

# Subsea Proppant Cyclone Update

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*29<sup>th</sup> January 2019*

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# Agenda

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- ❖ Business Opportunity
- ❖ System Basis
- ❖ Process Description
  - ❖ Subsea Facilities
  - ❖ ROV Vessel based system
  - ❖ Flushing Operation

# Business Opportunity

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- ❖ Lower cost solution for smaller, tight, gas pools for 1 to 2 well developments.
- ❖ OGA Southern North Sea Tight Gas Strategy, June 2017.
  - ❖ *The OGA estimates that there are some 3.8 TCF of remaining gas that is accessible within the Southern North Sea (SNS), inclusive of infill opportunities, undeveloped discoveries and prospects.*
- ❖ UKCS Unsanctioned Discoveries Pack, Oct 2016.
  - ❖ *172 UKCS gas pools totalling 1586 mmboe (P50).*
  - ❖ *153 gas 'small pools' (<50mmboe) totalling 1001 mmboe (P50).*
- ❖ Relevant to other similar tight-gas shallow-water basins, worldwide and including other SNS sectors.

# System Basis

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## ❖ Subsea facilities

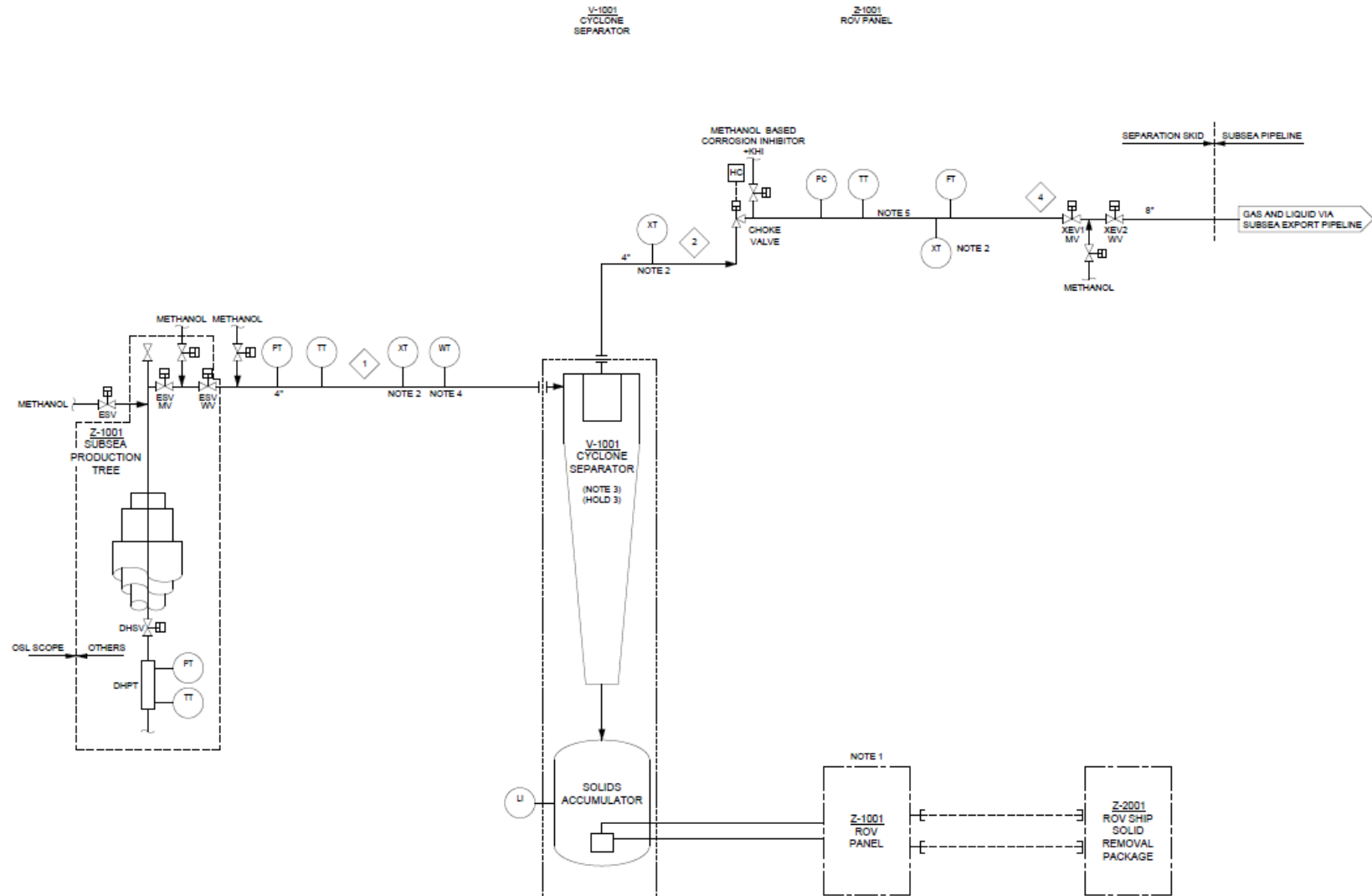
- ❖ Single / two well fracked developments.
- ❖ Well placement to suit drilling & not platform location.
- ❖ Locked onto well-conductor as per conventional technology.
- ❖ Drill Rig deployable (i.e. on drill-string).
- ❖ Solids removal subsea to eliminate need for platform.
- ❖ Solids recoverable to ROV/vessel.
- ❖ Up to 30MMSCFD (but could be designed to be higher).
- ❖ Up to 50m water depth.
- ❖ Utilising existing technologies.
- ❖ Standardised generic design.

# Process Description - Subsea

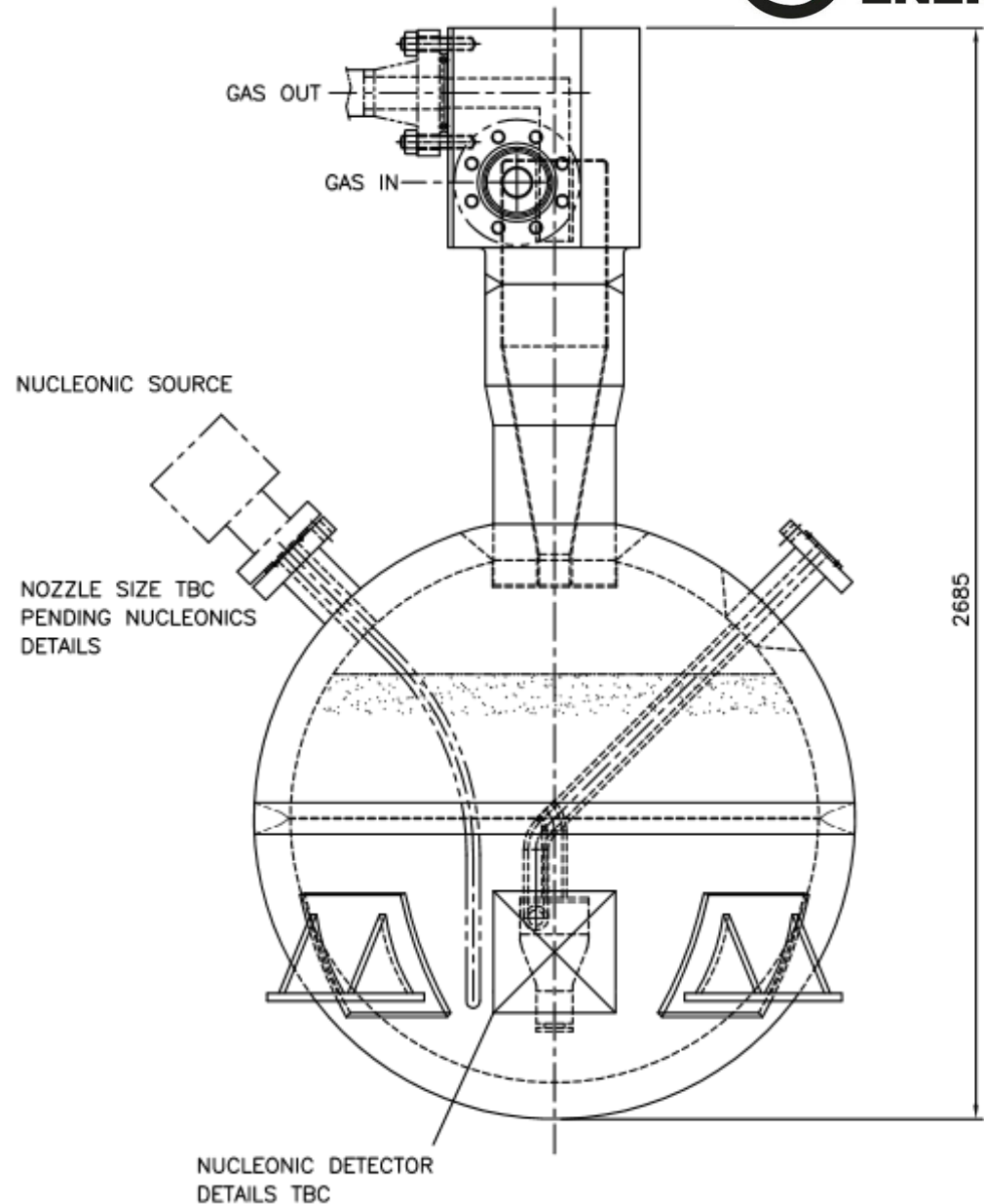
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- ❖ Subsea facilities (mostly conventional items)
  - ❖ Conventional subsea well and Xmas tree.
  - ❖ Subsea proppant cyclone, integrated with a solids accumulator, upstream of choke valve. Integral solids fluidisation unit for solids removal and collection.
  - ❖ Choke valve.
  - ❖ Chemical injection facilities including accumulator base flush.
  - ❖ Isolation proving facilities.
  - ❖ Pipeline.
  - ❖ Umbilical.
  - ❖ Subsea controls.
  - ❖ ROV interface panel.

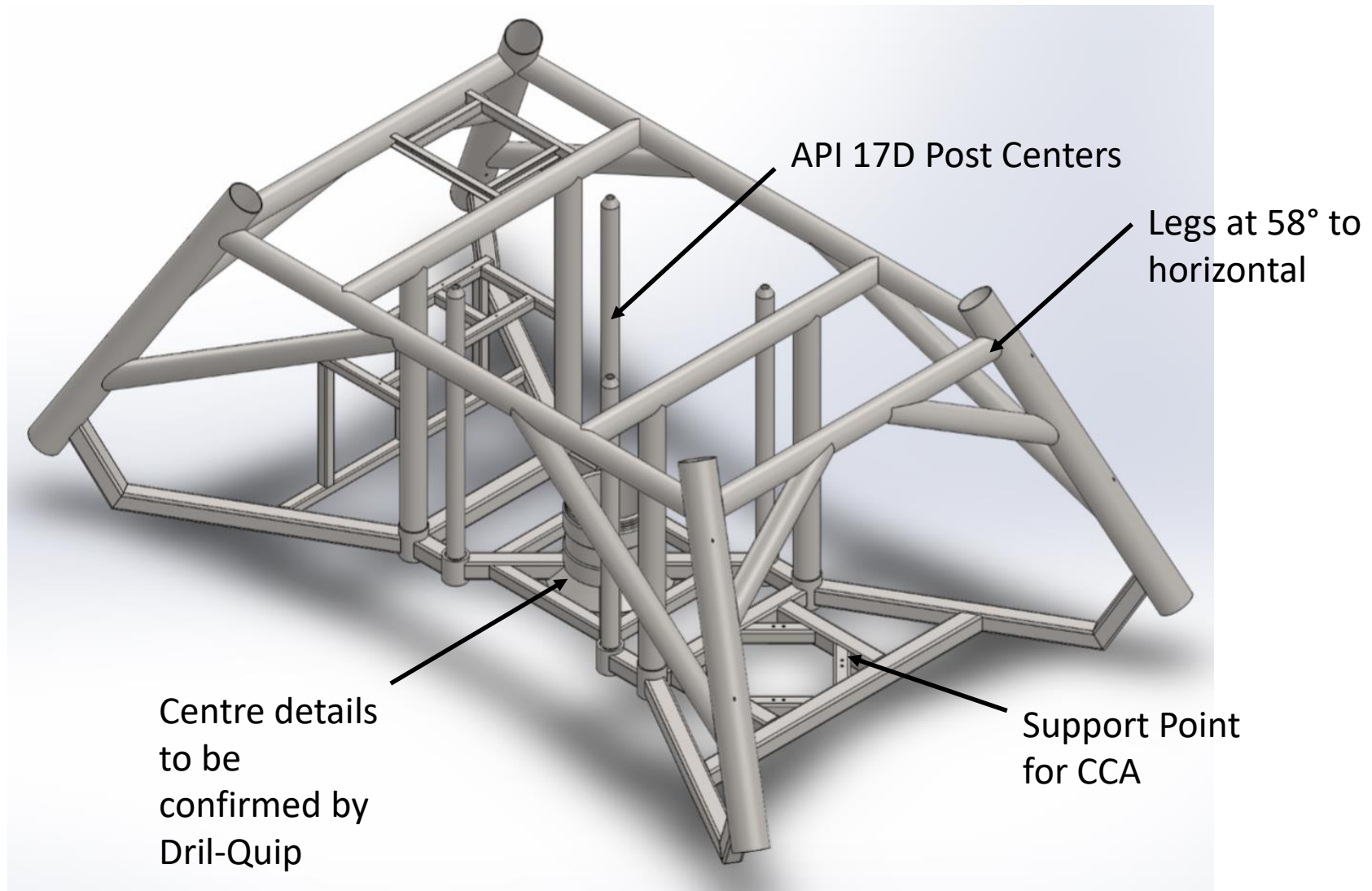
# Process Flow Diagram



- Combined Cyclone/Accumulator.
- Integral Nucleonic level detection.
- Integral solids fluidisation unit.



# Subsea Proppant Cyclone Facilities – PGB Design





# Subsea Proppant Cyclone Facilities

Subsea Control Module and Guide

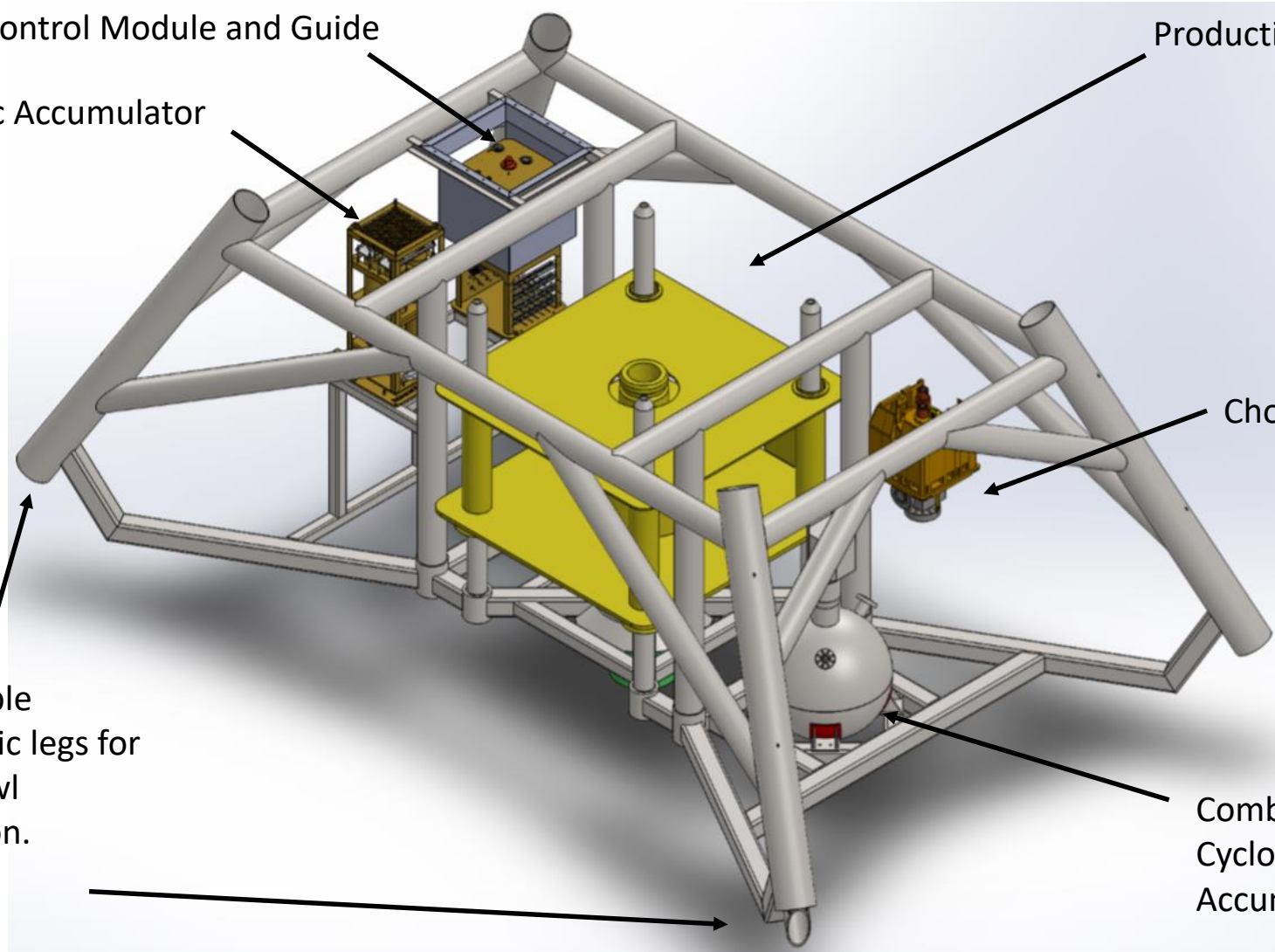
Hydraulic Accumulator

Production Tree

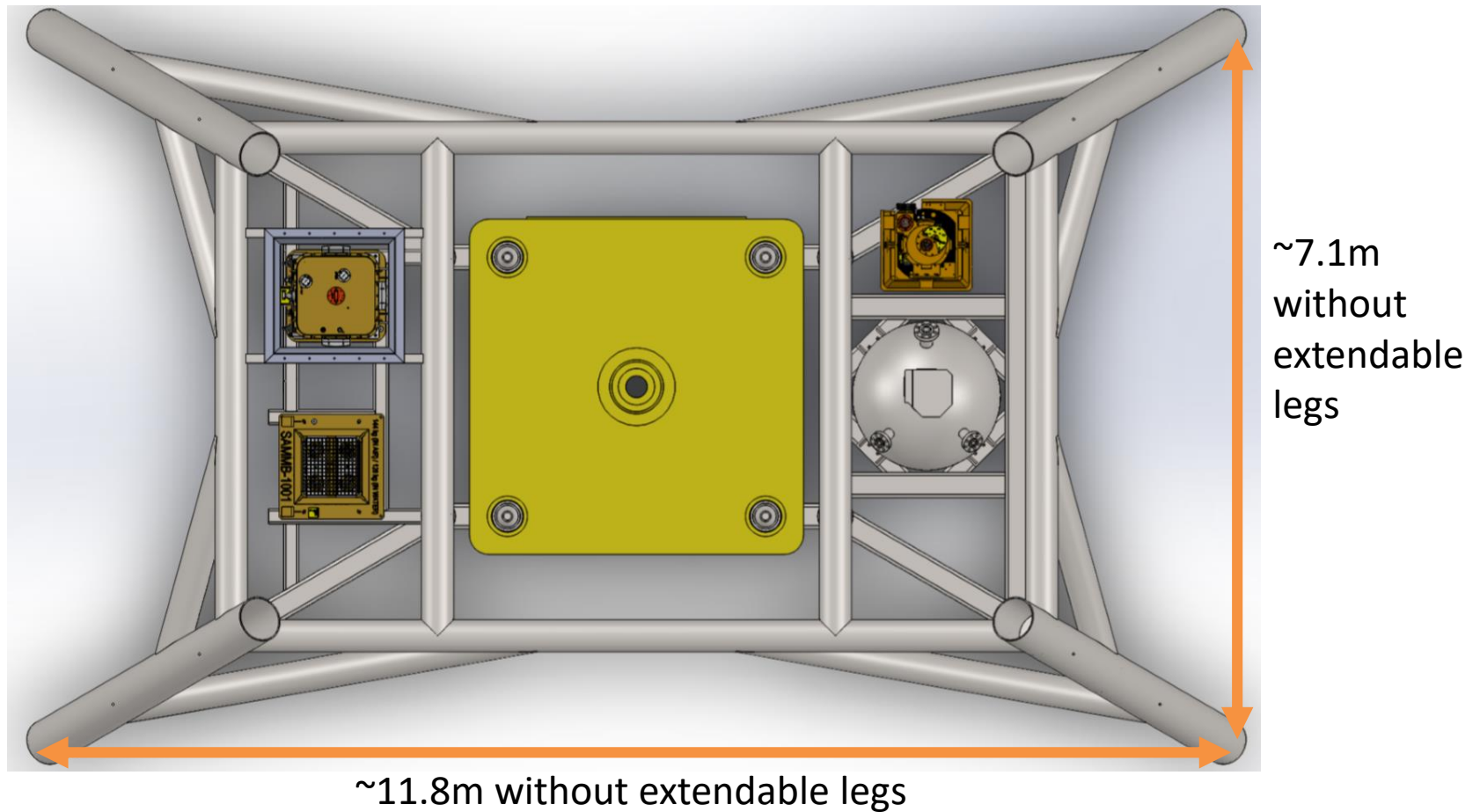
Choke Valve

Extendable  
concentric legs for  
over-trawl  
protection.

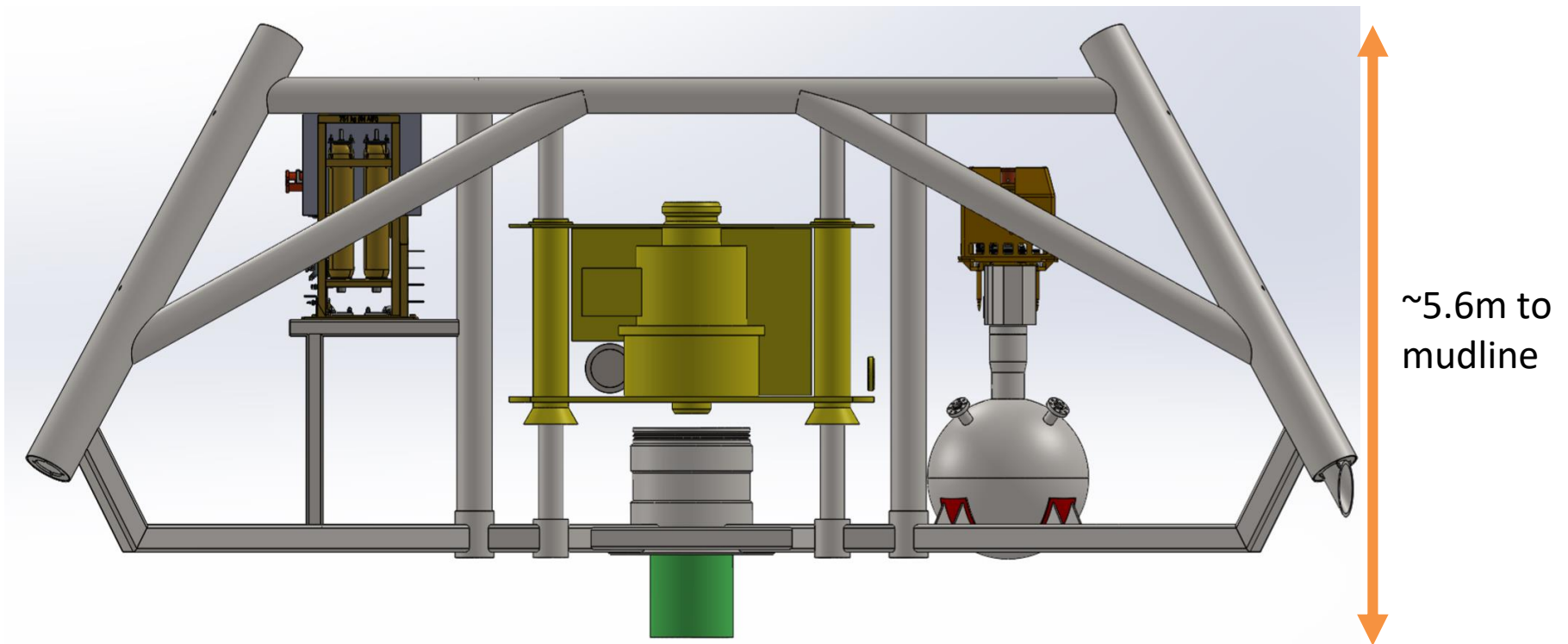
Combined  
Cyclone  
Accumulator



# Subsea Proppant Cyclone Facilities - Dimensions



# Subsea Proppant Cyclone Facilities - Dimensions

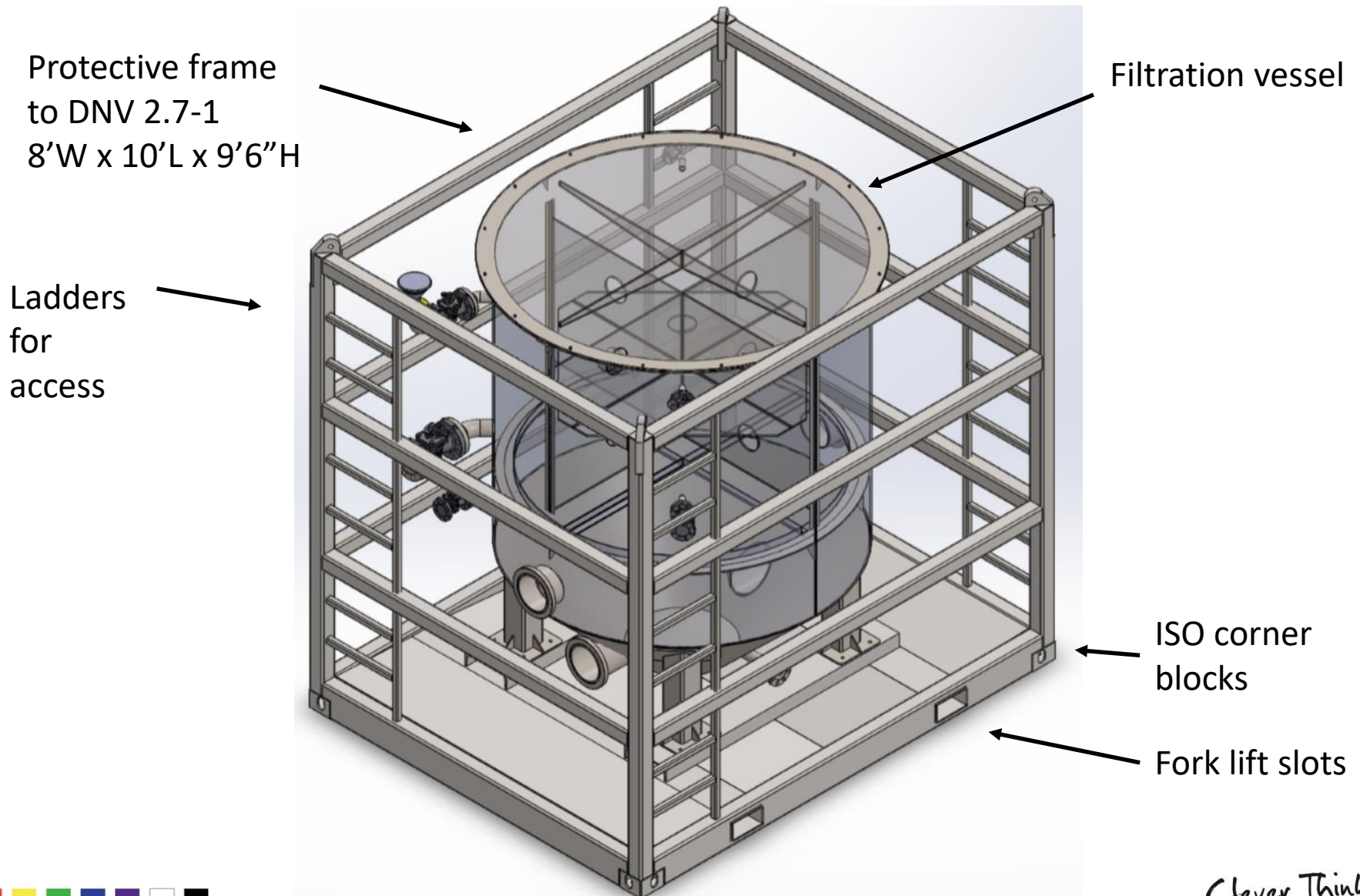


# Process Description - Ship

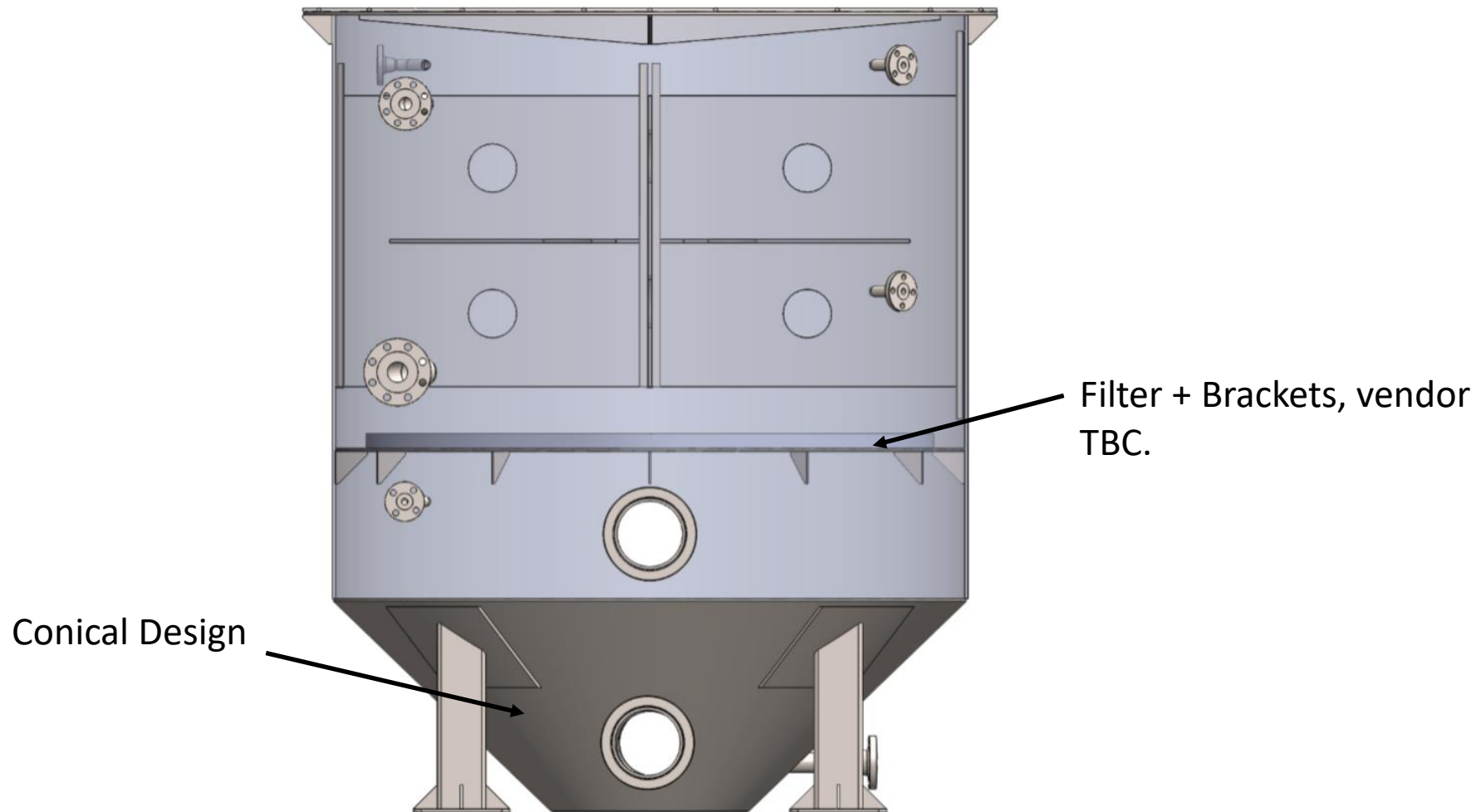
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- ❖ Ship facilities (all conventional items)
  - ❖ Solids collection tank
  - ❖ Solids removal pump
  - ❖ Hose deployment system (LARS – launch and recovery system).
  - ❖ Tooling umbilical + flushing stab unit

# Ship Based Facilities – Filtration Vessel Skid



## Ship Based Facilities – Filtration Vessel





# Ship Based Facilities – Pump Skid

Control Panel.  
Stops/starts  
Pressure and flow  
indication + trend  
Power incl.  
correction  
for frequency,  
voltage and  
phase rotation.

Provisional  
dimensions

Open sides  
frame

Piping  
Layout  
Design  
Ongoing

Hose  
Connection  
Point (to  
Filtration  
vessel Skid)

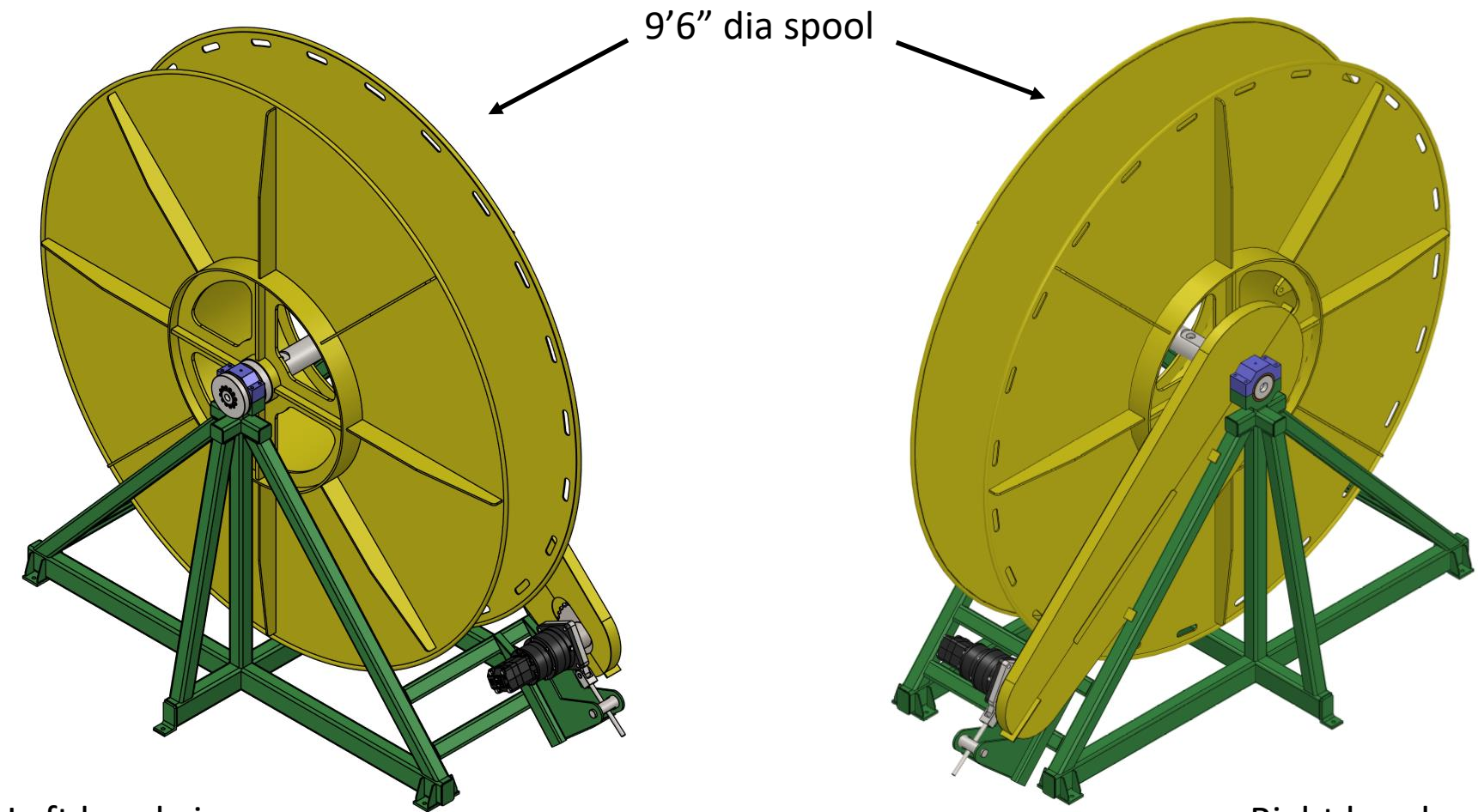
Hose  
Connection  
Point (to LARS  
Skid)

Currently 18ft x 8ft  
Container Size, to be  
reduced to 15ft x 8ft  
Container Size

Pumps A&B

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## Ship Based Facilities – LARS Skid Reel Drum



Sits on a skid: provisionally 7'W, 22'L and 11'6"H



# Process Description - Operation

- ❖ Conventional subsea well operation w.r.t:
  - ❖ J-T Cooling.
  - ❖ Pipeline flow regime.
  - ❖ Back-pressure control.
- ❖ Solids collected in combined cyclone-accumulator (CCA)
  - ❖ Indicated by level indicator
- ❖ Subsea production suspended for solids removal using ship-based systems and ROV: **THIS WILL TAKE LESS THAN 24 HOURS**

## Host Platform

1. Shut-in subsea system
2. Isolate
3. Prove (RIT or PBU)
4. Vent system (displace gas)
5. Host 'Lock-out'



## ROV/Ship

6. ROV 'Lock-out'
7. Vent isolation interspaces to prove.
8. SFU-wash.
9. Close all interspace vents
10. Remove ROV 'Lock-out'.



## Host Platform

11. Remove Host 'lock-out'.
12. Open choke.
13. Equalise export valves and open.
14. Close choke.
15. Equalise PMV and PWV.
16. Ready for restart.

# Solids Removal Frequency

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## ❖ *1 m<sup>3</sup> accumulator vessel:*

### ❖ Low solids producer:

❖ 0.1lb/MMSCF @ 10MMSCFD= 166kg/yr or 88 litre/yr bulk.

❖ So visit every 10 years.

### ❖ Solids producer:

❖ 1lb/MMSCF @ 30MMSCFD= 4,977kg/yr or 2.6 m<sup>3</sup>/yr bulk.

❖ So visit every 20 weeks.

### ❖ Well-clean up:

❖ 5lb/MMSCF @ 30MMSCFD= 24,866kg/yr or 13.2 m<sup>3</sup>/yr bulk.

❖ So visit every 3.5 weeks.

# Subsea Proppant Cyclone

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## QUESTIONS