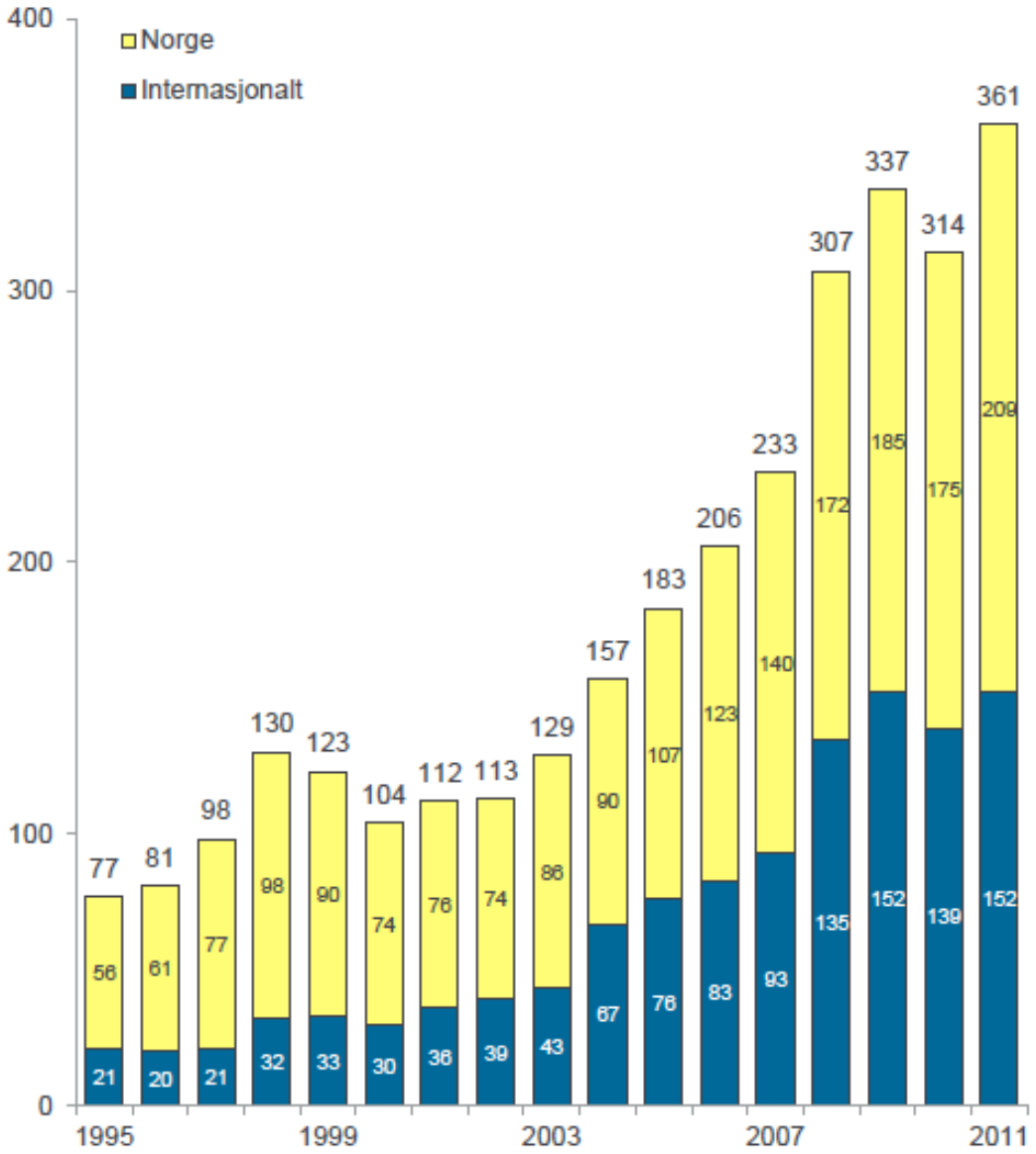
Suppliers and technological style Comparing oil and gas sector in Norway, Brazil and U.S. GoM

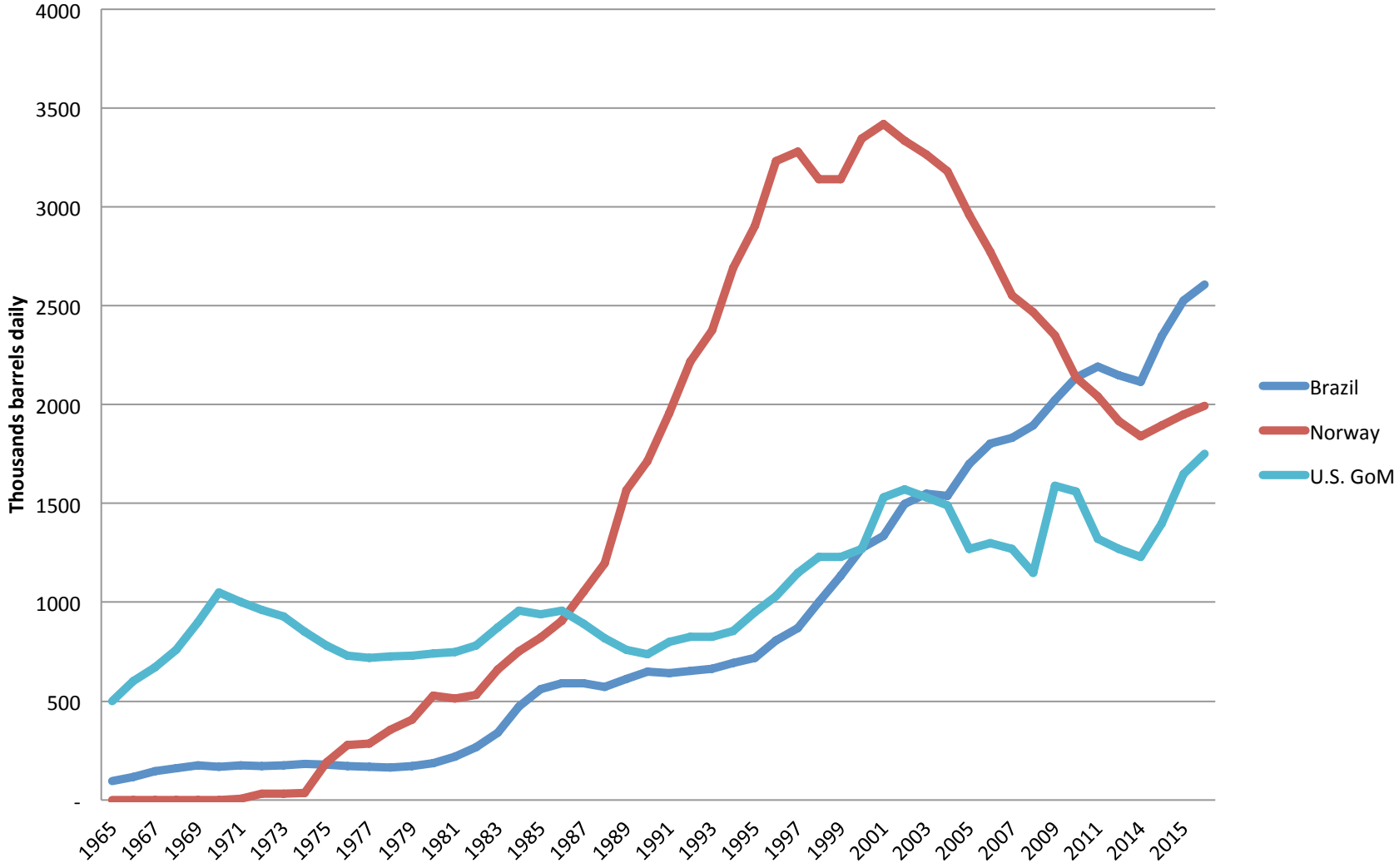
Helge Ryggvik, September 2017

Figur 3.4: Total omsetning fra norske leverandører, Norge vs Internasjonalt
NOK milliarder

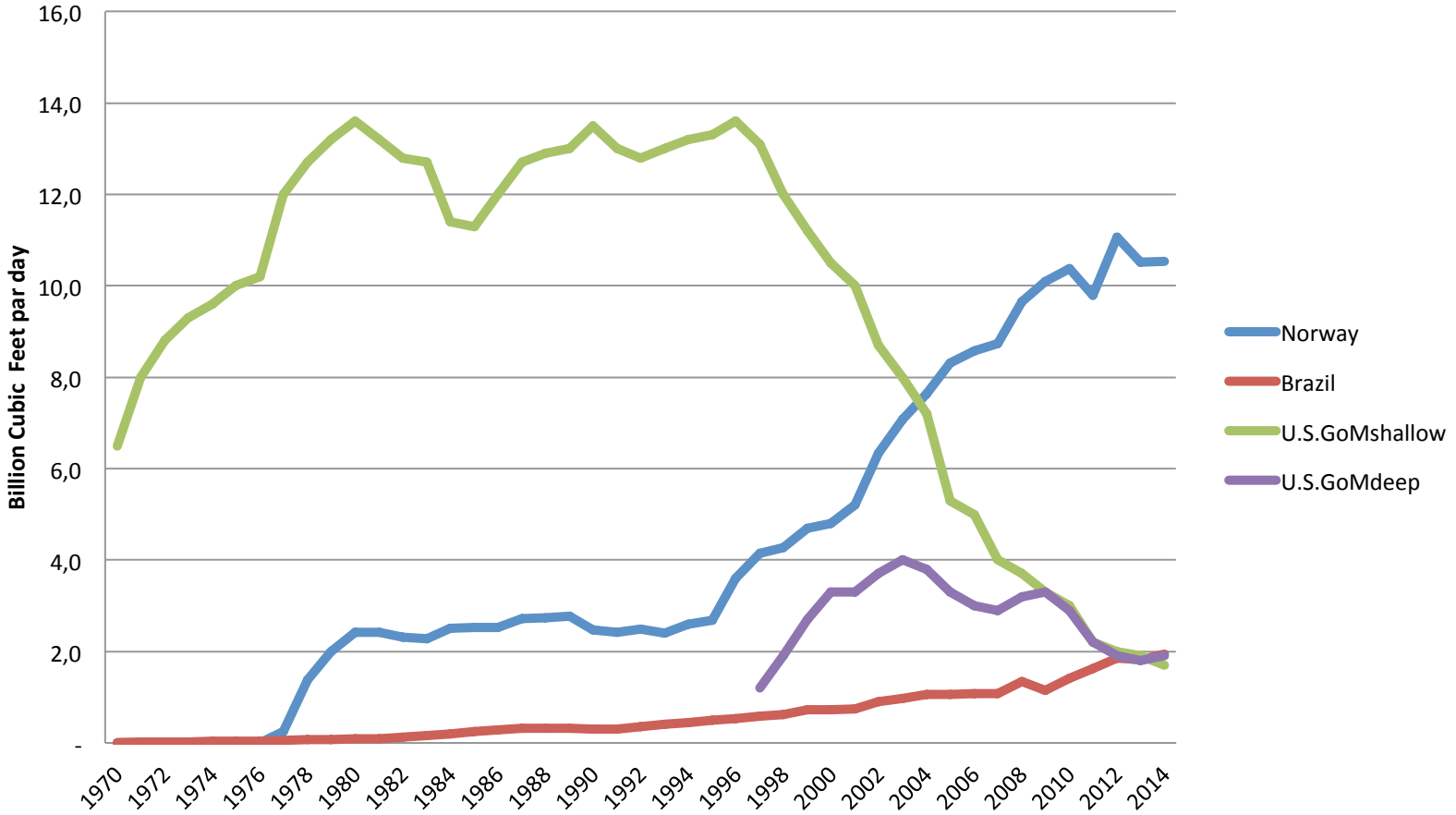


3x, The first Norwegian diving firm

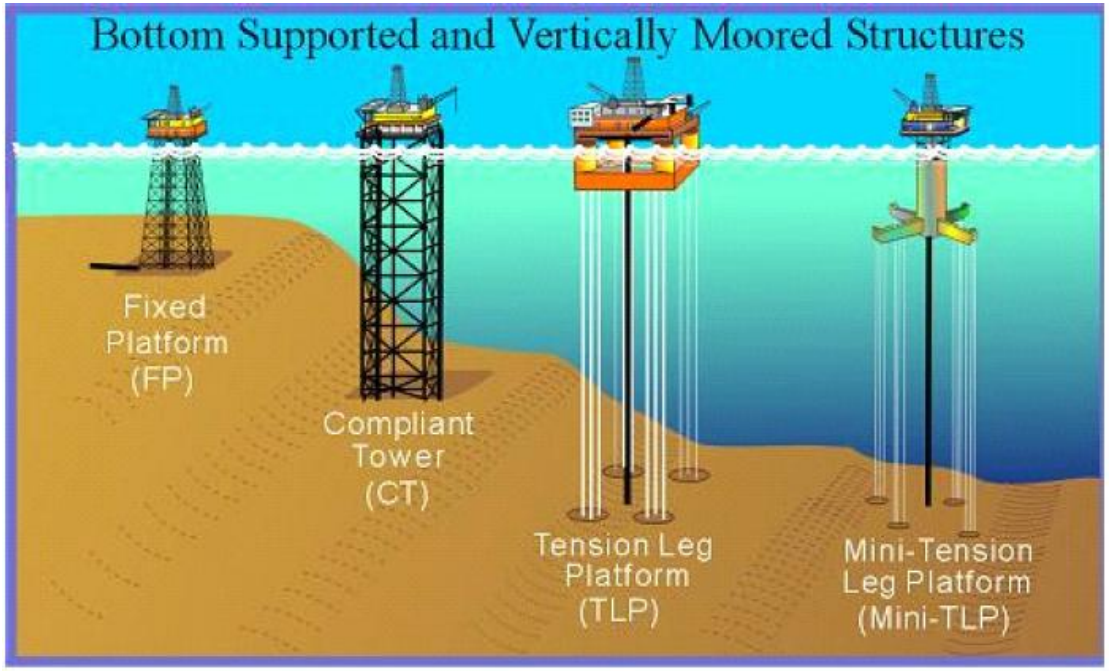
Oil production
1965-2016

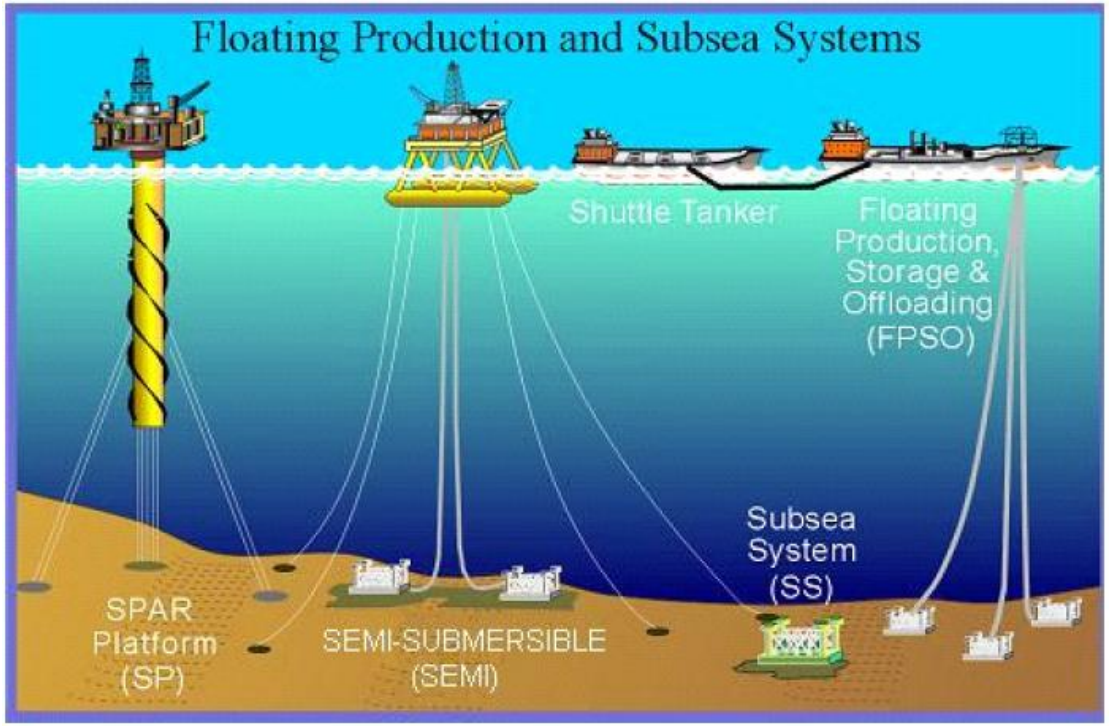


Gas Production
1970-2014



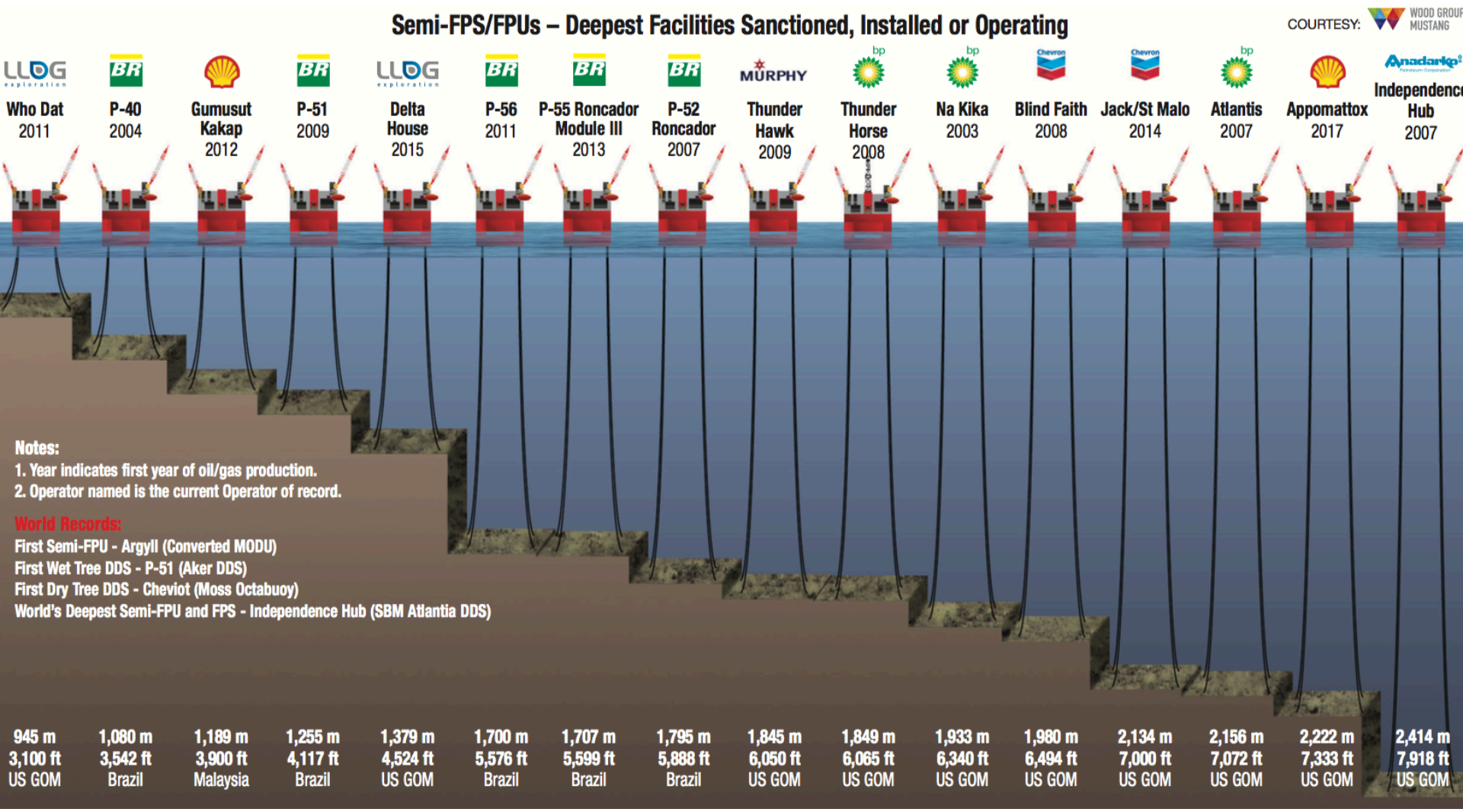
	Norway	Brazil	U.S. GoM
Geography & Climate	Most O & G fields located in water depth of 60- 350 m. 100 to 350 km from the coast. Cold winter storms, the 30 meter hundred years wave	Shallow shelf (20-60 m.) from the coast. Then steep slope down to deep and ultra-deep sea (800-2600) meters. Warm climate, waves up to 8 meters.	Shallow shelf (10-60 m.) from the coast. Then steep slope down to deep and ultra-deep sea (600-2900 meters). Warm climate, but hurricanes
Geology	Most fields in layers the range of 200 meter to 4000 meters	To floors: Post salt & Pre-salt Down to 8000 meters	To floors: Post salt & Pre-salt Down to 10.000 meters
Field size	Dominated by "elephants" in the start. (Several 2-6 Bb.o.e. fields)	Few small fields in shallow waters Large fields Deep Sea Campos "Elephants" in pre-salt	Large number of small and medium fields in shallow waters. Deep-sea fields from small to 800 mill b.o.e
Infra-structure	Complex developed infrastructure, first to international markets in Europe, then to processing in Norway,	Large national market close, but little developed infrastructure in the form of pipelines	Complex network of pipelines in shallow waters, connected to large downstream industry


Bottom Supported and Vertically Moored Structures
Fixed Platform (FP)
Compliant Tower (CT)
Tension Leg Platform (TLP)
Mini-Tension Leg Platform (Mini-TLP)


Floating Production and Subsea Systems
Shuttle Tanker
Floating Production, Storage & Offloading (FPSO)
Subsea System (SS)
SPAR Platform (SP)
SEMI-SUBMERSIBLE (SEMI)

Semi-FPS/FPUs – Deepest Facilities Sanctioned, Installed or Operating

COURTESY: WOOD GROUP MUSTANG

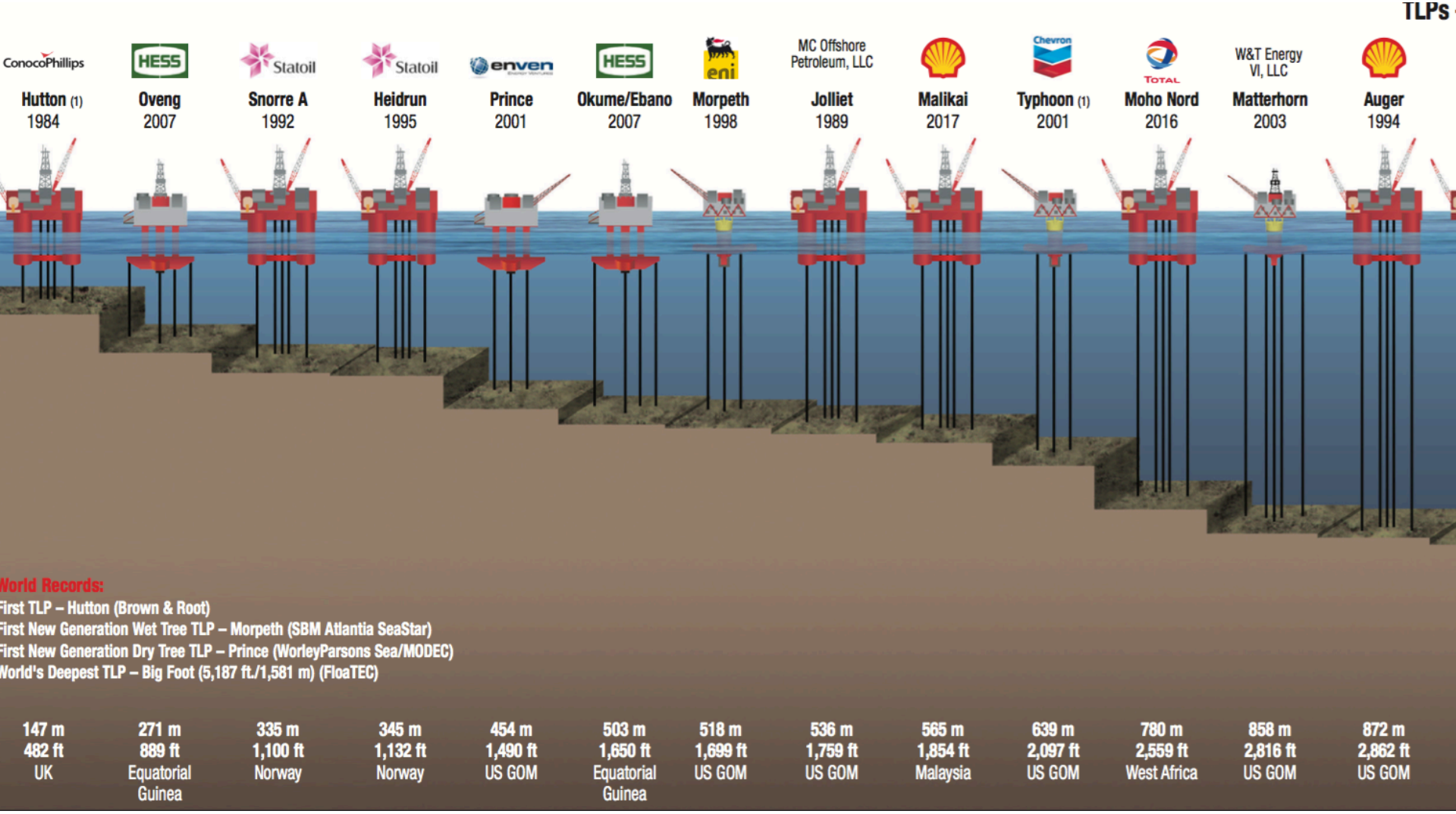


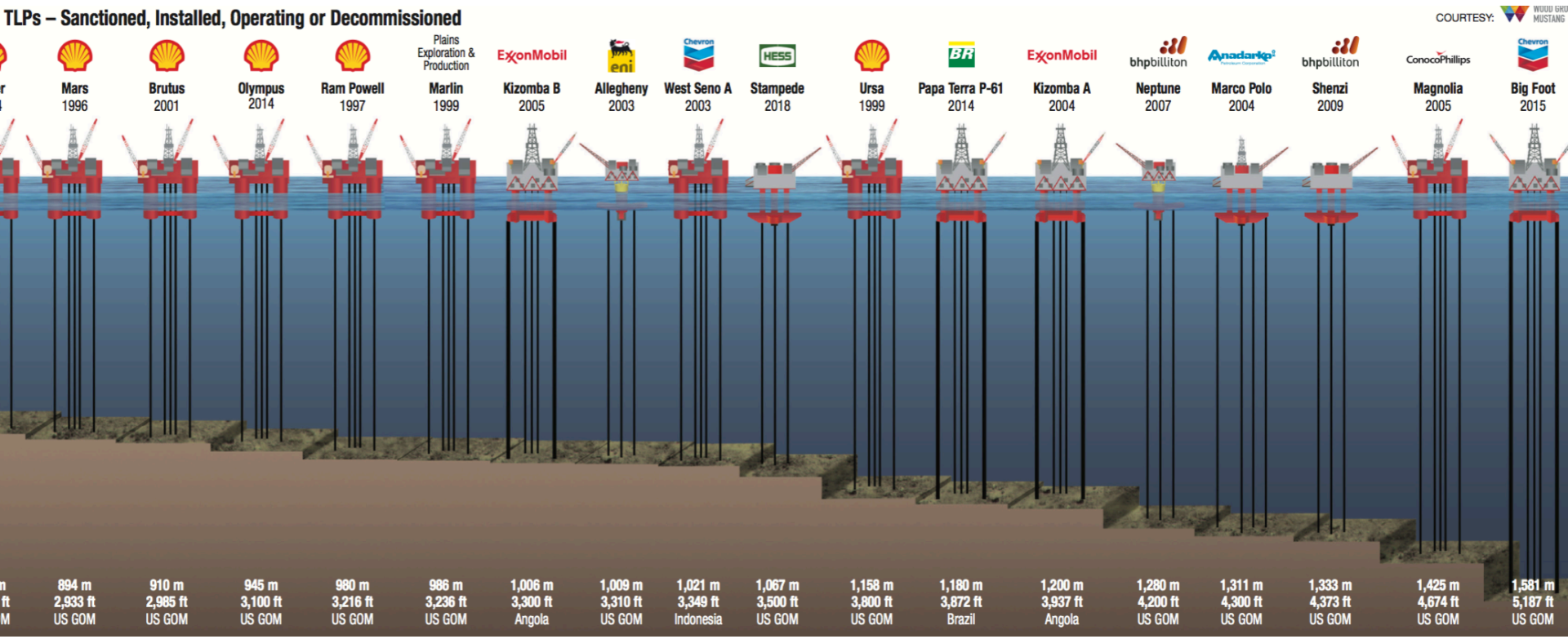
Notes:

1. Year indicates first year of oil/gas production.
2. Operator named is the current Operator of record.

World Records:

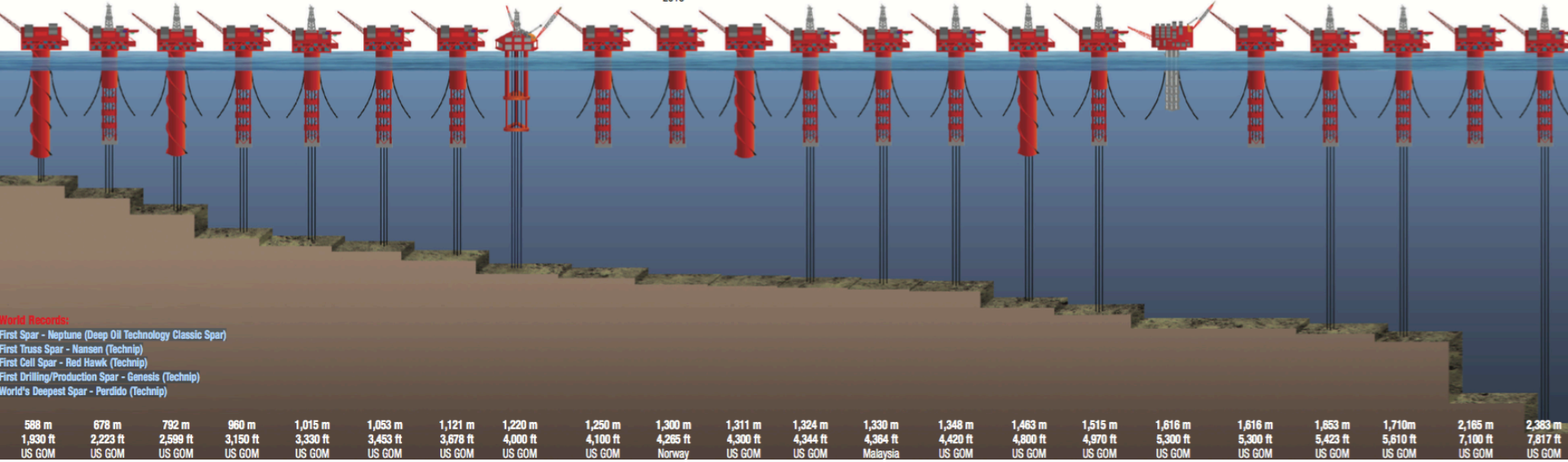
First Semi-FPU - Argyll (Converted MODU)
First Wet Tree DDS - P-51 (Aker DDS)
First Dry Tree DDS - Cheviot (Moss Octabuoy)
World's Deepest Semi-FPU and FPS - Independence Hub (SBM Atlantia DDS)


TLPs
ConocoPhillips
Hutton (1)
1984
147 m
482 ft
UK
HESS
Oveng
2007
271 m
889 ft
Equatorial Guinea
Statoil
Snorre A
1992
335 m
1,100 ft
Norway
Statoil
Heidrun
1995
345 m
1,132 ft
Norway
enven
Prince
2001
454 m
1,490 ft
US GOM
HESS
Okume/Ebano
2007
503 m
1,650 ft
Equatorial Guinea
eni
Morpeth
1998
518 m
1,699 ft
US GOM
MC Offshore Petroleum, LLC
Jolliet
1989
536 m
1,759 ft
US GOM
Malikai
2017
565 m
1,854 ft
Malaysia
Chevron
Typhoon (1)
2001
639 m
2,097 ft
US GOM
TOTAL
Moho Nord
2016
780 m
2,559 ft
West Africa
W&T Energy VI, LLC
Matterhorn
2003
858 m
2,816 ft
US GOM
Auger
1994
872 m
2,862 ft
US GOM
World Records:
First TLP – Hutton (Brown & Root)
First New Generation Wet Tree TLP – Morpeth (SBM Atlantia SeaStar)
First New Generation Dry Tree TLP – Prince (WorleyParsons Sea/MODEC)
World's Deepest TLP – Big Foot (5,187 ft./1,581 m) (FloaTEC)


TLPs – Sanctioned, Installed, Operating or Decommissioned
COURTESY:
Mars 1996
Brutus 2001
Olympus 2014
Ram Powell 1997
Plains Exploration & Production
Marlin 1999
ExxonMobil
Kizomba B 2005
eni
Allegheny 2003
Chevron
West Seno A 2003
HESS
Stampede 2018
Ursa 1999
BR
Papa Terra P-61 2014
ExxonMobil
Kizomba A 2004
bhpbilliton
Neptune 2007
Anadarko
Marco Polo 2004
bhpbilliton
Shenzi 2009
ConocoPhillips
Magnolia 2005
Chevron
Big Foot 2015
894 m 2,933 ft US GOM
910 m 2,985 ft US GOM
945 m 3,100 ft US GOM
980 m 3,216 ft US GOM
986 m 3,236 ft US GOM
1,006 m 3,300 ft Angola
1,009 m 3,310 ft US GOM
1,021 m 3,349 ft Indonesia
1,067 m 3,500 ft US GOM
1,158 m 3,800 ft US GOM
1,180 m 3,872 ft Brazil
1,200 m 3,937 ft Angola
1,280 m 4,200 ft US GOM
1,311 m 4,300 ft US GOM
1,333 m 4,373 ft US GOM
1,425 m 4,674 ft US GOM
1,581 m 5,187 ft US GOM

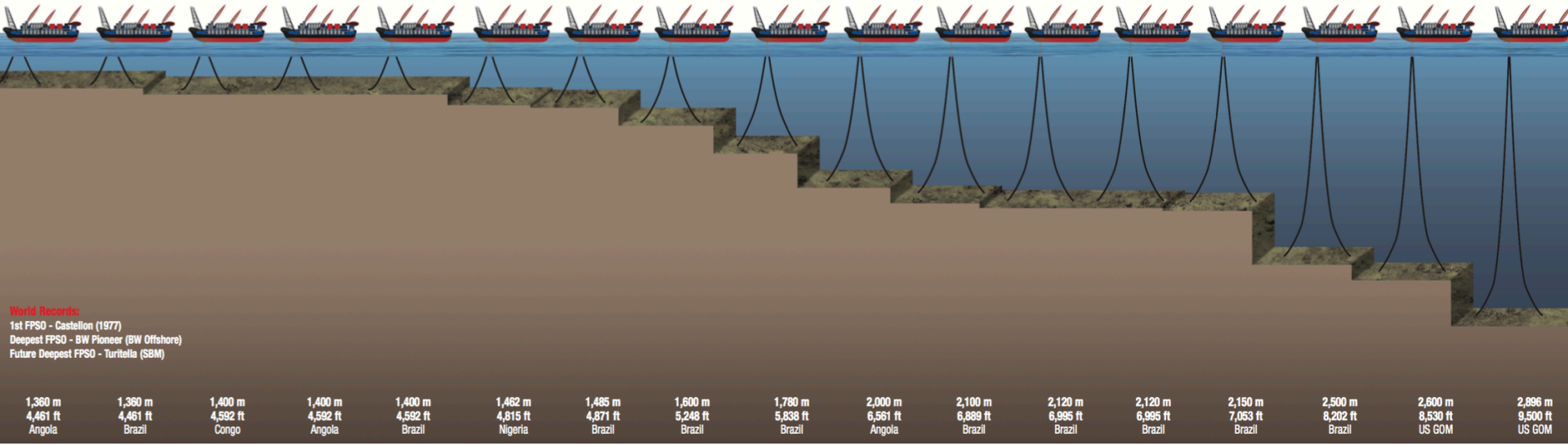
Spars, DDFs, DDCVs – Sanctioned, Installed or Operating

COURTESY: WOOD GROUP MUSTANG



FPSO Deepest Facilities – Sanctioned, Installed or Decommissioned – As of March 2015

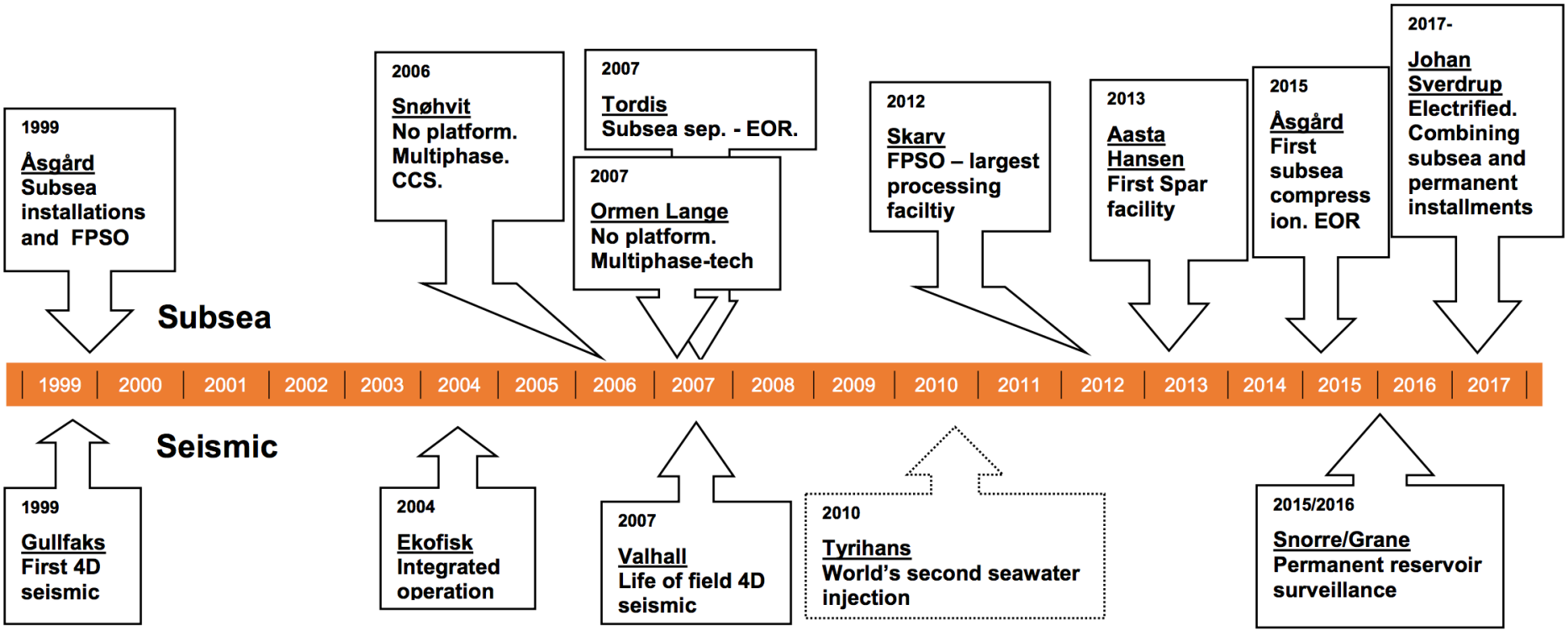
COURTESY: WOOD GROUP MUSTANG



Dalia	Brasil	Azurite	Girassol	P-54	Agbami	Capixaba	Piranema Spirit	BC-10 Espirito Santo	PSVM	MV-23 Cidade de Sao Paulo	Cidade de Paraty	BW Cidade de Sao Vicente	MV-22 Cidade de Angra dos Reis	Dynamic Producer	BW Pioneer	Turitella
2006	2002	2009	2001	2007	2008	2010	2007	2009	2012	2013	2013	2009	2010	2011	2012	2016
1,360 m	1,360 m	1,400 m	1,400 m	1,400 m	1,462 m	1,485 m	1,600 m	1,780 m	2,000 m	2,100 m	2,120 m	2,120 m	2,150 m	2,500 m	2,600 m	2,896 m
4,461 ft	4,461 ft	4,592 ft	4,592 ft	4,592 ft	4,815 ft	4,871 ft	5,248 ft	5,838 ft	6,561 ft	6,889 ft	6,995 ft	6,995 ft	7,053 ft	8,202 ft	8,530 ft	9,500 ft
Angola	Brazil	Congo	Angola	Brazil	Nigeria	Brazil	Brazil	Brazil	Angola	Brazil	Brazil	Brazil	Brazil	Brazil	US GOM	US GOM

World Records:
1st FPSO - Castellon (1977)
Deepest FPSO - BW Pioneer (BW Offshore)
Future Deepest FPSO - Turitella (SBM)

Main technologies developed after 2000



	Norway	Brazil	U.S. GoM
Protectionism?	Strong before 1990. Open market in the 2000s	No restrictions on foreign ownership in supply, but strong local content restrictions	Barriers to entry very high for EPC-suppliers. Elements of informal protectionism?
Other kind of government support	Research. Several supportive institutions strengthened from the early 2000s.	Some research. Strong state policy initiatives.	
Industry associations	Important, with state support and sometimes with union participation	Important, with strong state support, no union participation	Important, anti-cartel laws restricts some activities. No state participation
Technical standards	NORSOK have a protectionist effect. Industry striving to internationalize standards in ISO	API influenced Standards, but with local adaption. Supporting ISO	Working for API to become the global standard

	Norway	Brazil	U.S. GoM
Regulation	Internal control Strong regulatory authority	Hybrid regulations Weak authority	Detailed safety regulation. Rather weak authority Insurance
National events	Bravo Blow – out/Alexander	Debt crises/ Corruption scandal	Exxon Valdez Deepwater Horizon
Trade unions	Strong, focused on safety	Rather Strong, focused on national ownership	No unions
Social mobilization	Environment group and fishermen opposing the industry moving north	National ownership	Weak in nearby states, strong nationally

	Norway	Brazil	USA
D.H. Well service	Moderate weak	Very weak	Very Strong
Drilling	Strong	Weak	Strong
… equipment	Strong	Very weak	Strong, in most parts
Subsea fabrication	Strong	Upgraded	Strong
… service	Very strong	Weak	Moderate strong
Fabrication hulls	Outsourced	Upgraded	Outsourced

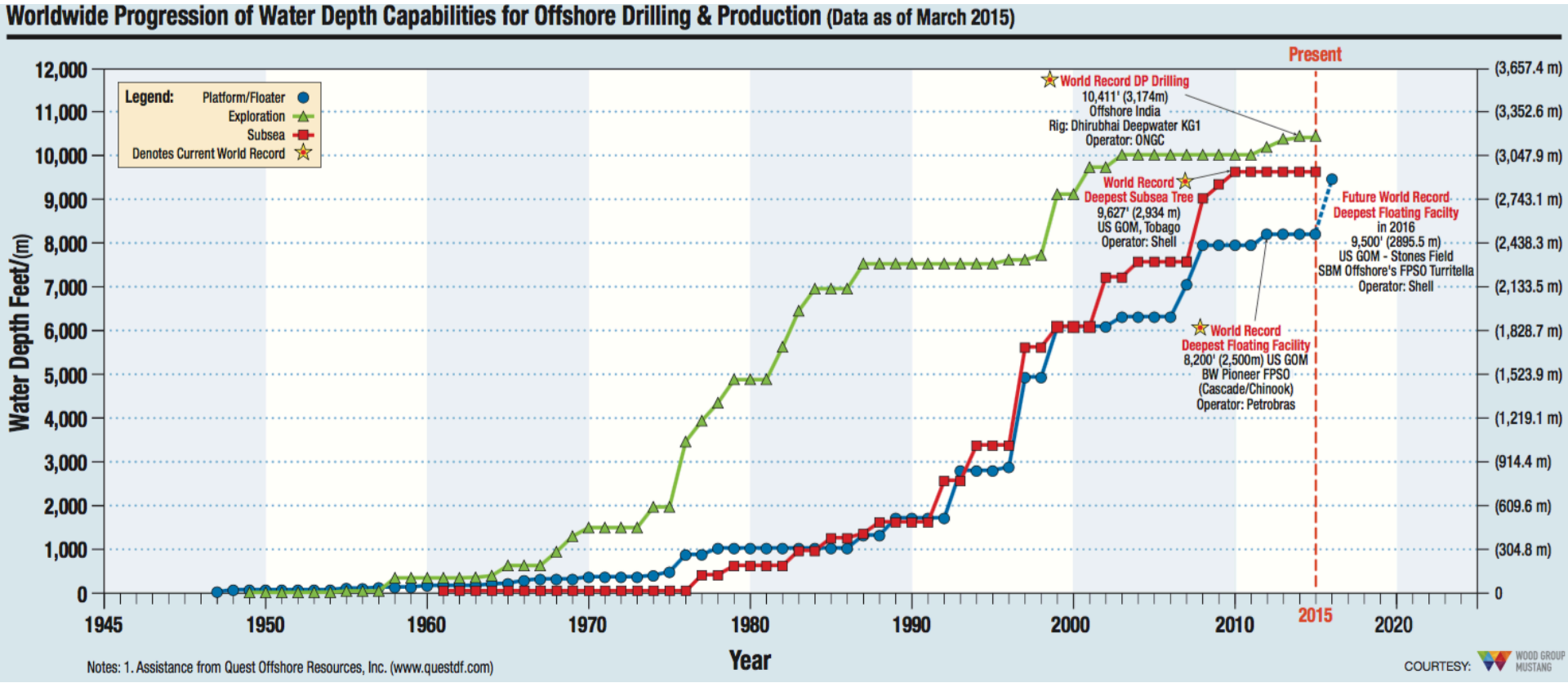
…topside	Partly outsourced	Upgraded	Strong
Supply maritime	Strong	Upgraded	Moderate strong
Seismic	Very strong	Very weak	Strong
Operation	Companies	Strong element of suppliers	Companies
M&M	Strong	Upgraded	Strong
Sub-suppliers	Upgraded	upgraded	


Campos Basin
Oil
Gas 1
Gas 2
Multiphase
BC-BU
RIO-BU
ES-BU
10 km
• 37 Floating Production Units
18 FPSOs
3 FSOs
16 SS
• 14 Fixed platforms
• 564 Oil production wells
• 16 Non associated gas wells
BALEIA ANÃ
ARGONAUTA
CACHALOTE
OSTRA
JUBARTE
BALEIA FRANCA
NAUTILUS
BALEIA AZUL
MANGANGÁ
ABALONE
CAXARÉU
PIRAMBÚ
CATUÁ
FRADE
RONCADOR
ALBACORA
ALBACORA LESTE
VERMELHO
CARAPEBA
MOREIA
GAROUPINHA
PARGO
VIOLA
VOADOR
PARATI
GAROUPA
ANEQUIM
CAMORADO
MARLIM
BAGRE
CHERNE
MARLIM LESTE
MALHADO
CORVINA
CONGRO
SALEMA
BARRACUDA
PIRAUNA
MARIMBA
BIJUPIRÁ
CARATINGA
BADEJO
BONITO
MARLIM SUL
LINGUADO
PAMPO
ESPADARTE
CARAPICU
CARATAÍ
MAROMBA
PAPA-TERRA
BARRA DE ITABAPOANA
Espírito Santo
Rio de Janeiro
CAMPOS DOS GOYTACAZES
LAGOA FEIA
São Tomé
Quissamã
Carapebus
Estação de Cabiúnas
MACAÉ
RIO DAS OSTRAS
BÚZIOS
CABO FRIO
LAGOA DE ARARUAMA
ES
RJ


Sistema da Qualidade Certificado
REGISTER QUALITY ASSU
ISO9001
ISO 9001
AkerSolutions
AkerSolutions
PLÁSTICO
JOGUE AQUI
AkerSolutions
PAPEL
JOGUE AQUI
AkerSolutions
NÃO RECICLÁVEIS
JOGUE AQUI


2016
CALANDRAPAR


MONITORAMENTO
3045-7765
LOCAL PROTEGIDO


Worldwide Progression of Water Depth Capabilities for Offshore Drilling & Production (Data as of March 2015)
Legend:
Platform/Floater
Exploration
Subsea
Denotes Current World Record
Present
World Record DP Drilling
10,411' (3,174m)
Offshore India
Rig: Dhirubhai Deepwater KG1
Operator: ONGC
World Record
Deepest Subsea Tree
9,627' (2,934 m)
US GOM, Tobago
Operator: Shell
Future World Record
Deepest Floating Facilty
in 2016
9,500' (2895.5 m)
US GOM - Stones Field
SBM Offshore's FPSO Turritella
Operator: Shell
World Record
Deepest Floating Facility
8,200' (2,500m) US GOM
BW Pioneer FPSO
(Cascade/Chinook)
Operator: Petrobras
Water Depth Feet/(m)
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
(3,657.4 m)
(3,352.6 m)
(3,047.9 m)
(2,743.1 m)
(2,438.3 m)
(2,133.5 m)
(1,828.7 m)
(1,523.9 m)
(1,219.1 m)
(914.4 m)
(609.6 m)
(304.8 m)
0
1945
1950
1960
1970
1980
1990
2000
2010
2015
2020
Year
Notes: 1. Assistance from Quest Offshore Resources, Inc. (www.questdf.com)
COURTESY:
WOOD GROUP MUSTANG

Some important background factors:

Norway

- Relevant construction industry
- Relevant shipbuilding industry
- dynamic, risk oriented shipowners
- Good, competent universities and technical schools
- strong federal state/ competent regulatory authorities
- outweighed by a strong civil society

Brazil

- Relevant construction industry
- Relevant, but less advanced, shipbuilding industry
- no strong shipping tradition
- Less support form the state in supporting universities and technical schools
- Local capital groups jumps on and off the oil train
- less strong federal state/less competent regulatory authorities

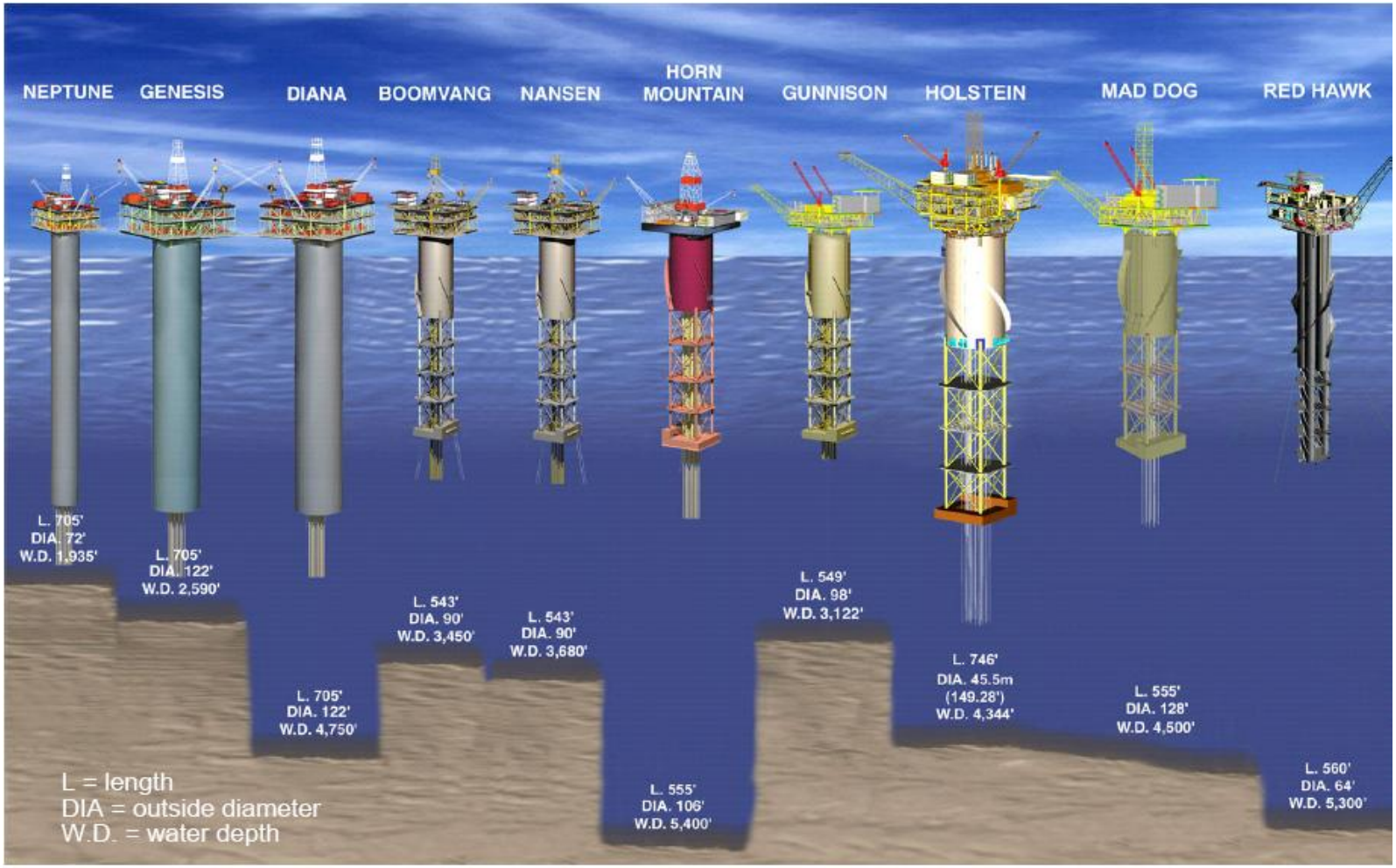


Figure 43. Progression of spar deepwater development systems (image courtesy of Technip-Coflexip).