



NOV Flexibles/Ariosh Consortium

API17J Pipes Solutions

Chevron Onshore/Swamp Flowline



September 2022



Agenda

- The Consortium
- NOV Flexibles
- Ariosh Overview
- Flexible Pipe Installation - Onshore/Swamp
- API17J Flexible Pipes - Onshore/Swamp
- Closing Remarks

The Consortium



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The strategic partnership between NOV Flexibles and Ariosh Ltd ensures that complex flexible pipe solutions can be offered to Nigerian producers, while both fully adhering and committing to all local content regulations and initiatives as set forth in the Nigerian Oil and Gas Industry Content Development Act of 2010.

The key focus is on making sure that in-country revenue generation, labor retention and local community development is kept in the center, while offering highly competitive and engineered solutions.

NOV Flexibles

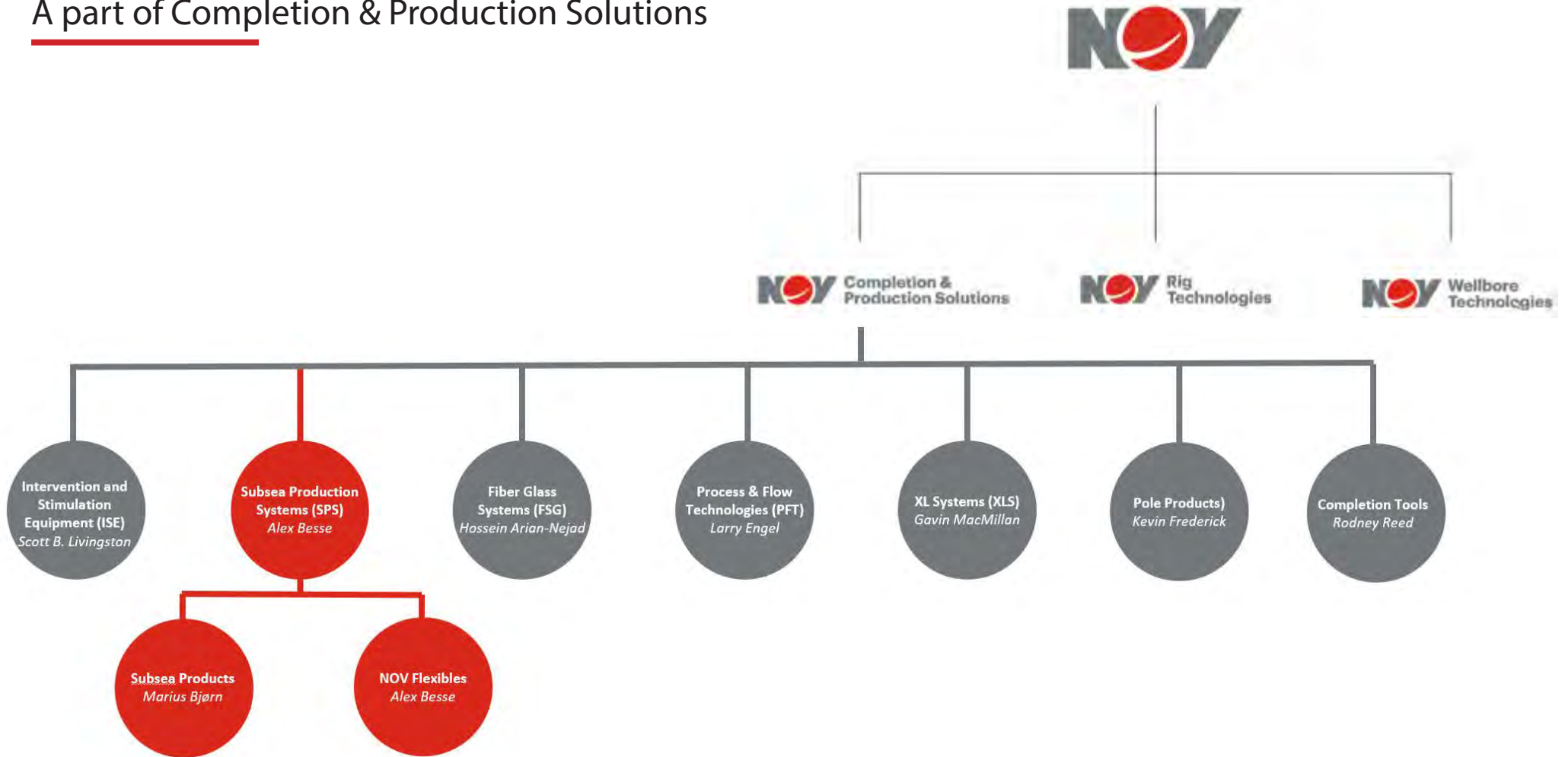
NOV Flexibles

- Preferred provider of reliable, high quality flexible pipe systems to the global offshore oil & gas industry
- Client base comprising major oil companies, contractors, engineering houses and suppliers in the industry



Subsea Production Systems

A part of Completion & Production Solutions



NOV SPS at a glance

300+

Engineers

375+

Employees at HQ

1,244

Employees globally

\$450M

Annual Revenue

Sales

Houston, Oslo, Kuala Lumpur, Stavanger

DK

Brøndby

Subsea

Houston, Oslo, Kuala Lumpur

Three

Houston, Oslo, Kuala Lumpur

Kalundborg, Denmark



Kalundborg, Denmark

100

km from CPH

310

employees

7-10m

Water Depth

Site

180,000 m²

Capacity

200

km/yr @ 6" ID_{eq}

2x

Pipes

2"-16" ID

6,000t

turntable storage

Açu, Brazil



Açu, Brazil

300

km from Rio

450

employees

10m

Water Depth

Site

121,000 m²

Capacity

200

km/yr @ 6" ID_{eq}

2x

Pipes

2"-16" ID

6,000t

turntable storage

Glenrothes, Scotland



Glenrothes, Scotland

Premium internal NOV provider and third-party supplier for all aspects of manufacturing

50

Km from Edinburgh

Precision

200

Welding Rigs

75

employees

Precision

12

CNC machines

Est.

1976

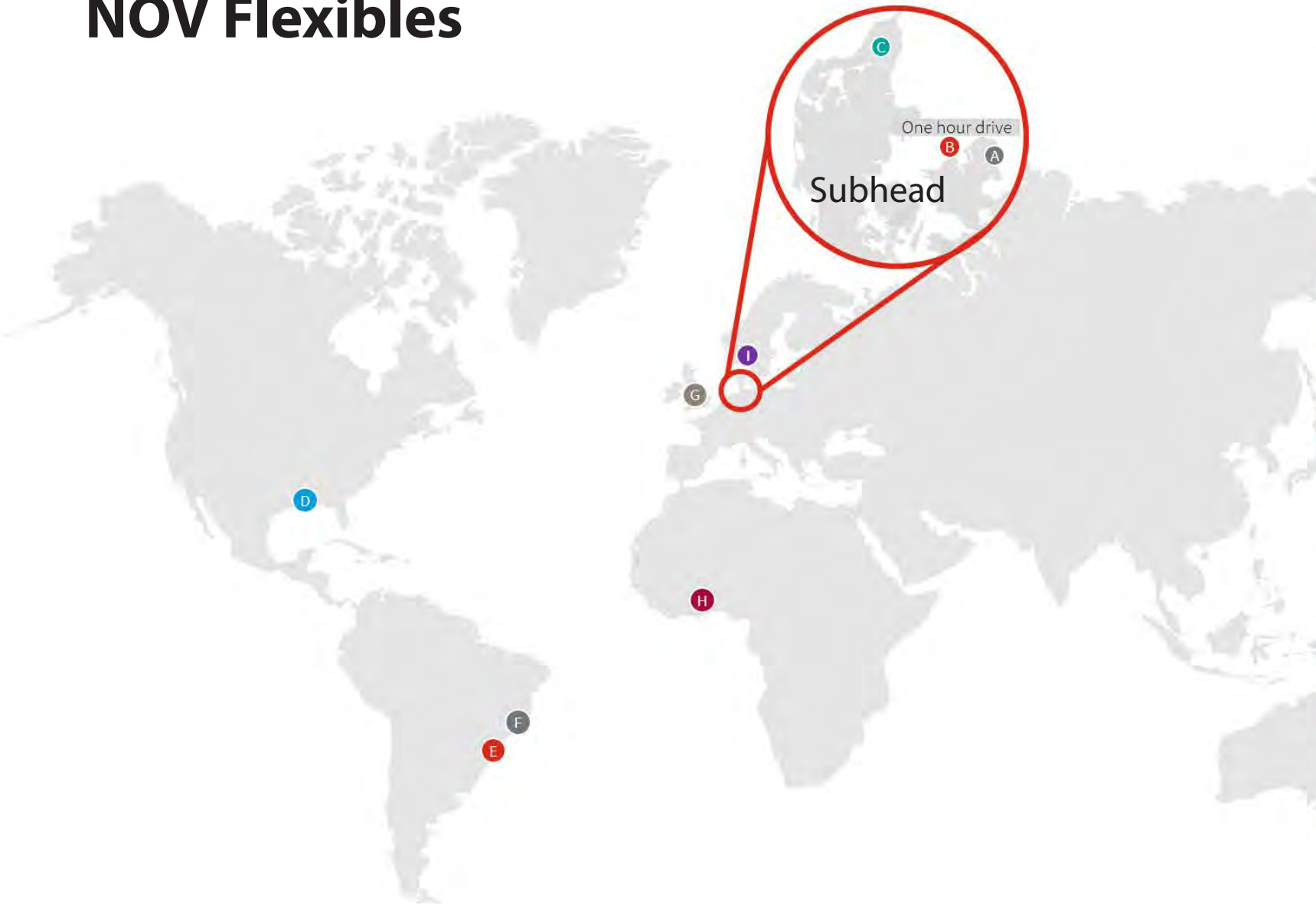
Acquired 2013

Certified

NDT

up to PCN level 3

NOV Flexibles



A Brøndby, Denmark:

- NOV Flexibles Headquarters
- Operations/projects
- R&D Laboratory & test facilities

B Kalundborg, Denmark:

- Production facility
- Capacity of ~200 km per year

C Aalborg, Denmark:

- R&D Laboratory
- Located inside university
- Used as recruiting channel

D Houston, US:

- NOV Headquarters
- NOV Flexibles sales office

E Rio de Janeiro, Brazil:

- NOV Flexibles sales office

F Port Açu, Brazil:

- Production facility
- Capacity of ~220 km per year

G Glenrothes, UK:

- NOV Flexibles UK
- Production facility

H Accra, Ghana:

- NOV Flexibles sales office

I Fornebu, Oslo, Norway:

- SSP Office

Competency Centers

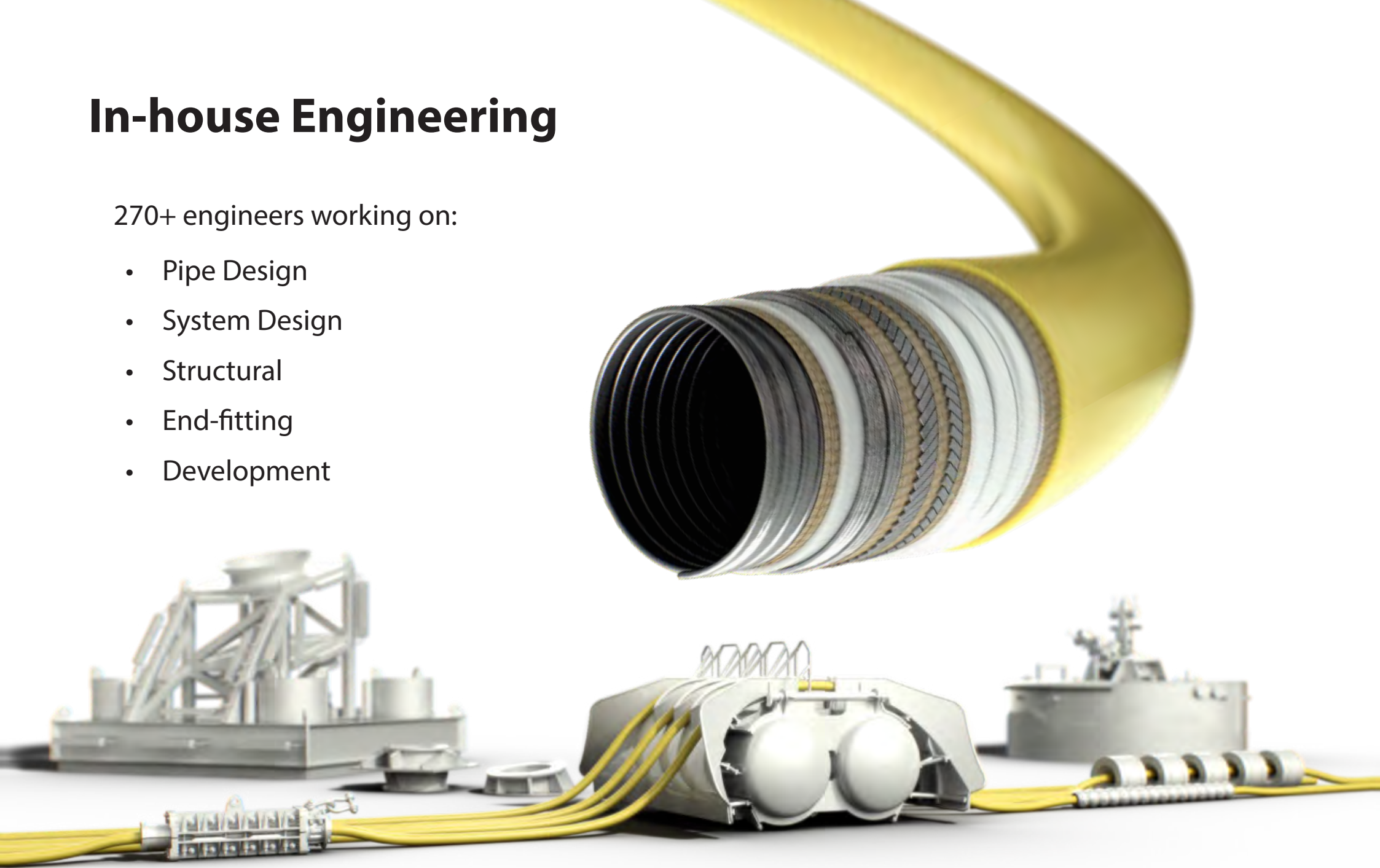
Polymeric Materials	<ul style="list-style-type: none"> • Raw material supplier qualification • Escalating technology innovation in polymeric materials • Extrusion process technology optimization
Metallic Materials	<ul style="list-style-type: none"> • Raw material supplier qualification • Escalating technology innovation in metallic materials • Welding procedure qualification
Structures & Mechanics	<ul style="list-style-type: none"> • Qualification of pipe product via prototype testing • Consolidation of new design rules/methodologies • Type Approval Certification expansion and maintenance
Manufacture Process Technology	<ul style="list-style-type: none"> • Process technology innovations • Coordination of R&D projects within process tool design • Optimisation of existing manufacture processes
R&D Material Laboratory	<ul style="list-style-type: none"> • Material and small-scale test qualification of materials • Project specific testing, eg. for sour service applications • Development of new test protocols
R&D Workshop	<ul style="list-style-type: none"> • Full- and mid-scale testing of prototype pipes • Test equipment construction, incl. data acquisition systems • Support to the factory and R&D laboratory as required



In-house Engineering

270+ engineers working on:

- Pipe Design
- System Design
- Structural
- End-fitting
- Development



Project Management

- 2 Senior Project Managers (20+ years exp)
 - 6 Project Managers with (2-12 years exp)
 - 3 Assistant Project Managers (10+ years exp)
 - 6 Project Coordinators (6-11 years exp)
 - 3 Project Assistants (10+ years exp)
 - 3 Shipping Coordinators (3-6 years exp)
 - 5 Planners (5-14 years exp)
-
- We execute 25-35 customer projects in parallel



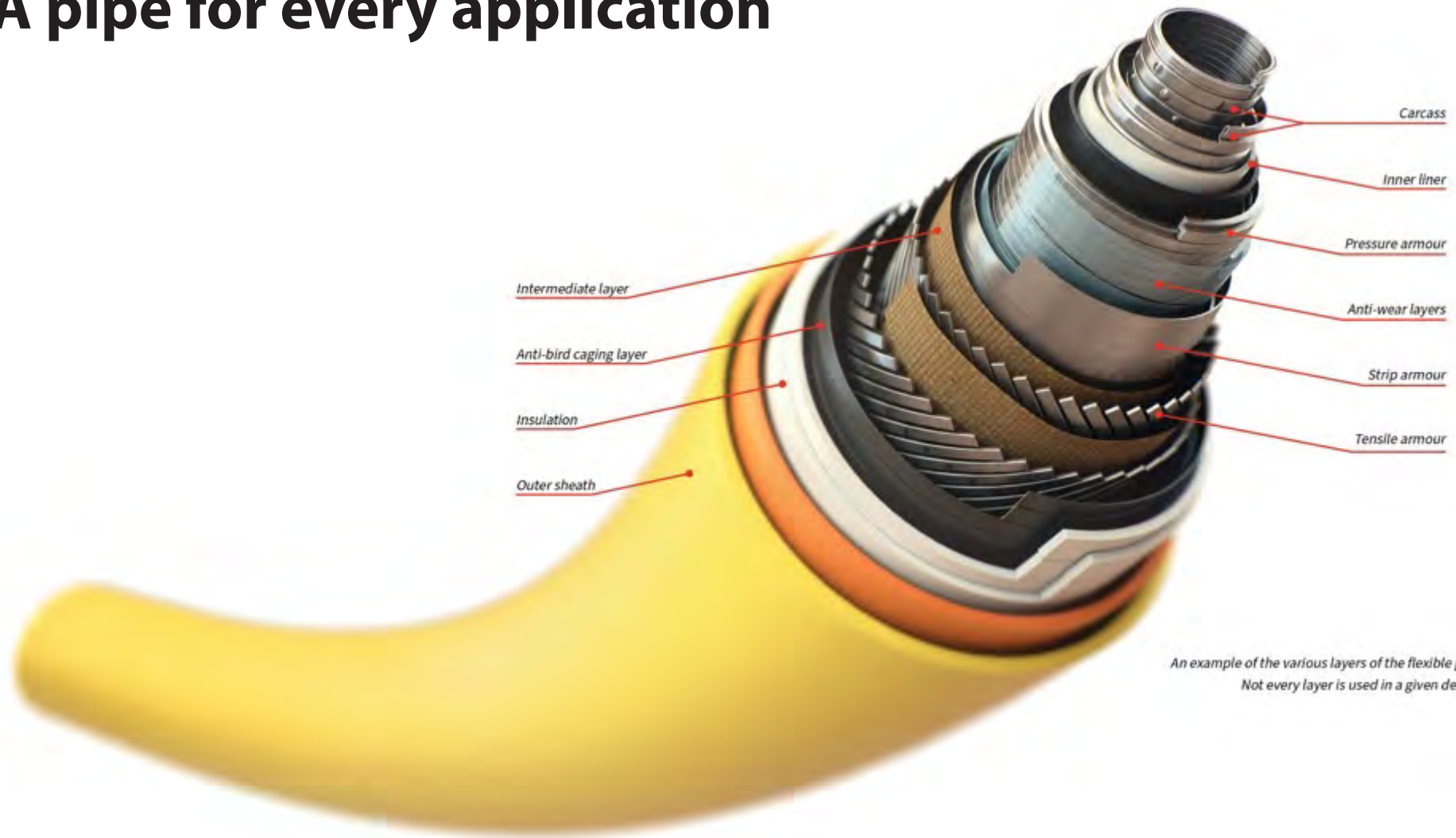
SCM

62 SCM staff working on:

- Purchasing
- Supply Chain
- Qualification of materials
- Logistics
- Shipping
- Compliance
- Incoming inspections



A pipe for every application



*An example of the various layers of the flexible pipe.
Not every layer is used in a given design.*

End-fitting

Flexible pipe to connector

Valve, Rigid Pipe, Flexible Pipe etc.

A mechanical device forming the transition between the flexible pipe body and the connector.

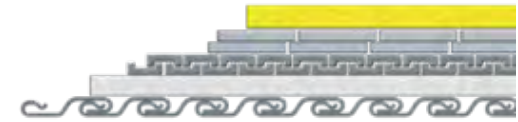
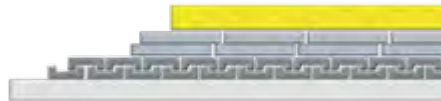
The different pipe layers are terminated in the end-fitting in such a way as to transfer the load between the flexible pipe and the connector.



Qualifications of Design

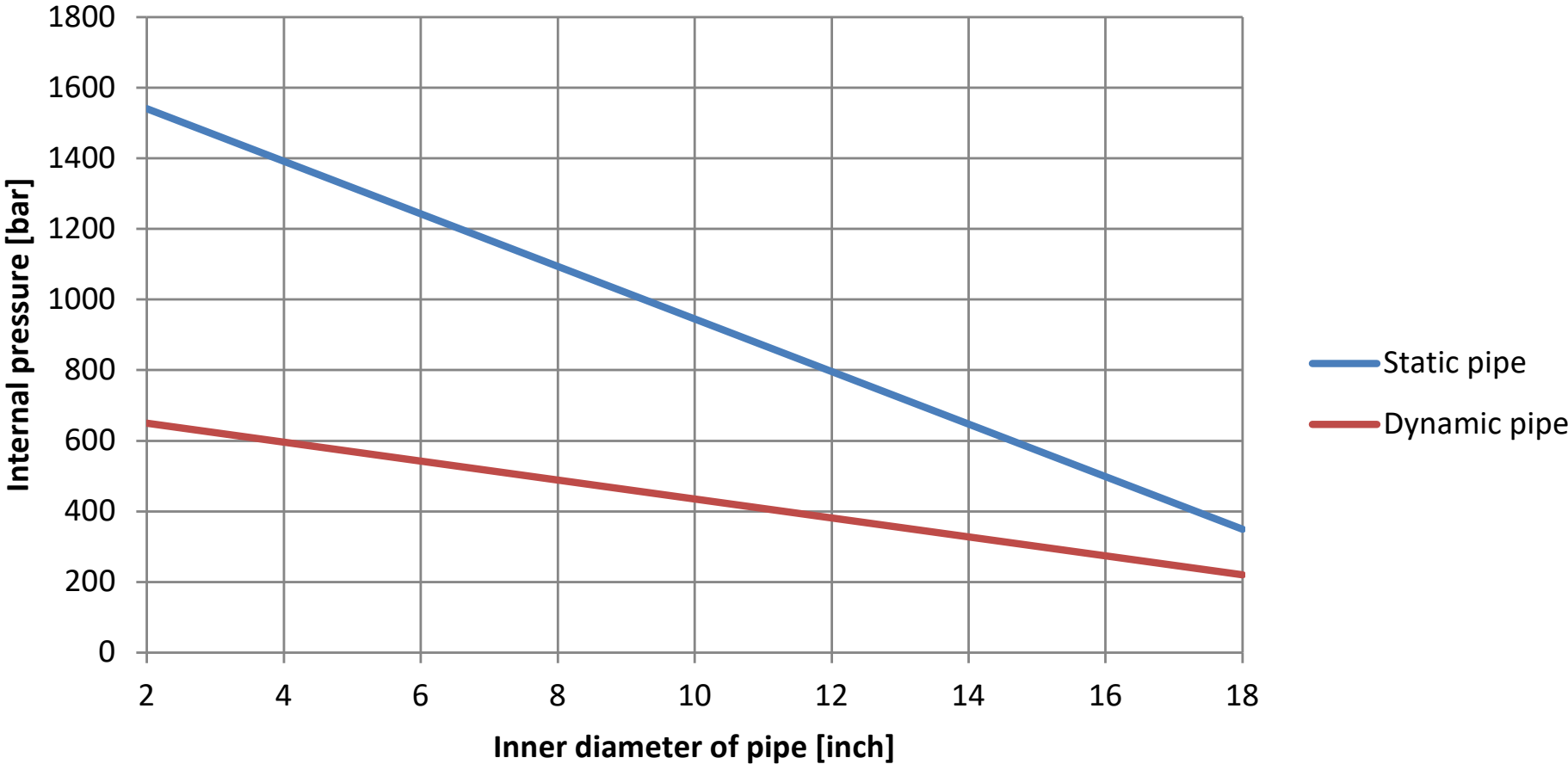
	Family II	Family I+III	
Parameter	Flowlines with combined tensile and pressure armor	Flowlines with steel strip pressure armor	Flowlines and risers with C-shape pressure armor
Design Pressure*	Up to 3,000 psi	Up to 7,500 psi	Up to 15,000 psi
Design Temperature*	-50°C - +130°C	-50°C - +130°C	-50°C - +130°C
Pipe Size*	4"ID – 8"ID	2.5"ID – 16"ID	2.5"ID – 16"ID
Fluid	Oil/gas/water/chemicals	Oil/gas/water/chemicals	Oil/gas/water/chemicals

*Boundaries may be expanded on a project basis following design review. Design pressures are from 15,000 psi for the smallest pipe bores to 3,000 psi for the largest. NOV Flexibles is the industry leader in design and manufacture of flexible pipes for high temperature applications with design temperatures as high as 130°C for both static and dynamic service.



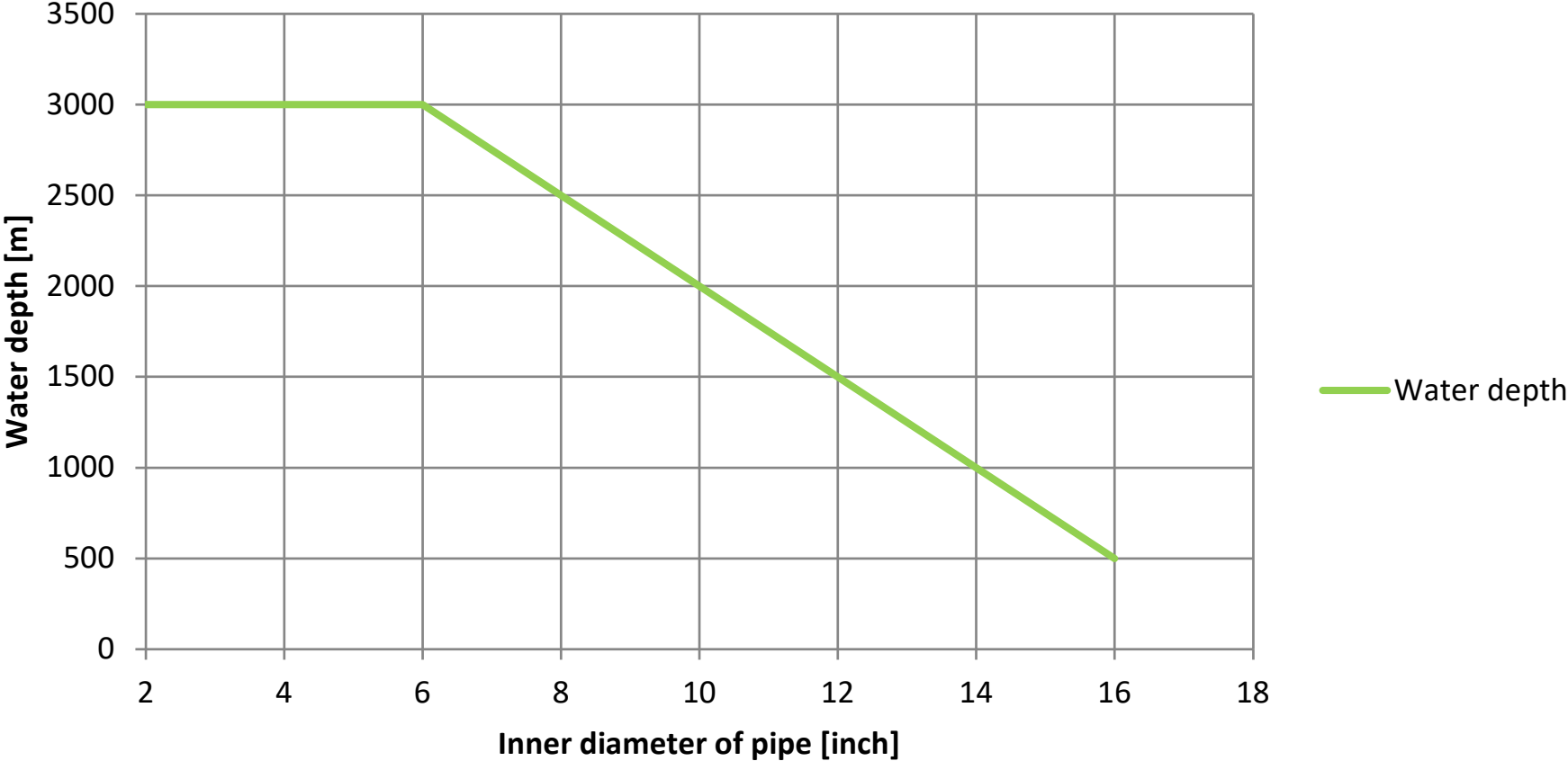
Capability

Operational Pressure



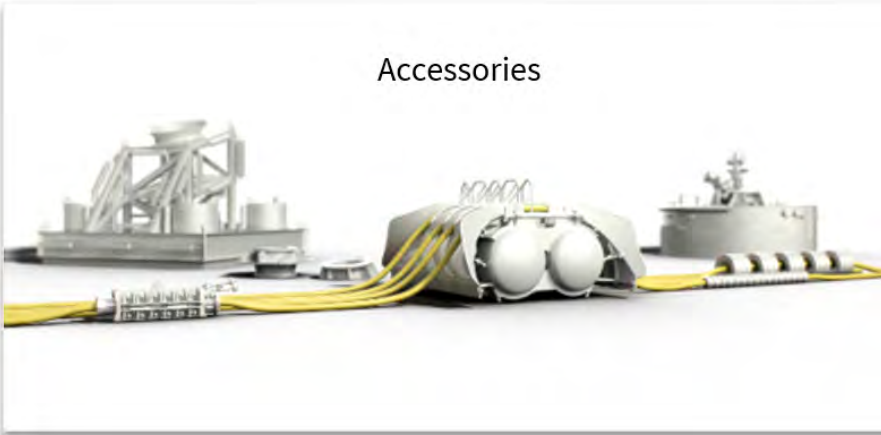
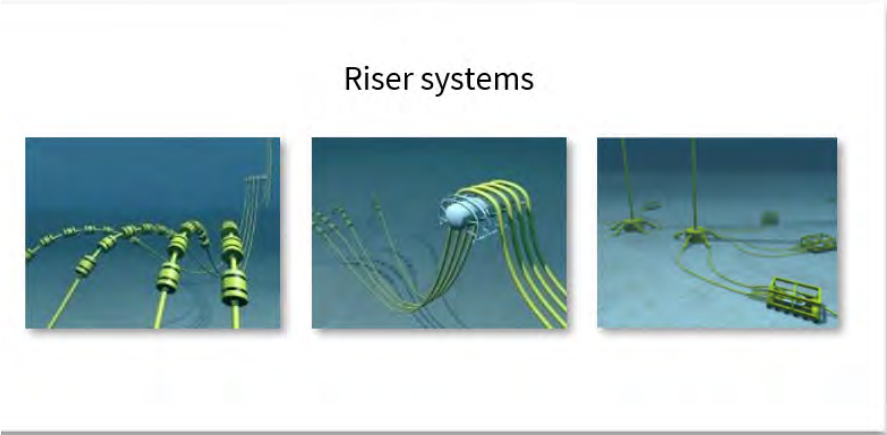
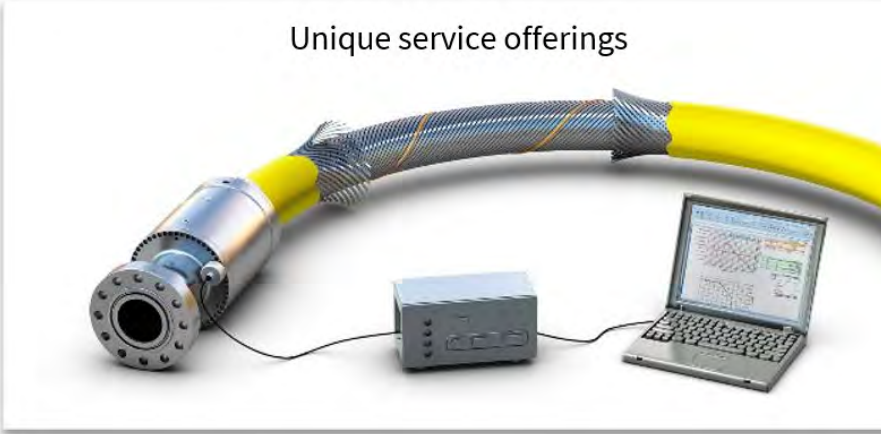
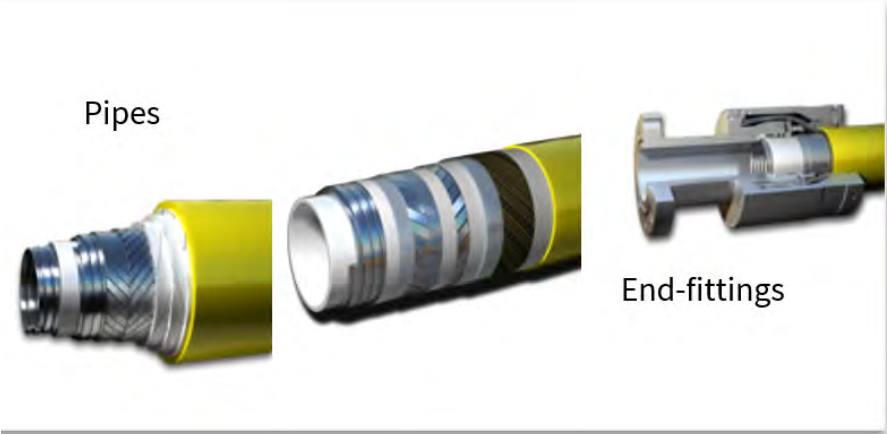
Capability

Water depth



Providing Complete Solutions

Examples of Current Offerings



Ariosh Overview

Overview



Established

1997

400+ Employees



Engineering & Construction



World Class Offices



ariosh
SAFETYFIRST!
Stay Alert... Always Remember

Fabrication Yard & Marine Logistics Base



Marine Assets



Oshe Honmi
Main Installation Vessel (MIV)
with Pipelay capabilities



Oshe Rewo
Anchor Handling Tug Supply (AHTS)



Oshe 3
Anchor Handling Tug (AHT)

Our Operations

Onshore

Engineering & Project Management
Fabrication
Marine Logistics Base

Offshore

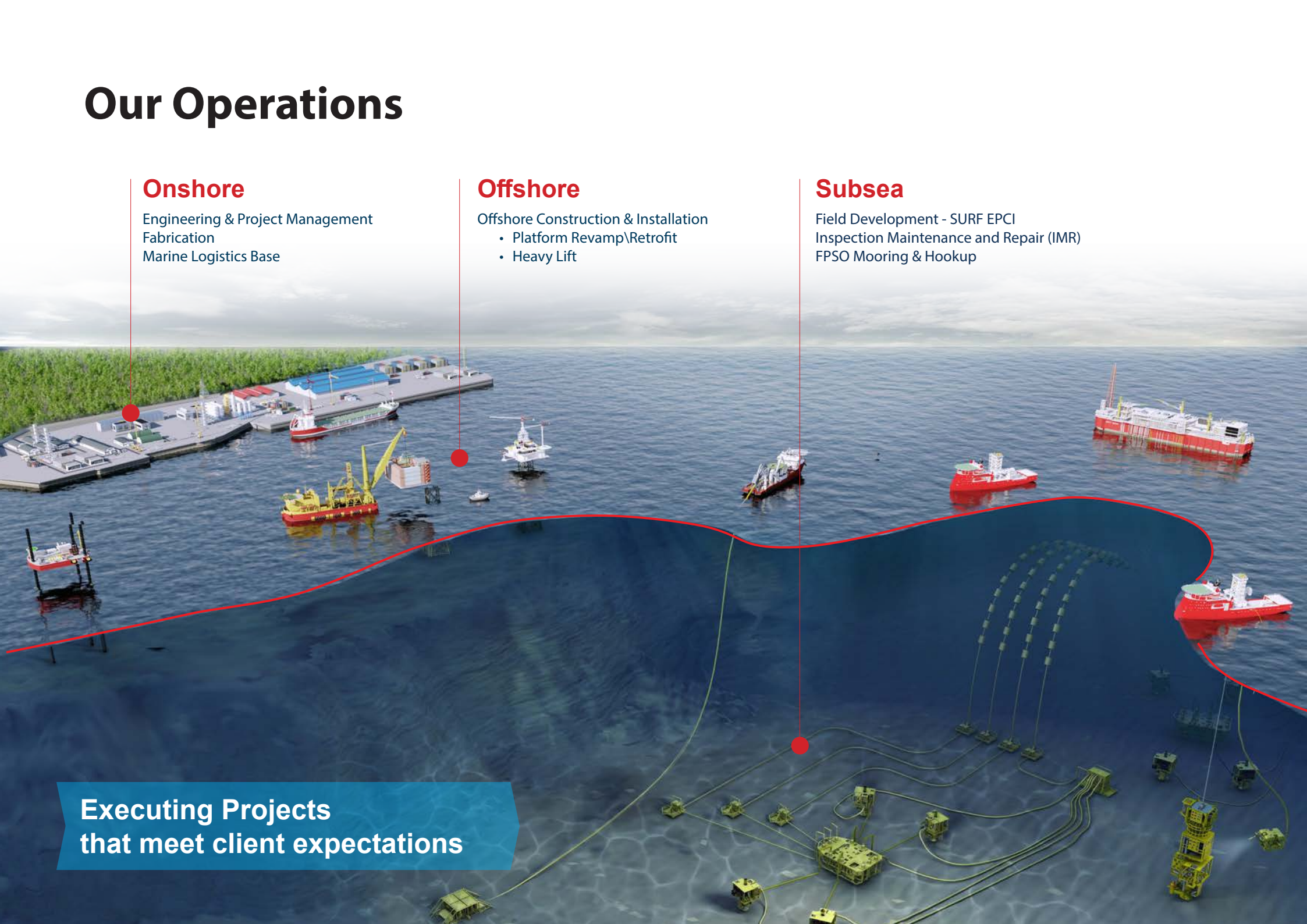
Offshore Construction & Installation

- Platform Revamp\Retrofit
- Heavy Lift

Subsea

Field Development - SURF EPCI
Inspection Maintenance and Repair (IMR)
FPSO Mooring & Hookup

Executing Projects
that meet client expectations



Vessel Fleet



Oshe Honmi Main Installation Vessel

- Accommodation - 402-Pax
- Deck Area - 1500 sq.m
- Deck Strength - 15T/m2
- Draft - 3.5m
- Helideck - CAP 437 Compliant



Oshe 3 DP1 (AHT)

- Accommodation - 20-Pax
- Deck Area - 170 sq.m
- Deck Strength - 5 T/m²
- Bollard Pull - 72.2T

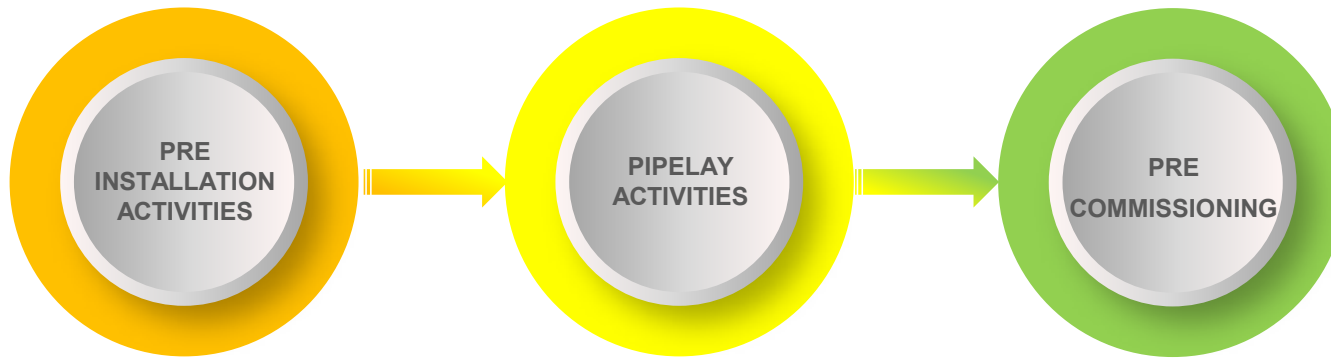


Oshe Rewo DP2 (AHTS)

- Accommodation - 48-Pax
- Deck Area - 450 sq.m
- Deck Strength - 7 T/m²
- Bollard Pull - 82.2T

Flexible Pipes Installation – Onshore/Swamp

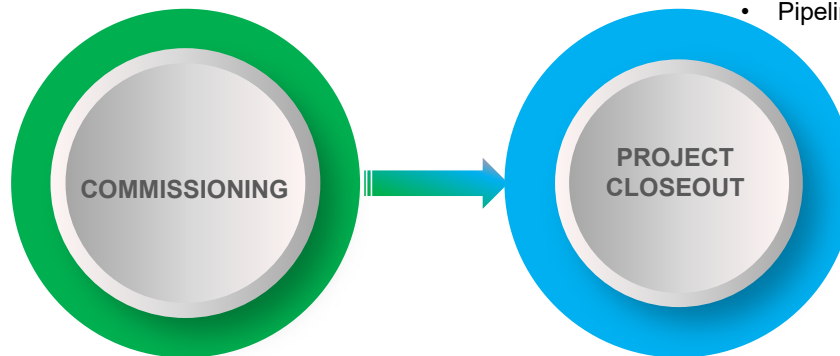
Flexible Pipe Installation - WBS



- Pre-installation survey
- Clearing and Grubbing Pipeline Right of way
- Pre-trenching Activities
- Positioning of Swamp Pipelay Barge

- Pipelay Activities
- Hose Floatation
- Installation and Testing

- Pipeline Cleaning and Gauging
- Pressure and Stabilization
- Hydrotesting
- Depressurization
- Pipeline Route Survey



- Pipeline Dewatering/Drying
- Nitrogen Purging
- Hose Burial

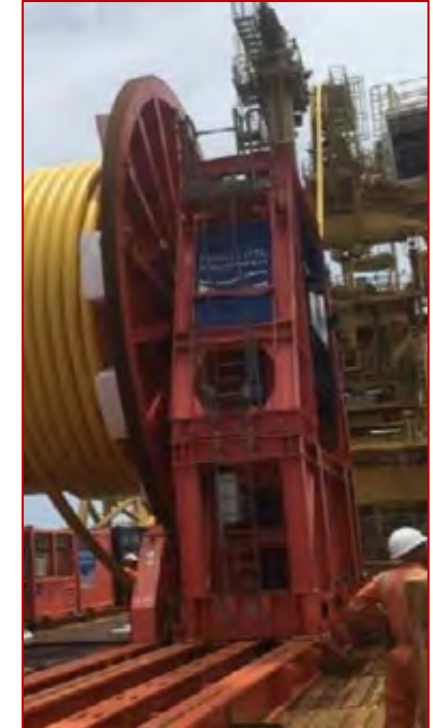
- Job Completion and Equipment Rig-down
- As-built Documentation
- Close-out Report
- Handing over DFO documentation & Surplus Material



PROJECT MANAGEMENT

- Project Management Services
- Engineering Management
- Third Party Services
- Permits and Certificates
- Insurances

Installation Spread



- Spud Barge
- Reel Drive System (RDS)
- Flexible Floaters
- Supply Vessel

- Flat Barge
- Tensioners
- Crane

- Towing Tug
- Chutes
- Swamp Excavator

- Security Boat
- Crew Boat
- Swamp Buggy

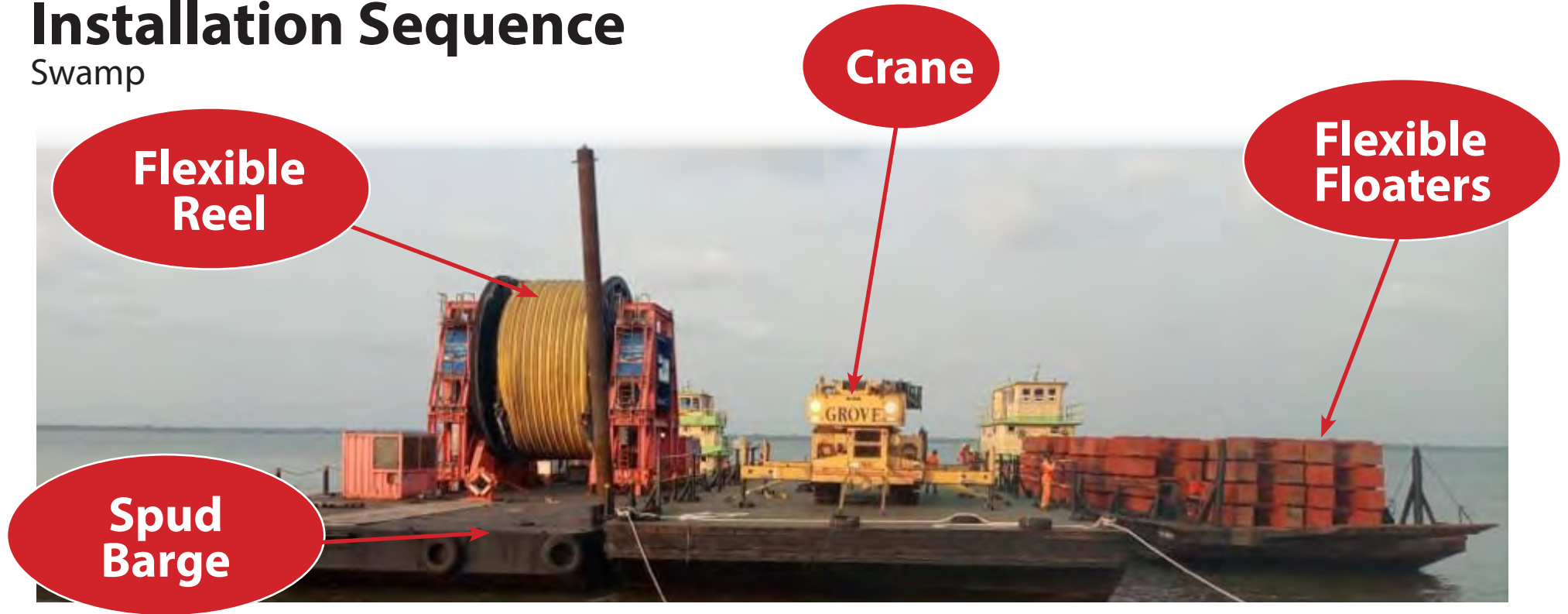
Work Plan

Pipeay

- Delivery of NOV reel to the port of client choice (preferably Escravos)
- Pre-installation survey of the Swamp Area
- Clearing, Grubbing and trenching of the pipeline right away
- Installation of reel system onto the pipelay barge
- Load out the reel on the spud Barge, Installation kit, floaters and crane on the barge
- Complete Passage Plan by Master & Barge Sail Away Certificate approval by MWS
- Mobilize to the pipelay startup location
- Laying of pipe following the pipeline lay route
- Installation of floaters on the pipeline
- Deploy floating flexible pipeline by use of swamp buggy and winches to the final tie-in location
- Hydrotesting, depressurizing of the pipeline
- Demobilization

Installation Sequence

Swamp



Step 1 - Onshore Mobilization

- Loadout of Flexible Reels on RDS & Spud Barge
- Mobilization and Sea fastening of Reel Drive System (RDS), Deployment Chutes & Tensioners, Cranes on the Barge
- Loadout of floaters on Barge
- Tug Tow out of barge (x 3), Security escort
- Personnel Mobilization
- Complete Passage Plan by Master & Barge Sail Away Certificate approval by MWS

Installation Sequence

Swamp

Step 2 - Barge Towing to Location

- Tug Tow out of barge (x 3) to location
- Security Escort
- Personnel transfer to site location

Step 3 - Installation

- Remove and cut sea-fastening and lashes
- Connect 1st end of the flexible to the crane & release from reel
- Connect the flexible floaters to the flexible end of the flexible
- Release the Reel Drive System and unspool the flexible flowline



Installation Sequence

Swamp

Step 3 Cont'd - Installation

- Connect multiple floaters along the flexible flowline
- Release flexible flowline along the survey lay route
- Guide, pull floating flexible to location,
- Release flexible from floaters and connect to the tie in point



Installation Sequence

Swamp

Step 4 - Precommissioning & Demobilization

- Perform Hydro-testing, Pipeline cleaning an
- Depressurization of the flowline
- Post lay survey
- Demobilization of Installation spread



Installation Sequence

Onshore/Land



Step 1 - Onshore mobilization

- Loadout of Flexible Reels with RDS on Hydraulic Module Low Truck
- Fastening the Flexible Reels on truck
- Loadout of flexible rollers, RDS and Tensioners
- Personnel Mobilization
- Complete Road Passage Plan approval by MWS

Installation Sequence

Onshore/Land

Step 2 - Set up at Onshore Location

- Position Flexible Reel with RDS on site location
- Put rollers in place to receive flexible flowline
- Lift the first end of the flexible connection with crane and put on the tensioner
- Move flexible along the flexible rollers to location



**Flexible
Rollers**



Tensioners

**Reel Drive
System**

Installation Sequence

Onshore/Land

Step 3 - Installation

- Slowly release the Reel Drive System and the tensioners to unspool the flexible flowline
- Move flexible flowline along the flexible rollers to location
- Drag / Move flexible to position with support of flexible rollers, crane and davit
- Release the positioned flexible flowline into the trenches



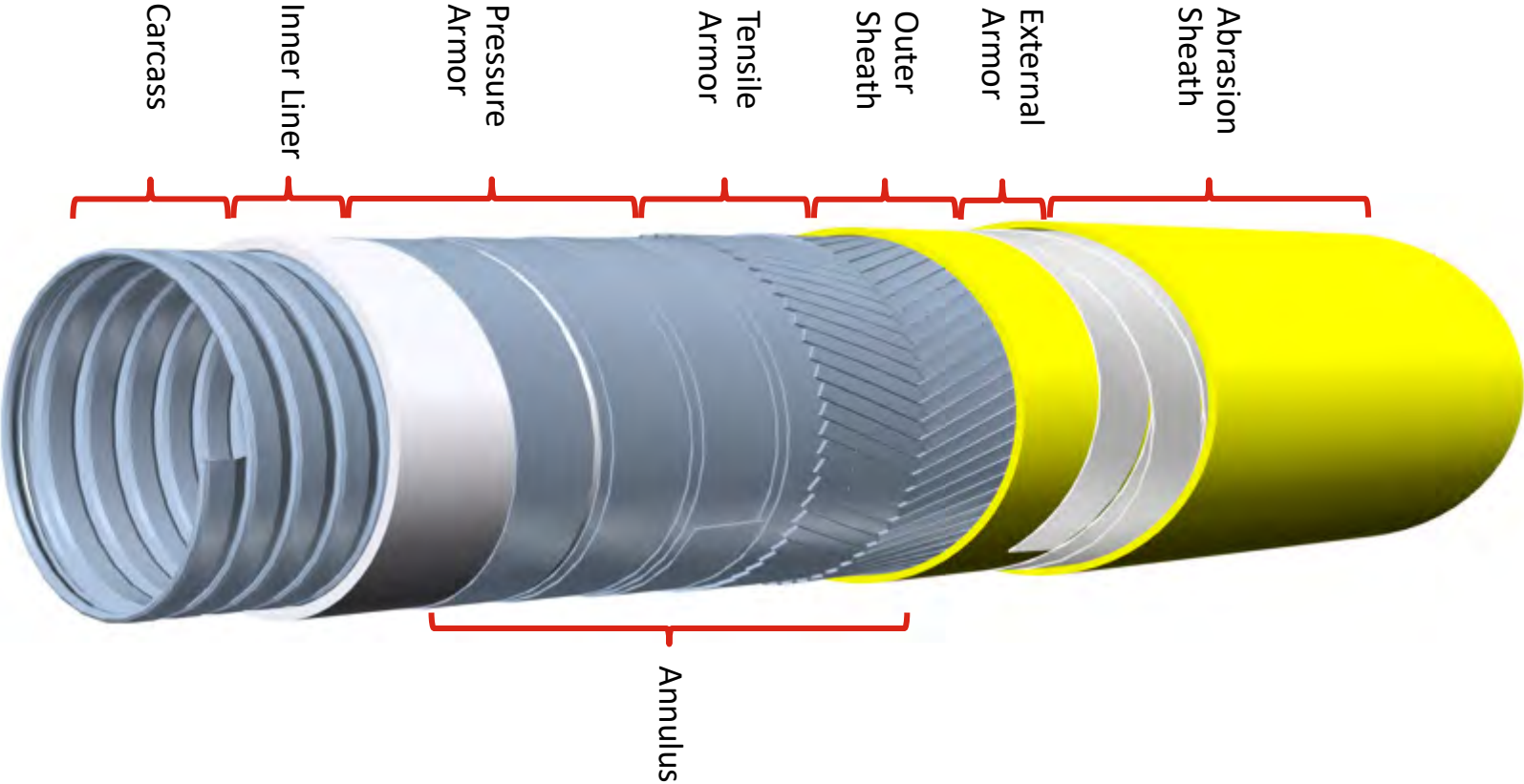
Step 4 - Pre-commissioning & Demobilization

- Perform Hydro-testing, Pipeline cleaning and
- Depressurization of the flowline
- Post lay survey
- Demobilization of Installation spread



API17J Flexible Pipes – Onshore/Swamp

API17J Flexible Pipes – Onshore/Swamp



API17J Flexible Pipes – Onshore/Swamp

Potential Safety Features

Abrasion Sheath (Optional Layer)

- Allow for installation by dragging from reel without compromising the primary outer sheath

External Armor (Optional Layer)

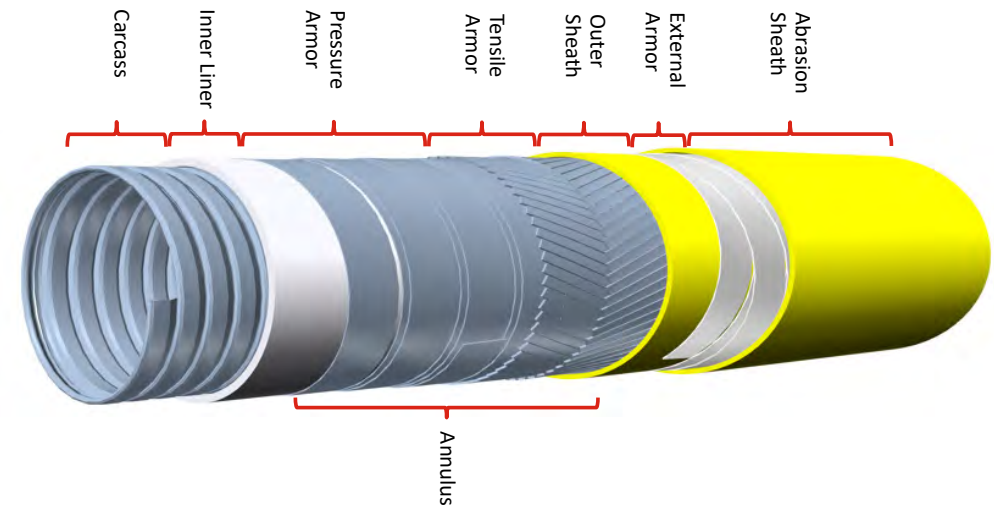
- Provides additional protection against tampering

Tensile and Pressure Armor (Primary Layers)

- Multiple steel wire layers making it difficult to drill and damage the inner sheath which is the fluid barrier of the pipe

Annulus (Primary Compartment)

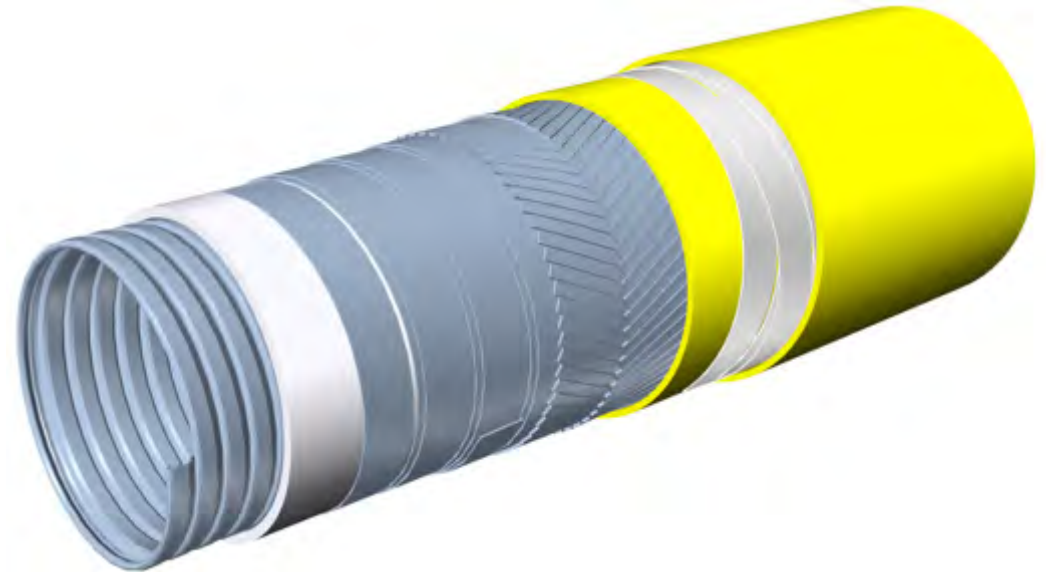
- Can as an option be filled and pressurized to 2bar with non-corrosive liquid deterrant as a measure to repel anyone that should manage to breach the three outer



API17J Flexible Pipes – Onshore/Swamp

Benefits of Flexible Pipes

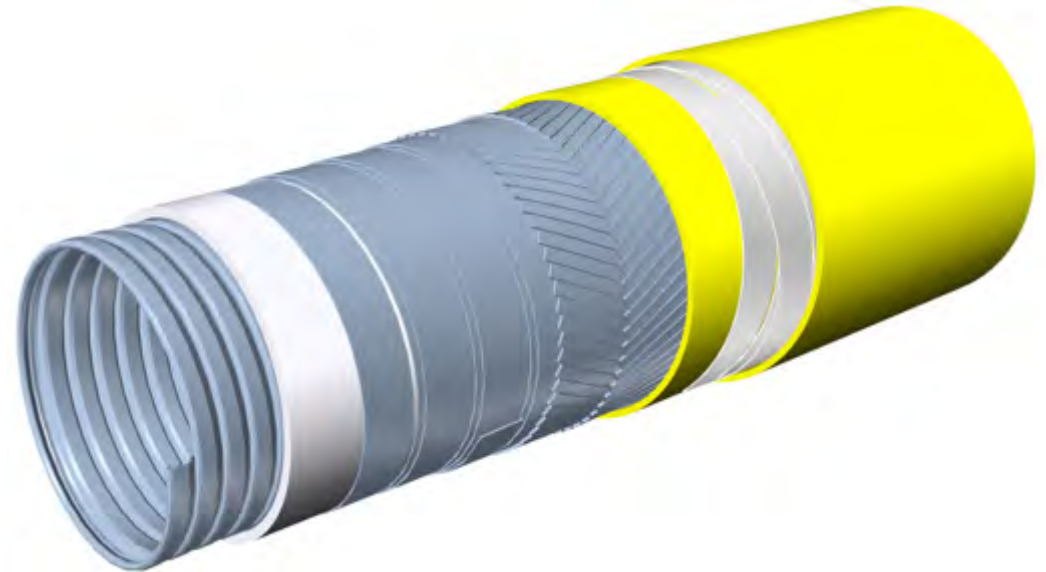
- API17J flexibles are ideal for laying in unstable terrain such as swampland, as the flexibles will accommodate the sinking and uneven contours without the need for concrete foundations and stabilizing measures. This makes the installation much simpler and the integrity of the pipe higher
- The pipe can be reeled and dragged. Additional abrasion sheath may be necessary depending on the terrain it is dragged across. If it is not possible to access the area with a vessel, the reels can be loaded onto specially equipped trucks and installed from such.
- The pipes themselves are virtually maintenance free. If installed in an onshore/swamp application the pipes will mainly require a yearly survey – but should not incur any damages.
- NOV's flexible pipes were deployed for Shell Nigeria's Odidi project in 2005. This was a swamp/on-shore application as well.



API17J Flexible Pipes – Onshore/Swamp

Benefits of Flexible Pipes

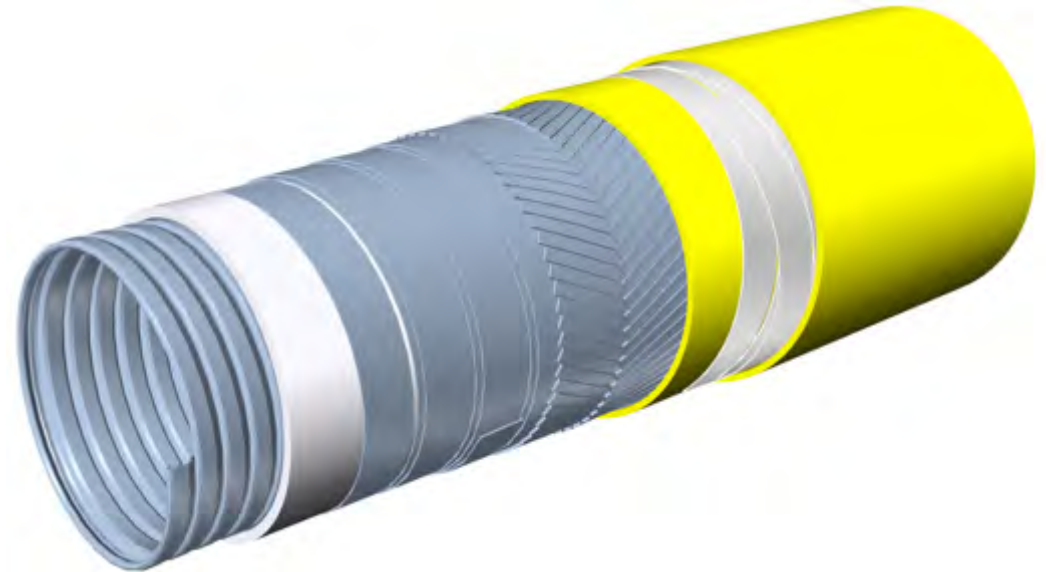
- Flexibles have been deployed in various both dynamic and static applications both offshore and onshore since the 90ies. Very few failures are identified throughout the years that have been associated with the technology itself. Flexibles are tailored to the specific application it is designated for. The flexibles are delivered as reeled product, cutting the installation time significantly compared to the typical approach for rigid pipes. While the product itself may be slightly more expensive than conventional carbon steel piping, it is when looking at the full “as installed costs” that the flexibles show their true value.



API17J Flexible Pipes – Onshore/Swamp

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ariosh **NOV**

Thank You!

