TechnipFMC

Interactive Simulation Solutions

CETO®

Centrales Energies, Mars 2018

L. Gross ; A. Hardy

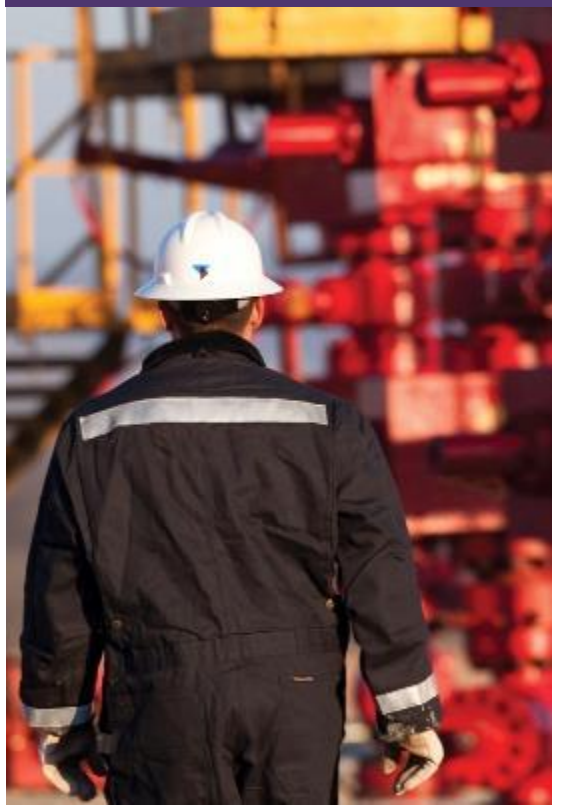
TechnipFMC in figures

126 Nationalities	**$15B** Total company Revenue[1]	**20** Vessels[2]
48 Countries in which we operate	**$13B** Total company Backlog[1]	**37,000** Employees

Footnotes:

[1] Source: TechnipFMC Q4 2017 results.
[2] With two vessels under construction.

Broadest portfolio of solutions for the production and transformation of oil and gas

Subsea	Onshore/Offshore	Surface
		

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Interactive simulation Framework

Business Needs

- Project Review tool
- Communication tool between engineering and operation
- Mission rehearsal and operator training
- Operations optimization
- Available at any location, even on vessels

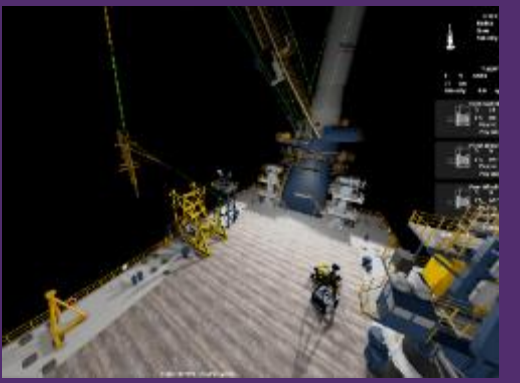
Field proven

(used on more than 20 projects)

Spool installation

Kaombo spool installation
(simulation is on the right)

Flet deployment



Moho Flet 11 deployment

ROV Simulation

LIZA manifold interface check

In house

- Developed by TechnipFMC Interactive Simulations Solutions (ITC) since 2014
- Uses world class physics engine developed by CEA since 2003, with Marine add-on module (exploitation exclusive to TechnipFMC in oil-and-gas domain)
- Strong differentiator with competition

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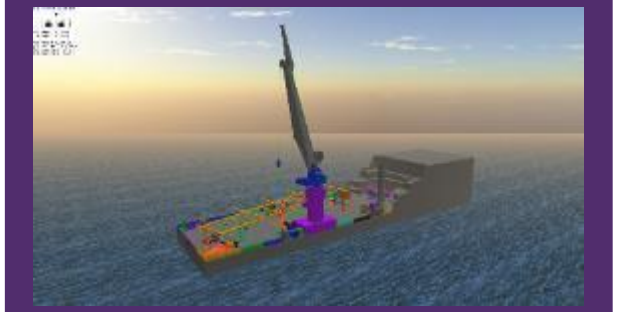
Interactive simulation Framework

2014	2015	2017	2018
			
Project kick off	Core modules	CETO	GEMINI
4 scenarios Tested by offshore personnel 1st Scenario in 3 months	Hydro upgrade FEA models XDE Native integration	CETO® Stand alone release Subsea behaviours Edition Capabilities	Advanced ROV model Full Size integration Editor release

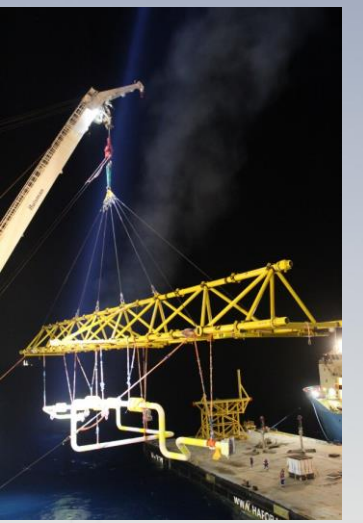
Kaombo

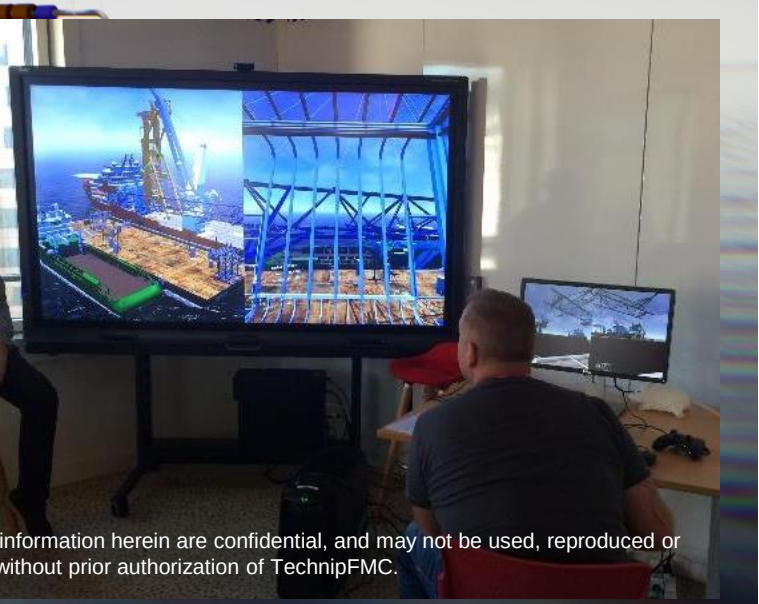
Large spool installation

Kaombo

Large spool installation

- Edition capabilities for deck layout (tagging towers, winches & bumpers)
- Multiple vessels with independent movement
- Rigid spool with flexibility
- Fast deployment of alternative scenario (less than a week)





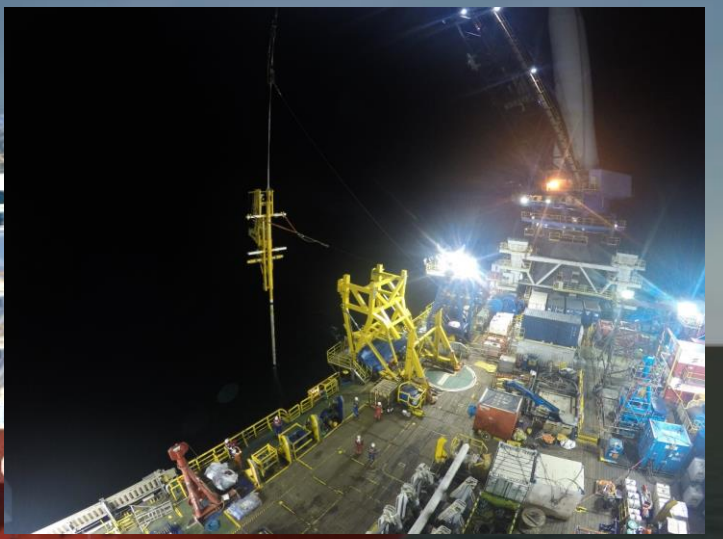
- Scenario built early in design phase
- Multiple changes implemented after simulation session with Installation/Structural Design teams
- Sessions organized with vessel crew (OCM, Crane Operator)
- Partners (HMC) discussions eased from simulation
- Vessel & Client satisfied and confident

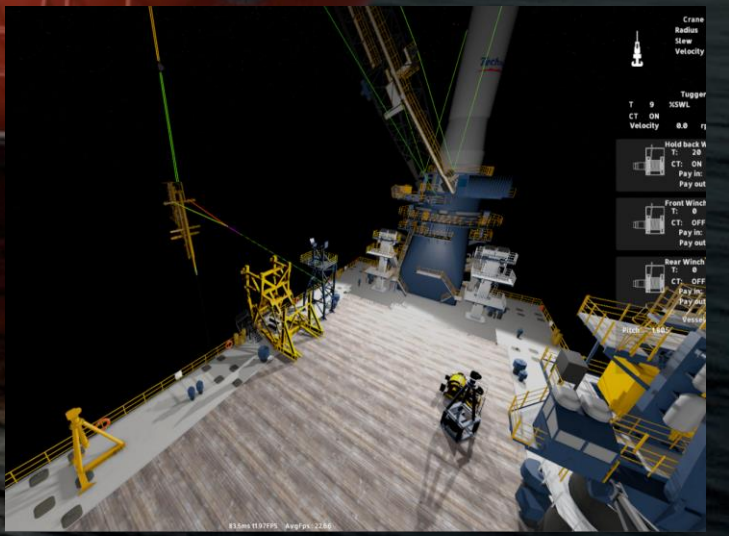
MOHO NORD

Flett11 Deployment

MOHO NORD
Flett11 Deployment

- Scenario built in late operation design phase
- Uncertainties wrt crane capacities (lead angles concerns)
- Video export of the simulation and sent to the vessel for feasibility feedback
- Conclusion: Removed the two deck winches
- Operational Weather window reduced to lower uncertainties



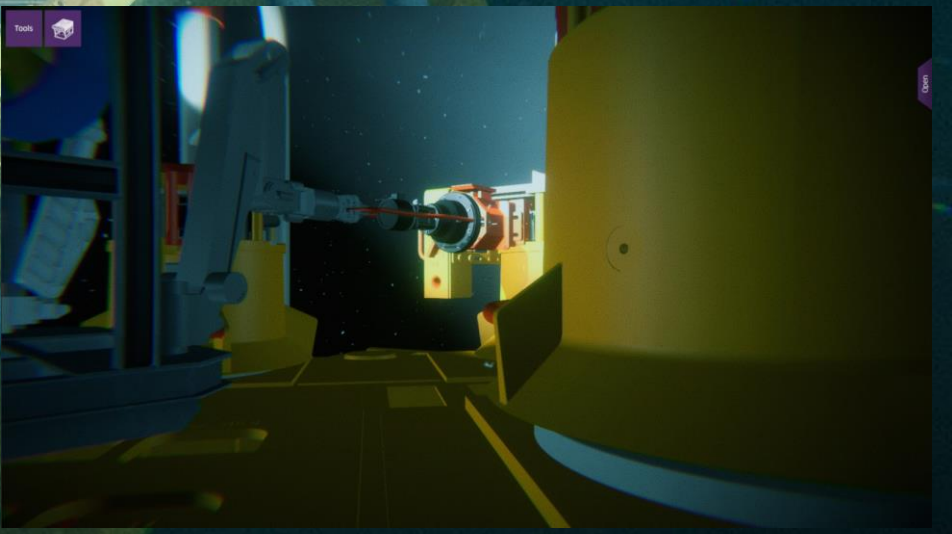


- 800m, >100t catenary.
- High density contacts (Forged piece in hang off module)
- Hydro-dynamics on subsea part of the pipe.

Appomattox & Lyza
ROV Interface Checks

Appomattox & Lyza
ROV Interface Checks

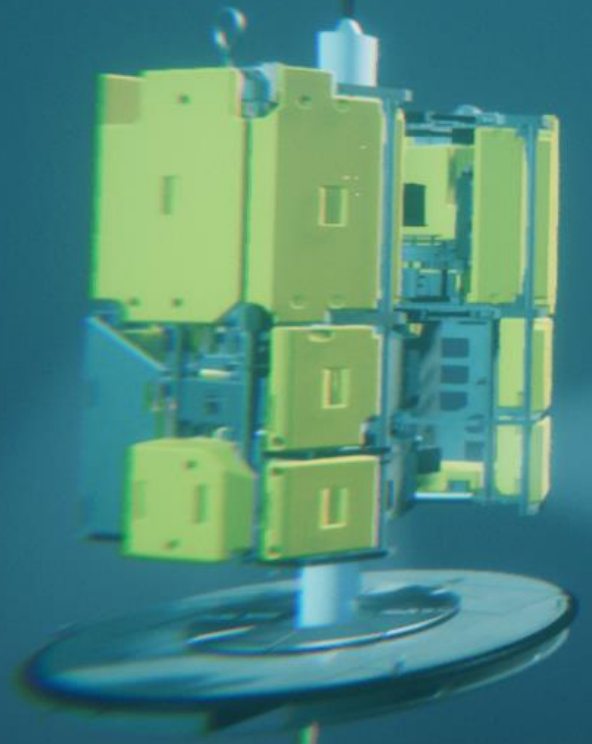
- Based on existing experience in the group
- Focus on lean process (reduce non productive time).
- Confirm similitude with actual processes
- Initiate tolling catalogue
- Target: Issue a report in less than a week (Lyza)

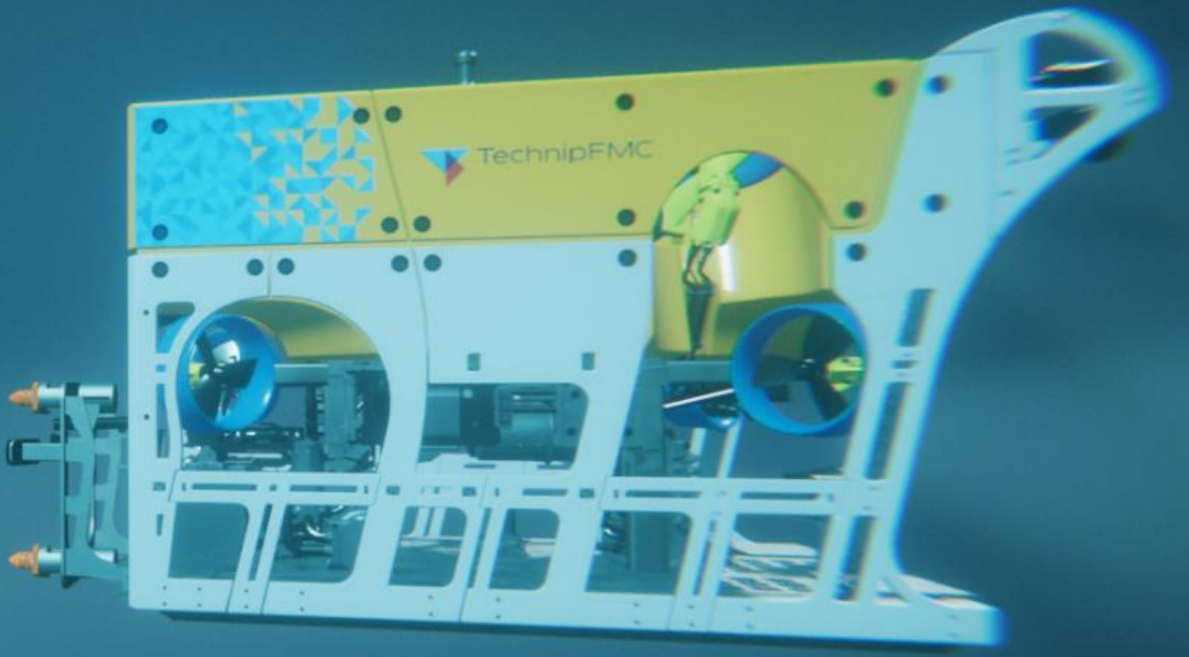


- Simplified ROV for ease of manipulation
- Client driven task definition
- Auto-report
- Graphics & Physical models convergence

IRIS

IRIS Deployment with ROV

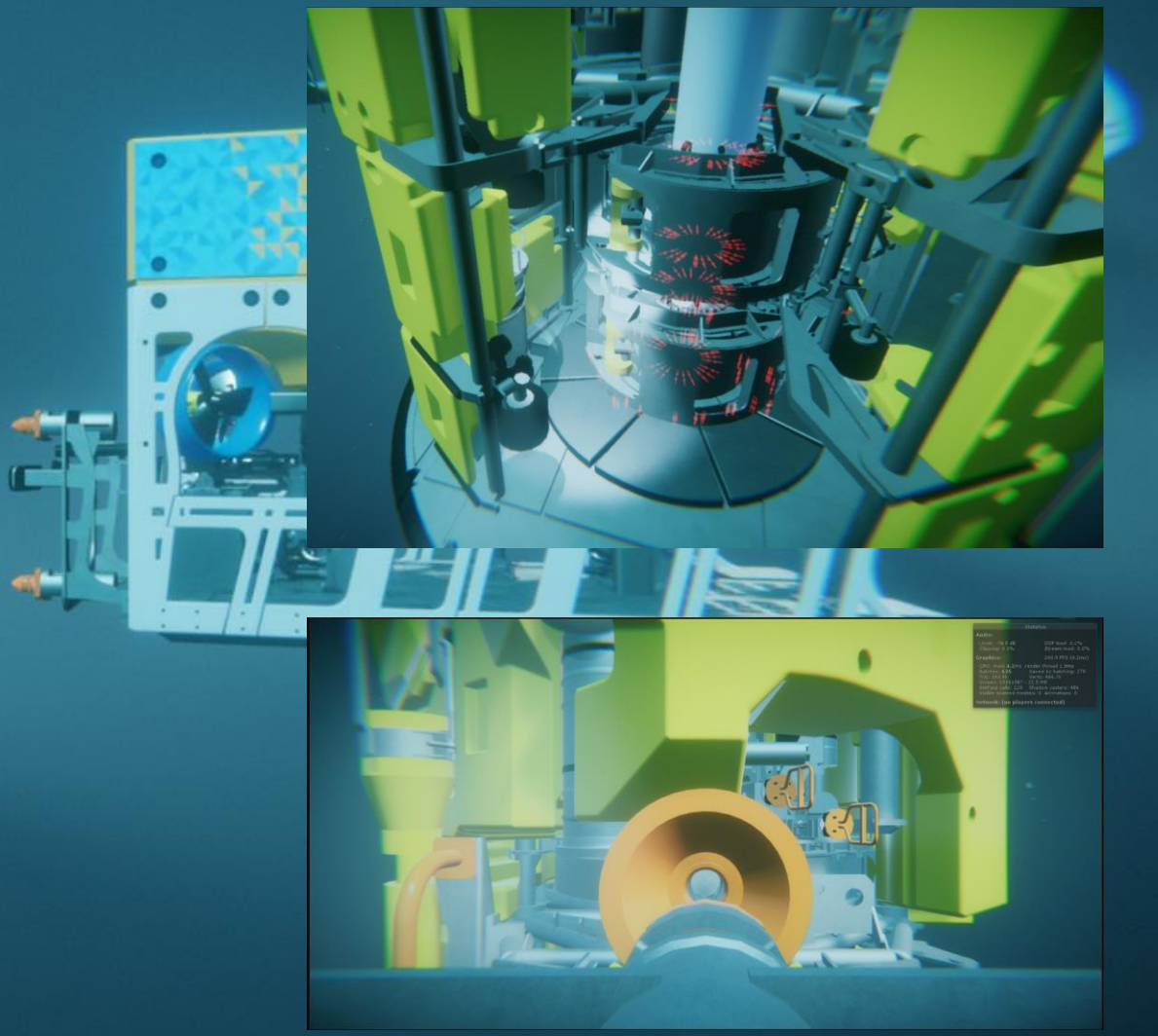




IRIS

IRIS Deployment with ROV

- Identify risks linked with IRIS AHC requirement
- Proposition for camera management.
- Assess ROV manoeuvrability impact linked with added mass of IRIS impact (shift of centre of rotation)



- Accurate Umbilical management (Real Time FEA).
- Accurate treatment of contacts (funnels, probes)
- Vessel motion impact on subsea loads
- Advanced Subsea Hydro behaviour (added mass & inertia)

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Interactive simulation Framework

Anticipate

- Simulate subsea operations with accurate dynamics
- Optimize designs/operations
- Simulate incidents
- Improve safety

Application :

- Lifting simulation
- ROV simulation

Operate

- Build virtual equipment models & scenario
- Train operators
- Improve operational efficiency

Application :

- Crane, ROV, Diving, VLS
- Full size training simulator
- ITS (offshore process)

Detect & Monitor

- Real time physical model to support decision making on site :
  - Cranes
  - Pipelay
  - Vessels (LNG)

Application:

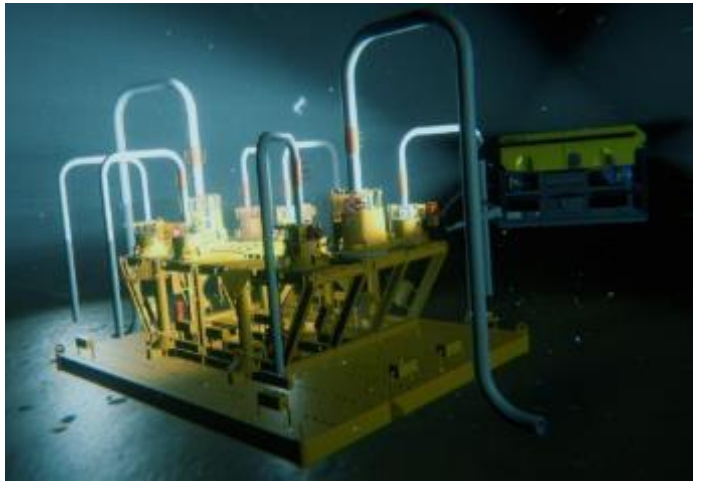
- Pipelay Monitoring
- Tandem Offloading

Collaborate

- Use simulation rooms and VR for interactive design reviews between TechnipFMC centres
- Use simulation to explain past incidents

Application :

- Hazid
- Project Reviews
- Interactive animations



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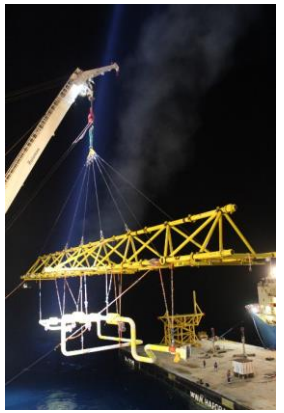
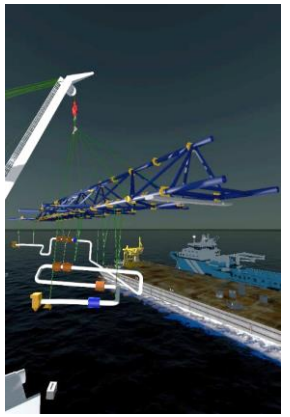
Interactive simulation Framework



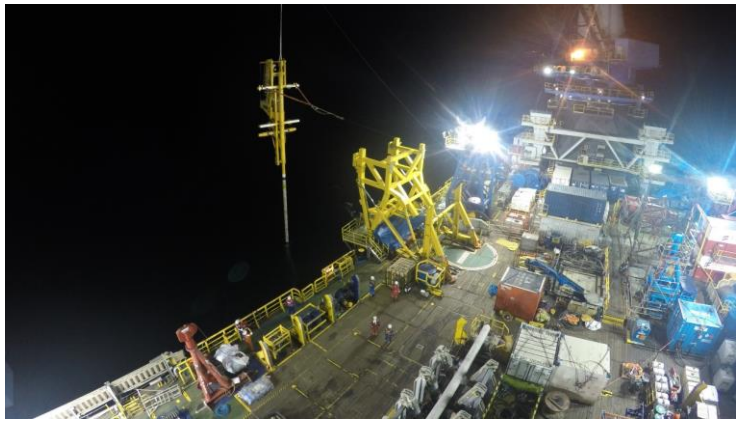


Improve safety of operations

Huge facilitator for team collaboration

Optimize engineering and operation

Reduce time & costs !



Be the reference for O&G interactive simulation


Crane
Radius 24.34 deg
Slew -86.69 deg
Velocity 0.00 RPM
Tugger
T 0 %SWL
Pay in 2 t
CT OFF
Pay out 2 t
Velocity 0.0 rpm
Front Winch
T: 6 %SWL
CT: ON
Pay in: 1 t
Pay out: 3 t
Rear Winch
T: 11 %SWL
CT: ON
Pay in: 1 t
Pay out: 3 t
SKANDI AFRICA
NASSAU
30.1ms 33.26FPS AvgFps : 37.04