

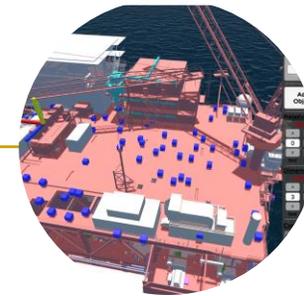
numeric engineering



Automation,
Instrumentation
& Monitoring



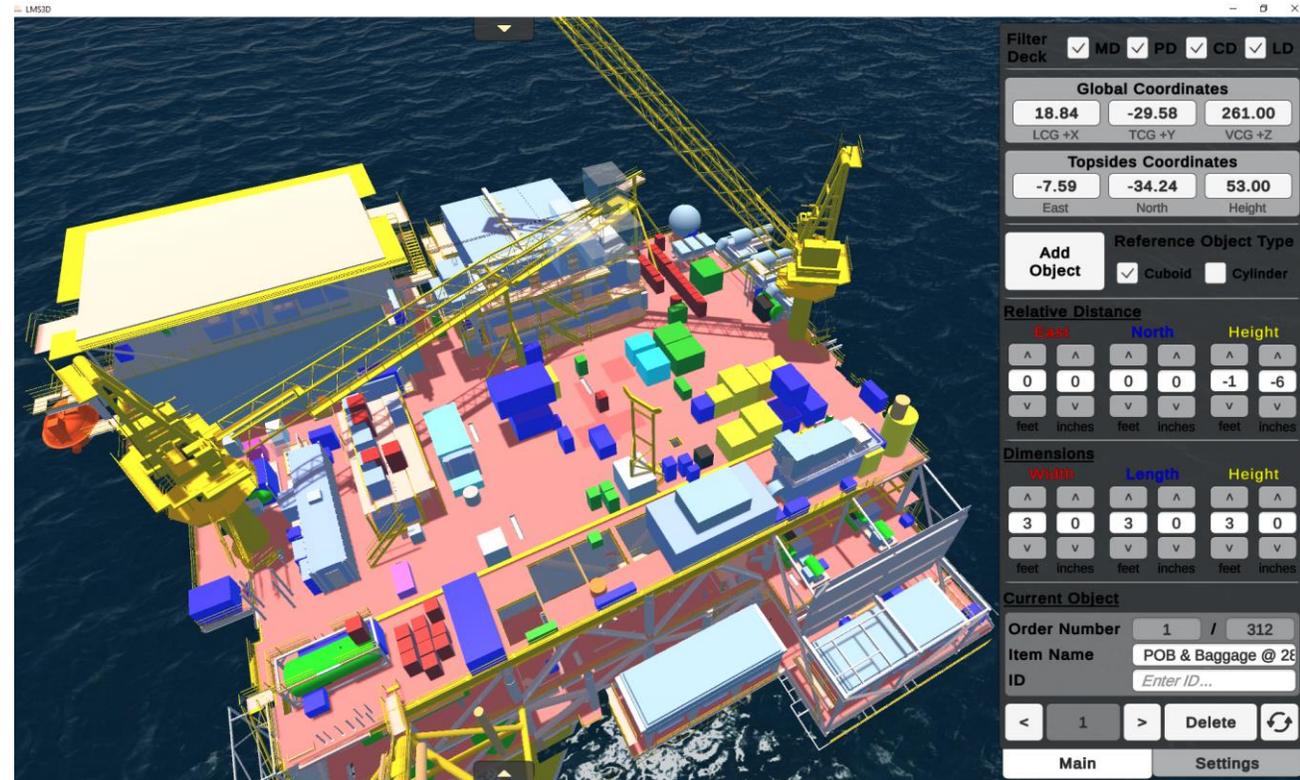
IoT & Digital Twin
Technology



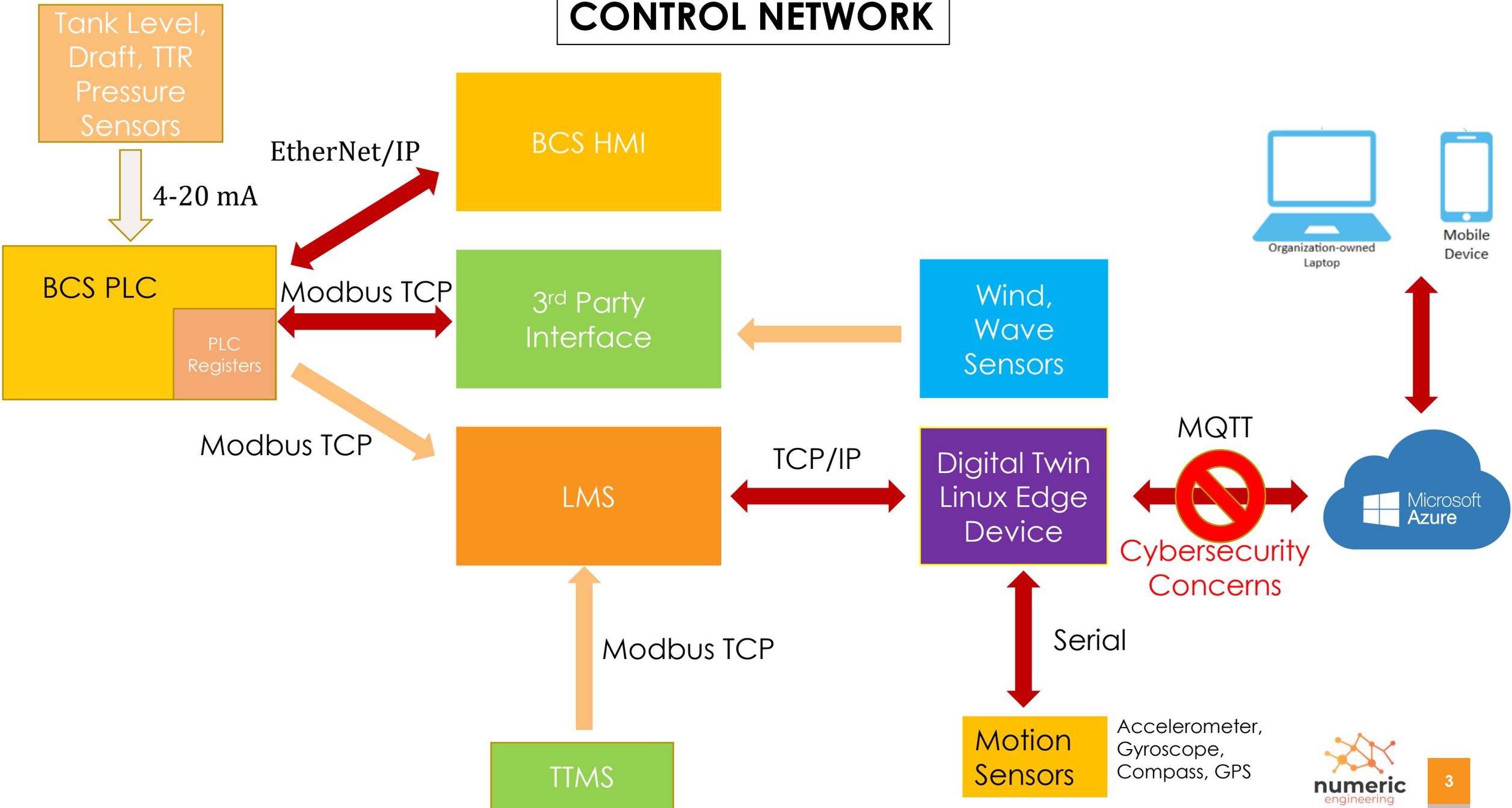
Custom
Software
Development

Numeric LMS – An Operator-Driven Solution

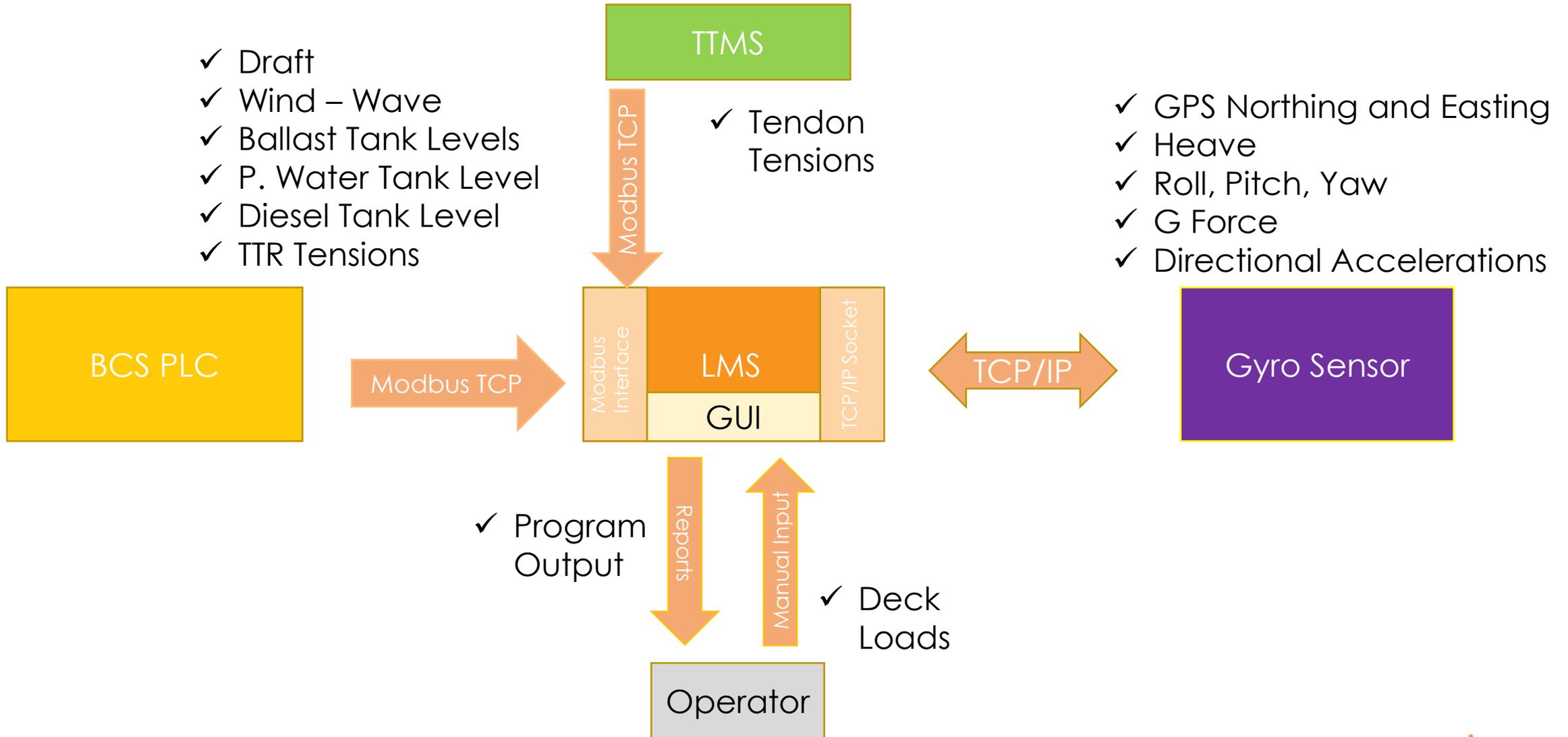
- The LMS software is a custom weight management solution that was designed based on continuous operator feedback.
- LMS utilizes a floating platform Digital Twin model to assist platform personnel in maintaining a safe operating load condition of the vessel.
- LMS receives real time monitoring data from various sensors and processes the information to determine the optimum ballast tank water levels at a given time and assists the platform personnel in maintaining a safe operating load condition of the platform.
- With its intuitive deck survey module, operators were able to identify and rectify 500kips of phantom weight, bringing phantom loads to an acceptable level.



CONTROL NETWORK



SYSTEM OVERVIEW



LMS STRUCTURE

Auto Readings

Deck Survey

- Text Based
- 3D Visual

Database and Redundancy

Load Summary and Ballast Advisory

Digital Twin and TTMS

Reporting

Auto Readings

- Operator input is not required unless a sensor malfunction occurs. Weights are calculated automatically from sensor readings.

The screenshot displays a software interface with a navigation bar at the top containing icons for Home, Deck Survey, Lightship, Auto Readings, Load Summary, Ballast Advisory, Simulation, Tendon Tensions, Vessel Motions, Environment, Alarms, Map, Settings, Report, and Help. The main content is organized into three primary sections: BUOYANCY (ft), TANKS (ft), and RISERS (kips). Each section contains multiple data points with numerical values, overwrite checkboxes, and secondary value boxes. A 'DETAILED VIEW' button is located in the bottom right of the RISERS section. At the bottom, a 'PROCESS LOG (v3.7)' shows three entries: '[9:17:33 AM] Focus on selected object. (Index: 101)', '[9:17:39 AM] Focus on selected object. (Index: 101)', and '[9:17:49 AM] Focus on selected object. (Index: 101)'.

BUOYANCY (ft)									
Draft C1	Draft C2	Draft C3	Draft C4	Airgap South	Airgap East	Airgap West	Total Buoyancy (kips)		
125.0	125.0	125.0	125.0	125.0	125.0	125.0	54,080.5		
<input type="checkbox"/> Overwrite	Use Airgap Sensors								
125.0	125.0	125.0	125.0	125.0	125.0	125.0	<input type="checkbox"/> Off		

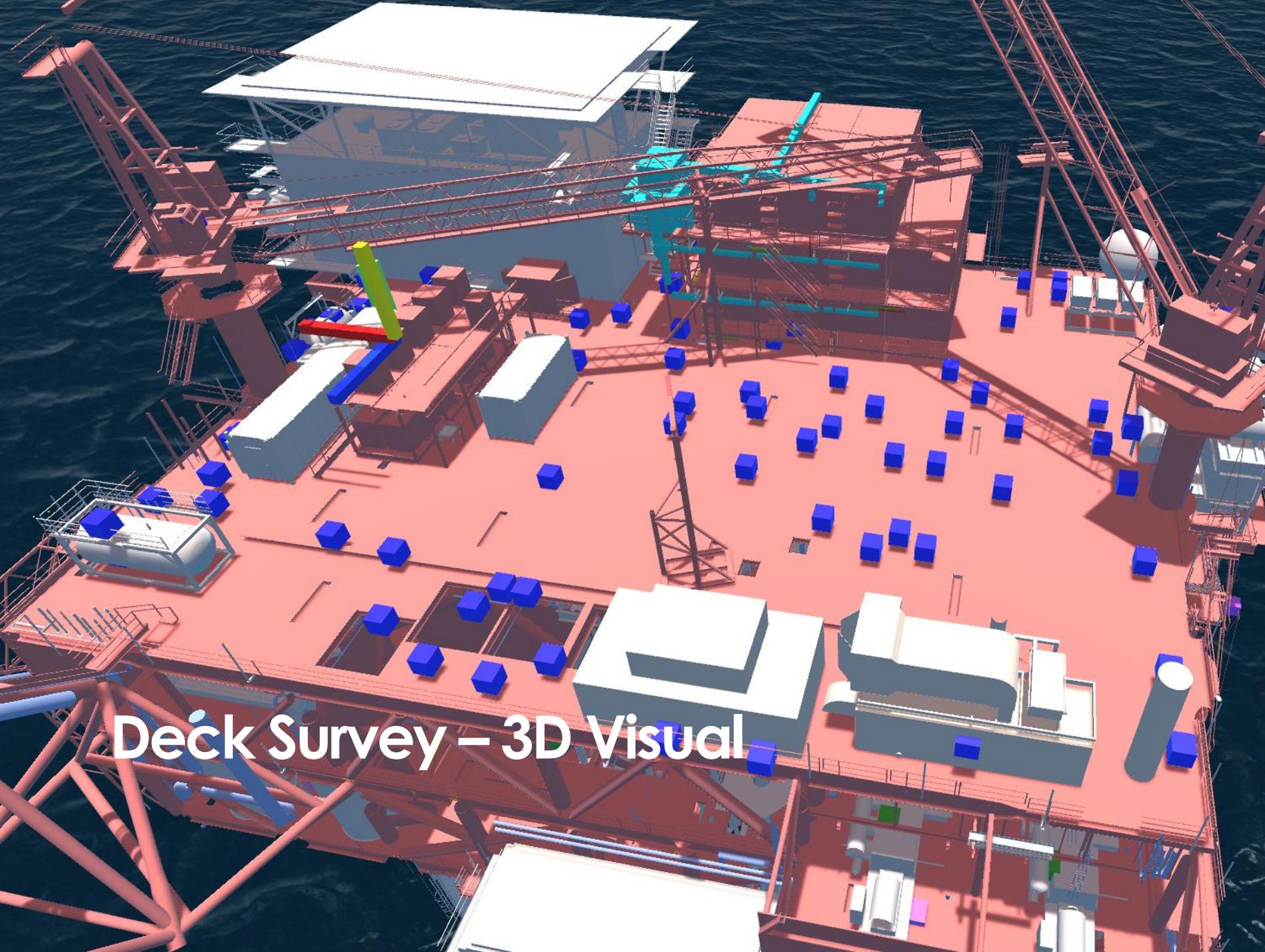
PW+DT (bbl)		TANKS (ft)							
Potable Water	Diesel Tank	TSS 11				Total Ballast Weight (kips)		Total Ballast Volume (bbl)	
300.0	100.0	20.0	20.0	20.0	20.0	3,715.7		10,287.0	
<input type="checkbox"/> Overwrite	TSS 11 (kips)	TSS 21 (kips)	TSS 11 (bbl)	TSS 21 (bbl)					
300.0	100.0	20.0	20.0	20.0	20.0	928.9	928.9	2,571.8	2,571.8
						TSS 31 (kips)	TSS 41 (kips)	TSS 31 (bbl)	TSS 41 (bbl)
						928.9	928.9	2,571.8	2,571.8

RISERS (kips)									
A3 - TTR	A5 - TTR	A6 -TTR	A7 - TTR	Shenzi	Gas Export SCR	Oil Export SCR	GC 518 N Prod SCR	GC 518 S Prod SCR	Total Riser Weight (kips)
428.9	428.9	428.9	428.9	65.8	313.0	386.9	196.3	189.6	
<input type="checkbox"/> Overwrite	4,041.5								
1,000.0	1,000.0	1,000.0	1,000.0	65.8	1,000.0	1,000.0	1,000.0	1,000.0	
K2 Main (Replacement)	K2 Main	K2 Gas Lift	518 Gas Lift	518 Main	K2 W Prod SCR	K2 E Prod SCR	GK W Prod SCR	GK E Prod SCR	
107.8	33.2	105.5	57.1	32.7	223.9	216.1	202.5	195.4	
<input type="checkbox"/> Overwrite									
107.8	33.2	105.5	57.1	32.7	1,000.0	1,000.0	1,000.0	1,000.0	

DETAILED VIEW

PROCESS LOG (v3.7)

[9:17:33 AM] Focus on selected object. (Index: 101)
[9:17:39 AM] Focus on selected object. (Index: 101)
[9:17:49 AM] Focus on selected object. (Index: 101)



Deck Survey – 3D Visual

Global Coordinates

61.91 LCG +X	33.91 TCG +Y	270.50 VCG +Z
------------------------	------------------------	-------------------------

Topsite Coordinates

67.76 East	-19.80 North	62.50 Height
----------------------	------------------------	------------------------

Add Object **Reference Object Type**

Cuboid Cylinder

Relative Distance

East		North		Height	
^	^	^	^	^	^
0	0	0	0	1	6
v	v	v	v	v	v
feet	inches	feet	inches	feet	inches

Dimensions

Width		Length		Height	
^	^	^	^	^	^
3	0	3	0	16	0
v	v	v	v	v	v
feet	inches	feet	inches	feet	inches

Current Object

Order Number: 101 / 270

Item Name: Biocide Injection Skid

Notes:

< 101 > Delete ↺

Main Settings

Deck Survey – Text Based

Home Deck Survey Lightship Auto Readings Load Summary Ballast Advisory Simulation Tendon Tensions Vessel Motions Environment Alarms Map Settings Report Help

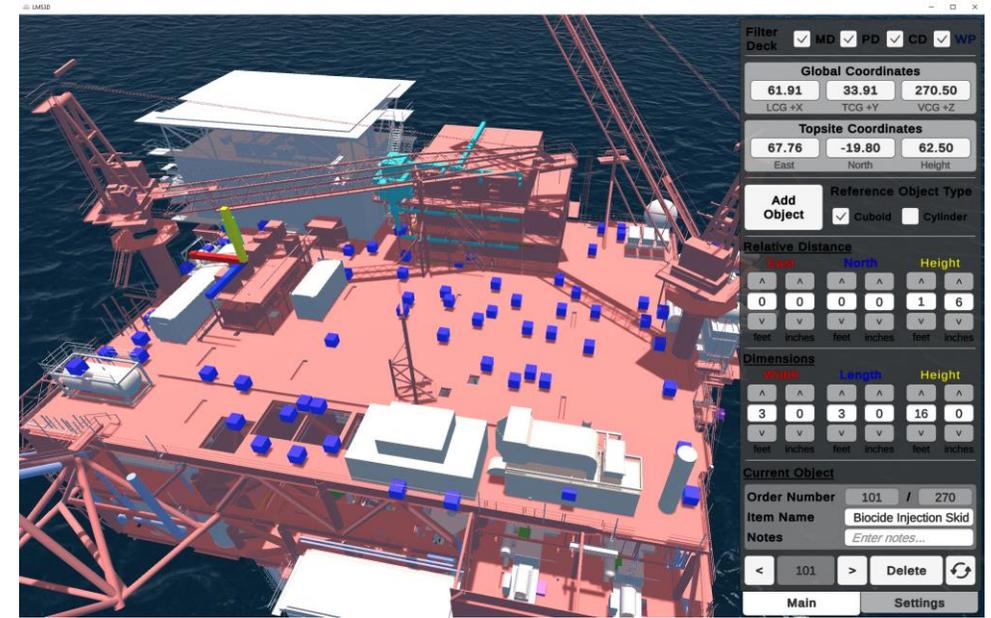
Ord...	Item Name	ID	Notes	Temporary or Long...	Date Loaded	Date Updated	Color	Max Fluid ...	% Full	Weight (ki...	Geometry	LCG +X (ft)	TCG +Y (ft)	VCG +Z (ft)	Deck	Company
233	Bulk Oil Degasser B MBD 106...		25.4k	Temporary	07/28/2021	02/07/2022	Blue...	0.00	0.00	10.67	Cuboid	26.45	8.91	218.00	Cellar	Source: R...
234	Bulk Oil Treater B MBK 107...		17175 Gals./ 14...	Temporary	07/28/2021	02/07/2022	Blue...	0.00	0.00	148.20	Cuboid	21.95	9.10	218.00	Cellar	Source: R...
235	LACT Charge Pumps A/B/C PB...			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	0.90	Cuboid	-16.27	-9.54	213.00	Cellar	Source: R...
236	LACT Unit (Fluid)			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	6.00	Cuboid	-5.48	-29.88	213.00	Cellar	Source: R...
237	Oil Pipeline Pumps A/B/C PB...			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	0.90	Cuboid	-8.41	29.49	211.00	Cellar	Source: R...
238	Oil Pipeline Pumps D/E/F PBX...			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	0.90	Cuboid	-0.49	21.57	211.00	Cellar	Source: R...
239	Flash Gas Compressor A (Flui...			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	6.00	Cuboid	-79.48	-9.90	216.00	Cellar	Source: R...
240	Flash Gas Compressor B (Fluid)			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	6.00	Cuboid	-60.74	-29.06	216.00	Cellar	Source: R...
241	Flash Gas Compressor C (Flui...			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	6.00	Cuboid	-36.90	-52.90	216.00	Cellar	Source: R...
242	Air Cooler #1 (Fluid)			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	2.30	Cuboid	-92.93	4.61	223.00	Cellar	Source: R...
243	Air Cooler #2 (Fluid)			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	3.50	Cuboid	-60.01	37.53	223.00	Cellar	Source: R...
244	Gas Filter Separator MAK 110...			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	0.30	Cuboid	-38.57	-32.56	215.00	Cellar	Source: R...
245	Gas/Glycol Heat Exchanger H...			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	1.40	Cuboid	-62.58	-56.57	218.00	Cellar	Source: R...
246	Glycol Contactor MAF1110 (...)			Temporary	07/28/2021	02/07/2022	Blue...	0.00	0.00	0.78	Cuboid	-59.34	-53.29	224.00	Cellar	Source: R...
247	Glycol Condensate Separator ...		47%/H2O	Temporary	07/28/2021	02/07/2022	Blue...	0.00	0.00	4.37	Cuboid	-6.83	-89.78	218.00	Cellar	Source: R...
248	Glycol Surge Tank ABJ 2030 ...			Temporary	07/28/2021	02/07/2022	Blue...	0.00	0.00	4.71	Cuboid	-7.33	-95.00	218.00	Cellar	Source: R...
249	Glycol Reboiler BBC 1220 (...)			Temporary	07/28/2021	02/07/2022	Blue...	0.00	0.00	6.96	Cuboid	-10.11	-92.82	218.00	Cellar	Source: R...
250	H.P. Flare Scrubber MBF 110...		90.3k ...	Temporary	07/28/2021	02/07/2022	Gold	0.00	0.00	0.00	Cuboid	0.00	0.00	0.00	Outside Deck Ra...	Source: R...
251	L.P. Flare Scrubber MBF 202...		107.5k ...	Temporary	07/28/2021	02/07/2022	Blue...	0.00	0.00	29.03	Cuboid	-4.63	69.33	218.00	Cellar	Source: R...
252	Flare Scrubber Pumps PBA ...			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	0.20	Cuboid	5.76	76.83	210.00	Cellar	Source: R...
253	Air Compressor Skid CBE 5...			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	0.10	Cuboid	20.44	-62.04	211.05	Cellar	Source: R...
254	Air Receiver MBL 1...			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	0.10	Cuboid	33.09	-59.61	213.00	Cellar	Source: R...
255	Fuel Gas Skid (Fluid)			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	0.10	Cuboid	0.45	-14.11	213.00	Cellar	Source: R...
256	Lube Oil Tank Skid ABJ 2120 A...			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	18.00	Cuboid	27.58	-67.46	213.00	Cellar	Source: R...
257	Water Maker Skid			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	0.60	Cuboid	59.89	-18.88	218.00	Cellar	Source: R...
258	Potable Water Tank & Pumps ...		35.3k	Temporary	07/28/2021	02/07/2022	Blue...	0.00	0.00	32.76	Cuboid	62.37	-1.98	213.00	Cellar	Source: R...
259	Seawater Lift Pump A PBE 61...			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	0.30	Cuboid	44.34	-14.76	213.00	Cellar	Source: R...
260	Seawater Lift Pump B PBE 61...			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	0.30	Cuboid	47.33	-14.40	213.00	Cellar	Source: R...

EDIT MODE On + ADD NEW - REMOVE ✓ APPLY 🖱️ FOCUS ON 3D 3D 3D INPUT

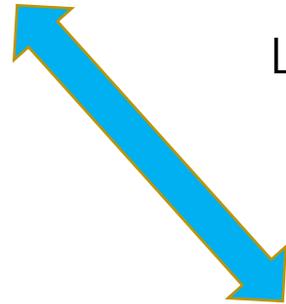
PROCESS LOG (v3.7)
 [9:17:33 AM] Focus on selected object. (Index: 101)
 [9:17:39 AM] Focus on selected object. (Index: 101)
 [9:17:49 AM] Focus on selected object. (Index: 101)

LMS Database & Redundancy

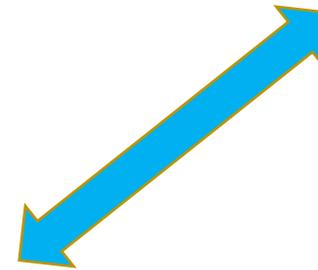
Obj.	Item Name	ID	Notes	Temporary or Long	Date Loaded	Date Unloaded	Color	Max Fluid	% Full	Weight St.	Geometry	LCG +/- (ft)	TGC +/- (ft)	VCG +/- (ft)	Deck	Company
233	Bu.Oil Dipositer B	MED 106.	25.4	Temporary	07/28/2021	02/07/2022	Blue...	0.00	0.00	10.67	Cuboid	26.45	8.91	218.00	Ceilar	Source: R...
234	Bu.Oil Treater B	MED 107.	17175 Gals./ 14.	Temporary	07/28/2021	02/07/2022	Blue...	0.00	0.00	148.20	Cuboid	21.95	9.10	218.00	Ceilar	Source: R...
235	LACT Charge Pumps A,B,C	PB...		Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	6.90	Cuboid	-16.27	-9.54	213.00	Ceilar	Source: R...
236	LACT Unit (P)A-D			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	6.00	Cuboid	-5.48	-29.88	213.00	Ceilar	Source: R...
237	Oil Pipeline Pumps A,B,C	PB...		Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	9.90	Cuboid	-8.41	29.49	211.00	Ceilar	Source: R...
238	Oil Pipeline Pumps D,E,F	PB...		Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	9.90	Cuboid	-0.49	21.57	211.00	Ceilar	Source: R...
239	Flash Gas Compressor A (P)A-D			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	6.00	Cuboid	-79.48	-9.90	216.00	Ceilar	Source: R...
240	Flash Gas Compressor B (P)A-D			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	6.00	Cuboid	-60.74	-29.06	216.00	Ceilar	Source: R...
241	Flash Gas Compressor C (P)A-D			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	6.00	Cuboid	-56.90	-52.90	216.00	Ceilar	Source: R...
242	Air Cooler #1 (P)A-D			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	2.30	Cuboid	-92.93	4.61	223.00	Ceilar	Source: R...
243	Air Cooler #2 (P)A-D			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	3.50	Cuboid	-60.01	37.53	223.00	Ceilar	Source: R...
244	Gas Filter Separator MAX 110.			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	0.30	Cuboid	-38.57	-32.56	215.00	Ceilar	Source: R...
245	Gas/Glycol Heat Exchanger H.			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	1.40	Cuboid	-62.58	-56.57	218.00	Ceilar	Source: R...
246	Glycol Contactor MAP 110 (C...			Temporary	07/28/2021	02/07/2022	Blue...	0.00	0.00	0.78	Cuboid	-59.34	-53.29	224.00	Ceilar	Source: R...
247	Glycol Condensate Separator ...	47%N2O		Temporary	07/28/2021	02/07/2022	Blue...	0.00	0.00	4.37	Cuboid	-6.83	-89.78	218.00	Ceilar	Source: R...
248	Glycol Surge Tank AB3 2030 (C...			Temporary	07/28/2021	02/07/2022	Blue...	0.00	0.00	4.71	Cuboid	-7.33	-95.00	218.00	Ceilar	Source: R...
249	Glycol Reboiler BHC 1220 (C...			Temporary	07/28/2021	02/07/2022	Blue...	0.00	0.00	6.96	Cuboid	-10.11	-92.82	218.00	Ceilar	Source: R...
250	H.P. Flare Scrubber MBF 110.	90.5k		Temporary	07/28/2021	02/07/2022	Gold	0.00	0.00	0.00	Cuboid	0.00	0.00	0.00	Outside Deck Ra...	
251	L.P. Flare Scrubber MBF 202.	107.5k		Temporary	07/28/2021	02/07/2022	Blue...	0.00	0.00	29.03	Cuboid	-4.63	69.33	218.00	Ceilar	Source: R...
252	Flare Scrubber Pumps PBA			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	0.20	Cuboid	5.76	76.83	218.00	Ceilar	Source: R...
253	Air Compressor Skid CBE S.			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	0.10	Cuboid	20.44	-62.04	211.00	Ceilar	Source: R...
254	Air Receiver MIL 1.			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	6.10	Cuboid	33.09	-59.61	213.00	Ceilar	Source: R...
255	Fuel Gas Skid (P)A-D			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	6.10	Cuboid	6.46	-14.11	213.00	Ceilar	Source: R...
256	Lube Oil Tank Skid AB3 2120 A.			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	18.00	Cuboid	27.58	-67.46	213.00	Ceilar	Source: R...
257	Water Meter Skid			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	6.60	Cuboid	99.89	-18.88	218.00	Ceilar	Source: R...
258	Potable Water Tank & Pumps ...	25.3k		Temporary	07/28/2021	02/07/2022	Blue...	0.00	0.00	32.76	Cuboid	62.37	-1.98	213.00	Ceilar	Source: R...
259	Seawater Lift Pump A PFE 6.L.			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	0.30	Cuboid	44.34	-14.76	213.00	Ceilar	Source: R...
260	Seawater Lift Pump B PFE 6.L.			Temporary	02/07/2022	02/07/2022	Blue...	0.00	0.00	0.30	Cuboid	47.33	-14.40	213.00	Ceilar	Source: R...



Process A

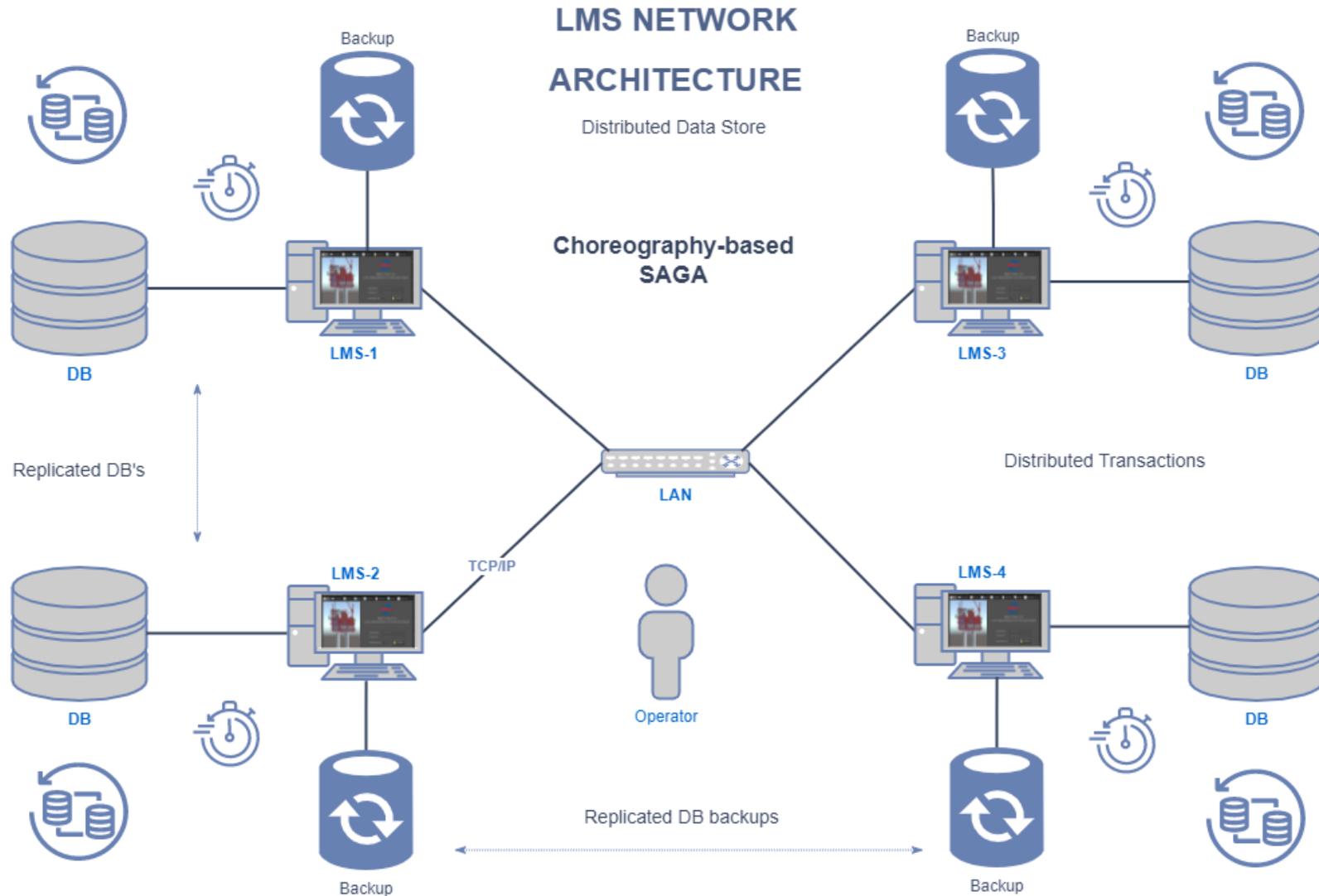


Local Database

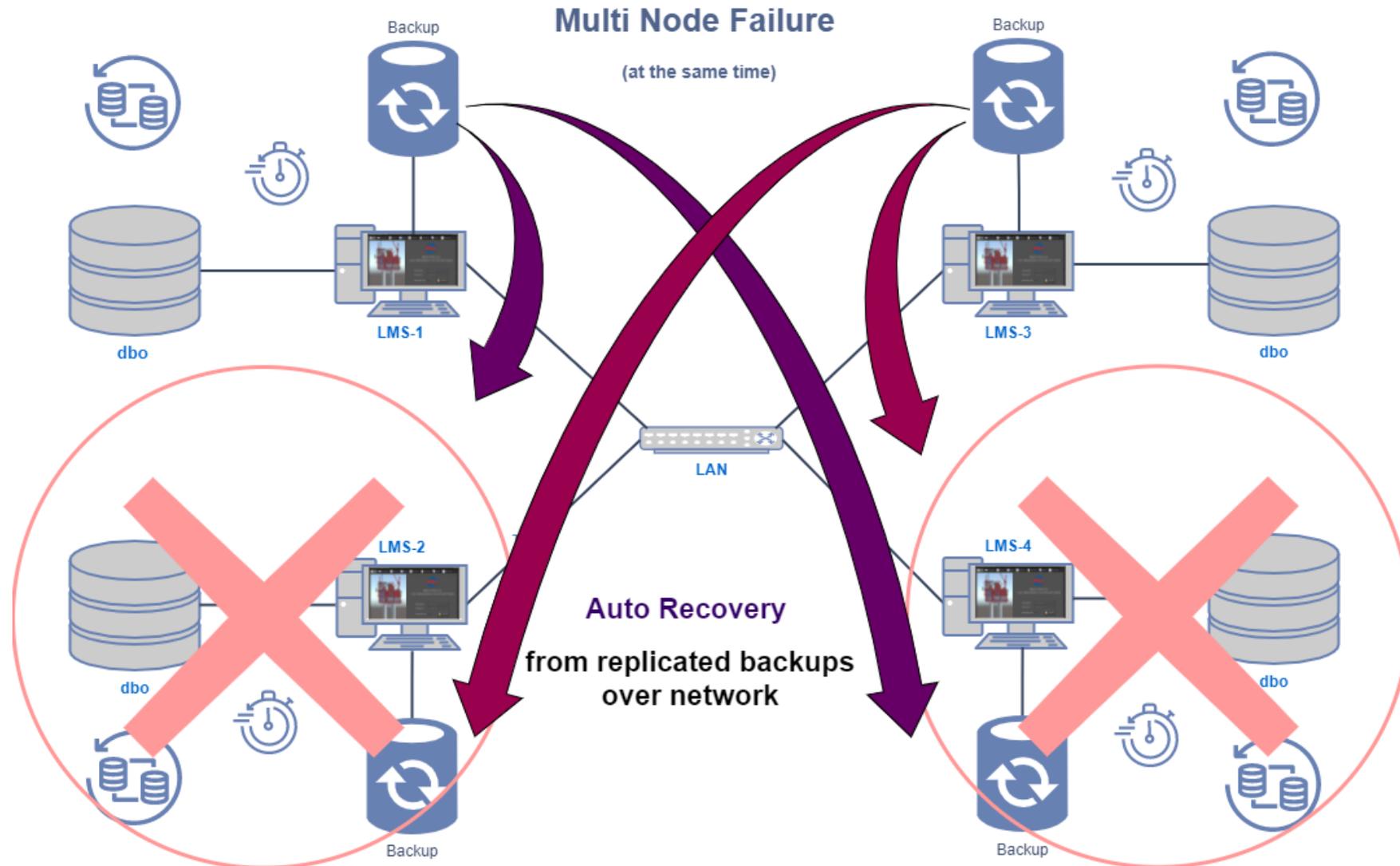


Process B

LMS Database & Redundancy



LMS Database & Redundancy



Load Summary and Ballast Advisory

Home Deck Survey Lightship Auto Readings Load Summary Ballast Advisory Simulation Tendon Tensions Vessel Motions Environment Alarms Map Settings Report Help

LOAD SUMMARY

Total Buoyancy	54,080.50 kips	↑
Deck Survey Load	2,729.03 kips	↓
Total Ballast Weight	3,715.67 kips	↓
Total Riser Load	4,041.49 kips	↓
Total Tendon Tension	15,300.00 kips	↓
Lightship Weight	27,722.26 kips	↓
Potable Water + Diesel Tank	135.08 kips	↓

PHANTOM WEIGHT

Phantom Weight	436.96 kips	↑
Vertical Eccentricity (KG)	148.82 feet	↕
Horizontal Eccentricity	1.16 feet	↔

PROCESS LOG (v3.7)

9:17:33 AM Focus on selected object. (Index: 101)
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Home Deck Survey Lightship Auto Readings Load Summary Ballast Advisory Simulation Tendon Tensions Vessel Motions Environment Alarms Map Settings Report Help

TSS11

Tendon Tension 11-12 (kips)	1,900.0	
Recommended Elevation (ft)	16.1	
Current Elevation (ft)	20.0	
Ballast Weight (kips)	-231.3	
Ballast Volume (bbl)	-640.3	

TSS21

Tendon Tension 21-22 (kips)	1,850.0	
Recommended Elevation (ft)	16.8	
Current Elevation (ft)	20.0	
Ballast Weight (kips)	-189.2	
Ballast Volume (bbl)	-523.8	

TSS31

Tendon Tension 31-32 (kips)	2,000.0	
Recommended Elevation (ft)	19.0	
Current Elevation (ft)	20.0	
Ballast Weight (kips)	-60.2	
Ballast Volume (bbl)	-166.8	

TSS41

Tendon Tension 41-42 (kips)	1,900.0	
Recommended Elevation (ft)	18.3	
Current Elevation (ft)	20.0	
Ballast Weight (kips)	-103.6	
Ballast Volume (bbl)	-286.8	

AUTO UPDATE: Off

SET TENDON TENSION (kips):

PROCESS LOG (v3.7)

9:17:33 AM Focus on selected object. (Index: 101)
 9:17:39 AM Focus on selected object. (Index: 101)
 9:17:49 AM Focus on selected object. (Index: 101)

BALLAST OP. REPORTING

Reporting

Home Auto Readings Deck Survey Lightship Load Summary Ballast Advisory Tendon Tensions Vessel Motions Environment Alarms Map Settings Report Help

Report

LOADING	GLOBAL COORDINATES				TOPSIDES COORDINATES			Deck	FSMT (ITT * SG)	FSML (ILL*SG)	Volume (barrels)	Net Volume (barrels)	Item	Date	
	Vertical Loads (kips)	LCG +X (feet)	TCG +Y (feet)	VCG abv BL (feet)	LCG +X (feet)	TCG +Y (feet)	VCG abv Cellar Deck TOS								
Topside Payload															
Diesel + Potable Water															
PW	141.20	0.00	63.33	169.01				0.0	0.0	393.01	0.00				<Copied>
DO	33.94	-3.58	51.25	188.02				1,280.8	93.9	111.83	0.00				<Copied>
Diesel + Potable Water Subtotal	175.14	-1.66	60.99	172.70				1,280.8	93.9	504.84	0.00				<Copied>
Tpsd Pylid=DO,PW,Vrbl,MDprod,,CirD	...														
Drill Deck, Production Deck, Cooler Ext	0.00	0.00	0.00	0.00						0.00				5/13/20	<Copied>
Cooler Extension, ABS Approved Additi	0.00	0.00	0.00	0.00						0.00				5/13/20	<Copied>
Tpsd Pylid = DO, PW, Vrbl, MDprod,,	0.00	0.00	0.00	0.00				0.0	0.0	0.00	0.00				<Copied>
Variable															
Pole Base on MD	120.00	0.00	0.00	261.50	0.00	0.00	53.50	Main		0.00			by IoTINX	2/22/2021	001
Pole Base on MD	0.00	0.00	0.00	262.00	0.00	0.00	54.00	Main		0.00			by IoTINX	2/22/2021	002
Pole Base on PD	0.00	0.00	0.00	236.00	0.00	0.00	28.00	Production		0.00			by IoTINX	2/22/2021	003
Pole Base on CD	0.00	0.00	0.00	209.00	0.00	0.00	1.00	Cellar		0.00			by IoTINX	2/22/2021	004
Center Pole	0.00	0.00	0.00	258.00	0.00	0.00	50.00	Cellar		0.00			by IoTINX	2/22/2021	005
ERA Fuel Tank ABJ 2130	12.10	67.38	47.34	265.00	81.11	-14.16	57.00	Main		0.00				9/12/2021	006
ERA Fuel Tote Tanks 4.5k full	9.00	72.29	37.51	264.00	77.64	-24.59	56.00	Main		0.00				9/12/2021	007
POB & Baggage @ 280 lbs each	11.78	14.84	-29.58	261.00	-10.42	-31.41	53.00	Main		0.00				9/12/2021	008
New Quarters 1 Building @39 Kips	351.00	26.88	-62.70	276.00	-18.26	-56.27	66.00	Main		0.00				7/20/2021	009
New Quarters 1 Buildings Operating Co	9.90	0.57	-62.84	264.00	-37.03	-37.84	56.00	Main		0.00				9/27/2019	010
Marco Polo (12 Pk) Nitrogen Rk. (6,	2.50	39.35	-7.03	264.00	22.85	-32.80	56.00	Main		0.00			Drill Dk.	7/28/2021	011
Filter Bin (Oily Rags & Filters) 4x4x4	0.80	39.81	65.82	264.00	74.99	18.39	56.00	Main		0.00			Drill Dk.	9/28/2021	012
B.B.Q Pit	0.44	118.90	6.95	264.00	88.99	-79.18	56.00	Main		0.00			B-B-Que Pit/Stand	2021	013
Tote Tank 200 Gal for Jet Fuel Waste (6	0.20	53.20	18.56	262.50	50.74	-24.49	54.50	Main		0.00			Jet A Waste 2"	6/1/2021	014
Tote Tank 200 Gal for Jet Fuel Waste (6	0.00	0.00	0.00	0.00	0.00	0.00	-208.00	Outside Deck Range		0.00			Jet A Waste .25	6/1/2021	015
Drums of Trasar-Trac (Corr. Inh.) (6,	0.30	-44.11	-74.39	262.50	-83.76	-21.41	54.50	Main		0.00			1-Drums (w/70 Gal	9/24/2017	016
Drums of waste Paint	0.40	-44.44	-79.59	264.00	-87.70	-24.85	56.00	Main		0.00			6	9/14/2021	017
Plastic (5 Gal) Pails of SHC-826 (Air Co	0.80	-44.44	-11.65	264.00	-39.66	23.19	56.00	Main		0.00			8-(5 Gal ea)	9/27/2019	018
Plastic (5 Gal) Pails of AR-AFFF	0.20	-34.75	44.78	264.00	7.09	56.24	56.00	Main		0.00			3-(5 Gal ea)	9/27/2019	019
Tote Tanks 180 gal	1.00	-21.34	42.71	264.00	15.11	45.29	56.00	Main		0.00			1	6/1/2021	020
Tote Tank 350 gal	10.00	-23.07	35.47	264.00	8.77	41.39	56.00	Main		0.00			5	6/1/2021	021
Tote Tank 400 gal	0.00	0.00	0.00	0.00	0.00	0.00	-208.00	Outside Deck Range		0.00			0	6/1/2021	022
Tote Tank 550 gal	85.00	-3.70	49.51	264.00	32.39	37.63	56.00	Main		0.00			15	8/5/2021	023

PROCESS LOG (v3.5 - BETA)

[10:59:00 AM] Focus on selected object. (Index: 1)
 [10:59:07 AM] Focus on selected object. (Index: 23)
 [10:59:12 AM] LMS 3D is loading. Please wait...

CREATE NEW

General Report

OPEN

CLOSE

GO BACK

Reporting

The screenshot displays a software interface for reporting pump run information. The main window is titled "Sounding and Ballast Report" and contains a sub-section for "Pump Run Information". This section is divided into four columns, each representing a different TSS (Tank Sounding System) location: Column 1 TSS 11, Column 2 TSS 21, Column 3 TSS 31, and Column 4 TSS 41. Each column contains a set of input fields for "Tank Reading Start (kips)", "Tendon Start (kips)", "Tank Reading Stop (kips)", "Tendon Stop (kips)", "Total in Barrels", and "Pump Run Time (minutes)". The "Total in Barrels" field for each column is highlighted in cyan and shows a value of 0.0. The "Pump Run Time (minutes)" field for each column shows a value of 1. At the bottom of the main data area, there is a "Total For NPDES" field, also highlighted in cyan, showing a value of 0.0. To the right of the main data area, there are three buttons: "CREATE NEW" (with a green plus icon), "OPEN" (with a folder icon), and "CLOSE" (with a red X icon). Below these buttons is a "GO BACK" button with a left arrow icon. At the bottom of the interface, there is a "PROCESS LOG (v3.5 - BETA)" section with a scrollable list of log entries:

- [10:59:00 AM] Focus on selected object. [Index: 1]
- [10:59:07 AM] Focus on selected object. [Index: 23]
- [10:59:12 AM] LMS 3D is loading. Please wait...

Redundant TTMS

- Software + Hardware Solution
- Most existing TTMS systems don't have a redundant mechanism to take over in case of a system failure.
- There is no easy method to analytically calculate the tendon tensions as the existing sensors, such as wind, wave and current, give only a rough estimate of the horizontal force (eccentricity) acting on the platform.
- Ballasting and de-ballasting operations solely rely on the readings from TTMS.
- A redundant TTMS system is also needed for monitoring the accuracy and the stability (drift issues) of the existing TTMS system.



Measured vs. Calculated Tendon Tension

