

Deepwater Isn't Really That Scary



Presentation to
OCSAB Workshop
Feb 3, 2016

Agenda

Presentation Goal: Give land professionals a broad overview on the history, challenges and development of deepwater projects.

1. Deep Gulf Energy
2. How Deep is Deepwater?
3. History of Deepwater Oil E&P
4. How Do We Decide Where and Whether To Drill?
5. Drilling and Completions
6. Macondo
7. Subsea Systems
8. Floating Production Systems
9. Project Management, Cost, Schedule
10. Major Messages

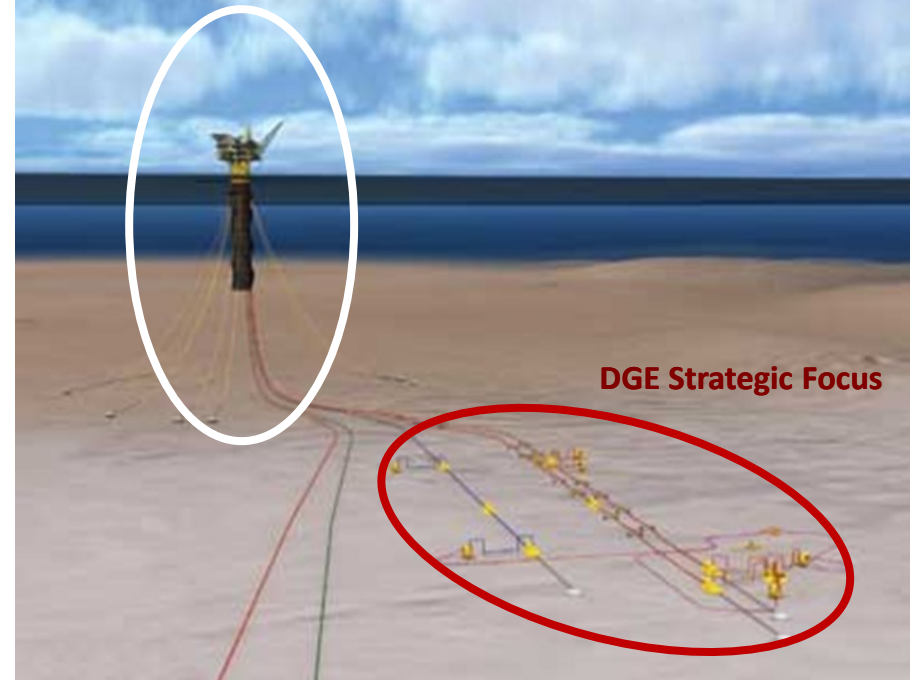
DGE Company Summary and Focus



DGE Highlights

- Formed 2005 by key management of Mariner Energy:
- Primary backer: First Reserve Corp
- Spent \$1.5B to date
- No LTAs or spills
- Specialize in subsea developments tied back to existing host platforms
- Develop projects that are not material to the major oil companies
- Focus on exploitation and low risk exploration prospects: 80% exploration success rate so far
- Concentrate in oil prone areas of the DW GOM near existing Infrastructure
- Low cost operator
- Get projects on stream quickly (less than 2 years from discovery to first production)
- Partner to diversify risk

Overview of Deepwater Development



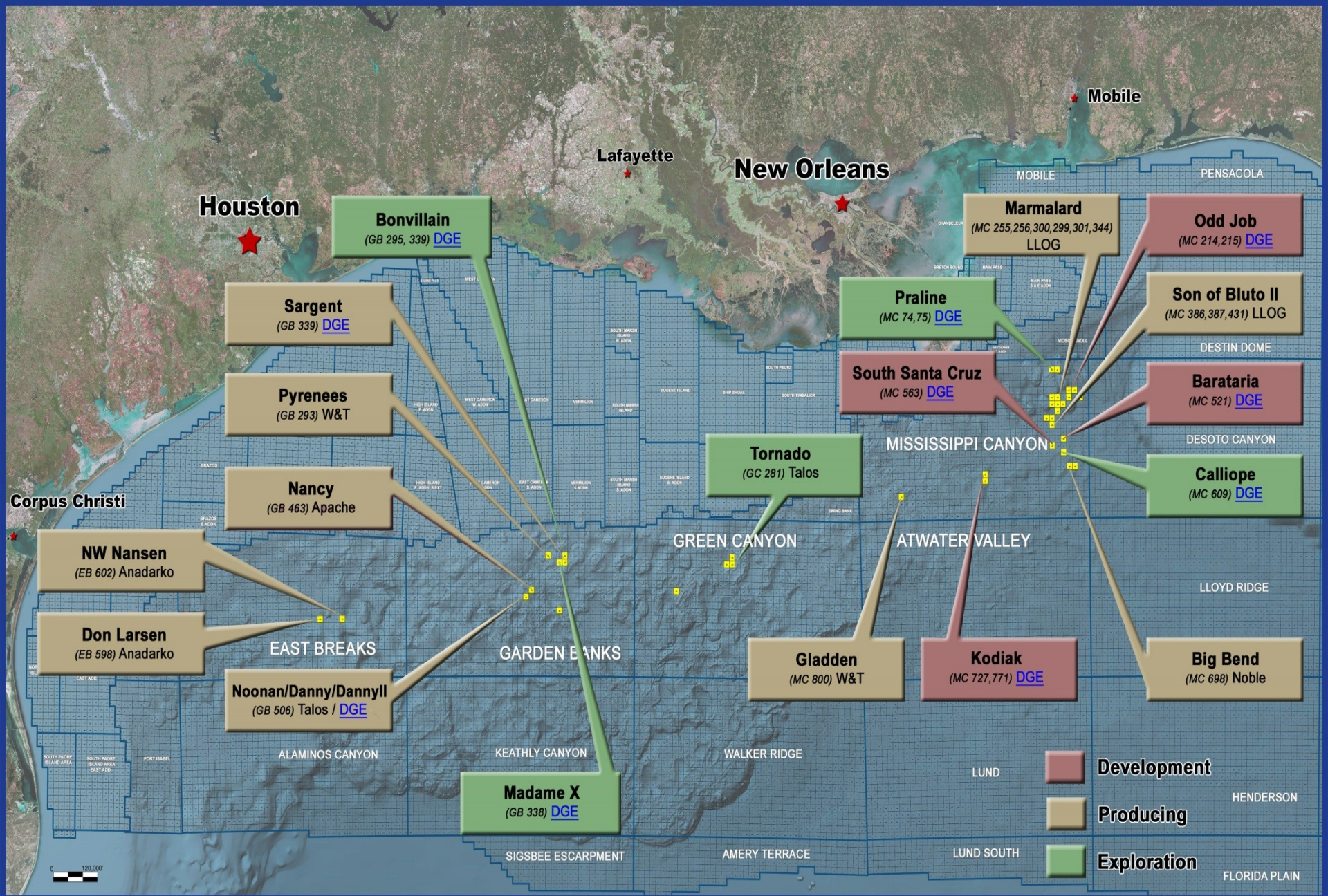
Standalone Development

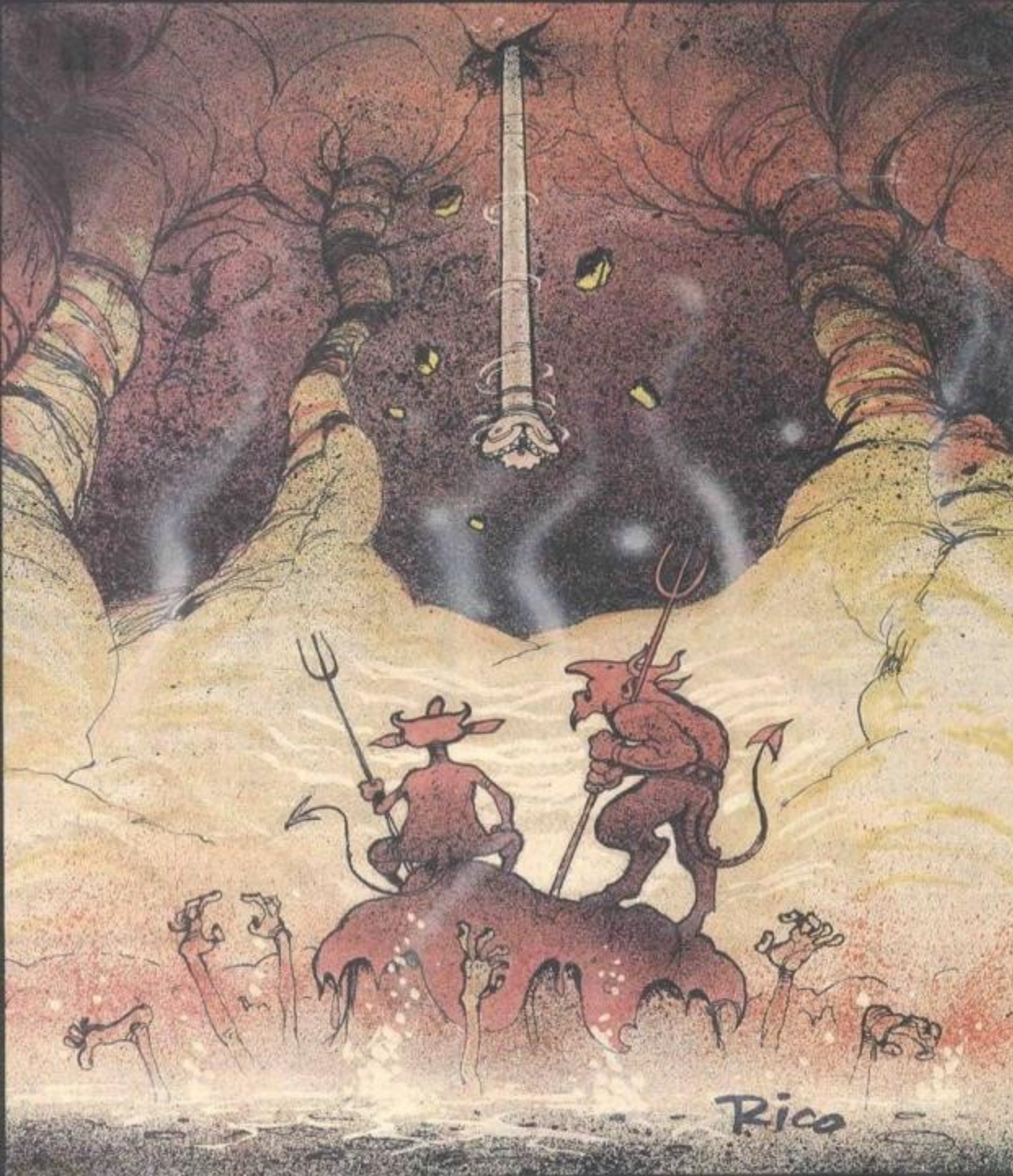
- Cost: \$4-6 billion
- Reserves: 250 Mmboe +
- Prod: 75 MBOPD
- First Prod: 5-10 yrs

DGE Subsea Development

- Cost: \$170-250 million
- Reserves: < 20 Mmboe
- Prod: 10 MBOPD
- First Prod: 2-3 yrs

Deep Gulf Energy – GOM Portfolio





“*&%\$&#*!!! –
another deepwater
development – they
must be getting
desperate up there.”



Traditionally “Deepwater” is 1000’ : Max normal working depth for divers



**Bullwinkle: GOM, 1066' W.D.
About as deep as you can go with gravity**



“Deepwater” is really the technology used, not just the water depth.



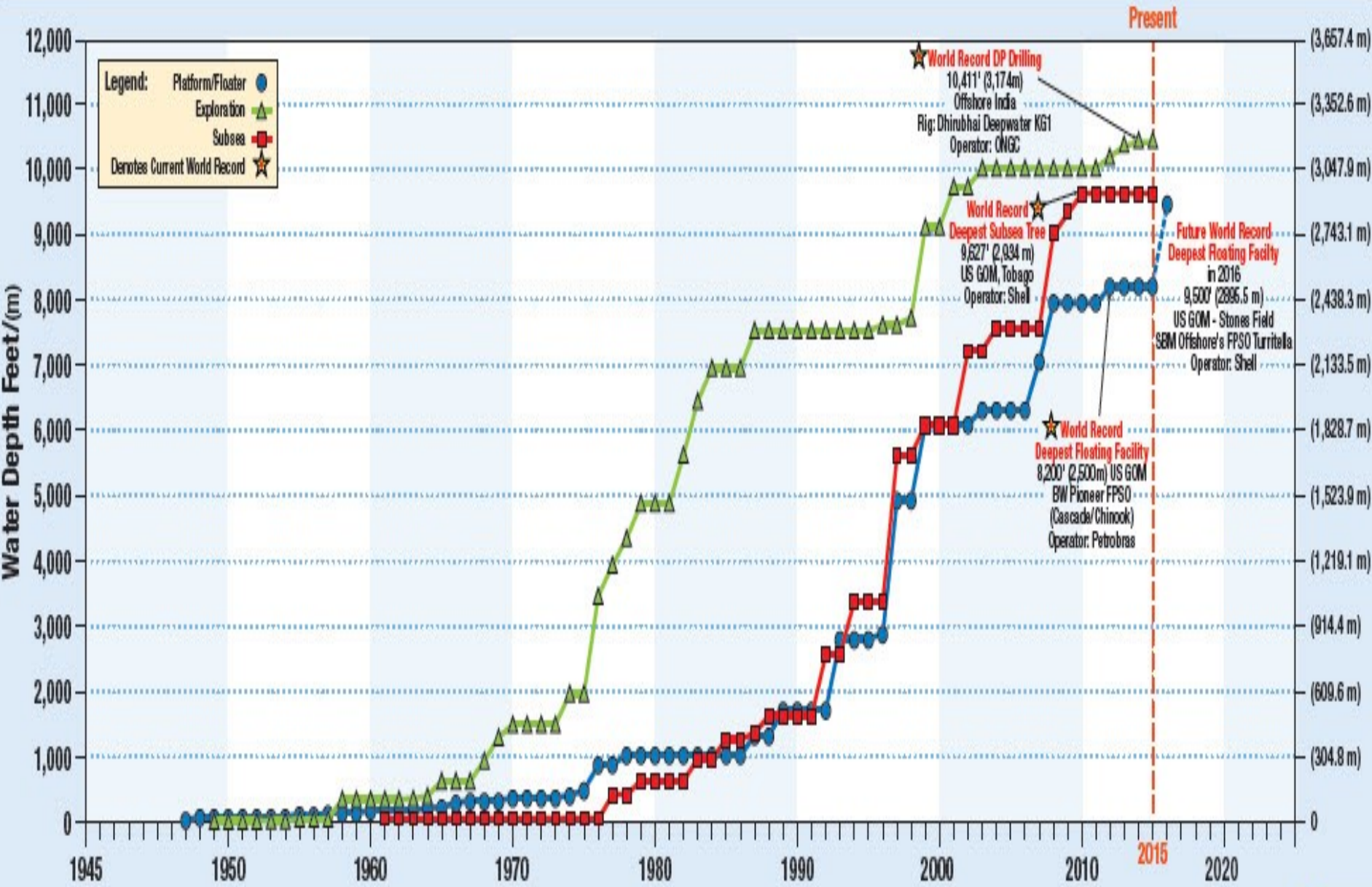
Does not float and thus not “Deepwater” 



**Troll Field
North Sea
426' W.D.**

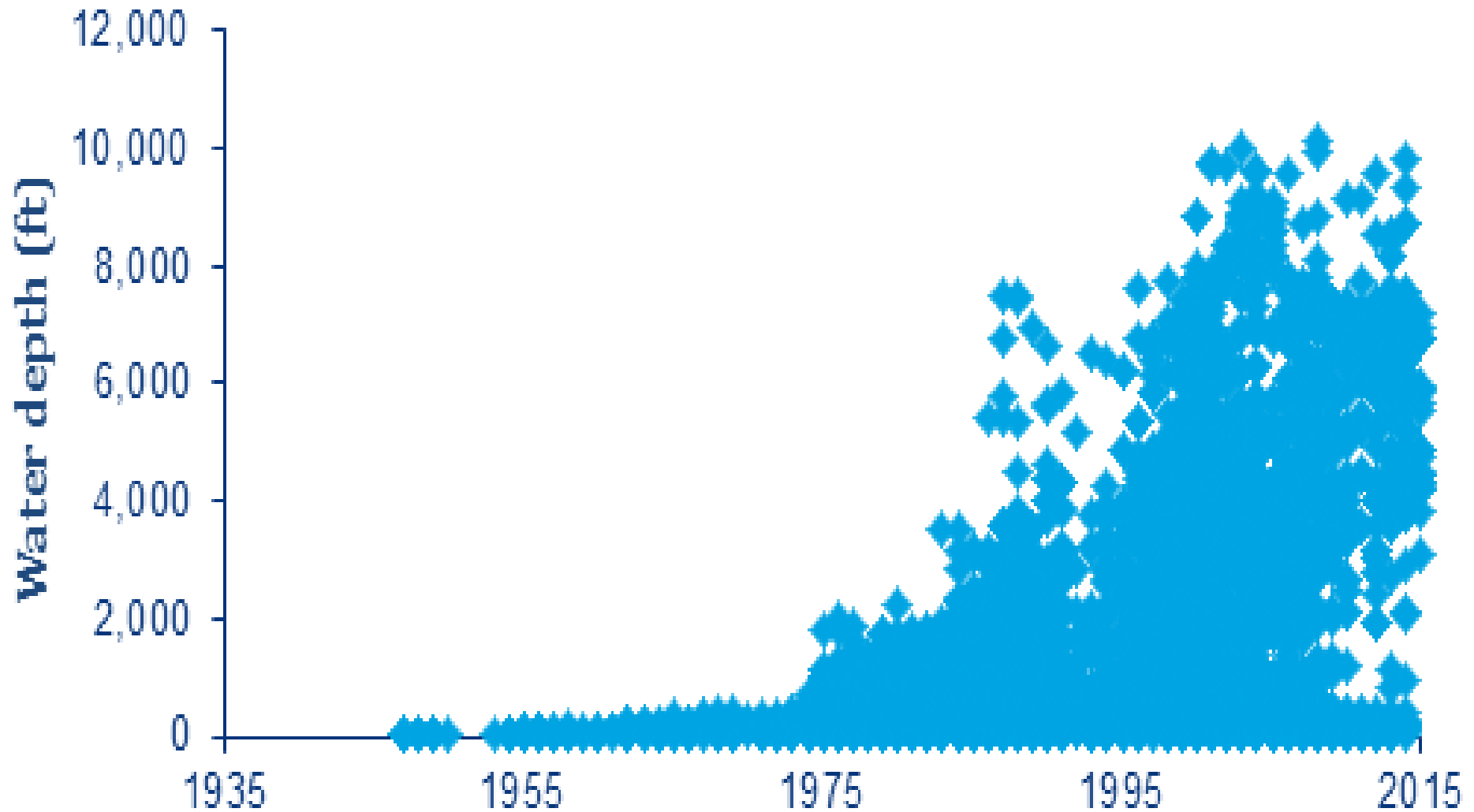
**Expensive
but not
deepwater**

Worldwide Progression of Water Depth Capabilities for Offshore Drilling & Production (Data as of March 2015)

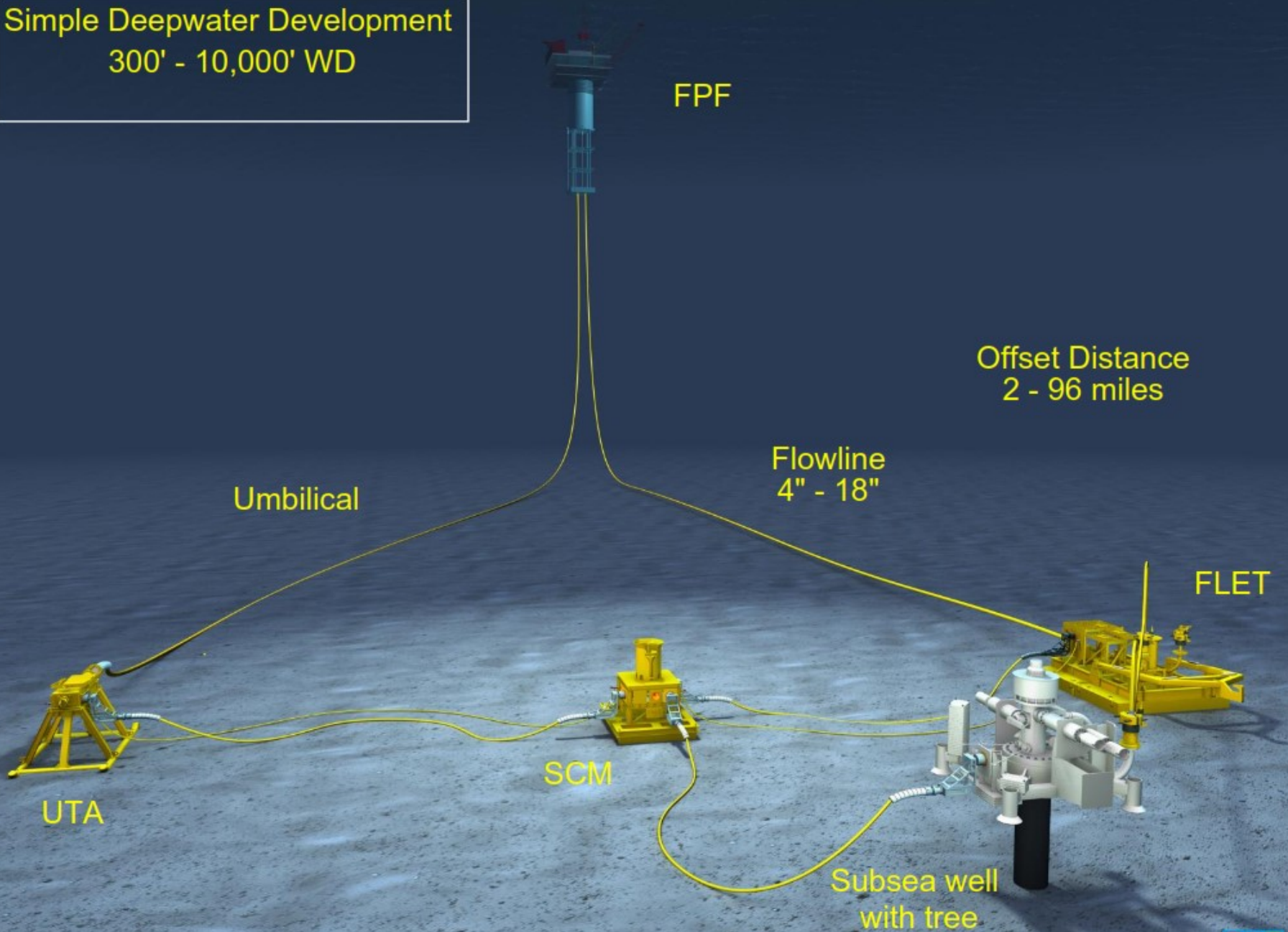


Notes: 1. Assistance from Quest Offshore Resources, Inc. (www.questoff.com)

GOM Offshore Wells

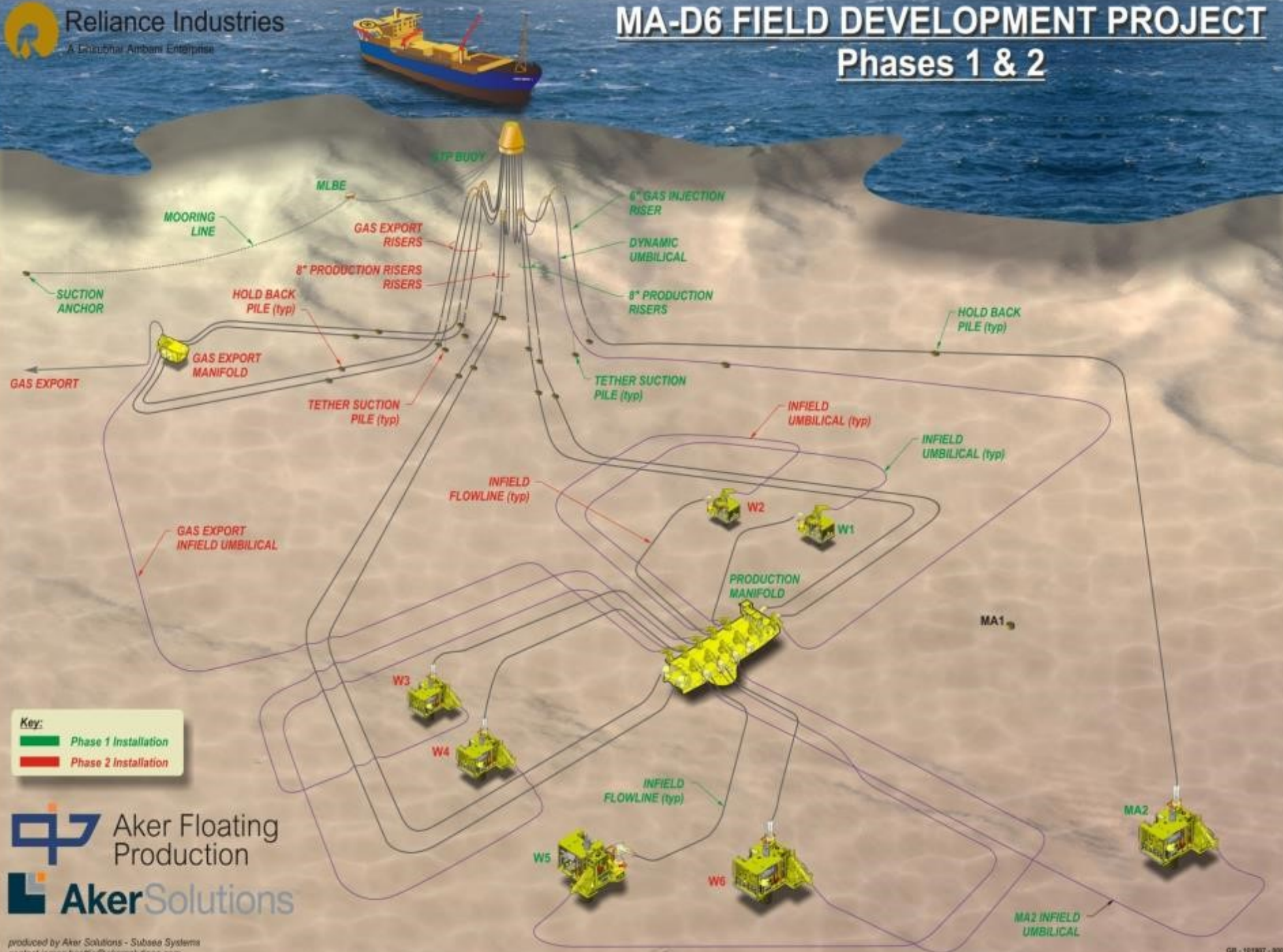


Simple Deepwater Development
300' - 10,000' WD



MA-D6 FIELD DEVELOPMENT PROJECT

Phases 1 & 2

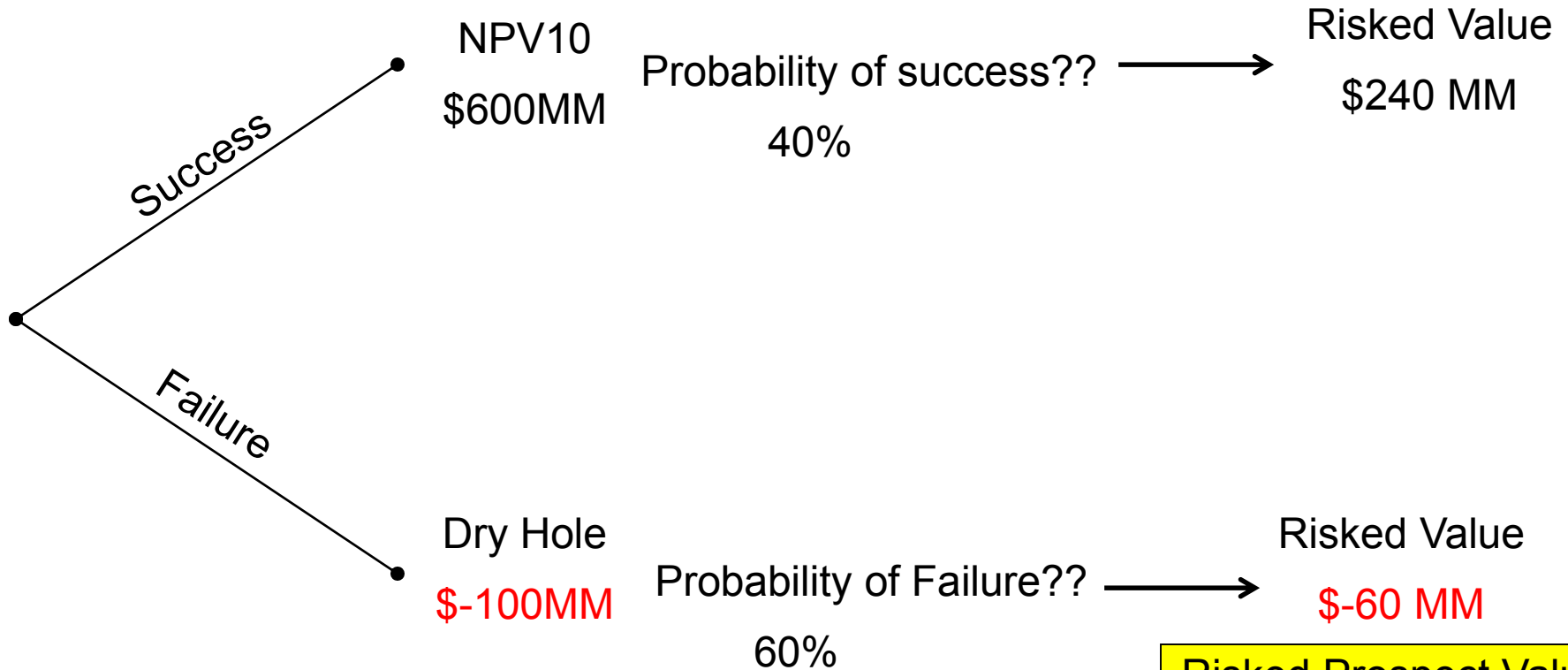


Key:
█ Phase 1 Installation
█ Phase 2 Installation



**How do we
decide whether
to drill?**

Prospect Evaluation



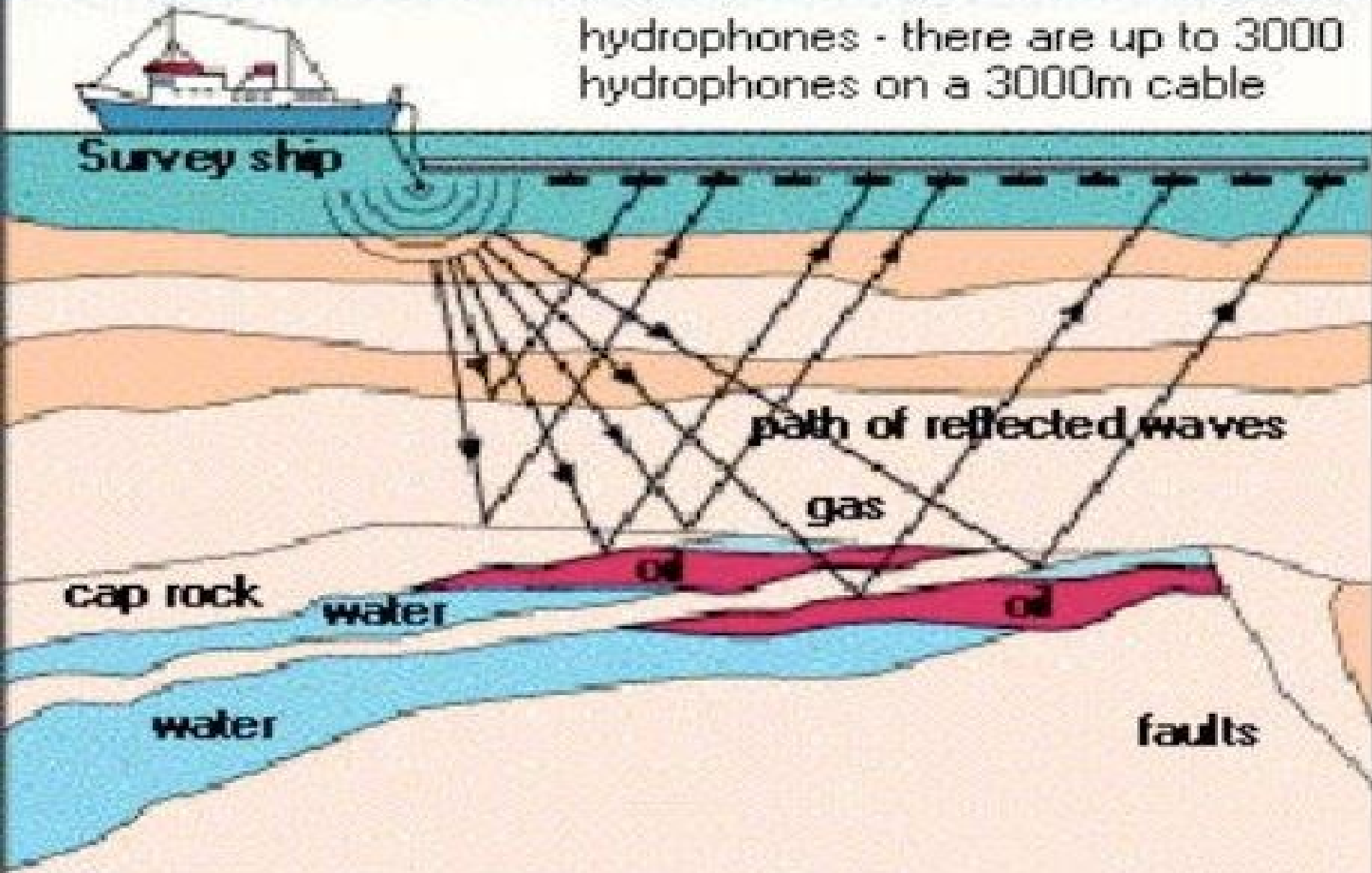
If the chance of success is 40%

Drill Baby Drill!

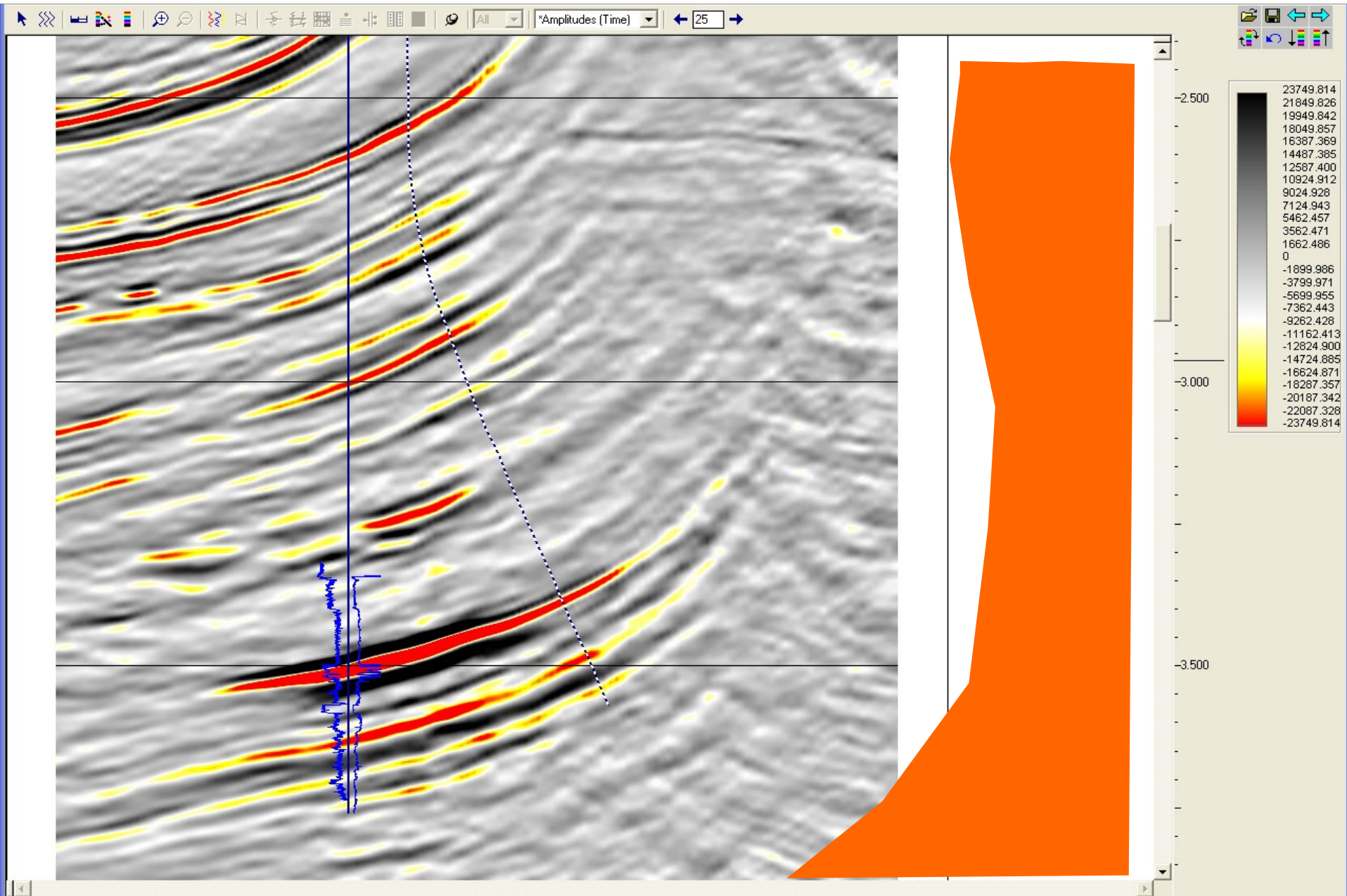


air-gun is the source of shock waves - compressed air is more environmentally friendly than explosives

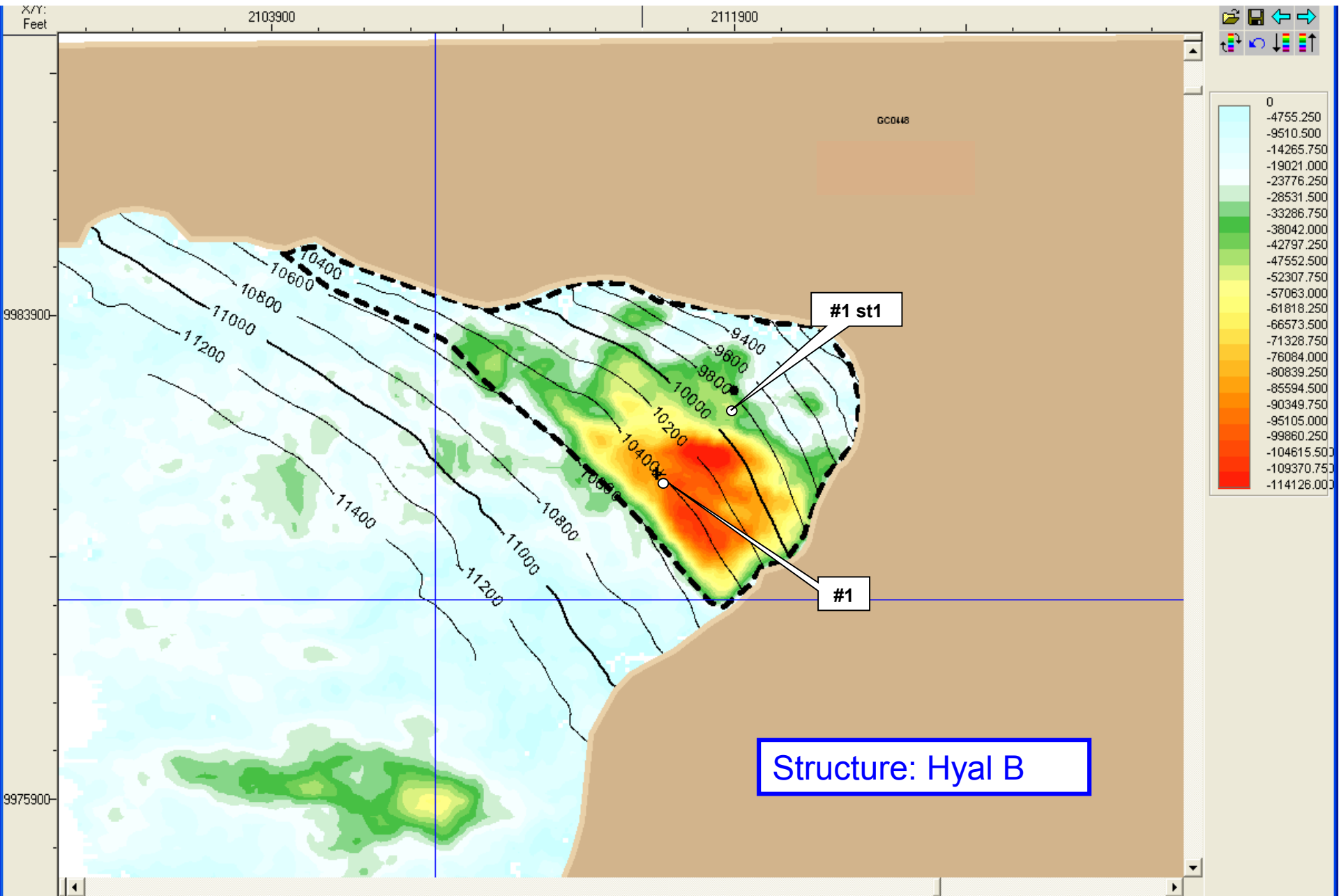
hydrophones - there are up to 3000 hydrophones on a 3000m cable



What are we looking for?

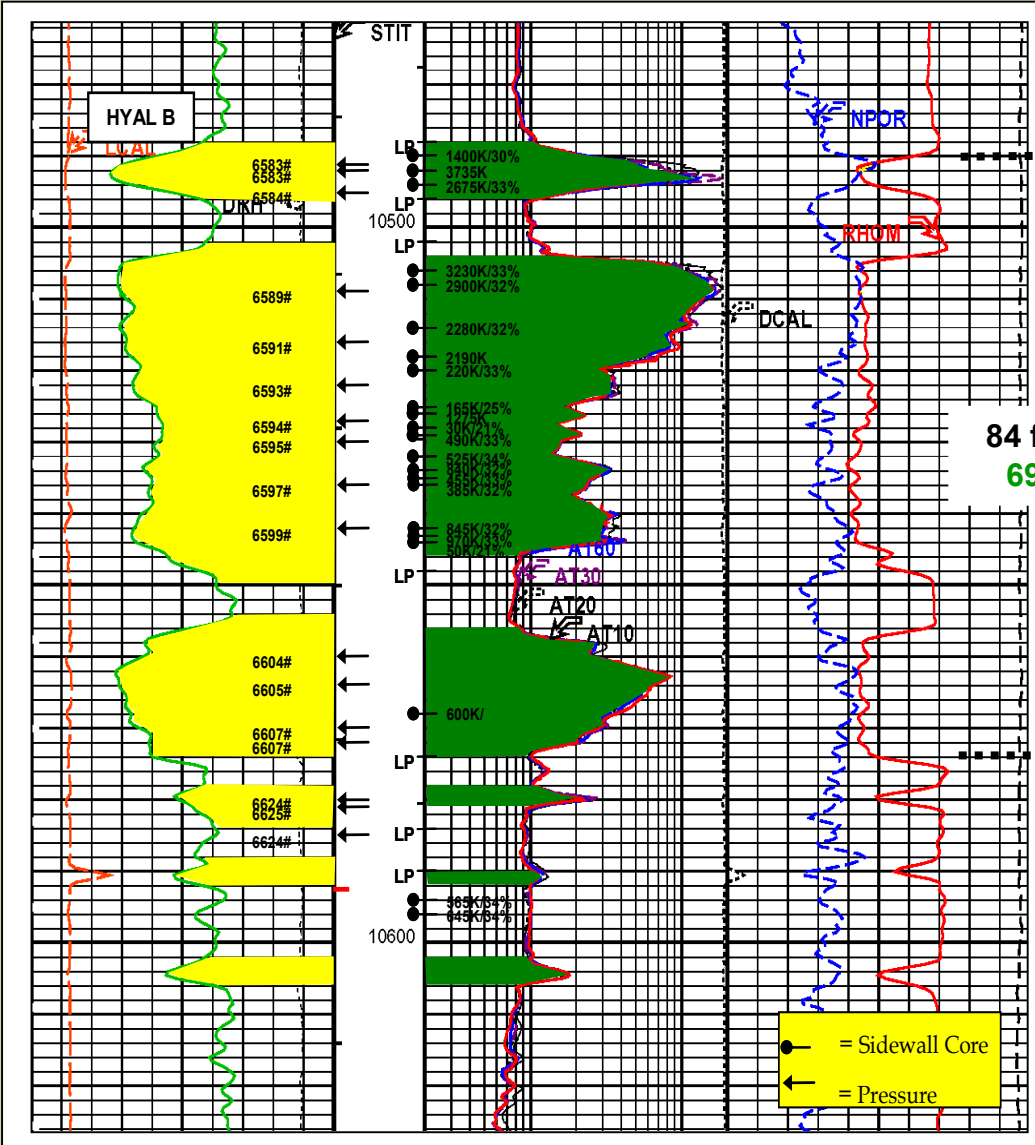


Is it big enough?



What is it?

5" T-COMBO



Key Parameters

82% N/G

32.9% PHI

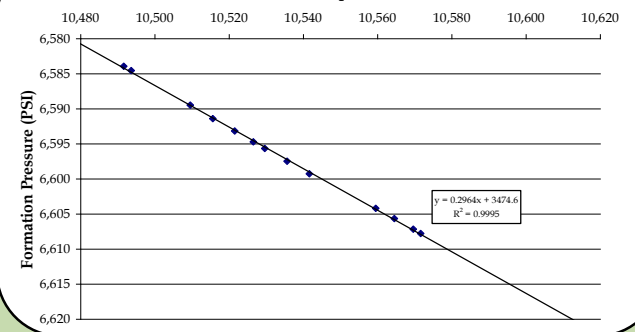
26.6% Sw

31 API

1229 GOR

Saturated

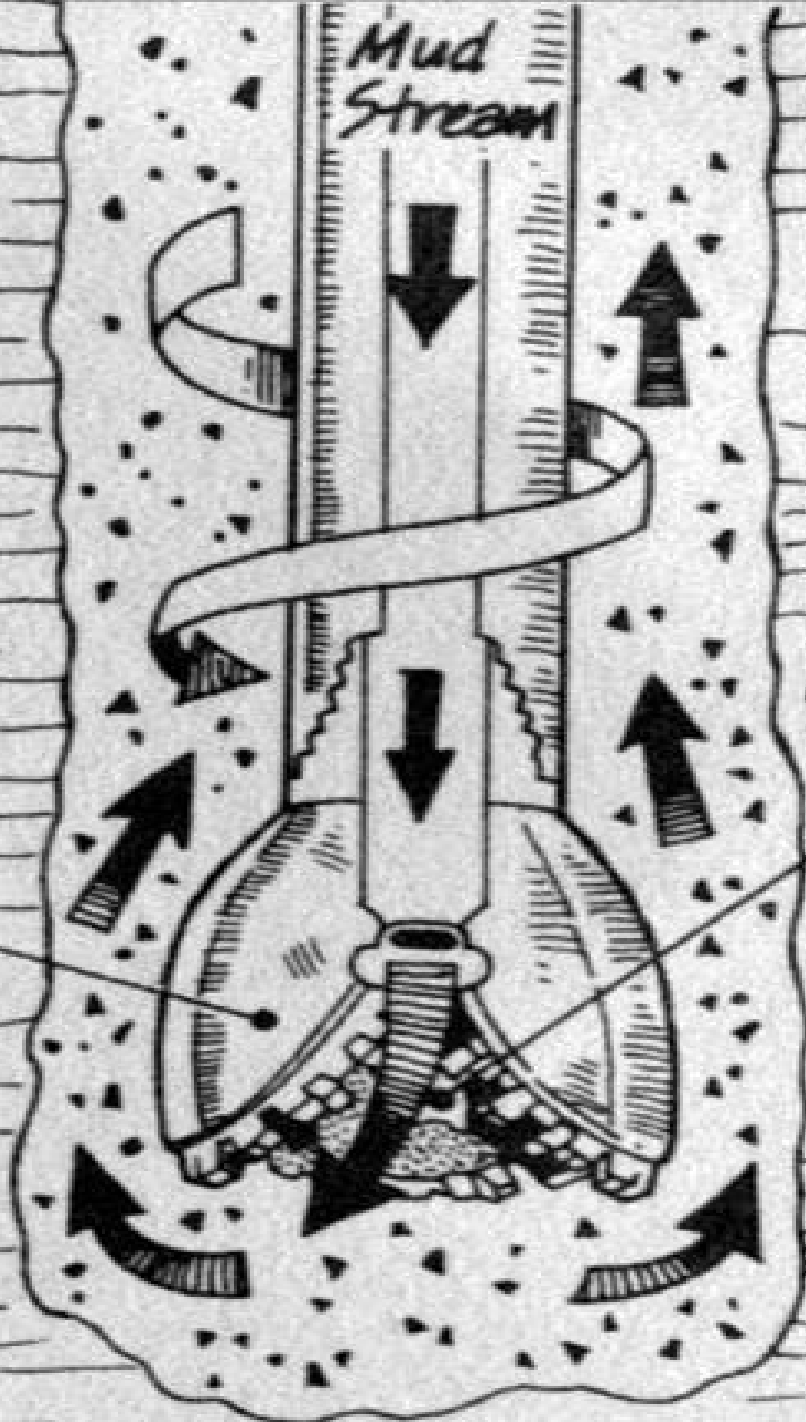
Formation Pressure Gradient



Drill Bit

Mud Stream

Mud passing through the bit, keeping it cool and carrying cuttings to the surface





GB 339 Wellbore Schematic

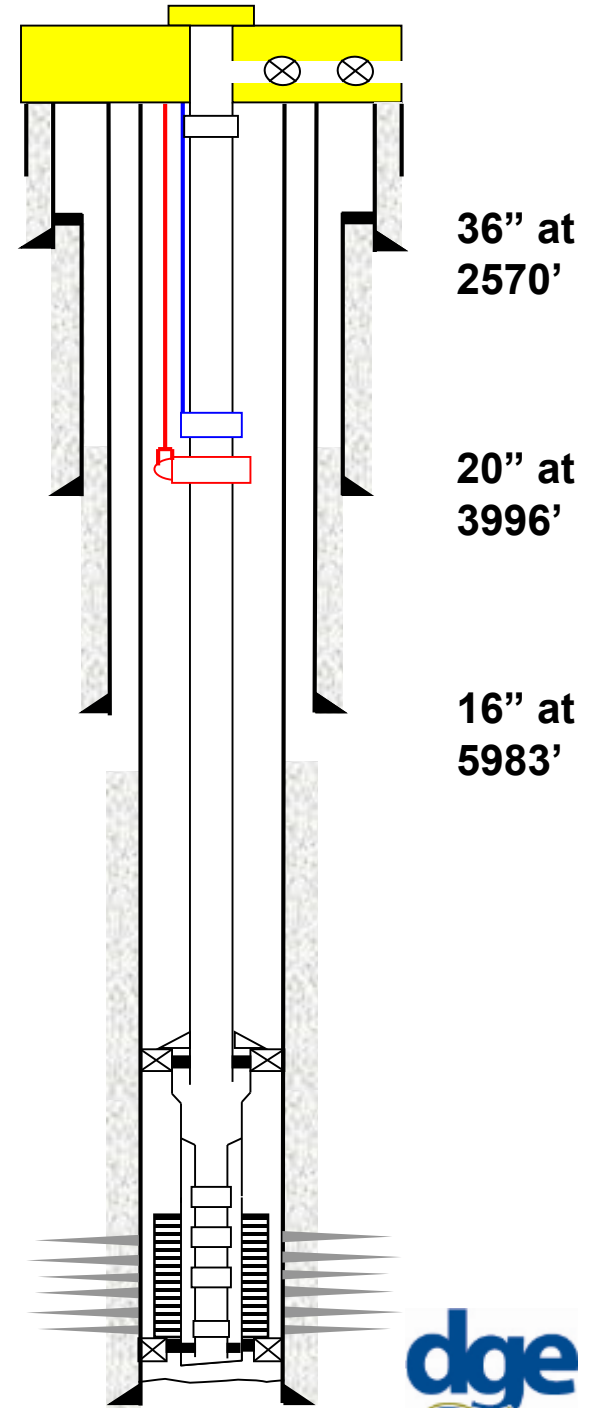
10,000 psi Vertical Tree

Chemical Injection Mandrel
Dome Charged SCSSV (below hydrate region)

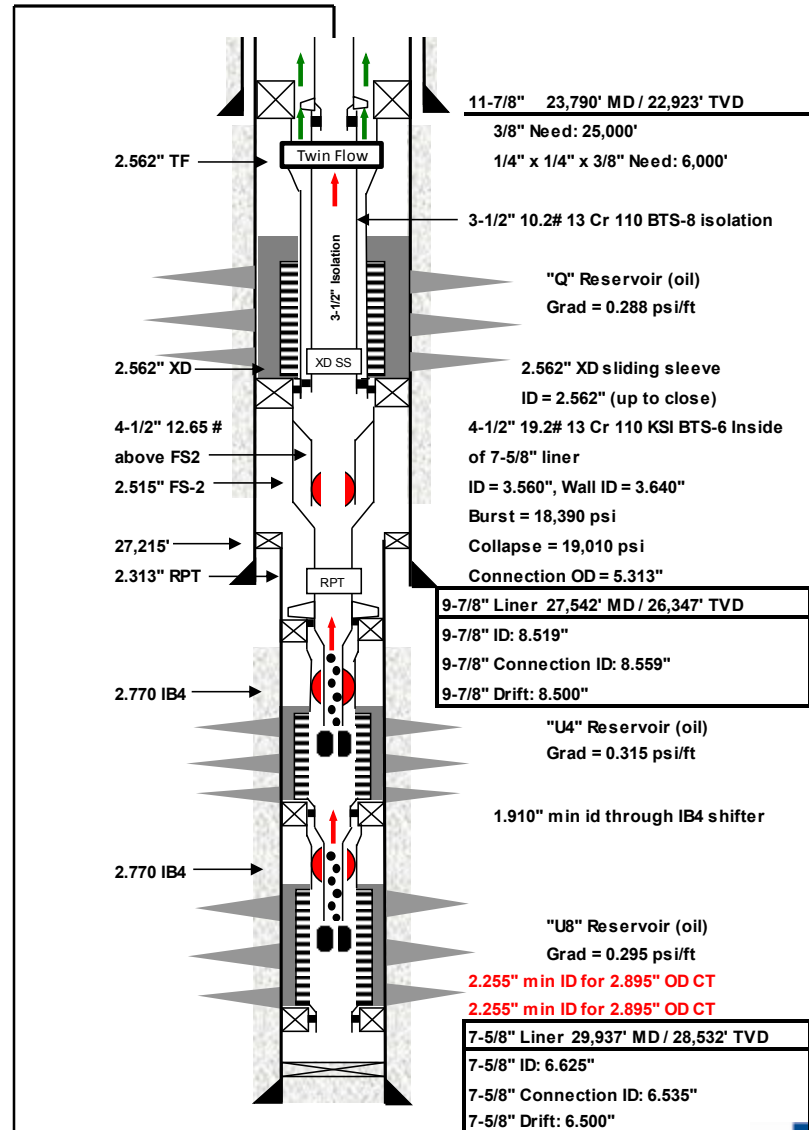
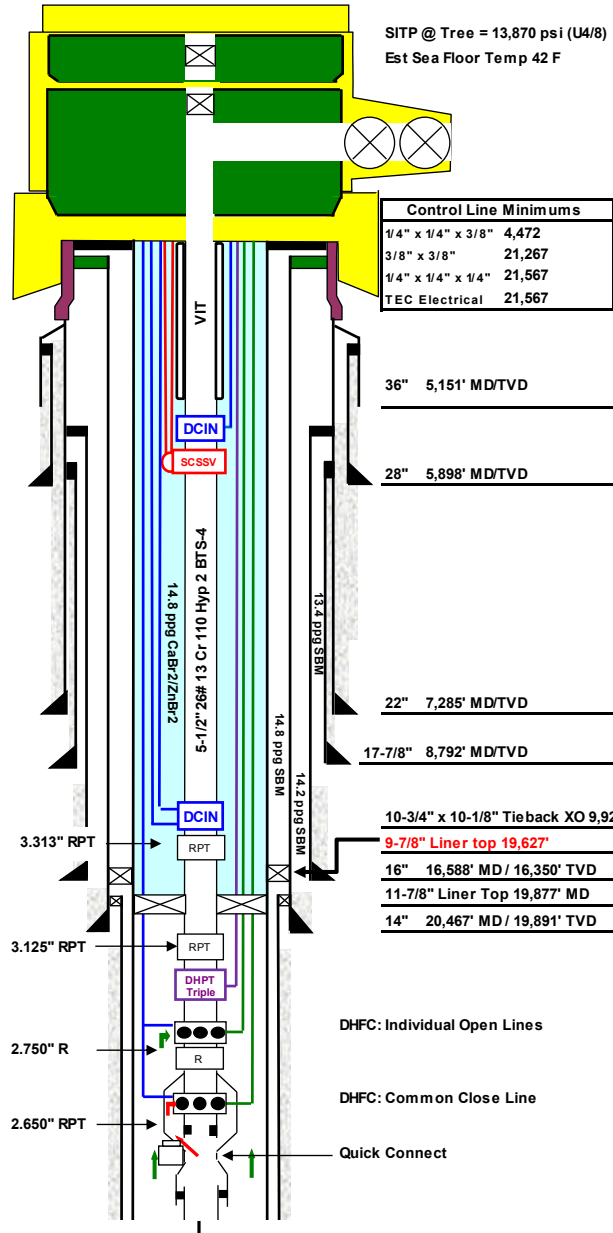
4-1/2" 13 Cr Tubing, Premium Connections

Frac Pack Completion

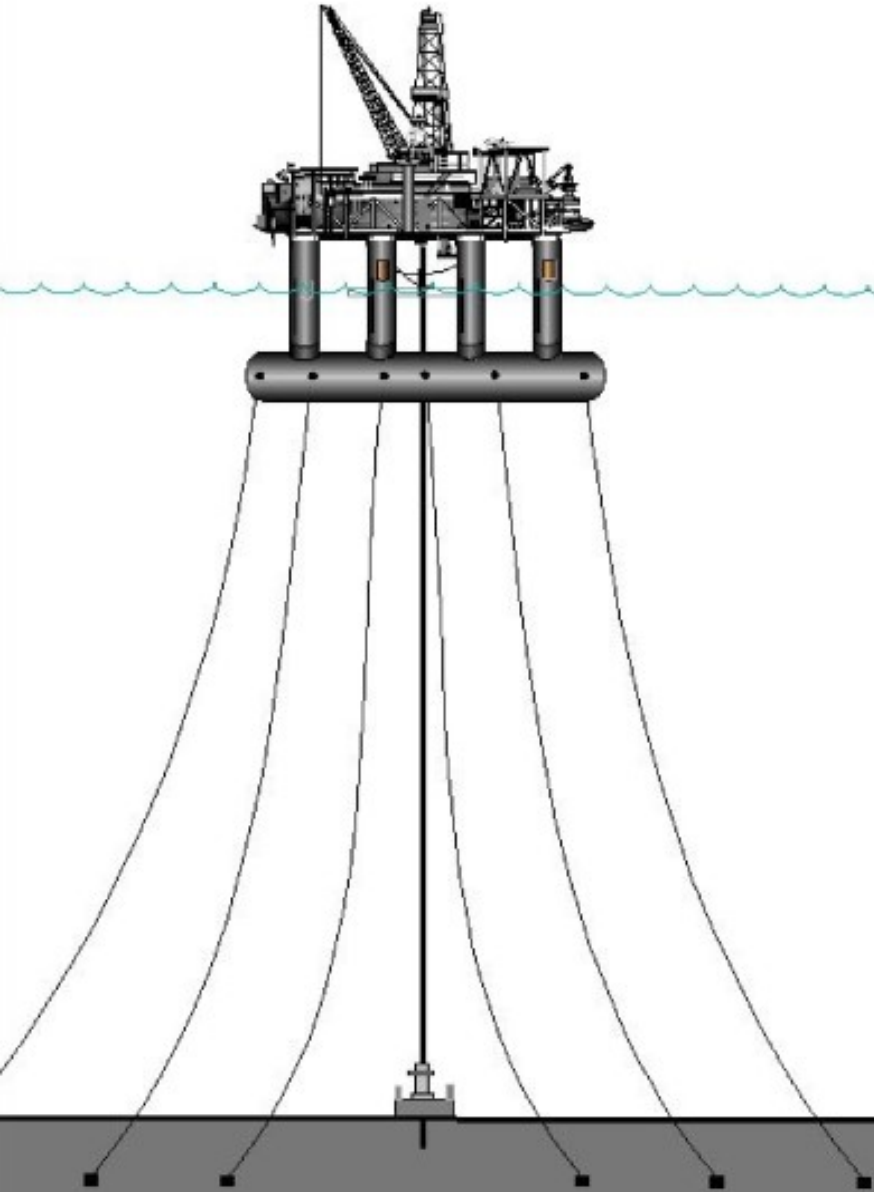
9-5/8" at 8473'



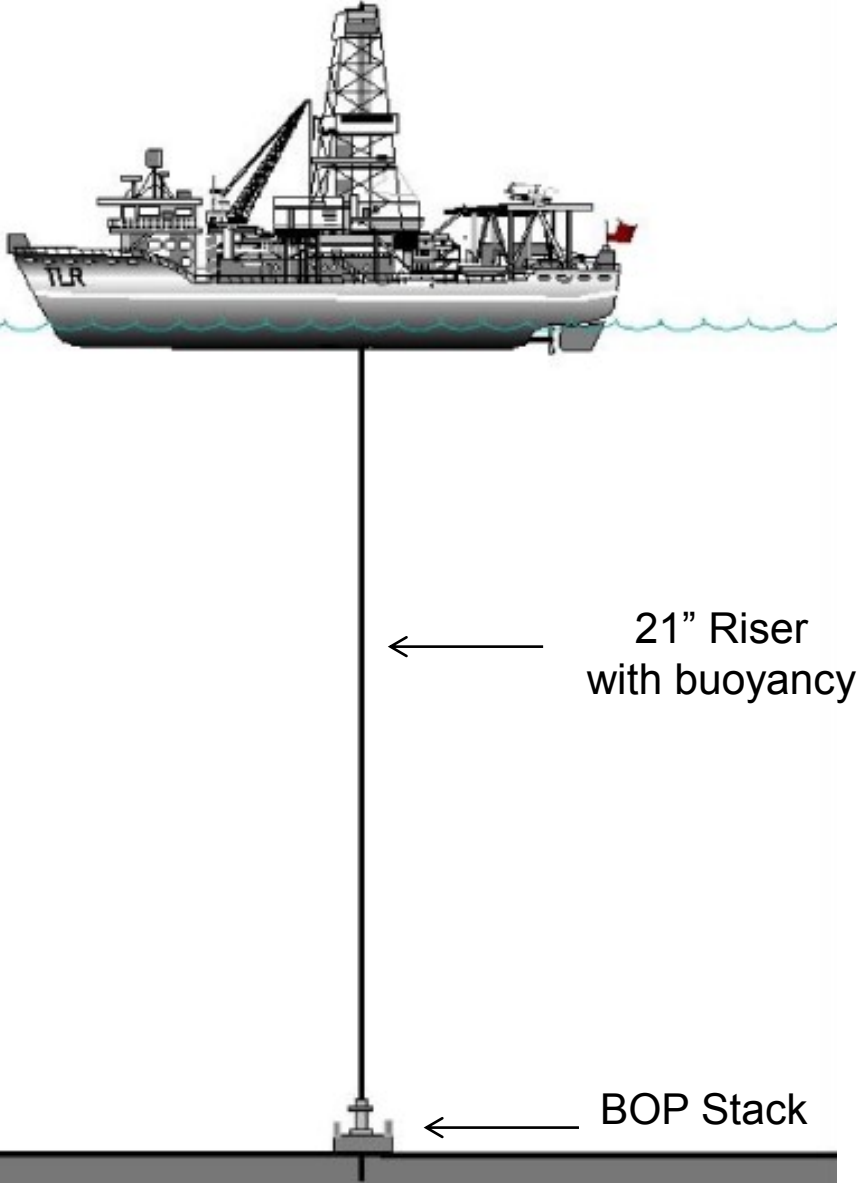
Kodiak Completion



Moored Semi-submersible



Dynamically Positioned Drillship



BOP Stack

Riser

LMRP

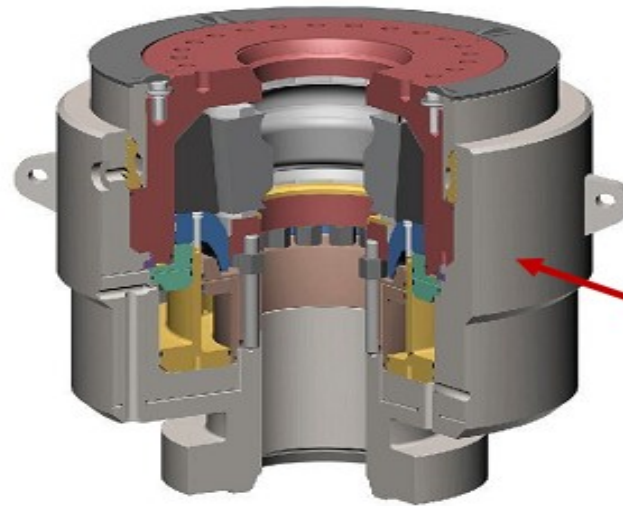
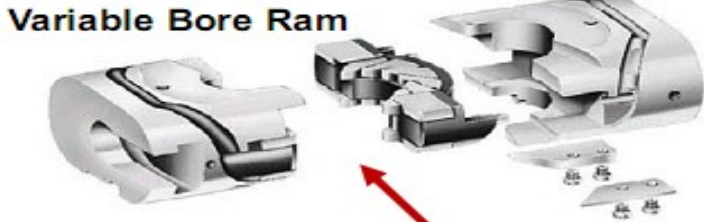
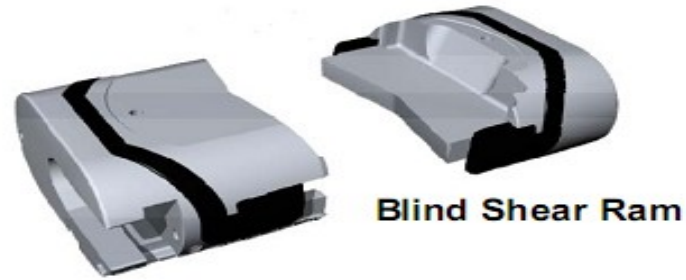
Lower Stack

Wellhead

Riser Being Run Thru Moonpool



BOP Stack



RISER ADAPTER

UPPER ANNULAR

LOWER ANNULAR

LMRP CONNECTOR

BLIND SHEAR RAM

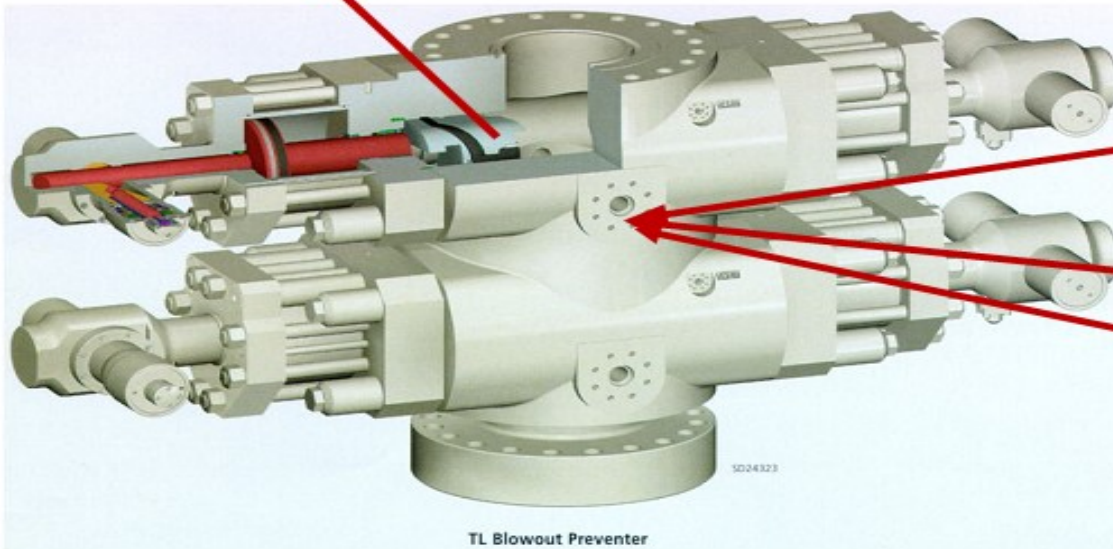
CASING SHEAR

3 1/2 TO 6 5/8 VBR

3 1/2 TO 6 5/8 VBR

3 1/2 TO 6 5/8 VBR Test Ram

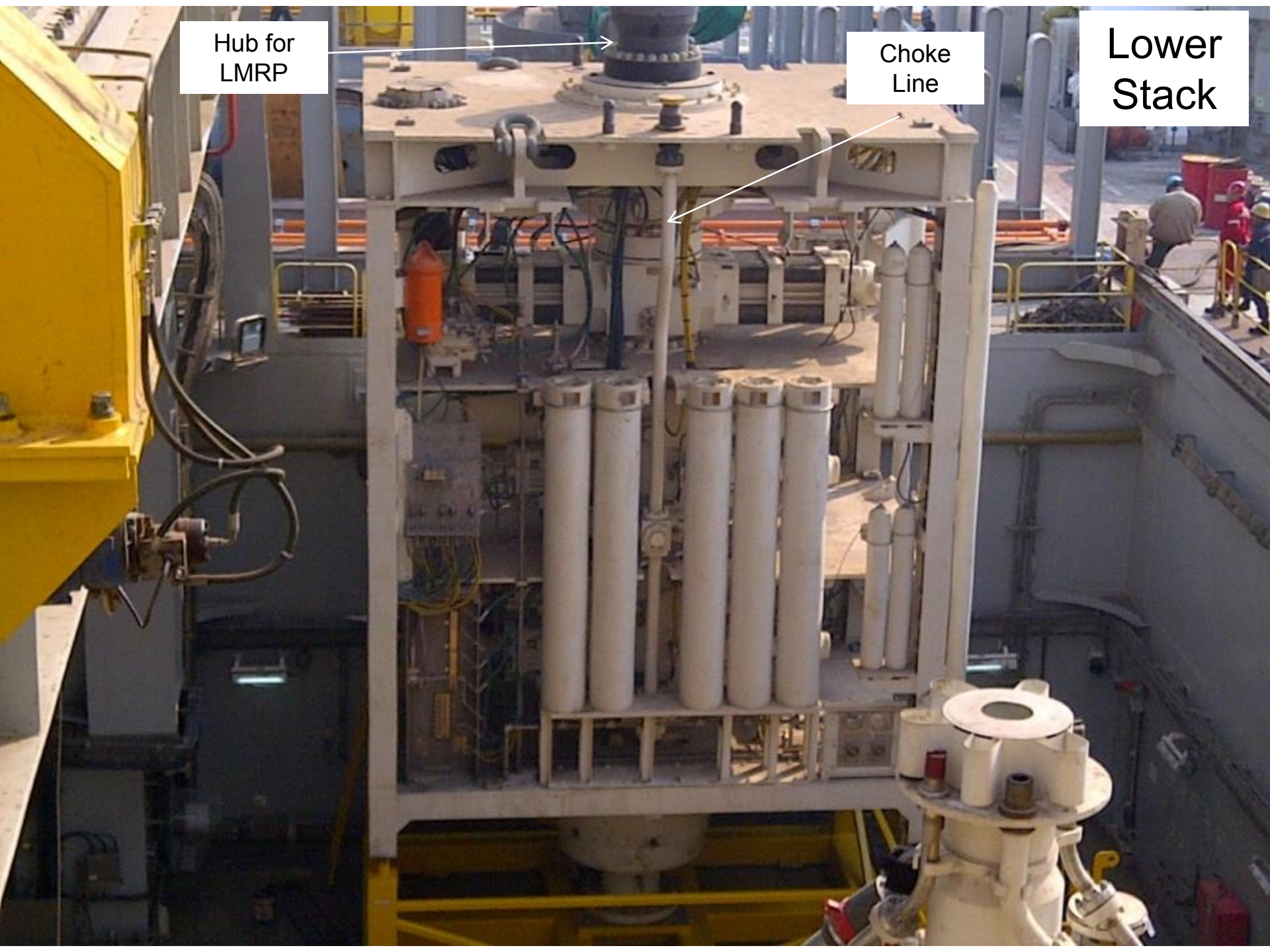
TOP OF WELLHEAD

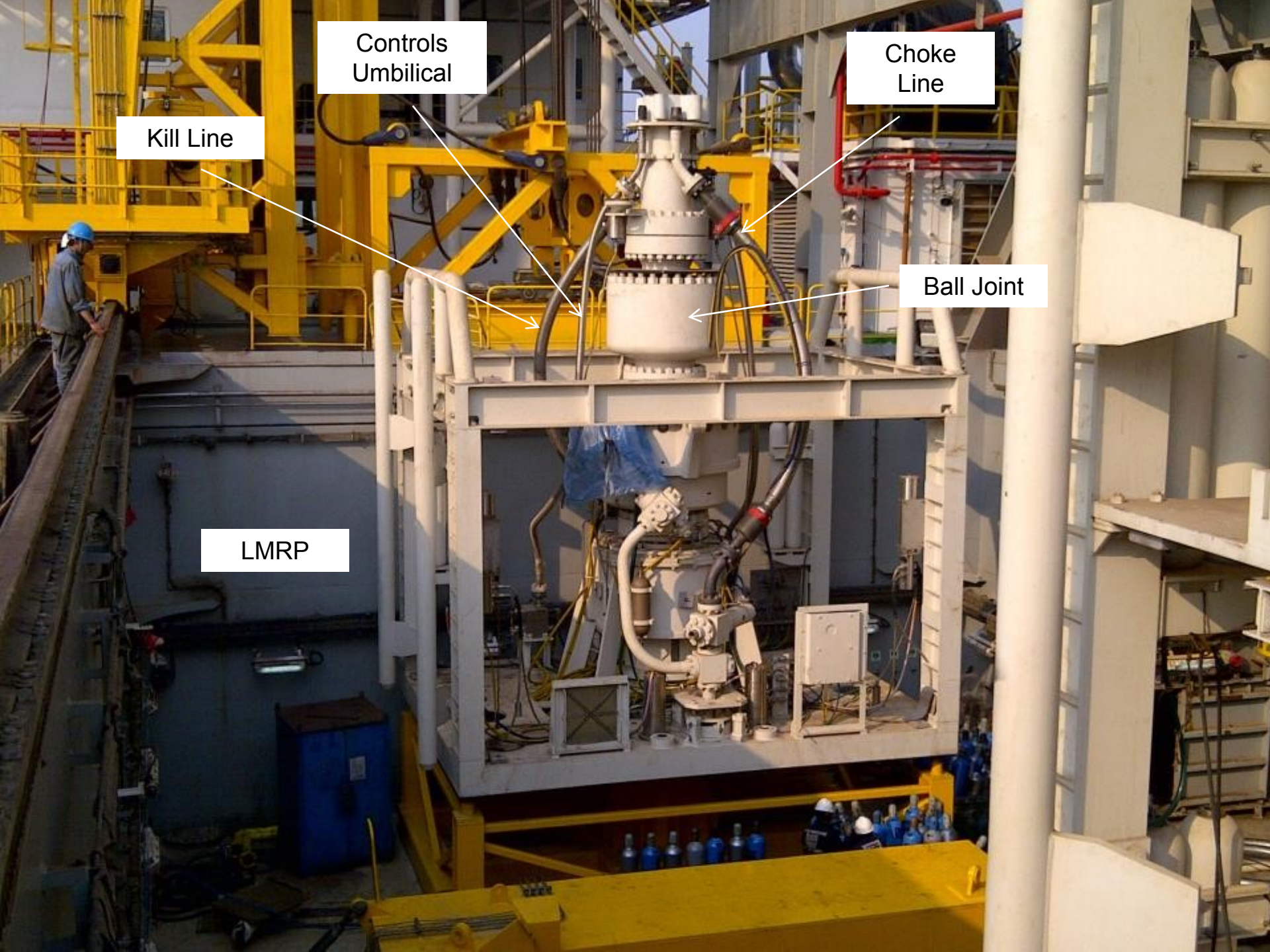


Hub for
LMRP

Choke
Line

Lower
Stack





Controls
Umbilical

Choke
Line

Kill Line

Ball Joint

LMRP



CUSS 1
The first
floating
drilling rig
1956

Conoco
Union
Superior
Shell



6th Generation DP Drillship

Twin derricks
for dual activity

Capable of drilling to 10,700m
(35,100') total depth.

Main derrick
rated to 907 Mt
(2,000,000 lbs)

Can rack back drill pipe
in quads 38 m (124')

180 man quarters



228m (748') OAL x 42m (138') Wide

Operate in 3000 m (9840') water depth.



Blue Water 1 industry's first semisubmersible drilling rig 1962



COSL Deepwater Semi- submersible Drilling Rig

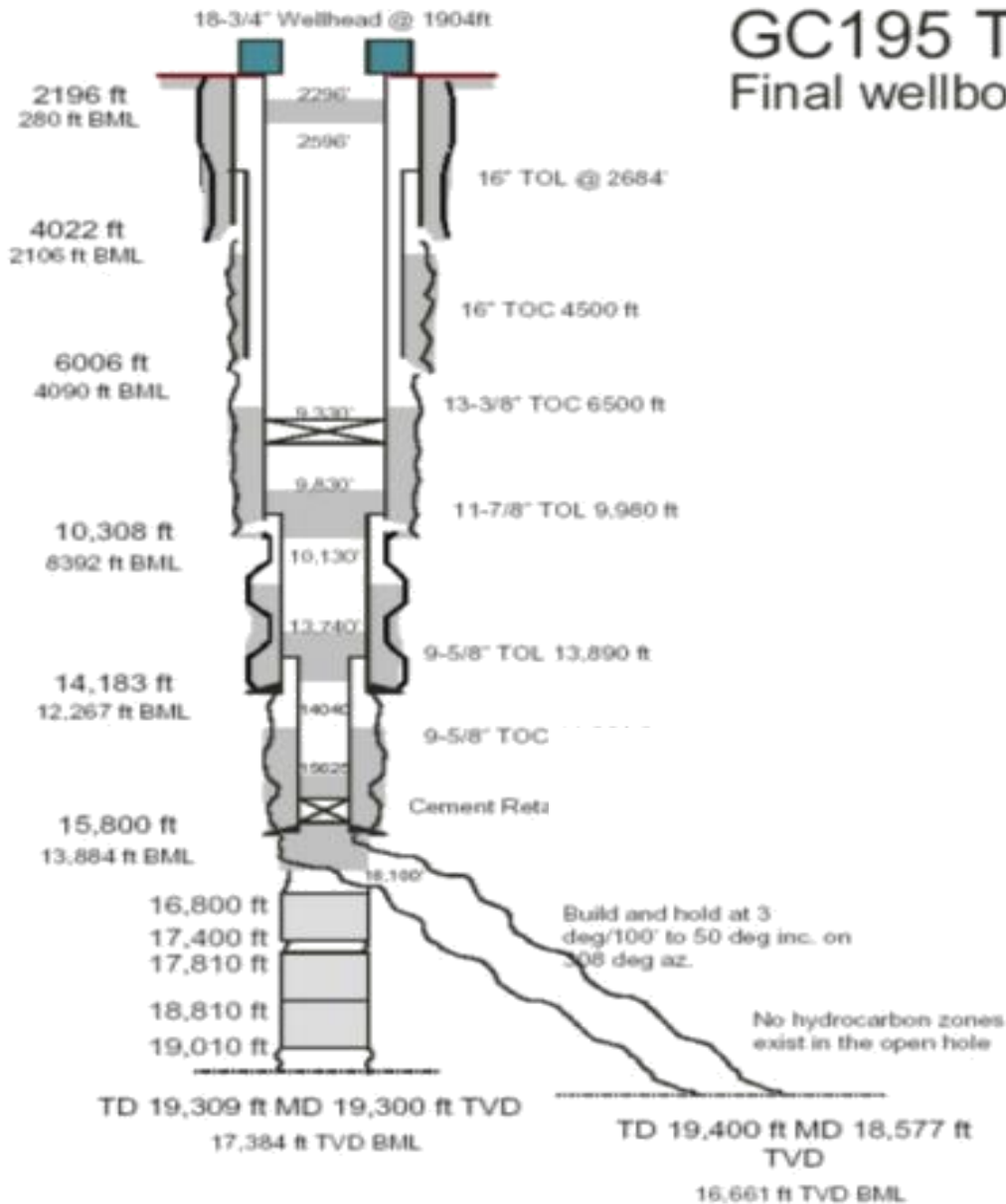


A new design of deepwater drilling rig based on the success of Spar production platforms



Directional Drilling

GC195 Tiger Final wellbore sketch and status





Deepwater Directional Drilling





Heck, deepwater drilling is not that much different than in shallow water!



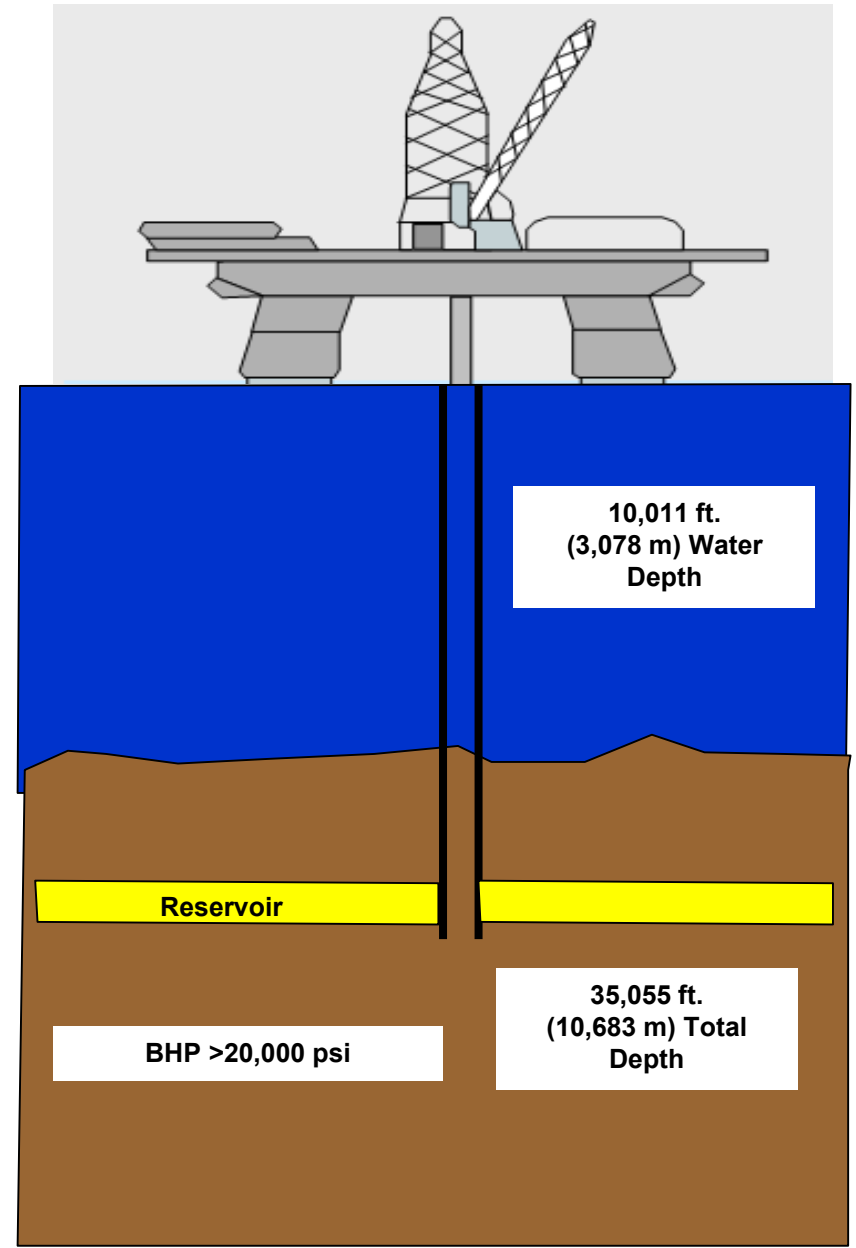
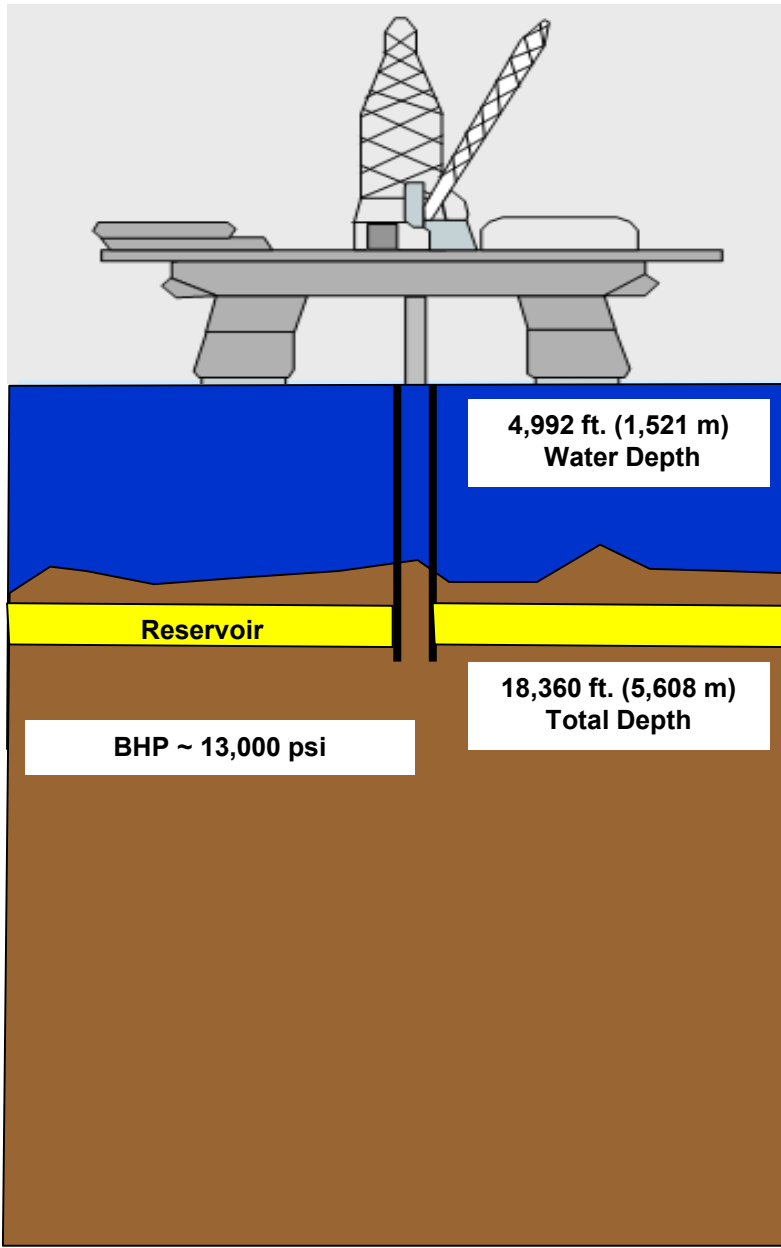


**She
came in!**

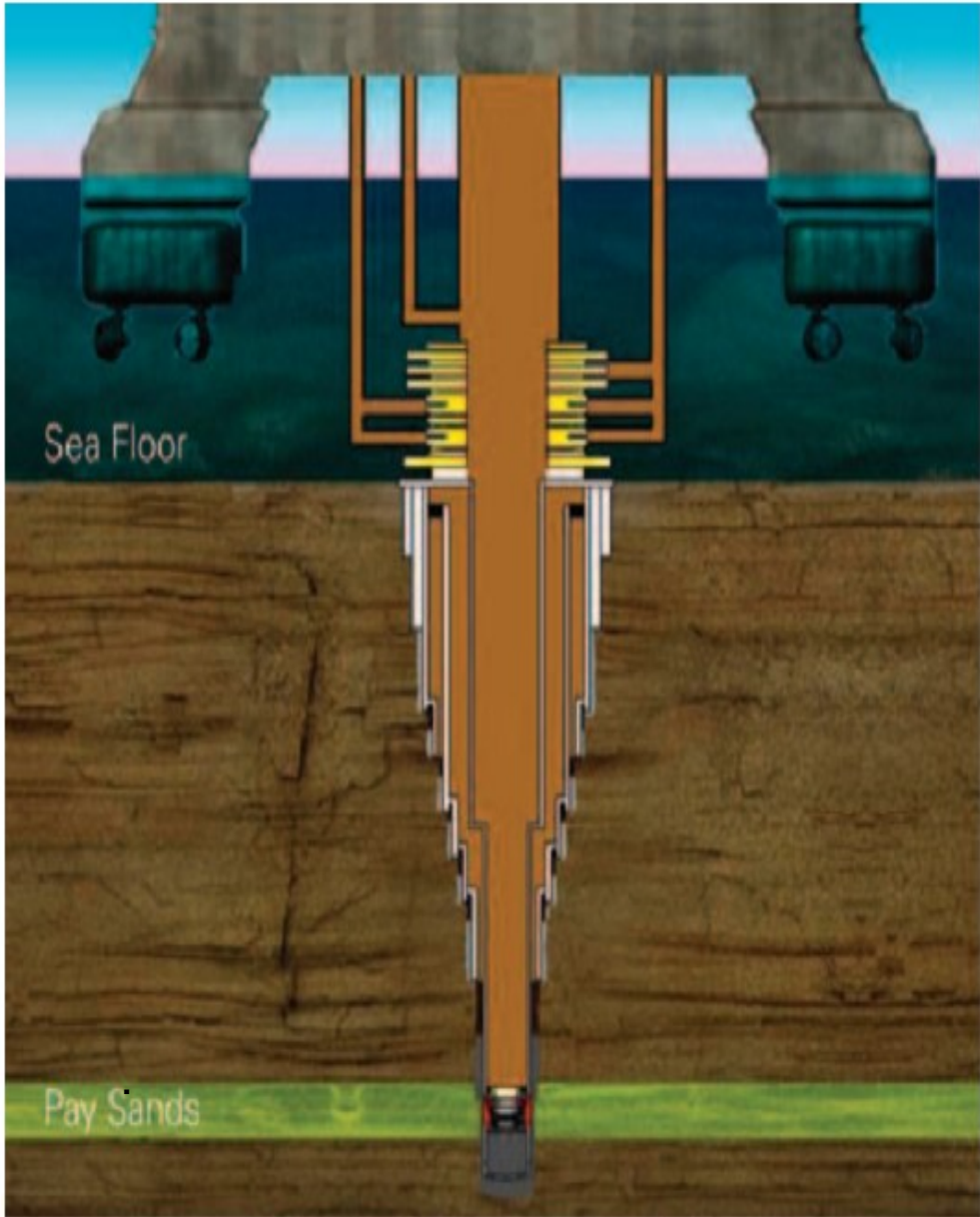
Macondo was not a difficult well: In Theory

Macondo Well - MC 252

Deepest Wells According to Water Depth/Total Depth

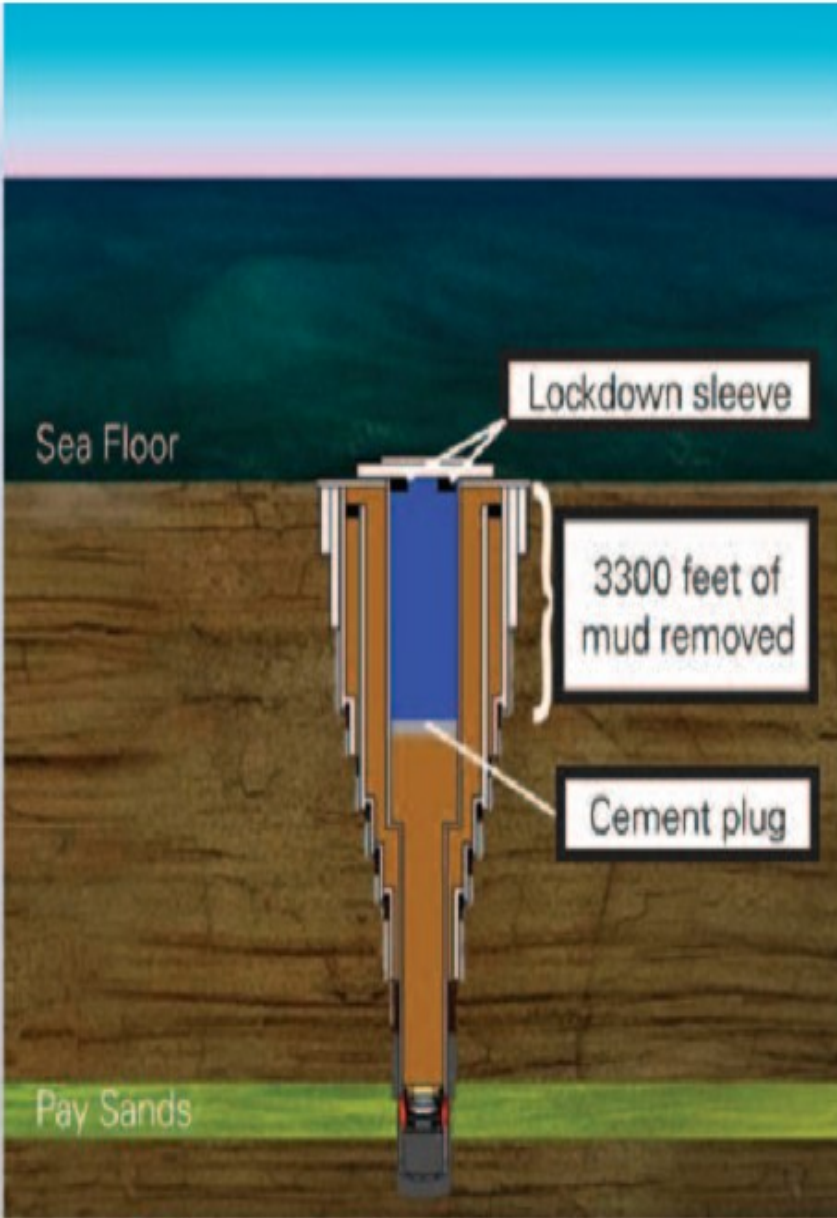


This is where they were



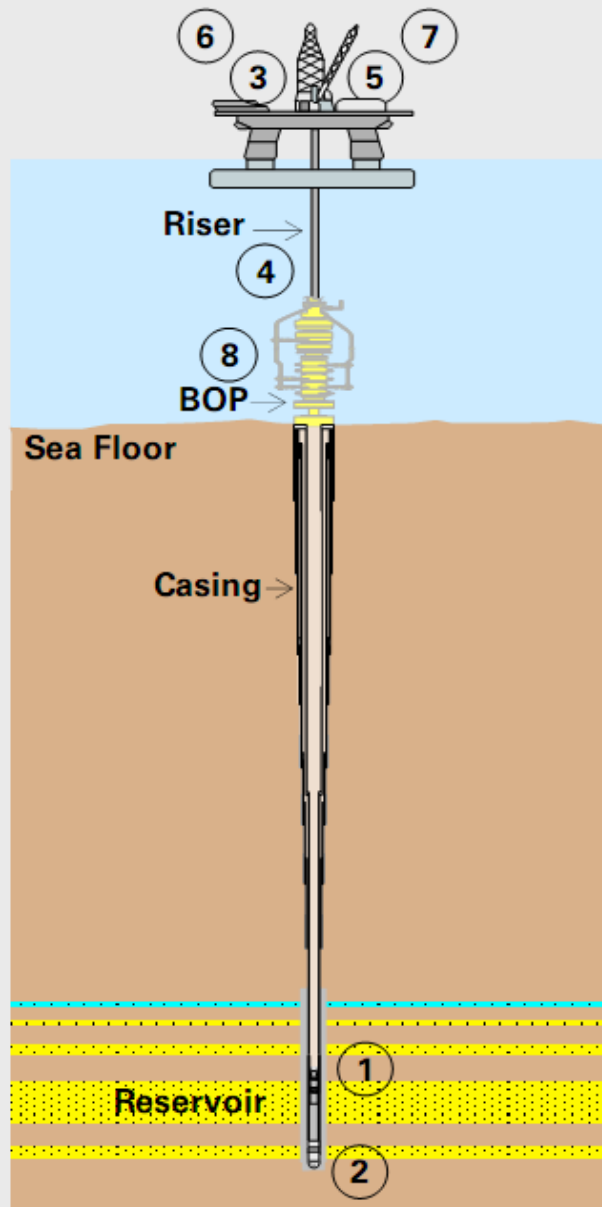
End of Cement Job

This is where they were going to



Temporarily Abandoned

Key Causes of Blowout



Well integrity was not established or failed

- 1 Annulus cement barrier did not isolate hydrocarbons
- 2 Shoe track barriers did not isolate hydrocarbons

Hydrocarbons entered the well undetected and well control was lost

- 3 Negative pressure test was accepted although well integrity had not been established
- 4 Influx was not recognized until hydrocarbons were in riser
- 5 Well control response actions failed to regain control of well

Hydrocarbons ignited on the *Deepwater Horizon*

- 6 Diversion to mud gas separator resulted in gas venting onto rig
- 7 Fire and gas system did not prevent hydrocarbon ignition

Blowout preventer did not seal the well

- 8 Blowout preventer (BOP) emergency mode did not seal well

Helix Fast Response System



Q4000

Non-DP Storage Tanker

12" Flex Export Line
Floating Offloading Barge
(Barge not shown)

Helix Producer 1



6-5/8" HD-543 Q-123
32 Joint Casing (3-5/8" ID)
(All Threaded, Q4000 installed)

Riser

3" 10,000 PSI
Flexible Riser

Intervention
Riser System



Stack Can Connect to BOP,
Wellhead or Tree

Riser

IRS

SSOD

BOP
Stack

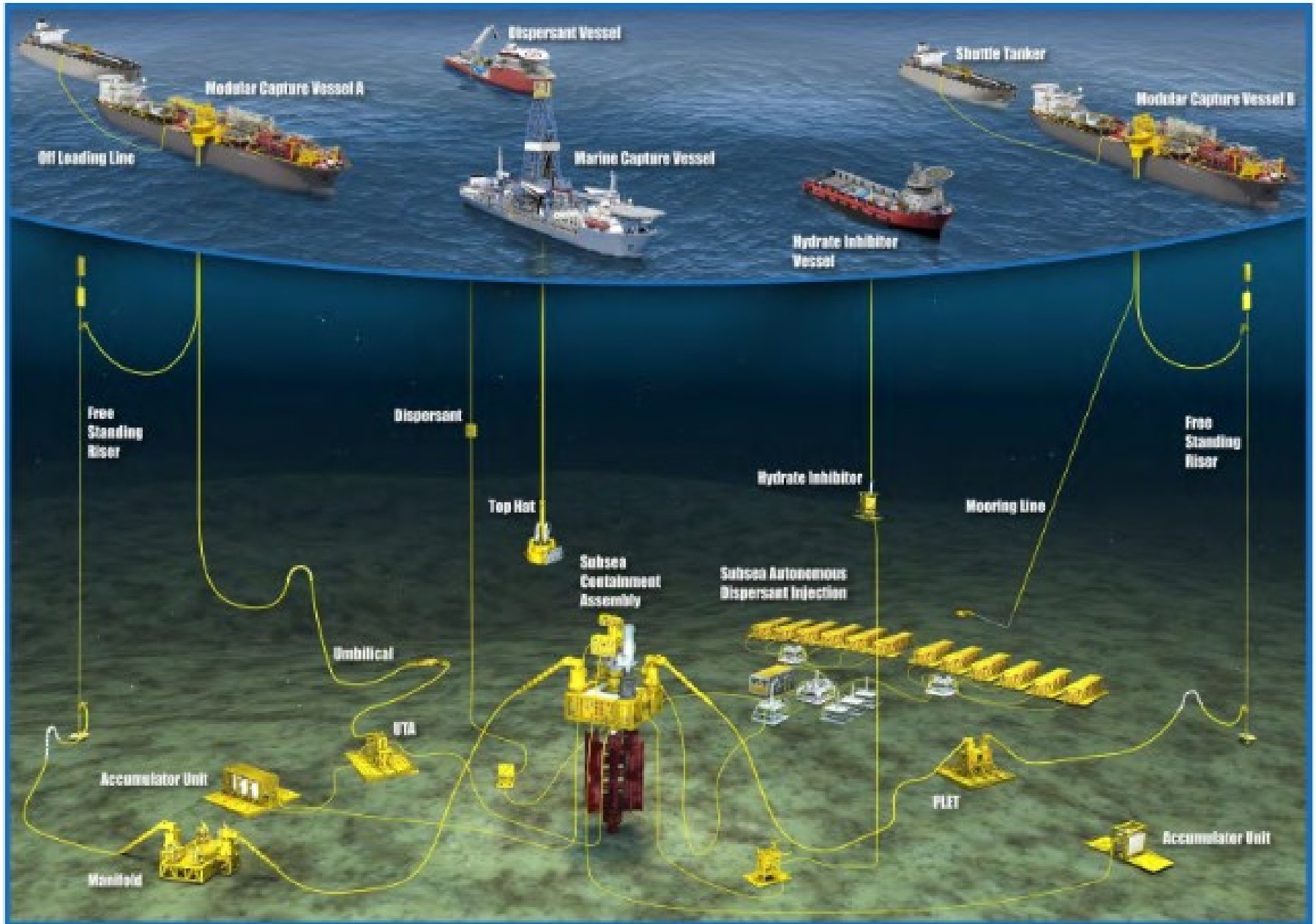
Subsea Shut Off Device /
Well Cap



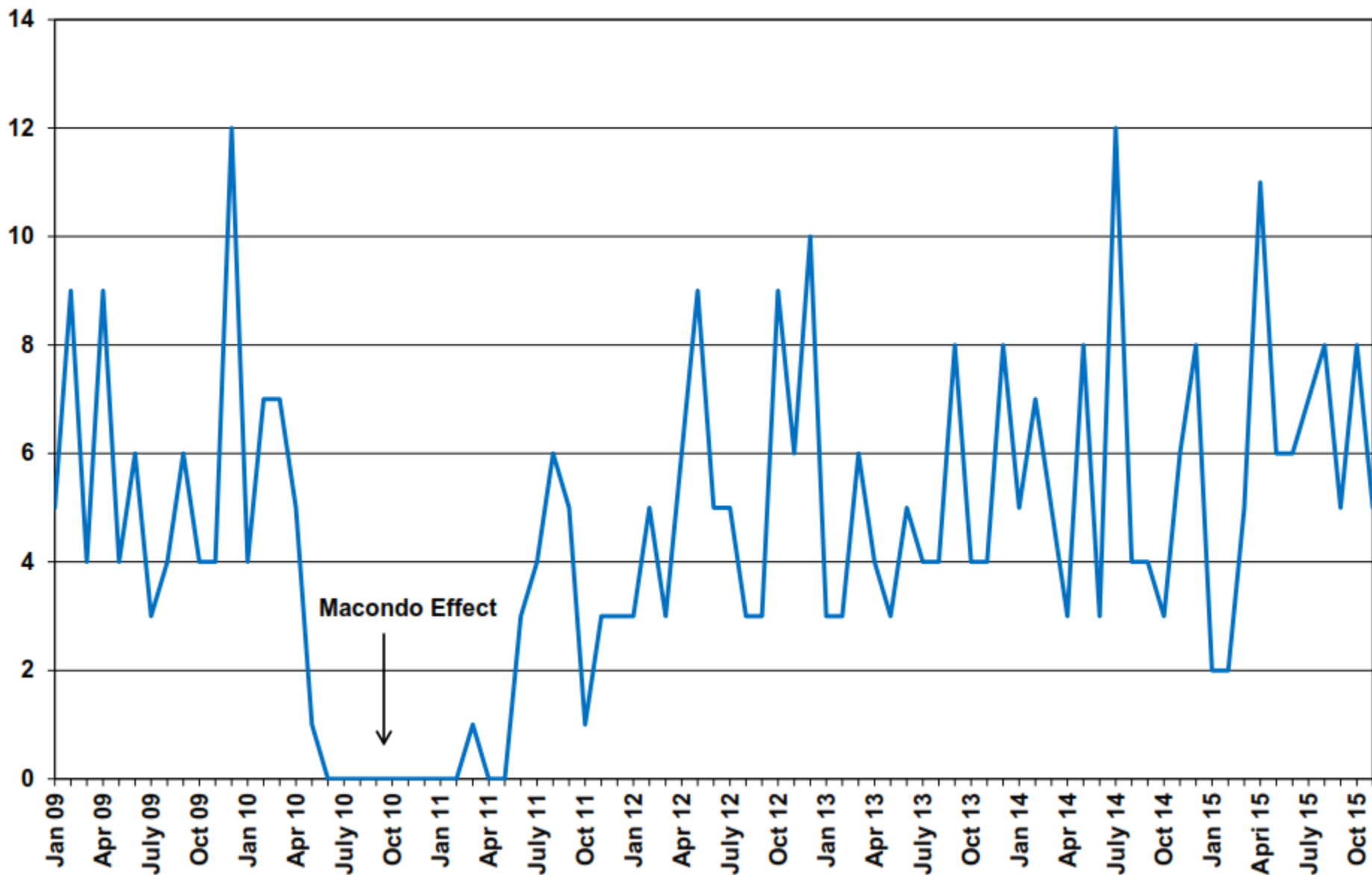
HELIX Capping Stack Being Tested



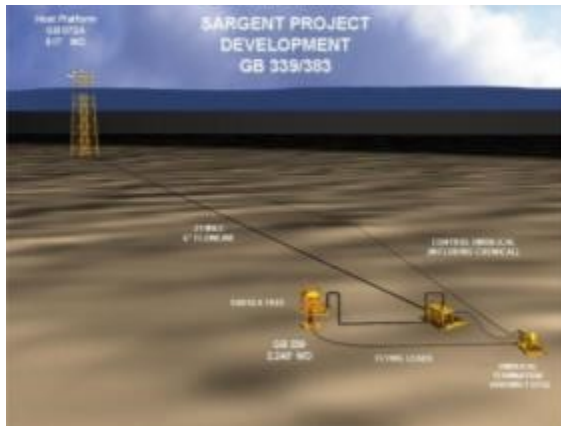
Containment System Overview



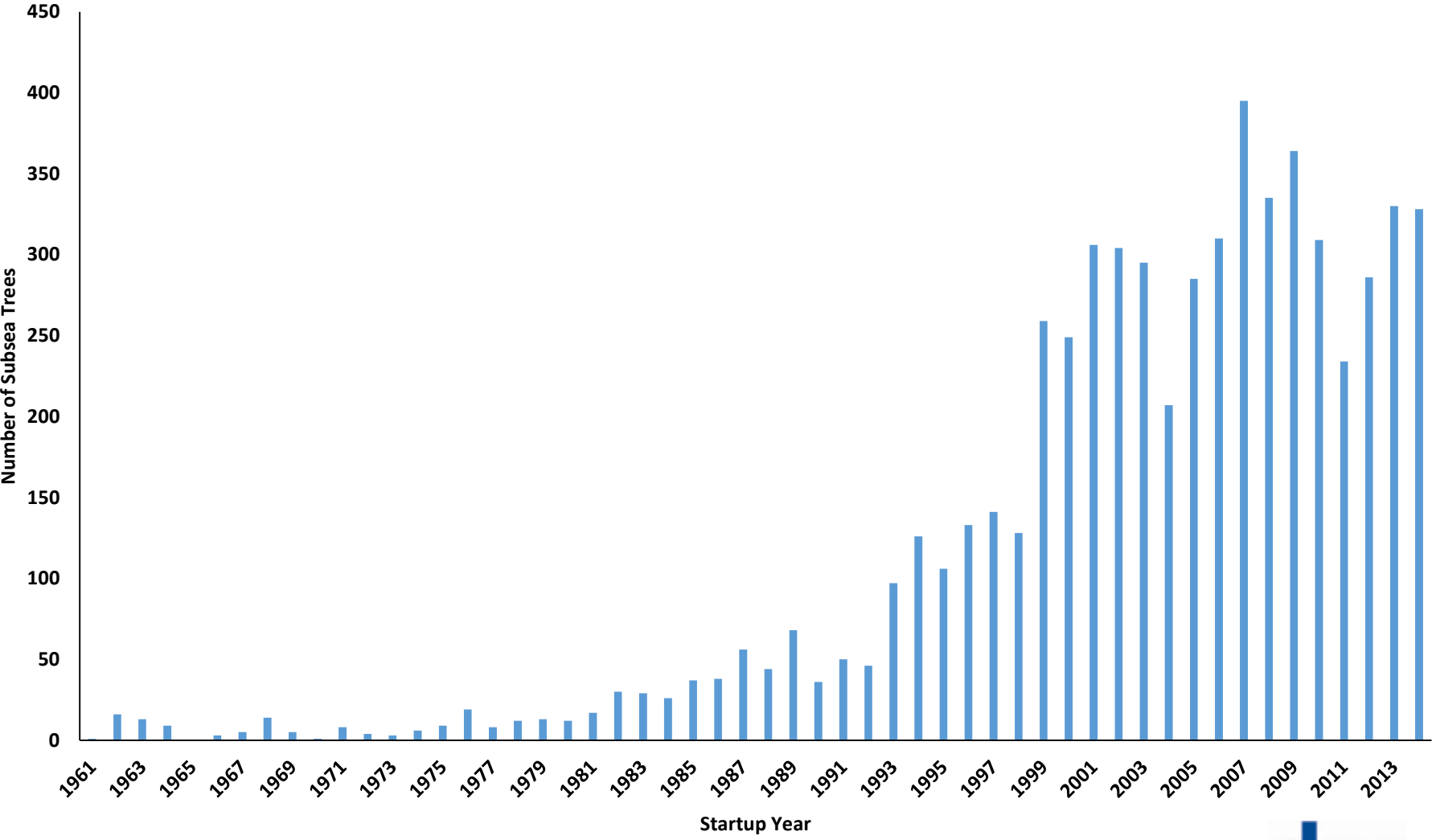
Approved Deepwater APD's



SUBSEA TREE



Subsea Well Completions Per Year Since 1961



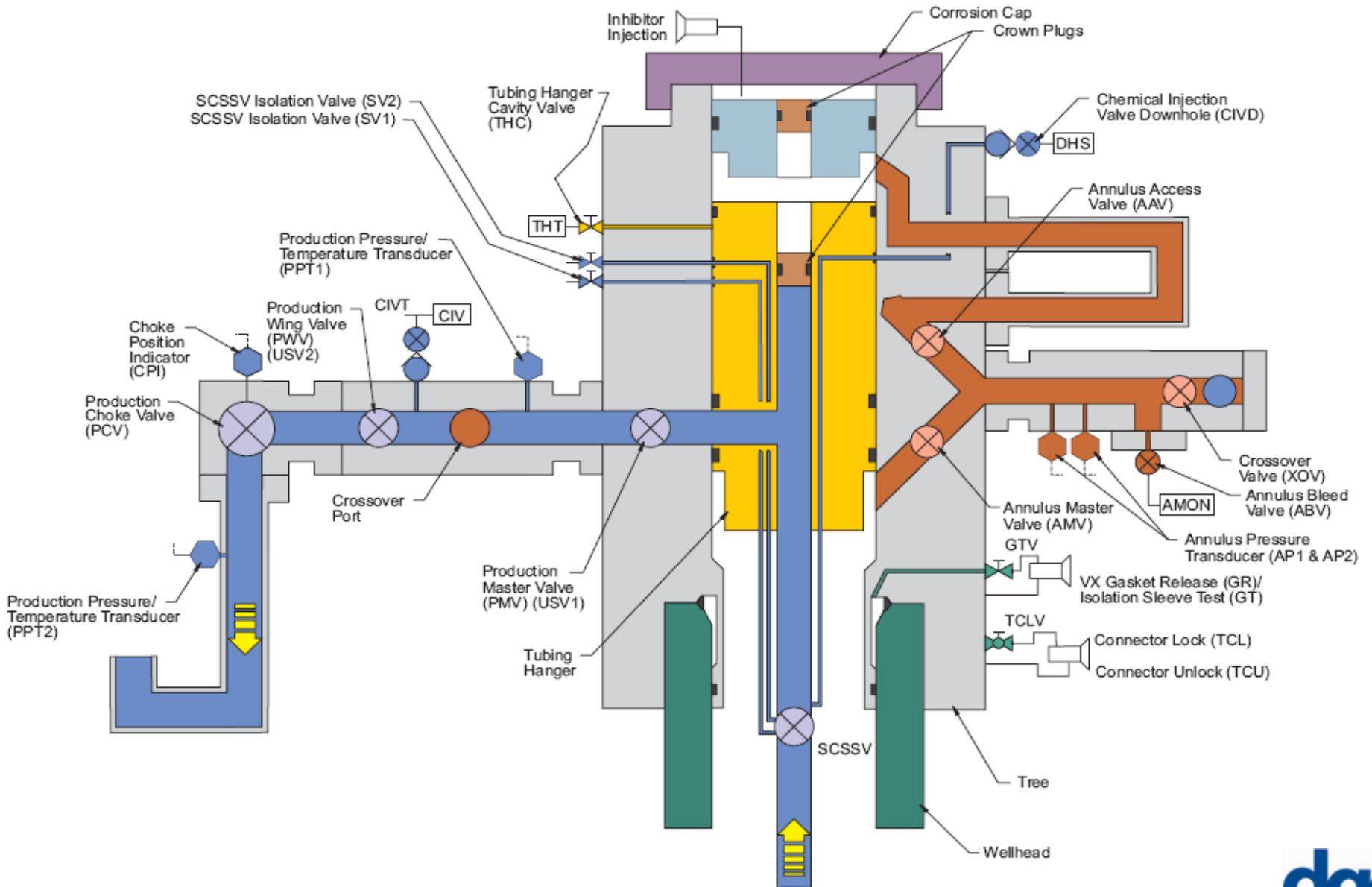


The world's first subsea tree being retrieved. 1961-1995

Modern Subsea Tree

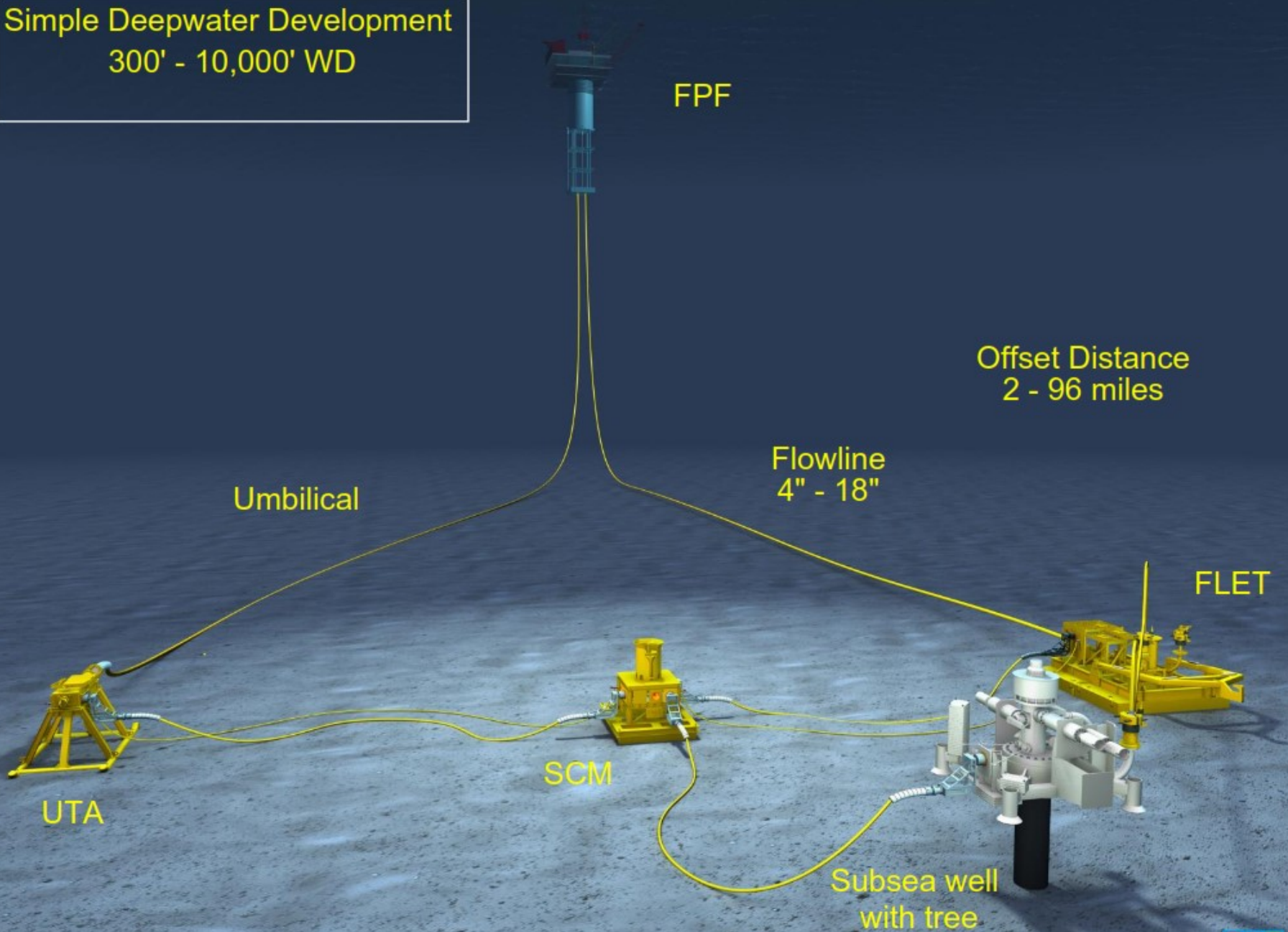


Odd Job Tree Schematic



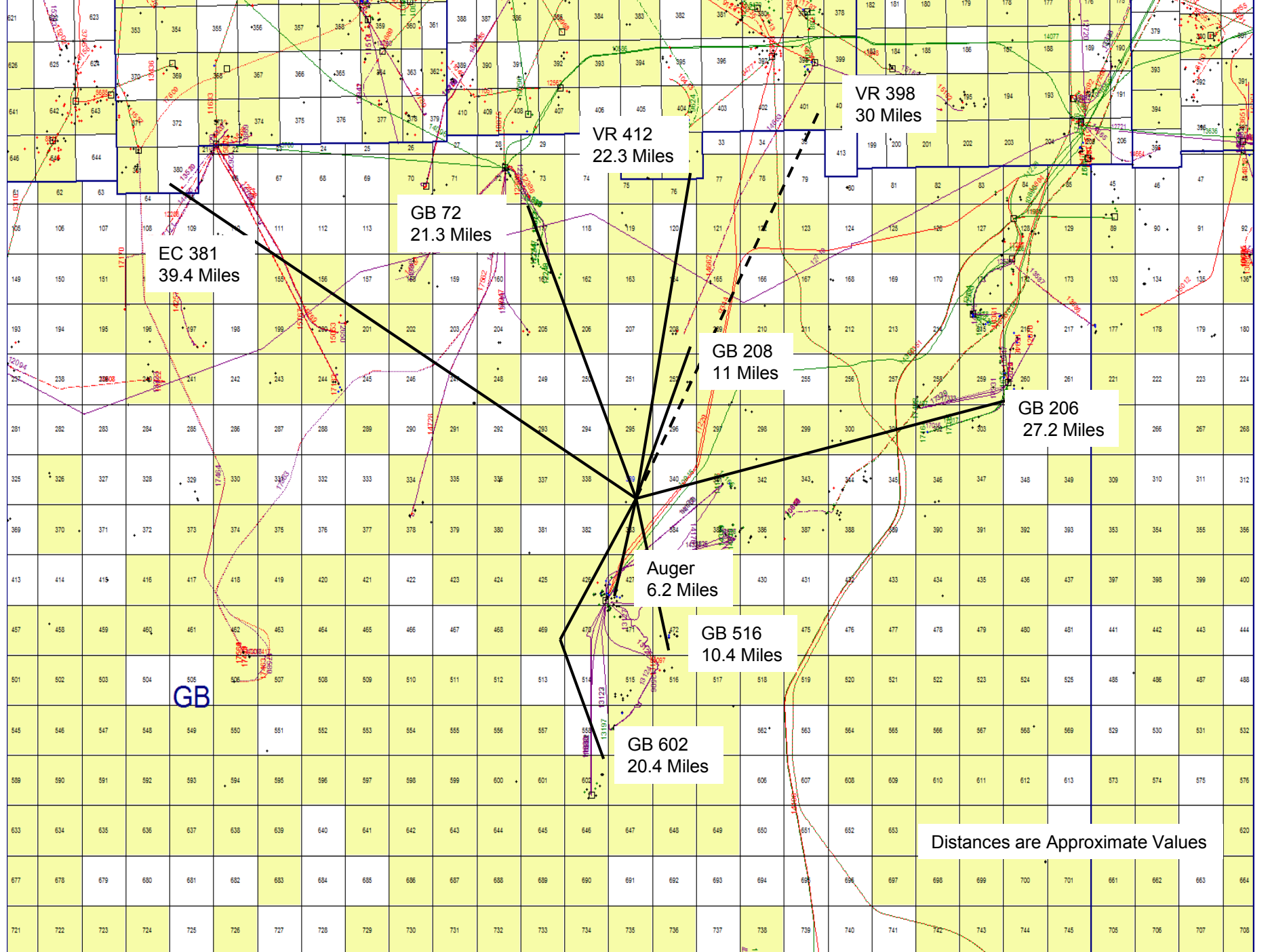
Deep Gulf Energy Tiger Production Horizontal Tree P&ID

Simple Deepwater Development
300' - 10,000' WD





**Where are we
going to tie back
to!?!**



EC 381
39.4 Miles

GB 72
21.3 Miles

VR 412
22.3 Miles

VR 398
30 Miles

GB 208
11 Miles

GB 206
27.2 Miles

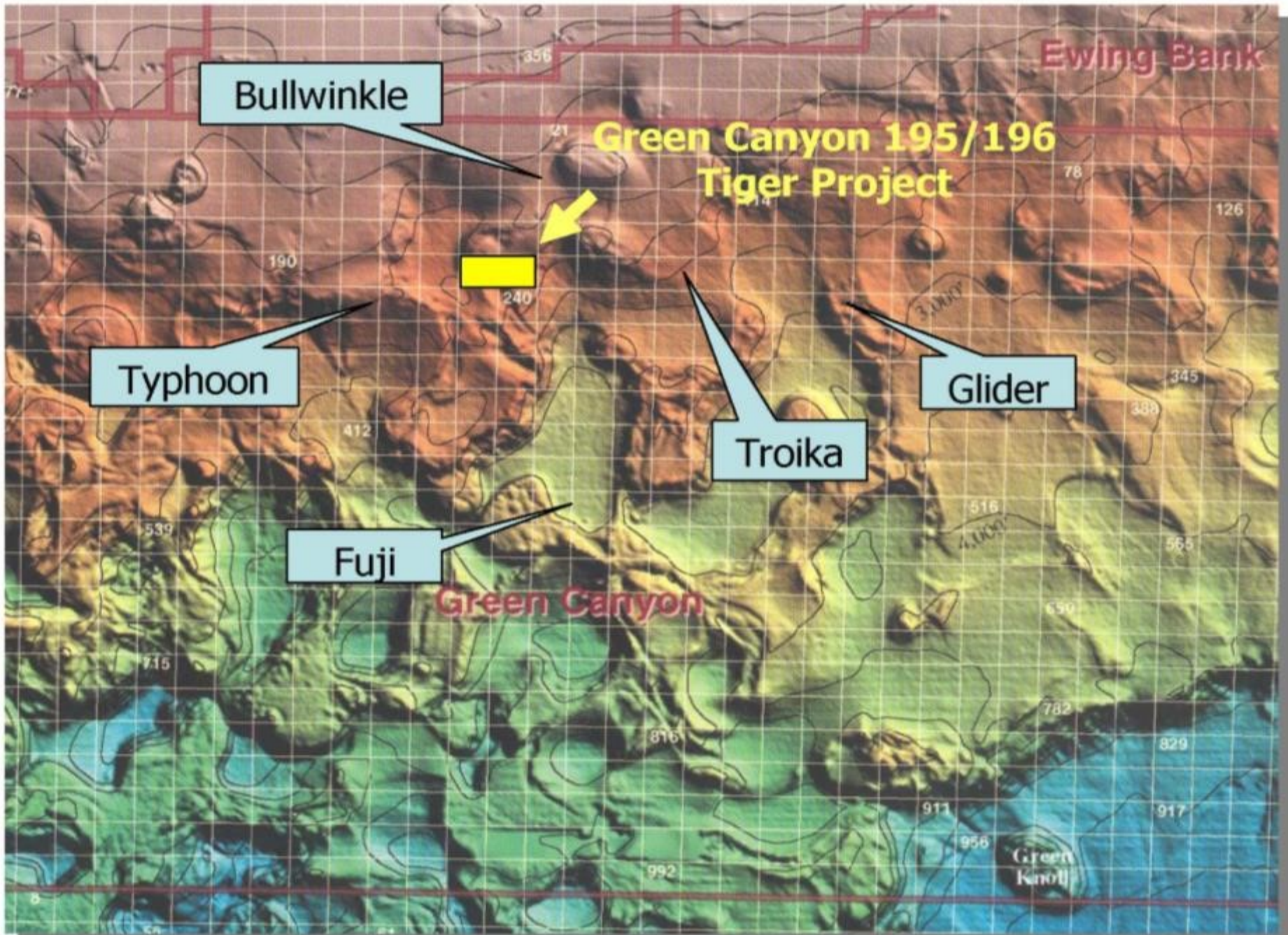
Auger
6.2 Miles

GB 516
10.4 Miles

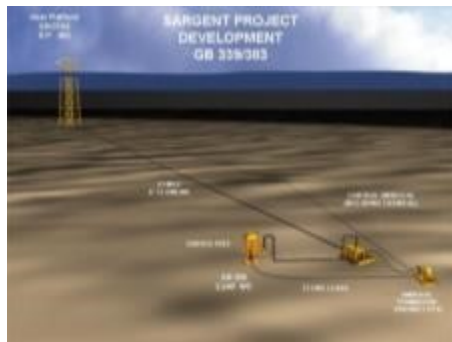
GB 602
20.4 Miles

GB

Distances are Approximate Values



CONTROLS



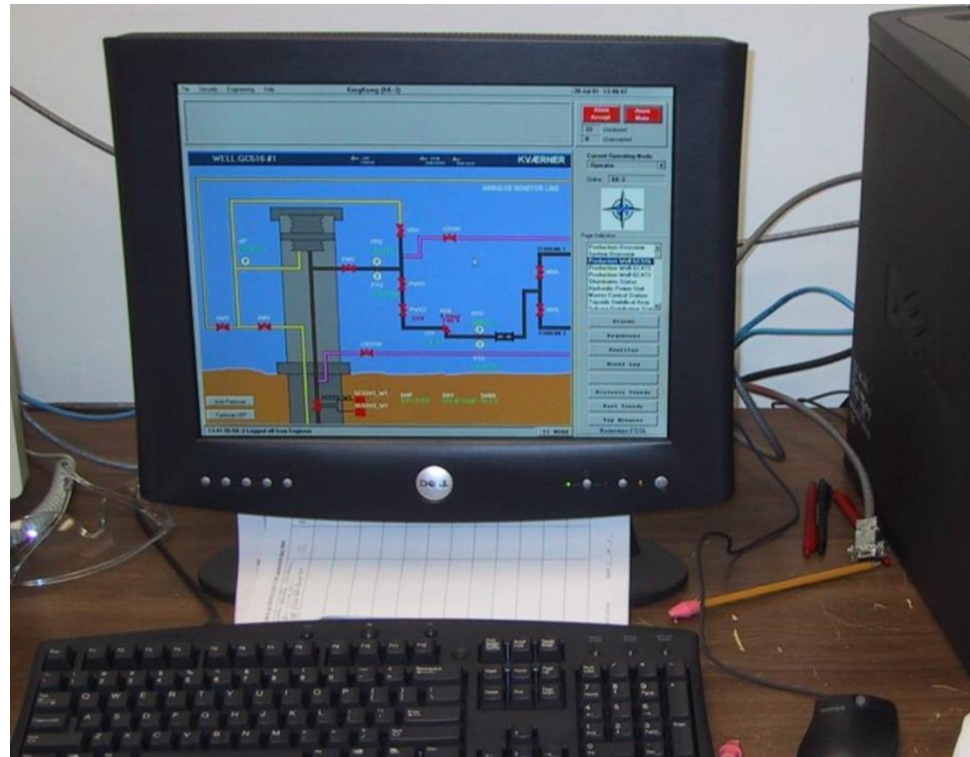
Control System



Hydraulic Power Unit



Master Control Station



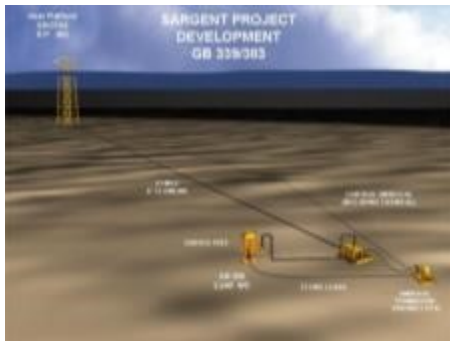
Subsea Control
Module C



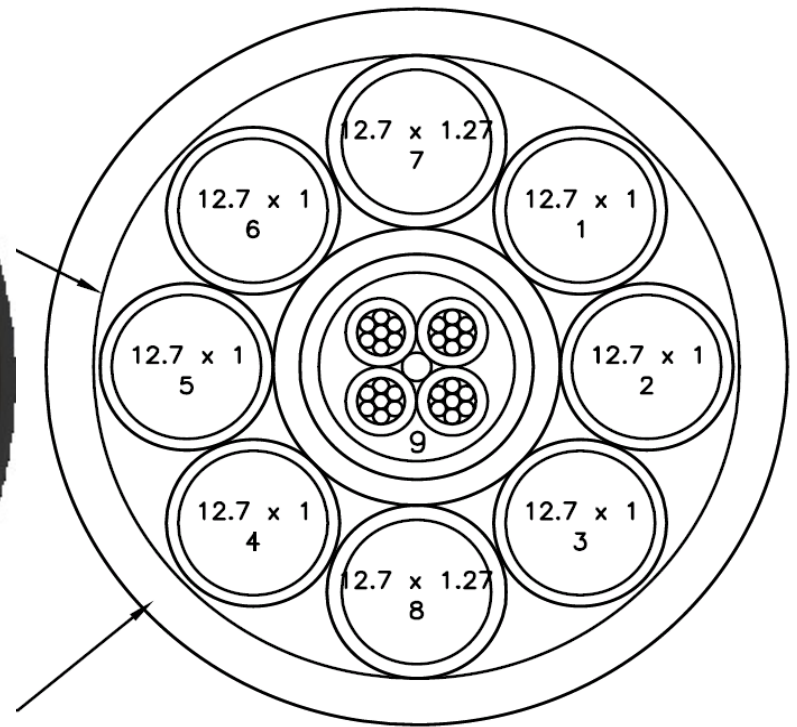
Internals



UMBILICAL



Umbilical System







Ocean Intervention 2

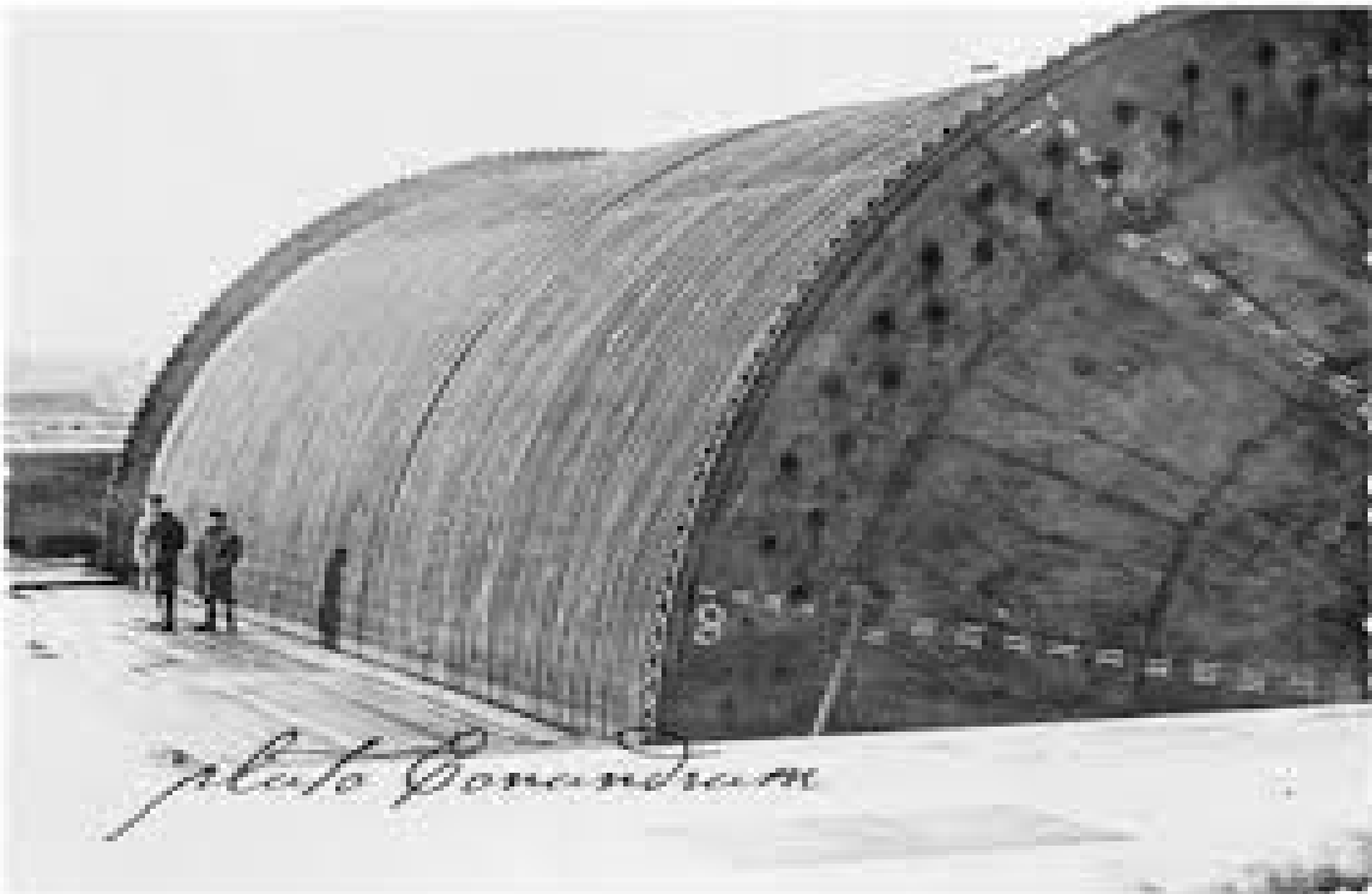


Test time!

When, where and why was the first subsea pipeline?

GREAT BRITAIN

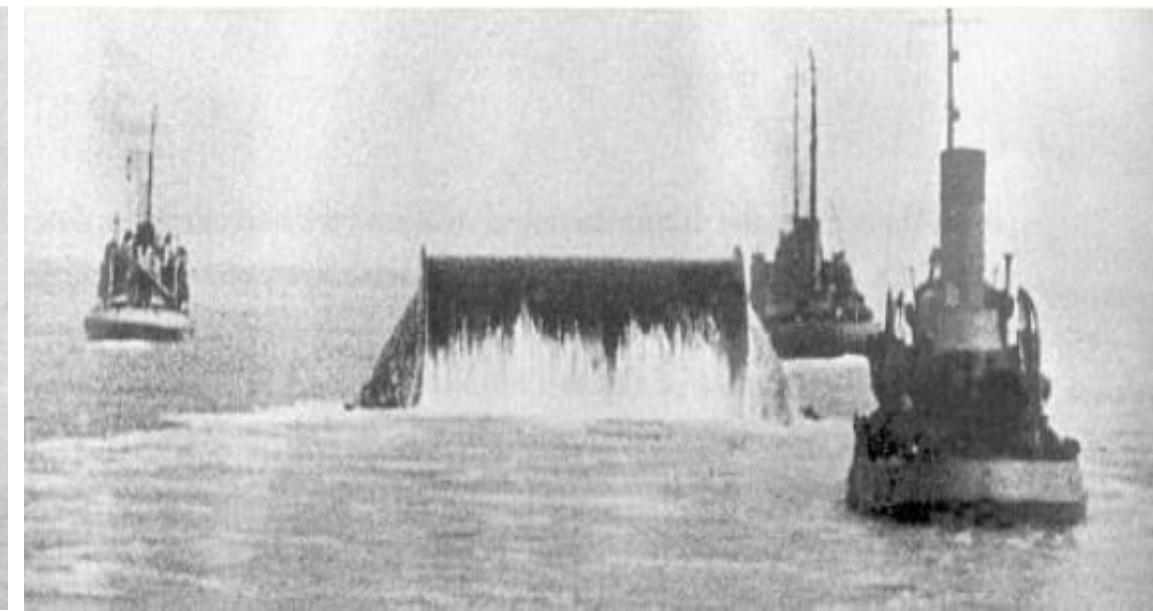
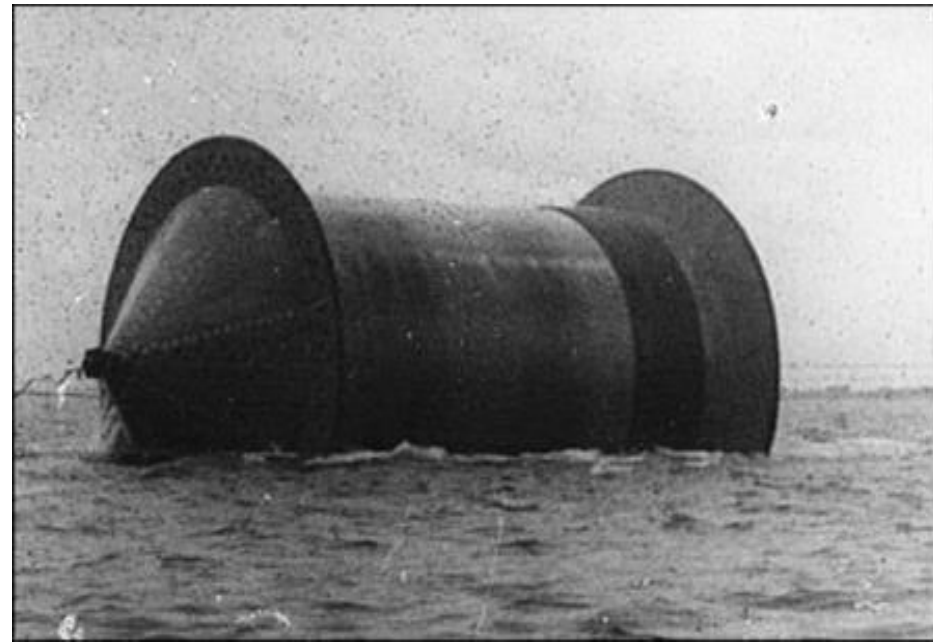
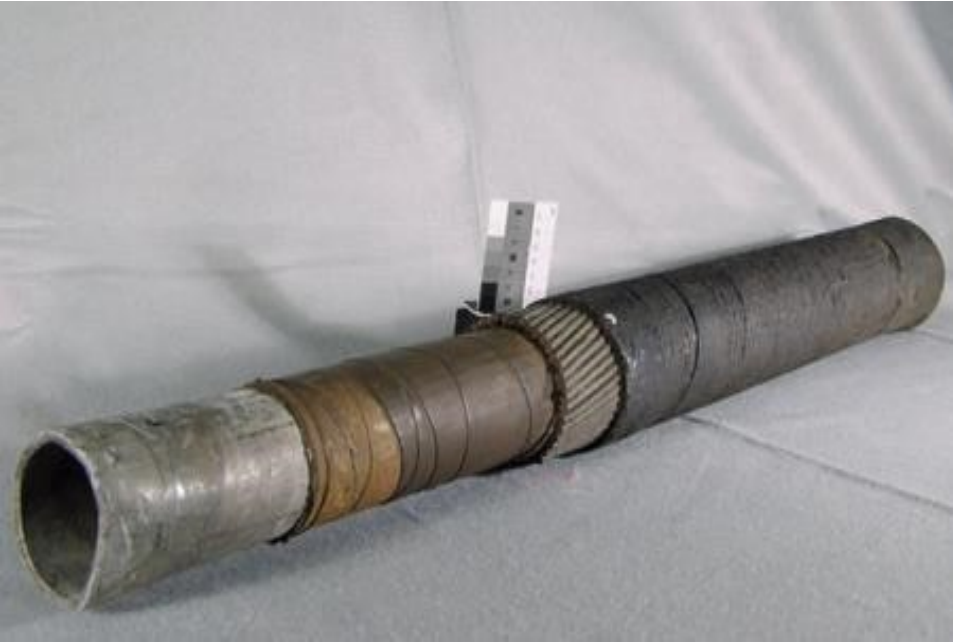




Project Pluto: Pipeline Under The Ocean



1'st subsea pipeline 1944





One of the most secret places in WW2





Pluto pumping station today





**Fluor
Chickasaw
1970
Scrapped
2014**



Santa Fe Apache, 1979
Now upgraded, Technip









Pipe being welded ready to reel on ship.



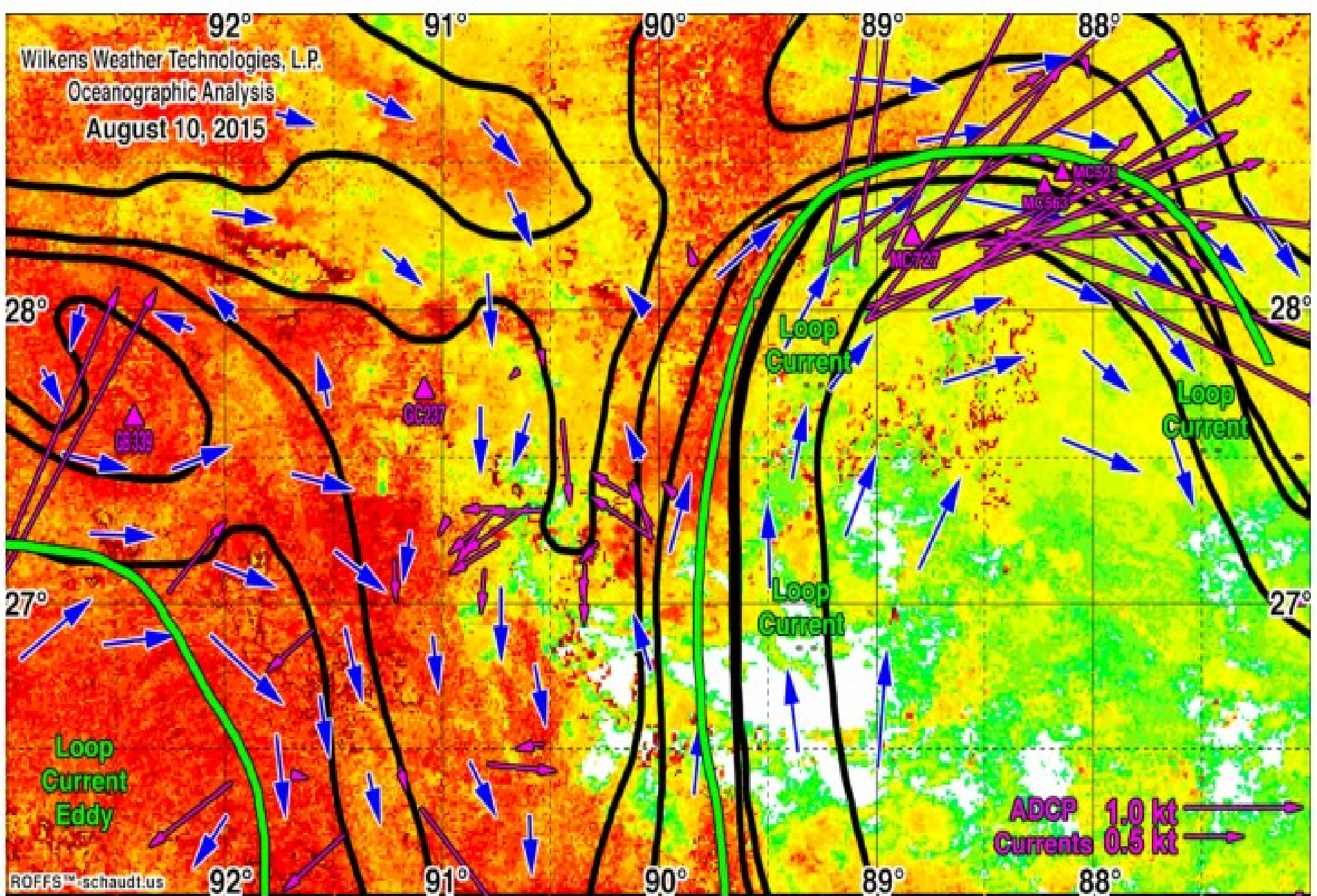


Allseas Solitaire
World's largest
deepwater
pipelay vessel





Any lawyers in the crowd?



Loops currents cost us more than hurricanes

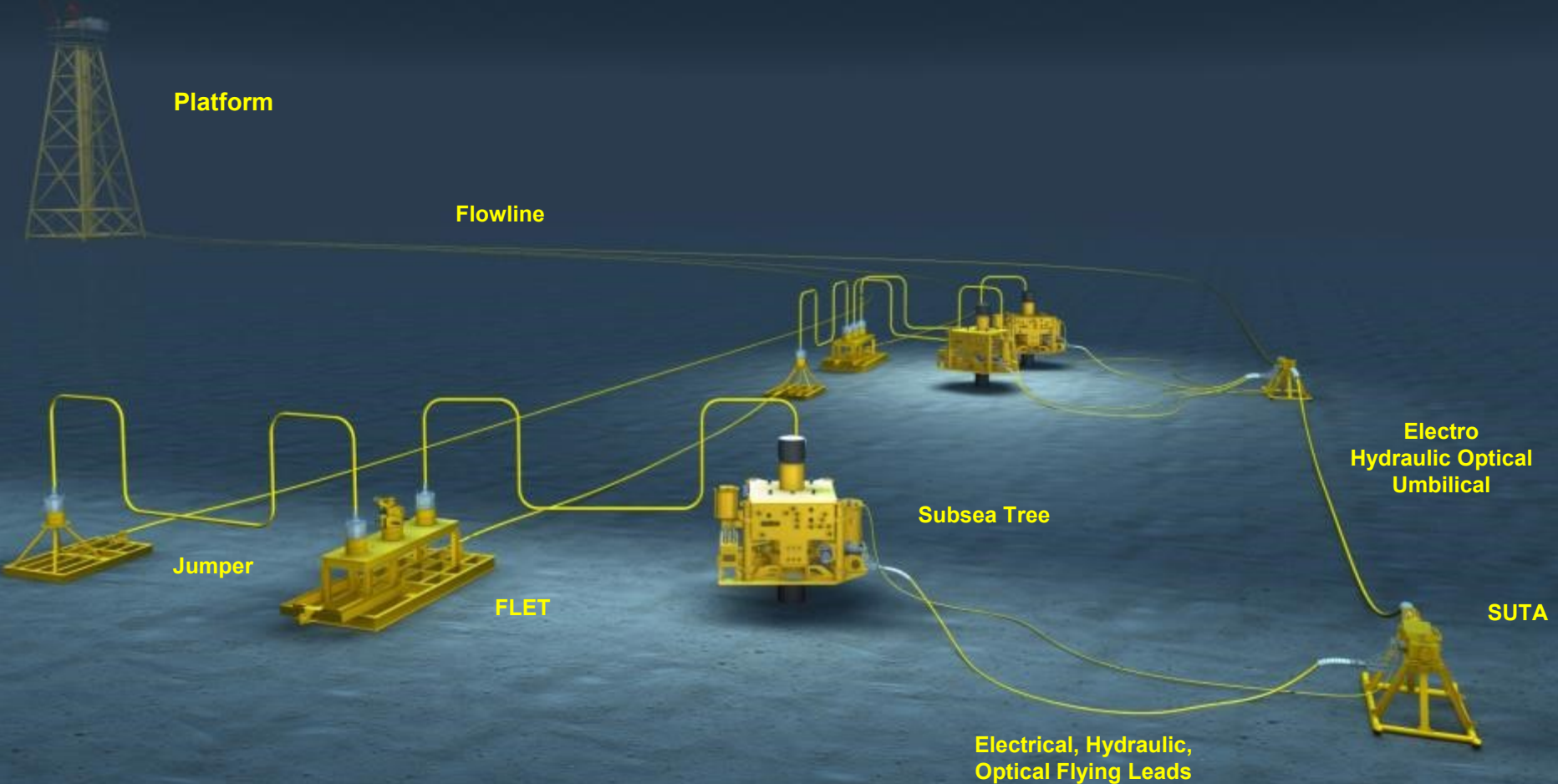




How do we hook
this stuff up?



Subsea Hookup



Platform

Flowline

Jumper

FLET

Subsea Tree

Electro Hydraulic Optical Umbilical

SUTA

Electrical, Hydraulic, Optical Flying Leads









Diver Dog!









World's First ROV: British Royal Navy "Cutlet" 1956





Shilling's latest Remotely Operated Vehicle (ROV)

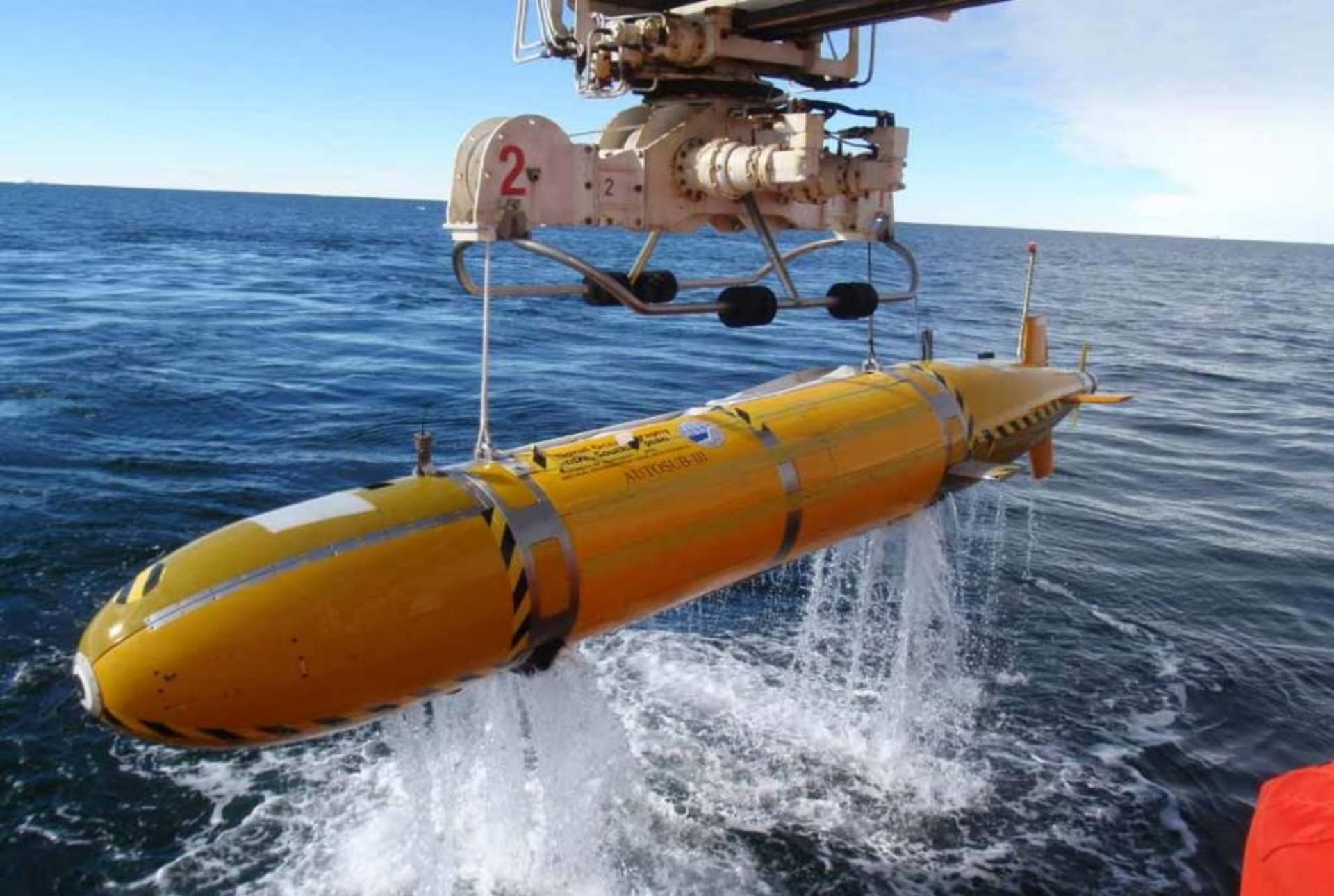


OCSG

OCEANEERING

OCEANEERING

PARK AYY
H TSI TO
CPT
GTS
SVI
SV2

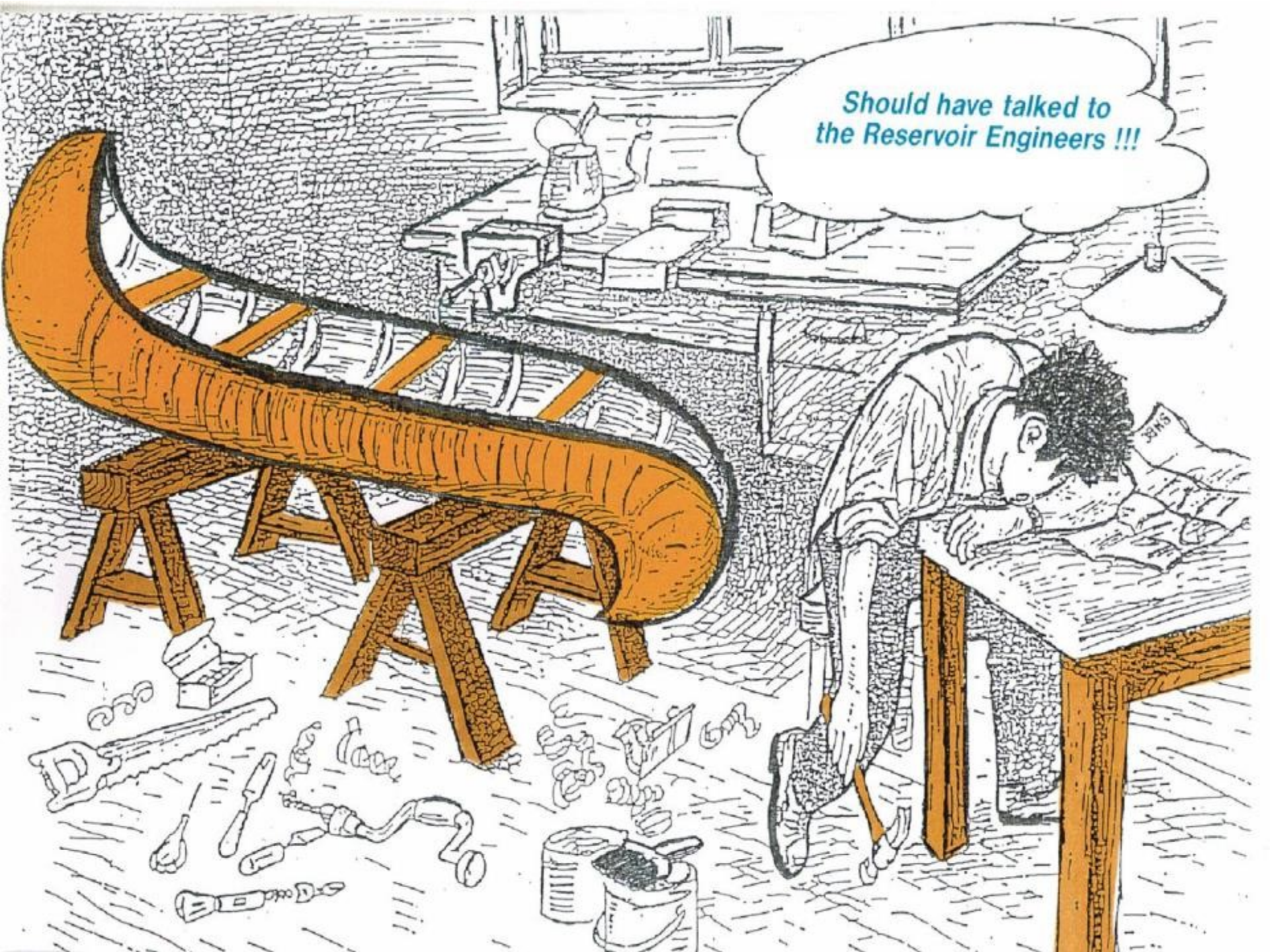


AUV





DOV (Dog Operated Vehicle) in action 



Should have talked to
the Reservoir Engineers !!!

Flow Assurance Challenges

- Prevention and remediation of;
 - Hydrates
 - Paraffin
 - Scales
 - Asphaltene
 - Corrosion
 - Erosion
- Production of heavy oil with low GOR
- Mechanical treatment;
 - Pigging
 - Scrapping
 - Chemical solvents
 - Thermal intervention
- Sand incursion & control measures



Hydrate



Paraffin



Hydrates and wax problems can be severe in deepwater: “Flow Assurance”



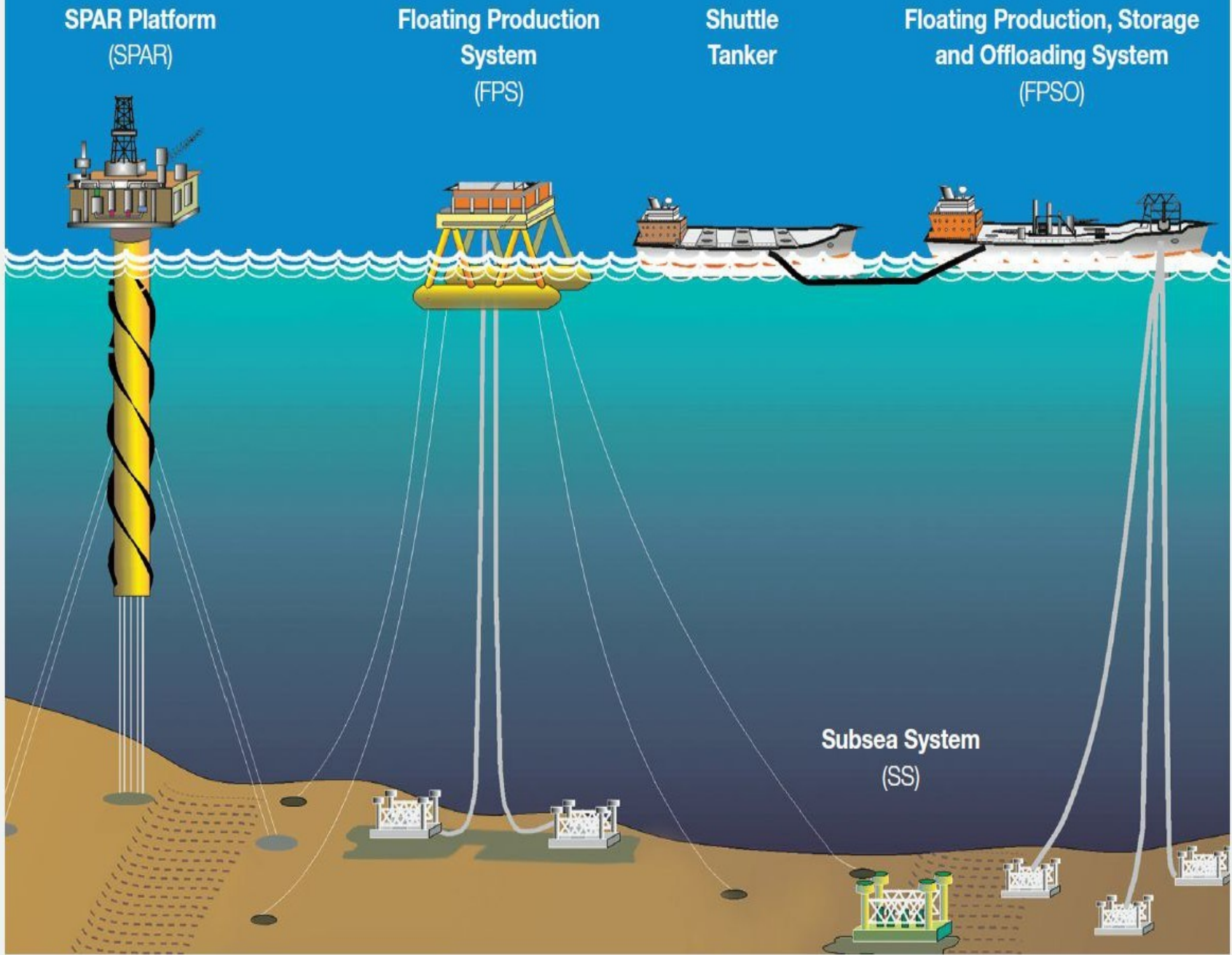


Image courtesy of The Bureau of Ocean Energy Management (BOEM)



TW 58, Argyll Oil Field - North Sea 1975

First floating production facility, first UK North Sea oil, Hamilton Brothers Oil & Gas





**BP Thunder
Horse
GOM
250,000 BOPD
World's
Biggest SS
FPF**



World's first FPSO – Shell's 'Castellon' - in Spain (1977) 



External turret FPSO





Total's Usan FPSO: World's biggest





Total's Dalia FPSO: World's Biggest





Total's PAZFLOR: World's biggest



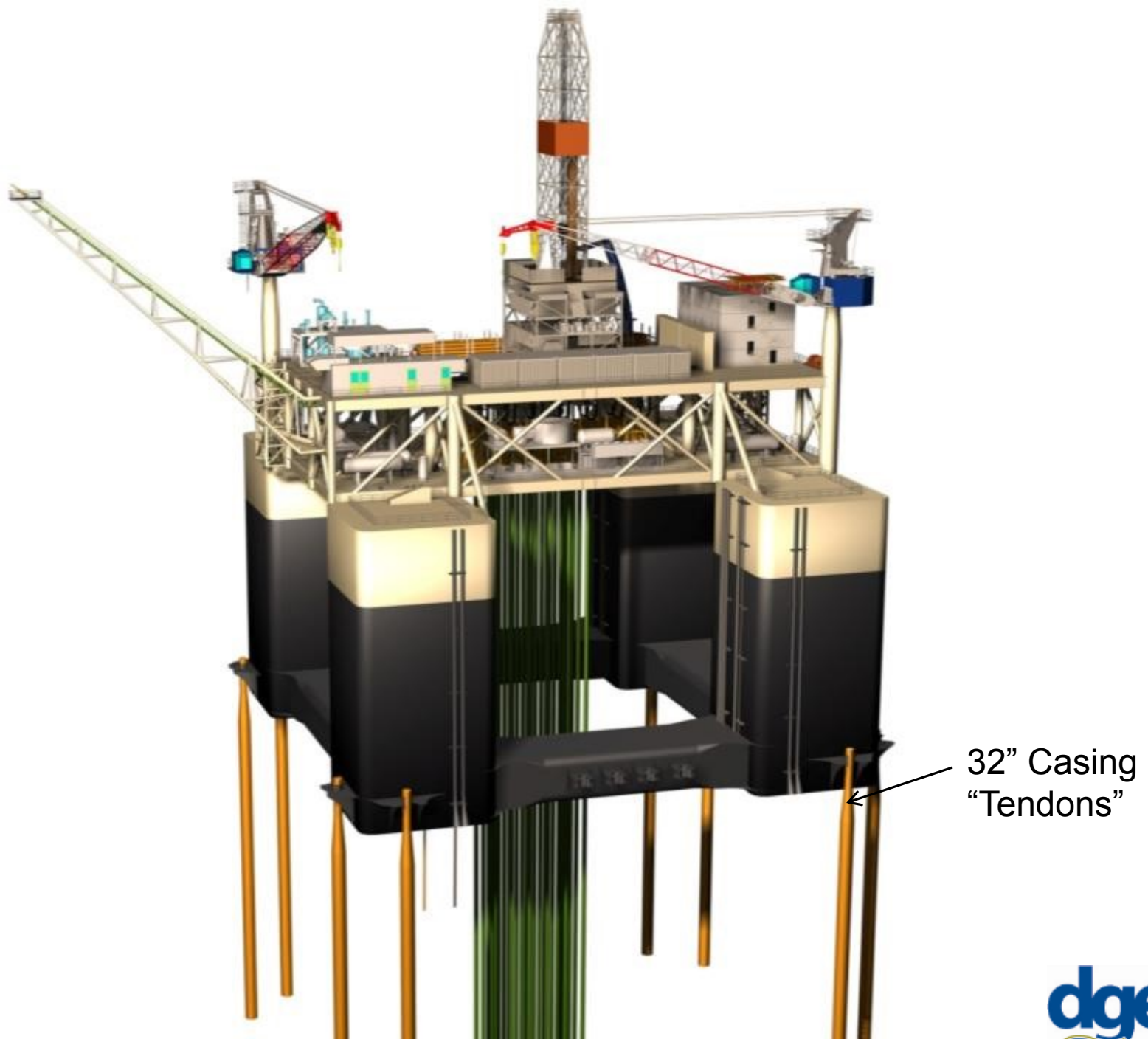


Petrobras Cascade, GOM, BW Pioneer, world's deepest





Marco Polo TLP (Tension Leg Platform)



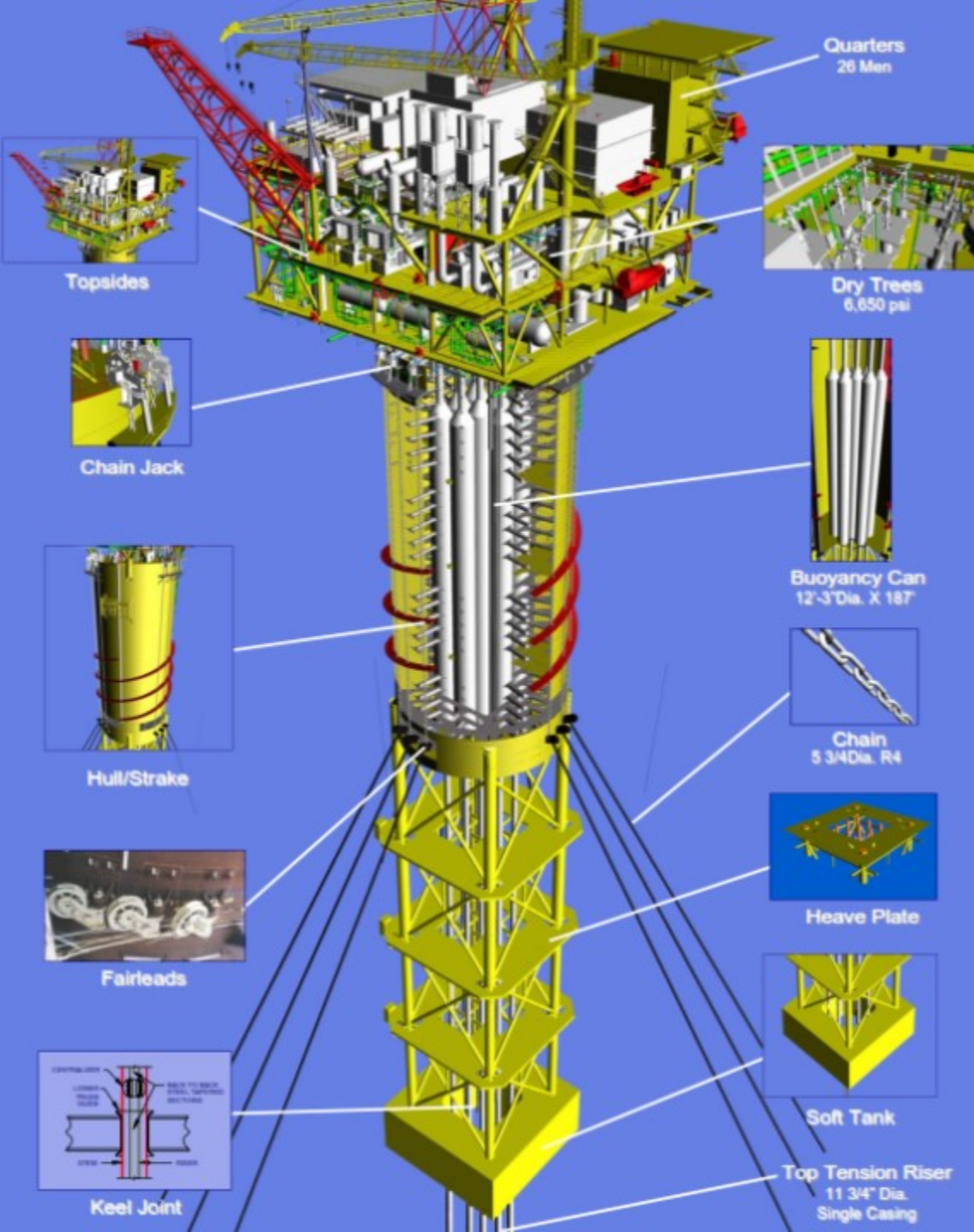
32" Casing
"Tendons"



Anadarko Constitution Spar GOM



Major Spar Equipment

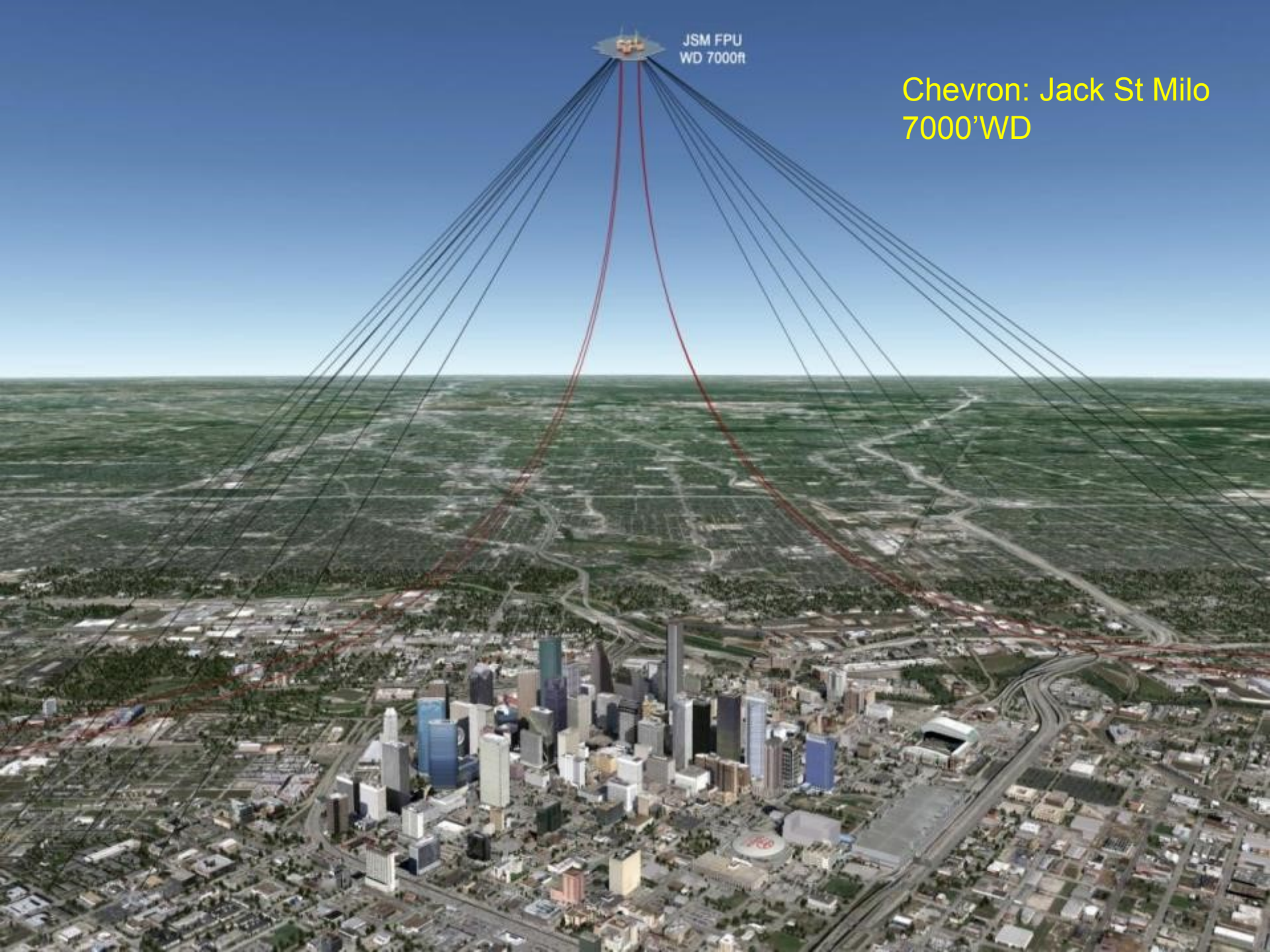






JSM FPU
WD 7000R

Chevron: Jack St Milo
7000'WD





S7000 setting deck on Spar







Saipem 7000 Crane Barge

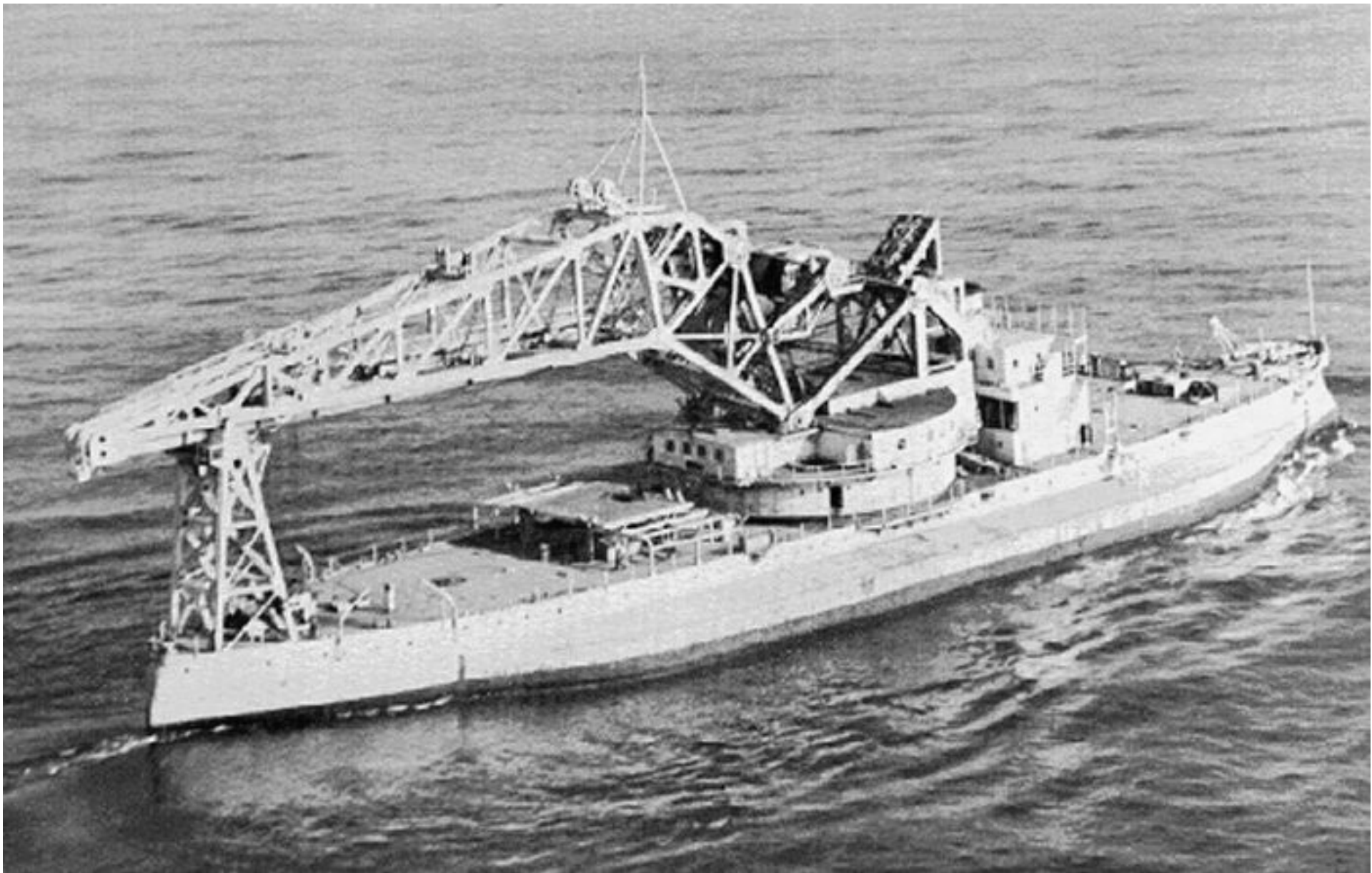




**Real Man
Hook!**







**USS Kearsarge as crane ship in 1922
250 tons lift capacity**

Project Management

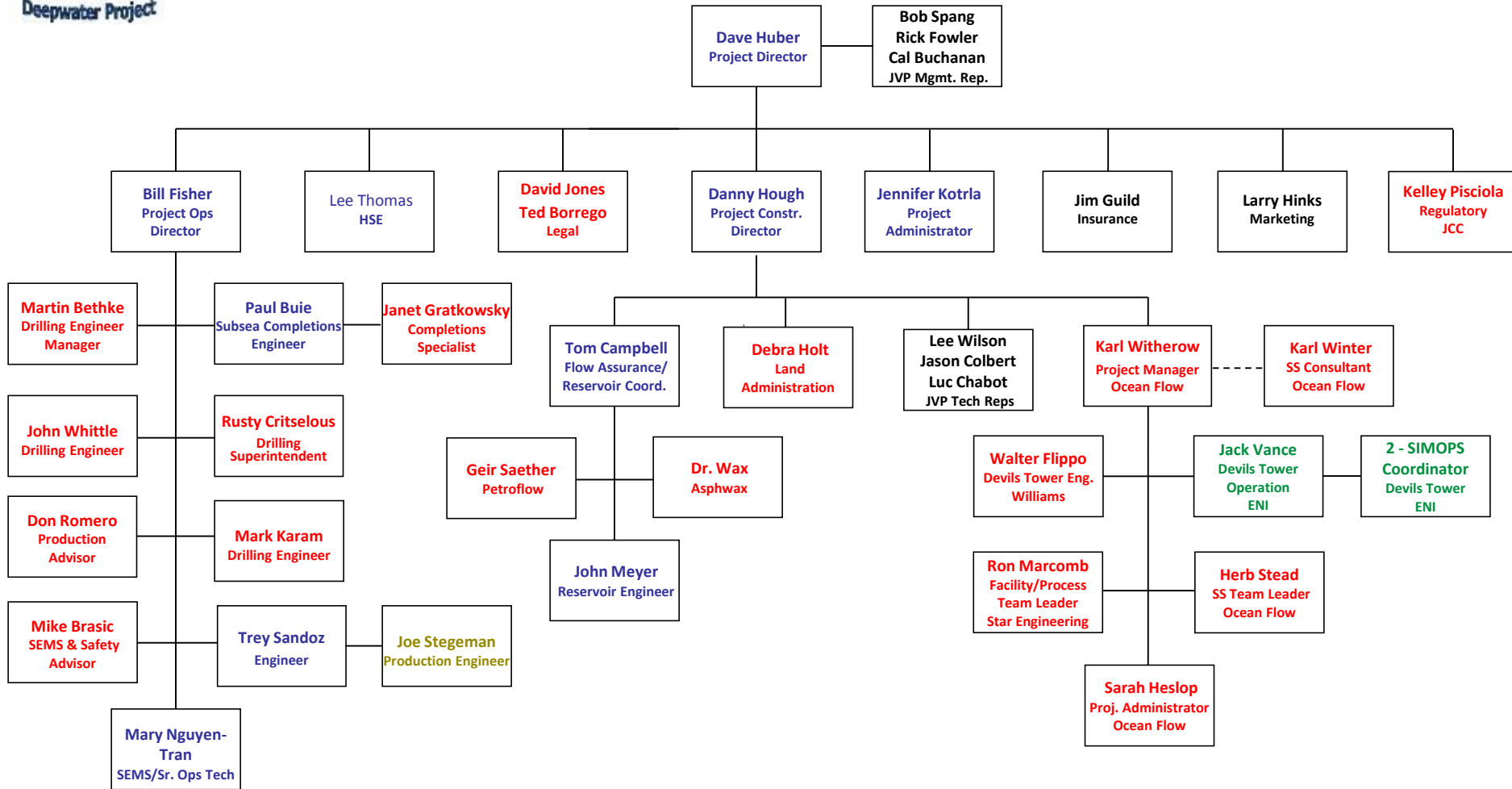
Where do we go to
get good people
these days?





KODIAK INTEGRATED PROJECT TEAM

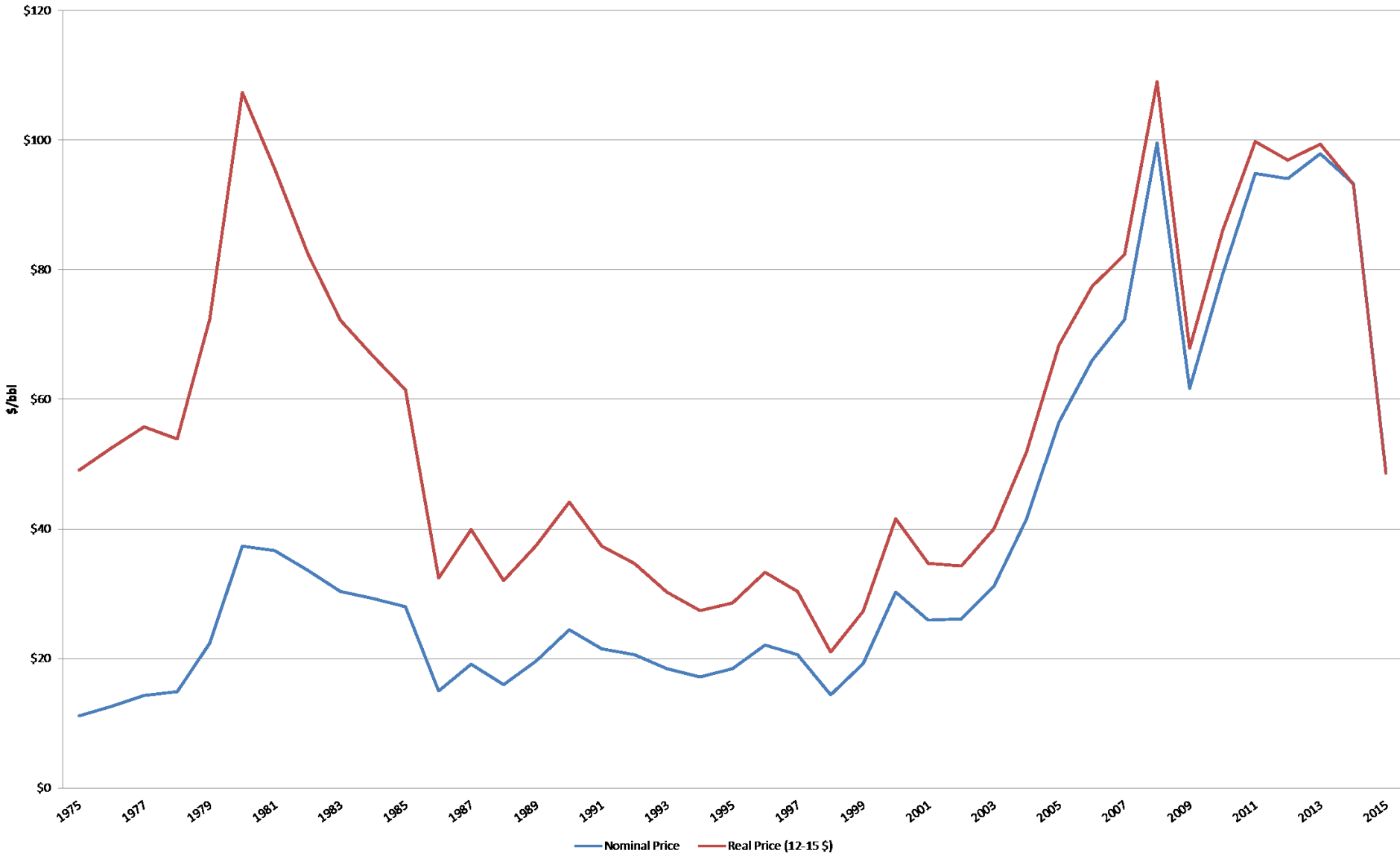
Level 3F Detailed Engineering



Deep Gulf Employee: Timewrite to Project
 Deep Gulf Consultant: Timewrite to Project
 ENI Consultants: Timewrite to Project
 IVP Employee: Timewrite to Project



1975-2015 Average Yearly Crude Oil Price - Nominal vs. Real (in Dec-15 \$)





The contractor's idea of a good deal these days!

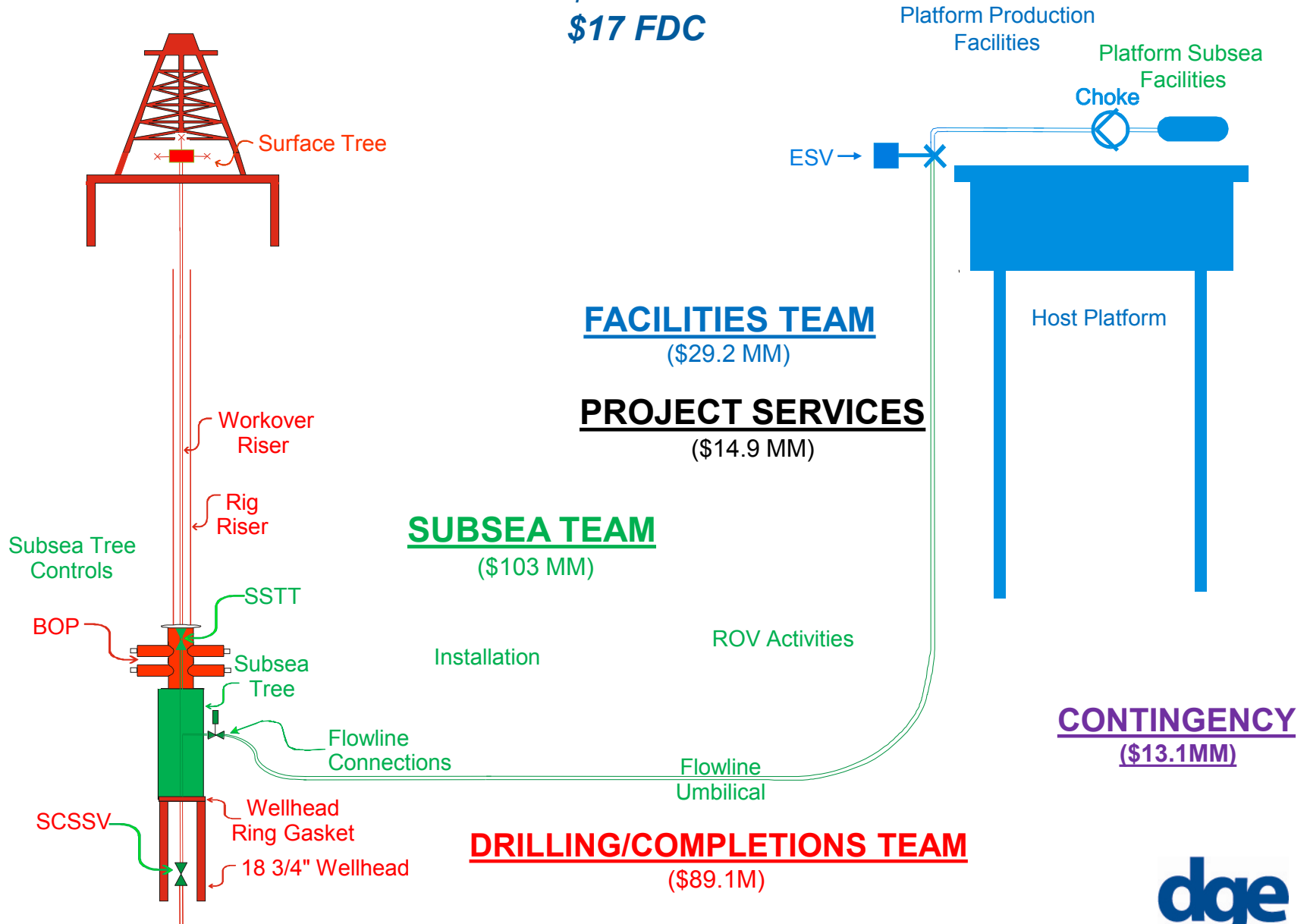


COST BY EQUIPMENT RESPONSIBILITY BOUNDARIES

Typical One Well

\$250MM

\$17 FDC





Get us on stream fast!



Major Challenges Overcome by the Deepwater Oil Industry

- Improved exploration results with deepwater seismic tools and interpretations
- Developed the technology to drill and produce not only in deepwater but in remote, harsh locations
- Survived terrible accidents in life, equipment and pollution
- Environmentally acceptable in most areas of the world
- Successfully negotiated difficult fiscal changes and nationalizations
- Rode the commodity rollercoaster
- Created huge wealth: Went from 0 to a \$170B/yr industry in 45 years



lawyer

landman

Ya see: deepwater is really not scary at all!

Major Messages for Deepwater Projects





Get the right engineers from day 1!





www.viagrarecords.com

Be prepared for all sorts of engineering surprises!





**It takes courage and confidence to operate in
deepwater!**





Contracts should be clear but fair.





Deal only with the best companies.





**Be the team
that works
together for a
common goal.**



Risk Management is key to success! 



**Humans cause most engineering disasters
Deepwater needs the best engineers in the world**





**Don't be afraid to
take on
deepwater
challenges.**



Hang in there! The oil price will come back. 



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And don't forget to work real hard!



It will be an exciting year for Deepwater!

