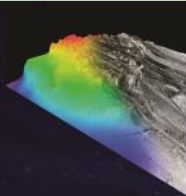




# XT Subsea Valve Skid - Life of Field Extension

AOG 2019, 14<sup>th</sup> March 2019

Dr Lev Roberts-Haritonov, General Manager, Subsea Engineering

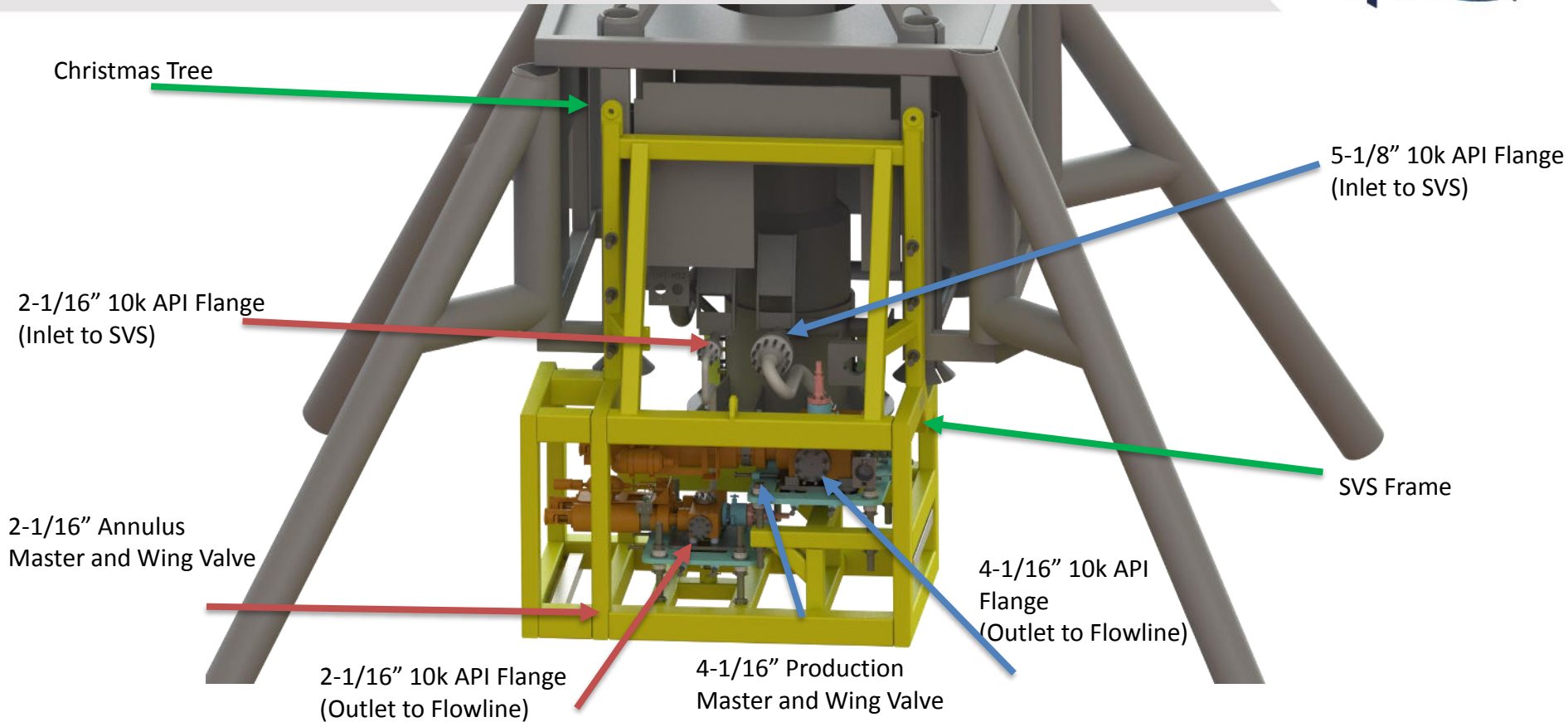


# Problem Statement



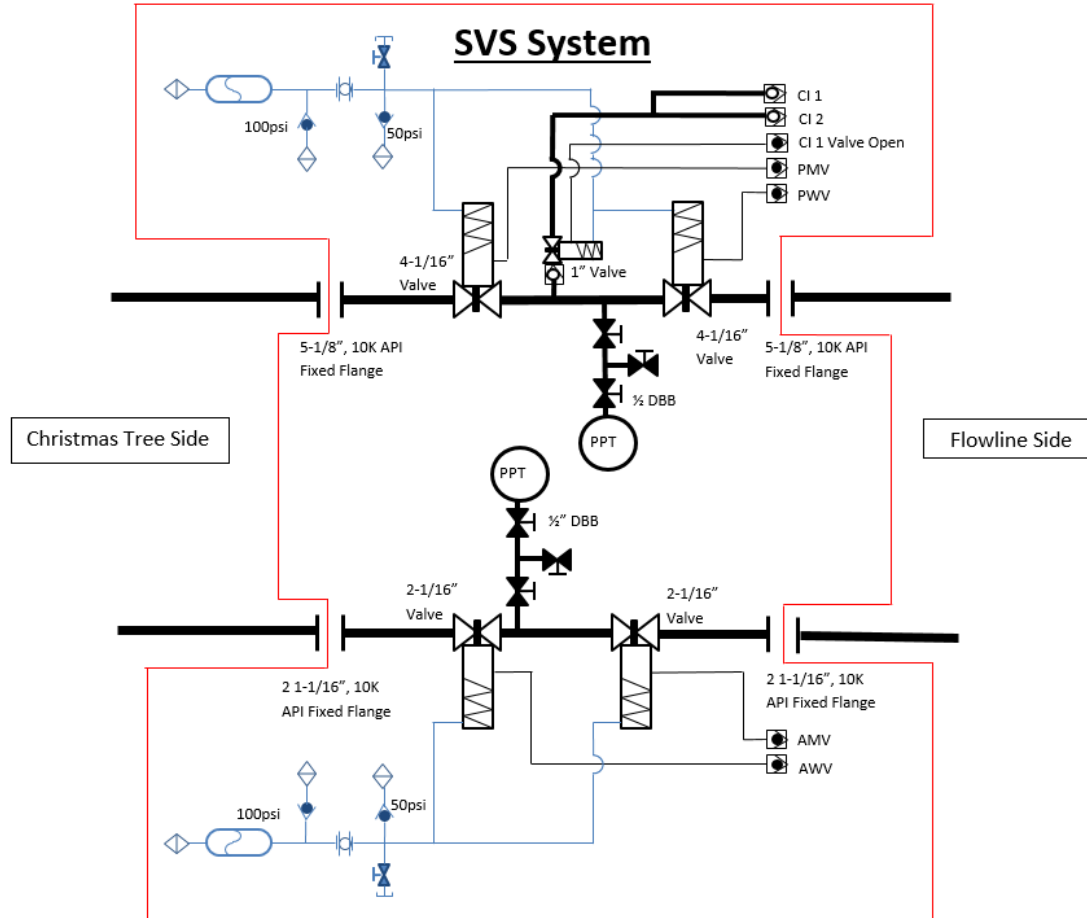
- ⌵ Subsea oil field has several years of operational life remaining
- ⌵ Subsea Tree (XT) Production and Annulus Master, and Wing Valves showing poor reliability – pressure barriers near compromised
- ⌵ Client Operator forced to plan a complete XT change out
- ⌵ Diver survey resulted in **very** low confidence in XT tie-in point locations (5-1/8" & 2-1/16" Flanges)
  - XT Production and annulus outlet flanges found to be substantially misaligned
    - Significant uncertainty in survey data
    - $\pm 50\text{mm}$  misalignment in each of  $x$ ,  $y$  and  $z$
    - $\pm 3^\circ$  angular misalignment in each of  $\phi_x$ ,  $\phi_y$ ,  $\phi_z$
- ⌵ Neptune Subsea tasked to find solution to avoid costly production downtime and XT change-out
- ⌵ A solution that would work right first time on installation

# SVS System Overview – XT Interface

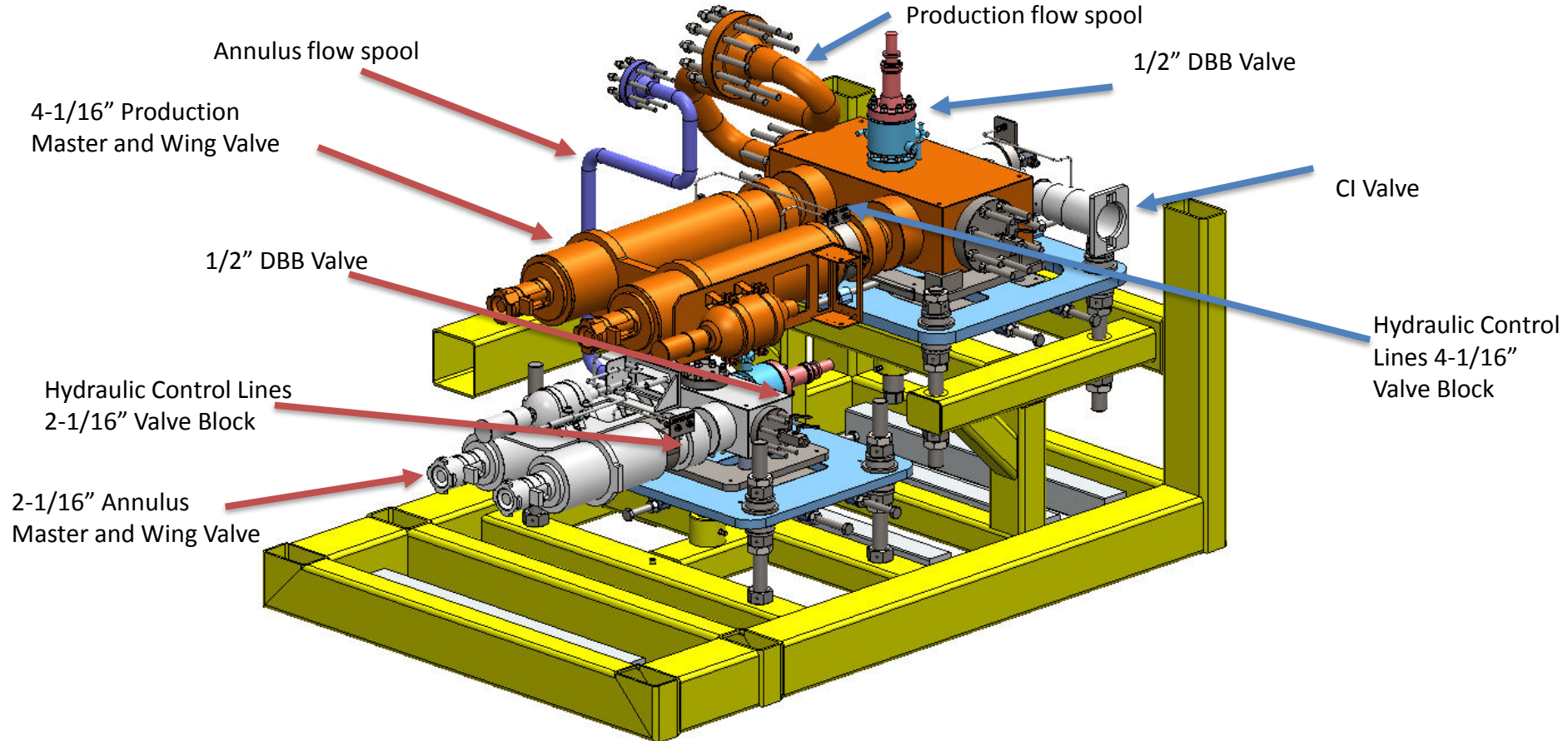


SVS is designed, manufactured and tested to API 6A, API 17D and DNV 2.7-3.

# SVS System P&ID-replacement pressure barrier



# SVS System Overview – Internal Components





# Solution – Stage 1 of 5



- ✚ Locating position of XT tie-in points and drilling mounting points on XT frame using a bespoke template with adjustable flanges.
- ✚ The flange positions represent the “impression” of the actual XT outlet positions

Diver Drill Alignment  
jig and template

Christmas Tree

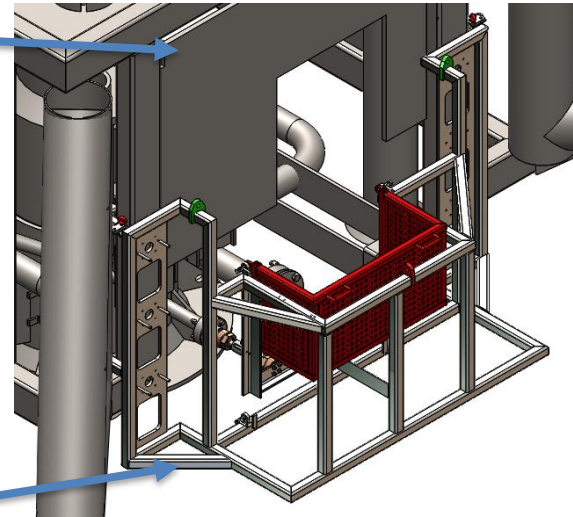
Protective Cage  
(rotates to protect flanges  
from impacts during  
lifting operations)

2-1/16”  
Adjustable Flange

5-1/8”  
Adjustable Flange

Drilling Template

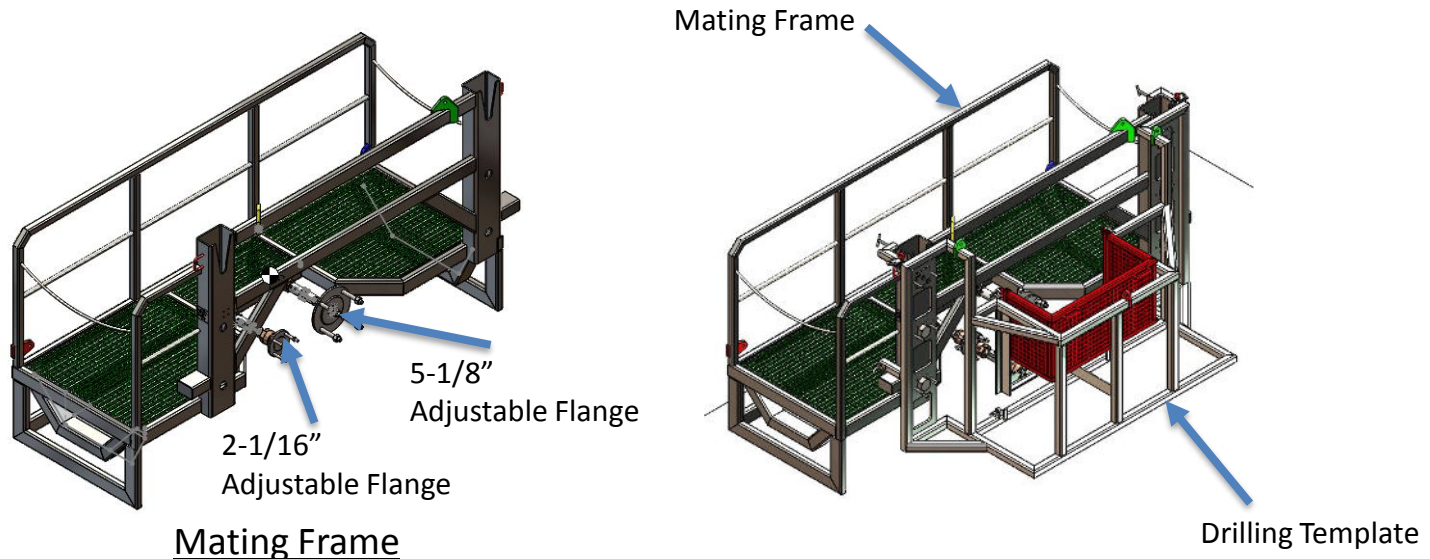
Drilling Template



# Solution – Stage 2 of 5



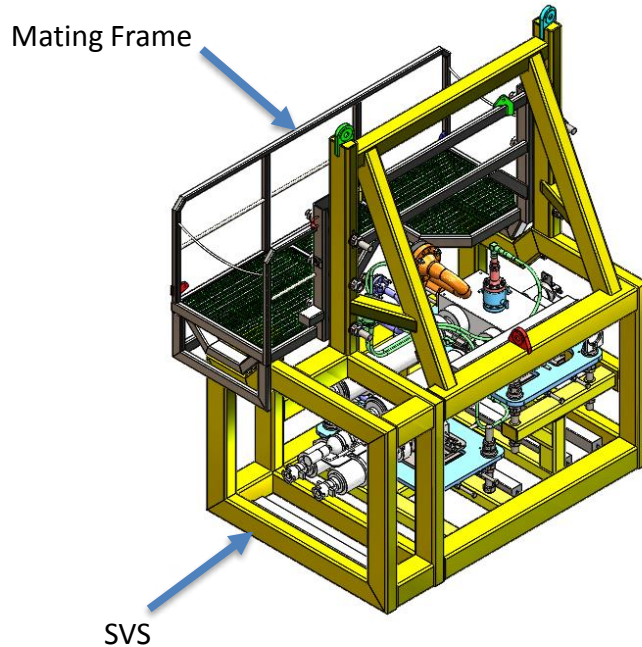
- Recovery of drilling template to surface and interface with Mating Frame.
- Mating Frame flanges are aligned with tie-in points on XT.
- The position of the flanges on the Mating Frame then represent the actual positions of the flanges on the subsea Christmas Tree.



# Solution – Stage 3 of 5



- ✚ Mating Frame interfaced with SVS to align flanges with Mating Frame and thus XT outlet position.
- ✚ The SVS will then have taken up the misalignment of the XT outlet flanges.



Positions of the two valve blocks are adjusted:

**Vertically** – using vertical jacking screw

**Laterally** – using lateral/transverse jacking screws

**Rotationally** – using central ball joint



# Solution – Stage 4 of 5



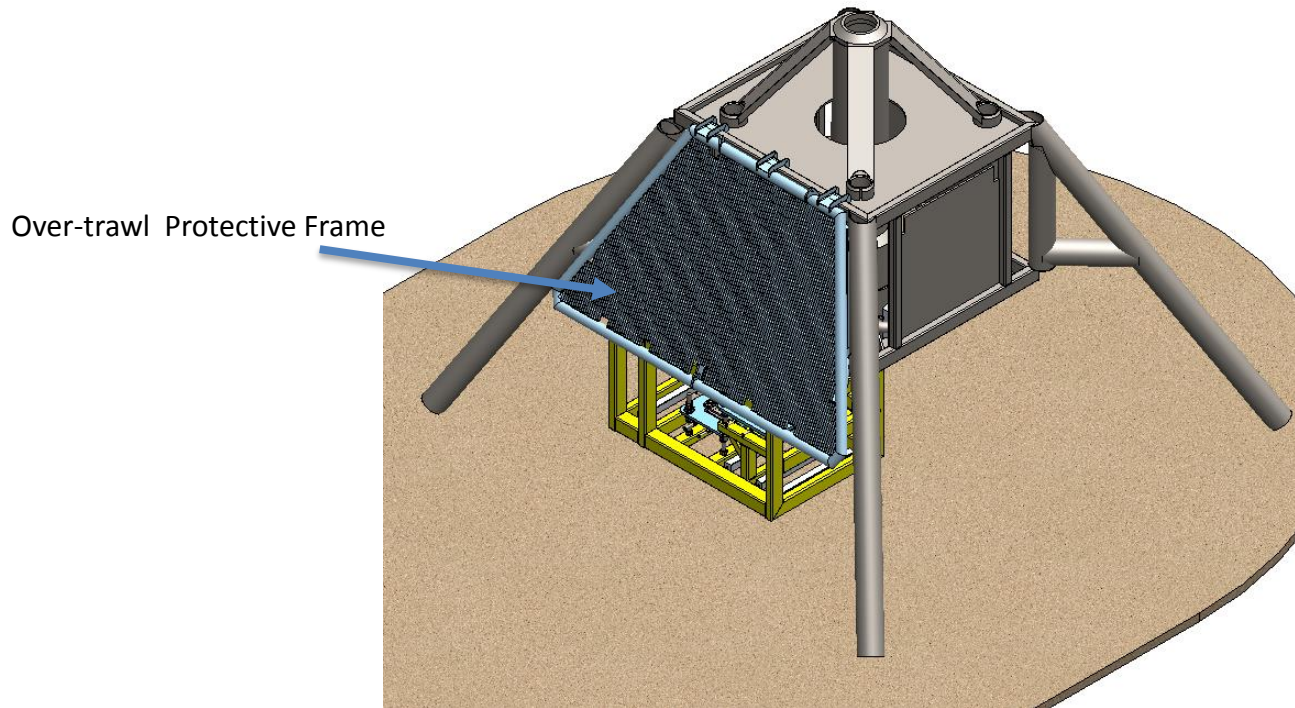
- SVS lowered subsea and secured to pre-drilled holes on XT frame (from Stage 1).
- Flanges are already aligned and ready to be made up (no subsea alignment needed).



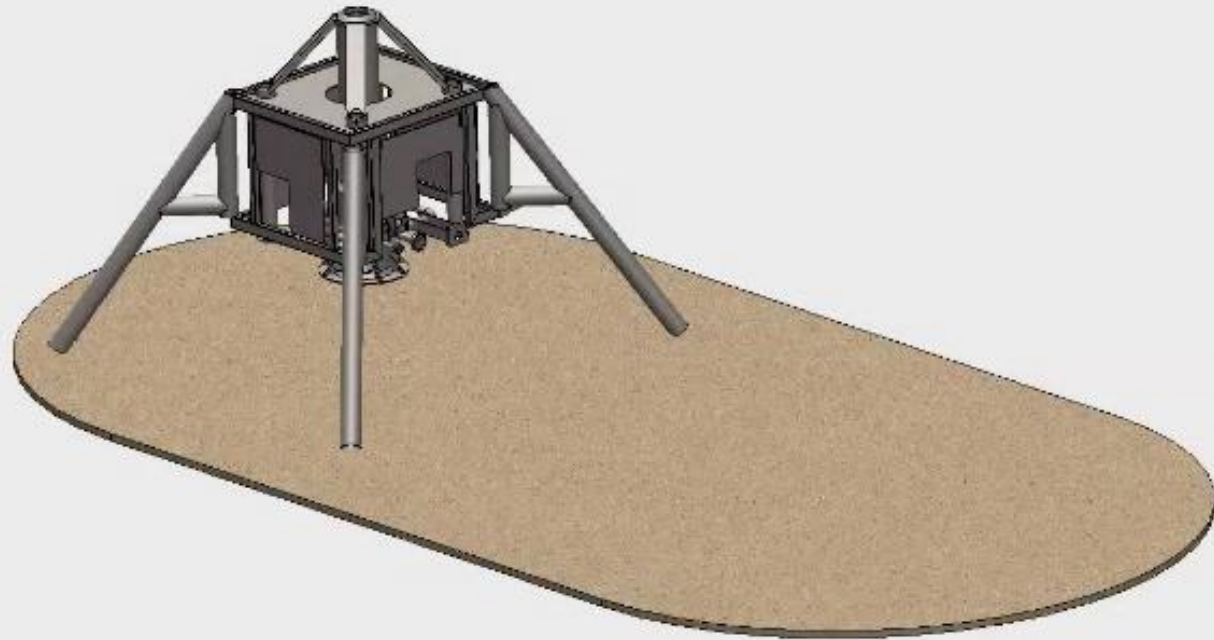
## Solution – Stage 5 of 5



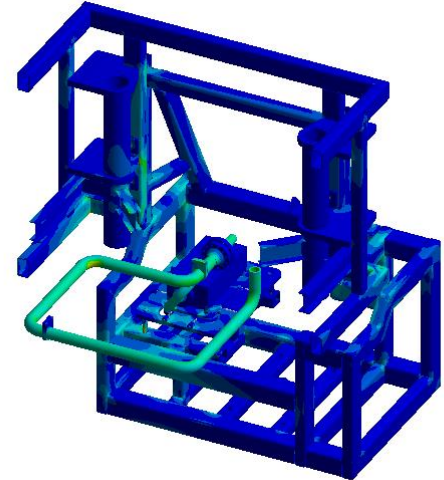
- Over-trawl protective frame lowered subsea and secured



# SVS installation animated sequence



- ✚ SVS underwent full design and analysis process. Considerations included:
- Flow assurance and erosion
  - Cathodic protection
  - Lifting analysis
  - Operating conditions – full thermal and pressure analysis
  - Reaction loads on XT frame
  - Effects on the existing XT flow lines



# Testing



- ✚ Full Factory Acceptance Testing (FAT) & Site Integration Testing (SIT) program
- ✚ Successfully commissioned offshore on three Christmas Trees.





Thankyou!



⇒ Questions