

# Floating Wind Solutions

## Cross-over from Oil & Gas Mooring Experience to Floating Wind

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Organized by



Quest Offshore



The Westin Houston, Memorial City 28-29 June 2021

# Cross-over from Oil & Gas Mooring Experience to Floating Wind

- Floaters
- Mooring
- Anchors
- Soil
- Safety Factors
- Recent Developments





MOOREAST



Suction Piles

Drag Embedment Anchors

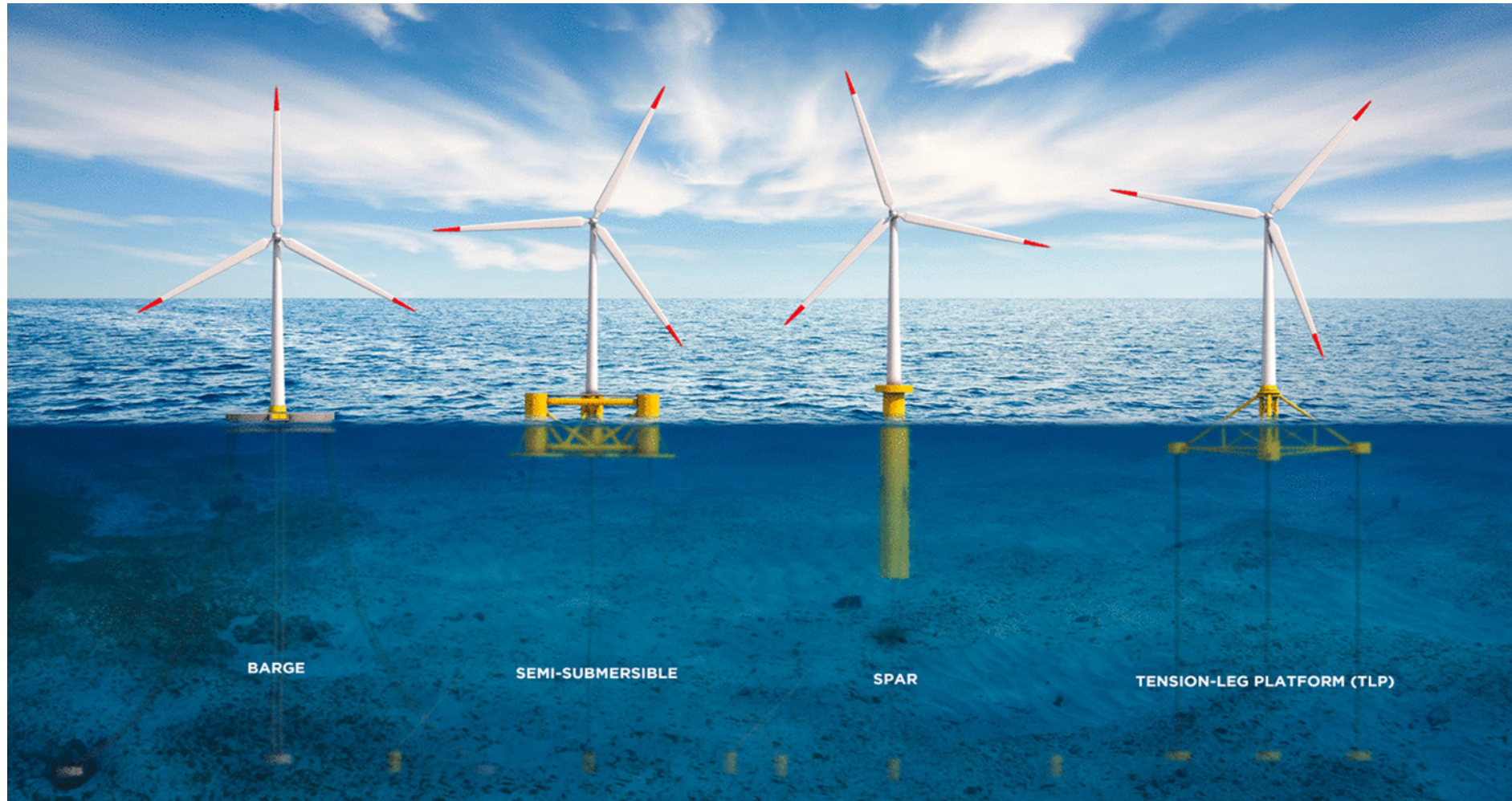
Torpedo Piles

# FLOATERS: Offshore Oil & Gas Experience



Courtesy of LMC

# FLOATERS: Offshore Wind



# FLOATERS: Comparison

FPSO: 300 mtr long

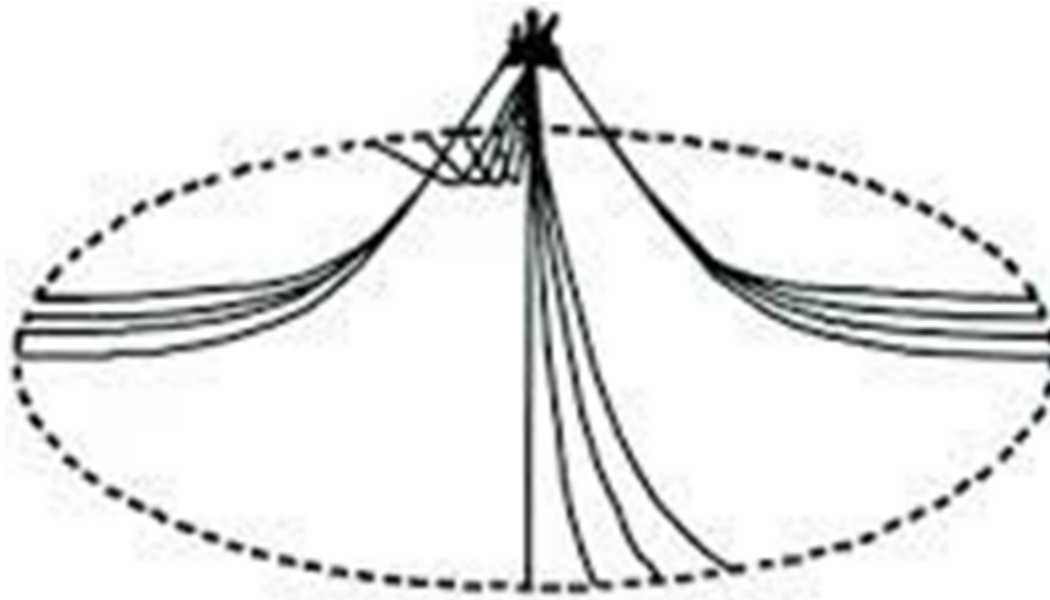


FWT: 15 MW 300 mtr high

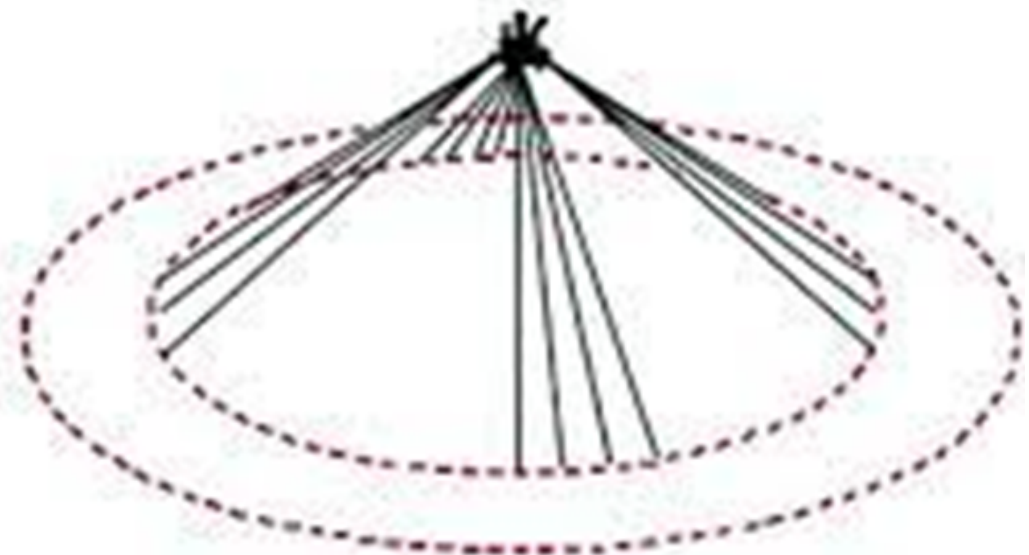




# MOORING: Catenary & Taut Leg



**Catenary Mooring**



**Taut Mooring**

# MOORING: Catenary & Taut Leg

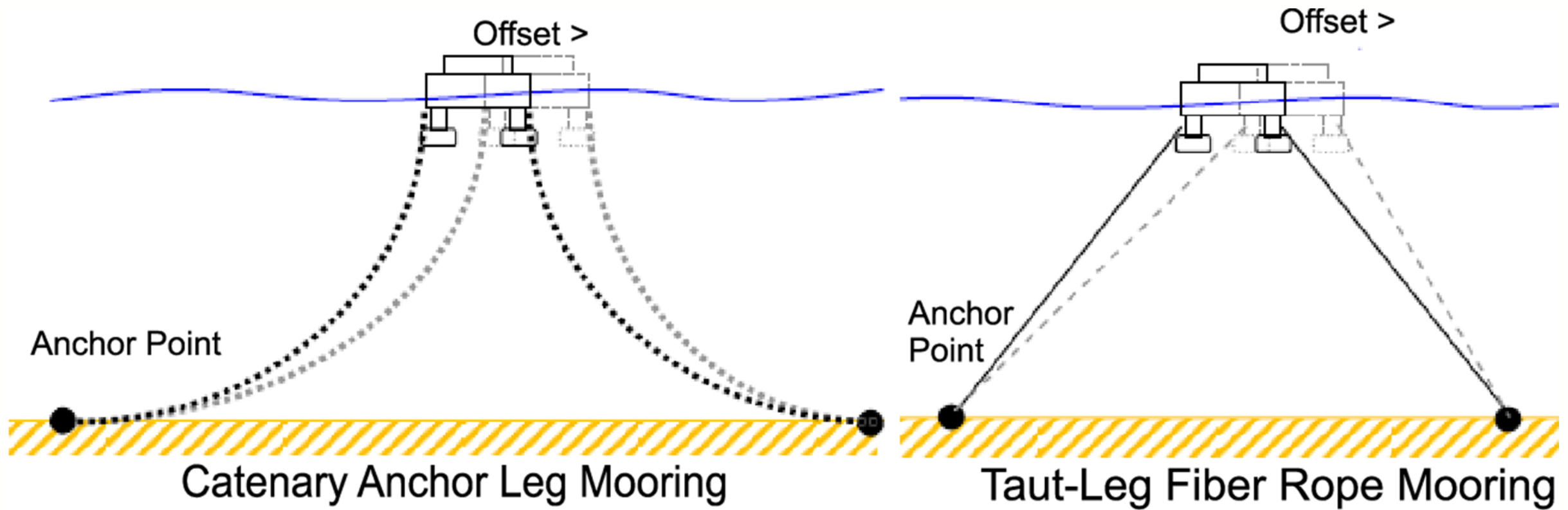
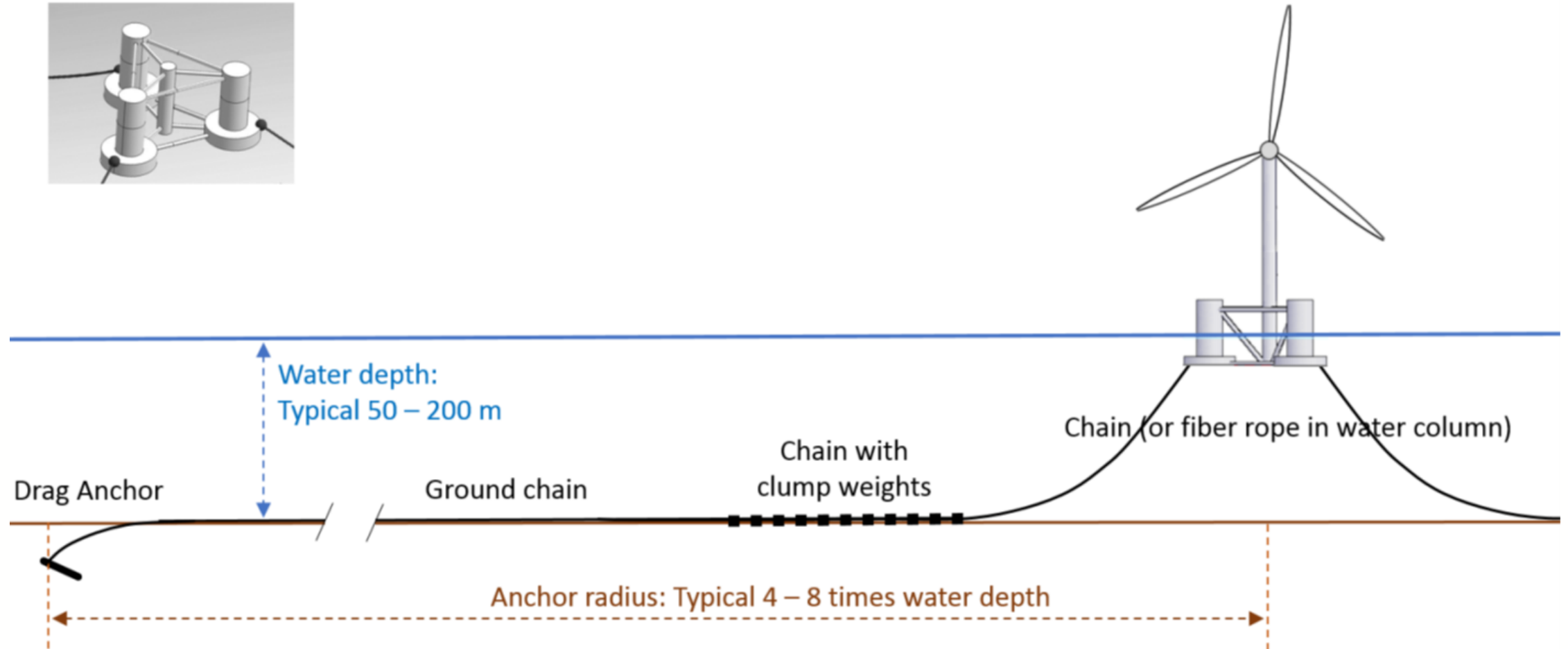
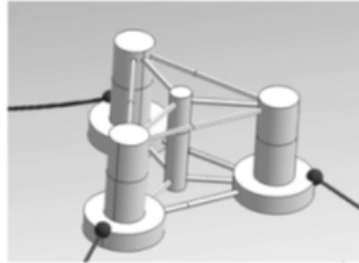


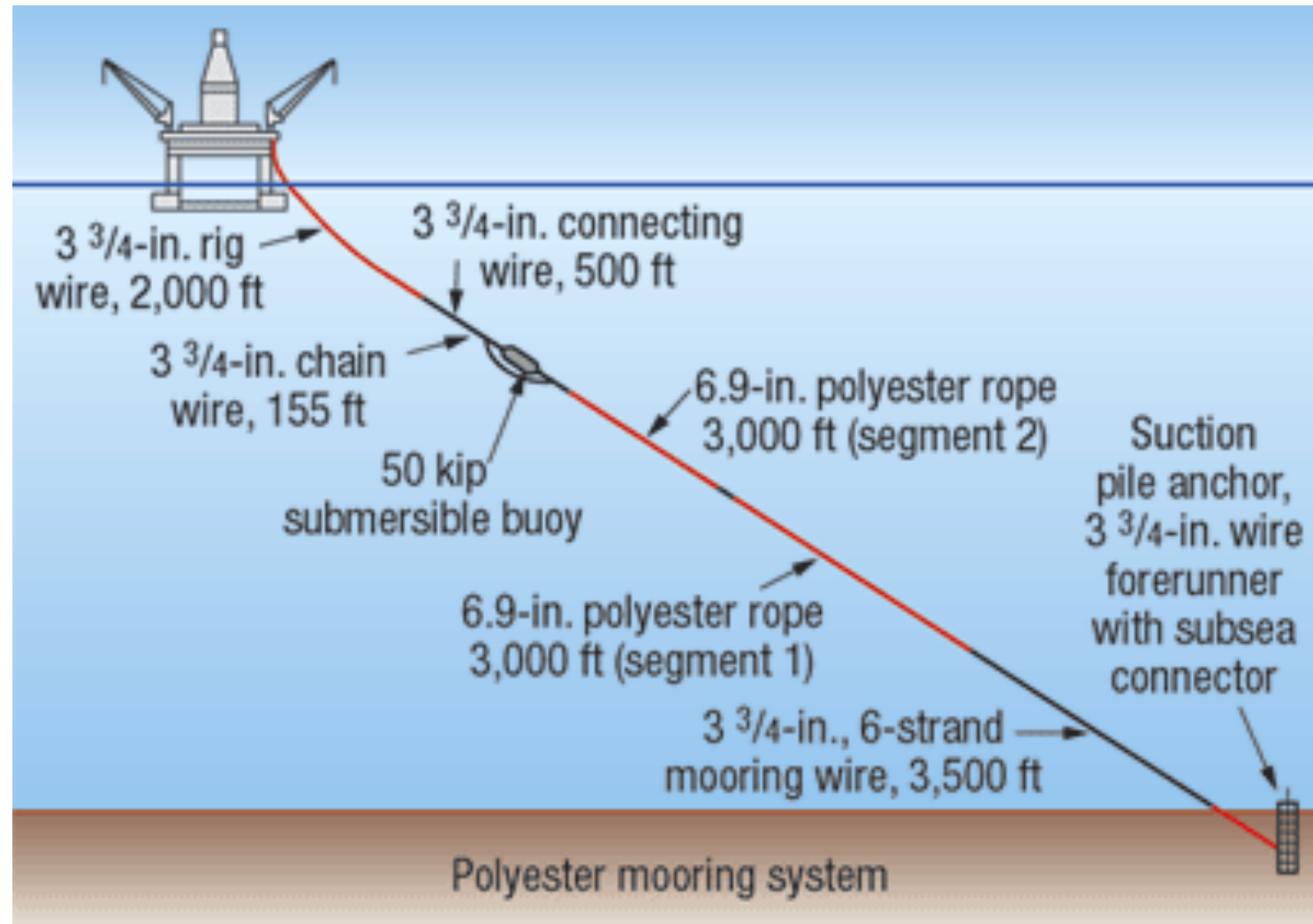
Figure 1 Catenary Anchor Leg and Taut-leg Fiber Rope Mooring Systems






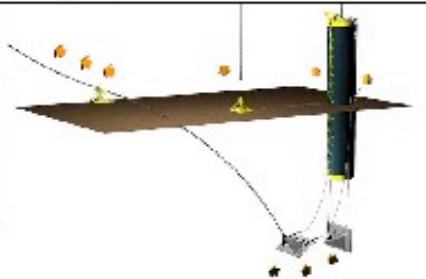



# MOORING: Typical catenary mooring system



# MOORING: Typical Taut leg mooring system



DRIVEN	DYNAMICALLY INSTALLED	SUCTION INSTALLED	DRAG INSTALLED
Driven Pile	Torpedo Pile	Suction Piles	Drag Embedment Anchor
			
	OMNI-Max	Sepla	VLA
			



# ANCHORS: Dynamically installed

Torpedo Pile

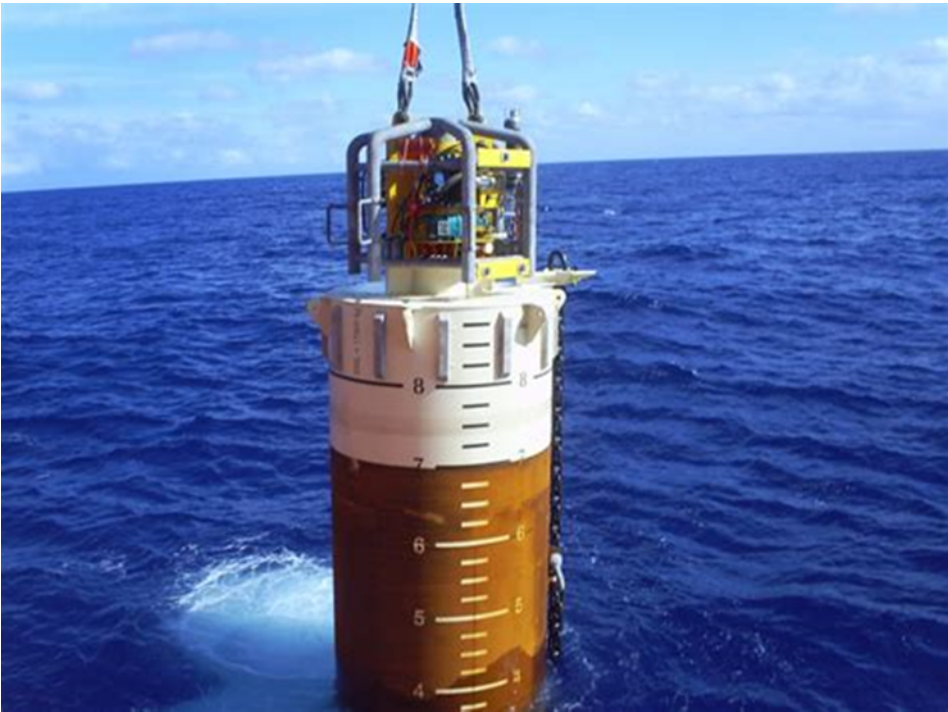


Omni-Max

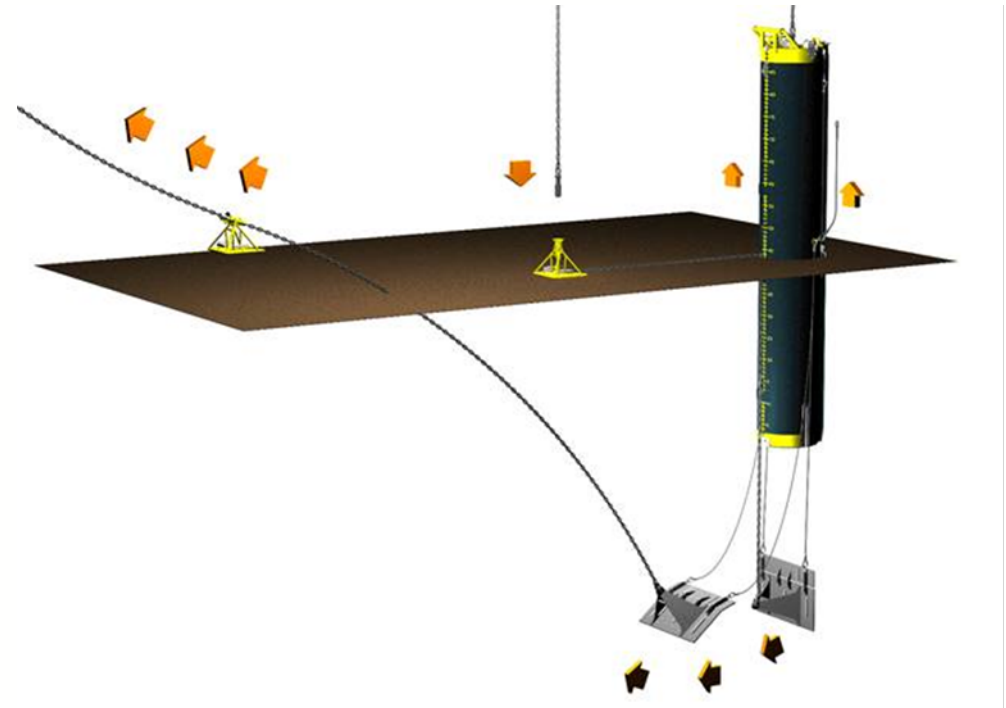


# ANCHORS: Suction installed

Suction Anchor



Suction embedded plate anchor





# ANCHORS: Drag installed

Drag Embedment Anchor










VLA





# SOIL

Anchor Type		Soil conditions			Suitability Taut Leg Moorings
		Clay	Sand	Hard	
Driven Piles		✓	✓	✓	✓
Torpedo Piles		✓	✗	✗	✓
OMNI-Max		✓	✗	✗	✓
Suction Piles		✓	🤔	🤔	✓
Sepla		✓	🤔	🤔	✓
DEA		✓	✓	✓	✗
VLA		✓	✗	✗	✓

# Anchor selection dependant on:

Soil

Waterdepth

Available installation vessels

Local fabrication / content

# SAFETY FACTORS O&G vs FOWT

Anchor Type	System	Condition	Oil & Gas**	Floating Wind***
			<b>100</b> Y RP	<b>50</b> Y RP
Drag Embedment Anchor	Redundant	Intact One line failure	1.5 1.0	1.5 1.0
	<b>NON</b> -Redundant	Intact	<b>X</b>	1.8*

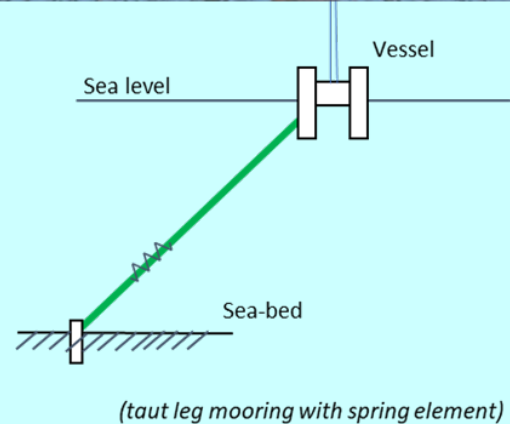
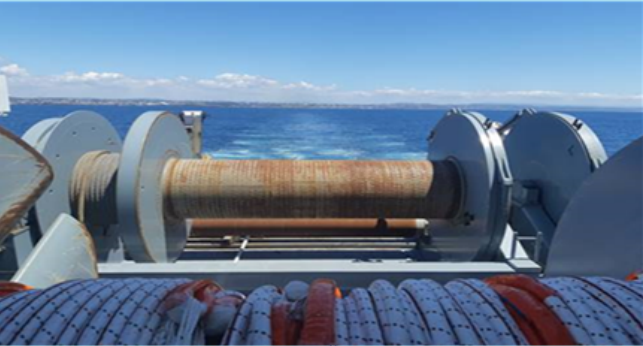
\* 20% increase over intact design

\*\* ABS Rules For Building and Classing Floating Production Installations January 2021

\*\*\* ABS Rules For Building and Classing Floating Offshore Wind Turbines 2020

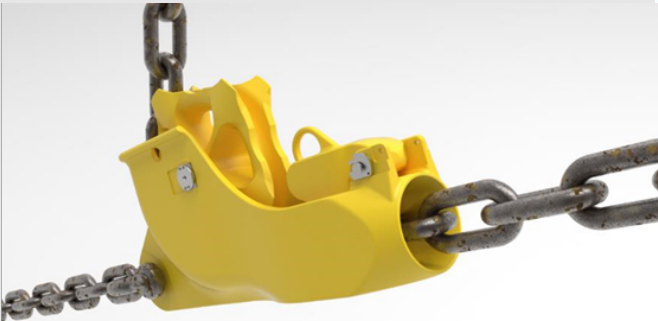
# RECENT DEVELOPMENTS

## Shallow water taut leg



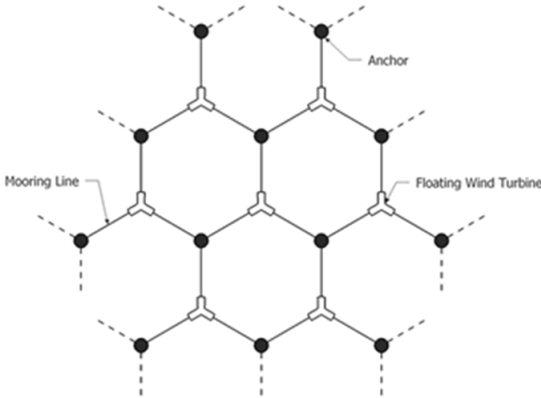
Courtesy of DSM

## In-Line Tensioners



Courtesy of Flintstone

## Shared Moorings



# Video 120 mT Torpedo Pile at seabed Entry



**Floating Wind Solutions**