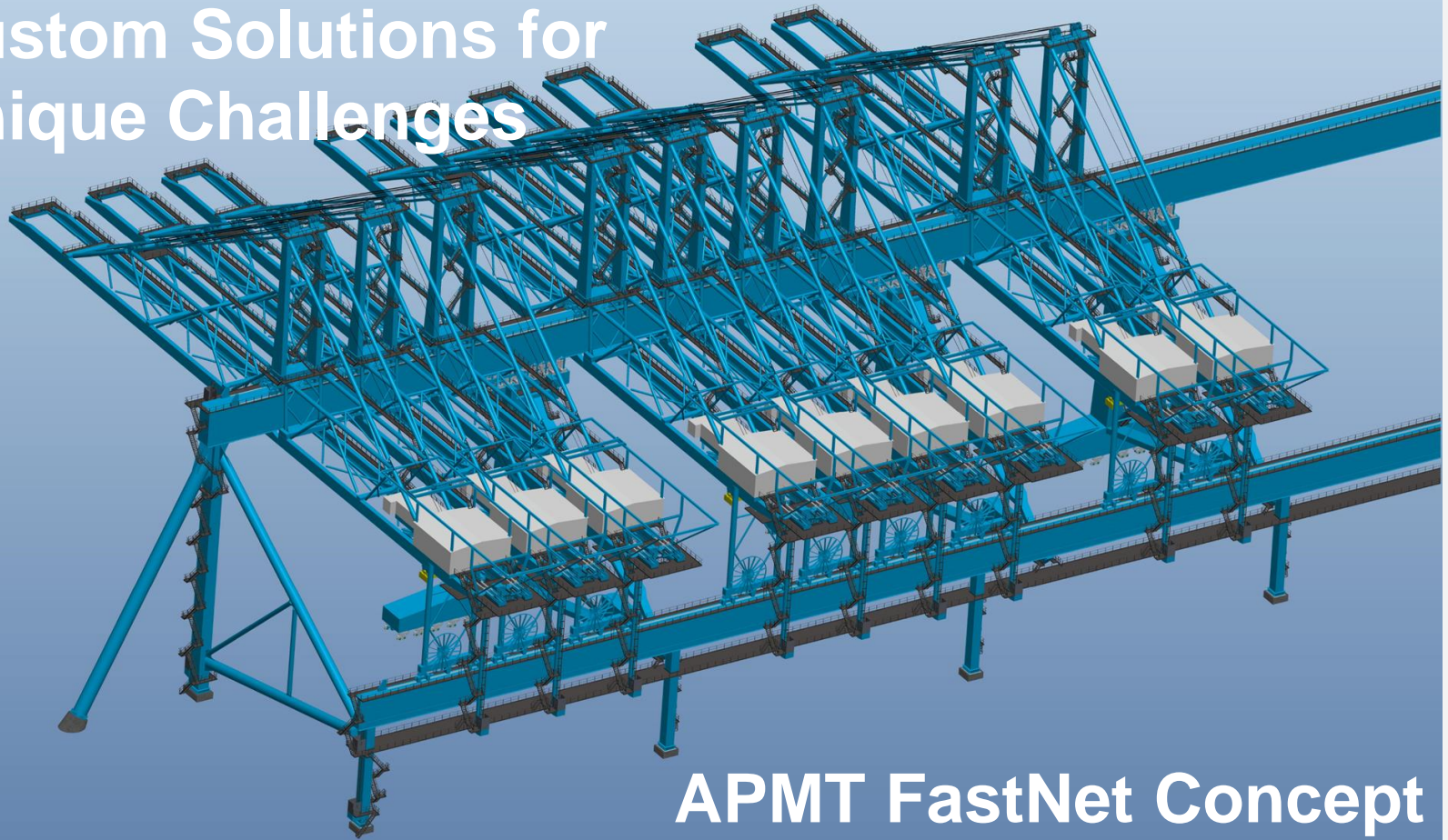
**Mobile
Equipment**

**Handling
Cranes**

**POL and
MOTEMS**

Concept Development & Design

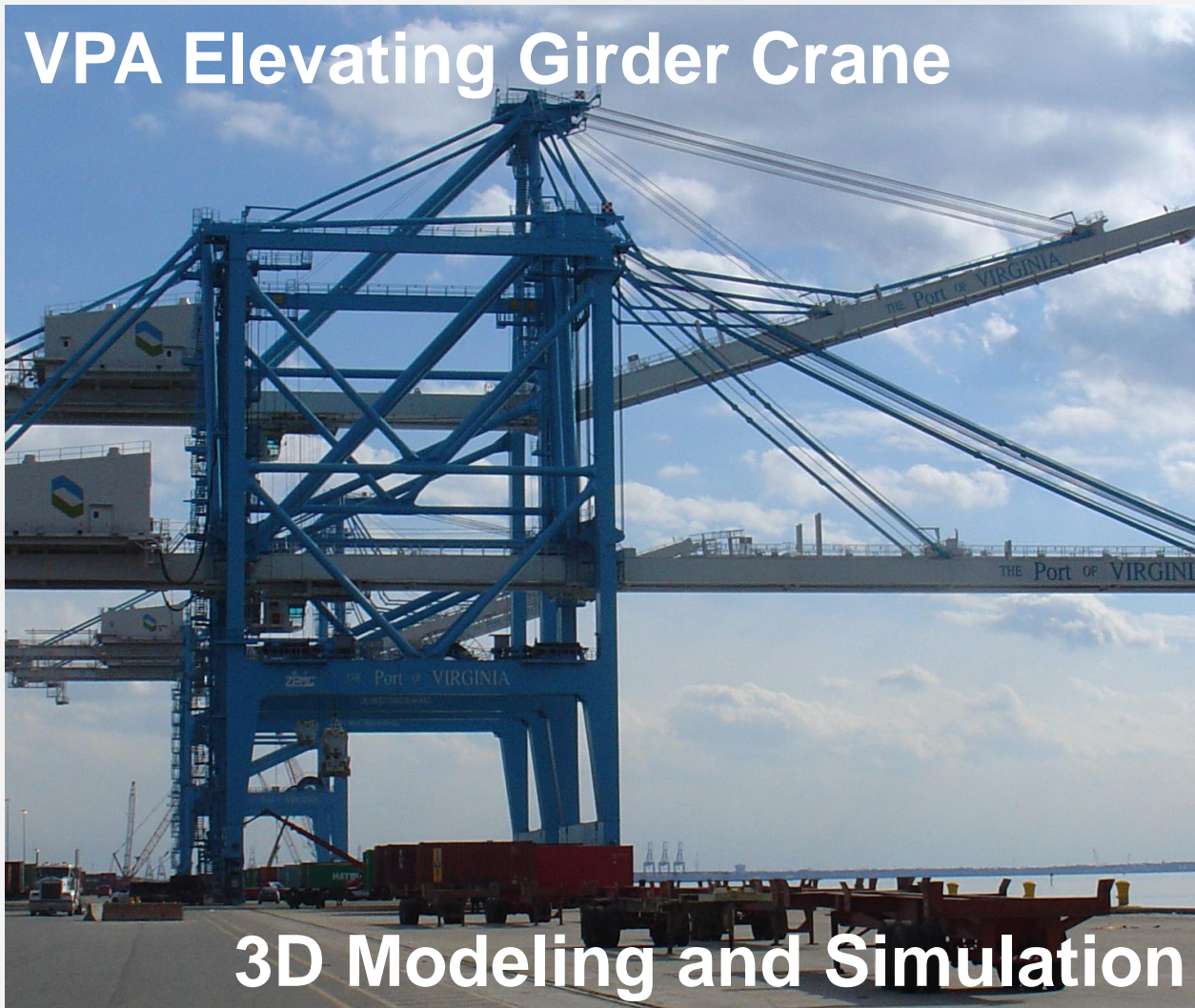
Custom Solutions for
Unique Challenges



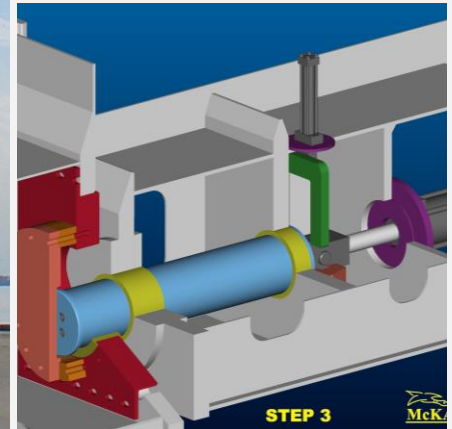
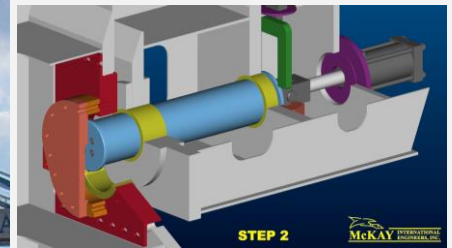
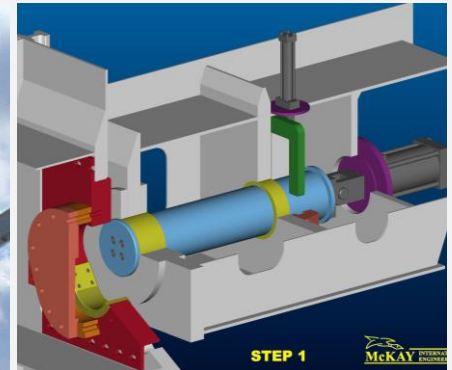
APMT FastNet Concept

Concept Development & Design

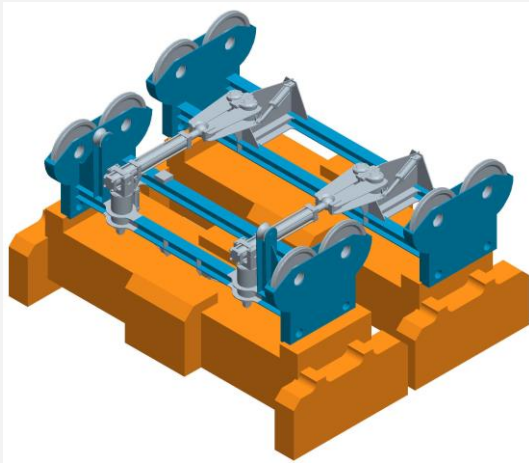
VPA Elevating Girder Crane



3D Modeling and Simulation

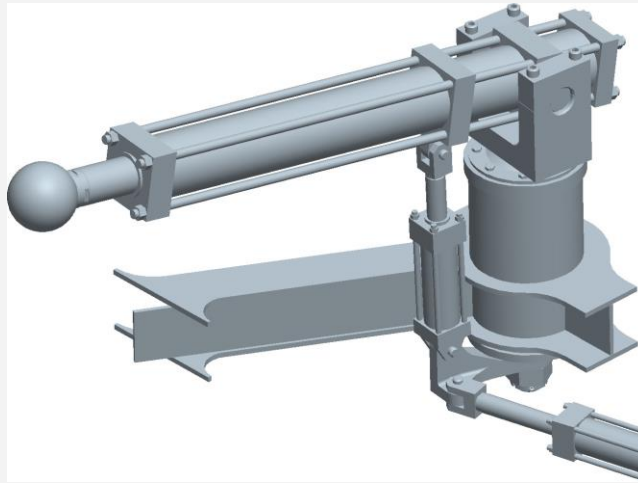


Concept Development & Design



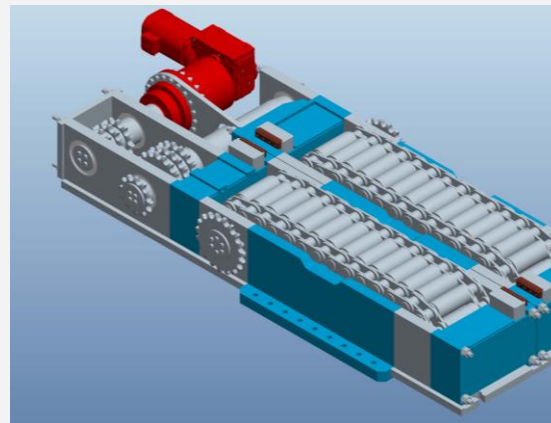
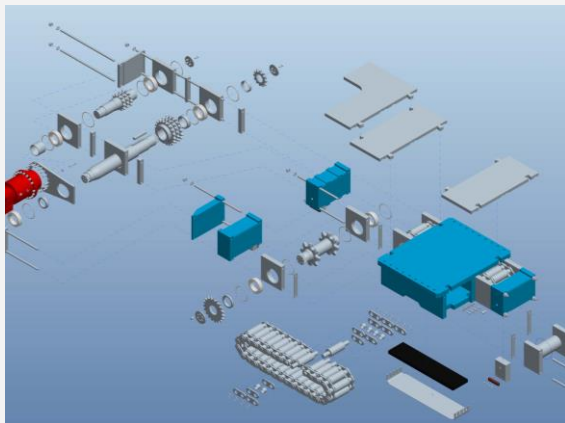
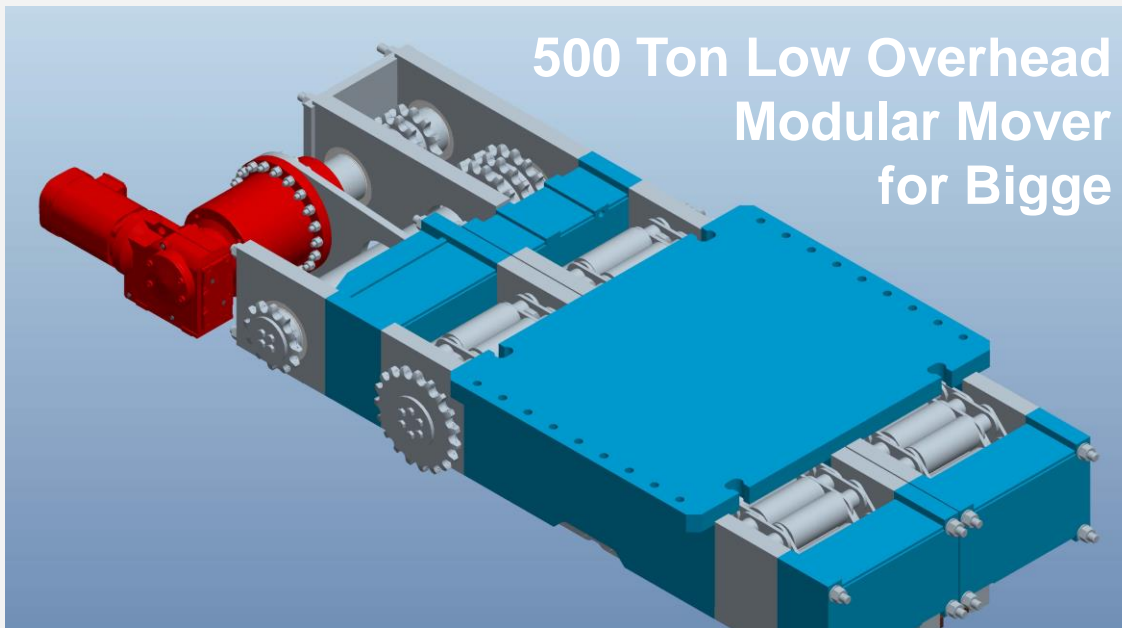
**Design
Improvement**

**Concept
Validation**



YICT DHT40

Specialty Equipment



**Rugged
Designs**

**Proven
Components**

3D Models

Detailed Parts

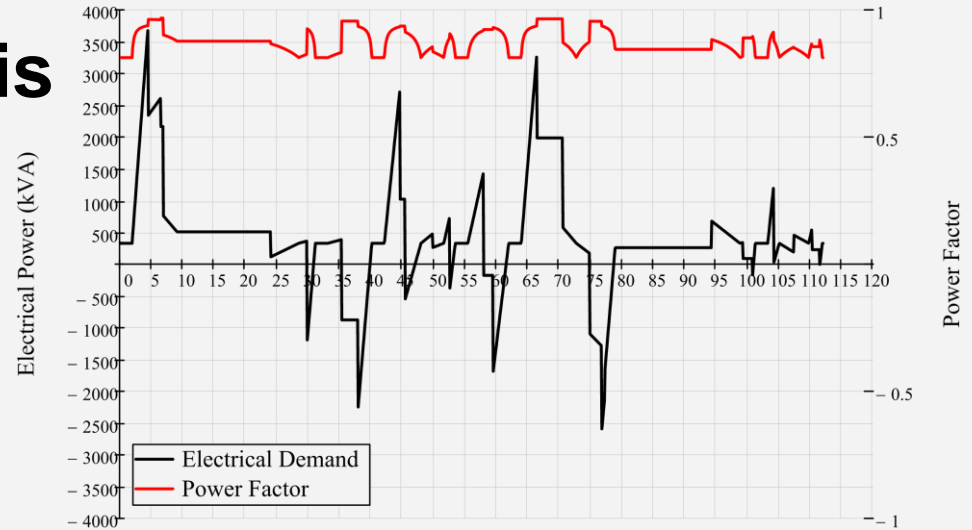
**Assembly &
Maintenance
Instructions**

Electrical Infrastructure

Power Demand Studies

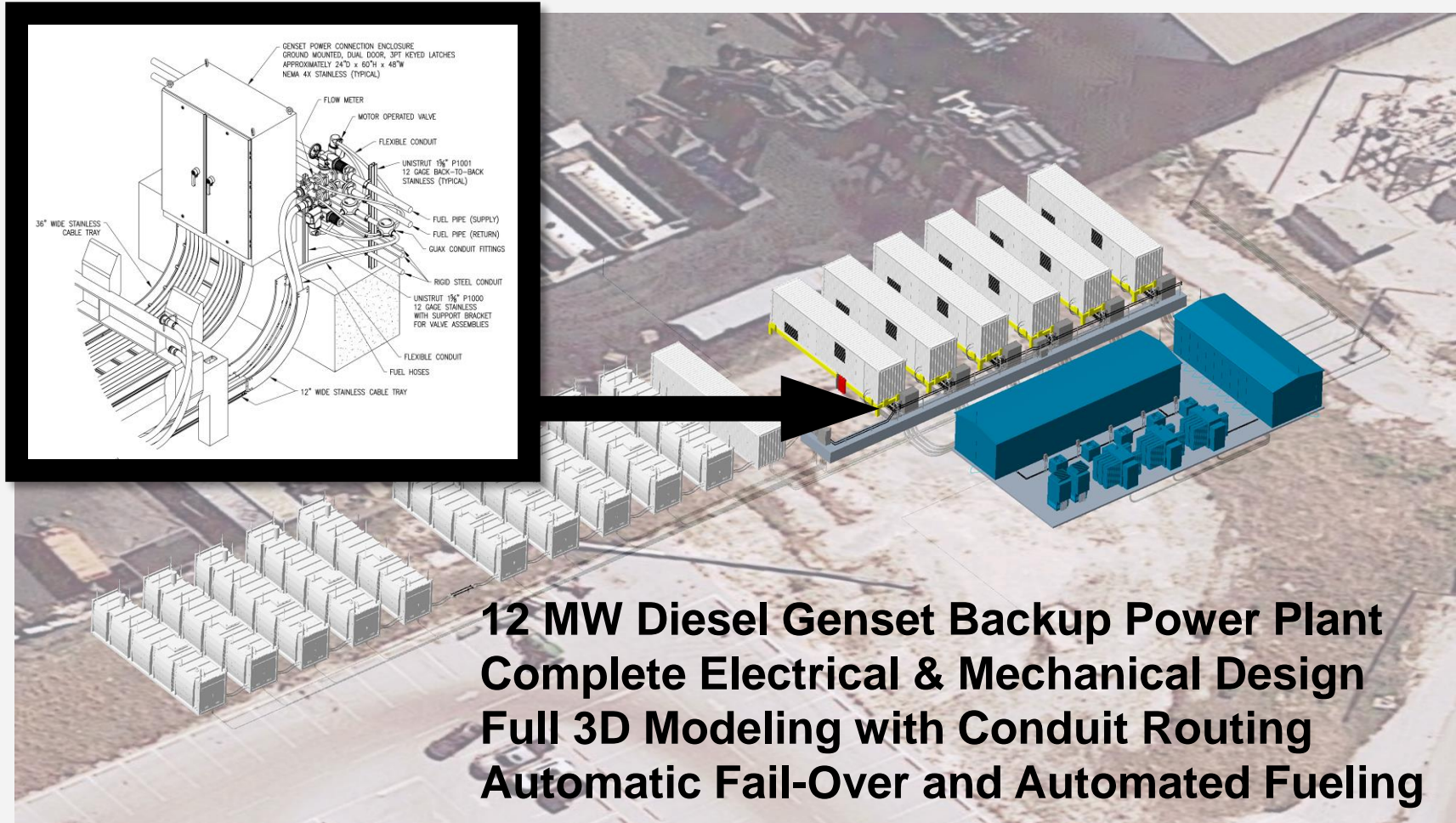
Voltage Drop Analysis

Network Analysis



Regenerative Power Handling
Circuit Protection Coordination
Switchgear and Transformers
Electrical Noise Mitigation

Electrical Power Systems



Emission Reduction Conversions

Zero Emission Studies

Power Demand Modeling

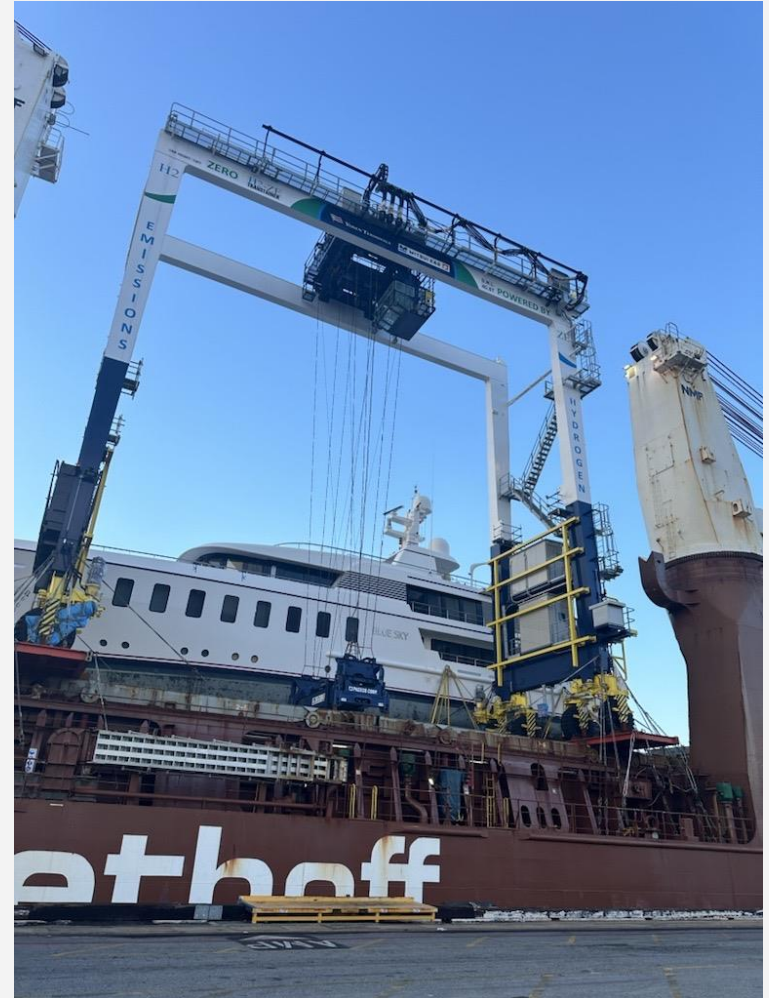
Diesel Hybrid Conversions

Battery Electric Systems

Charging Systems

H₂ Fuel Cells & Storage

Alternatives Investigation



Failure Analysis

1 PARAMETERS

1.1 COORDINATE SYSTEM
 +X Direction, Trolley Toward Water
 +Y Direction, Gantry to Operator's Left
 +Z Direction, Hoist Upward

1.2 PERFORMANCE PARAMETERS
 Number of hours of mechanical components
 $L_{mech} := 25000 \text{ hr}$
 Number of moves per hour (double move duty cycle)
 $f_{moves} := 60 \div \text{hr}$
 Number of cycles required
 $NA := L_{mech} \cdot f_{moves}$ REF: Spec Table 3.1 $NA = 1500000$

1.3 HEADBLOCK PARAMETERS
 Longitudinal distance between twistlocks
 $a := 5436 \text{ mm}$ REF: As Built
 Lateral distance between twistlocks
 $b := 762 \text{ mm}$ REF: As Built
 Weight of headblock
 $HB := 6547 \text{ kg}$ REF: As Built $HB = 6.5 \text{ t}$
 Headblock micro motion (x,y)
 $E_{HB} := (0 \ 0) \text{ in}$ REF: Spec 3.9.17 $E_{HB} := (0 \ 152.4) \text{ mm}$

1.4 LOAD PARAMETERS
 Lateral loading (LATT) and wind loading (WLO) are ignored, as their effects on the load of the twistlock are small.

Mechanism	Examples in Load Path	FEM Cases I & II	FEM Case III	Overload	Fatigue	FEM Classification
Headblock	Sheave Pins, Spreader Connections & Twistlocks	LS + LLE + LATT + WLO	STL SV	STL	LS + LL + LATT + 50% WLO	3B

Table 3.2: Mechanical Load Combinations

Lifting system	$LS := 37500 \text{ lb} - HB$	REF: Spec 1.6.16	$LS = 10.5 \text{ t}$
Lifted load	$LL := 50 \text{ LT}$	REF: Spec 1.6.13	$LL = 50.8 \text{ t}$
Eccentric lifted load, 40ft	$LLE_{40} := 40 \text{ LT}$	REF: Spec 1.6.14	$LLE_{40} = 40.6 \text{ t}$
Eccentric lifted load, twin 20ft	$LLE_{20} := 25 \text{ LT}$	REF: Spec 1.6.14	$LLE_{20} = 25.4 \text{ t}$

2.2.2 Twistlock Calculation R3.x.mcd Printed: 8/18/2008 4:13 PM

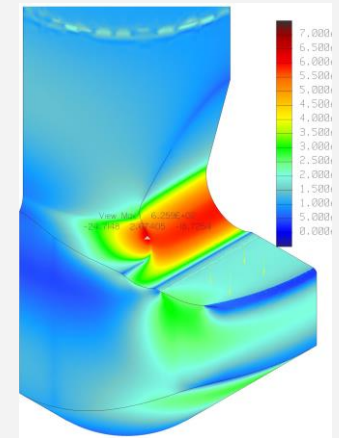
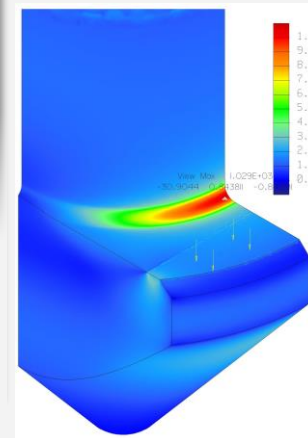
EF: Spec 1.6.14 $E_{40} := (229 \ 1219) \text{ mm}$
 EF: Spec 1.6.30 $E_{20} := (229 \ 610) \text{ mm}$
 $8.005 \frac{2}{1155.6 \text{ mm}} \text{ STL} = 120.4 \text{ t}$
 1.6.29 and the motor torque per lead line, taken of drum, multiplied by 8 lines at the headblock pins
 ZPMC SUB NO: Vcal09 SV = 160 t
 KG #42 "Calculation for Snag Device"
 FEM T.2.1.4.1.2., 1500000 cycles = Class B7
 T.2.1.4.4., Spectrum class = Class P2
 From E6 above
 World Guide to Equivalent and Steels* 4th ed. Page China - 42CrMo*
 Sample Twistlock
 Machinery's Handbook 27th Ed. 8 & 1789 Fig. 3
 Peterson, Stress Concentration Factors. $K_B = 2.7$ 5.6 "Bolt and Nut."
 REF: Solid Model, Appendix A
 REF: Solid Model, Appendix A
 REF: Solid Model, Appendix A $LF_C := 41.2 \text{ mm}$

FEM Case	Overload	Fatigue
III, Snag		
[kN]	[kN]	[kN]
392.3	295.2	158.6
FATIGUE		

Case	Over	Fatigue	Fatigue	Fatigue
Snag	load*	σ	τ	Comb**
10.0	1080.0	1080.0	1080.0	---
10.0	753.3	161.6	93.3	0.48
17.6	261.6	58.6	32.6	0.25
11	4.13	18.42	33.16	---
173	2.88	2.76	2.86	1.92
FATIGUE				

Set forth by 3.1.5 of the Spec.
 values, but rather normalized values
 nation.

FEM Case	Overload*	Fatigue, σ
III, Snag		
1080.0	1080.0	1080.0
600.0	753.3	186.3
317.0	238.5	102.5
3.41	4.53	10.53



Advanced Analysis and FEA Design Improvement

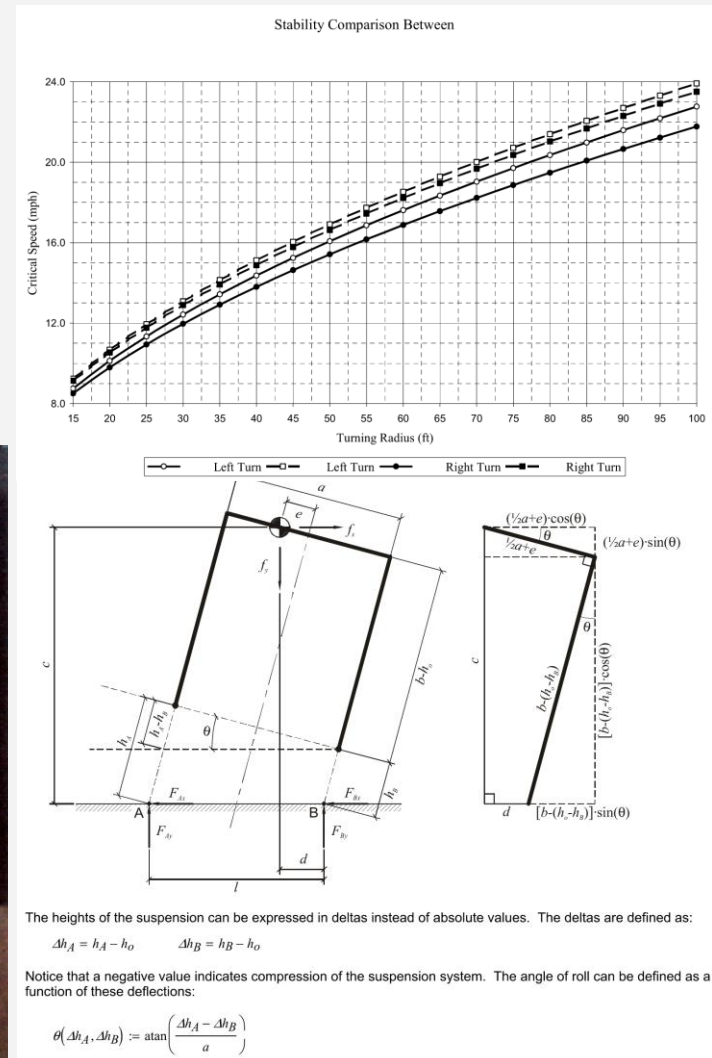
Mechanical Failure Investigation

Accident Investigation

Mechanical Failure Analysis

Root Cause Identification

Expert Witness



Electrical Failure Investigation

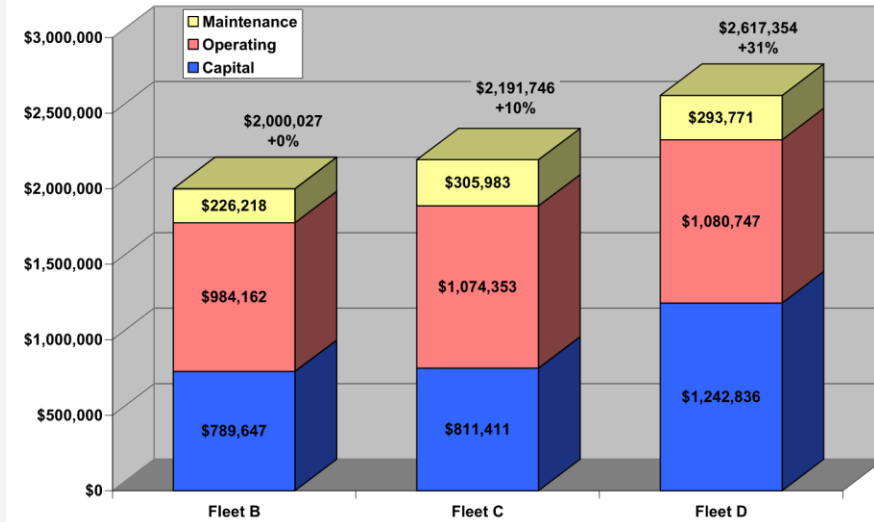
**Circuit Protection
Fuse Coordination
Root Cause Identification
Mitigation Recommendations**



Engineering Studies

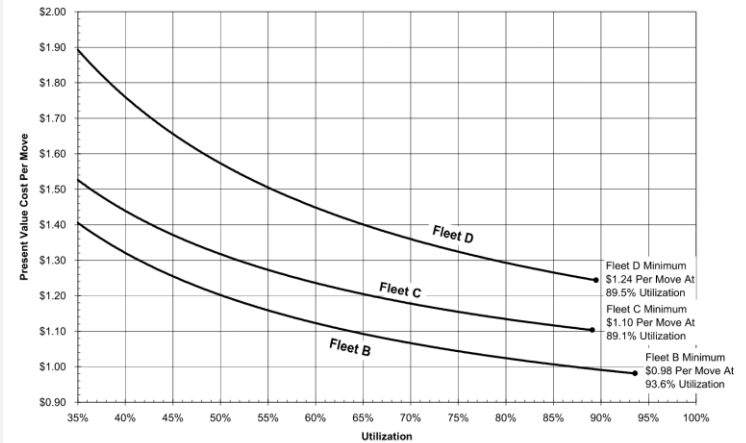
Present Value Cost For Equivalent Throughput At 50% Utilization

Values in U.S. Dollars

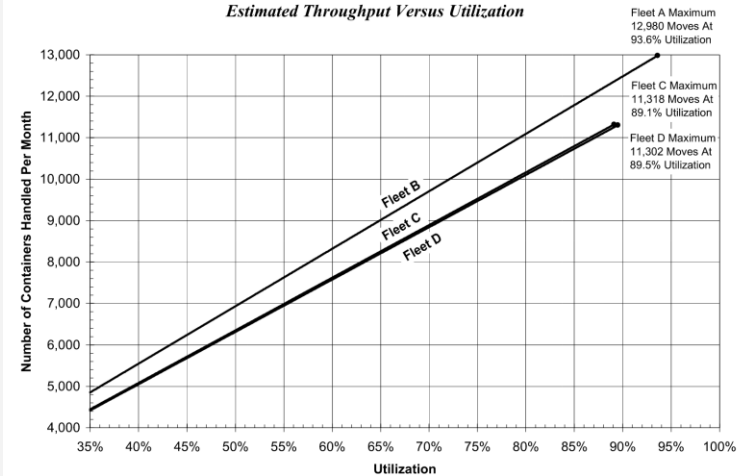


Cost Per Move Versus Utilization

Values in U.S. Dollars



Estimated Throughput Versus Utilization



Thank You

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www.Liftech.net

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