



THE FUTURE OF CONSTRUCTION
01. UND 02.03.2023 IN HAMBURG

Digitale Innovation im Offshore Einsatz

Siemens Gamesa nutzt digitale Technologien um den globalen Bedarf nach Offshore Wind zu decken. Ein Einblick wie die Baustelle der Zukunft schon heute auf rauer See Wirklichkeit ist.

1

SGRE Introduction

2

Predict - Digital Twins

3

Prepare - Connected Workers

4

Perform - Advanced Sensors



Key facts and figures¹



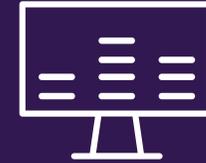
127.5 GW
Globally installed



27,600
People



€9.8 billion
Annual revenue



€12.2 billion
Market capitalization



€35 bn
Order book



Truly **global**,
modern and scalable
footprint



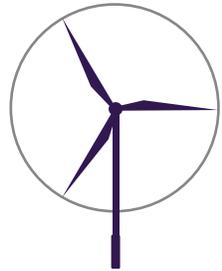
Advanced **digital**
capabilities



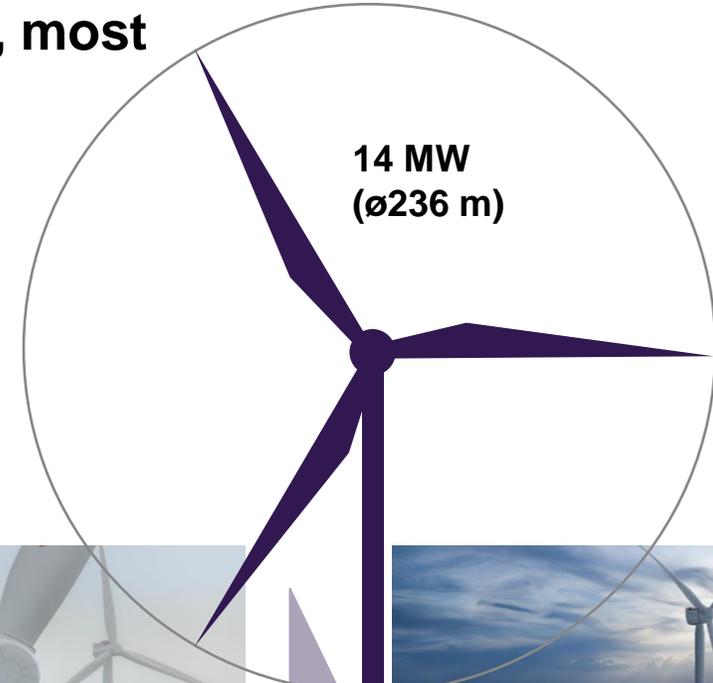
Portfolio
covering all requirements

¹ End of September 2022

The offshore wind turbine manufacturer with the longest, most extensive history in the industry



450 kW (ø35 m)



14 MW
(ø236 m)



World's first offshore project

4.95 MW
Vindeby, DK



First power plant-sized project

630 MW
London Array, UK



First large-scale offshore DD project

574 MW
Race Bank, UK



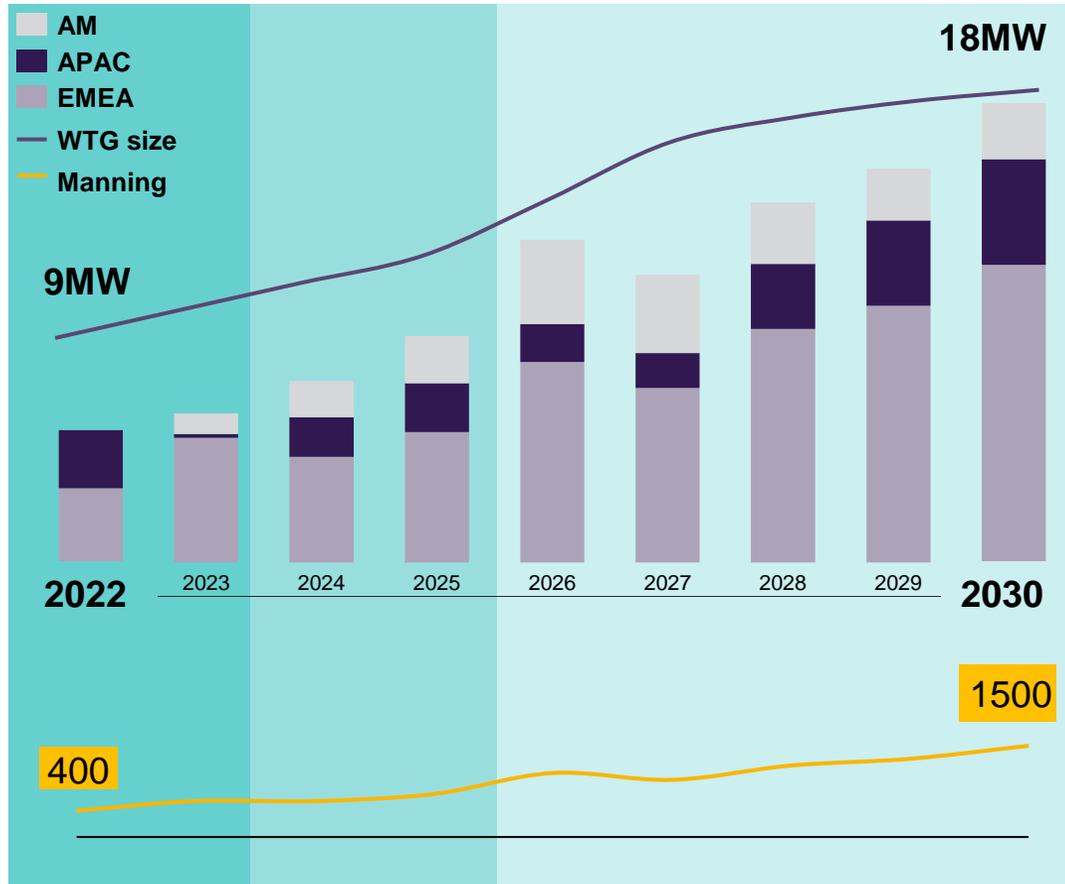
First subsidy-free offshore project

1.54 GW
Hollandse Kust Zuid, NL

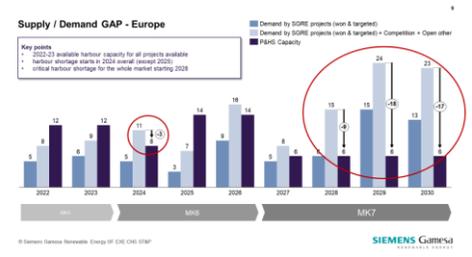


Why do we need to accelerate on Digitalization?

Units and average WTG size



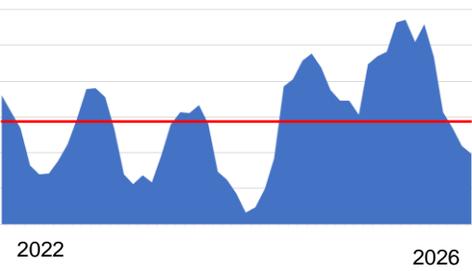
Port infrastructure



Vessel availability



Expert & Technician demand



Insights into 3 areas of digital Innovations for Offshore sites



Predict Digital Twin

We can't prevent all errors....
So let's do them virtually!



Prepare Connected Worker

Support your workers with cutting edge digital technology



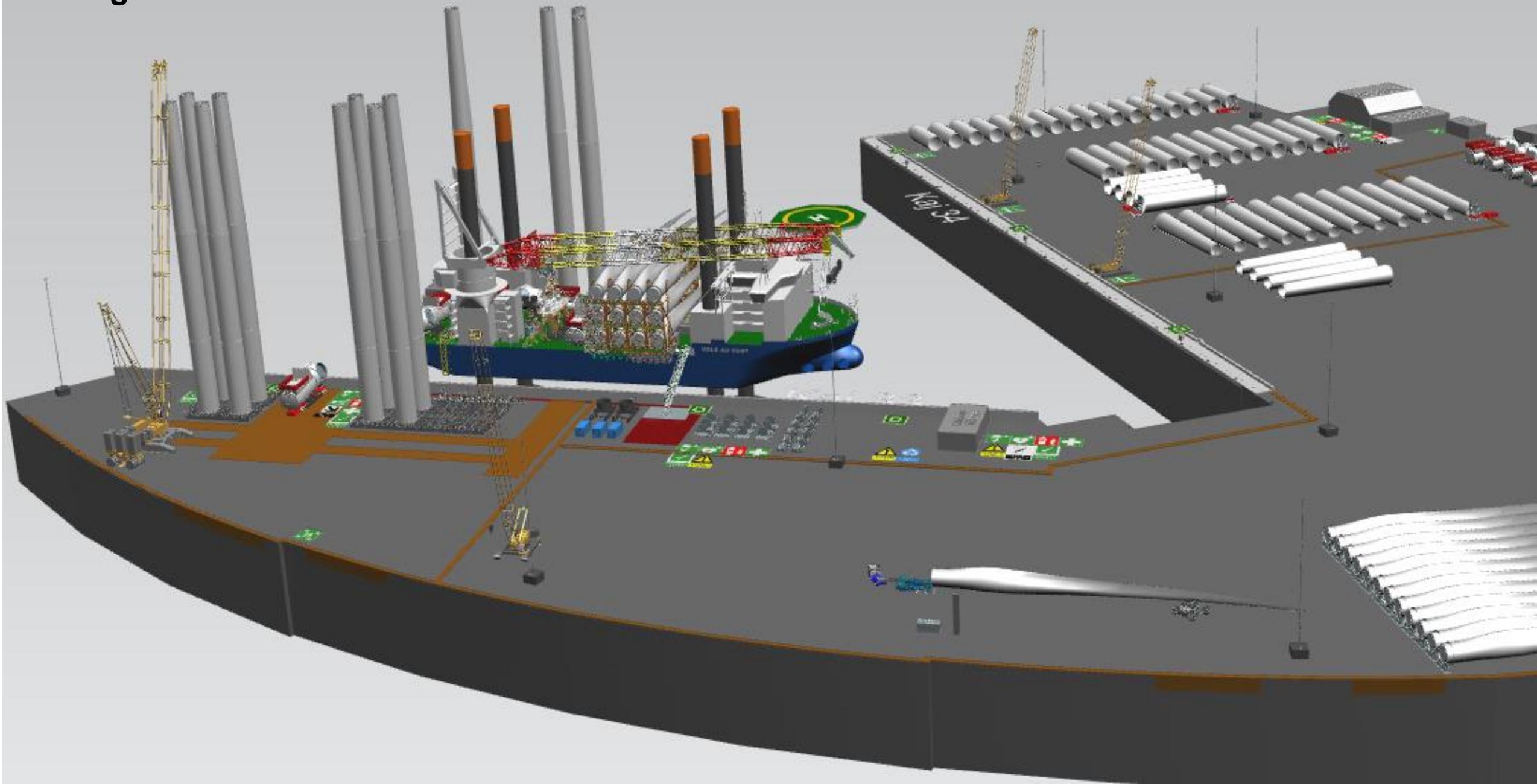
Perform Advanced Sensors

Manage Performance with data based approaches

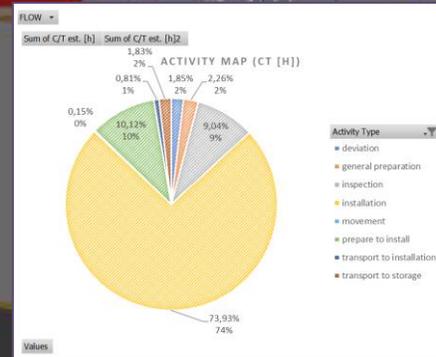
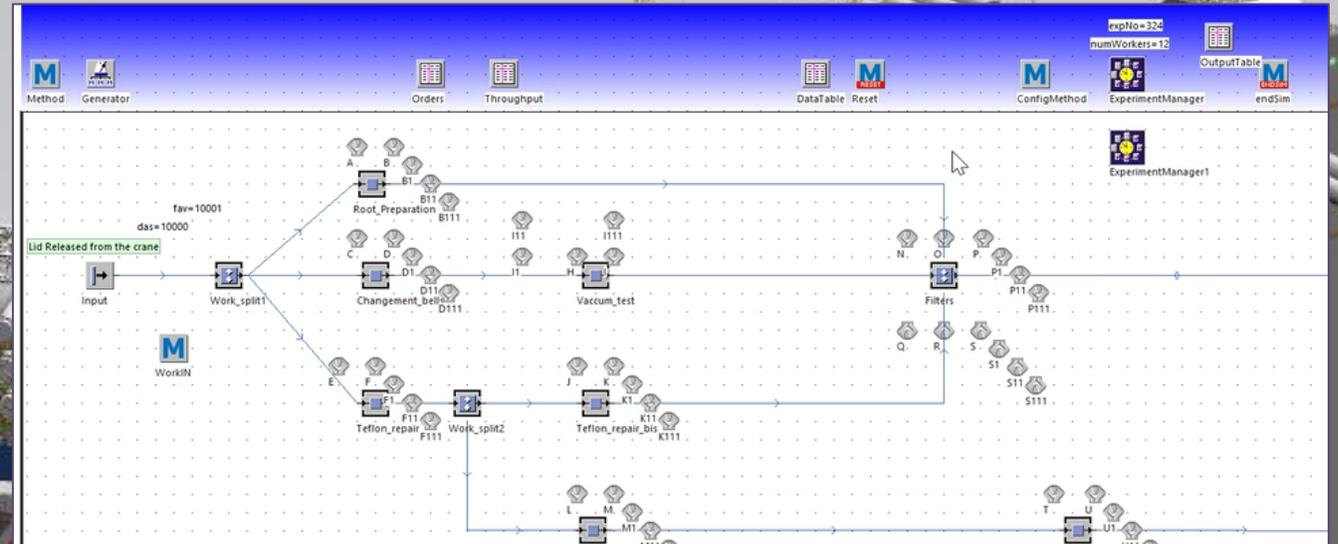
Safety is my choice



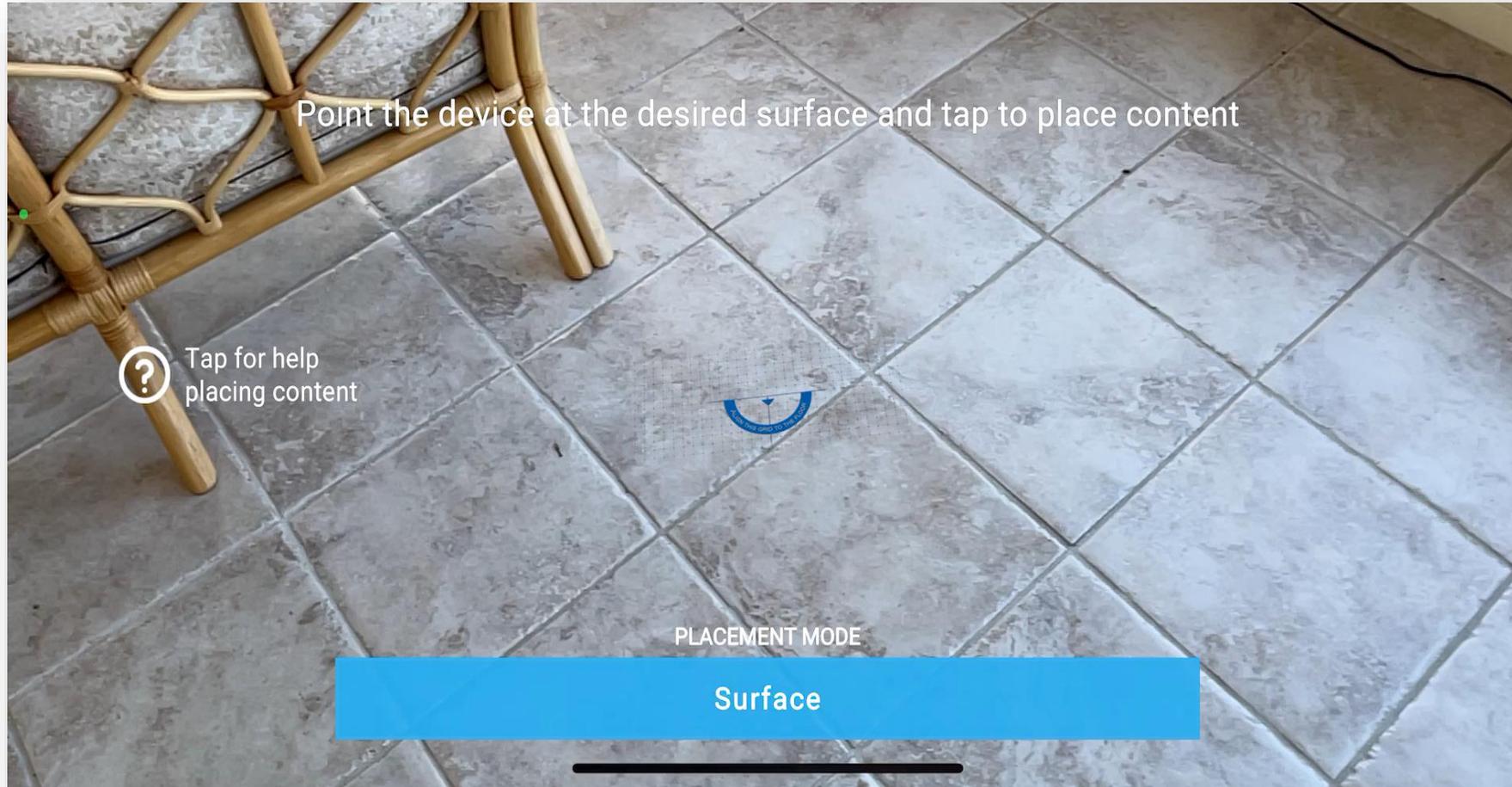
Digital Twin - Process Simulations



Digital Twin - Process Simulations



Digital Twin “to-go”



Connected Worker - what are we talking about?

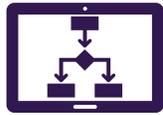


Remote Assist

```

1 1 1 1 1
0 0 1 0 0
1 1 0 1 1
0 0 0 0 0
0 1 0 1 0
1 0 1 0 0
0 1 0 1 1
1 0 0 0 0
0 1 0 1
0 0 1 0
0 1 0 1
1 0 0 0
0 0 0 1
1 0 1 0
1 1 0 0
1 0 1 1
1 1 1 0
0 0 1
1 1
0

```



XR Manuals

```

1 0 1 1 1
0 0 1 0 0
1 1 0 1 1
0 0 0 0 0
0 1 0 1 0
1 0 1 0 0
0 1 0 1
0 1 0
0 0 0
0 1 0
1 0 1
0 0 0
0
1
0

```



Digital TRIR viewer

```

1 1 1 0 1 1 0 1
1 0 0 1 1 0 1 0
0 0 1 0 0 0 0 0
1 1 1 1 1 1 1 1
0 0 0 1 0 0 1 0
1 1 1 0 1 1 0
0 1 0 1 0 0 1
0 0 1 0 0 0 0
0 1 0 1 0 0 1
1 0 0 0 1 1 0
0 1 0 0 0 0 0
0 1 0 1 0
0 0 1 0 1
0 1 0 1 0
1 0 0
0 1 0
1 0 0
0 1
0

```



Digital Caliper

```

1 0 1 1 1
0 0 1 0 0
1 1 0 1 1
0 0 0 0 0
0 1 0 1 0
1 0 1 0 0
0 1 0 1
0 1 0
1 0 1
0 0 0
0
1
0

```



Digital Troubleshooter

```

1 0 1 1 1
0 0 1 0 0
1 1 0 1 1
0 0 0 0 0
0 1 0 1 0
1 0 1 0 0
0 1 0
0 0 0
0 1 0
1 0 1
0 0 0
0 1 0 1
1 0 1 0 0
0 1 0 1
0 1 0
0 0 0
0 1 0
1 0 1
0 0 0
0
1
0

```

—— current ——— upcoming

Remote Assist



- Hands-free assisted reality headsets
- Microsoft teams on devices
- Operator point-of-view for back-office specialists
- On-device library of hotline support contacts:
 - HV support
 - SCADA support
 - LOTO support
 - Product support

Remote Assist



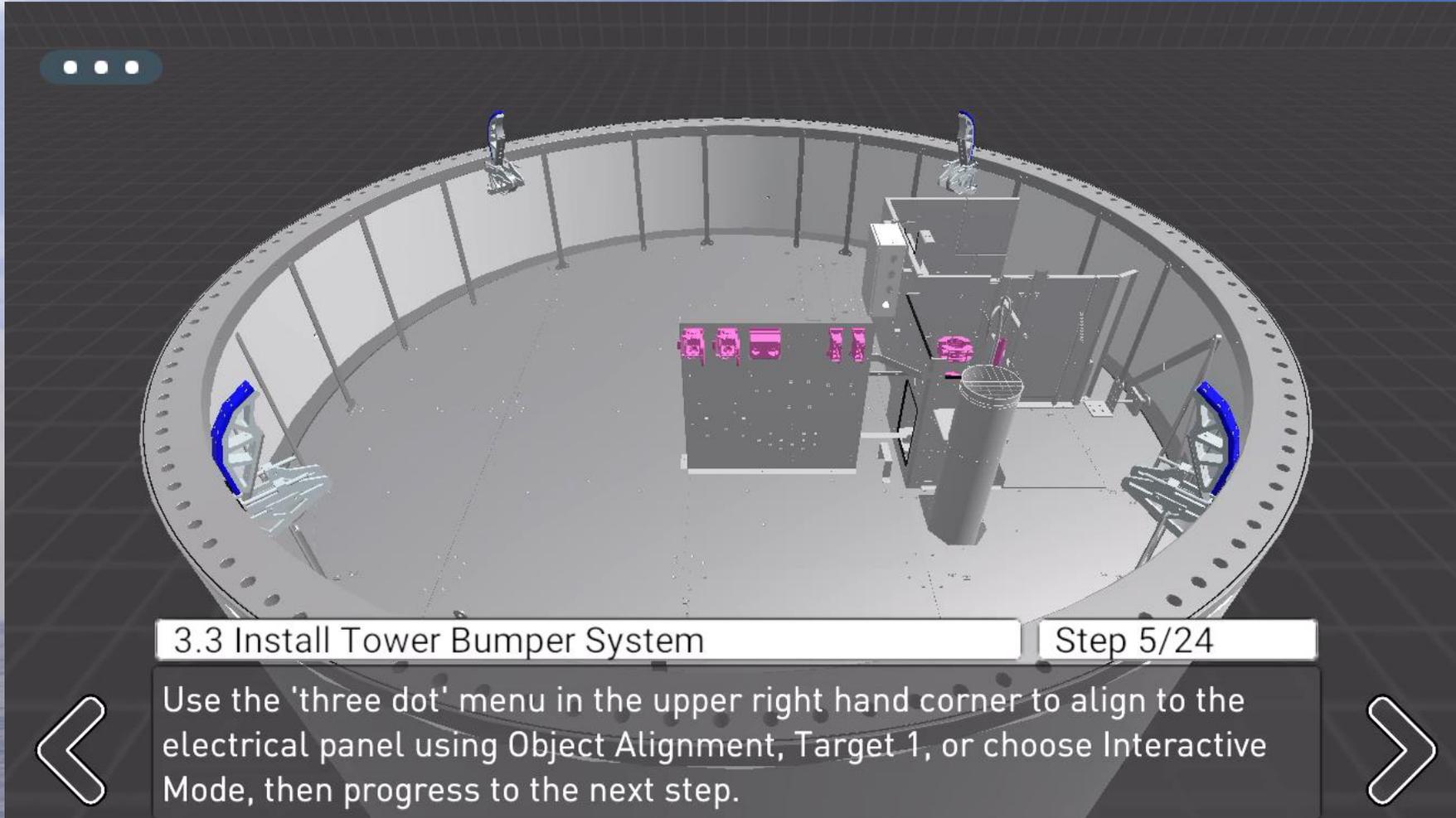
- Hands-free assisted reality headsets
- Microsoft teams on devices
- Operator point-of-view for back-office specialists
- On-device library of hotline support contacts:
 - HV support
 - SCADA support
 - LOTO support
 - Product support



XR Manuals



XR Manuals



The image shows a virtual reality (XR) manual interface. The main view is a 3D model of a circular tower bumper system, rendered in a semi-transparent grey. The system consists of a large circular ring with several vertical support beams. In the center, there is a complex assembly of components, including a large cylindrical structure and various smaller parts. Some components are highlighted in blue and pink. In the top left corner of the interface, there are three white dots on a dark background. At the bottom of the interface, there is a white text box with a black border containing the following text:

3.3 Install Tower Bumper System Step 5/24

Use the 'three dot' menu in the upper right hand corner to align to the electrical panel using Object Alignment, Target 1, or choose Interactive Mode, then progress to the next step.

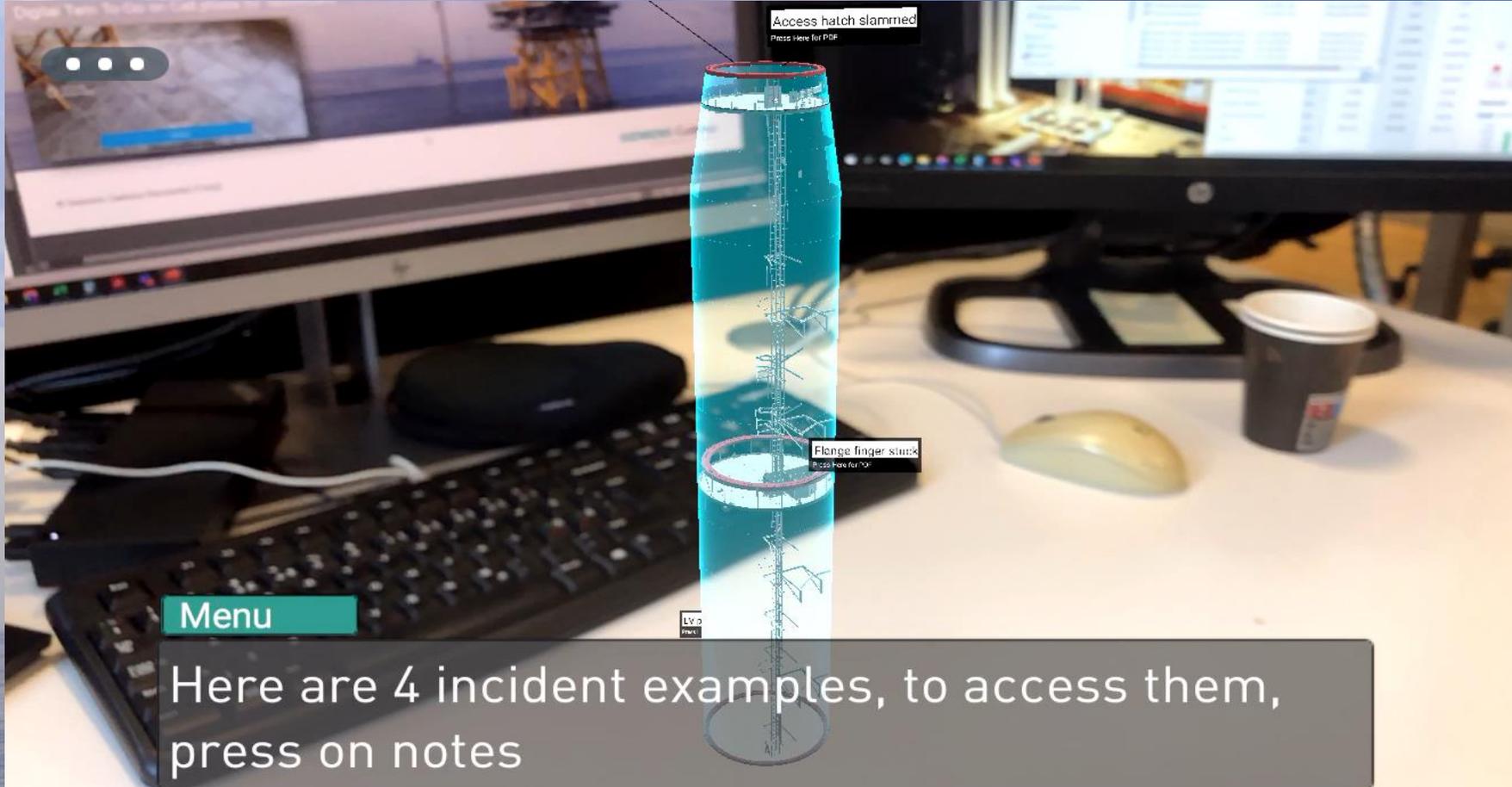
Navigation arrows (left and right) are visible on the bottom left and right sides of the interface.



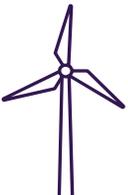
Digital TRIR viewer



Digital TRIR viewer



Advanced Sensors - what are we talking about?



Environment Sensors

```

1 1 1 1 1 1
0 0 1 0 0
1 1 0 1 1
1 0 1 0 0
0 0 0 0 0
1 0 1 0 0
0 1 0 1 1
1 0 0 0 0
0 1 0 1
0 0 1 0
0 1 0 1
1 0 0 0
0 0 0 1
1 0 1 0
1 1 0 0
1 0 1 1
1 1 1 0
0 0 1 1
1 1 0 1
0 0 1 1
1 0 1
0

```



Lifting Events

```

1 0 1 1 1
0 0 1 0 0
1 1 0 1 1
0 0 0 0 0
0 1 0 1 0
1 0 1 0 0
0 1 0 1
0 1 0
0 0 0
0 1 0
1 0 1
0 0 0
0
1
0

```



Cameras
Pre-Assembly

```

1 1 1 0 1 1 0 1
1 0 0 1 1 0 1 0
0 0 1 0 0 0 0 0
1 1 1 1 1 1 1 1
0 0 0 1 0 0 1 0
1 1 1 0 1 1 0
0 1 0 1 0 0 1
0 0 1 0 0 0 0
0 1 0 1 0 0 1
1 0 0 0 1 1 0
0 1 0 0 0 0 0
0 1 0 1 0
0 0 1 0 1
0 1 0 1 0
1 0 0
0 1 0
1 0 1
0 0 0
0
1
0

```



Cameras
Installation

```

1 0 1 1 1
0 0 1 0 0
1 1 0 1 1
0 0 0 0 0
0 1 0 1 0
1 0 1 0 0
0 1 0 1
0 1 0
0 0 0
0 1 0
1 0 1
0 0 0
0
1
0

```



Safety
Observations

```

1 0 1 1 1
0 0 1 0 0
1 1 0 1 1
0 0 0 0 0
0 1 0 1 0
1 0 1 0 0
0 1 0 1
0 1 0
0 0 0
0 1 0
1 0 1
0 0 0
0
1
0

```



- Internal Analysis & Reporting on Performance on site
- Customer Dashboard with automated DPR
- Increased Safety on site

—— current —— upcoming

Starlink as preferred solutions in the Offshore environment



Environmental conditions sensors

Wave radar

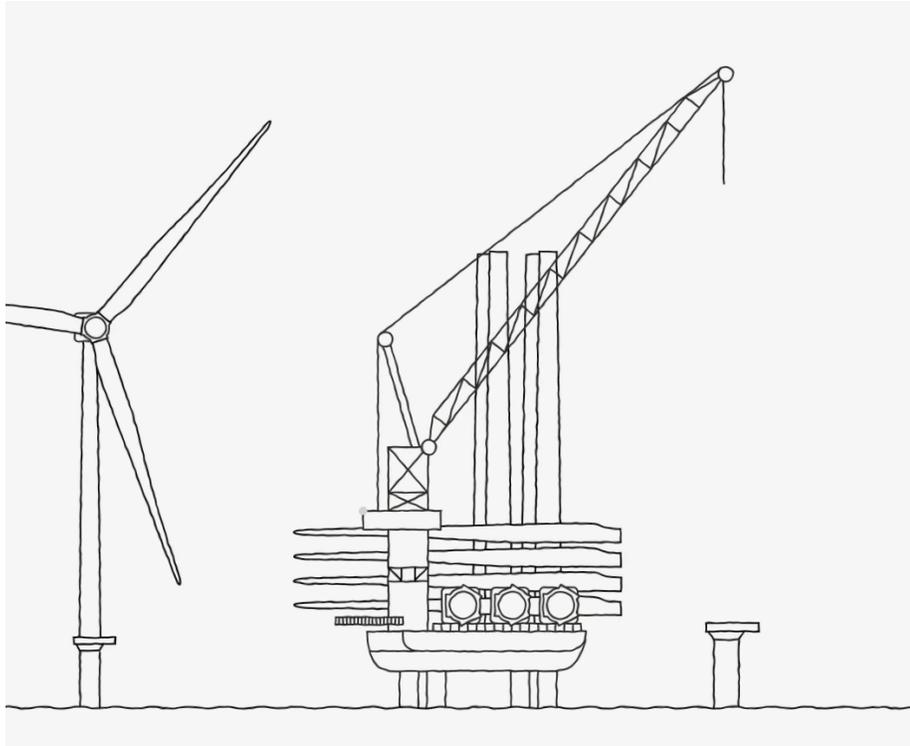


Wind Lidar

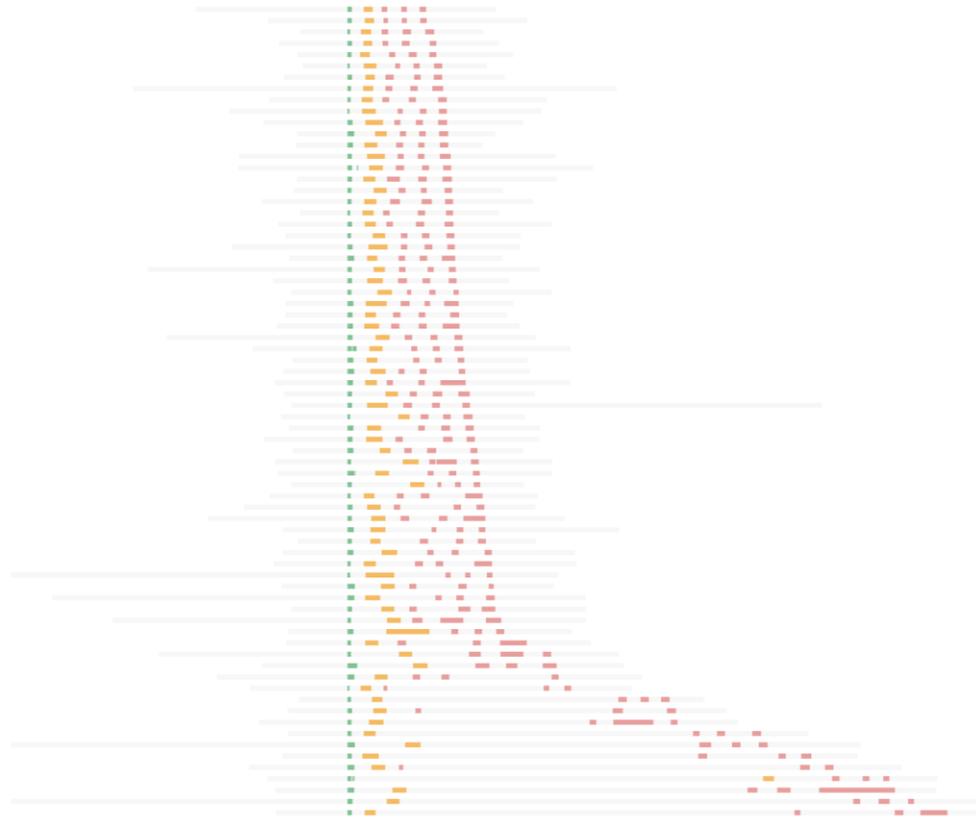


Lifting Events

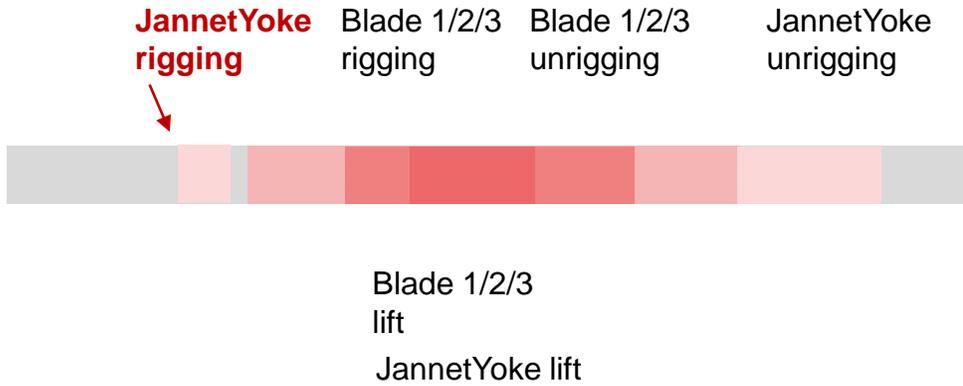
Lean workflow



TIMELINE



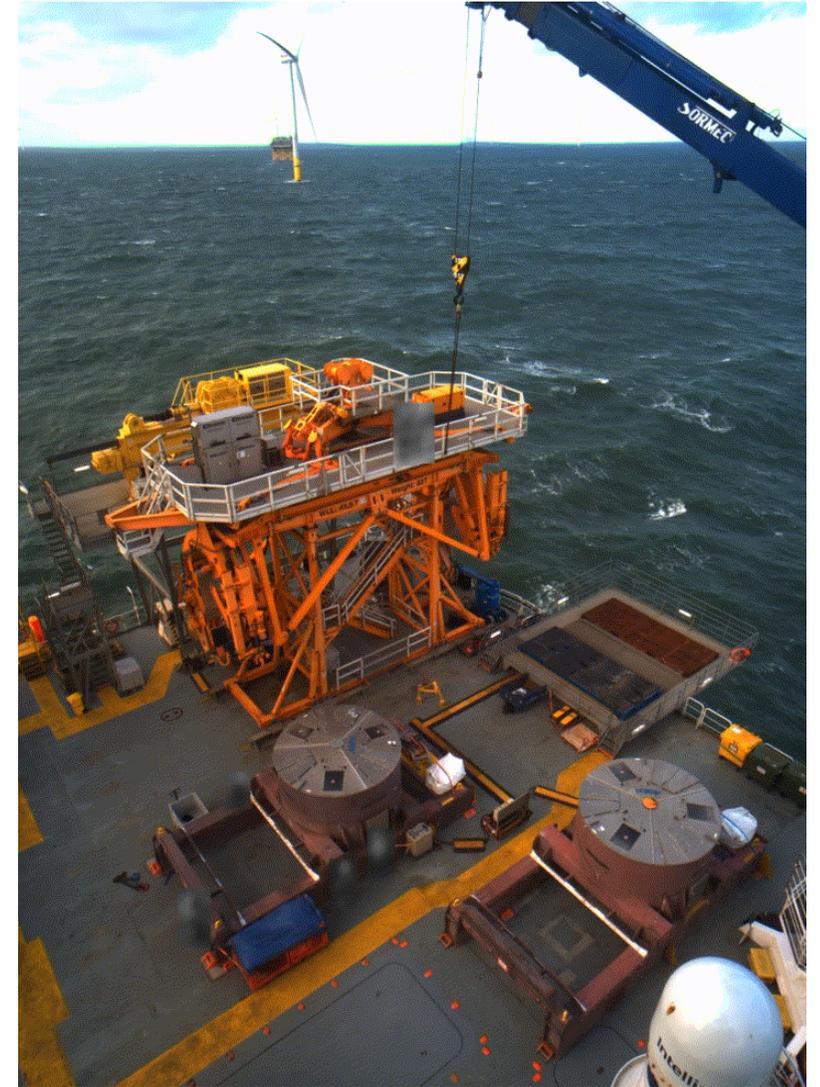
Blade Installation



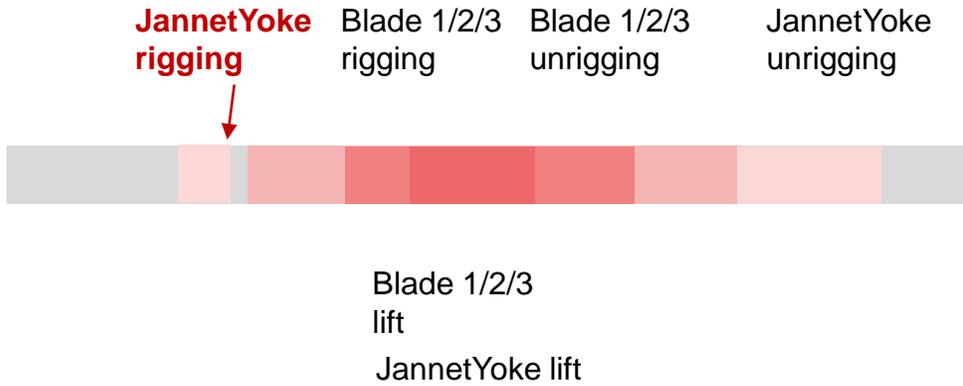
JannetYoke rigging start

Frame: 153

Personnel starts interacting with the black straps on the crane hook



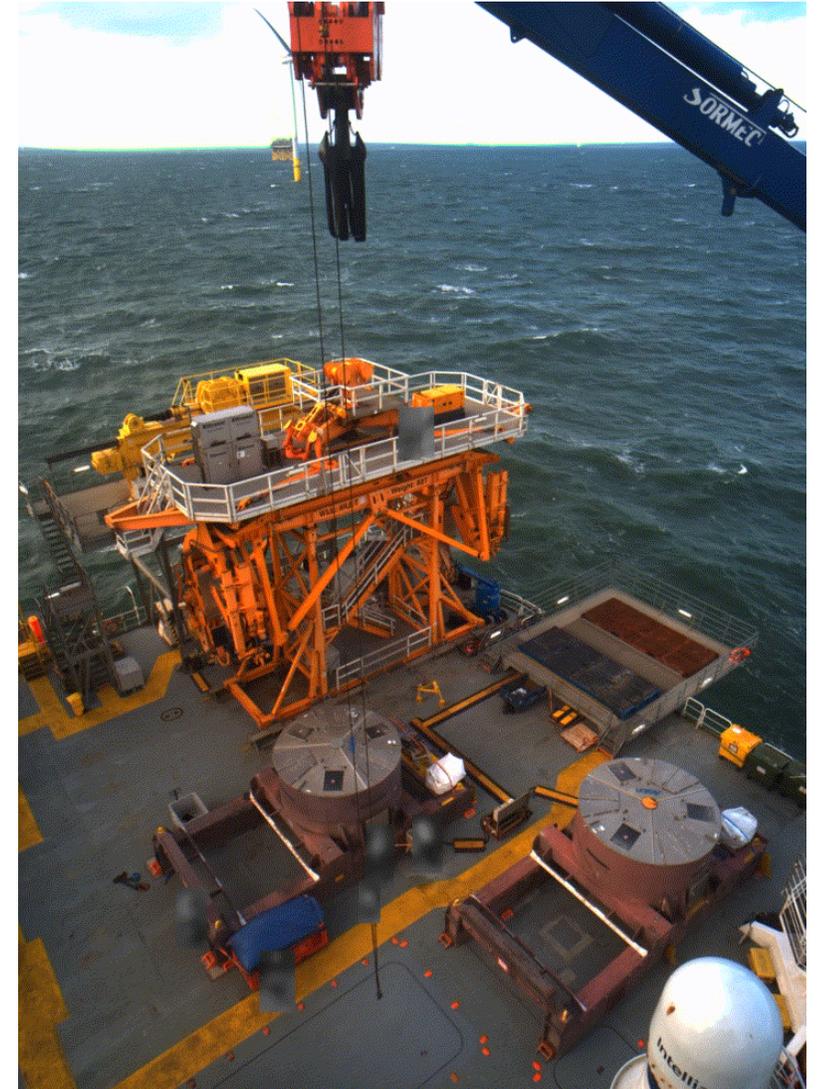
Blade Installation



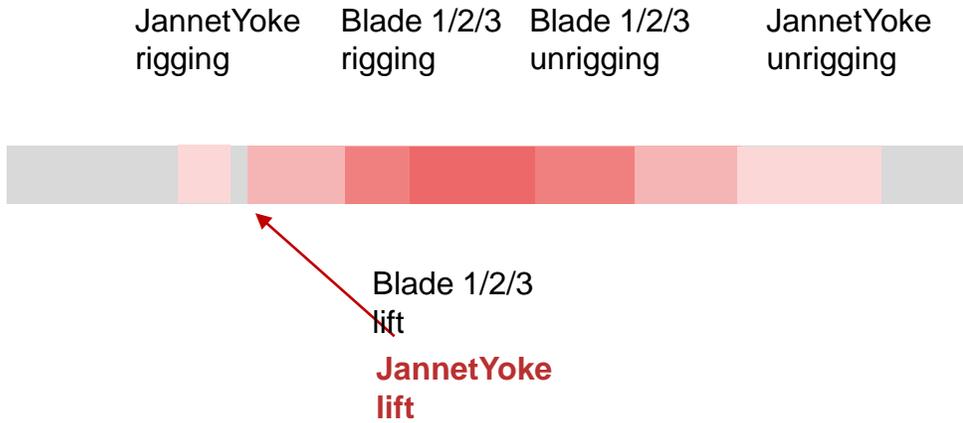
JannetYoke rigging end

Frame: 156

Personnel stops operating on the smaller submodule



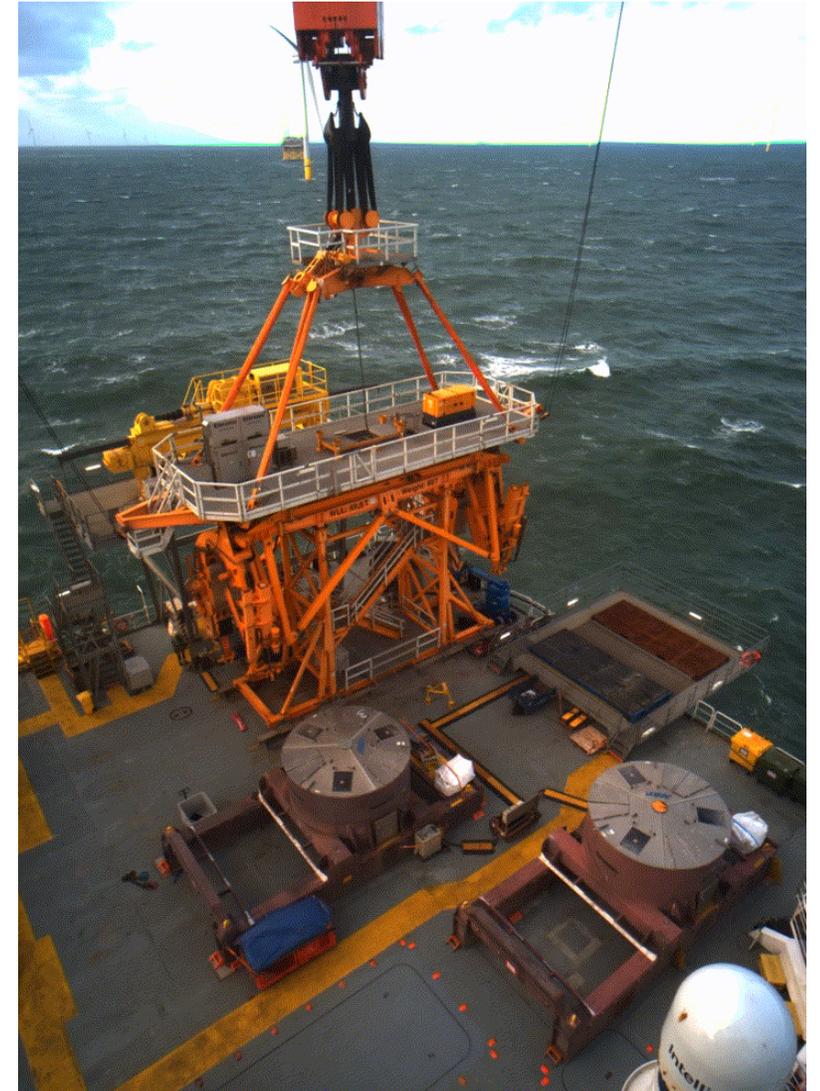
Blade Installation



JannetYoke lift start

Frame: 22

Hook straps are tight and the lift of the whole yoke starts



Our Commitment to Safety



Advanced Sensor Program - SAFE

Increase Site Safety Through Technology

	Observations*	Average clearing time**
Nacelle Yoke Lift	5/0	1.25 min
Nacelle Lift	0/0	N/A min

* An observation is a person entering the sensor being monitored. A walk under load event is registered if a person is within 2 meters of load area. It is being clear the load area.
** The time it takes for a person under a heavy load to leave the load area.

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Construction Summit 2023

Identifying Personal Protection Equipment

Computer Vision models that can analyze camera footage in a fraction of a second detecting...

PPE incidents in time

The scene
This report covers activity at pre-assembly in the eastern part of Hull (see below).

From 92 observations* we found

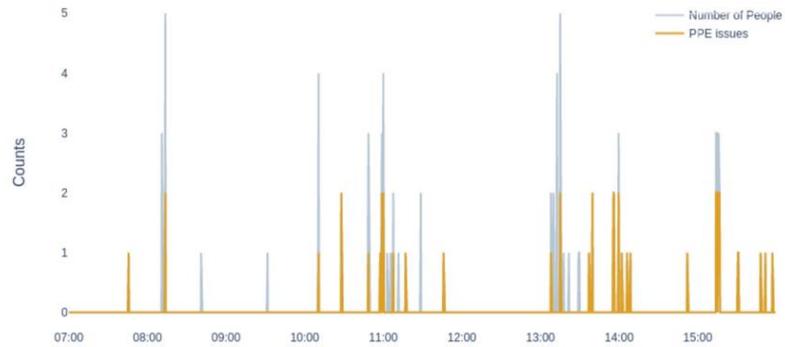
23	11	28
Helmet off	High-viz vests off	High-viz trousers off

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Identifying Personal Protection Equipment

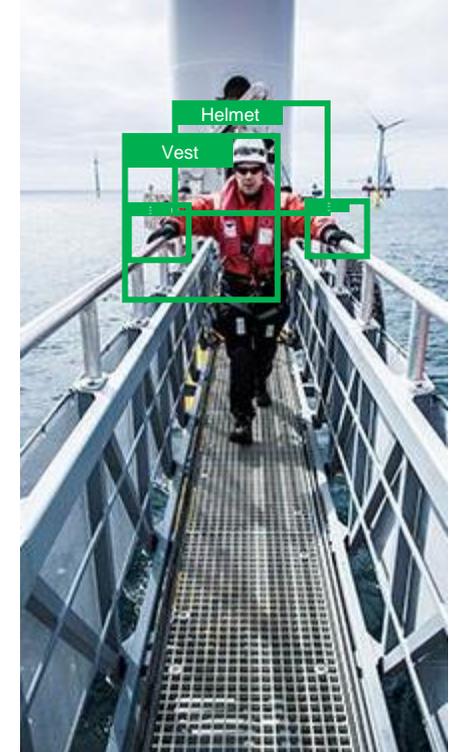
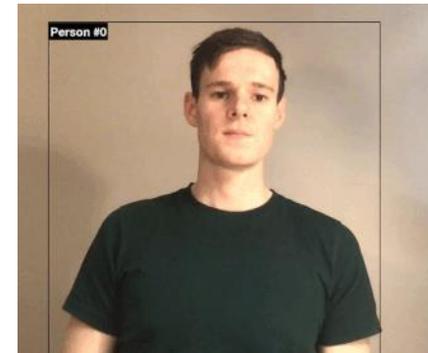
Computer Vision models that can analyze camera footage in a fraction of a second detecting...

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The scene

This report covers activity at pre-assembly in the eastern part of Hull (see below).



From 92 observations* we found

23
Helmets off

11
High-viz vests off

28
High-viz trousers off

n Slapka (Offshore Construction)

Insights into 3 areas of digital Innovations for Offshore sites



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We can't prevent all errors....
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Manage Performance with data based approaches

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Thank you!

Simon Slapka

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Offshore Construction

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