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6th of July 2016

Shipping Challenges

Brazilian Pre-salt Lifting
logistics

0. Galp evolution to upstream activities

Logistic evolution

1. Brazil pre-salt production and logistics context

Field Overview

2. Dynamic Position Vessels

Shipping market

Comparison with conventional vessels

Anna Knutsen - Building overview

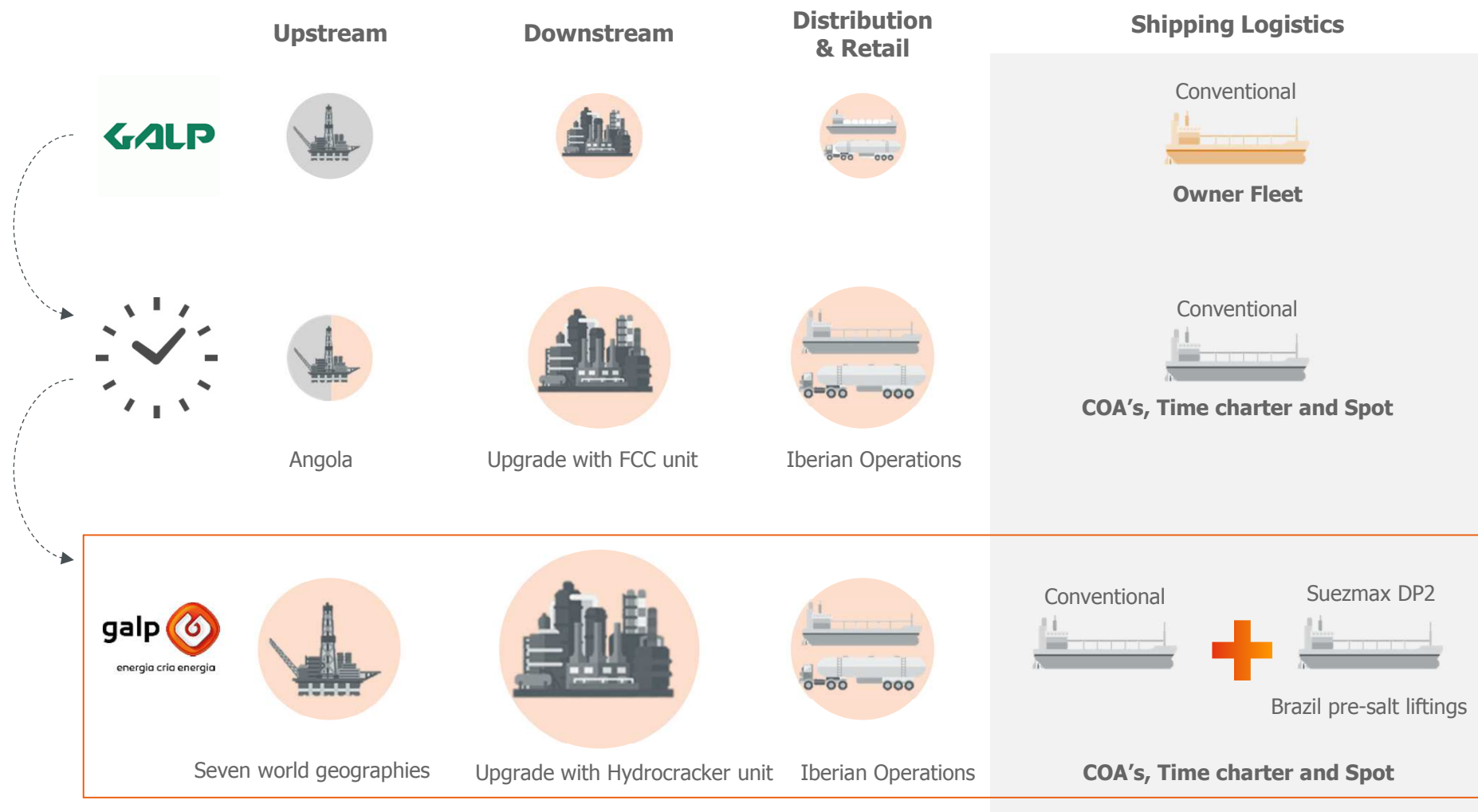
3. Lifting's Logistics

Cargo tracking

STS Operation

0. Galp evolution to upstream activities

Logistic component



0. Galp evolution to upstream activities

- For several years Galp had their upstream activity limited to Angola regarding on & offshore production, but the marketing of this oil did not require specific logistic.
- After Galp decision to investment on E&P, with particular good results on Brazil pre-salt, similar to the others players, our organization faced several new challenges, linked with **knowledge** and **technology**, which are the issues raised up by the new oil & gas discoveries that bring the industry to a new frontier.
- In this presentation we narrow our analyze to the logistic that support the placement of this new oils production on the markets.

1. Brazil pre-salt production and logistics context



The discoveries made in the Brazilian pre-salt are among the world's most important in the past decade. The pre-salt basins comprise large accumulations of excellent quality oils, and are divided into three main areas:

- Espírito Santo Basin
- Campos Basin
- Santos Basin

Galp has participation in **Santo Basin** where 5 Floating Production Storage Offloading (FPSO) are currently producing, 1 more is starting production and 6 more are expected till 2020.

Rio de Janeiro to Santos Basin FPSO's
around **160 nm**

Milha Nautica	CAR	CIT	CMA	CMB	CPY	CSA
CAR		24,8	7,4	20,5	9,9	4,5
CIT	24,8		21,1	5,3	18,1	22,7
CMA	7,4	21,1		16,1	13,0	3,0
CMB	20,5	5,3	16,1		3,3	17,9
CPY	9,9	18,1	13,0	3,3		5,9
CSA	4,5	22,7	3,0	17,9	5,9	



Cidade Angra dos Reis (CAR)



Cidade de Paraty (CPY)



Cidade Mangaratiba (CMB)



Cidade de Itaguaí (CIT)



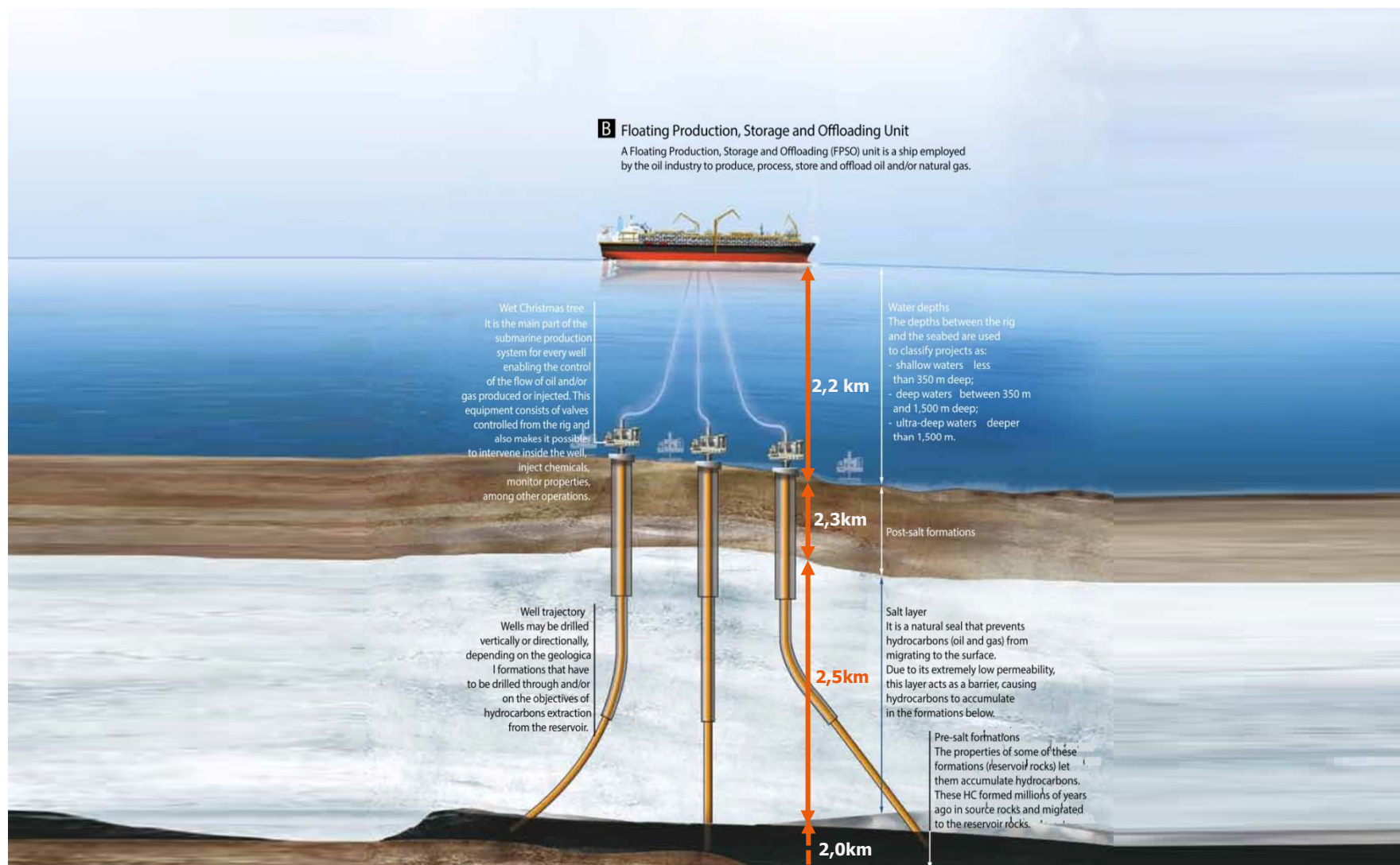
Cidade Maricá (CMA)



Cidade de Saquarema (CSA)
(on going)

1. Brazil pre-salt production and logistics context

Field Overview



2. Dynamic Position Vessels

Dynamic Position Vessel (DP) maintains its position in relation to the FPSO using sophisticated positioning systems and other sensors.

According with Classification Societies the class notation of this vessels are:

Class 1: ships are able to keep their position at least in automatic mode and joystick mode;

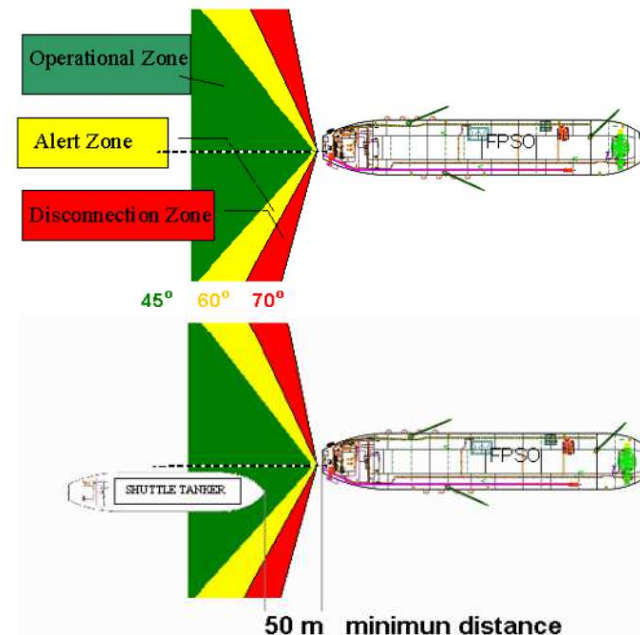
Class 2: requirements for class 1 plus redundancy in all active components - generators, distribution system, power management system (PMS), thruster system, DP and non-DP relevant auxiliary systems – with automatic transference between them.

Class 3: requirements for class 2 plus redundancy for static components and physical separation of DP relevant systems.

To lift oil cargos in Santos Basin DP 2 vessels are required to ensure safety operations in the fields area.





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2. DP vessels

Shipping market

Suezmax		 DP Vessel	 Conventional Vessel
Tech			
	PMS	>	<
	Position control	>	<
	Propulsion capacity	>	<
Availability		Taylor made	Commodity
Building Price		~100 M\$	~60 M\$

The pre-salt lifting's logistic is based on suezmax DP2 vessels.

At the moment Galp is supporting its Brazil operation with the Sallie Knutsen, as bridge vessel, till the delivery of two new buildings: **Anna Knutsen** and **Coimbra**.

2. DP2 vessels

Comparison with conventional vessels

DP2 oil tanker (minimal requirements)



**Azimuth thrusters
one ahead + one aft**



**Tunnel thrusters
one ahead + one aft
Bow loading system**



Propellers double system

Conventional oil Tanker



Single system of propeller



Single tunnel thruster

2. DPST vessels

Anna Knutsen - Building overview



Owner:

- Knot Shuttle Tankers
30 AS

Shipyard:

- Cosco (Zhoushan)
Shipyard – China,
Xangai

Delivery data (yard):

- 31-12-2016

Similar process with DP2 Coimbra

- **Owner:** Tsakos Energy Navigation
- **Shipyard:** Sungdong Shipbuilding & Marine Engineering – South Korea
- **Delivery data (yard):** 15-02-2017

3. Lifting's Logistics

Cargo Tracking



Operation	Average Duration (days)	Approximate Distance (nm)
Loading at FPSO	2,8	160 X 2*
Trip to La Paloma	3,9	940
STS Operation	5,4	-
Return Trip	3,1	940
Trip	15,2	2200

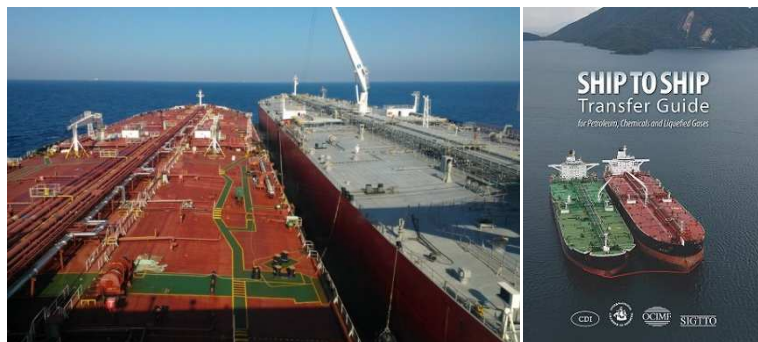
* Distance from Rio de Janeiro to Santos Basin

Since DP vessels are much more expensive than conventional ones, right now they are mainly used as shuttle tankers.

Nowadays for all producers at pre-salt Brazil, except Petrobras, the nearest point to transfer the cargo from the DP vessel to a conventional one is at La Paloma, Uruguay area, through a ship to ship transshipment, however the constraints that are preventing this kind of operations at Brazil are being revised.

3. Lifting's Logistics

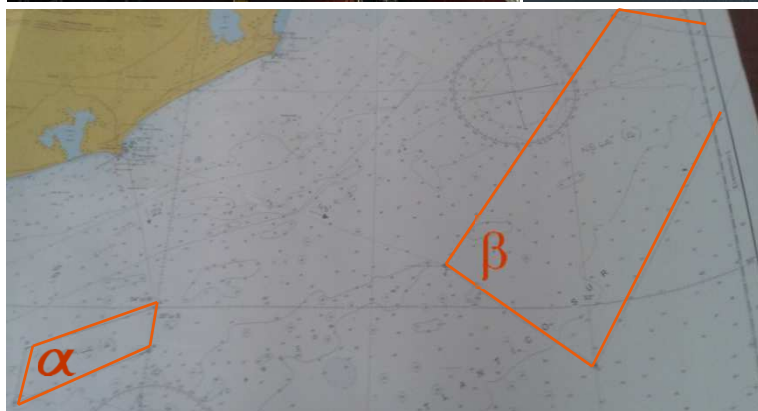
STS Operation



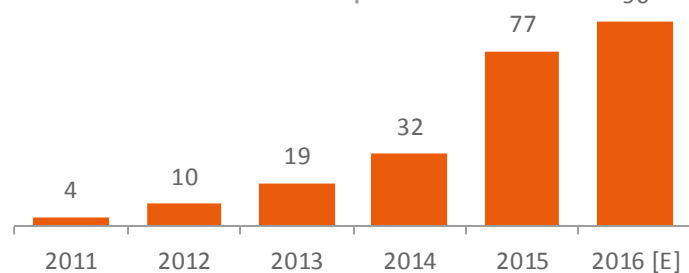
A STS operations is a ship to ship transfer performed offshore. The reference of good practice of this kind of operations is regulated by OCIMF at manual " Ship to Ship Transfer Guide for Petroleum, Chemicals and Liquefied Gas".

The STS involves oil transferences between Suezmax DP2 and conventional Suezmax or VLCC, at La Paloma - Uruguay, can be realized in two areas available:

- Alfa zone – 22 to 30 miles of URY coast
- Beta zone – 43 to 70 miles of URY coast



Uruguay – La Paloma
STS Operations



Operations are perform by a STS Operator who provides:

- Support vessel to transport equipment's and personnel (operators, supervisors and Uruguay authorities);
- Equipment's required;
- Qualified human resources (2 mooring masters + 2 assistant mooring + 1 seaman).

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Thank You