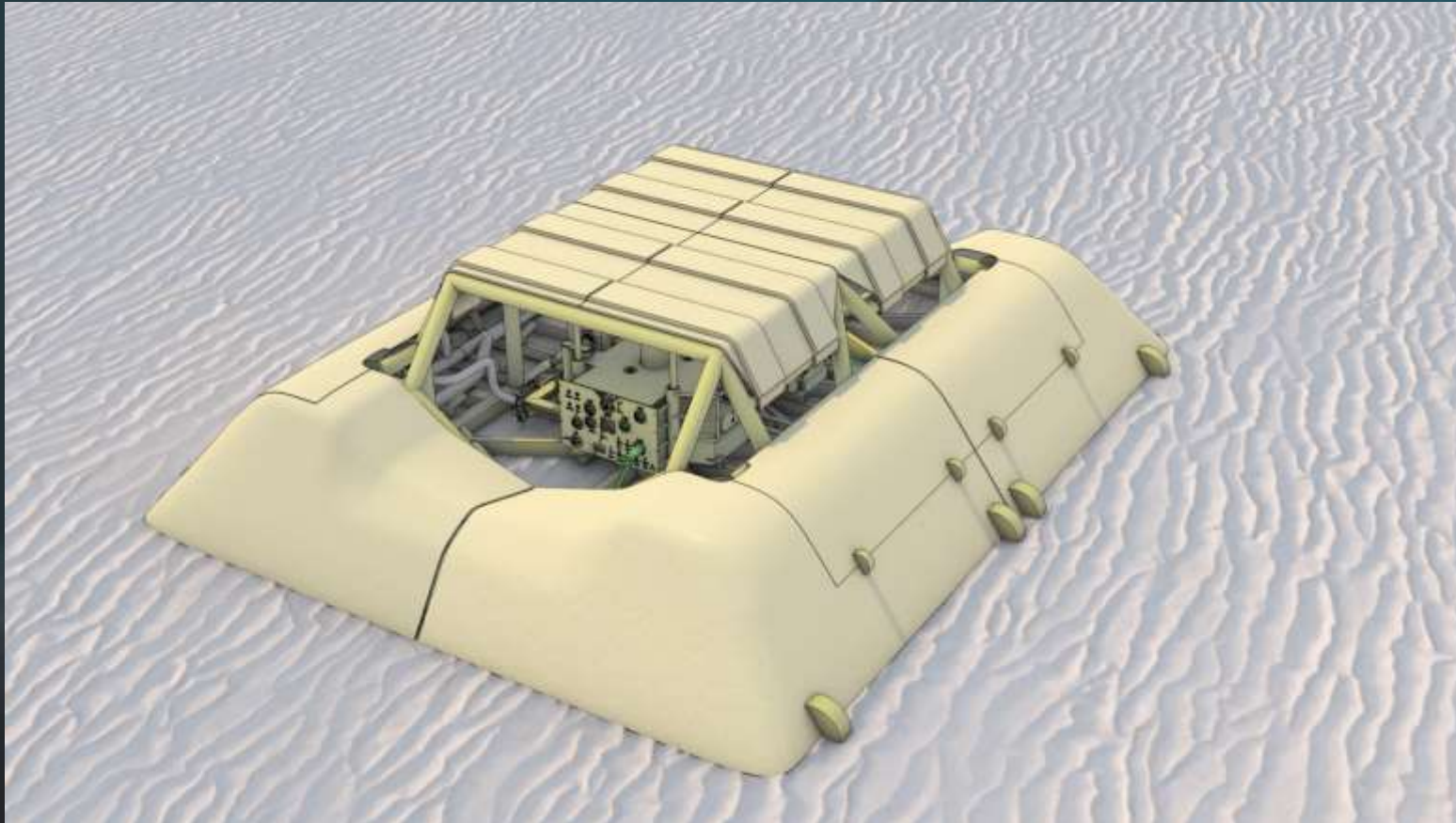


# The TURTLE Concept

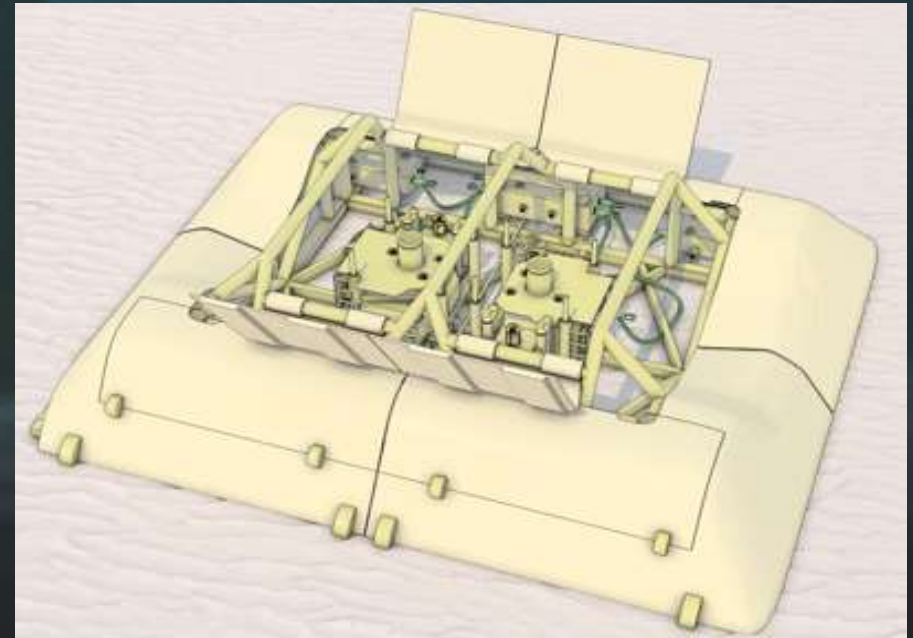
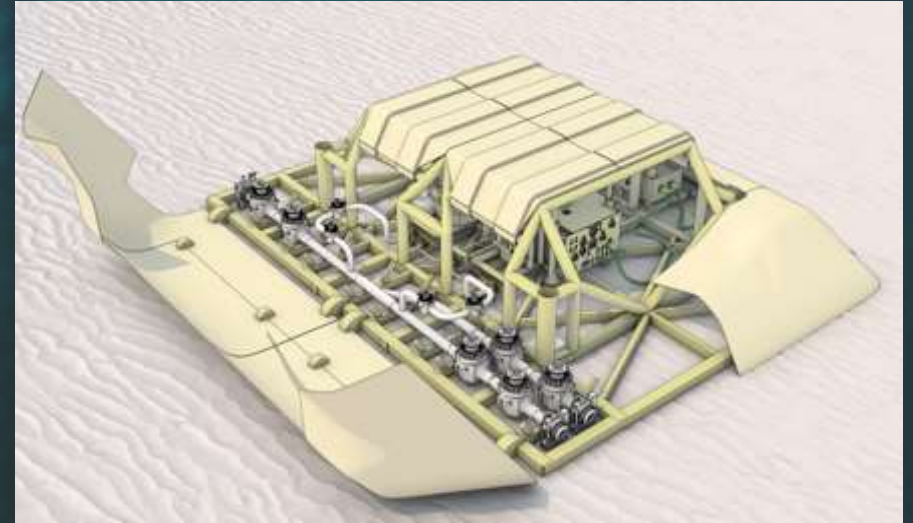


## Contents:

- General Assumptions
- The Turtle In Brief
- Why Developing the Turtle
- Turtle Lay Outs
- A Field Presentation
- The Delta TURTLE Concept

## General assumptions

- It must be possible to develop an overall system that integrates all of the existing equipment packages and subsea items into as few structural components and locations as possible
- Possible to arrive at the best flexibility and the best overall lifespan cost efficiency
- The system can be utilised in field locations where single satellites normally are required as well as in locations that normally would favour a dual satellite and or a three- slot system that now uses a four slot unit



## The TURTLE In Brief

T = The X-mas Trees are located along the centre line of the structure

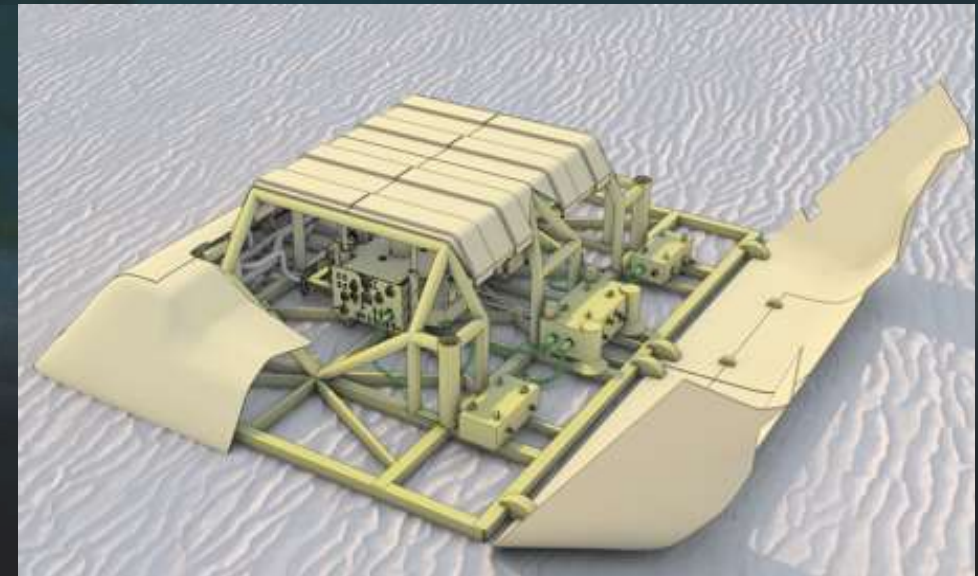
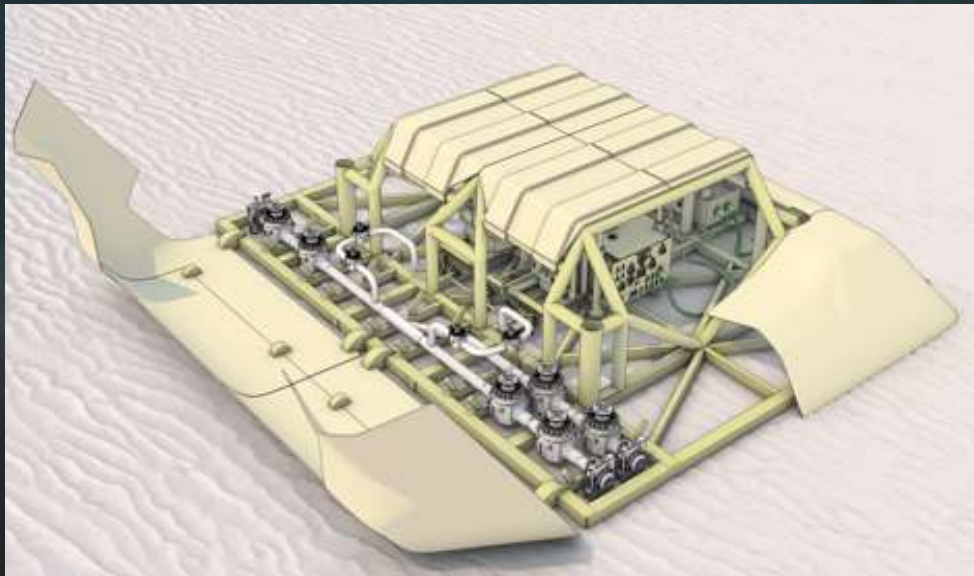
U = Umbilical assemblies and manifold piping are located at each side of the structure

R = ROV/ AUT access optimisation and storage provided within structure

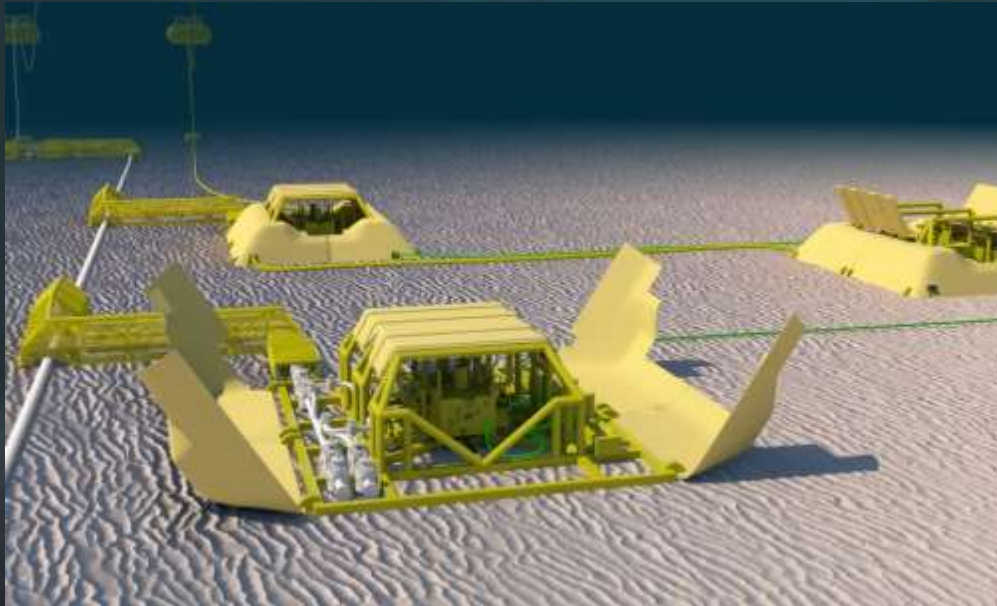
T = Tie-in porches may be heavily simplified, even eliminated

L = Low overall centre height as well as stepping down to a low structure height at sides

E = Elevation reduction to positioned equipment result in reduced protection requirements

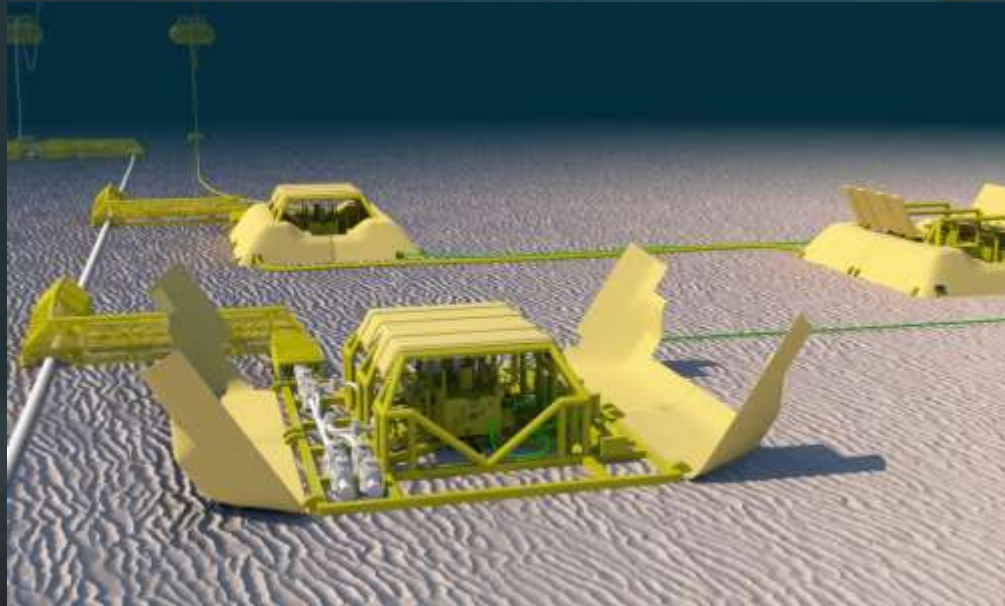


## Why develop the Turtle?



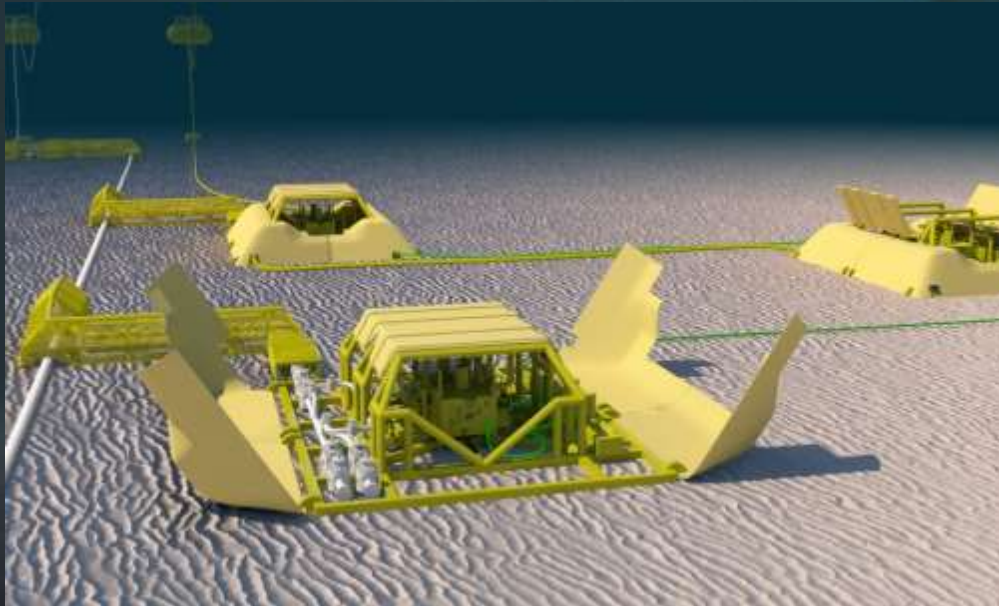
- To be a low cost alternative
- Have low weight
- Have minimal footprint on the seabed
- Allow maximum protection to sensitive equipment
- Allow maximum see through for ease of visual inspections
- Allow alternative installation methods and vessel types & configurations to be employed
- Be modular to allow lighter vessels to perform parts of transportation and installation
- Allow both water injectors and producers within the same structure
- Allow full protection of all tie-in areas
- Allow direct deployment and lay-in of rigid spools with ends in positions to perform tie-ins
- Allow direct lay in of flexible tails and alike with ends in positions to perform tie-ins
- Allow direct lay in of umbilical end terminations to template / satellite receiving unit to simplify connections to existing production and control systems

## Why develop the Turtle?



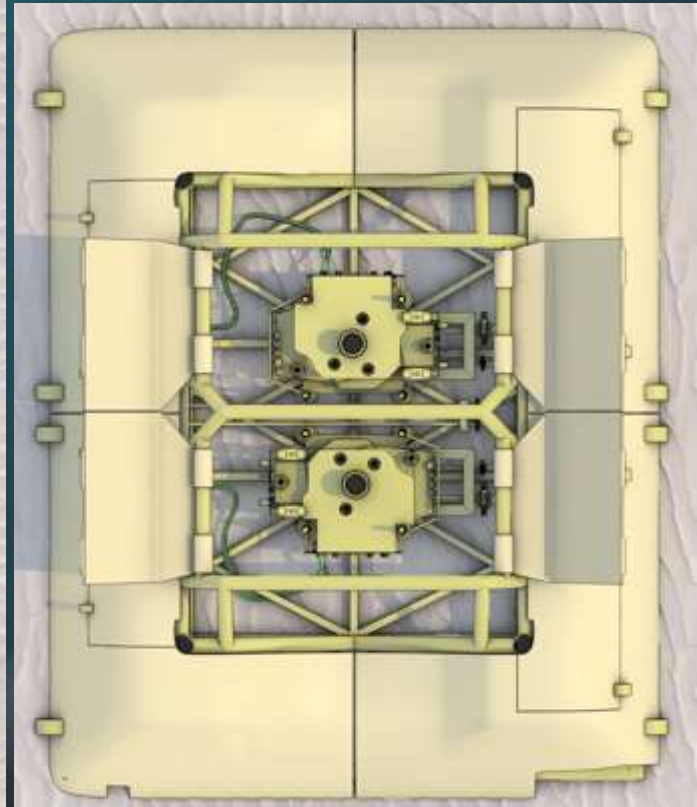
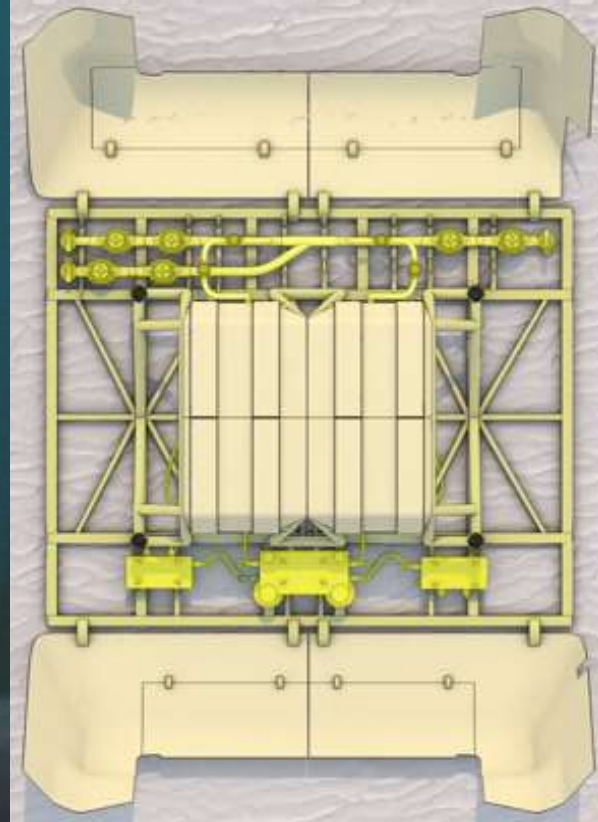
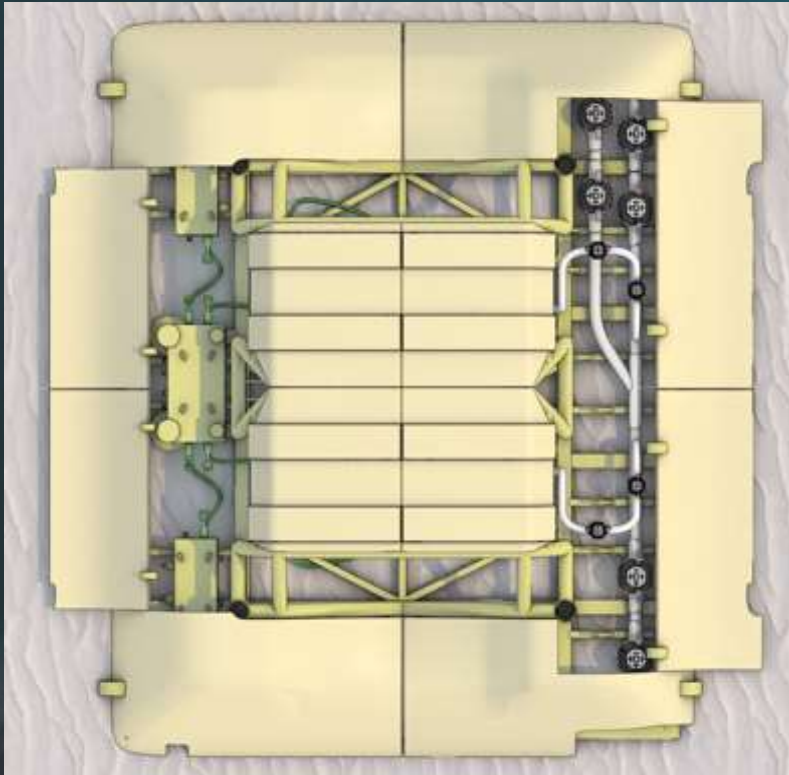
- To allow implementation of all new / planned for AUV and ROV solutions on the market.
- To allow implementation of increasing digitalisation requirements to existing inspection and control systems, as well as new systems and routines implemented for the day-to-day operational control
- To allow change out of discretised pipe runs in manifolds without a total shut down of the unit in case major repairs i.e. double manifold piping can be incorporated
- To allow easy change out of valves etc. without disconnection to spools or x-mas trees when such features are designed for in the installed components
- To allow through pass of well stream in separate pipe runs that can be preinstalled or retrofit to template to save a direct tie-in point to an inline tee or pipeline connection point etc.
- To allow use of all known X-mas tree solutions & concepts
- To allow all known types of foundation systems inclusive piling and suction anchors to be allowed implemented in the design

## Why develop the Turtle?



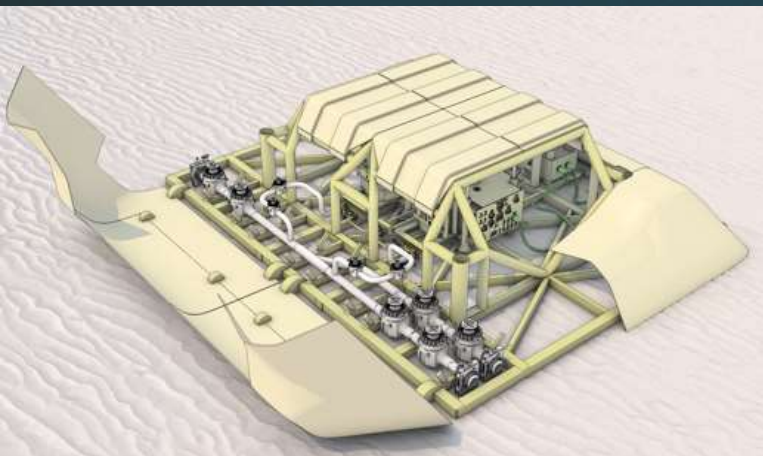
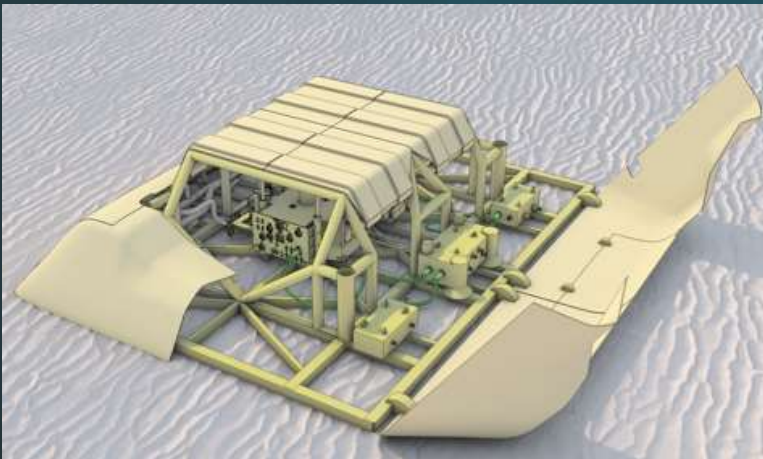
- To allow connection of step outs, added wells, etc.
- Ensure sensitive equipment such as X-mas trees is located in the centre of the structure to minimise the overhead protection structures.
- Ensure manifold and valve piping can be located to one side and at a low elevation
- Ensure umbilical termination units and umbilical systems can be located to the other (opposite) side of the structure and at low elevation
- Direct integration of tie-in spool at low elevation, even without a dedicated tie-in porch if the spool system allows
- Include easy - to - operate and low – height fully enclosed protection structures above the areas housing manifolds, tie-in areas and umbilical, controls, pods and alike, underneath

Typical layouts  
(manifolds, controls, hatches)



## Layouts

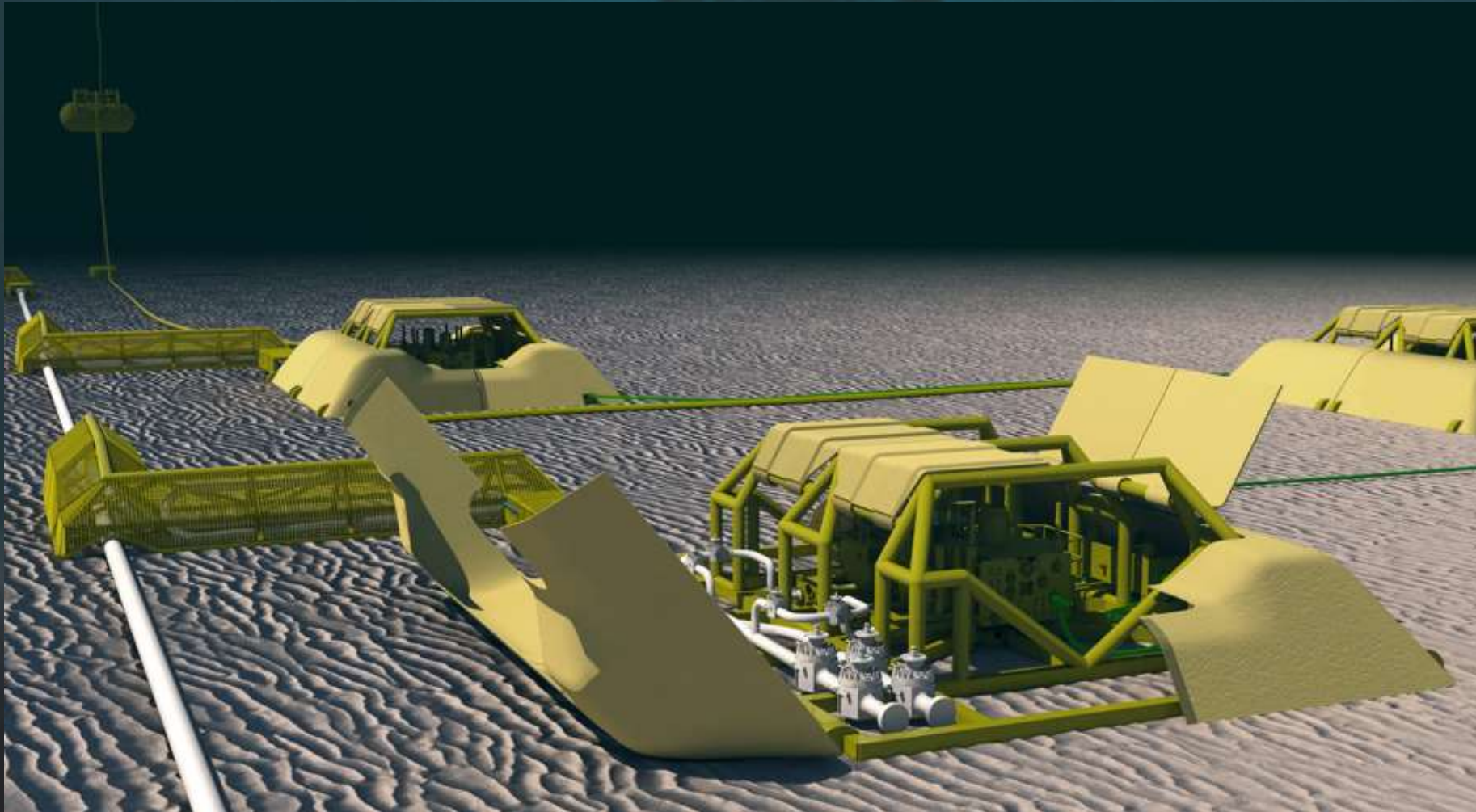
- Manifold systems to one side
- Umbilical systems to one side
- Centralised trees
- Various Hatch combinations





A field presentation including:

- Turtle Dual Tree System
- Step Outs
- The STING
- Pipeline Tees



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