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Use of Novel Technologies for the Development of Epsilon field

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ENERGIA, 1st Energy Tech Forum
April 1st, 2016- Athens Technopolis Gazi

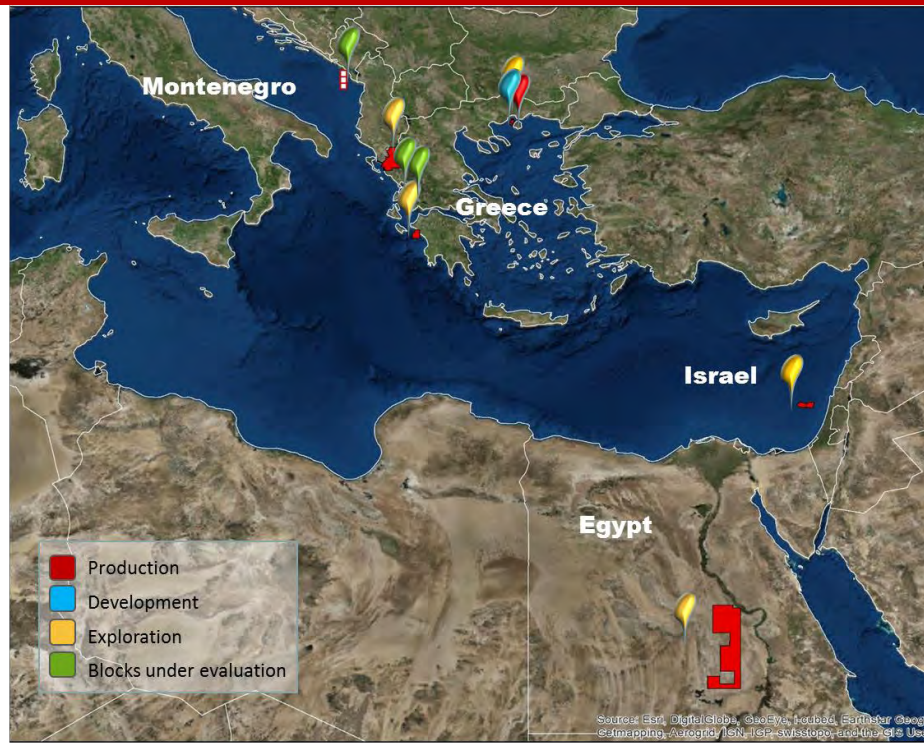
Agenda

1. Who we are
   - Energean Operations and the Prinos Basin

2. Epsilon Development Overview
   - Engineering and Construction Methods

Energean at a glance

- A private E&P company focused in the Mediterranean and North Africa
- The only Oil & Gas producer in Greece with current production of 3,000 bbls/day and infrastructure capacity up to 30,000bbls/day
- 30 mmbbls 2P Reserves & 28 mmbbls 2C Resources
- BP offtake agreement- 6 year term
- $200 ongoing million investment plan to increase production to 10,000 bbls in 2016/17 - 15 wells, 2 already drilled
- Owned Offshore drilling rig and supply boat
- Exploration Upside in Western Greece, Egypt and Montenegro
- Unparalleled HSE track record of 35 years as an offshore operator and producer of hydrocarbons in environmentally sensitive areas and high H_2S concentrations
- 400 highly qualified professionals in Kavala and Athens
- Strategic Investment by Third Point, a major US fund and Private Greek Shareholders



Overview of the Prinos Basin

Background

- Energean has, over the last 30+ years, successfully managed the exploration, appraisal, development and production operations for a technically complex group of assets in the north Aegean Sea.
  - Pristine environmental location 5km from tourist resorts
  - High pressure fields located pre-salt
  - Hydrogen Sulphide concentrations up to 60% in gas phase
  - Significant Carbon Dioxide concentrations
  - Offshore: minimum-manned platform operations
  - Onshore: processing complex including sulphur production
  - Operation of own drilling and workover rigs
  - SPM Buoy and tanker loading operations
  - Marine logistics fleet
- Success underpinned by sound engineering and operations practices and rigorous application of HSE-MS and HEMP principles

Beaches of Thasos Island

Prinos complex: 5km from Thasos island

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Existing Offshore Facilities & Drilling

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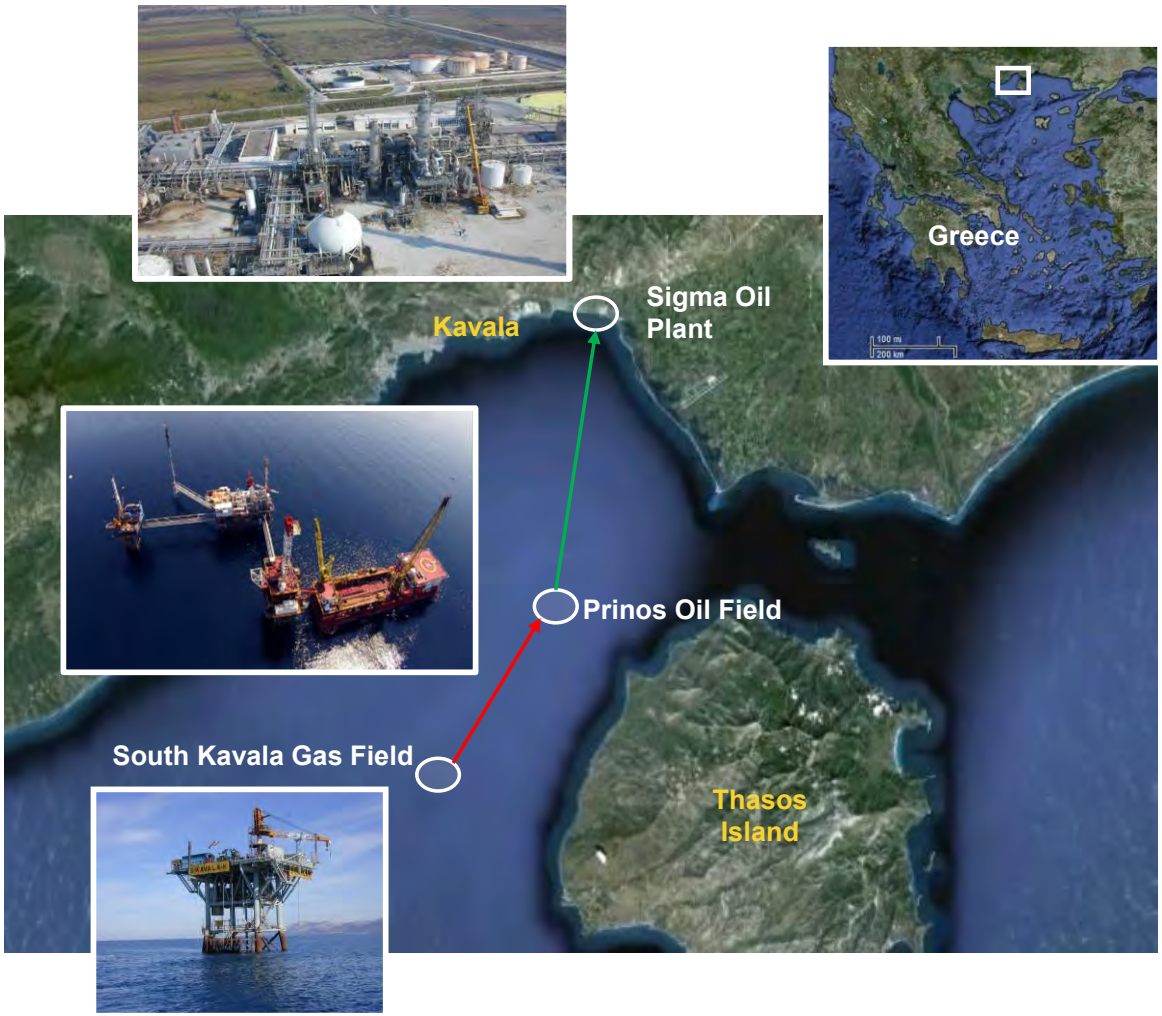
Prinos Basin assets

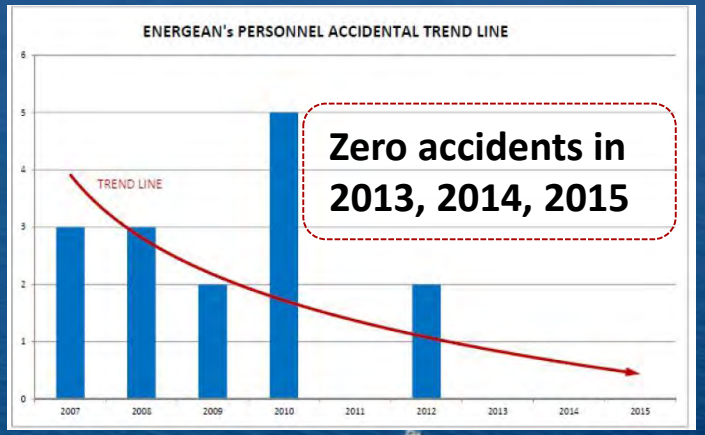
- Prinos complex comprises four platforms:
  - 2 drilling jackets
  - 1 process platform (Delta)
  - 1 flare platform
- South Kavala (sweet) gas field ties back to Prinos
- Prinos Delta:
  - Gas Oil separation and gas dehydration
  - Water Oil separation and water treatment/disposal
  - Sea water treatment for water injection
- Dry gas and dehydrated oil sent to onshore processing plant (Sigma):
  - H2S removal (amine)
  - Sulphur production (claus)
  - Oil de-salting and stabilization
  - Condensate and LPG production
  - Power generation
  - Crude storage and loading via SBM
- Prinos field:
  - 18km from Sigma
  - 12km from South Kavala



HSE Mission

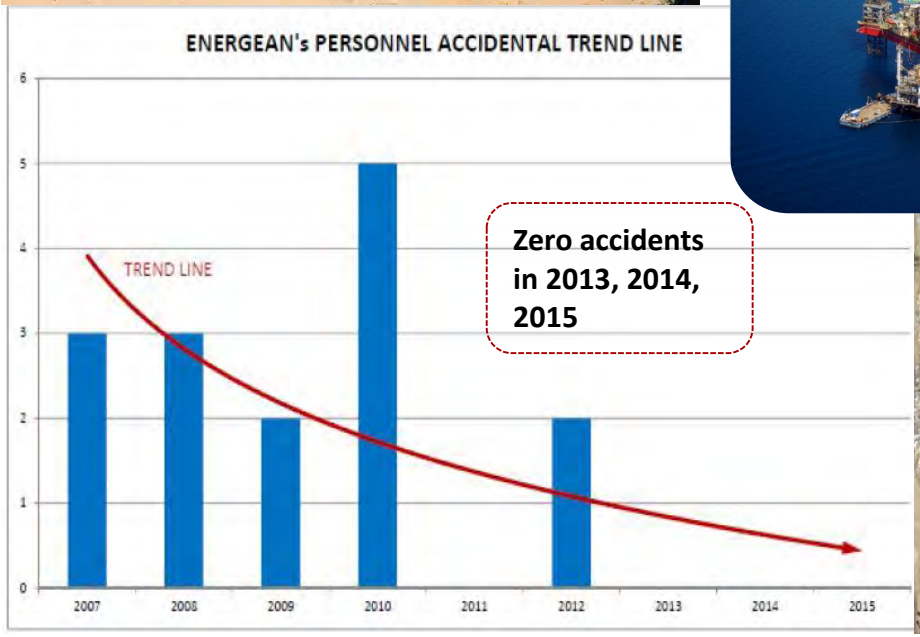
To transfer our 35 Years experience of working safely in environmentally sensitive locations in NE Greece to every area we operate

Kavala and Thasos:
15 blue flags every year
for the last 15 years



Prinos Production Complex: 18km from Kavala, 7km from Thasos Island

The Prinos Experience - E&P can co-exist with Tourism



Zero accidents in 2013, 2014, 2015

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CSR - Strong Relationships with the local communities

Kavala Special Education Elementary School, Donation for educational and cultural purposes , February 2015

Nautical Club Of Kavala, Sponsorship of 2015 World Finn Master Championship, May 2015

Kavala, Association for the Visually impaired, Donation of laptops with special software, June 2015

OUR VISION is to become a leading independent E&P company. Our primary objective is to create value for all our stakeholders and be capable of sustainable economic growth, by being dynamic and innovative. By adhering to our corporate principles and values we aspire to be a responsible corporate citizen and to be recognized as a global champion in sustainability issues".

Kavala, Volunteer Firemen, Donation of personal protection equipment, August 2015

Annual Volunteering Sea-shore Cleaning

Close collaboration with TEI KAVALA:
90 hrs of training - 40 hrs of lectures- 10 scholarships for post graduate studies - 65 internships- 30 people employed, in 2007-2014

Epsilon Field Development

Engineering and Construction Methods

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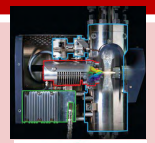
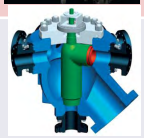
Overview of Technologies applied in Epsilon Development

Technology		Safety	Environment	Installation	Operation & Maintenance	Production Performance
Multiphase Flow Metering		✓			✓	✓
Multi port Flow Selector		✓		✓	✓	✓
Self Installing Platform		✓	✓	✓	✓	
Strand Jack Installation				✓	✓	
Suction Pile Technology			✓	✓		
Tender Assist Drilling & mooring		✓	✓	✓		
Pipeline Wet Towing		✓	✓	✓		
Normally Unmanned Installation		✓	✓		✓	

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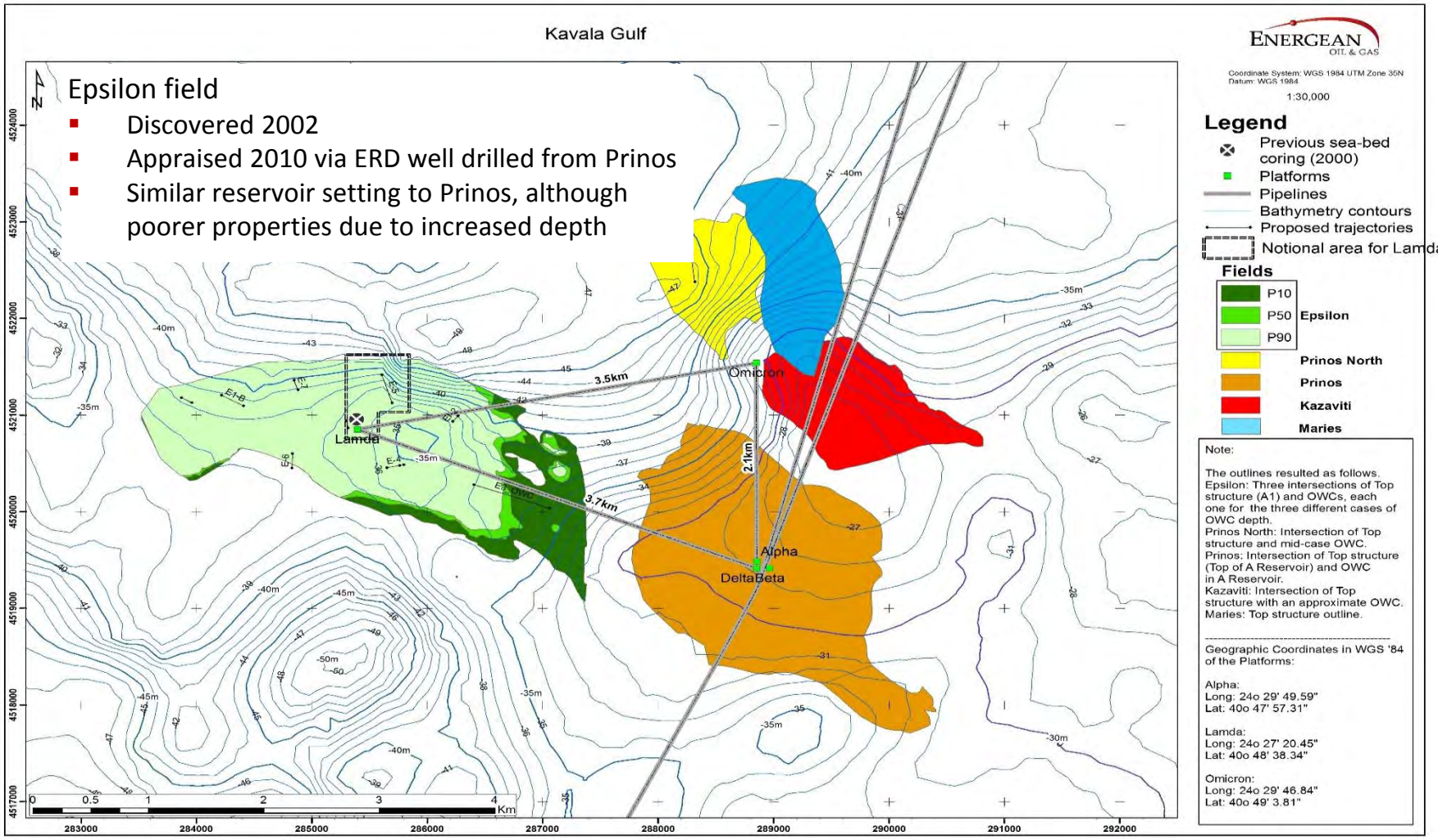
Prinos Basin - Epsilon Field Green



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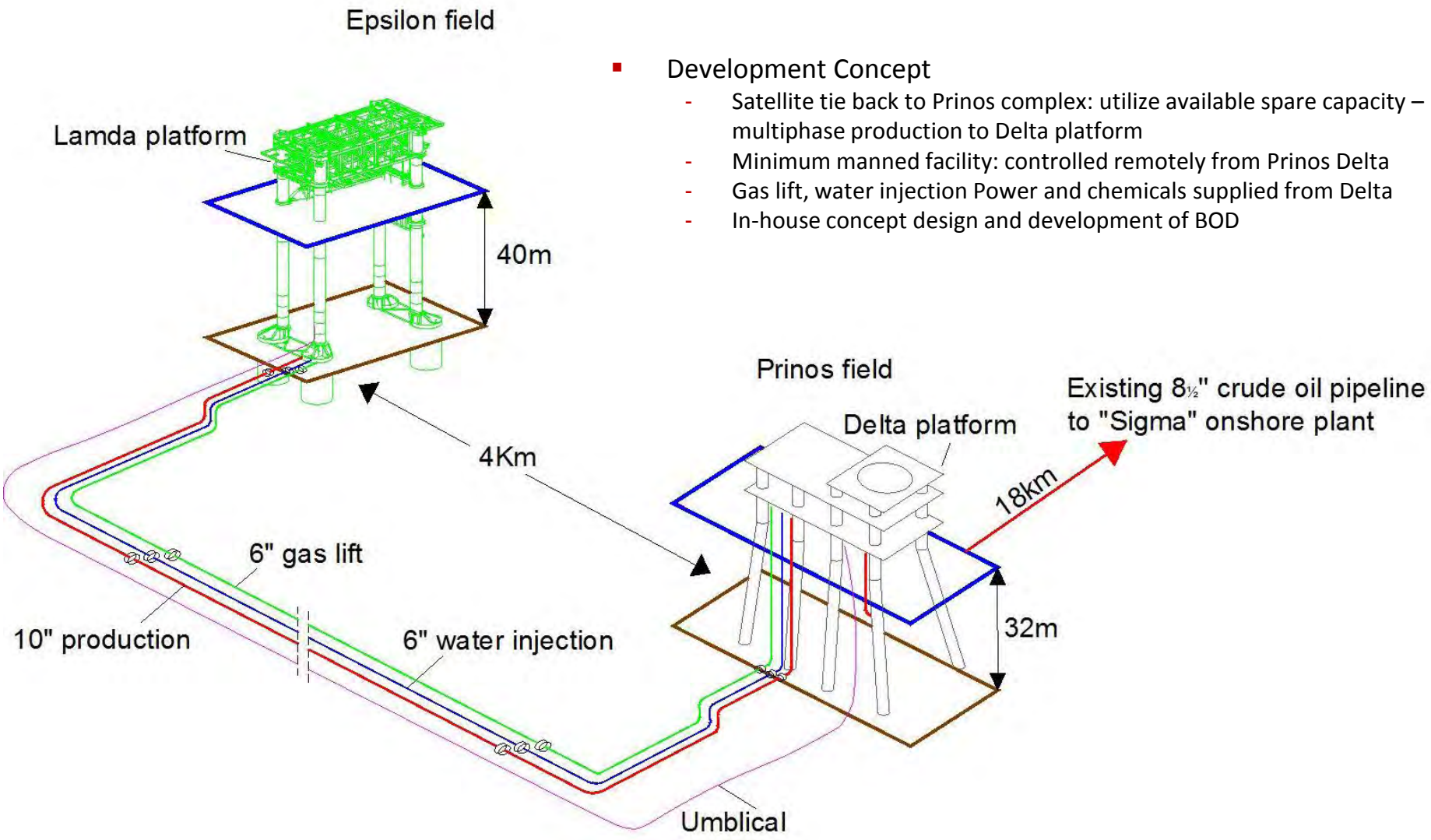
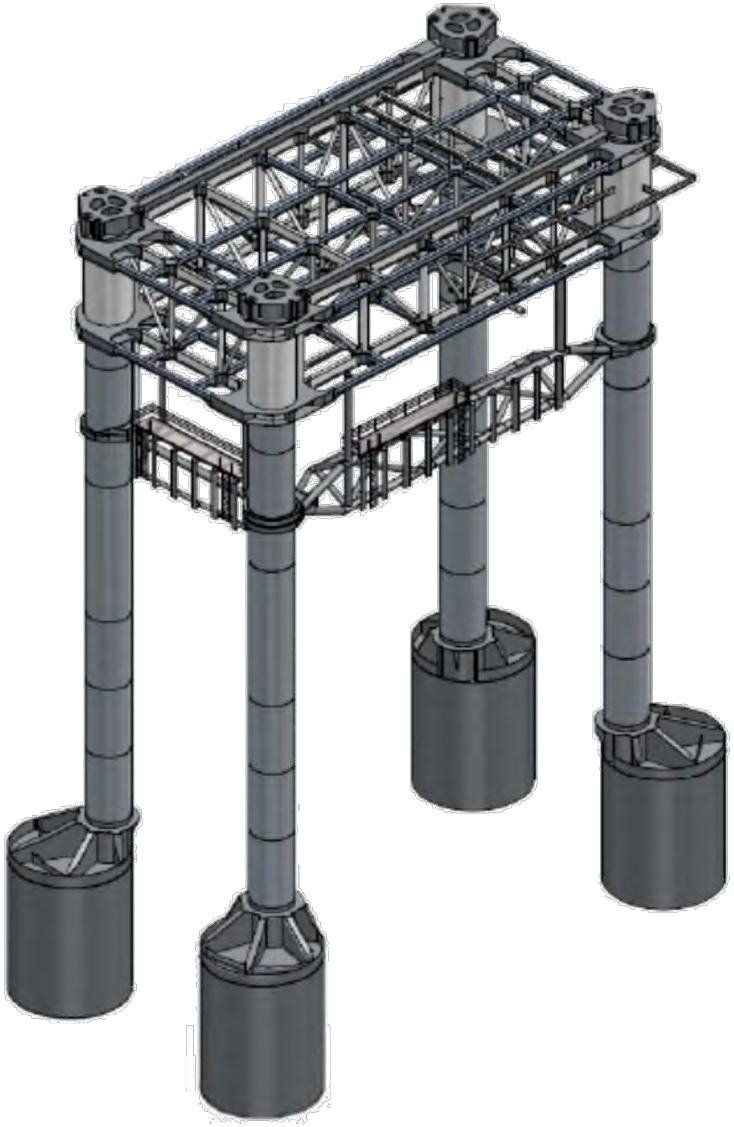
Field Layout Schematic



- Development Concept
  - Satellite tie back to Prinos complex: utilize available spare capacity – multiphase production to Delta platform
  - Minimum manned facility: controlled remotely from Prinos Delta
  - Gas lift, water injection Power and chemicals supplied from Delta
  - In-house concept design and development of BOD

Lamda Platform SIP-2 Design



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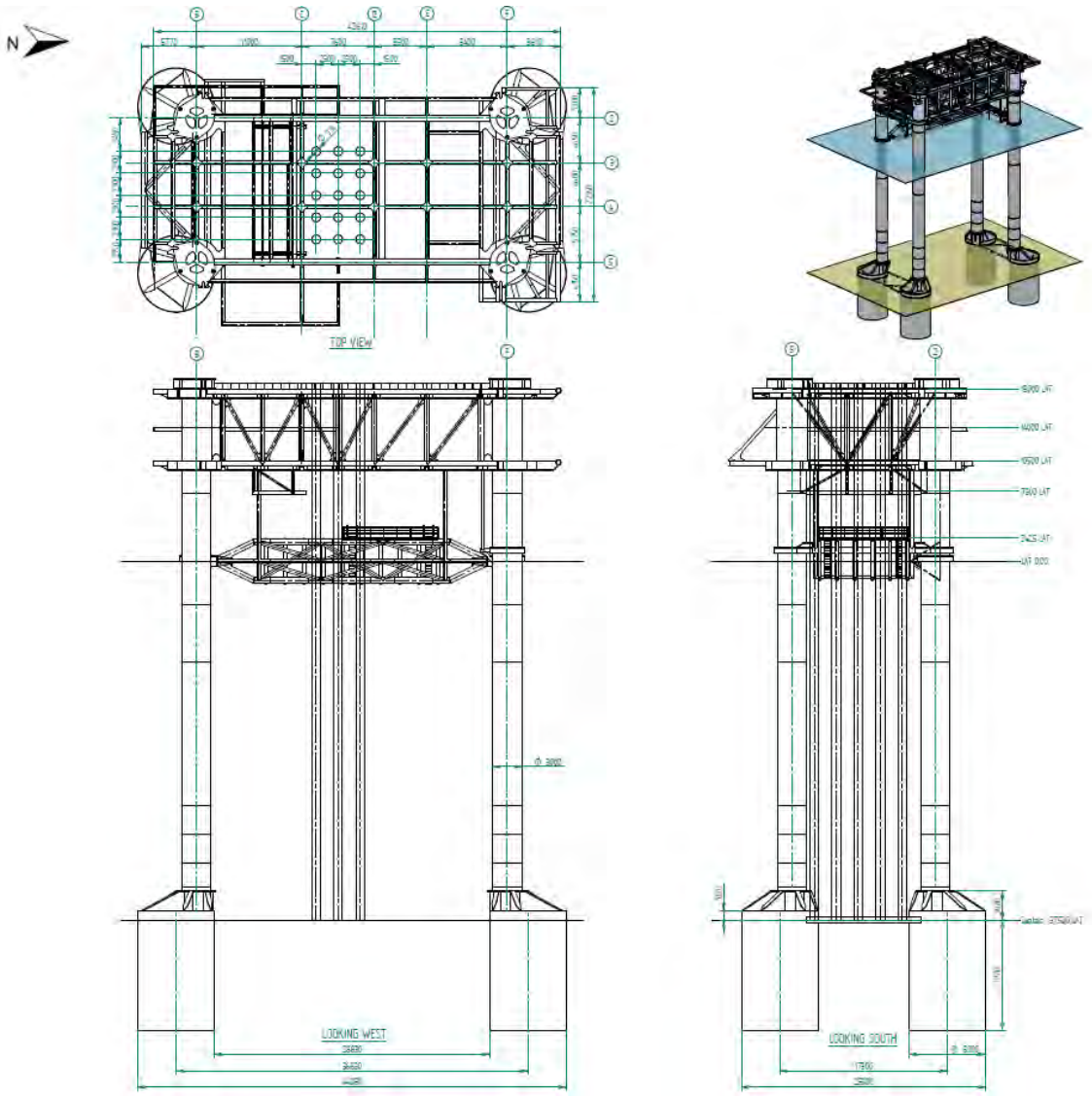
SIP-2 Platform Dimensions



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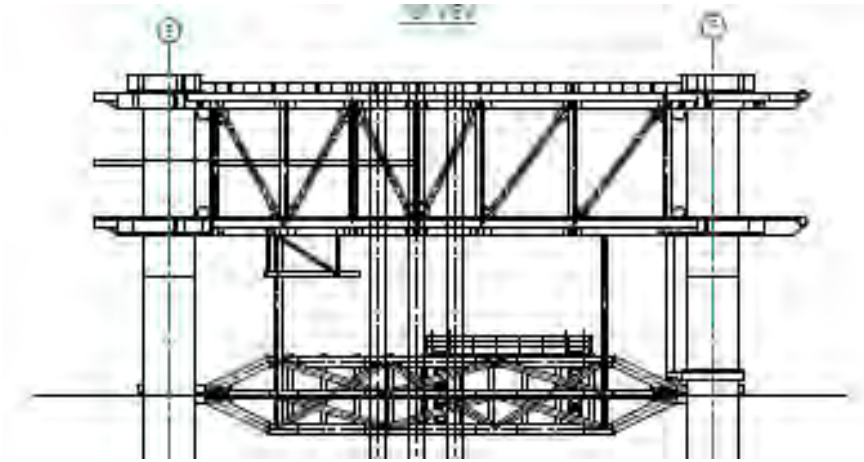
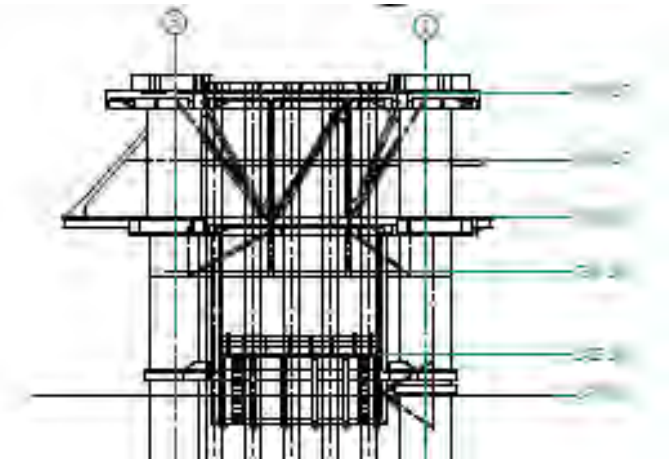
Lamda Platform Topside Main Components

- 2 main decks, Drilling Deck (EL 18m) and Production Deck (EL 10.5m) (with Mezzanine Deck in between EL 14m)
- 15 Well Slots, with Well Services pumps/Heaters
- Mechanical Equipment – Pumps/Drain Tanks/Pig Launchers Receivers/Platform Crane
- Instrumentation – Wellhead ESD's/Metering/F&G System/Process Control System/ESD/Chokes
- Safety Equipment – Firefighting/Breathing Air System/Life Rafts
- E&I – Power Junction Boxes/Transformer/ 400 V Switchgear/AC-DC UPS
- Bulks – Piping/Valves/Cables





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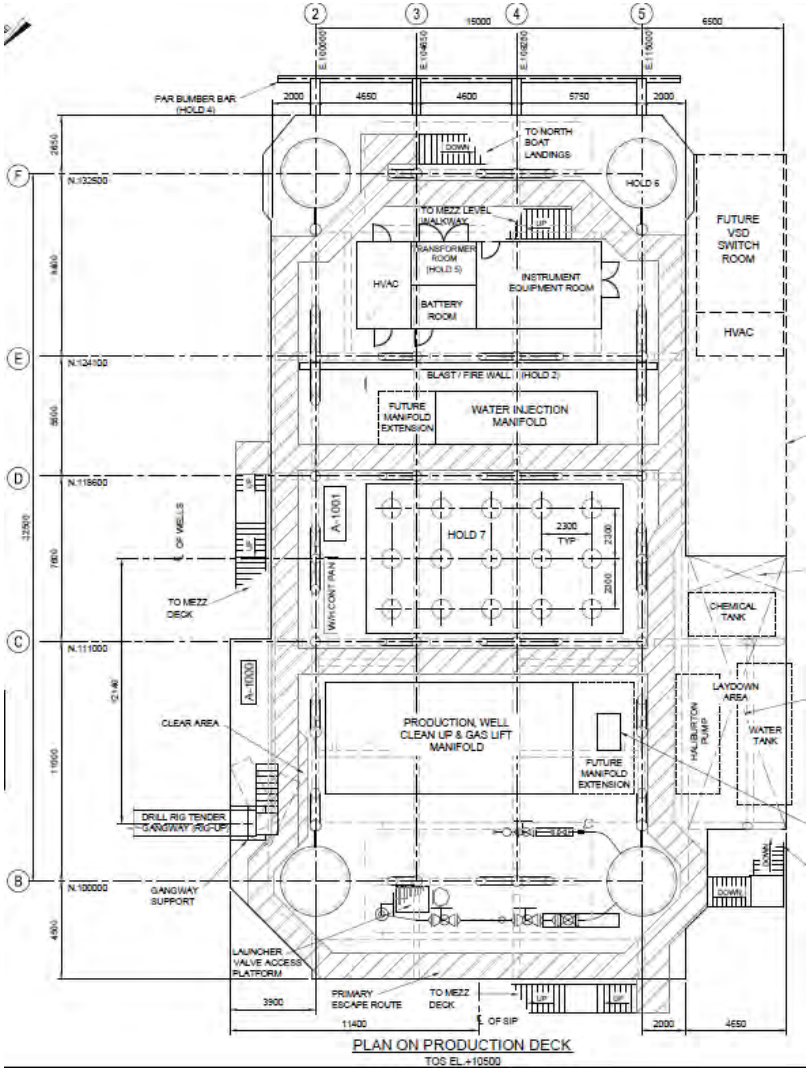
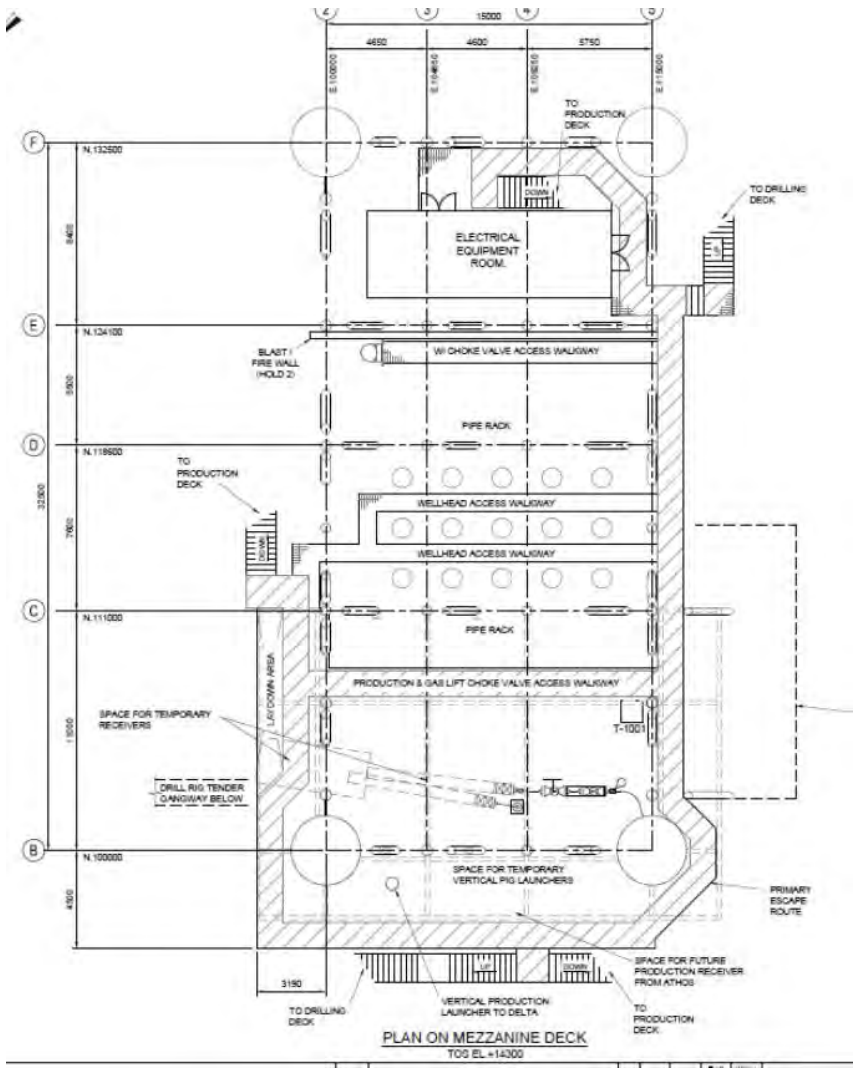
Production and Mezzanine Deck Equipment Plot Plans

Production Deck (EL 18m)



Mezzanine Deck (EL 10.5m)

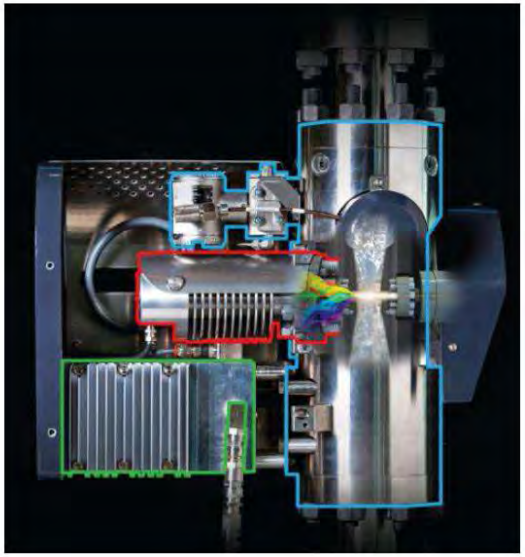


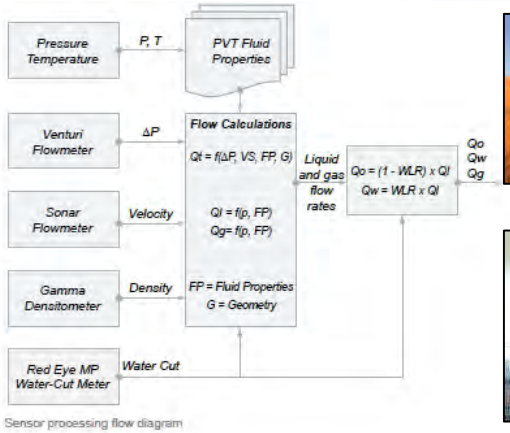
Platform Topside Technology Highlights

- **Multi Phase Flow measurement:** avoids expensive process equipment & regular interventions

- **Venturi and MVT**
  → total mass rate

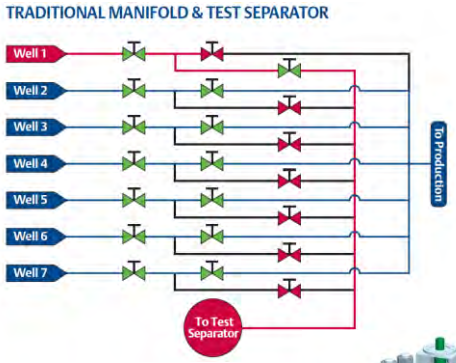
- **Compact flow computer**
  → conversion from line to standard conditions

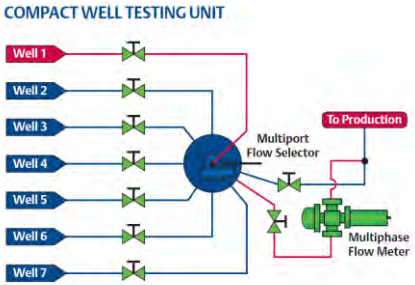


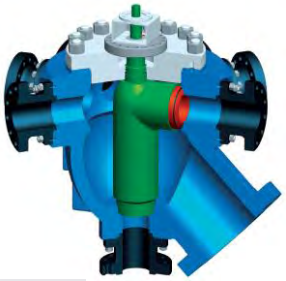


Sensor processing flow diagram

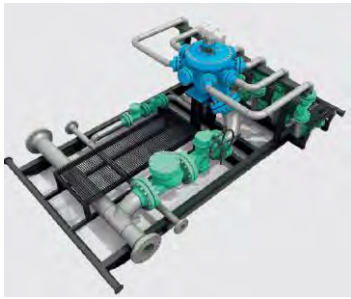
- **Multi Port Selector:** reduces further valves costs, improves safety of personnel and reduces further interventions



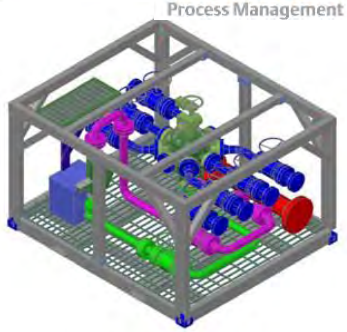




DAFRAM
VALVOLE A SFERA - BALL VALVES



EMERSON
Process Management



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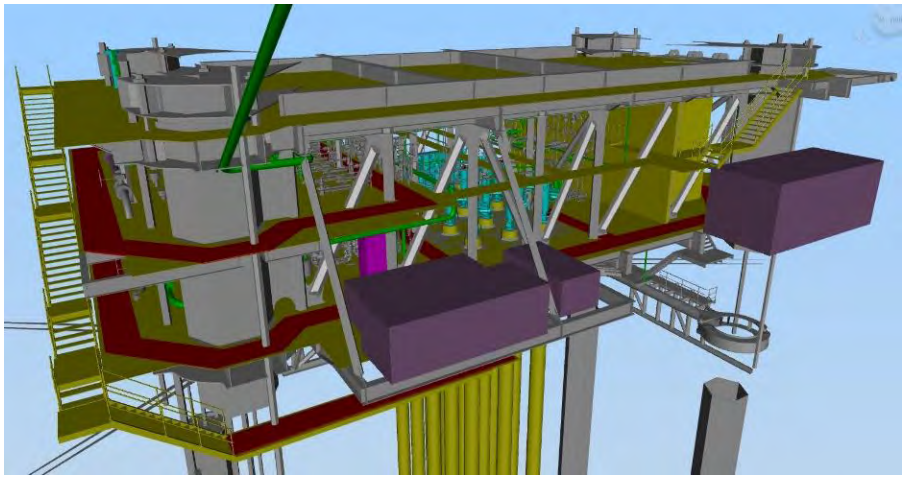
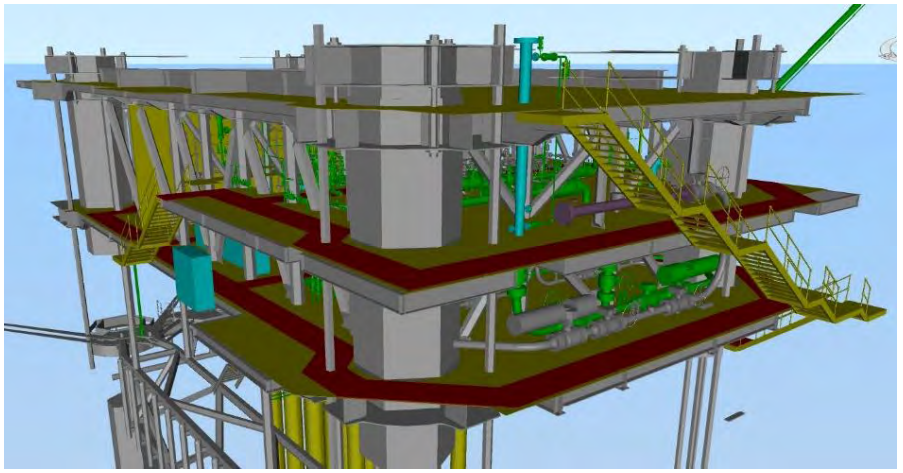
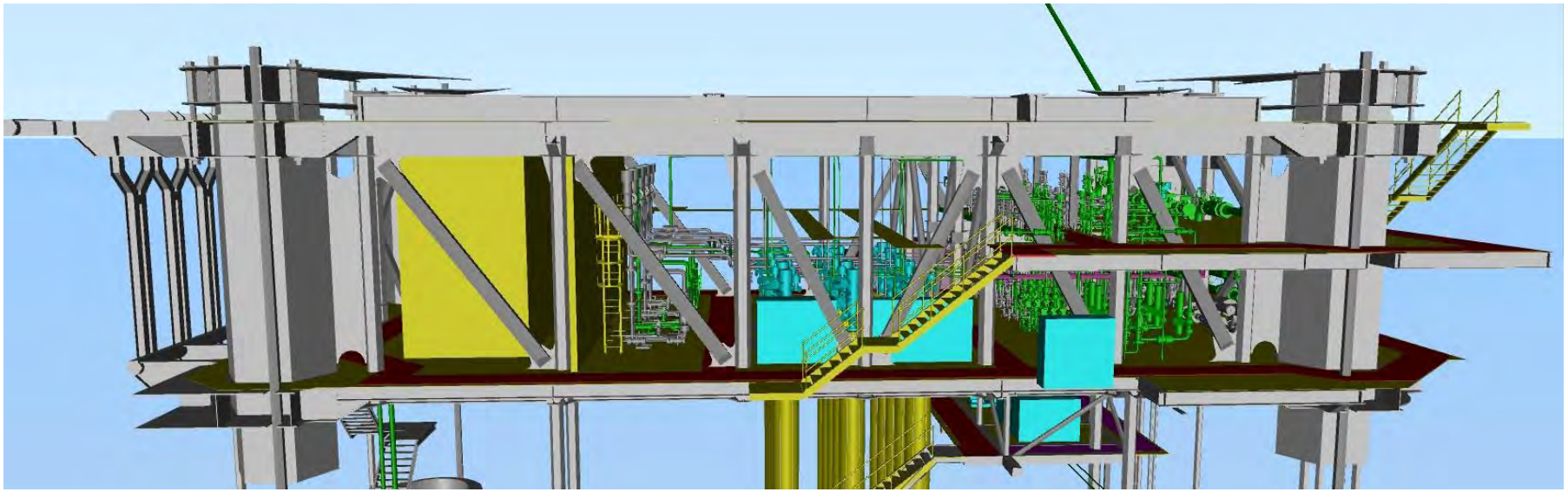
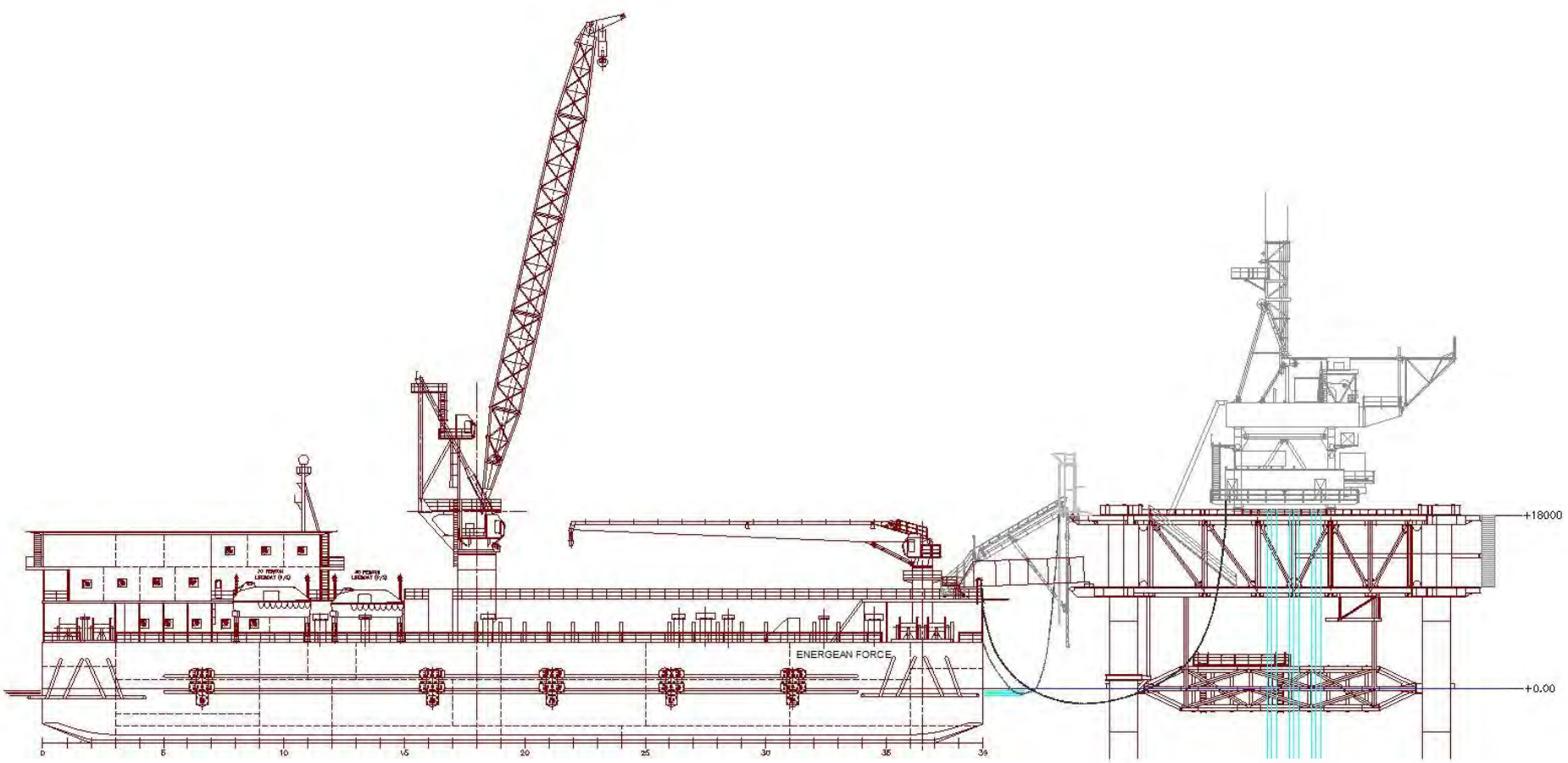
Lamda Process Facilities Screenshots







Epsilon Platform Designed To Support Drilling Operations From Energean Force



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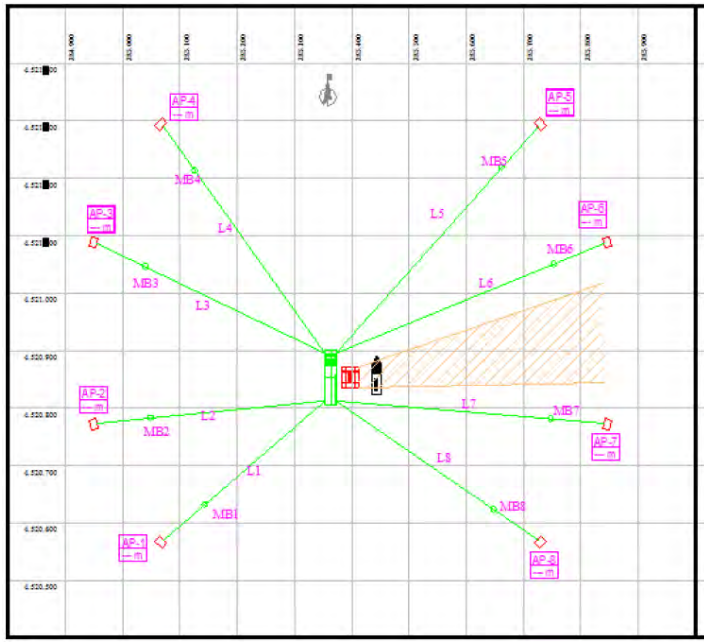
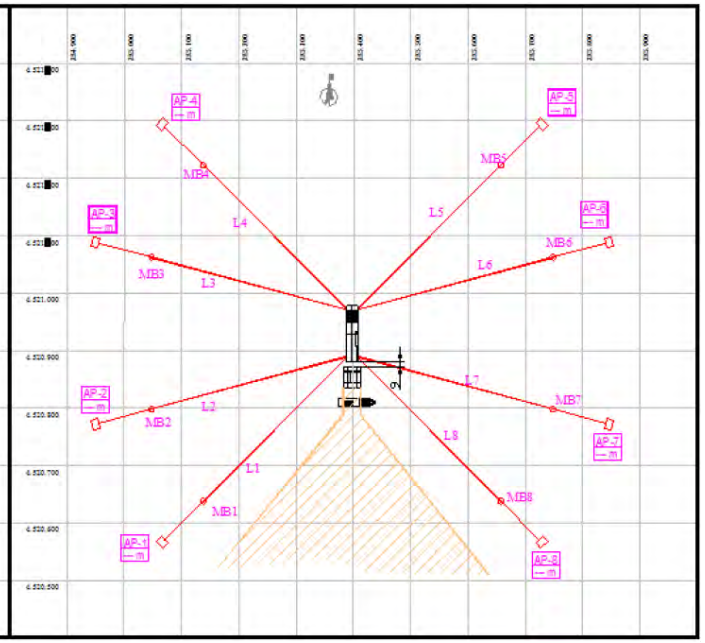
Energean Force mooring technology



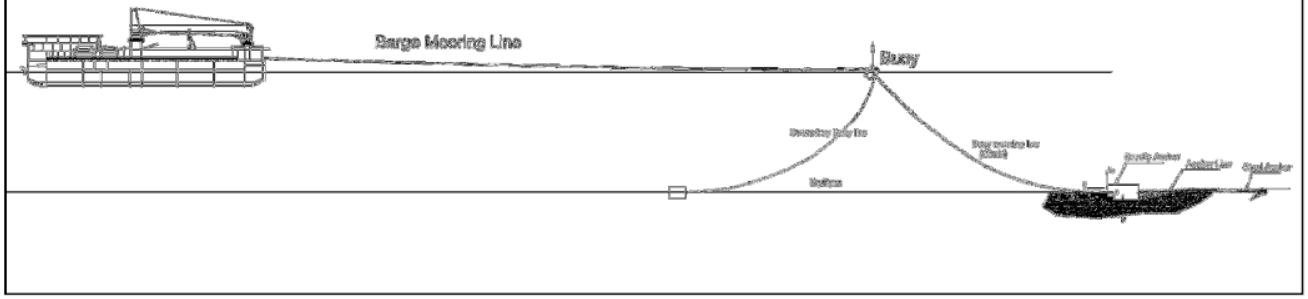
Rig up position

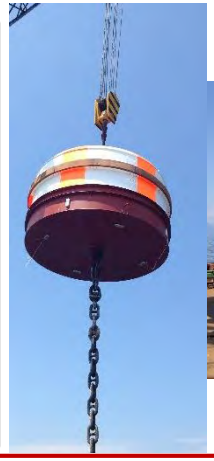


Drilling position

- A new mooring technology from Offshore Energy Systems
- Specially applicable in shallow waters
- Very robust performance and minimum spread
- Rapid position change over & limited wire rope length

Line Composition





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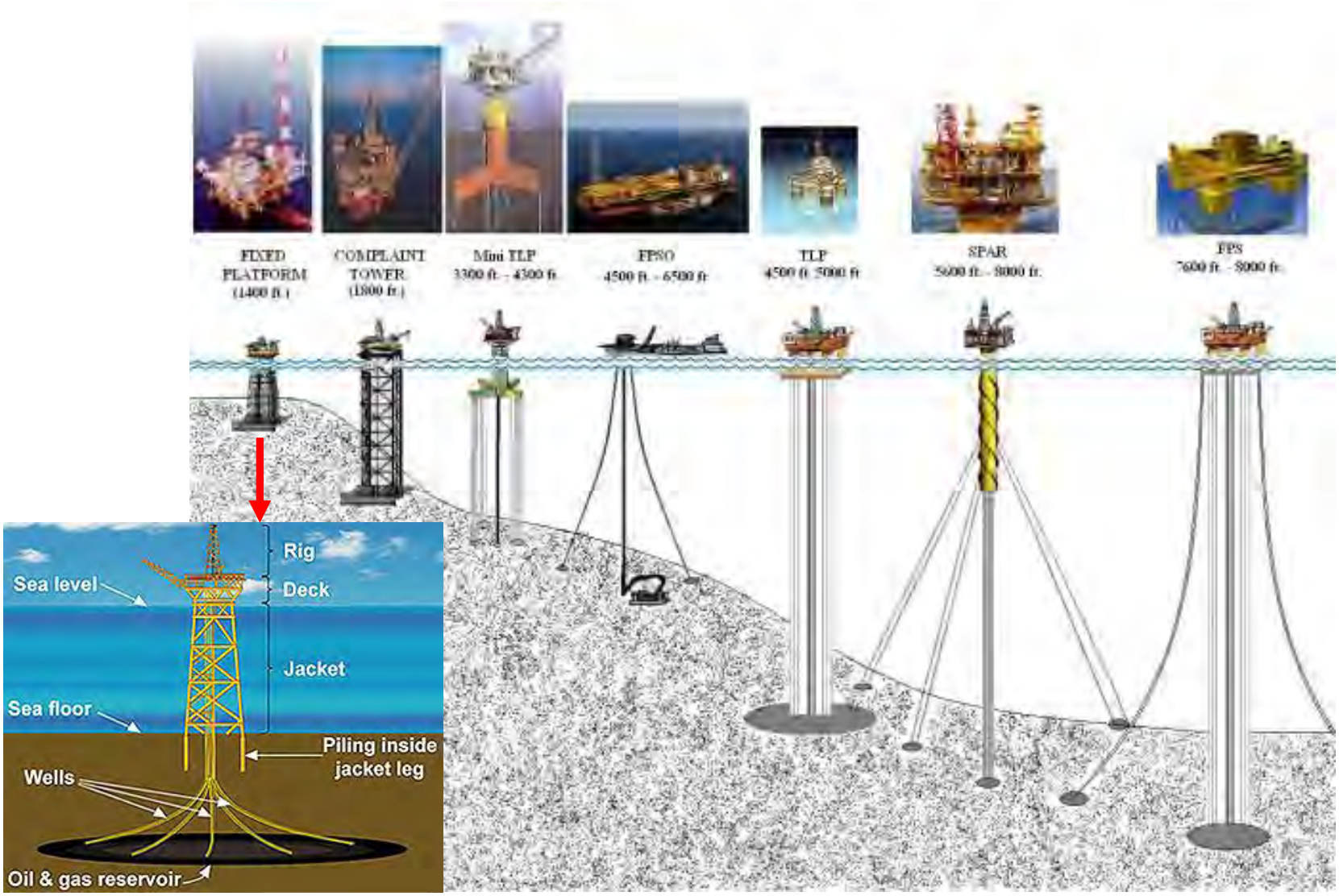
Platform Concept Selection Process



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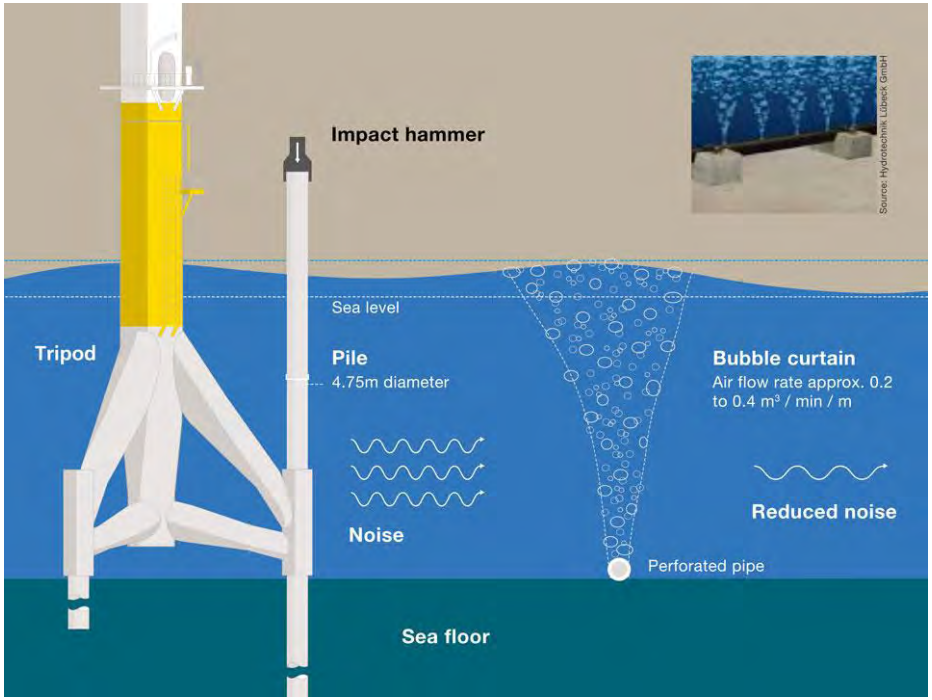
Standard Offshore Platform Installations by Crane Barge

Standard Platform Piling

OFFSHORE CRANE BARGE REQUIRED WITH PILING HAMMER EQUIPMENT



NOISE POLLUTION TO THE ENVIRONMENT

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Topsides Lifting By Crane Barge

Standard Platforms Decommisioning

SPT Offshore SIP- 2 Concept Primary Drivers

- NO OFFSHORE CRANE UTILIZATION
- SIMPLE FABRICATION
- FOUNDATIONS (Suction Piles very suitable to sand conditions)– est 550t (No PILING, NO NOISE POLLUTION)
- SUBSTRUCTURE (Simple standard tubes) – est 750t
- TOPSIDE STRUCTURE – EST 750t
- ADDITIONAL STEEL REQUIRED FOR INSTALLATION – 200t
- INSTALLATION OF SUBSTRUCTURE AND TOPSIDE by barge, single installation activity.
- 2 DAY OFFSHORE INSTALLATION PERIOD
- REVERSIBLE PROCESS FOR DECOMMISIONING, NO OFFSHORE CRANE UTILIZATION

Platform Structure Tow Routes

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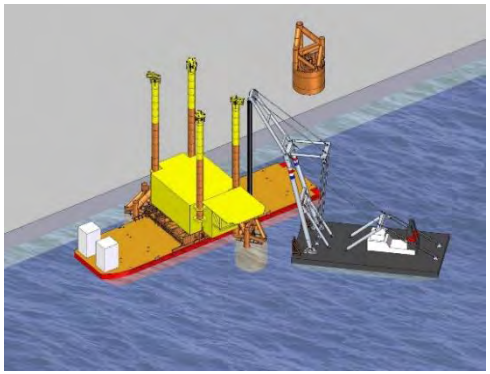
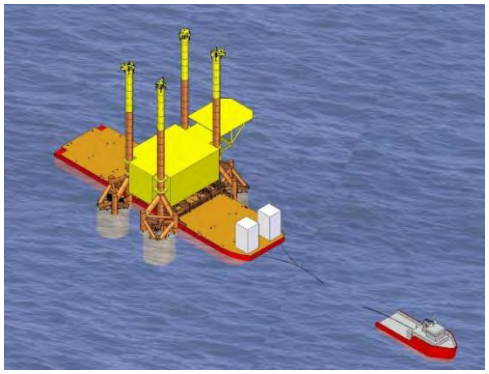
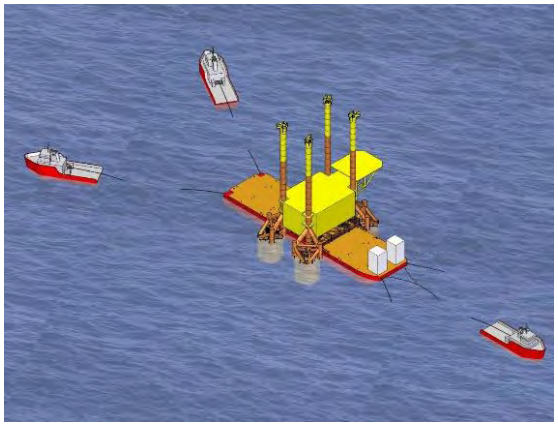
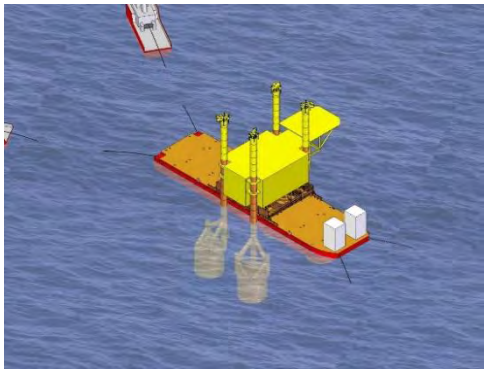
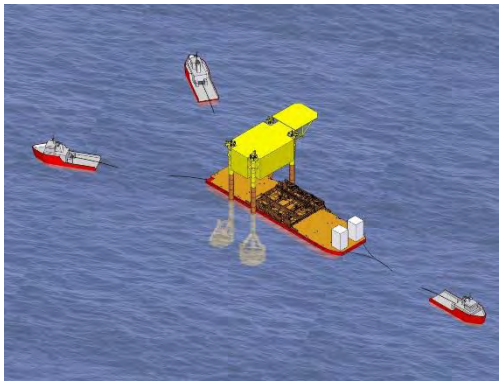
Installation Sequence

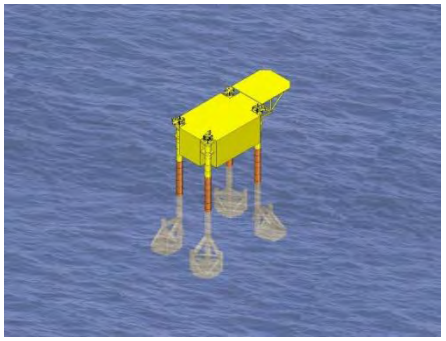




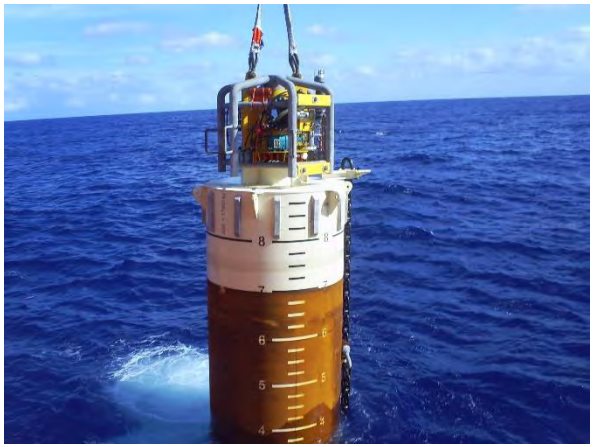




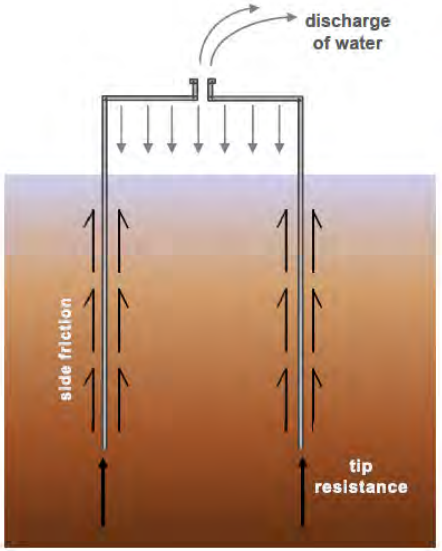




Suction Pile Technology



- How Does Suction Installation Work?
  - Lower suction pile to seabed
  - Self-weight penetration
  - Discharge of water, causes difference in water pressure inside and outside
  - Driving force on the top-plate (10 tonne / m² / bar)



Lower caisson + suction pump

Caisson touchdown & penetrates initially by own weight

Pump water out from inside the caisson and develops lower inner pressure for installation

Design penetration depth reached

Undock suction pump

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Suction Pile Benefits

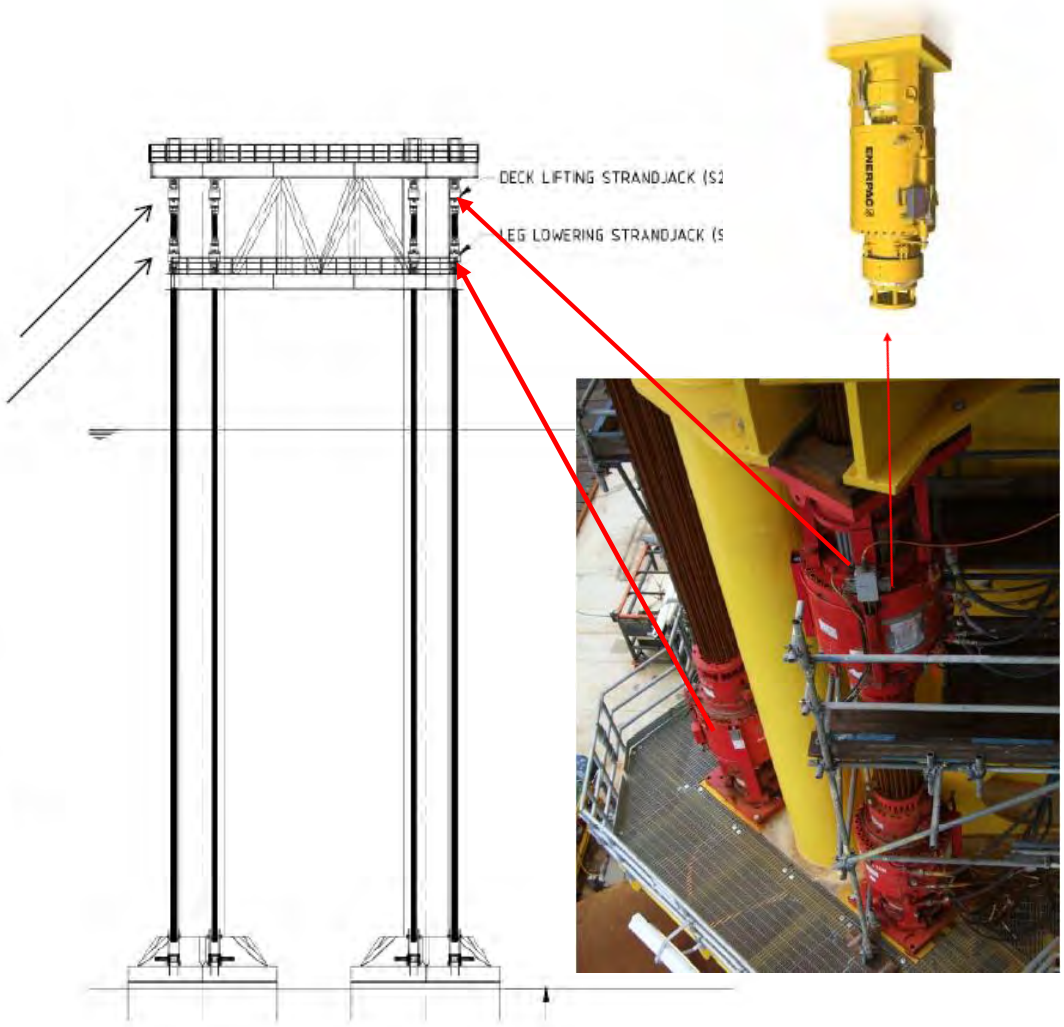
- Key benefits compared to driven piles
  - Easy to install - no expensive hammer and pile handling spread required
  - Swift to install - only few hours compared to many hours of pile driving
  - Noise free - no risk to marine life, no risk of delaying the offshore operation
  - Simple to level - through control of the suction pumps; no leveling spread required
  - Easy to decommission and re-usable - by reversing the suction process; no trace left behind

Strand Jack Heavy Lifting Technology

Per leg:
- 2 strand bundles
- 2 strand jacks per strand:
  - Deck lifting, below top deck
  - Leg lowering, on main deck

In total:
- 8 strand bundles
- 16 strand jacks
- 1 additional strand jack in yard for pre-tensioning

Strands connected at leg head (anchor block) and suction caisson top plate (diver-less release)



SPT Offshore

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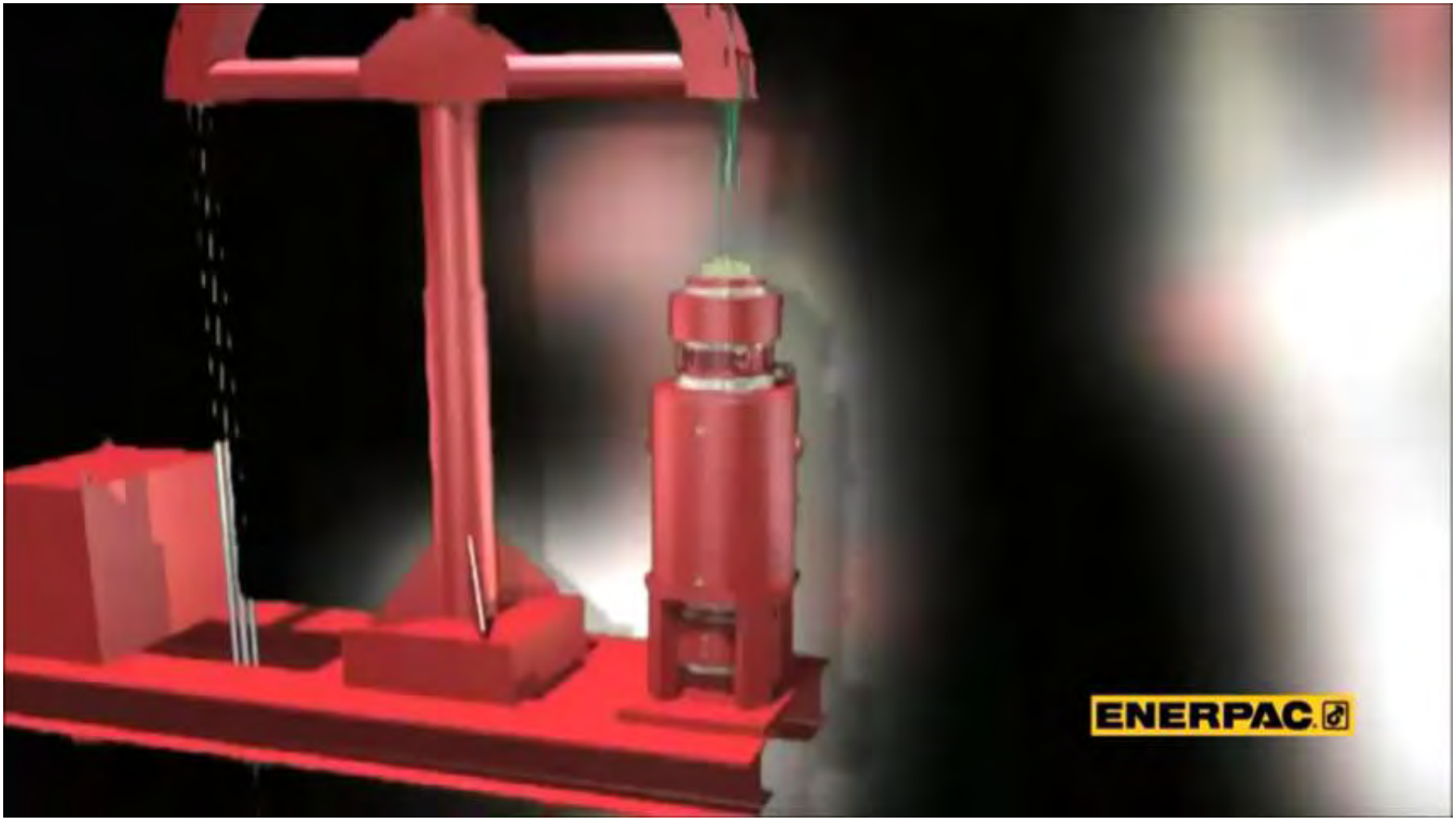
Strand Jack Mechanics



Platform Installation Sequence

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SPT Offshore Previous Projects – CLIENT CENTRICA

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SPT Offshore Previous Projects – CLIENT Global Tech

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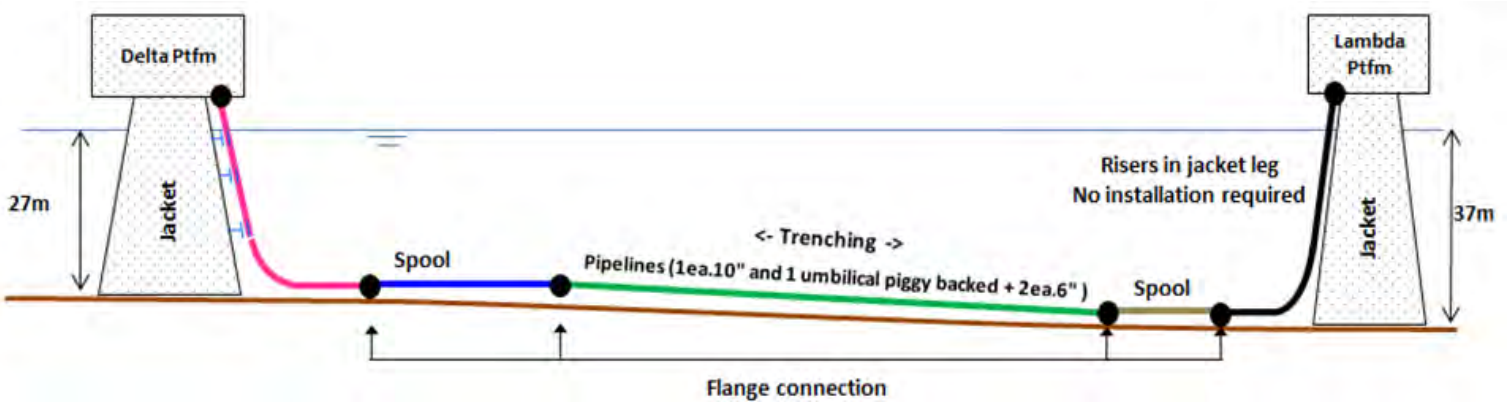
Subsea Scope

- Installation of pipelines, base case, by fabrication of pipeline sections onshore, and tow out to location (either one by one or by bundle). Options also being considered for S-Lay or Reeling.
- Installation of umbilical by dedicated vessel similar to reeling or by piggy back to 10” line during towing or S lay.
- Installation of Risers and umbilical J tube on DELTA platform by dedicated diving support vessel.
- Installation of interconnecting spools to the platforms by dedicated. (DSV)
- Burial of pipelines and Umbilical by post trenching spread on a dedicated vessel
- Pre commissioning



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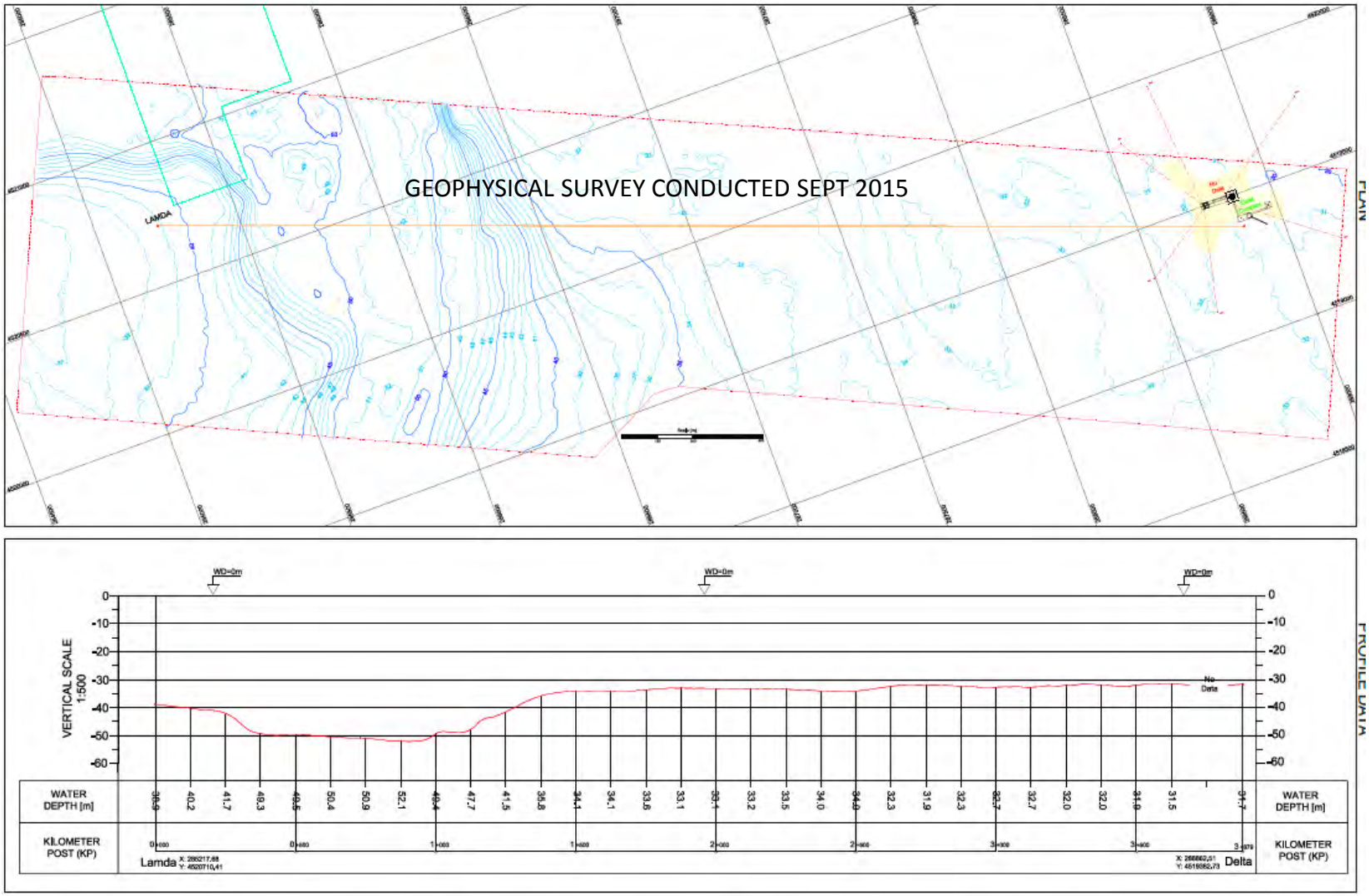
Pipelines And Umbilical Route/Bathymetry



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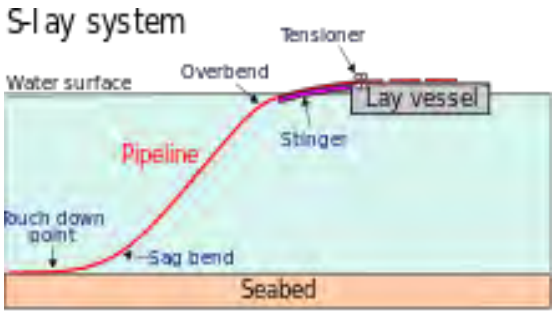
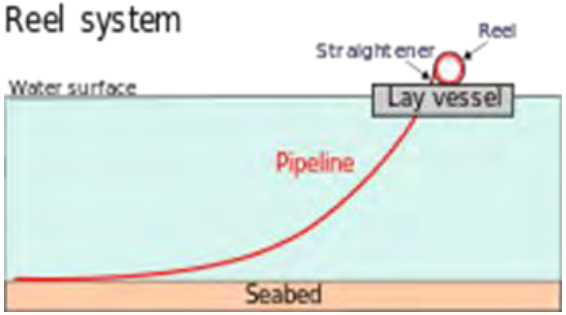
Traditional Pipelay Installation Methods

S LAY PIPELAY SHIP

REELING PIPELAY SHIP





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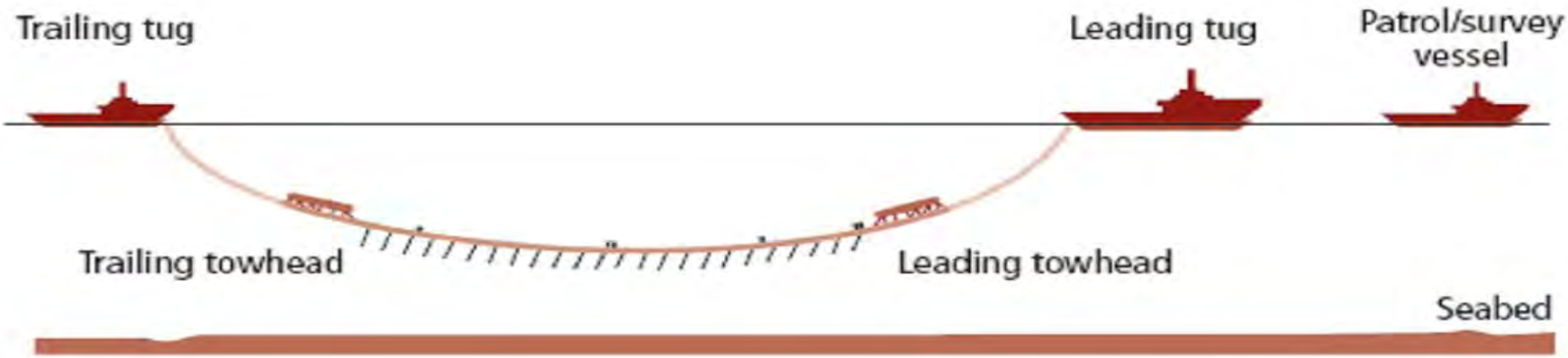
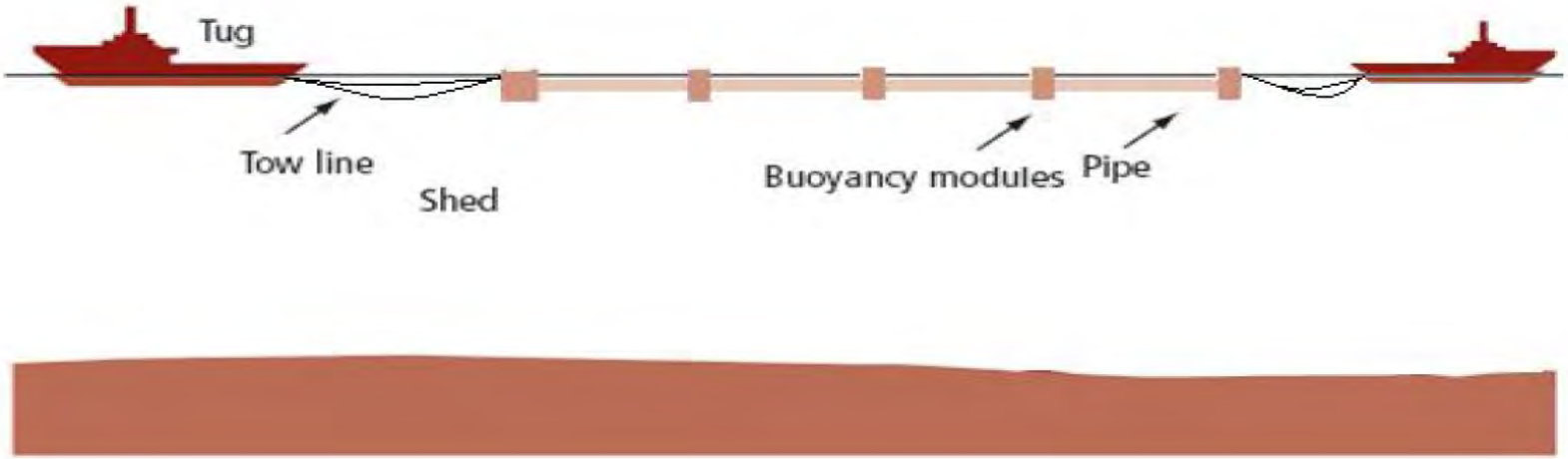
Pipeline Towing Methods





Pipeline Towing Routes

Pipeline String Yard Location

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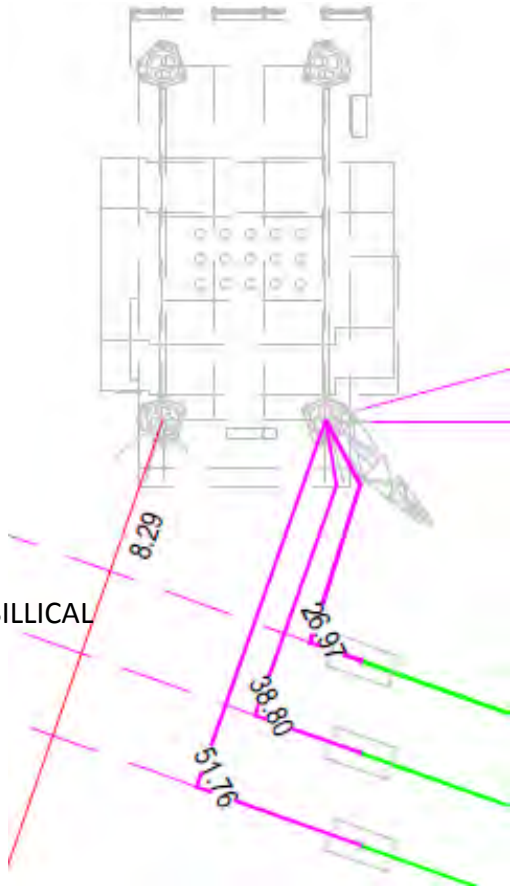
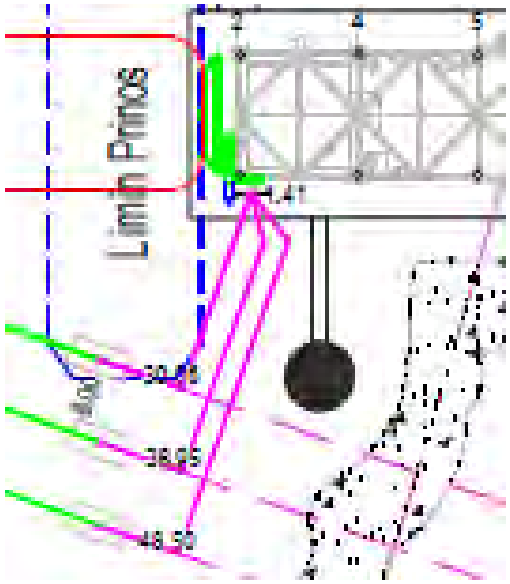
Pipeline String Yard Activities

Pipeline and Umbilical Connections to the platforms



3 No. TIE IN SPOOLS AT NEW LAMDA PLATFORM



3 NO. TIE IN SPOOLS AT EXISTING DELTA PLATFORM

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MADE IN GREECE!

MAIN ACTIVITIES	% GREEK
ENERGEAN PROJECT MANAGEMENT TEAM	70
3rd PARTY VERIFICATION and MWS	80
PROJECT INSURANCES	90
GOVERNMENT PERMITING PROCESS	60
METOCEAN STUDY FOR DD	80
GEOPHYSICAL AND GEOTECHNICAL INVESTIGATIONS	70
DETAILED DESIGN	0
TOPSIDES PROCUREMENT	40
PIPELINES/RISERS PROCUREMENT	0
UMBILICAL PROCUREMENT	100
FABRICATION LAMDA PLATFORM (TOPSIDES AND SUBSTRUCTURE)	100
PLATFORM INSTALATION	50
PIPELINES/UMBILLICAL INSTALLATION AND SUBSEA WORKS	50
DELTA BROWNFIELD MODIFICATIONS	100
COMMISIONING	70
ANCHORING SYSTEM FOR ENERGEAN FORCE	100

AVERAGE: 70%

Energean Project Management Team

Dr. Stephen Moore – Group Technical Director

- E&P technical professional with 28 years' experience at Shell, Maersk Oil and Mubadala
- Joined Energean from the position of Senior Vice President – Technical at Mubadala where he successfully managed all technical functions of the company worldwide
- Dr. Moore has worked extensively in the FSU, the Middle East, SE Asia and the UK section of the North Sea

Vassilis Zenios, Project Manager

- 25 years oil & gas experience, with onshore construction, pipelines and heavy lift installation Contractors.
- Joined Energean in 2015, after working with Vesrabar Inc. for 10 years in innovative offshore heavy lift solutions and execution services to operators, worldwide locations, notably the simultaneous raising of the LIMA field complex platforms and bridges, East Java Sea Indonesia
- 15 years with Saipem, various worldwide locations performing fast track offshore pipelines and heavy lift projects

Vincent Reboul-Salze, Facilities Engineering Manager

- 10 years of industry experience, mostly gained at Shell Upstream International.
- Joined Energean in 2014, after having served for 3 years as the Lead Process Engineer at Kashagan field Start-Up in Kazakhstan, for Shell/ AGIP KCO. Prior to that, he worked with Shell Upstream development teams, as a Concept Development Engineer supporting New Business Development and Concept projects. Also worked for 4 years in the Dutch and Southern North Sea production areas (mainly gas fields),

- The Project Management Team will be based in ATHENS, ENERGEAN corporate headquarters with support from the KAVALA OIL technical team.
- Project Services – Including Contracts, Procurement, Accounts, Planning, Document Control, Administration, Legal.
- HSE – Corporate HSE Leader
- Project Technical Team – Specialist Project Engineers, QA/QC team, technical operations staff from KAVALA OIL.

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