

# MICEDD

## DEEPWATER DEVELOPMENT

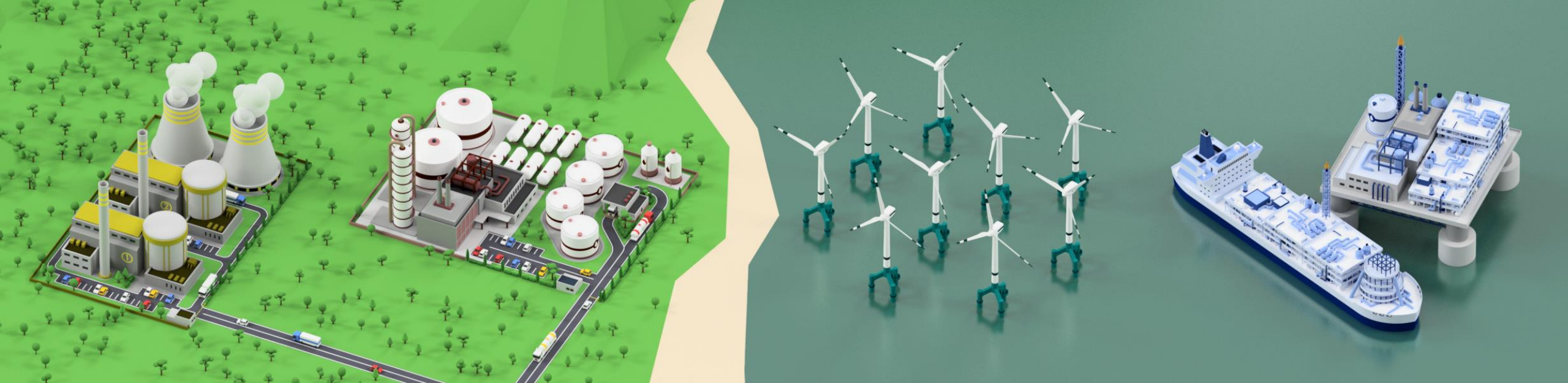
28 - 30 March 2023 | Millennium Gloucester Hotel | London, UK

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Quest Offshore

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# Lessons Learnt from an Offshore Late change management on a Floating OW Turbine



Christophe Paillusseau – EVP Sales & Marketing

- What are the Stakes for non intrusive fastening in both FPSO and OW ?
- Technology and lessons learnt on FPSO
- First experience on OW modifications
- A new solution for the outfitting of OW towers (construction phase)
- Conclusions





# What are the Stakes FPSO and OW wrt Structural Fastening



## FPSO construction

- How to avoid ruining underface painting or lining?
- Allow Late management of change (last 3 months)

## FPSO Operations

- Avoid **Hot works** and be capable to work during **live production**
- Avoid **intrusiveness** on primary structure

## OW construction

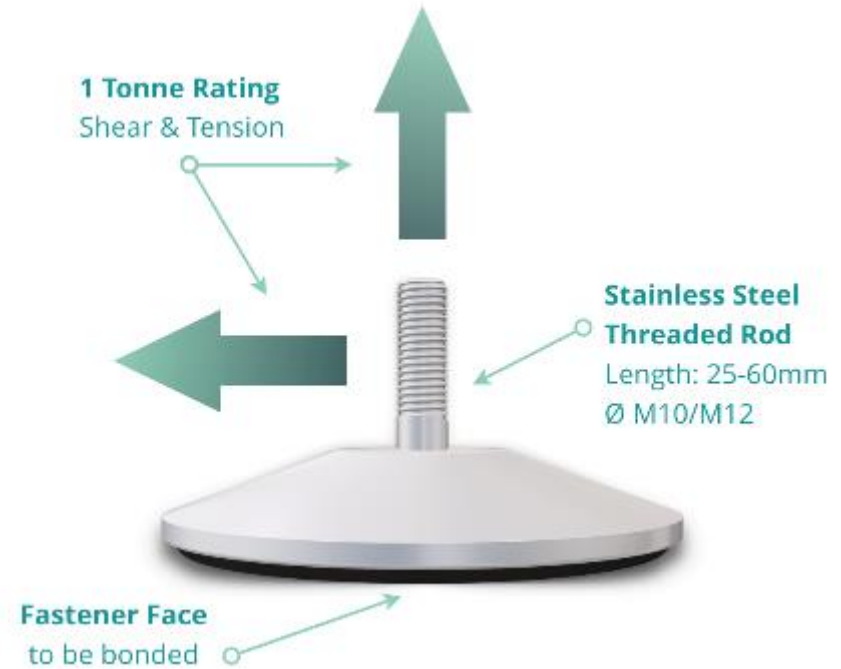
- Avoid intrusiveness on primary structure like the Tower (**fatigue**)
- Reduce **CO2 footprint**

## OW Operations

- Avoid intrusiveness on primary structure like the Tower (**fatigue**)
- Be quick to deploy (1 day) – no bedspace

# An alternative to Welding for FPSO

## Non Intrusive & heavy duty mechanical fasteners for STEEL

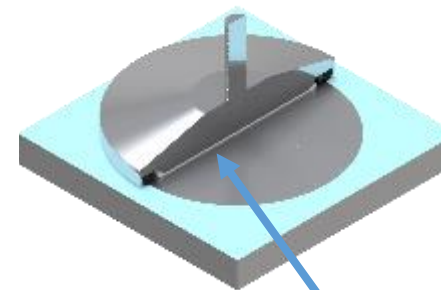


Rated & Heavy duty  
mechanical capacity

Repeatable performance for  
Offshore weather condition

High durability

A true alternative to  
welding or drilling



# Reliable & durable adhesive bonding for Marine environment

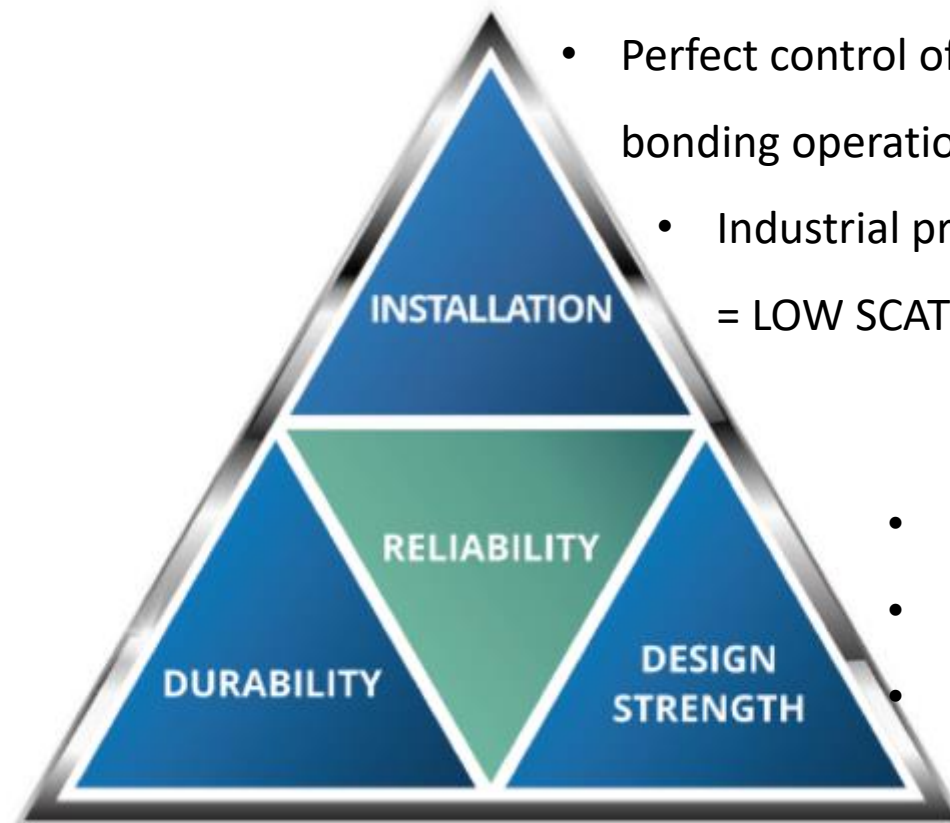
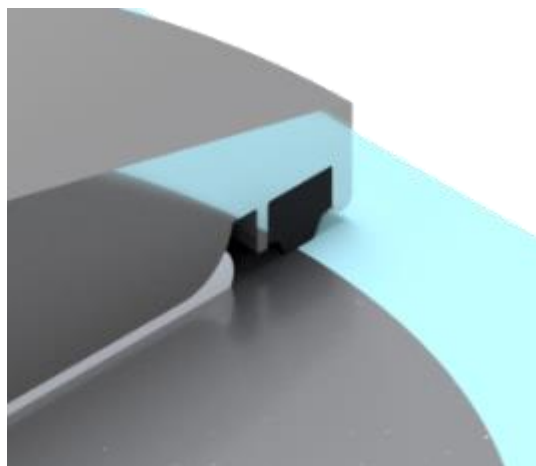
## ADHESIVES ARE VULNERABLE TO HUMIDITY

Reliability can be achieved by overcoming the following technical obstacles:



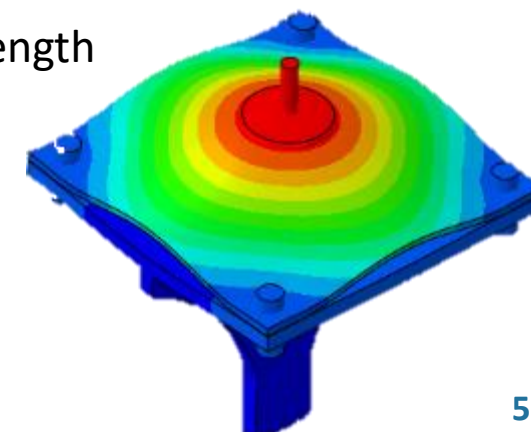
## Adhesive Encapsulation

High Durability  
Even in marine environment



- Perfect control of bonding operations in “offshore” conditions;
- Industrial process (AUTOMATION) = LOW SCATTERING

- Design and strength
- Predictability
- Edge effects



Safe, Reliable & Durable



# Typical business cases / FPSO

## Construction

How to avoid ruining underface painting or lining?

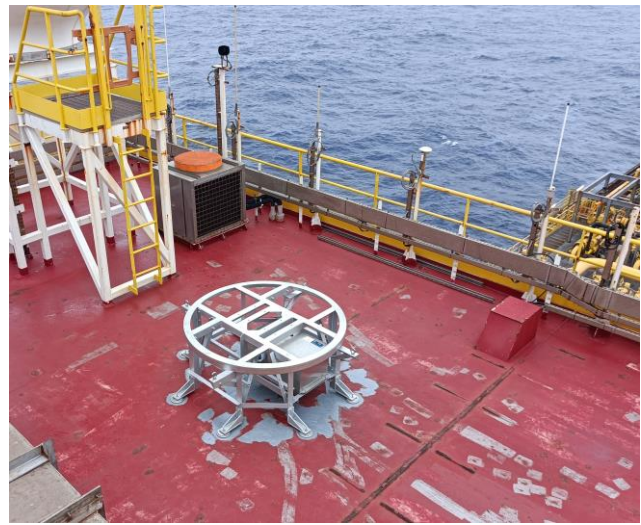
Allow Late management of change

## FPSO Operations (Maintenance, Shutdown, Life extension)

Avoid Hot works during live production (adjacent tank)

Avoid intrusiveness on primary structure

Debottleneck Shutdown ops



Low SCF

no HAZ

no residual stresses

No crack initiation → NO impact on SN curves

No Paint Touch up on opposite surface

→ NO DETRIMENTAL STRUCTURAL FOOTPRINT

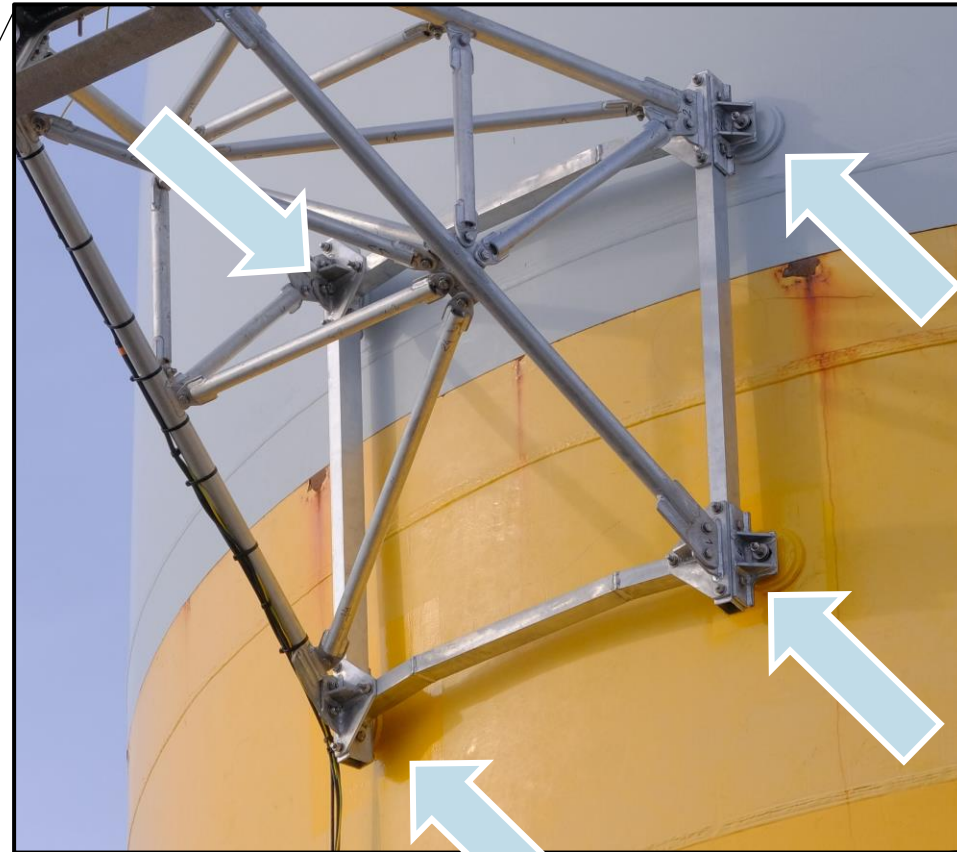


But....

What is the point  
for  
OW applications?



# OW – onsite modification How to add a Radar Structure onto the transition piece



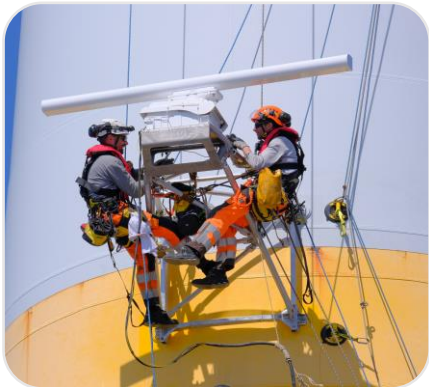
Safe, Reliable & Durable

**Be compatible  
with rope  
Access**

**Onsite  
Productivity**  
Fasteners,  
structure and  
cabling

**Safety**

**Ergonomics**



<3 days overall  
Rigging for rope  
access was the  
most time  
consuming

**No  
HSE  
incident**



Self supported Tool is  
a strong benefit  
  
To be improved :  
volume of associated  
tooling

**Obj : 1 day shift**



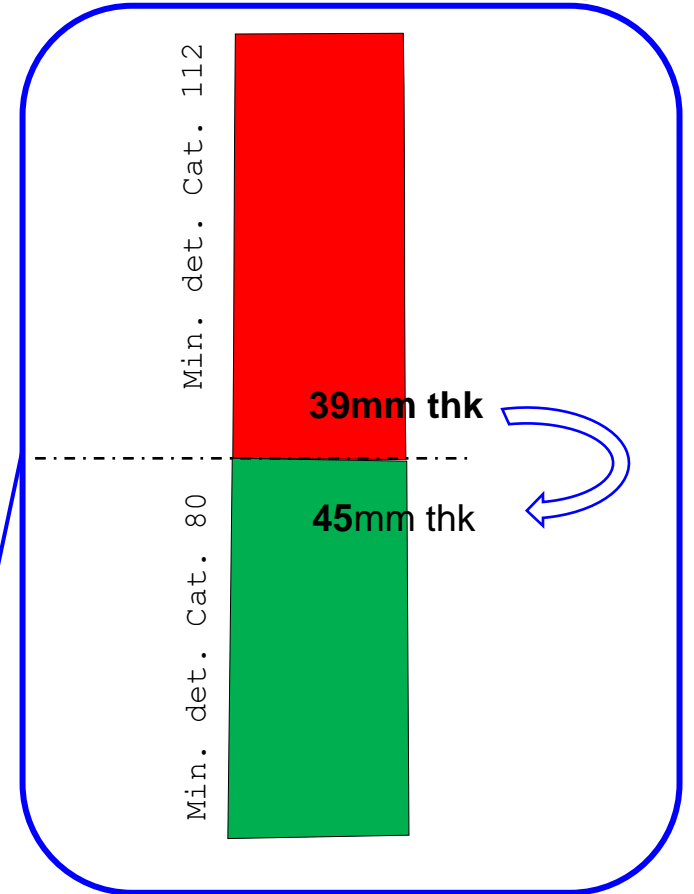
# OW construction

## Challenge: material saving by avoiding welding and drilling



It is only allowed to drill or weld onto 10% of the tower

No Drilling  
No Welding



39mm to 45mm → +13%

→ steel saving by avoiding welding/drilling

OW construction  
Challenge: material saving by avoiding welding and drilling

2 Examples of *tricks* used to overcome the issue for **fixed OW**:



Magnets used to fasten horizontally




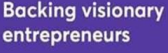


Compression ring used to fasten horizontally

Will those tricks be good enough for **floating OW** ?

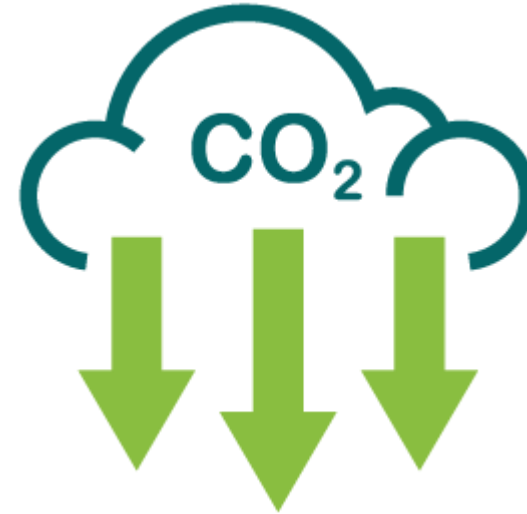


# Comparison Magnet VS Bonded Mechanical fastener

Features	Magnet 	Bonded Fastener   
Capacity (regulatory)	3kN (updated)	4kN
Capacity (ultimate)	?	12kN to 27kN (SF from 3.0 to 7.0)
Reliability / Robustness	?	high
Design Lifetime (marine)	magnet coating?	> 35years (target)
Installation time	Less than 1min?	Around 1min
Installation stage	After painting only	Before or after painting (qualif.)
Material sourcing /volatility	Rare earth	None
Price (for 1000 pieces)		40 to 60% cheaper

# OW construction

How to make it safer, cheaper and more sustainable ?



## Improved total cost of ownership

-50% Lower unit cost  
2mn to install vs 1mn

**180t of CO2**  
saved for 15MW

1000T of steel for  
a 15MW tower  
10% steel saving = 100t

## Sustainable Sourcing

magnets are demanding in  
terms of **Rare Earth**



# Innovation is a long road..... transitioning from OG to OW

## 1st Product (NO HOT WORKS)

- Innovation breakthrough
- Niche Market –FPSO only (<300 units)
- Market perception : Revolution but Expensive



## 2nd Product

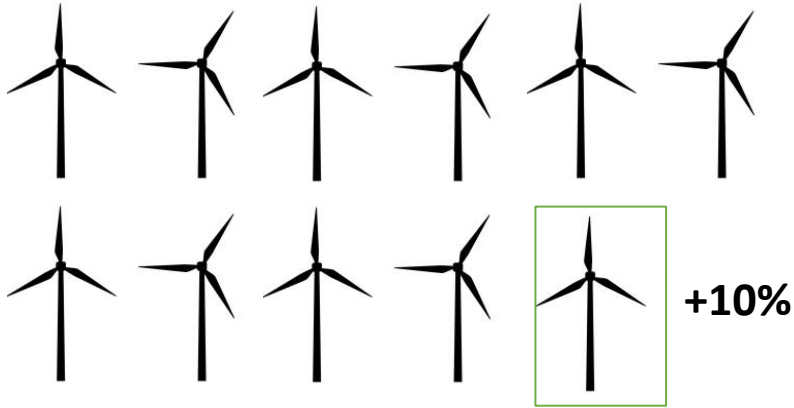
- Miniaturization of technology
- Wider market beyond FPSO only
- Market perception : handy, new tool for designers, low productivity

## 3d Product (NON INTRUSIVE)

- Design to Cost through Horizon Europe
- Extremely wide market (+1200/year or >500MUSD)
- Market perception : handy, Commodity pricing, rapid to install

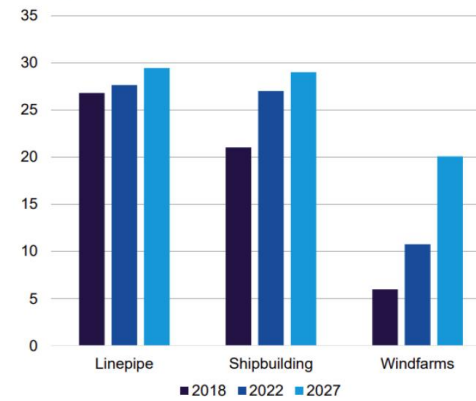


# Conclusions

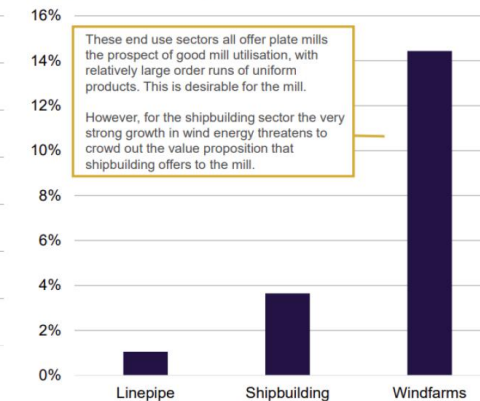


## Traditional baseload plate demand areas must now compete with wind

Steel plate demand by selected sector, Mt

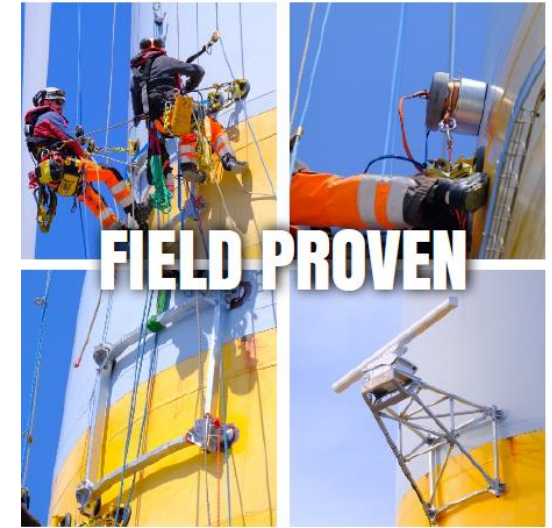


Steel plate demand by selected sector, CAGR 2018-27



These end use sectors all offer plate mills the prospect of good mill utilisation, with relatively large order runs of uniform products. This is desirable for the mill.

However, for the shipbuilding sector the very strong growth in wind energy threatens to crowd out the value proposition that shipbuilding offers to the mill.



DATA: CRU

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**DEBOTTLENECK SUPPLY CHAIN of OW TOWERS**

**+10% for the same quantity of steel**

**ENABLER for FLOATING OW**

Compatible with accelerations  
Lower weight means smaller Floater

**Offshore Maintenance & Modifications**

**Available**

Offshore, rope access, shipyard





**Christophe PAILLUSSEAU**

*VP Sales and Marketing*  
Tel : +33 14554 7987  
Mob: +33 61927 6979  
[cp@cold-pad.com](mailto:cp@cold-pad.com)

*Paris Innovation Boucicaut*  
130, rue de Lourmel  
75015 PARIS - France  
<http://www.cold-pad.com>

- Durability is essential in Marine environment : What kind of durability are you looking at with your products ? Has it been approved by Third Parties ?
- What are the main differences between FPSO stakeholders and OW stakeholders when it comes to Innovation ?
- Have you heard of any problems of falling magnets ?





# C-CLAW installation



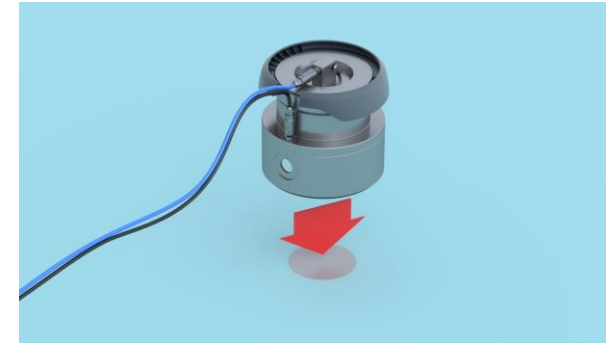
Surface preparation



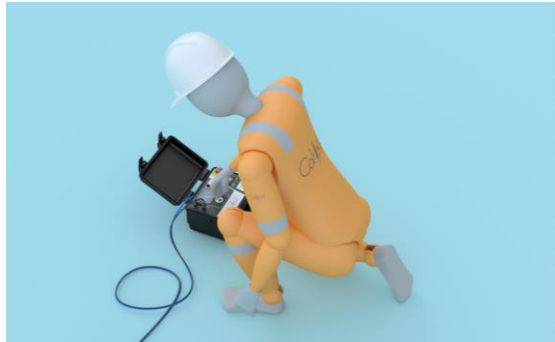
Inserting the C-Claw in the vacuum bell (C-Hawk)



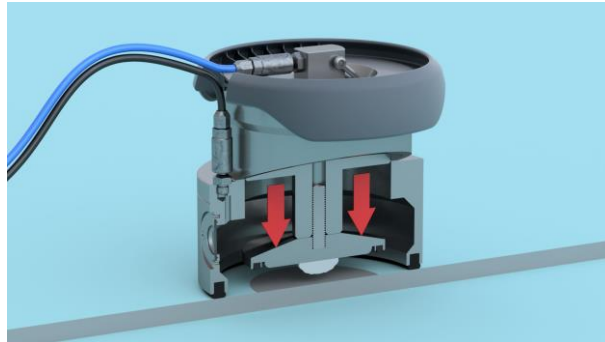
Dispensing the adhesive



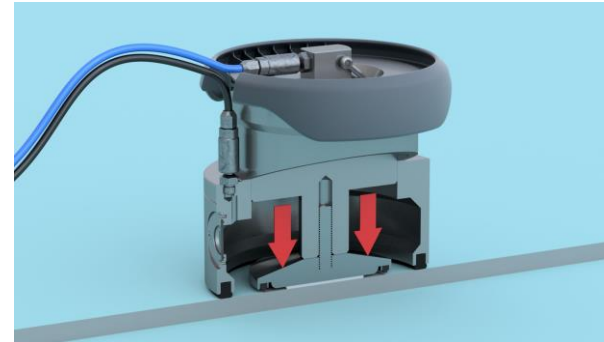
Place the C-Hawk on the prepared surface



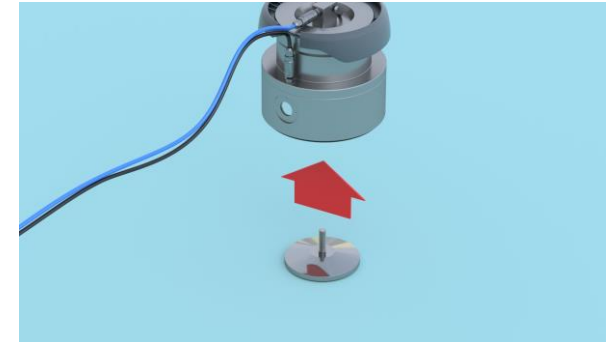
Activate the automated installation process



Deydration of the atmosphere inside the C-Hawk for optimal bonding condition



C-Claw automatically being pressed

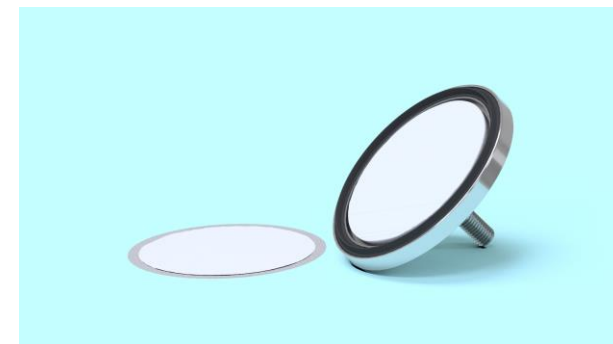
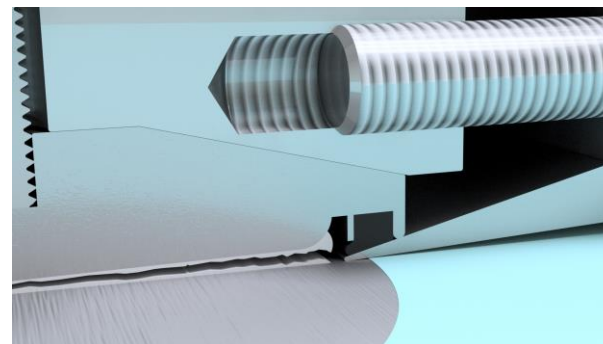
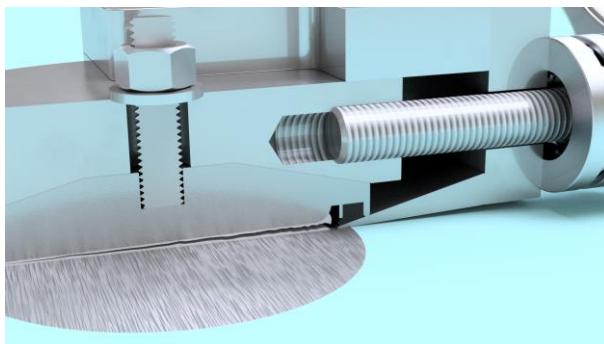
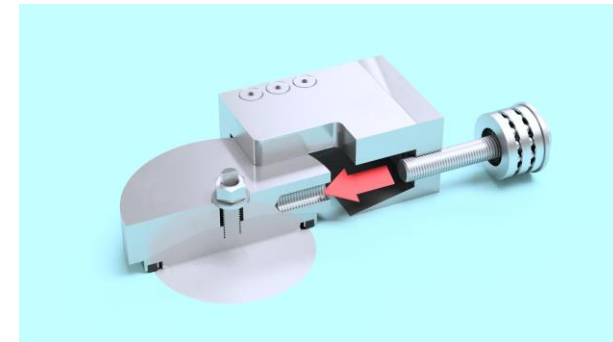
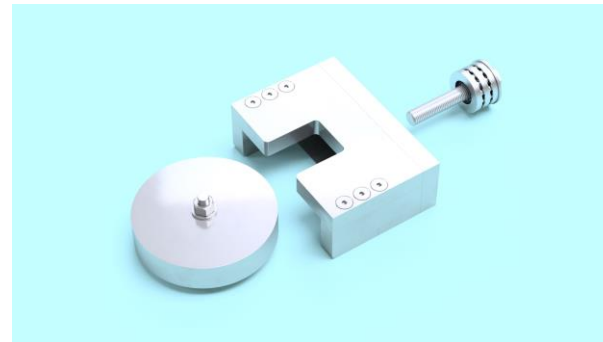
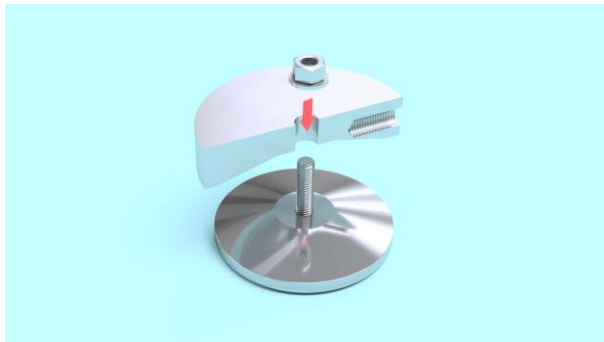
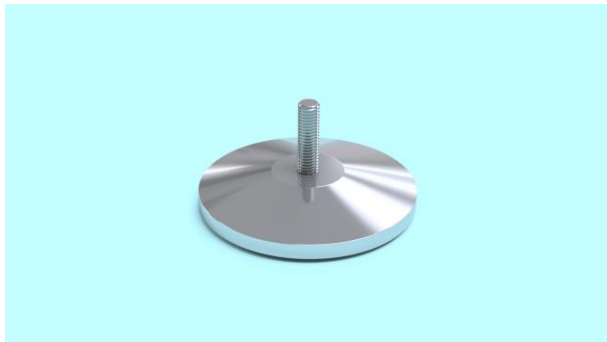


Remove C-Hawk. C-Claw is installed

Installation time  
~15min



# C-CLAW removal



Removal time  
~5min



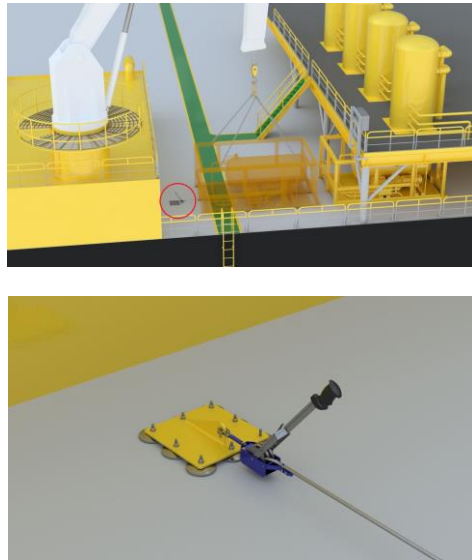
# How to debottleneck Shutdown operations ?

Being capable to create structural anchor points with no hot works prior to Shutdown provides strong benefits for debottlenecking shutdown ops.

Lifting padeyes  
<5 tonnes



Skidding padeyes  
<20 tonnes



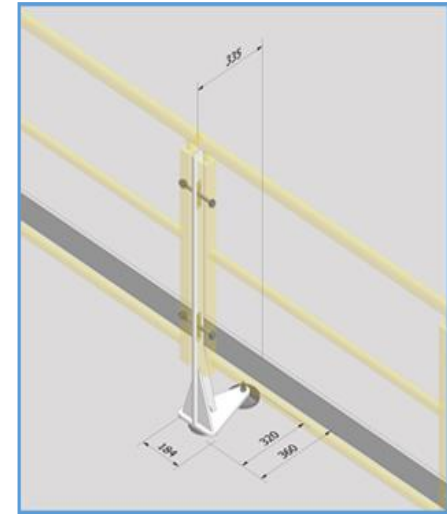
Pipe supports



seafastening



Handrails





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