IBC's FPS 2009

24th Annual FPSO Conference

London

2-3 December 2009

The First FPSO in GoM: The Fourteen Year Journey

Despite FPSOs being widely used for many years elsewhere in the world it has been strangely different in GoM. From the first operator discussions with GoM regulators it will be fourteen years until the first FPSO starts production in GoM. This story tells of what went on to get to where we are today, and from that, what may now be ahead for FPSOs in this unusual marketplace.

Peter Lovie PE, PMP, FRINA

Houston

FPSO Most Widely Used Hull Type – but not in GoM!

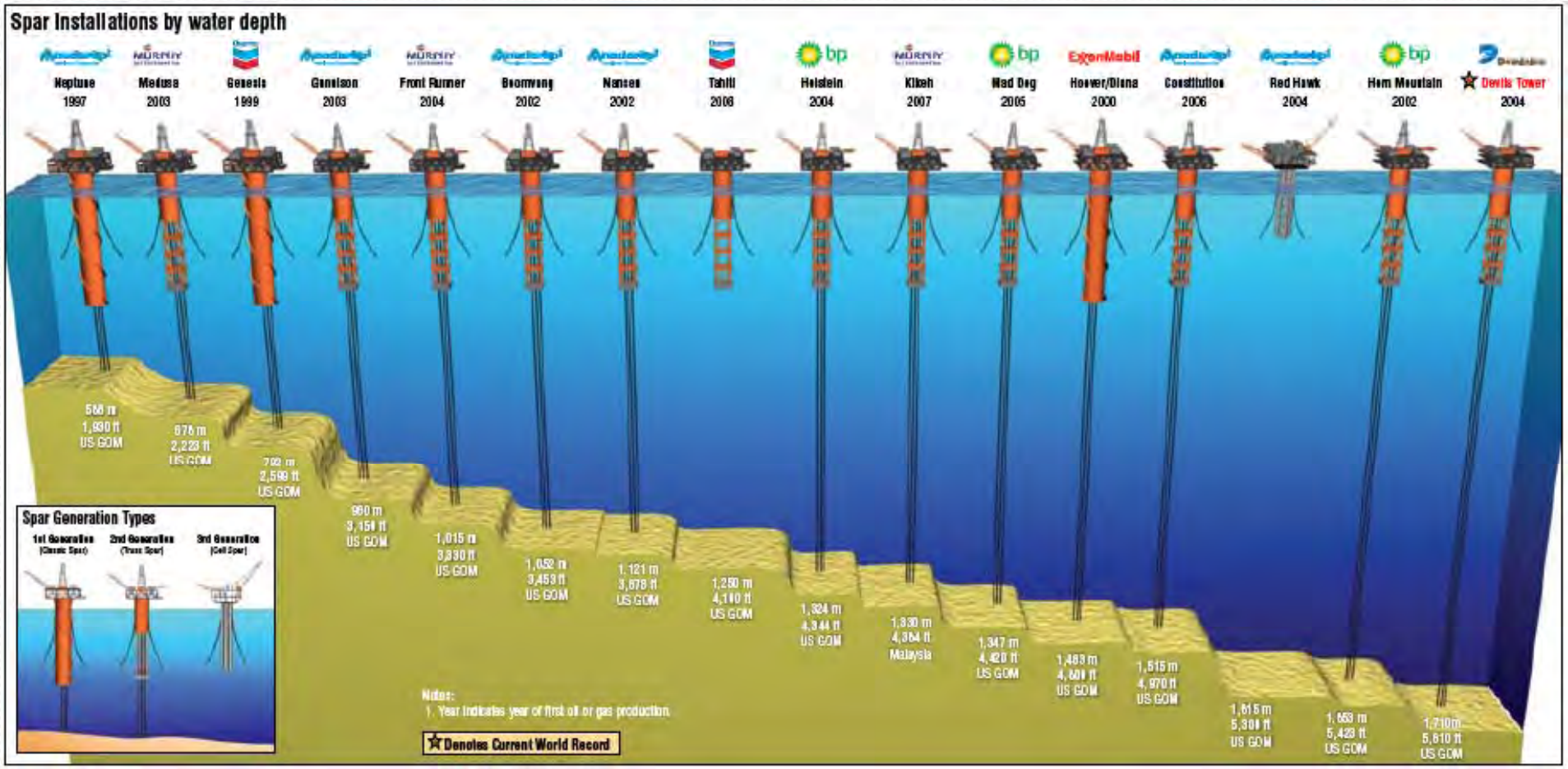
The world fleet in service at the end of 2008 comprised:

Floating Production Storage Offloading (FPSOs)	144	) Mostly tanker conversions, some newbuilds
Floating Storage Offloading (FSO) vessels	86	)
Semisubmersibles	42	) Generally field specific newbuilds
Tension Leg Platforms (TLPs)	22	)
Spars	16	)
Production Barges	6	Various
Floating Storage Re-liquefaction Units (FSRU)	2	Conversions

	318	

Source: International Maritime Associates

Contrast - All the World's Spars are in GoM



15 of the world's 22 TLPs are in GoM

6 production semis out of 42 are in GoM

Words of Wisdom!

There is nothing more difficult to take in hand,

More perilous to conduct,

Or more uncertain in its success,

Than to take the lead in the introduction of a new order of things.

Machiavelli, "The Prince", *Chapter 6, 1513*

Today's Themes - Understanding FPSOs for US GoM

1 Update on First FPSO in GoM;

2 The Fourteen Year Journey;

3 The Thought Processes that Led to Choice of First FPSO in GoM;

4 Influence of Export: Pipelines, Shuttle Tankers & Jones Act;

5 The New World of The Lower Tertiary;

6 What's Ahead for FPSOs in GoM - Conclusions.

1 Update on First FPSO in GoM

The FPSO at *Cascade/Chinook* is an Early Production System (EPS), to gain production experience in the Lower Tertiary;

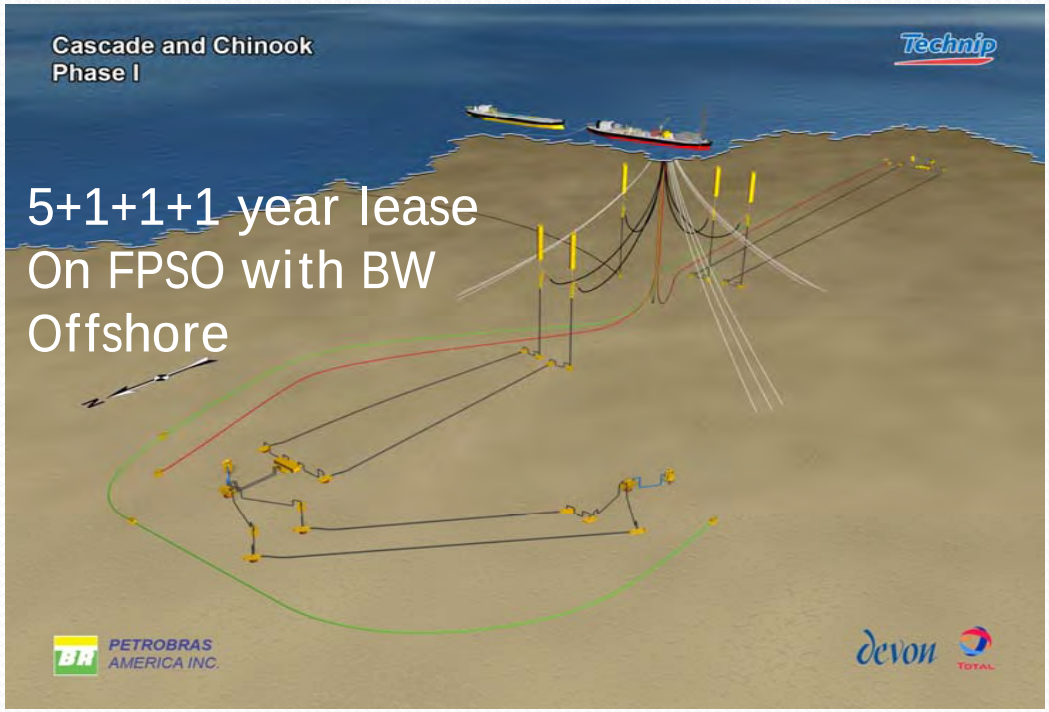
A full field development solution not yet decided, not necessarily an FPSO;

An FPSO record of 8,200 ft. water depth;

Coincident with this commitment is the first use of Jones Act shuttle tankers In GOM;

Cascade is 50:50 Petrobras:Devon,

Chinook is 2/3:1/3 Petrobras:Total



+ 600,000 bbl storage,
+ 80,000 bopd production,
+ Export: Shuttle tankers for oil, pipeline for associated gas,
+ 250 miles from New Orleans
+ Delivery: ex shipyard December 2009, first oil June 2010.

Design Conditions

Disconnection

FPSO and systems designed for 100 year winter storm;

Time to disconnect and sailing speed must be sufficient to move away from the path of a hurricane that may be born in the GoM;

Target is disconnect in <1 hr. at design wave height of 4.5 meters. Riser excursion limit may govern some disconnects.

Internal Turret

5 Free standing hybrid risers
- 4 Production
- 1 Gas Export line

4 Catenary umbilicals;

Production from two fields;

Tandem Offloading;

Gas export by pipeline;

2 The Fourteen Year Journey

Although FPSOs used widely elsewhere in the world, starting in the 1970s, they are new to the US GoM, even though GoM saw the first production offshore (1947, Kerr McGee) and GoM has been a consistent pioneer in offshore operations and technology.

1996 First approach by US operators to the regulators (MMS & USCG) concerning approval of FPSOs in GoM;

1997 Studies started by two operators on the use of an FPSO in GoM. Ultimately one development was non commercial and the other decided to use a semisubmersible as the development solution;

1998 Start of DeepStar funded work on an Environmental Impact Statement by MMS, with USCG support, for approval in principle to enable FPSOs to be in operators' development "toolbox";

2000 One operator considered FPSO and FSO solutions for a GoM complex but the regulatory position was not clear, competition was close and another system was chosen in mid 2001;

More History

2001 January Environmental Impact Statement (EIS) on FPSOs in GoM published;

December MMS issued the Record of Decision approving use of FPSOs and shuttle tankers in US waters;

2002 January Two shuttle tanker companies (American Shuttle Tankers and Seahorse Shuttling) offer services for future FPSO developments;

May Unocal's discovery at *Trident* has everyone excited at OTC about a future for FPSOs in GoM;

October SPE's FPSO Global Workshop – lot of interest and talk but no operator talking of any FPSO development. Rick Meyer of Shell says it's "Economics, economics, economics";

2003 Industry wonders if Shell's discovery at *Great White* will be the first FPSO;

Little operator interest in FPSOs for GoM, market for FPSOs looks dead;

Key Regulatory Policy Documents on FPSOs

OCS EIS/EA
MMS 2000-090

Proposed Use of Floating Production, Storage, and Offloading Systems On the Gulf of Mexico Outer Continental Shelf

Western and Central Planning Areas

Final Environmental Impact Statement

Author

Minerals Management Service
Gulf of Mexico OCS Region

Prepared under MMS Contract
1435-01-99-CT-30962

Cover

Turret-moored FPSO in a tandem offloading configuration with shuttle tanker (illustration courtesy of Advanced Production and Loading AS, 1999).

Published by

MMS U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Region

New Orleans
January 2001

_____ **Alternative B-4** (Approve the general concept of using FPSO's with a requirement for an attendant vessel.)

_____ **Alternative C** (No action at this time (insufficient information to make a decision)).

_____ **Other** _____

This decision, authorized by the signature below, and this Recommendation and Decision Document together establish the Agency's Record of Decision on the Environmental Impact Statement prepared on the Proposed Use of Floating Production, Storage, and Offloading Systems on the Gulf of Mexico Outer Continental Shelf, Western and Central Planning Areas. This programmatic decision is effective immediately. This decision does not constitute approval of any specific FPSO project. Submission, review, and approval of all required OCS plans, permit applications, and other submittals must be completed for every proposed FPSO system.

Dated: 13 December 2001

Carolita U. Kallaur
Associate Director for
Offshore Minerals Management

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The signed Record of Decision: Government says FPSOs OK in principle in GoM

January 2002: MMS Announces "Open for FPSO Business"

MMS News Releases

U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Region

FOR RELEASE: January 2, 2002

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MMS Reaches Decision about FPSO's in Gulf of Mexico

The Minerals Management Service (MMS) announced today its decision to accept applications for the use of floating production, storage and offloading systems (FPSO's) in the Gulf of Mexico. FPSO's, currently in use around the world, offer an option to develop areas in the Gulf that challenge or exceed current infrastructure or technologies and to help meet the nation's growing need for energy resources.

"MMS has completed a rigorous environmental and safety review of FPSO's for use in the deepwater areas of the Central and Western Gulf of Mexico. We examined the environmental risks and found them comparable to other types of production systems currently accepted for use in these deepwater areas. Therefore, we have concluded not to categorically exclude them from use as an offshore production system," said MMS's Acting Director Lucy Querques Denett. "While we will accept applications for the use of FPSO's, each will be considered on a case-by-case basis," according to Denett.

The decision is documented in the Record of Decision, which is the culmination of the programmatic environmental impact statement (EIS) process on the potential use of FPSO's. The EIS evaluated a permanently moored, double-hulled, ship-shaped FPSO with up to 1 million barrels of crude oil storage capability. FPSO's store crude oil in tanks located in the hull of the vessel and periodically offload the crude to shuttle tankers or ocean-going barges for transport to shore. Consideration of the proposed action covered a 10-year period, 2001 through 2010. Rapidly changing technologies make projections beyond that time frame very uncertain.

"While this programmatic level decision does not approve any specific FPSO site or project, it provides a foundation for considering a specific request by a company to use an FPSO for a project. When a specific project is applied for, MMS will still conduct a site-specific environmental assessment as well as a project-specific technical and operational review before a project is approved. A review for projects that fall within the base case can now be completed in less time, since an EIS has already been prepared," noted Denett.

Further technical and environmental evaluation will be required for specific FPSO proposals. The MMS will require submission and approval of a deepwater operations plan and a development operations and coordination document before any FPSO operation could occur. Any proposed FPSO operation that is not within the range of operations evaluated in the programmatic EIS will require a more extensive environmental review and National Environmental Policy Act documentation than would a proposed operation within the range addressed in the EIS.

FPSO operations have not previously been proposed or approved for use in the U.S. Gulf of Mexico; however, there are more than 70 FPSO's currently installed and in use around the world. "Today's programmatic decision provides an additional production system option for industry to consider as companies develop projects in the deepwater areas of the Gulf of Mexico," said Associate Director for Offshore Minerals Management Carolita Kallaur.

"Industry is encountering a variety of situations in the more than 100 discoveries of oil and gas in the deep waters of the Central and Western Gulf of Mexico," said Kallaur. "Sometimes these discoveries are small and sometimes they are distant from existing infrastructure. These types of discoveries represent potential use of FPSO's to produce oil and gas resources that would not be developed using current technology and infrastructure. This decision simply gives industry the opportunity to submit a plan to use an FPSO for a specific project, and gives MMS the ability to consider this type of development project."

Today's decision excludes the use of FPSO's in a 471-block area just off the continental shelf from Galveston to New Orleans, part of the U.S. Coast Guard lightering-prohibited areas. The MMS will not approve the use of FPSO's in this area for a period of two years while it continues discussions with the Coast Guard. The two-year period will allow a fuller discussion of what measures might be necessary to protect the environment should FPSO's be considered for use within the lightering-prohibited areas. The environmental assessment completed 10 years ago by the Coast Guard in support of the rulemaking that established the lightering-prohibited areas will also be reviewed for applicability during this two-year period. In addition, the MMS will continue to work with the Coast Guard to delineate jurisdictional issues on the basis of the memorandum of understanding between the two agencies.

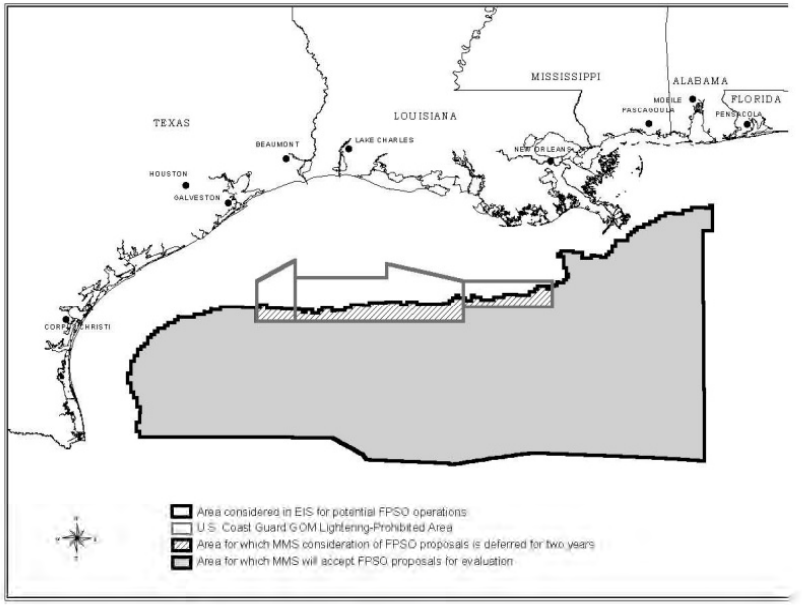
The MMS has worked closely with the Coast Guard to assess all aspects of FPSO's. The Coast Guard was an advisory agency in the preparation of the EIS and was heavily involved in the preparation of a comparative risk analysis (CRA) prepared under contract by Offshore Technology Research Center. The MMS-funded CRA was performed to compare the relative risks of an FPSO system with three other deepwater development systems: fixed platform production hub, a spar, and a tension leg platform. The overall intent of the CRA was to provide MMS context and perspective for FPSO risks, and to help in MMS decisions regarding the potential use of FPSO's in the Gulf. The CRA was also designed to help MMS understand the risk contributions of the various components (subsystems) and phases of operation.

Kallaur noted that, "MMS has a strong regulatory framework to evaluate the technical merits, including safety and environmental measures for an FPSO proposal. This was confirmed with the rigorous review that has occurred over the past two years."

The MMS gathered information from the international community to learn about FPSO systems during the early stages of the FPSO regulatory model development. Much of this effort was targeted at gaining a clear understanding of the historical operating experiences. This effort engaged representatives from all facets of offshore oil and gas development, including lease operators, contractors, consultants, classification societies, and regulatory agencies from numerous countries with FPSO developments. The domestic and international resources involved in this effort represent a significant segment of the world's deepwater experience and expertise in equipment design, construction, operation, and risk studies. The technical expertise and practical experience of the engineering personnel involved have allowed the successful development of a sound regulatory framework. Key components of this regulatory framework include the deepwater operations plan (NTL 2000-N06) and the development operations coordination document (30 CFR 250.204) with associated conservation reviews (NTL 2000-N05) and environmental reviews (NTL 2000-G21). Additional engineering reviews of the facility and safety systems will ensure the FPSO can operate safely. Once an FPSO system is installed, MMS inspectors will examine the facility on a routine basis.

For more information about FPSO's, including frequently asked questions, the EIS and the CRA, go to: http://www.gomr.mms.gov/homepg/offshore/fpsooffsp.html

MMS is the federal agency in the U.S. Department of the Interior that manages the nation's oil, natural gas, and other mineral resources on the outer continental shelf in federal offshore waters. The agency also collects, accounts for, and disburses mineral revenues from federal and Indian leases. These revenues totaled nearly $8 billion last year and more than $110 billion since the agency was created in 1962. Annually, nearly $1 billion from those revenues go into the Land and Water Conservation Fund for the acquisition and development of state and federal park and recreation lands.



-MMS-GOM-
MMS's Website Address: http://www.mms.gov
Return to News Releases

Note the expected areas for FPSOs and the lightering areas

2005 a Pivotal Year

2004 Hurricane *Ivan* causes widespread offshore damage on surface, many pipeline breaks;

MMS & USCG suggest storage tanker backup, the idea of FPSOs looks attractive;

2005 May OTC paper on FPSOs, GoM State of the Art, and industry consensus – FPSO with Permanent Mooring;

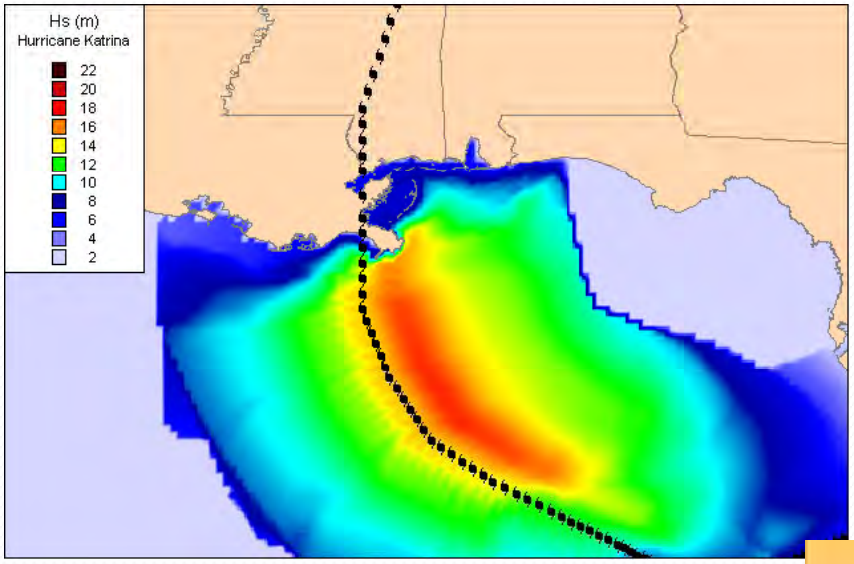
August Hurricane *Katrina*, onshore and offshore devastation, production interruptions. MODUs adrift;

October Hurricane *Rita*, production interruptions now worst ever, more facilities damage;

Industry recognizes the intolerable risk of MODUs adrift in a hurricane near a crude filled FPSO – in future must have disconnectable FPSOs;

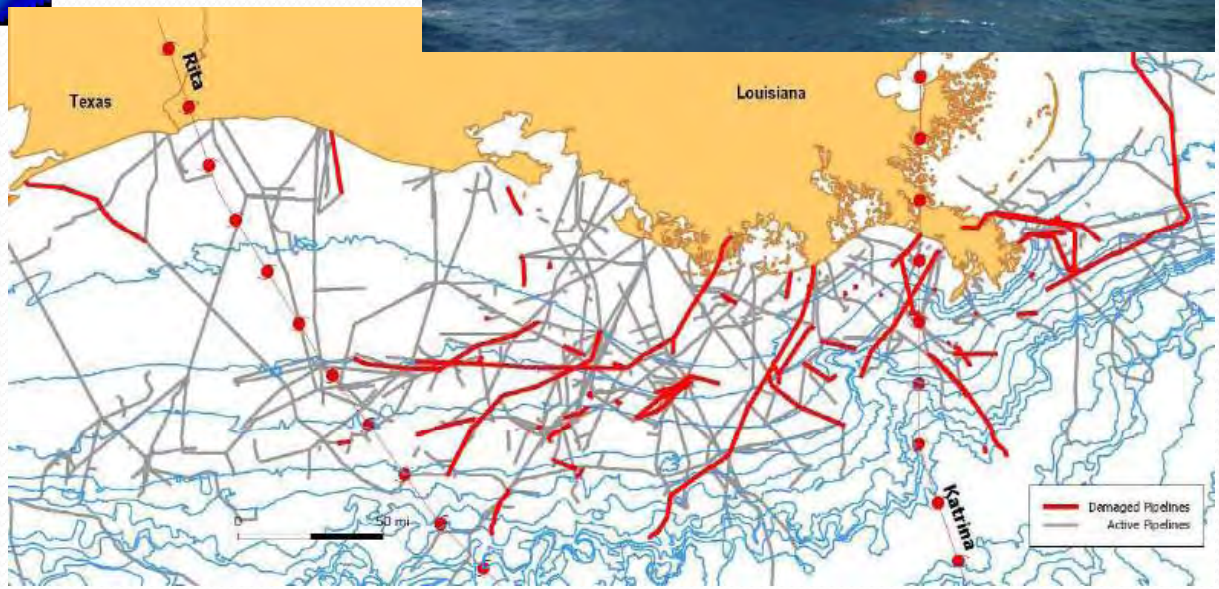
In the middle of all this, studies start on an FPSOs for EWT or EPS service for two ultra deepwater GoM developments;

2005 – Annus Horribilis, i.e. Mayhem



Map of Hs for Hurricane *Katrina*, with Water Depth Effects Included

Example of Topsides Damage Due to Wind



Hurricane Damage to GoM Pipeline Network
(Source: MMS)

Engineers get busy on diagnoses and design code revisions, to be presented at OTC 2007

Then Less Mayhem, Serious Progress

2006 Petrobras takes over operatorship of *Cascade/Chinook;*

Major find: BP's *Kaskida* in Keathley Canyon;

Petrobras and partners announce plans for first FPSO at C*ascade /Chinook*;

2007 March Bids were solicited for the third FPSO in GoM - and first on US side – for a minimum lease of five years.

May OTC: GoM design practices extensively revised, tightened;

August Stiff competition on contract for FPSO, signed with BW Offshore;

First shuttle tankers in GoM contracted – 2 from OSG;

2008 Hurricane *Ike* reminds industry – and Houston – that Mother Nature can be a mean mother!

2009 Another big find: BP's *Tiber* in Keathley Canyon.
FPSOs are considered seriously but only for a few prospects;

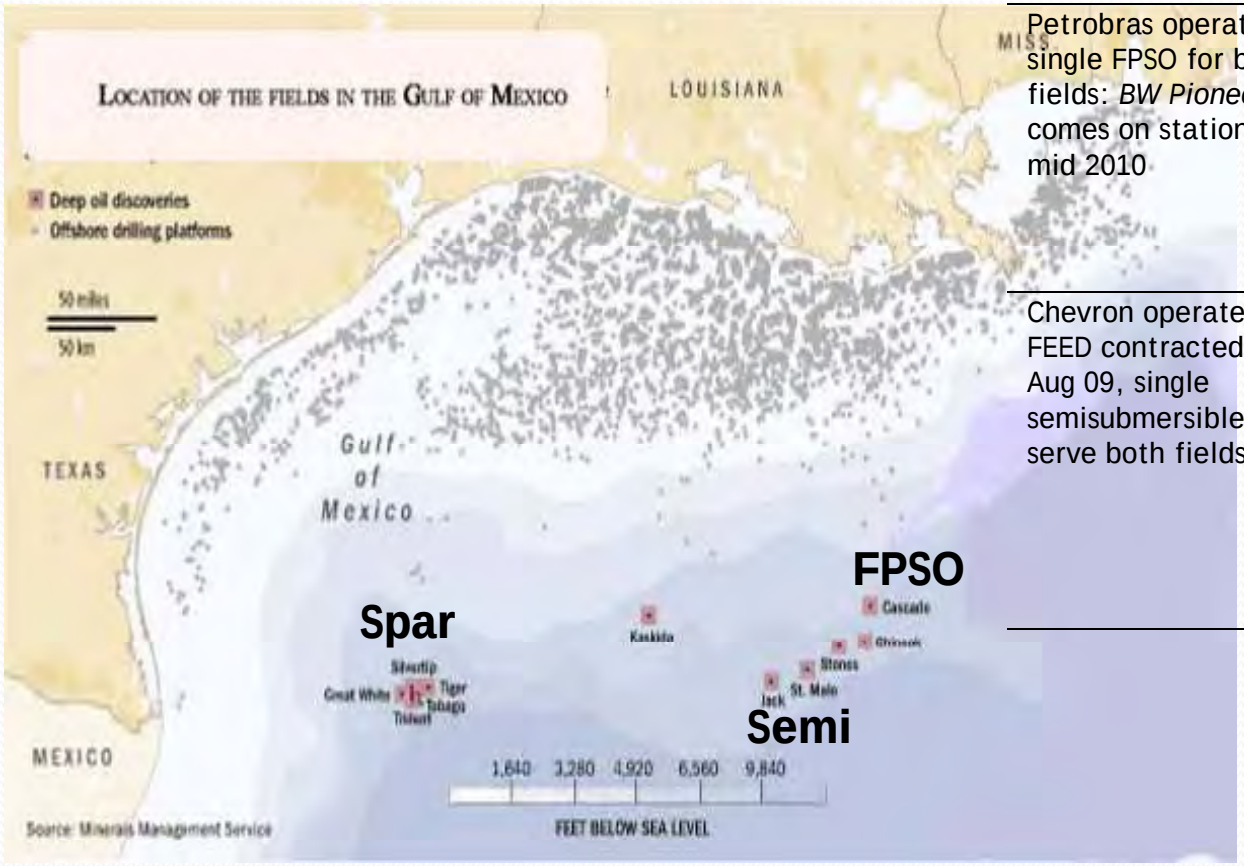
.

And then 2010: *BW Pioneer* to Enter Service, The First FPSO in US GoM

3 The Thought Processes that Led to Choice of First FPSO in GoM

During 2005-2006 Partners in two ultra deepwater developments faced serious unknowns:

- Producing from untested formations;
- Risks huge for a new development.



Key Ultra DeepWater Fields in US GoM

Operator & Development Status in 2009	Field Name	Partners
Petrobras operated: single FPSO for both fields: *BW Pioneer* comes on station mid 2010	*Cascade*	Devon 50%, Petrobras 50%
	Chinook	Petrobras 66.67%, Total 33.33%
Chevron operated, FEED contracted Aug 09, single semisubmersible to serve both fields	*Jack*	Chevron 50%, Devon 25%, StatoilHydro 25%
	St. Malo	Chevron 43.75%, Devon 22.5%, Petrobras 22.5%, StatoilHydro 6.25%, ENI 3.75%, ExxonMobil 1.25%

Different fields, not far apart;

Different operator philosophies.

Extended Well Test (EWT) or Early Production System (EPS)

a. EWT service: Produce 1-2 wells operation a contract minimum term of several months might be desirable for operator but contractor will traditionally look for say 3-4 years to amortize investment exposure;

b. For EPS service the operator might look for say 4-7 years service with say 4-6 wells, i.e. roughly comparable to the *BW Pioneer* contract at *Cascade/ Chinook* in GoM;

c. EWT and EPS tried before in North Sea and Brazil – successful for Petrobras;

d. Mobilizing to location without prior special and separate installation of moorings and risers is desirable;

e. Ability to offload to readily available export tankers, e.g. can an FPSO on DP handle the hawser loads of a conventional tanker?

Initially DP FPSOs were Considered

f. Two separate teams of operators and their partners wrestled with somewhat similar requirements for DP FPSOs for ultra deepwater GoM:-

Cascade/Chinook	Petrobras operator	Devon & Total partners
Jack St. Malo	Chevron operator	Devon, StatoilHydro, Petrobras, ENI partners

g. Principle of testing production at one well - or more that one well – at formations where there was no experience: estimates of production per well were still in a far too large range;

h. Multiple contractors contributed their ideas to the debate:-

Bluewater	Teekay
Sofec	SBM

i. They started in 2005, worked through 2006 and reported on their work in the April 2007 in partner meetings and at FPSO Research Forum;

j. By that time some patterns and conclusions had become clear;

k. And all this led to decisions being made on field development choices for GoM and helped educate the GoM regulators

Chevron and Petrobras with their Non Op Partners, Worked the Problem

l. Using typical shuttle tanker and FPSO characteristics for GoM, limits could be derived on how quickly disconnections should happen;

m. Stiffness of mooring and risers and how they compared to DP performance could be calculated;

n. Economics, operations and risks for single and multiple well operations were debated;

o. Similarly, economics and performance of DP and light moored FPSO station keeping could be compared;

p. DeepStar meetings were valuable. True collaboration of professionals was facilitated as all in a single location (Houston). Not a planned combined campaign but practically and informally multiple oil companies and contractors worked the problem.

q. Different nearby developments with same dilemma, and yet quite different operator styles – Chevron and Petrobras;

What Some of us Learned from the 2005-2007 Deliberations on an FPSO for GoM

r. Risk of loss of one well during disconnection - a possibility, no one wants – still an acceptable risk in EWT;

s. But the loss of multiple wells during a fast disconnection for loss of DP is not a risk anyone wants to take. Hence the risk of disconnection of multiple risers is usually a deal killer and DP on EPS is unacceptable;

t. Up front demonstration of regulatory acceptability needed for an unusual EWT or EPS operation;

u. Must try to contain scope creep, to adhere to project target economics, i.e. simple EWT stays that way!

v. Tough to avoid design by committee – classic conflict of "nice to have" versus practical commercial constraints;

w. Failure to stick to initial EWT or EPS scopes, risked construction of the dreaded oilfield morphadite!

4 Influence of Export: Pipelines, Shuttle Tankers & Jones Act

Facility Two main options:-

(a) Semisubmersible or Spar

Not disconnectable

Without storage

Illustration: *Independence Hub*, entered service 2008

Drilling: An option

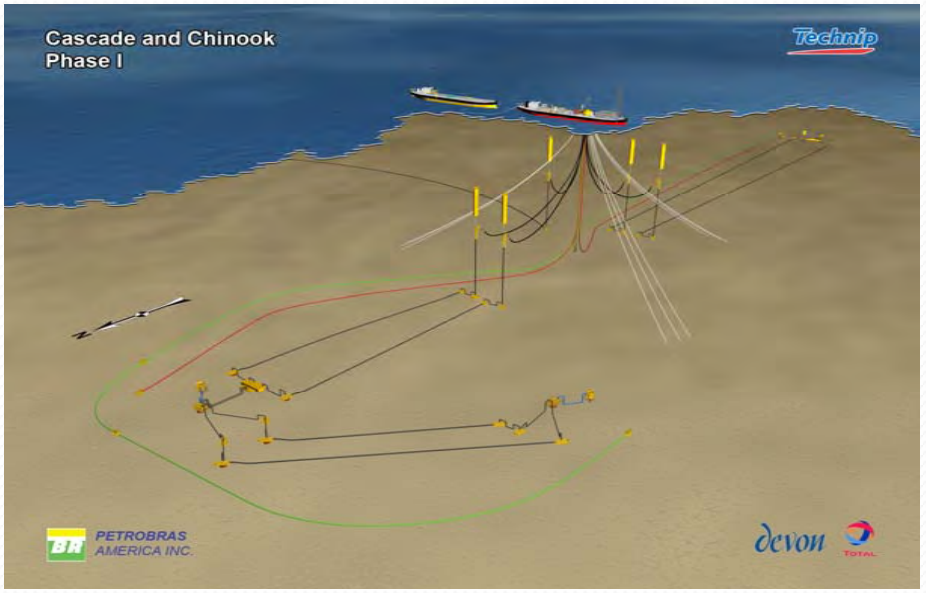
(b) FPSO

Disconnectable

With storage

Illustration: *Cascade /Chinook,* enters service 2010

Drilling: NOT an option



The Two Linked & Ongoing Debates: Facility and Transportation

Transportation Choices

Pipeline

OR

Shuttle Tanker OR FSO + Shuttle Tankers

OR Hiload + Conventional Tankers

But: Aggregation risks:

+ Lining up multiple developments for an area wide pipeline export system is tough, a risk;
+ Incrementally easier with tankers.

AND: Facility Choices

Semisubmersible or Spar

+ Drilling from the Platform
+ Mostly dry trees with a few subsea tiebacks
+ "Fixed" platform

OR

FPSO

+ No drilling from platform, use MODU(s)
+ Disconnectable
+ All subsea completions

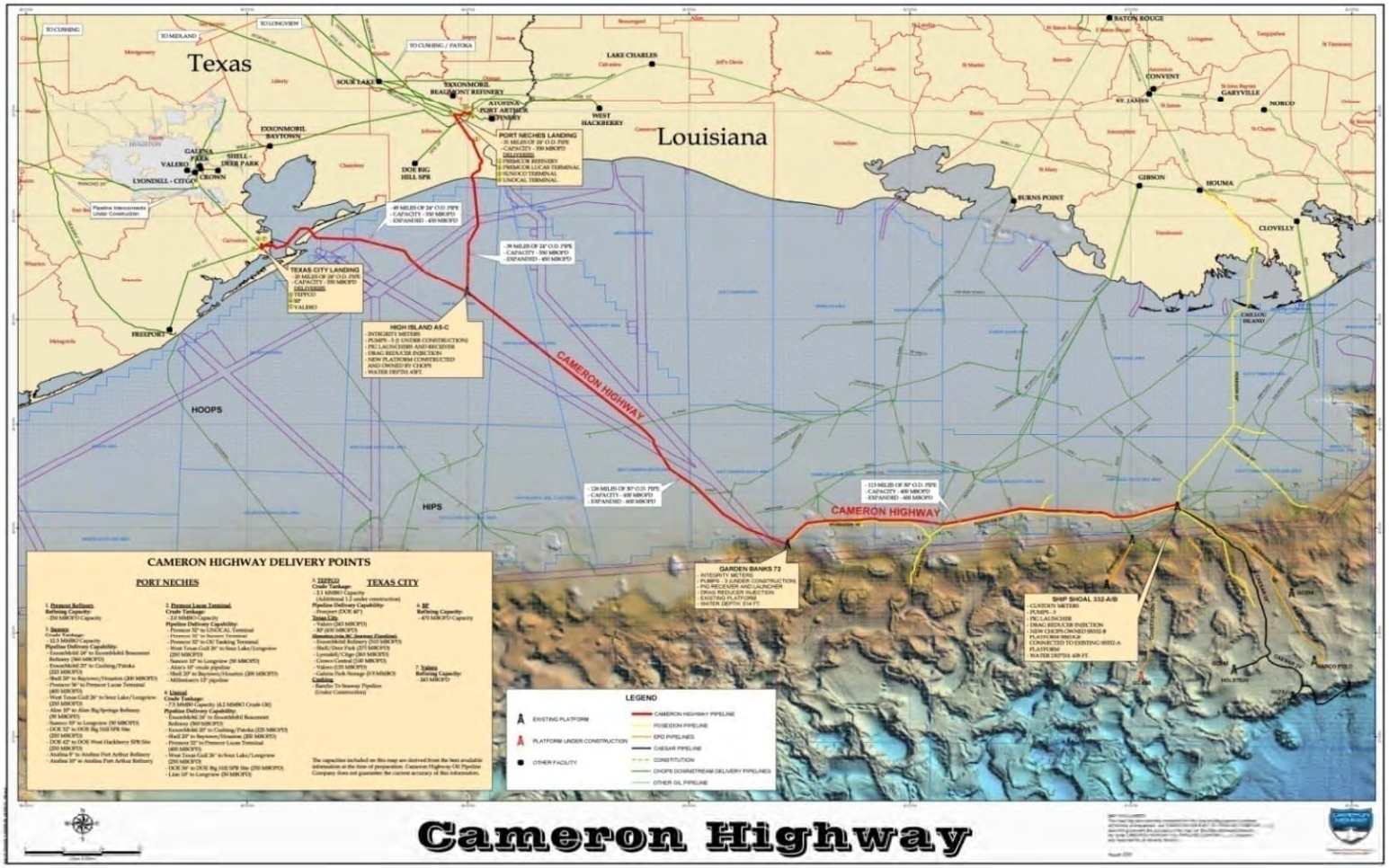
Probable FPSO Locations
Lower Tertiary Discoveries in WR & KC

Transportation: Existing pipelines come close to some discoveries; Shuttle tankers can easily reach all locations.

Shuttle Tankers Face Serious Pipeline Competition

Shipping lanes are already well travelled by lightering tankers.

While pipeline breaks may occur in the hurricane season, in an emergency shuttle tankers could deliver to East Coast refineries, e.g. Philadelphia.



Flat

Mountains of the moon!

The Merchant Marine Act of 1920 (The "Jones Act")
Does Apply to Shuttle Tankers, does not apply to FPSOs

Senator Wesley Livsey Jones (1863-1932), Republican from the state of Washington, author of the Jones Act, intended to protect his state's trade with Alaska. Jones served five terms in the House of Representatives and then 22 years in the U.S. Senate.

a. The Jones Act applies to ships engaged in coastwise trade: US law requires shuttle tankers to be Jones Act compliant: US built, 75+% US owned, US crewed, and OPA 90 compliant (double hull). In contrast a production platform is considered a US port, not subject to the Jones Act.

b. From the protectionist era of the 1920s, through wartime objectives, the Jones Act has evolved in 2009 to have a powerful alliance of lobbies, e.g. shipyards, ship owners, pipelines, truckers, railroads, unions.

c. There are attempts about every ten years to do away with the Jones Act – it is said to cost the country $10billion per year – but none has succeeded. Last attempt was in 2001 by Senator John McCain, trying to eliminate waste in the marine industry (Marad and Jones Act).

Special Requirements for Shuttle Tankers in GoM

US law requires shuttle tankers to be Jones Act compliant:
- US built, 75+% US owned,
- US crewed,

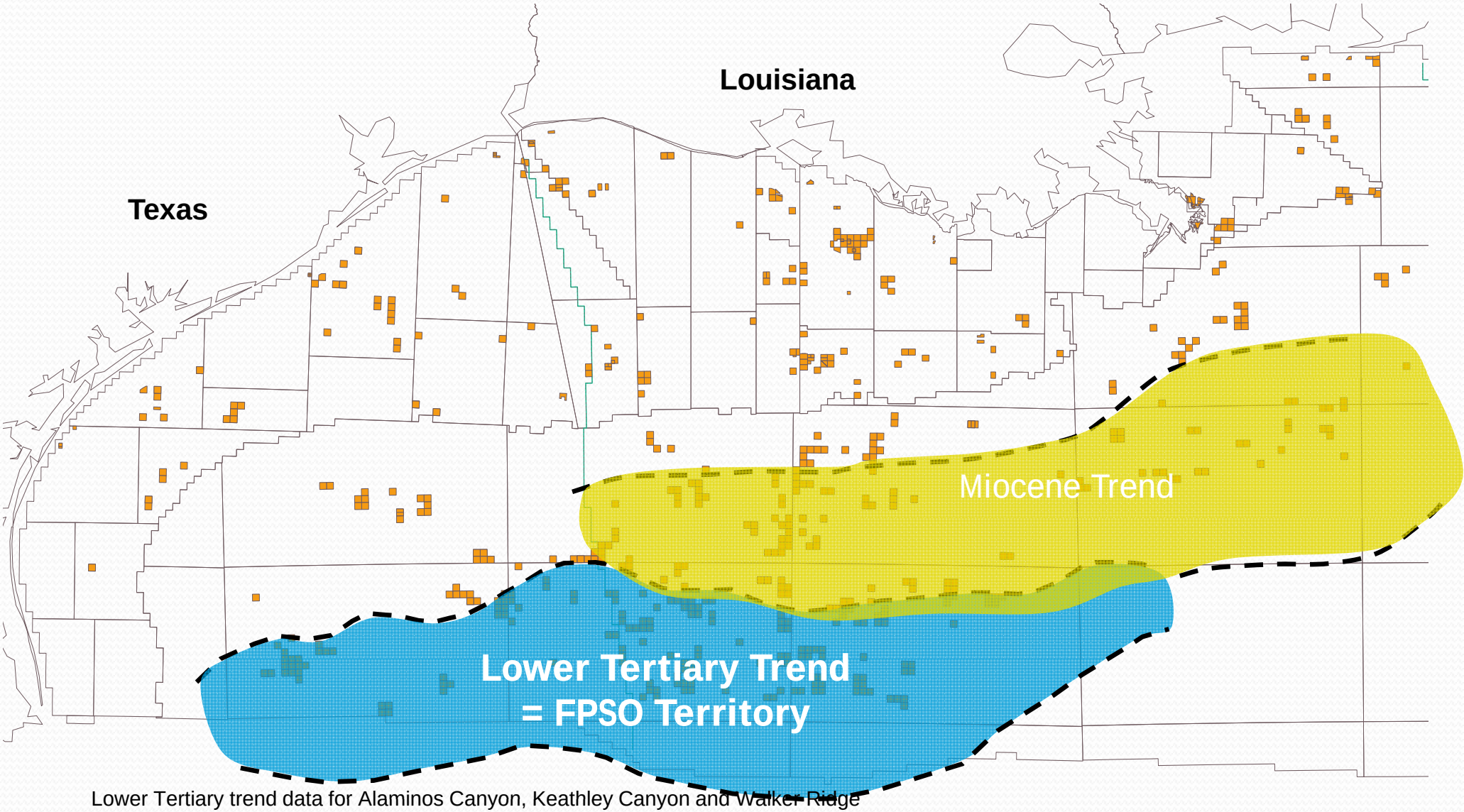
and OPA 90 compliant (double hull);

Port drafts dictate maximum 40 ft. draft, hence maximum of about 550,000 bbl capacity;

Current limited market for shuttle tanker service demands backup trade, hence use of tankers that can work in the products trade, i.e. about 330,000 bbl capacity.

Additional features:
- Bow Loading System,
- Added maneuverability for maximum safety: CPP / Thrusters / DP2

5 The New World of the Lower Tertiary



Lower Tertiary trend data for Alaminos Canyon, Keathley Canyon and Walker Ridge
Miocene trend data for East Breaks, Garden Banks, Green Canyon, Atwater Valley, Mississippi Canyon

Remote Deep Wells Stretch Drillers, And Slows Field Developments

Extreme depths: 30,000+ ft. RKB not unusual, e.g. BP's *Tiber* discovery in Keathley Canyon, announced September 2009 is a 35,000+ ft. well!

Extreme pressures in reservoirs, e.g. 18-22,000 psi;

Mountainous seabed;

Reservoir rocks with little production history;

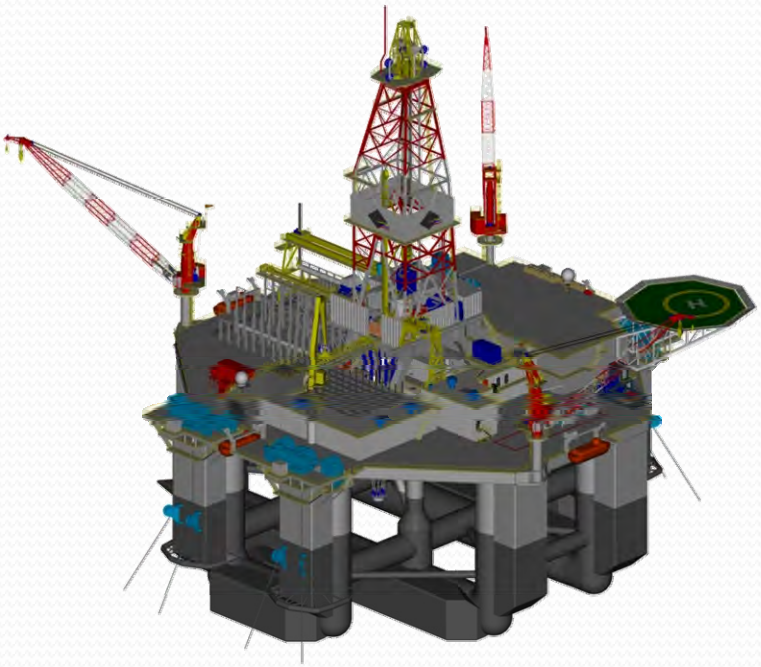
MODU availability limited, long deliveries;

Experienced people in operator, drilling contractor and vendor organizations are more critical than ever for wells like these;

But these people are in short supply.

Drilling Economics Affect Choice of Development Solution: Hence FPSO or Not

Drilling and completion for one well may take six (6) to nine (9) months in the Lower Tertiary and an investment in the region of $250+ million per producing well;



Well costs dramatically high for the Lower Tertiary: some of it day rates, lot to do with well characteristics;

Facility choices more driven by drilling than 5-10 years ago: well CAPEX about 2/3 now of field development, instead of 1/3 before. Major choice is to drill from platform , OR from MODU(s) with subsea completions;

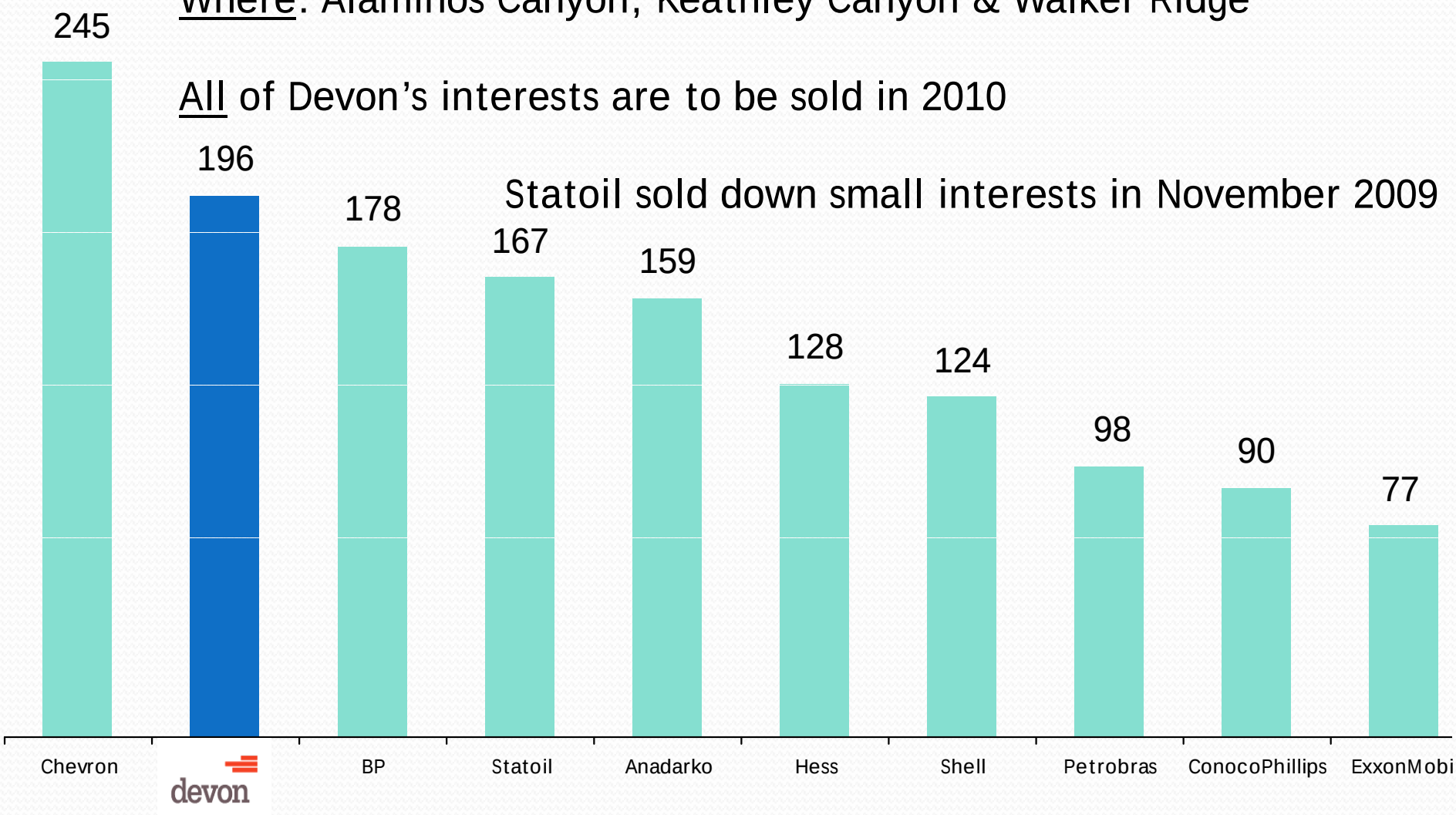
Developments may take several years to drill up, hence production ramp up may be slower.

Lower Tertiary Block Ownership
Not a traditional line up for a frontier!

Where: Alaminos Canyon, Keathley Canyon & Walker Ridge

All of Devon's interests are to be sold in 2010

Statoil sold down small interests in November 2009



Source: Devon, OWL Database ©1991-2007, Lexco Data Systems, Inc. – August 2008

6 What's Ahead for FPSOs in GoM?

Disconnectable. Run before storms like in Far East. Also benefit of easier to modify, expand or maintain;

Long field life, e.g. Lower Tertiary fields may produce for as long as 30-50 years, i.e. about double past field lives. Important effect on facility design and on exposure to extreme storm events;

New more remote areas of Lower Tertiary turning out to be very prospective (potential for high rates). Examples: BP's discoveries at *Kaskida* in 2006 and *Tiber* in 2009;

Long way out, over mountainous seabeds, pipeline routes much longer, more circuitous and more expensive than hitherto (export economics may favor FPSOs);

Pressure to cut the cycle time to improve economics is countered by risks of reservoirs performing differently from expectations (timing on a firm FPSO contract less clear than before);

A Sound Business Case Can Exist for FPSO and Shuttle Tankers in GoM

i. Export matters: Shuttle tanker export may indeed offer an economic benefit over pipelines, even for large fields in the remote ultra deepwater of GoM (e.g. Lower Tertiary): could be in the order of a $Billion saving over field life;

ii. Downside risks: In the event of a field being a bust, FPSO and tankers being re-deployable mitigate risks on export service commitments. Pipelines are not good at being reeled up and redeployed!

iii. Aggregation: Large enough volumes enable an economic pipeline system - more difficult in the Lower Tertiary than closer to shore. A pipeline is economically difficult for EPS - risks and economics favor tankers;

iv. Flexibility: Tankers can easily change destinations for maximum margin from production - and in event of hurricane damage can be re-directed to alternate delivery points.

v. Producibility: Can one reliably depend in remote field developments producing from unproven formations?

Key Messages from the Lower Tertiary

i. Technical and financial risks for field developments are very high. BP's record *Tiber* discovery in Keathley Canyon was a 35,000+ ft. well. Simultaneous drilling of an appraisal well at *Kaskida* nearby was almost as deep and $300+million;

ii. Two thirds of field development investment being in drilling changes drivers for development strategy;

iii. New field development flexibility desired to mitigate these risks, e.g. can an FPSO enable an earlier and lower risk start, yet not degrade economics?

iv. Arriving at a sanctionable development solution is taking longer than often expected, e.g. *Jack St. Malo*, *Kaskida;*

v. Producibility risks can demand dry trees and rule out FPSOs;

vi. Export economics are more important in these remote locations;

vii. Not much chance of FPSOs in GoM other than in deep remote waters of Lower Tertiary.

Conclusions . . . .

a. There are links in US GoM between reservoir conditions, well established extensive pipeline infrastructure and the choice of development solutions other than FPSOs;

b. Fields that are particularly remote, with uncertain reservoir conditions, might favor another EPS such as *BW Pioneer;*

c. Operator risk and field development philosophy IS a factor, e.g. compare Chevron and Petrobras: *Jack St. Malo* and *Cascade/Chinook*;

d. Some field development solutions in US GoM have got accepted more quickly than FPSOs, e.g. Spars and TLPs. Curiously these two have been slow to catch on elsewhere in the world;

e. Despite the ebb and flow of business since the 1940s, GoM based oil companies do remain a key influence in the worldwide market, and do seriously contemplate FPSOs for outside GoM waters;

f. FPSOs are now considered more than ever for GoM, but another FPSO after *BW Pioneer* is not a sure thing, far less an FPSO for full field development.

Thank you

Questions?

For more on the documents, presentations & history leading to the acceptance of FPSOs in GoM this link can help:
www.lovie.org/fpso.html

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