



## **SUCCESSFUL DEPLOYMENT OF AN INNOVATIVE PASSIVE WELL MONITORING TECHNOLOGY.**

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# DEVELOPMENT JOURNEY



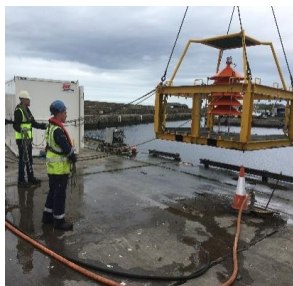
**APRIL 2018**  
Sentinel  
incorporated



**NOVEMBER 2018**  
Tracer based Trigger  
(SWIFT) solution  
development starts

**DECEMBER 2018**  
With NZTC Field Trial offered for  
Tracer based solution deployed  
onto drilled development well

**AUGUST 2019**  
Tested capture  
system in Buckie  
Harbour



**SEPTEMBER 2019**  
Successful Field Trial  
of capture system from  
the Noble Hans Deul  
Drilling Rig

**JANUARY 2019**  
Hydrocarbon  
Triggers  
development begins

**MARCH 2020**  
Spirit Energy identifies  
opportunity to deploy  
Hydrocarbon detection  
system onto suspended  
well

**FEBRUARY 2021**  
Hydrocarbon Triggers  
available for development

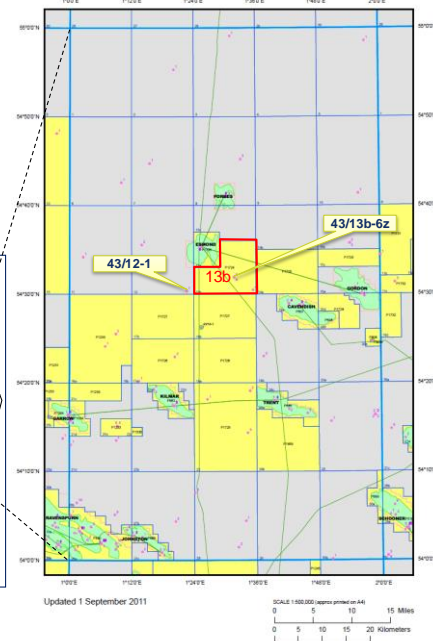
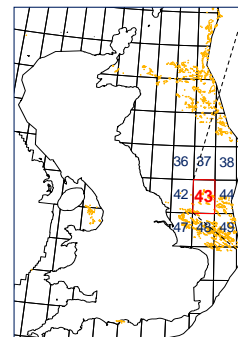
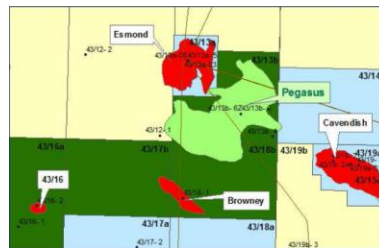
**JUNE 2021**  
WellSentinel™ Coral  
system successful  
deployment onto  
Pegasus West Well





# PEGASUS WEST WELL - LOCATION

- UKCS Block 43/13b
- Southern North Sea (SNS)
- West of the Cavendish Field, East of the Andromeda
- 30km NW of Trent (43/24a)
- 55km West of Cygnus (44/12a)
- Drilled by NJR (B391) Jack Up in 2014





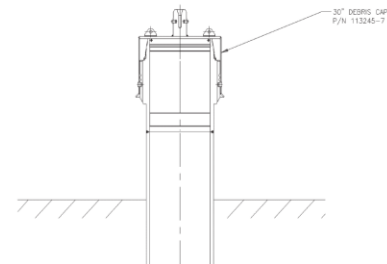
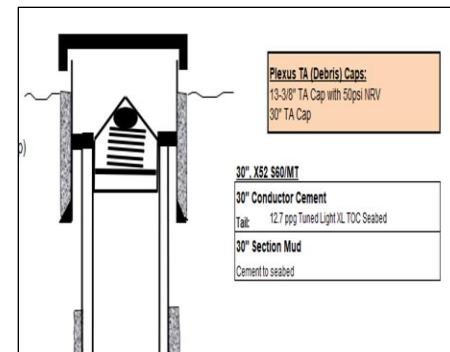
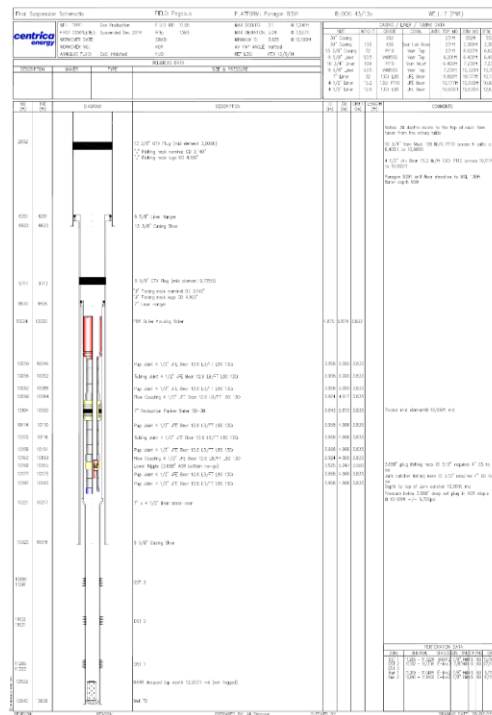
# WELL HISTORY AND SUSPENSION STATUS

## Well History

- 43/13b-7 drilled by the NJR (B391) in 2014
- Full hole casing design – 9 5/8" liner / no tieback
- Well logged & tested 3 separate zones
- Well suspended for future re-entry

## Current Status

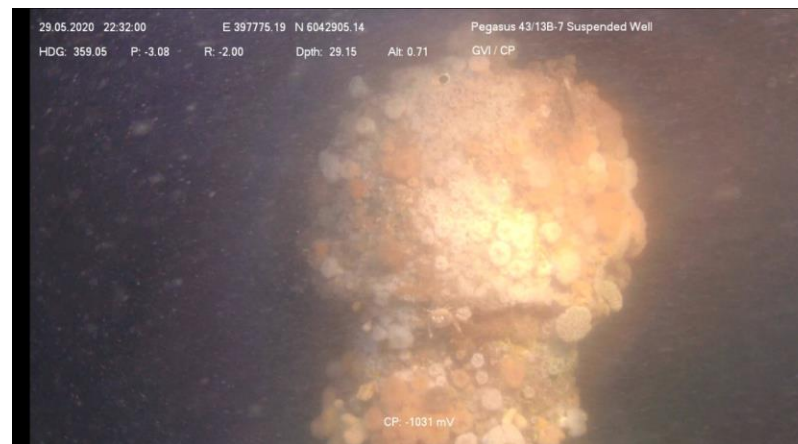
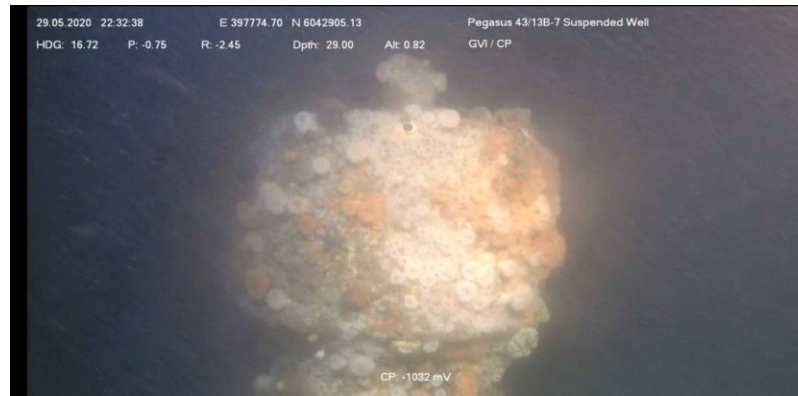
- 4 1/2" liner perforated across 3 sands
- Hydrocarbon gas across the perforations in 4 1/2" liner
- Lower completion tailpipe left in place
- Wireline plug installed in completion tailpipe nipple
- Well displaced to 11.05 ppg CaCl<sub>2</sub> kill weight brine
- 9 5/8" and 13 3/8" bridge plugs set in casing
- 13 3/8" Corrosion cap installed below mudline
- Trash Cap installed on the 30" conductor





# THE CHALLENGE

- Long-term suspended well without active monitoring
- No infrastructure in place
- Bi-annual visual inspection (IRM) only
- Looking for a remote monitoring solution
- Deployment integrated with 'routine' IRM campaign

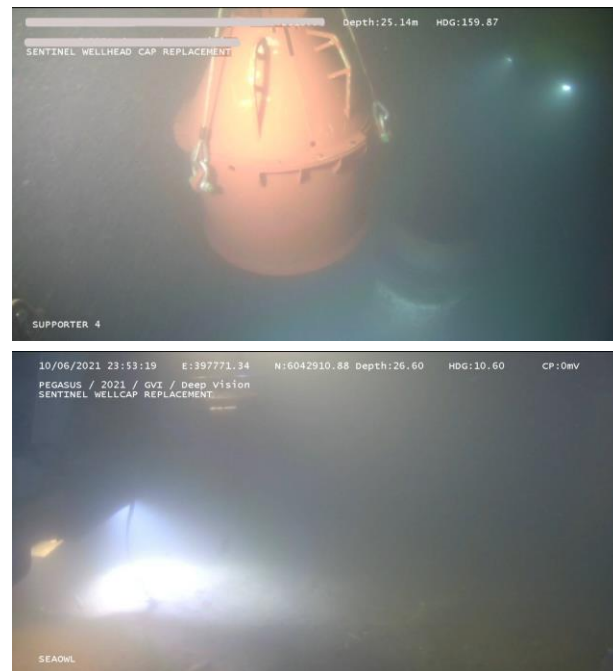
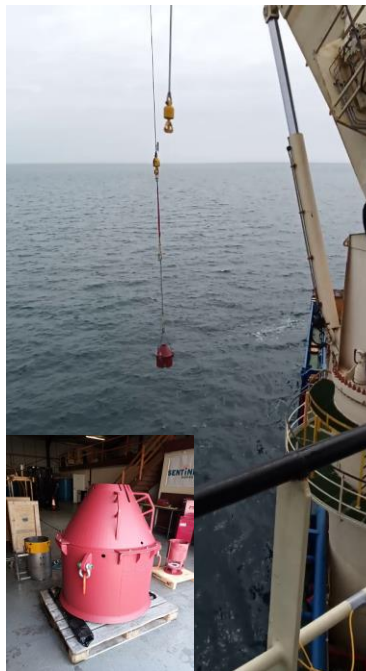


June 2020 - Visual Inspection



# FIRST WELSENTINEL™ INSTALLATION

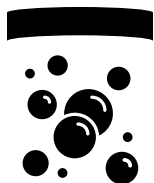
- Passive WellSentinel™ Coral monitoring successfully installed
- Technology does not require active electronics or data comms
- Collects and chemically detects gas and /or oil in the subsea environment
- 10+ years monitoring with no intervention
- Early alert through existing Iridium satellite network



*June 2021 - Successful deployment from Subsea  
IRM survey vessel with WROV support*

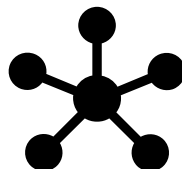


# WELLSENTINEL™ HOW IT WORKS



## Gather

Gathering Structure installed to capture fluids of interest in the subsea environment.



## Detect

Passively detect specific fluids without the use of electronics or data telemetry.



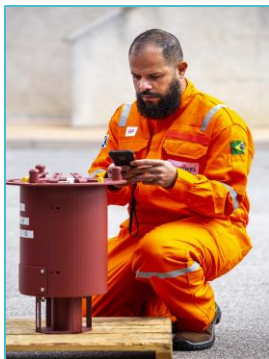
## Alert

Mechanically release a coded Alert Beacon to signal fluid detection.

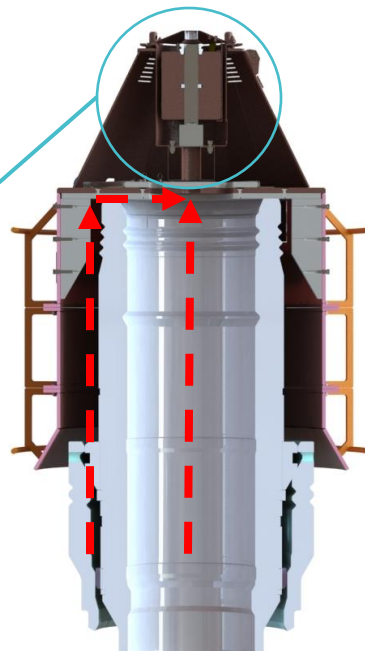


# WELSENTINEL™ CORAL PRINCIPLE

Gathering Structures direct buoyant fluids into a chamber within a system's ROV-deployable and recoverable Monitoring Module. This houses Sentinel's proprietary Trigger mechanism.



*Monitoring Module*



*Buoyant fluids guided into Reaction Chamber at bottom of Monitoring Module*



*WellSentinel™ Coral on 18 3/4" wellhead*



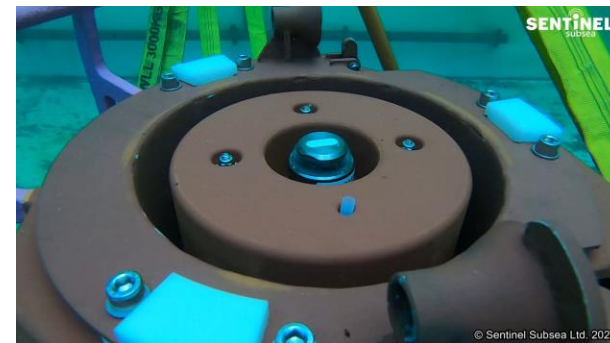
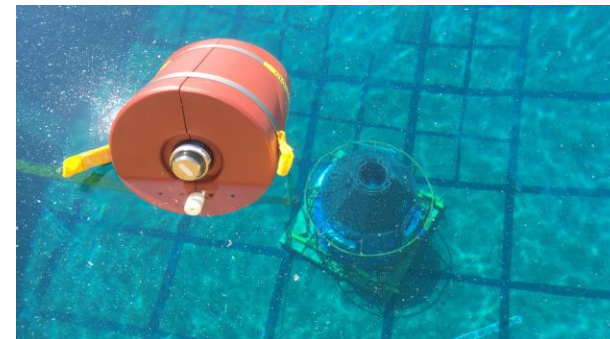
# DETECTION

Exposure to target materials begins degrading the Triggers. Triggers respond only to the fluid of interest and nothing else they may encounter in the subsea environment.

Once Triggers are degraded, buoyancy launches beacon to surface

## Trigger Detection Capability

<b>Gas</b>	Reacts to thermogenic (reservoir) gas
<b>Oil</b>	Reacts to liquid hydrocarbons
<b>Tracer</b>	Reacts to proprietary tracer fluid (SWIFT)
<b>CO<sub>2</sub></b>	Reacts to CO <sub>2</sub>
<b>Mixed</b>	Multiple Triggers can be fitted in one system
<b>Custom</b>	Custom Triggers can be investigated

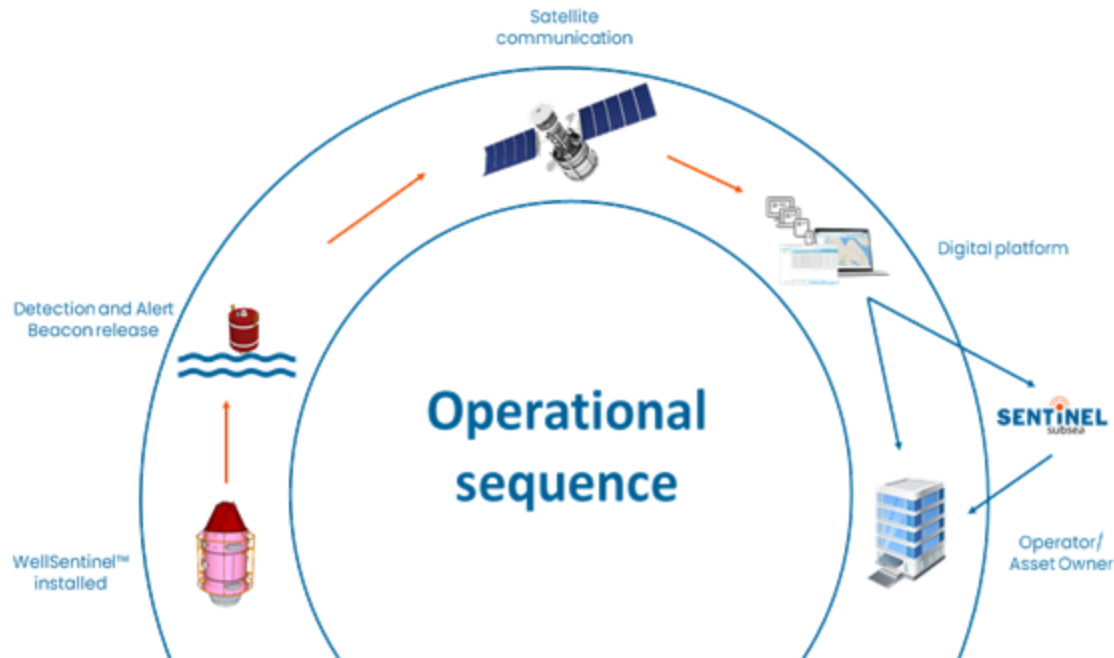


*Note: Module lid not fitted for demonstration*

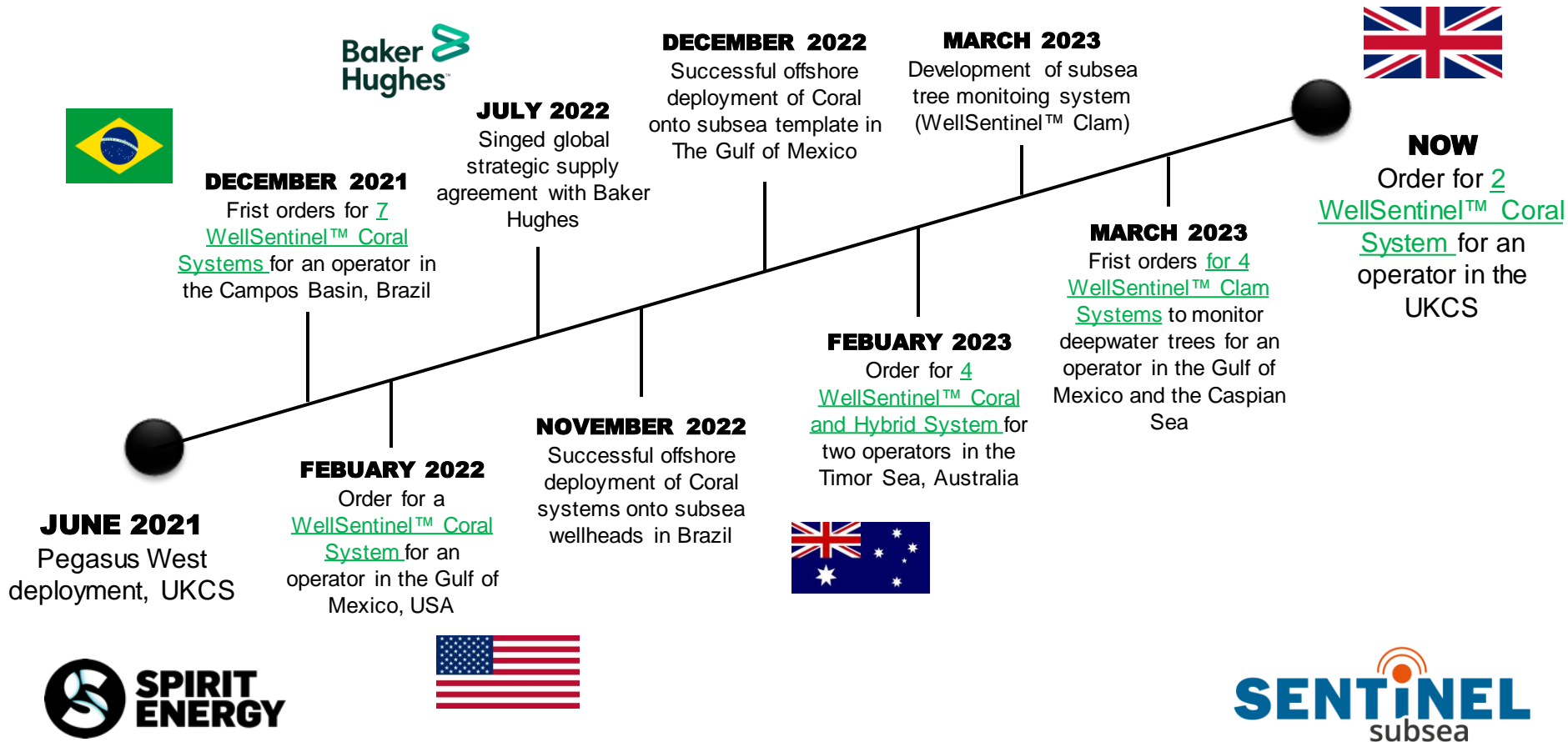


# ALERT TO WELL OWNER

- On surfacing beacon automatically switches from quiescent to active mode and communicates via satellite to digital platform
- Each beacon is individually coded and cross-referenced to a specific asset
- Asset owner is notified and contingency plans activated



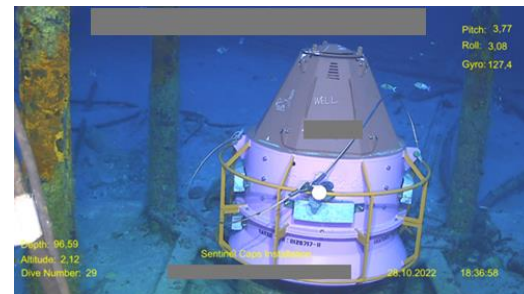






# CORAL DEPLOYMENTS – CAMPOS BASIN, BRAZIL

- Operator recently acquired a mature field with a number of legacy wells
- 7 systems for a mixture of wellhead profile sizes including 36", 18 3/4", 16 3/4"
- Stock of suspended subsea wells awaiting intervention
- Provide ALARP continuous monitoring before intervention activities



*Note: Various size and length of Coral cap to fit wellhead profile*



# CORAL DEPLOYMENTS – GULF OF MEXICO, USA

- Operator suspending single well while other wells maintaining production
- 1 system for 18 3/4" wellhead at over 900 m (3,000')
- Subsea well part of a larger template
- Continuous monitoring allows campaign approach to full template decommissioning in 7 to 10 years





## CORAL DEPLOYMENTS – TIMOR SEA, AUSTRALIA

- Operator with wells in a remote offshore location (2-3 day transit)
- 2 WellSentinel™ Corals for 18 3/4" wellheads
- Suspended wells at 360 m (1,200')
- Using both Oil and Gas Triggers



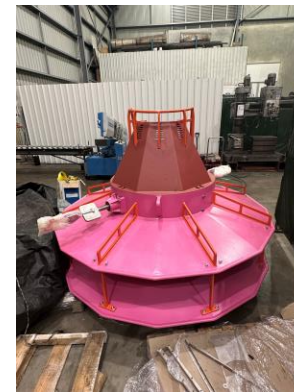
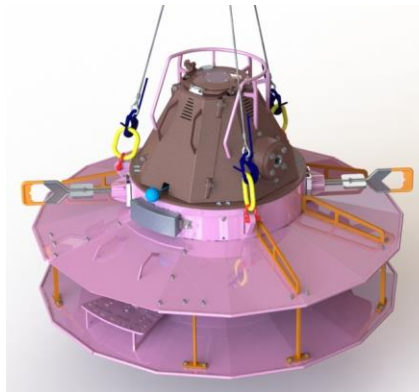
### Stack up test to check for clash





# HYBRID DEPLOYMENTS – TIMOR SEA, AUSTRALIA

- Operator with two suspended wells at 100 m (330')
- 2 WellSentinel™ Hybrids for 18 3/4" wellheads
- Mixture of Coral type system and Frond type capture
- Capability to capture from wellhead and externally 5m away from well centre using capture funnels



*Field Trial w/ Spirit Energy from Noble Hans Deul rig in the North Sea, 2019)*





# CORAL DEPLOYMENT – UKCS, UNITED KINGDOM

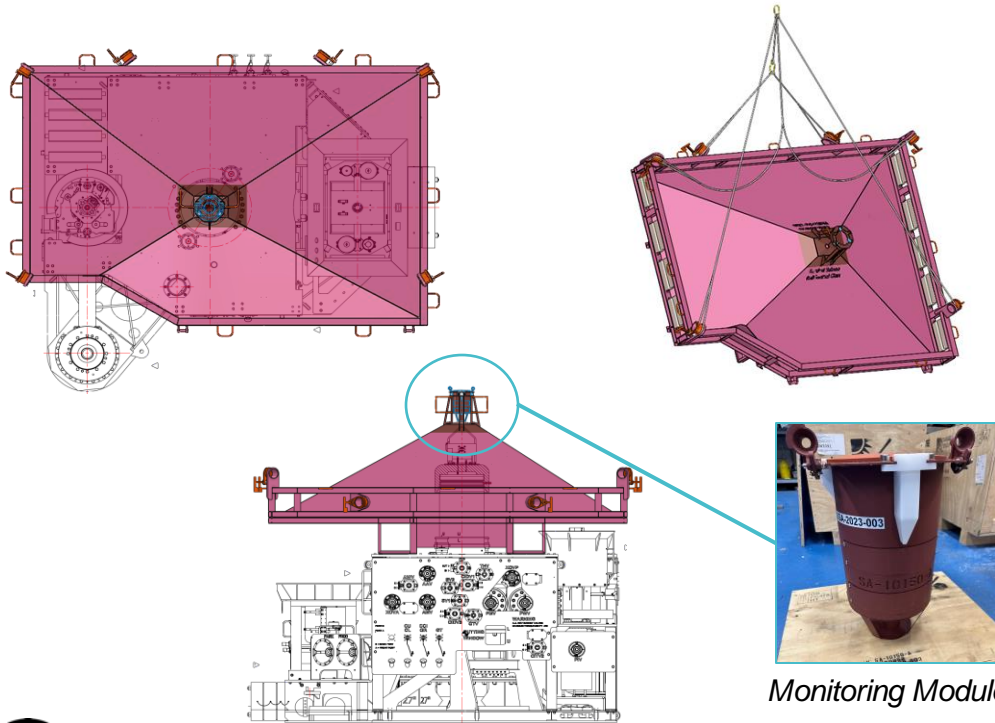
- Operator required monitoring during suspension period once completion operations have concluded until the installation of xmas tree
- 2 WellSentinel™ Corals for 18 3/4" wellheads
- Suspended development wells at over 90 m (300')
- Deployment from drilling rig
- Provide ALARP continuous monitoring





# CLAM DEPLOYMENT – GULF OF MEXICO, USA

For operator that has producing subsea trees at over 1,800 m (6,000')



Monitoring Module





# CLAM DEPLOYMENT – CASPIAN SEA, AZERBAIJAN

For operator that has producing subsea trees at over 600 m (2,000')





# WELLSENTINEL™ SOLUTIONS



Year	Subsea Asset Type	Operator(s)	Region(s)	Systems
2022	Wellhead	2	Campos Basin	7
2023/Q1 2024	Wellhead, Xmas Tree	4	GoM, Caspian Sea, Timor Sea, UKCS	9