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Remote monitoring of a solids management system in the North Sea

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OUTLINE

PROJECT BACKGROUND

CYCLONE TECHNOLOGY RECAP

TECHNICAL & LOGISTICAL CHALLENGES

THE SOLUTION

RESULTS

Project Background

A well, in the SNS, was shut-in due to clay and proppant production

Asset management wanted the 1,100 bbl/day well to be reinstated

A 7-week production clean-up was planned to reinstate the production while removing clay/proppant solids
- while continuously monitoring the well performance

FourPhase was tasked with delivering a cyclonic DualFlow solids removal system

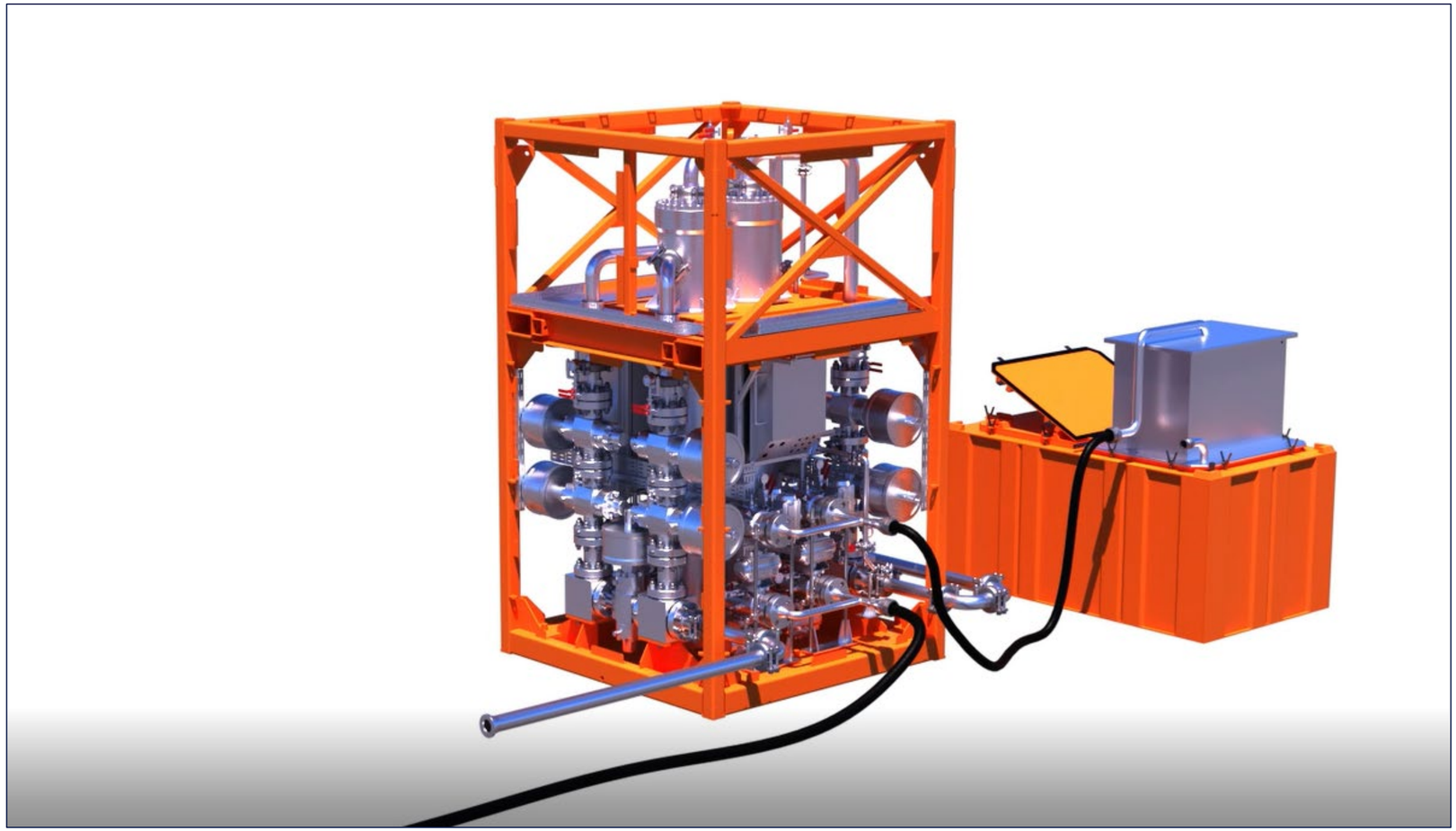
Normal DualFlow operation - 2 x crew day/2 x crew night operating the DualFlow offshore

SNS platform was a Normally Unmanned Installation (NUI)
- the DualFlow was to be monitored from onshore, and a nearby control platform

Periodic visits by a FourPhase Supervisor to the NUI for DualFlow flushing and inspection

Cyclone Technology Recap

Play Animation



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Technical & Logistical Challenges

Remote monitoring of solids production on NUI
Case study: Challenges

A NUI so no overnight crew support

Required a secure remote connectivity of the DualFlow to the control platform and onshore

Expected high solids production from the well which would require frequent solids flushing

Tight access to well bay laydown area

Limited crane capacity of 8tonnes – DualFlow semi-dismantled

Walk-to-Work vessel utilised during rig-up and commissioning phase

Only 12-hour daily operations window when crew shuttled offshore for vessel flushing/system inspection

Equipment semi-dismantled
Case study: Challenges

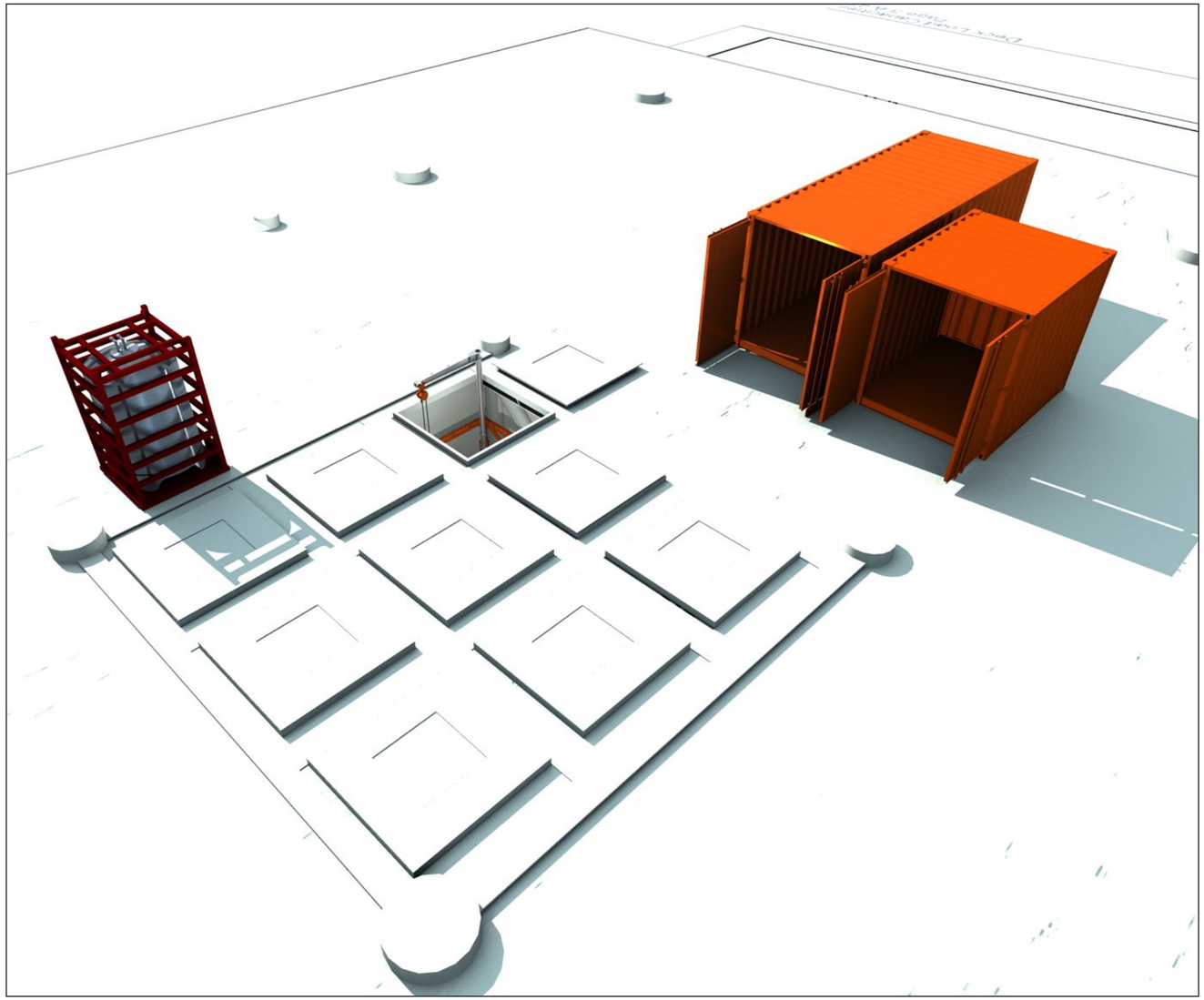
Removed one cyclone vessel of the DualFlow unit so under 8tonne crane capacity

Being loaded for road transport to customer port

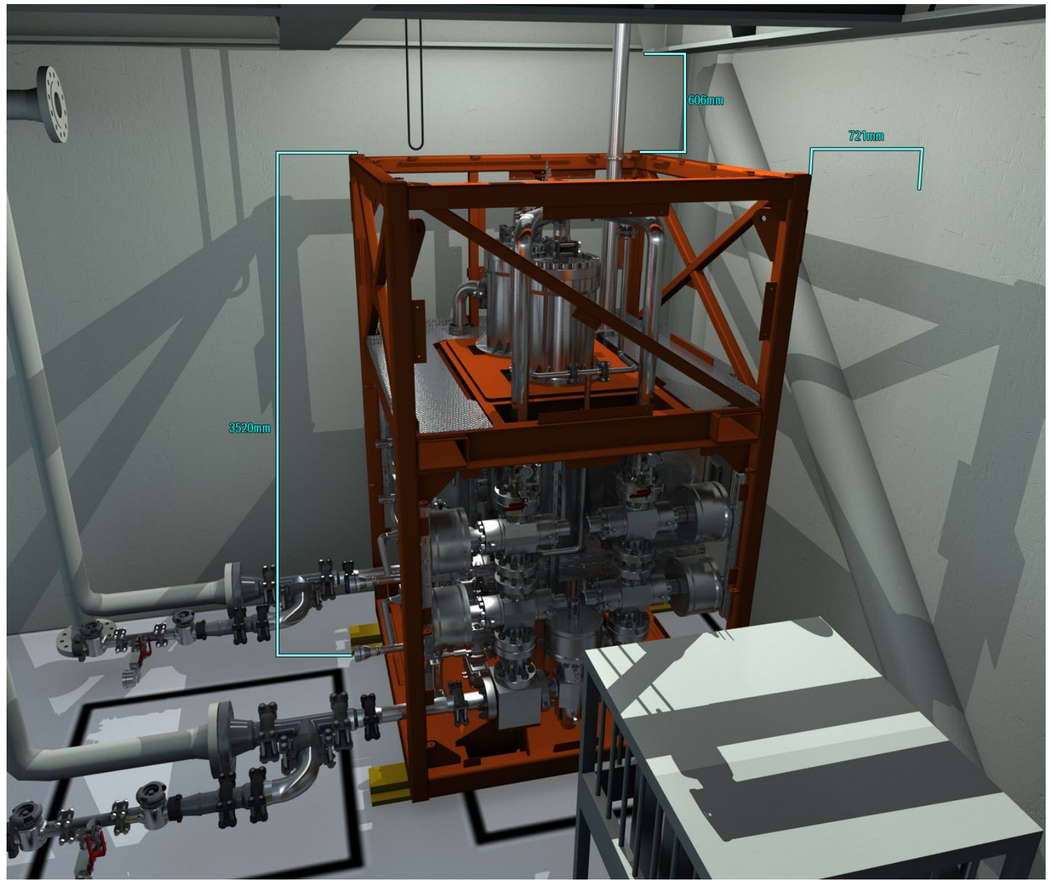
Access
Case study: Challenges

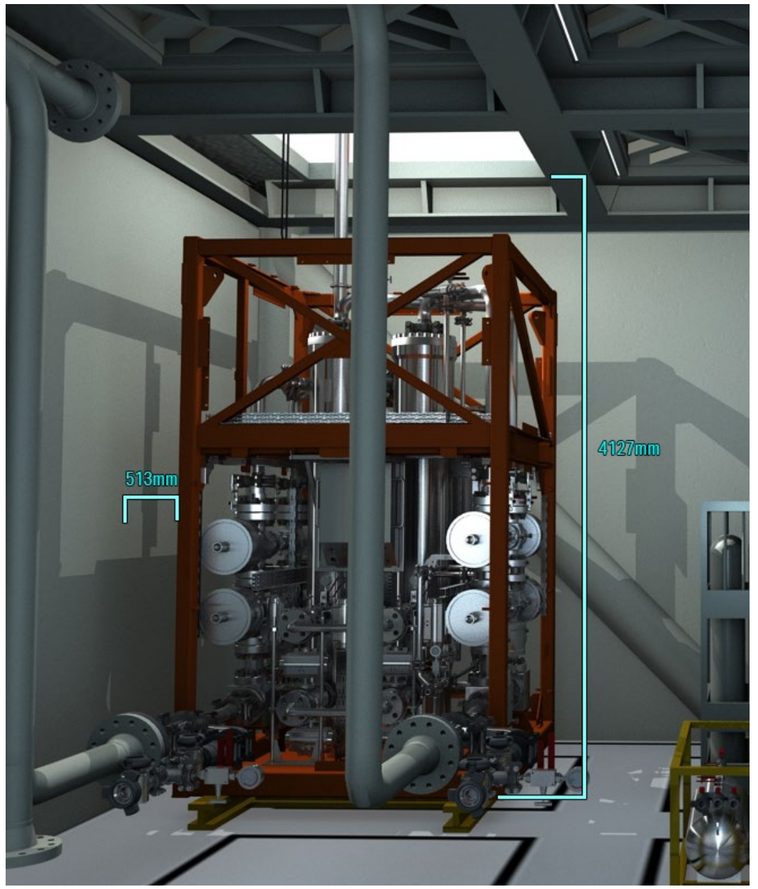
Tight hatch entrance for lowering equipment down into the well bay 2.2m x 2.2m

Reassembling DualFlow in a restricted space



Identifying relative equipment dimensions/locations
Case study: Challenges

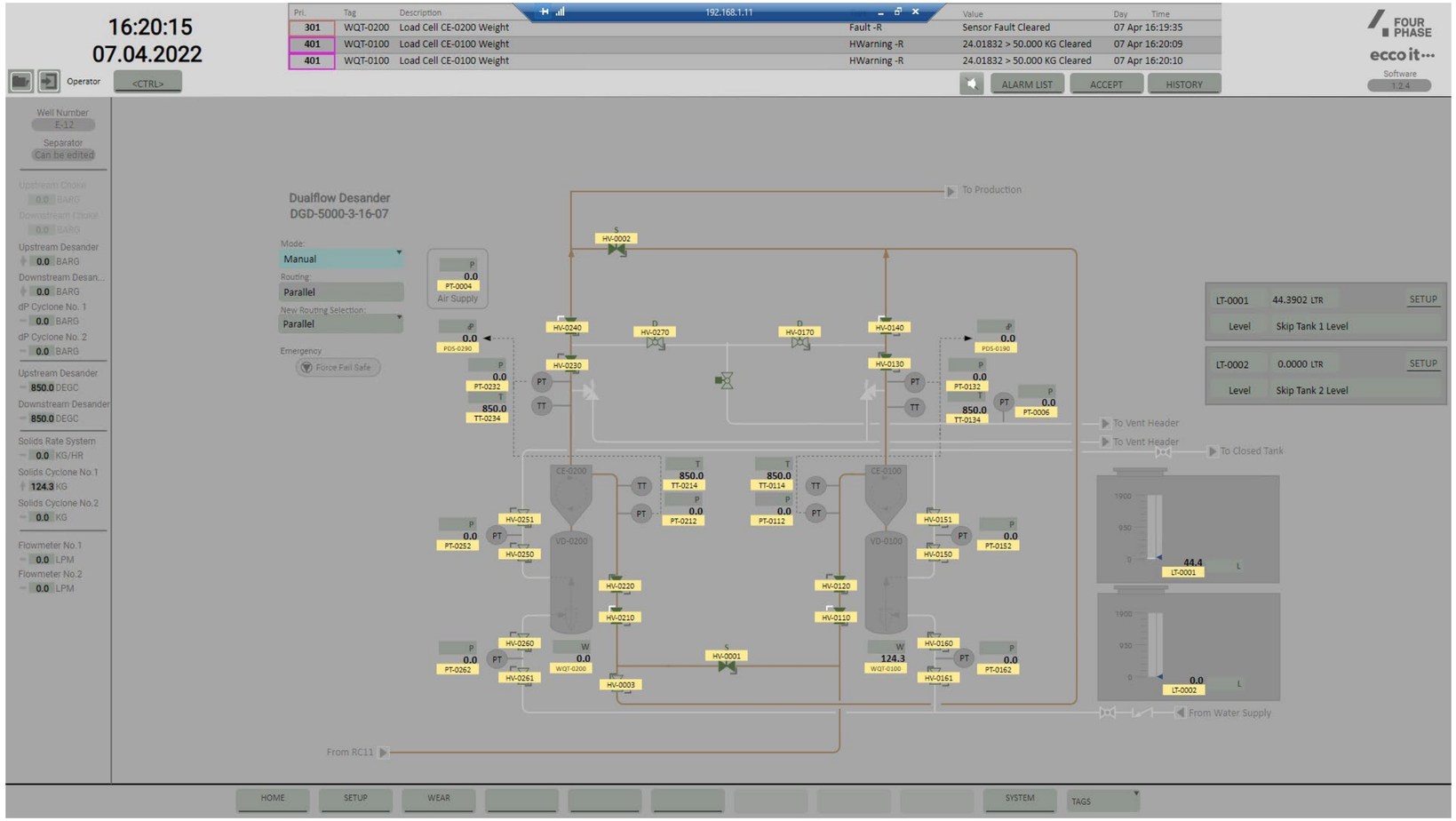




Identifying laydown areas and calculating pipework lengths and routing

Remote monitoring to shore
Case study: Challenges

Standard
DualFlow HMI



Correct interfaces and protocols required to ensure a reliable and secure network to the control platform

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The Solution

Feasibility study – Ensuring separation efficiency
Case study: Solution

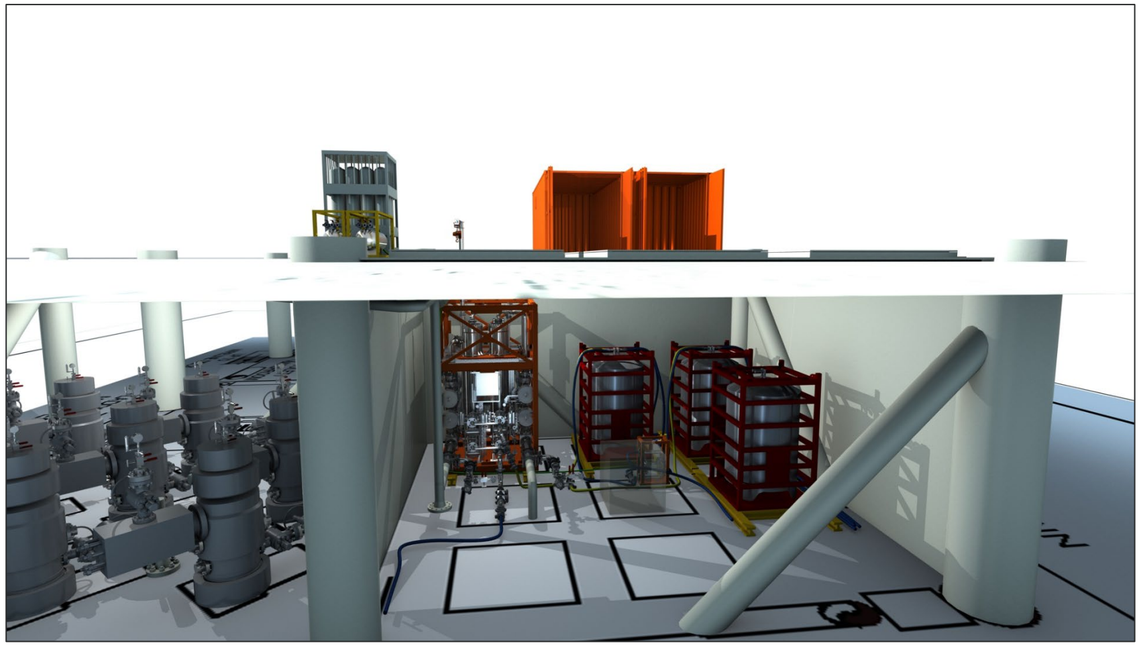
Basic well data was captured – flow rates, oil/gas properties, pressure, temperature, expected solids production, expected erosional rates etc.

A site visit was conducted to identify laydown areas, pipework routing, connections, utilities

Simulations were performed to ensure the planned operation was within the operating window of the DualFlow

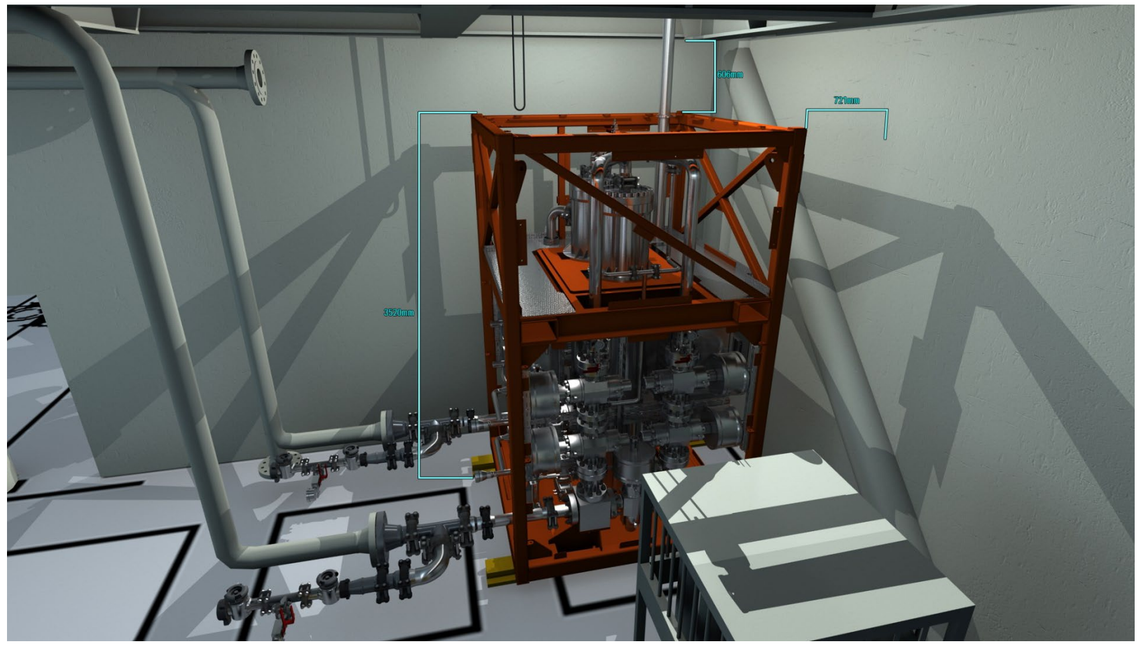
The Feasibility Report captures all this information and becomes a central guiding document for the operation

Planning using accurate 3D renders
Case study: Solution



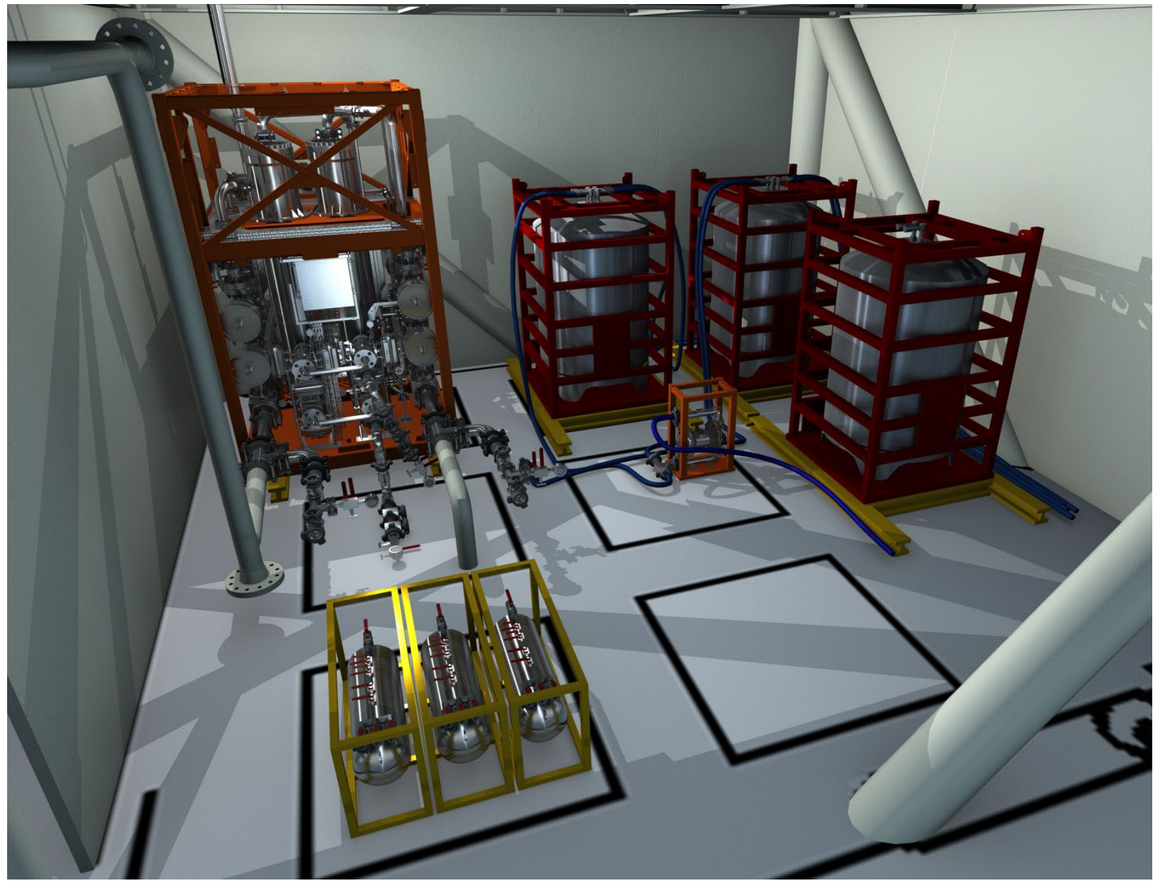
Creating a 3D rigup ensures an efficient rigup once offshore

Due to limited crane capacity the DualFlow installation was performed in two lifts then assembled/ disassembled despite tight well bay access



Using accurate measurements for equipment and piping ensured no excess material was shipped offshore – addressed ESG (Environment) metrics

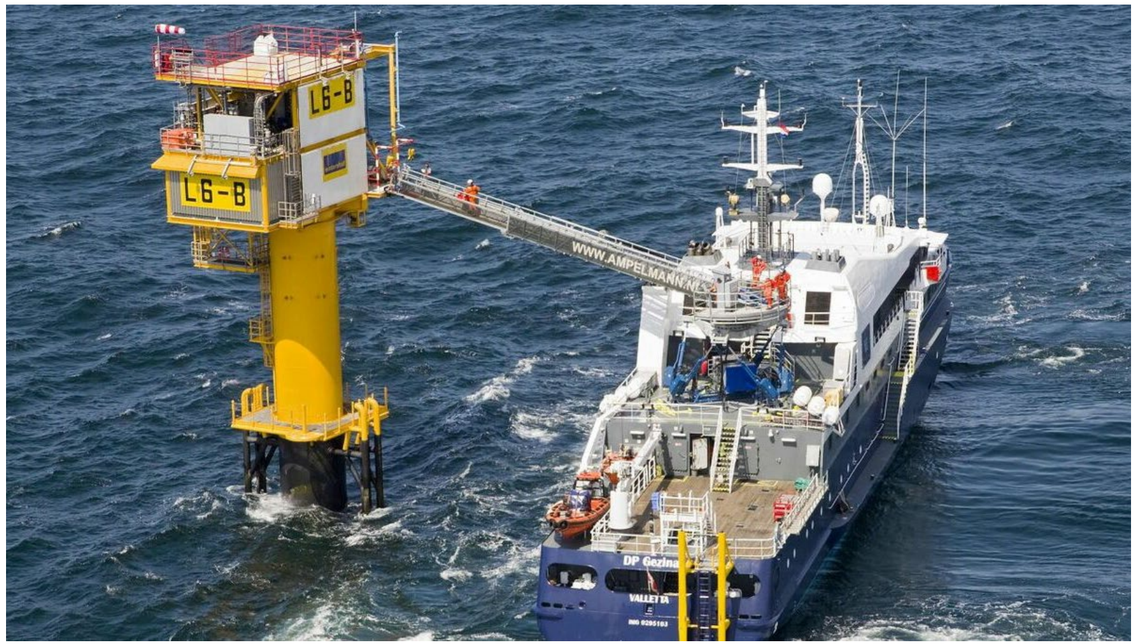
3D simulation v Actual equipment location
Case study: Solution



A 3D simulation allowed accurate equipment locations to be determined prior to rig-up operations

Actual DualFlow and Debris Tanks in position in wellbay

Minimising POB
Case study: Solution



Walk-to-Work vessel alongside during rig-up and initial flow back

Shuttling of FourPhase Supervisor for vessel flushing and system inspection

One Supervisor on stand-by onshore

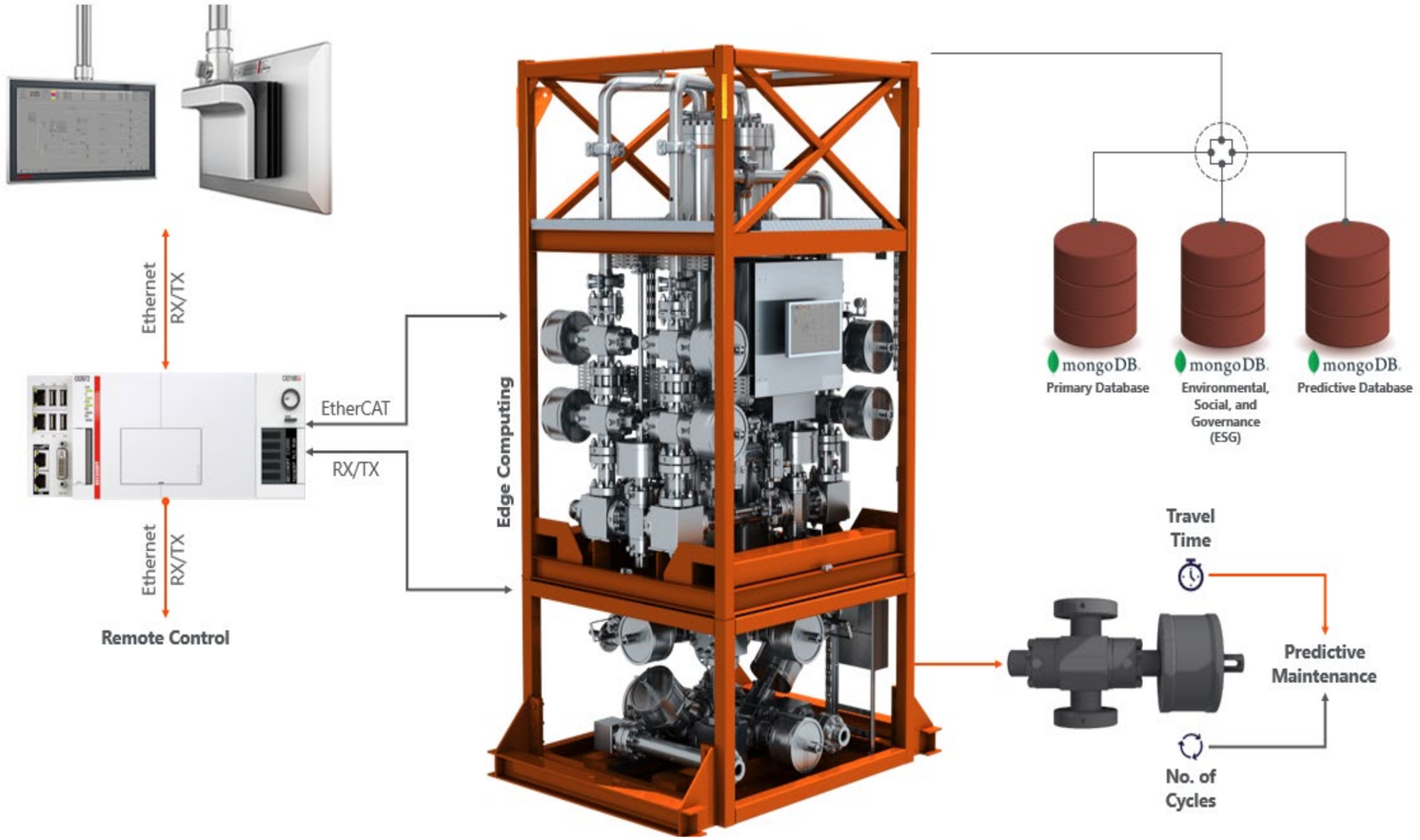
Remote operator stations onshore in FourPhase's Bergen and Aberdeen facilities and remote access from the control room in the nearby control platform

Remote monitoring
Case study: Solution

The latest generation control system enables remote operation of all FourPhase equipment

An Industrial Personal Computer (IPC) runs a virtual Programmable Logic Controller (PLC) allowing a single IPC to operate all devices

A predictive maintenance program is supported through realtime data gathered from 500 soft & 60 hard sensors to optimise each clean-up operation

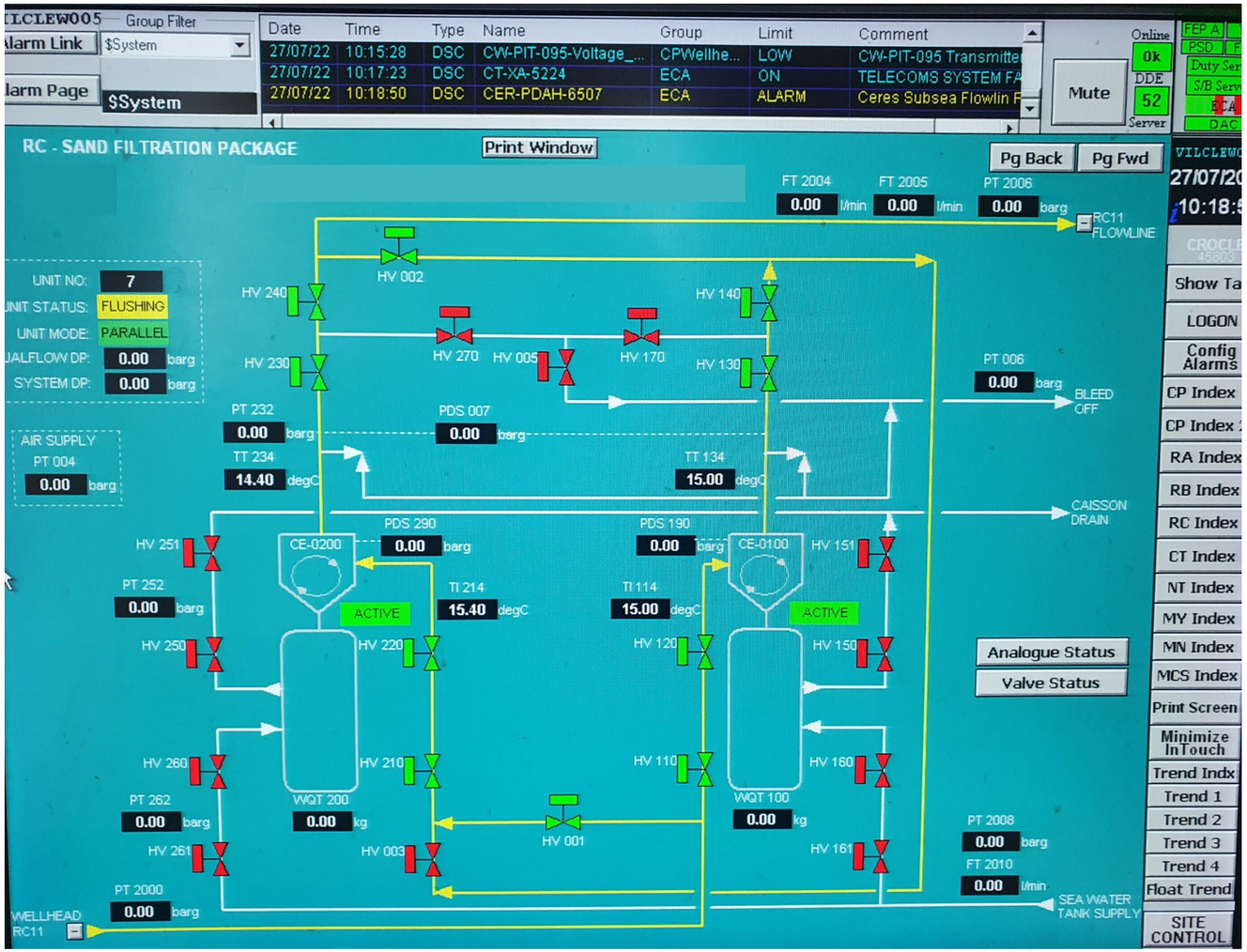


Remote monitoring HMI
Case study: Solution

The Human Machine Interface (HMI) was adapted to the customer specific interface including setting alarms – solids production, flow, differential pressure, air supply etc.

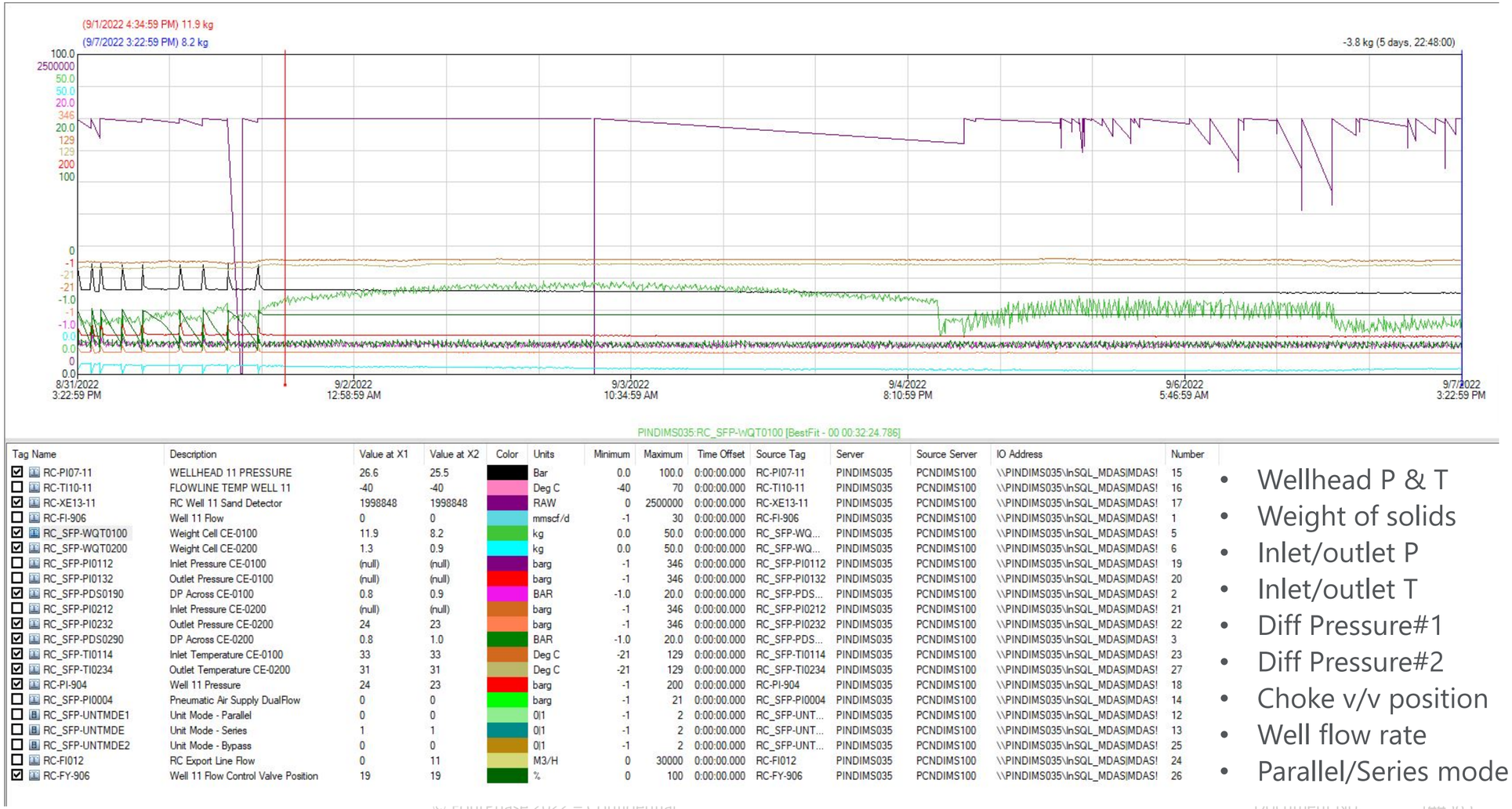
The DualFlow IPC integrates with the customer SCADA system

Remote access was granted to view a page of their SCADA system so the DualFlow could be monitored remotely. Cyber security protocols were followed to ensure read-only access



Remote monitoring – Trending Screen
Case study: Solution

Remote access to a trending view on the control platform SCADA permitted real-time observations of multiple data sets by the operations support team



Tag Name	Description	Value at X1	Value at X2	Color	Units	Minimum	Maximum	Time Offset	Source Tag	Server	Source Server	IO Address	Number
RC-PI07-11	WELLHEAD 11 PRESSURE	26.6	25.5		Bar	0.0	100.0	0:00:00.000	RC-PI07-11	PINDIMS035	PCNDIMS100	\\PINDIMS035\InSQL_MDAS\MDAS!	15
RC-TI10-11	FLOWLINE TEMP WELL 11	-40	-40		Deg C	-40	70	0:00:00.000	RC-TI10-11	PINDIMS035	PCNDIMS100	\\PINDIMS035\InSQL_MDAS\MDAS!	16
RC-XE13-11	RC Well 11 Sand Detector	1998848	1998848		RAW	0	2500000	0:00:00.000	RC-XE13-11	PINDIMS035	PCNDIMS100	\\PINDIMS035\InSQL_MDAS\MDAS!	17
RC-FI-906	Well 11 Flow	0	0		mmscf/d	-1	30	0:00:00.000	RC-FI-906	PINDIMS035	PCNDIMS100	\\PINDIMS035\InSQL_MDAS\MDAS!	1
RC_SFP-WQT0100	Weight Cell CE-0100	11.9	8.2		kg	0.0	50.0	0:00:00.000	RC_SFP-WQ...	PINDIMS035	PCNDIMS100	\\PINDIMS035\InSQL_MDAS\MDAS!	5
RC_SFP-WQT0200	Weight Cell CE-0200	1.3	0.9		kg	0.0	50.0	0:00:00.000	RC_SFP-WQ...	PINDIMS035	PCNDIMS100	\\PINDIMS035\InSQL_MDAS\MDAS!	6
RC_SFP-PI0112	Inlet Pressure CE-0100	(null)	(null)		barg	-1	346	0:00:00.000	RC_SFP-PI0112	PINDIMS035	PCNDIMS100	\\PINDIMS035\InSQL_MDAS\MDAS!	19
RC_SFP-PI0132	Outlet Pressure CE-0100	(null)	(null)		barg	-1	346	0:00:00.000	RC_SFP-PI0132	PINDIMS035	PCNDIMS100	\\PINDIMS035\InSQL_MDAS\MDAS!	20
RC_SFP-PDS0190	DP Across CE-0100	0.8	0.9		BAR	-1.0	20.0	0:00:00.000	RC_SFP-PDS...	PINDIMS035	PCNDIMS100	\\PINDIMS035\InSQL_MDAS\MDAS!	2
RC_SFP-PI0212	Inlet Pressure CE-0200	(null)	(null)		barg	-1	346	0:00:00.000	RC_SFP-PI0212	PINDIMS035	PCNDIMS100	\\PINDIMS035\InSQL_MDAS\MDAS!	21
RC_SFP-PI0232	Outlet Pressure CE-0200	24	23		barg	-1	346	0:00:00.000	RC_SFP-PI0232	PINDIMS035	PCNDIMS100	\\PINDIMS035\InSQL_MDAS\MDAS!	22
RC_SFP-PDS0290	DP Across CE-0200	0.8	1.0		BAR	-1.0	20.0	0:00:00.000	RC_SFP-PDS...	PINDIMS035	PCNDIMS100	\\PINDIMS035\InSQL_MDAS\MDAS!	3
RC_SFP-TI0114	Inlet Temperature CE-0100	33	33		Deg C	-21	129	0:00:00.000	RC_SFP-TI0114	PINDIMS035	PCNDIMS100	\\PINDIMS035\InSQL_MDAS\MDAS!	23
RC_SFP-TI0234	Outlet Temperature CE-0200	31	31		Deg C	-21	129	0:00:00.000	RC_SFP-TI0234	PINDIMS035	PCNDIMS100	\\PINDIMS035\InSQL_MDAS\MDAS!	27
RC-PI-904	Well 11 Pressure	24	23		barg	-1	200	0:00:00.000	RC-PI-904	PINDIMS035	PCNDIMS100	\\PINDIMS035\InSQL_MDAS\MDAS!	18
RC_SFP-PI0004	Pneumatic Air Supply DualFlow	0	0		barg	-1	21	0:00:00.000	RC_SFP-PI0004	PINDIMS035	PCNDIMS100	\\PINDIMS035\InSQL_MDAS\MDAS!	14
RC_SFP-UNTMDE1	Unit Mode - Parallel	0	0		0|1	-1	2	0:00:00.000	RC_SFP-UNT...	PINDIMS035	PCNDIMS100	\\PINDIMS035\InSQL_MDAS\MDAS!	12
RC_SFP-UNTMDE	Unit Mode - Series	1	1		0|1	-1	2	0:00:00.000	RC_SFP-UNT...	PINDIMS035	PCNDIMS100	\\PINDIMS035\InSQL_MDAS\MDAS!	13
RC_SFP-UNTMDE2	Unit Mode - Bypass	0	0		0|1	-1	2	0:00:00.000	RC_SFP-UNT...	PINDIMS035	PCNDIMS100	\\PINDIMS035\InSQL_MDAS\MDAS!	25
RC-FI012	RC Export Line Flow	0	11		M3/H	0	30000	0:00:00.000	RC-FI012	PINDIMS035	PCNDIMS100	\\PINDIMS035\InSQL_MDAS\MDAS!	24
RC-FY-906	Well 11 Flow Control Valve Position	19	19		%	0	100	0:00:00.000	RC-FY-906	PINDIMS035	PCNDIMS100	\\PINDIMS035\InSQL_MDAS\MDAS!	26

- Wellhead P & T
- Weight of solids
- Inlet/outlet P
- Inlet/outlet T
- Diff Pressure#1
- Diff Pressure#2
- Choke v/v position
- Well flow rate
- Parallel/Series mode

Case study: Results

Secured 1,000hrs of continuous production on an unmanned platform

Oil and gas production was kept at a higher rate because solids were continuously removed

Successful remote monitoring from multiple locations was achieved

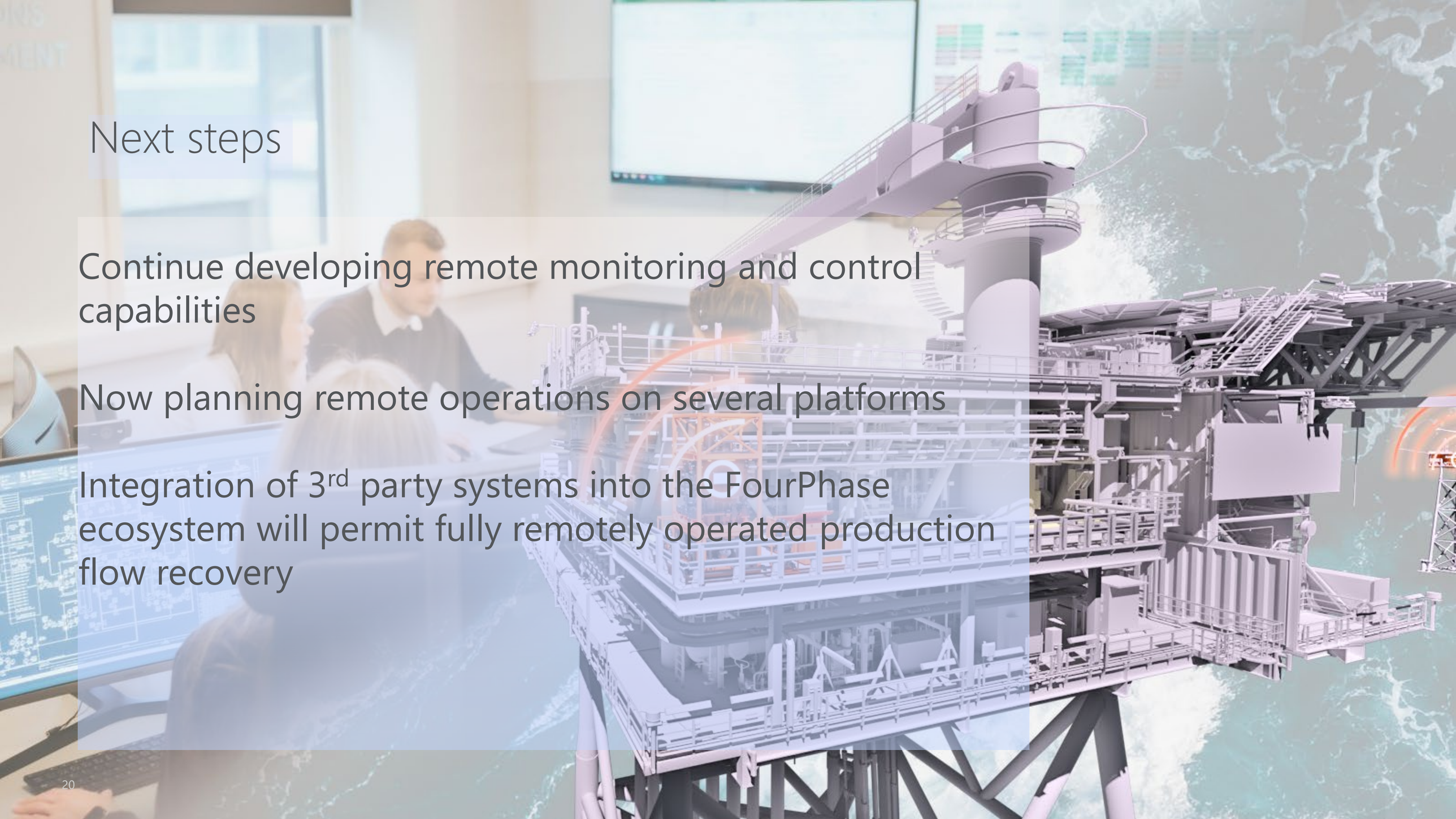
By monitoring the DualFlow remotely, there was a significant reduction in personnel offshore costs and travel emissions

Next steps

Continue developing remote monitoring and control capabilities

Now planning remote operations on several platforms

Integration of 3rd party systems into the FourPhase ecosystem will permit fully remotely operated production flow recovery



Final thoughts

With an increasing number of marginal fields and NUIs offshore, innovative solutions are required for managing offshore energy production. Without personnel onboard, secure connectivity and data flow are the key drivers to achieving reliable and safe offshore operations.

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Thank you