

# A Step Change for Tullow and Ghana

1 October 2008





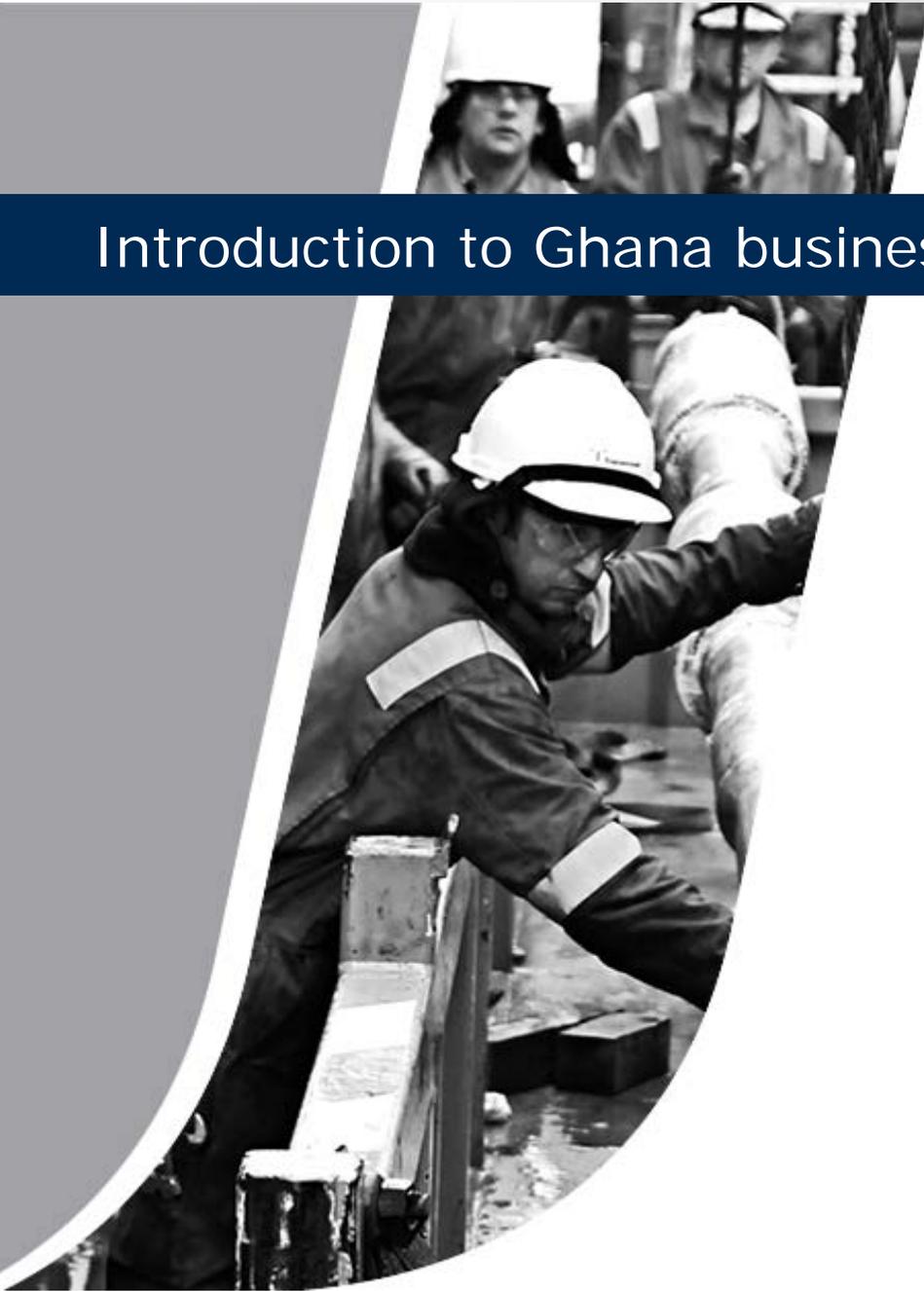
## A key asset in Tullow's portfolio

- Opportunity to substantially increase the Group's production and reserves base
- Developing offshore deepwater expertise as the operator of a world-class field
- Platform for future growth

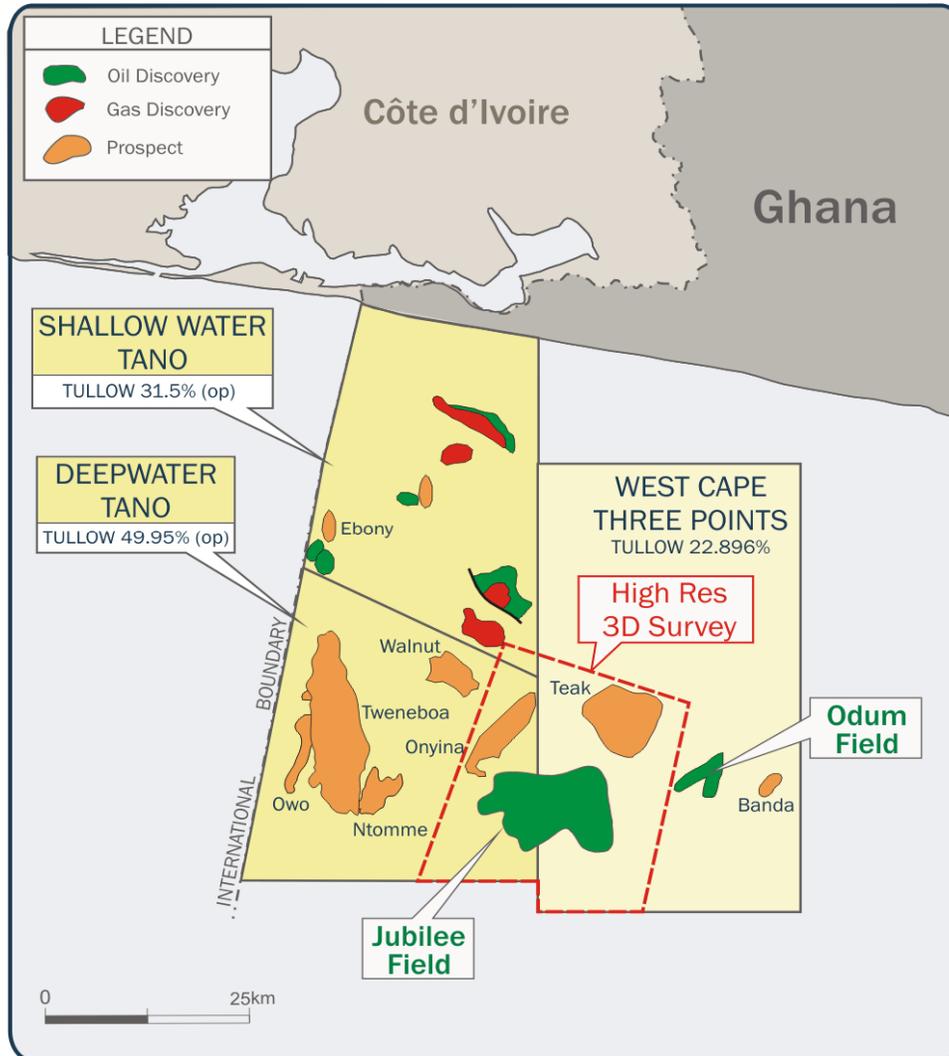
## Exceptional opportunity for Ghana

- Potential to become the next West African oil industry hub
- Generate substantial revenues and contribute to the development of Ghana
- Continue the impressive economic growth and political reform in the country

## Introduction to Ghana business – Andrew Fisher



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## Enviably position in Ghana

- Benefitting from strong regional knowledge
  - Licences signed 2006
  - Jubilee Field discovery 2007
  - Tullow selected as unit Operator 2008
- Excellent joint venture support
- Long-term business and CSR strategy

## Outstanding progress being made

- Fast-track exploration and development
- Organisational preparation well advanced
- Gas commercialisation planning ongoing
- EHS systems continuously improved
- Long term CSR commitment
- Upside exploration opportunities identified

- Leverage partner capabilities
  - Tullow long-term player in the region
  - Kosmos exploration experience in West Africa
  - Anadarko deepwater development track record
  - GNPC supportive participant
  - Valuable local minority partners
- Partnership principally aligned on exploration, appraisal and development strategy
- Tullow is the selected unit operator
- Major appraisal and exploration upside to be tested over 2008/9
- Tullow committed for the long term



**E.O. Group**

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# Effective development process established

- Jubilee commercial reserves established; phased development under way
- Exceptional reservoirs, likely to offer continued reserves growth and expansion opportunities
- Proven FPSO and sub-sea technology standard for West Africa deepwater developments
- Significant rig capacity secured for short-medium term need
- Commercialisation of gas reserves well advanced
- Logistics and supply-chain challenges being managed, planning for long-term requirements ongoing



# Building the Ghana organisation

- Rapidly building deepwater operated development capability – key long-term business benefit
- Integrated project team utilises partner strengths
- Operating organisation growing rapidly
  - over 100 people already employed/contracted
  - Anticipate staffing of over 200
- Strong emphasis on quality of people with relevant experience
- Tullow culture and world-class project is attractive to high calibre professionals, despite tight market
- Recruitment, training, development of Ghanaian staff a top priority



## Close relations with National stakeholders

- GNPC fully integrated into the executive team managing the Jubilee development
- Regular coordination with central and regional government
- Consultations with local communities

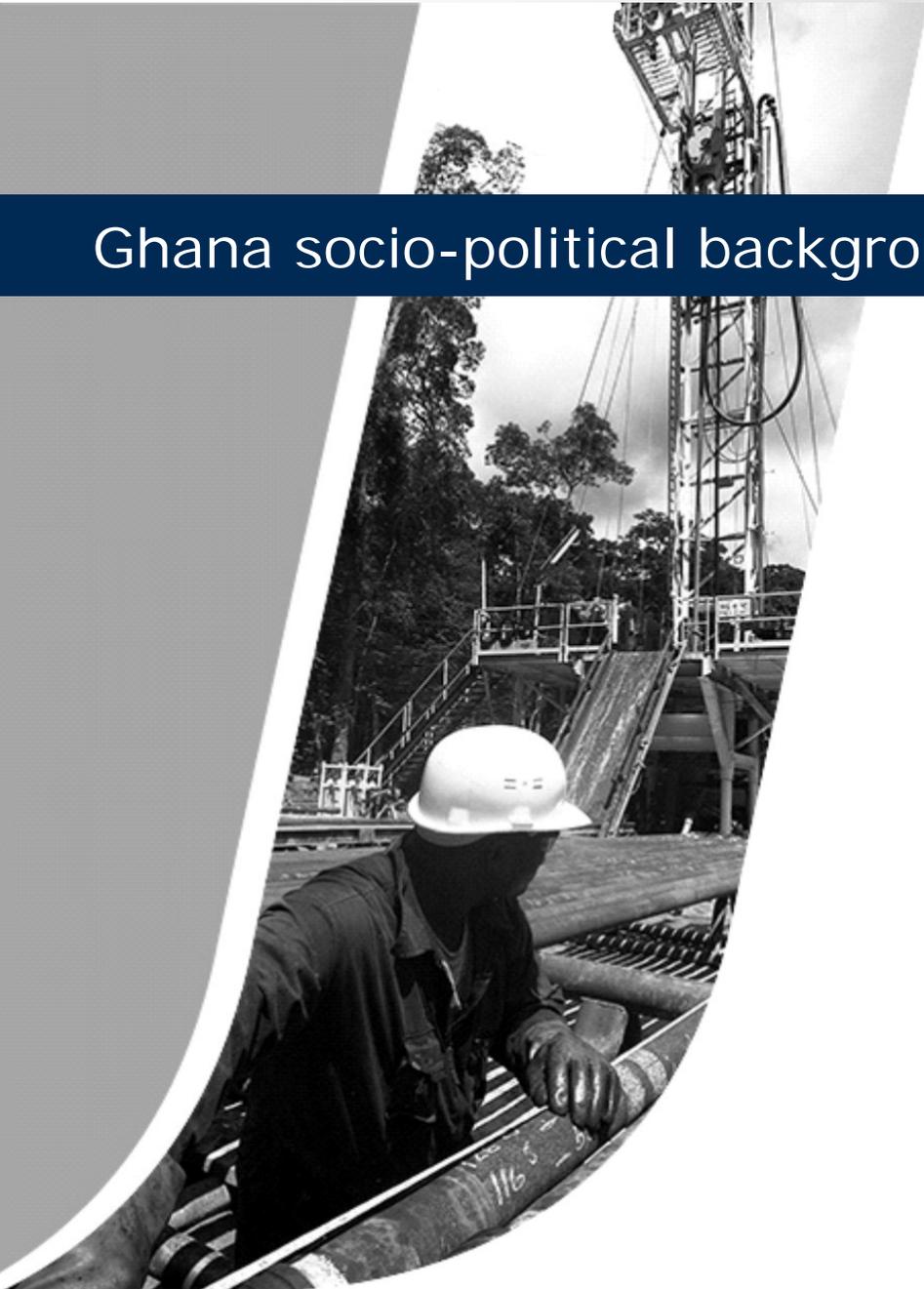
## Oil industry brings many benefits

- Oil revenues
- Employment of Ghanaian nationals
- Expanded skill base
- Development of regulatory environment
- Establish sound environmental standards
- Emergency response – air/sea rescue
- Expansion of logistics and port infrastructure

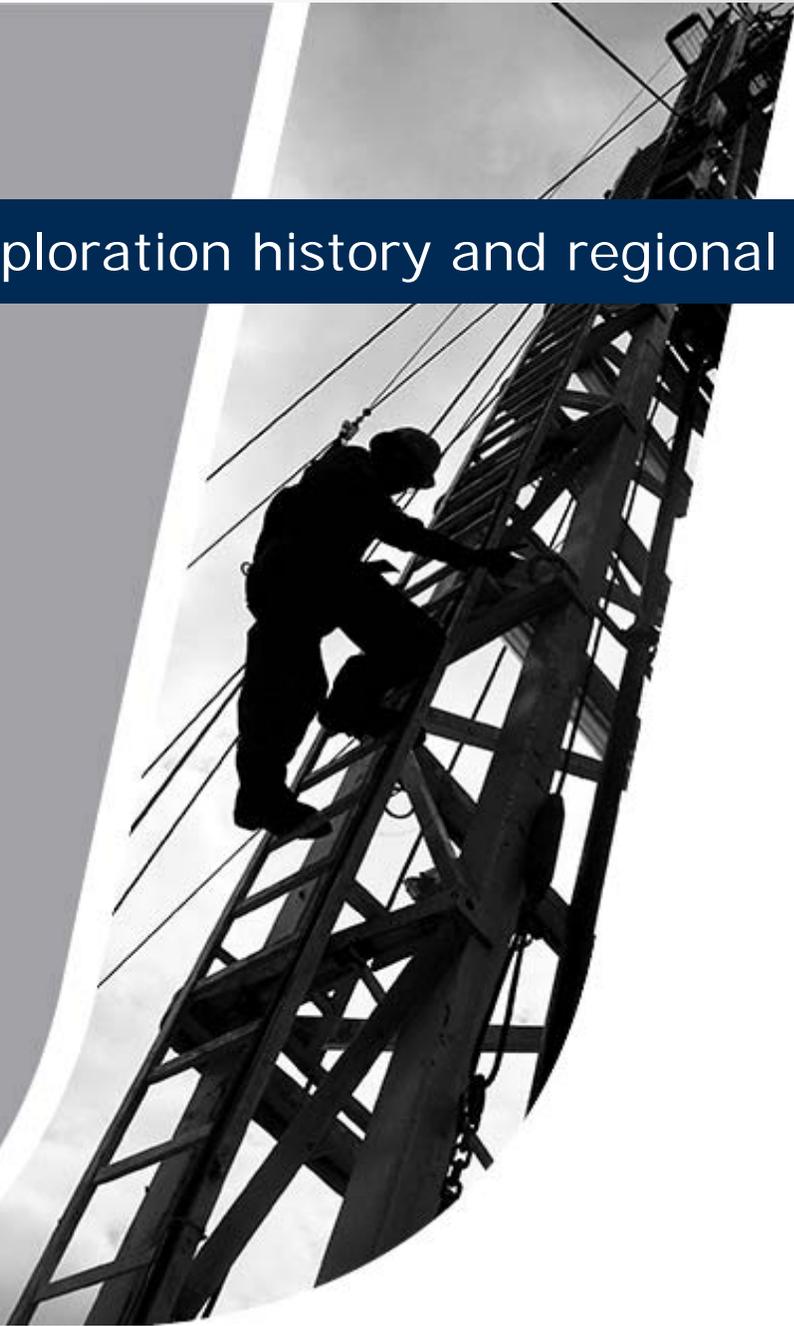


## Ghana socio-political background – Sam Mensah

**See separate presentation**



## Exploration history and regional geology – Robin Sutherland

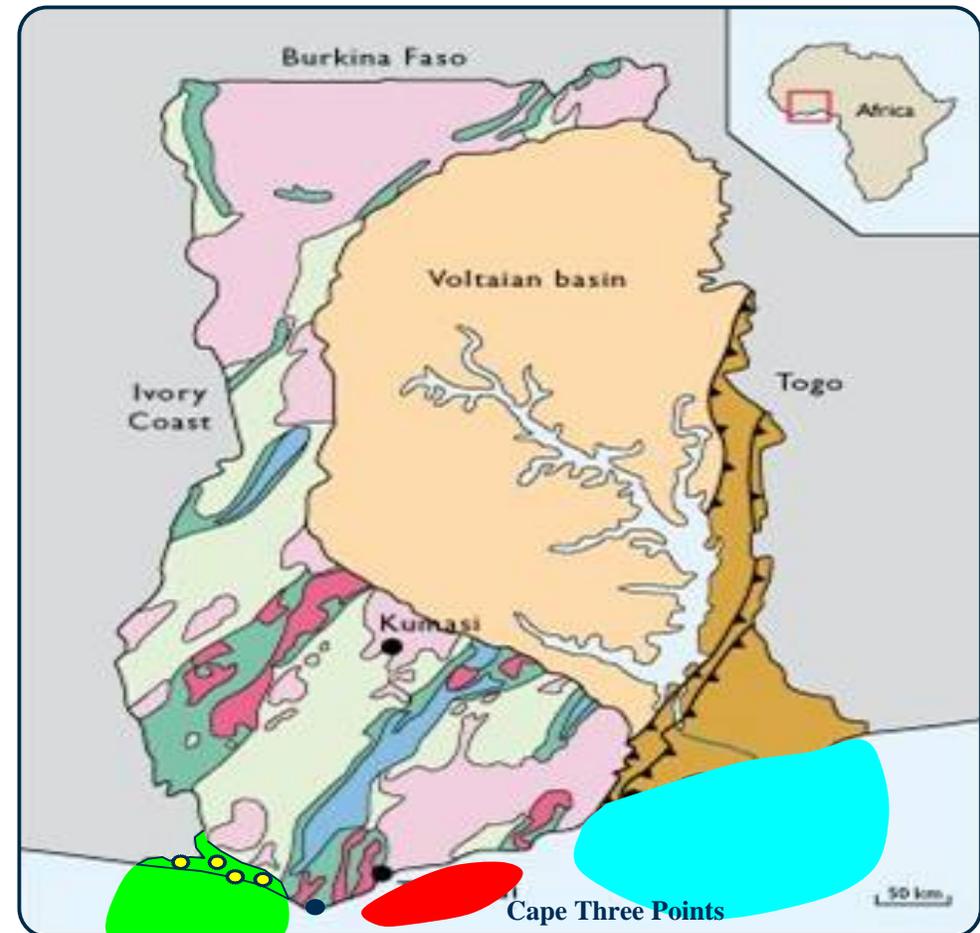


# Jubilee field: A century of preparation

- Ghana, the Gold Coast, is famous for its gold but oil exploration dates back to the end of the 19<sup>th</sup> Century
- Ghana has two Cretaceous sedimentary basins (Tano and Keta) and two Paleozoic Basins (Saltpond and Voltaian) which have all been explored to some extent

Basin	Age of Sediments	Wells Drilled to date
Tano	Cretaceous	62 includes appraisal wells and shallow onshore boreholes
Keta	Cretaceous	10
Saltpond	Paleozoics	20 includes appraisal wells
Voltaian	Paleozoics	1

Geological Map of Ghana



- Tano Basin
- Saltpond Basin
- Oil Seep
- Keta Basin

## Limited success through early frontier exploration – oil shows

- 1896 - 1903 West African Oil and Fuel Co. Ltd
- 1909 - 1913 Societe Francaise de Petrole, now Elf/Total
- 1923 – 1925 African and Eastern Trading Corp
- 1956 – 1957 Gulf Oil Co

## 1957 Independence from UK – then first oil and gas field discoveries

- 1966 – 1967 Government of Ghana contracted Romanian exploration team
- 1970 - Signal Oil discovered Saltpond Field offshore within Devonian.
  - Estimated oil in place 45 million barrels, on stream 1978
- 1970 - Volta Petroleum find oil in Volta Tano-1X, in first offshore Tano well
- 1973 - Zapata discovers first offshore gas with Cape Three Points-1X
- 1978 -1980 Phillips discover oil & gas in North and South Tano
- 1985 - PetroCanada International Assistance Corp (PCIAC)

## GNPC established as statutory body with E&P responsibilities in 1985

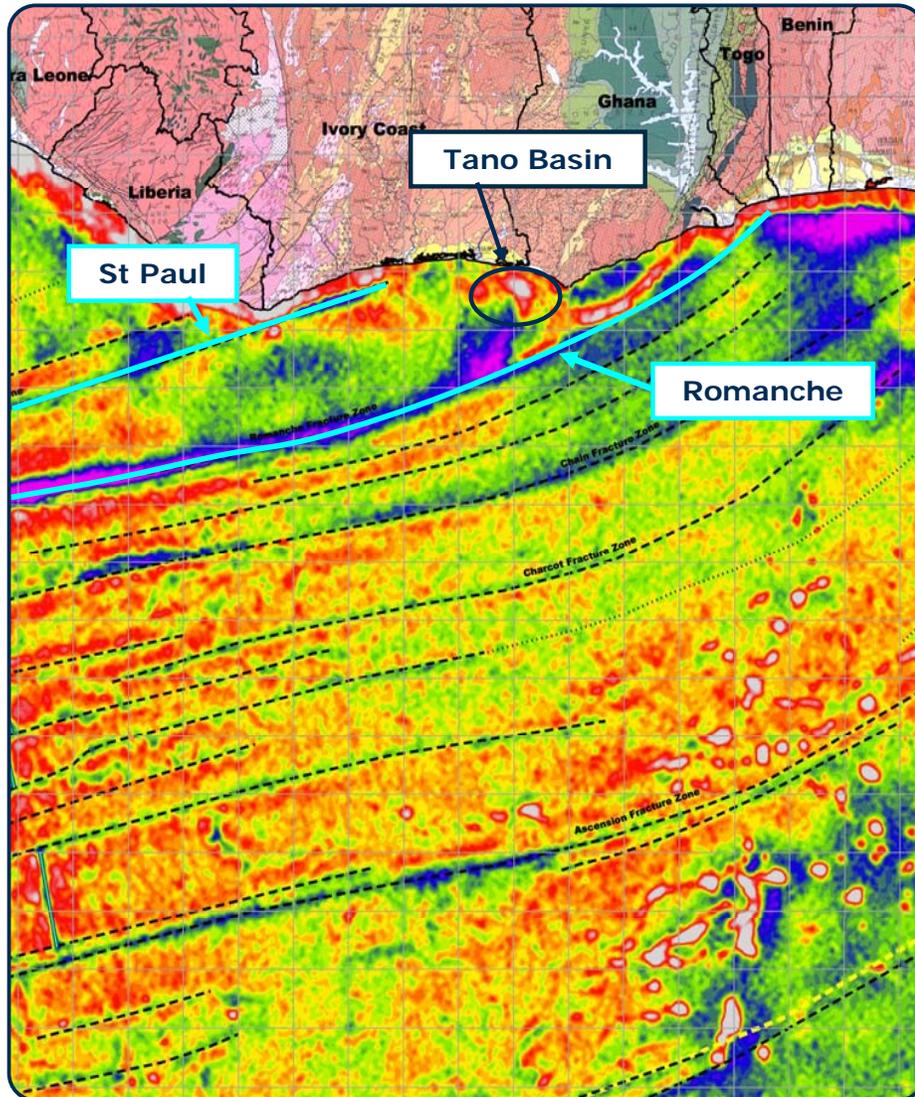
- 1985 - Law establishes legal and fiscal framework for E&P activities
- 1986 - Diamond Shamrock drill onshore
- 1987 - Government of Japan through JICA and JNOC acquire seismic over Saltpond
- 1988 -1989 Arco TP-1 well is first to test a stratigraphic play. Encounters oil shows in an Upper Cretaceous turbidites
- 1989 - 1994 GNPC acquires 3D seismic over South Tano discovery
  - appraisal wells on South Tano drilled, one drillship and three rigs purchased
- 1990 - Amoco drill offshore
- 1999 - Hunt Oil drilled West Cape Three Points-2 well near South Dixcove-1X.
  - Encountered 14ft of light oil in Upper Cretaceous
- 2002 - Dana encounters light oil down-dip of TP-1 in Upper Cretaceous reservoir

## Exploration focus shifts towards deepwater stratigraphic traps

- 2004 - Kosmos Energy acquired Deep Water Cape Three Points block
- 2006 Tullow Oil signed package of Deep and Shallow Water Tano blocks:
  - Shallow Water Tano low materiality - farmed down to 31.5%
  - Deepwater Tano signed 49.95% with major partners Kosmos & Anadarko
  - Pre-agreed trade with Kosmos and Anadarko for 22.9% in West Cape Three Points
- 2007 - Mahogany-1 discovers Jubilee Oil Field
- 2007 - Hyedua-1 follow-up confirms Jubilee as a world class sweet oil field
- Major breakthrough after a 'Century of Preparation'!

## Regional geology





## Tano Basin, West African Transform Margin

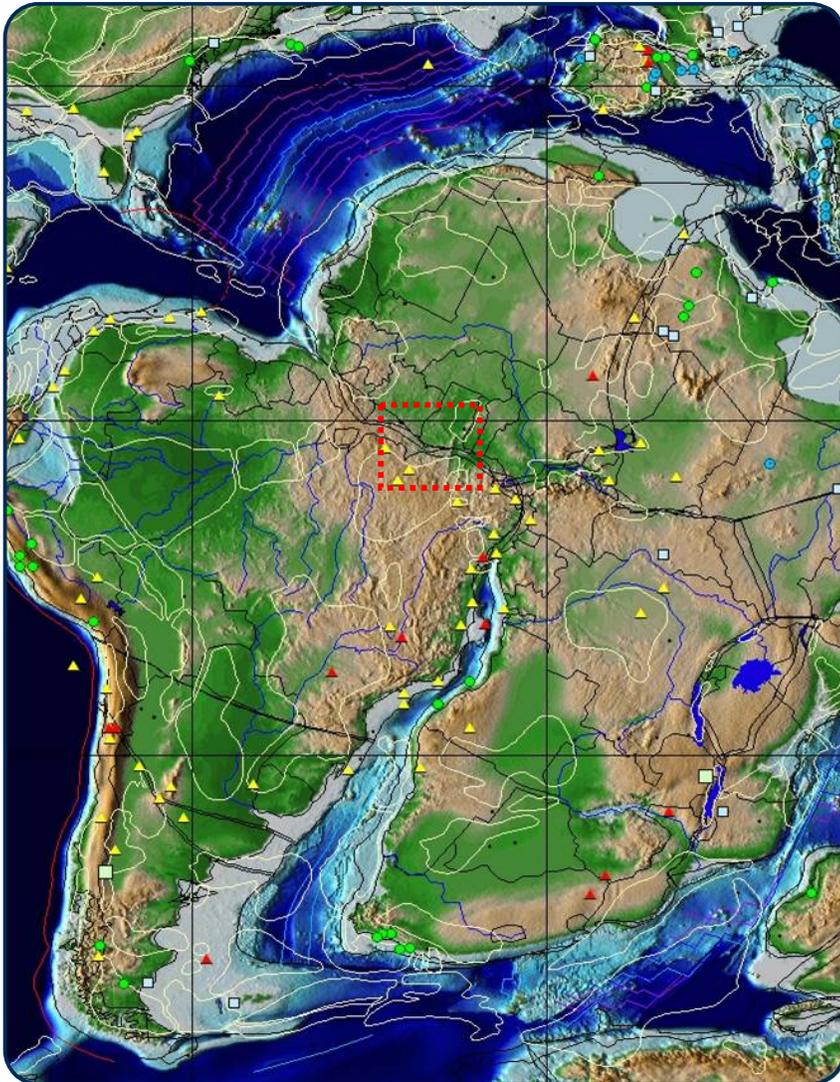
- Between Romanche & St Paul transform faults
- Mainly extensional structural style

## What is a Transform Margin?

- Differential movement in spreading oceanic crust
- Accommodated by slip on transform faults
- Transform faults meet the continents at transform margins

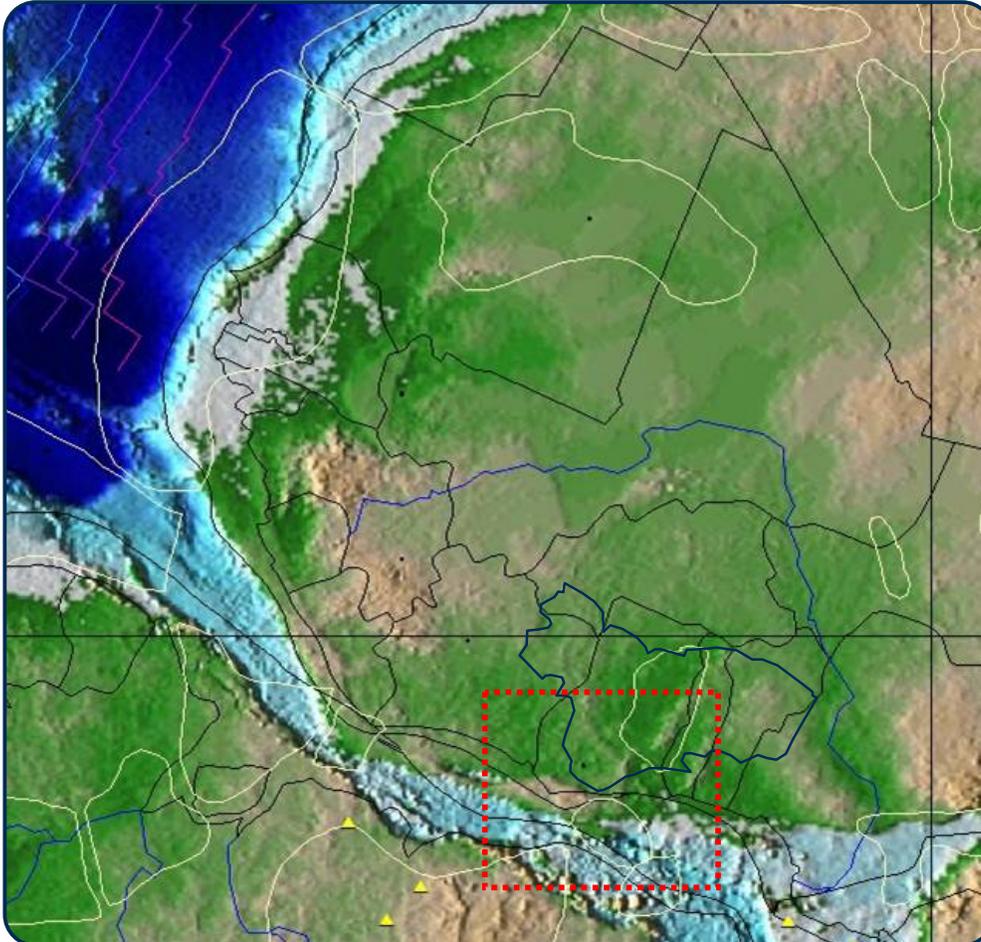
## Impact for oil potential?

- Transform margins are often associated with restricted oceanic circulation
- Anoxic conditions preserve organic material
- Organic material, if buried sufficiently, generates hydrocarbons



## Early Aptian 122 Ma

- North and South Atlantic were opening
- West African Transform Margin not yet part of an open ocean, but due to plate movement significant topography was developing
- West African Transform Margin similar to present day East African Rift Basins, with rift lakes
- Lakes were an important environment for deposition of organic matter which, following later burial, generated hydrocarbons

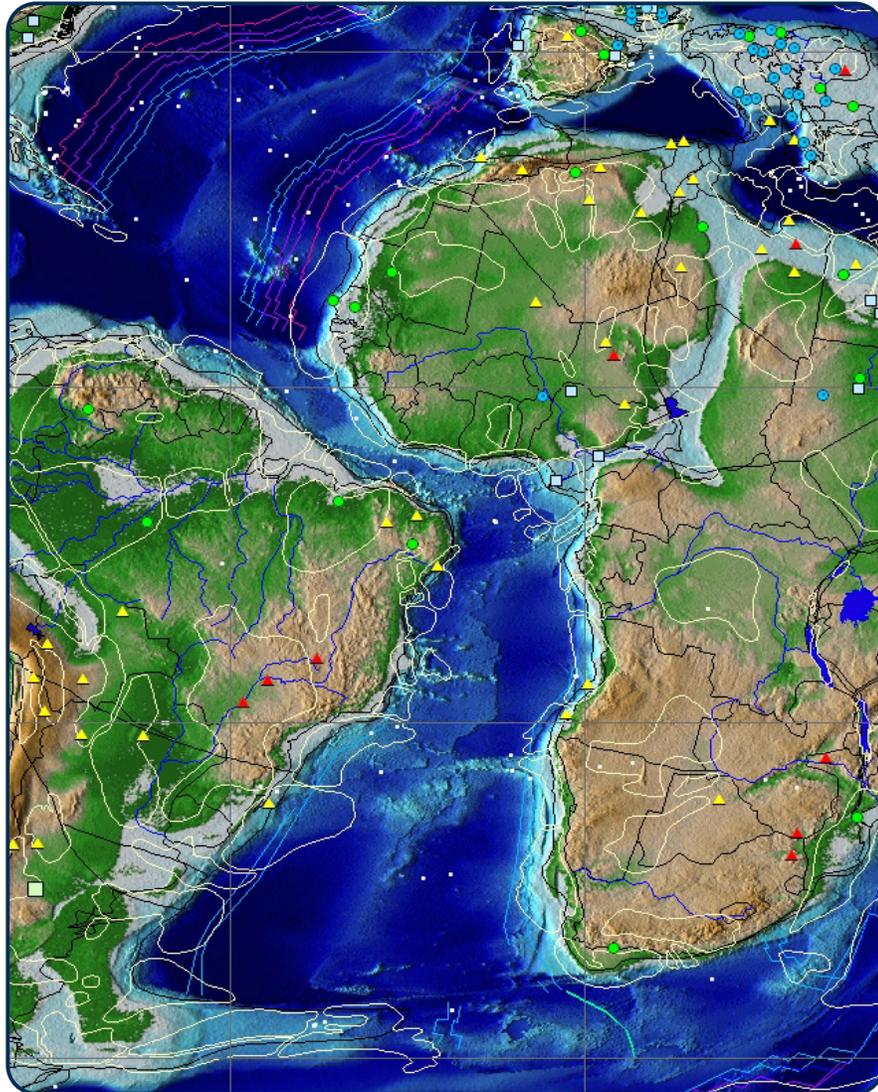


## Early Albian – 108 Ma

- South America & Africa become fully separated
- Last point of contact in western Cote d'Ivoire
- Tano Basin part of an extensional Rift Basin system which received substantial clastic sediment input from the African continent

## Middle Albian

- Significant uplift and erosion occurred
- Topography influenced Tano Basin deposition
- South Tano High was instrumental in the creation of the Jubilee field



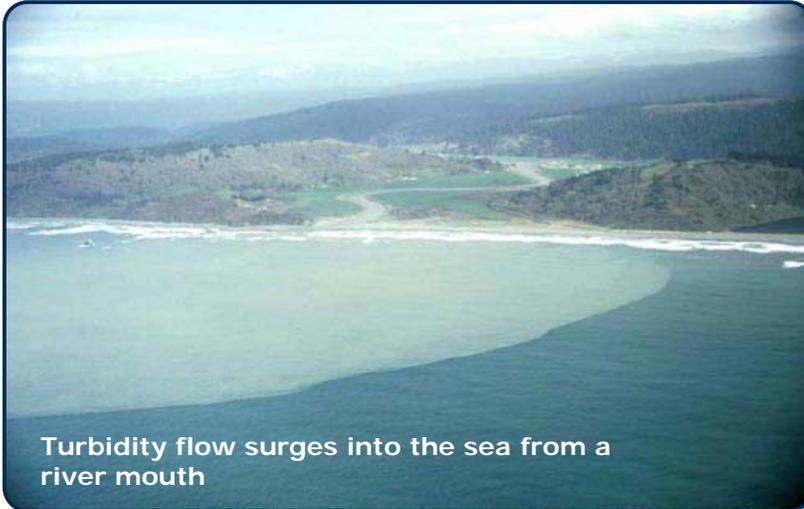
## Cenomanian-Turonian - 93 Ma

- South America and Africa completely separated
- Onset of “drift” and oceanic crust

## West African Transform Margin

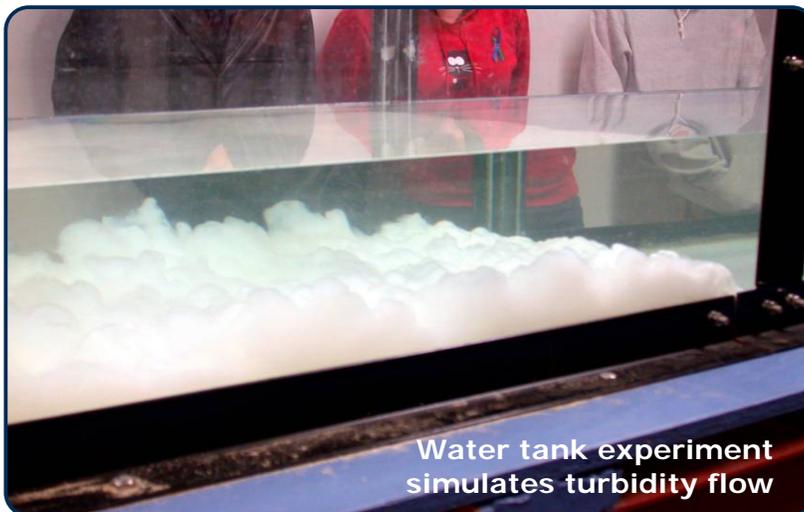
- Rapid drowning the West African Transform Margin created ideal conditions for deposition of thick rich source rock in Cenomanian
- Creation of a deep basin, with significant river systems onshore, led to deposition of large turbidite fan/channel complexes in deep water
- Jubilee is amongst the oldest of several fans
- Continued extension and subsidence resulted in deposition of thick shale which seals Jubilee and the other prospects in the margin
- Turbidite fans form Stratigraphic Traps for oil

# What are turbidity flows and turbidite fans?



Turbidity flow surges into the sea from a river mouth

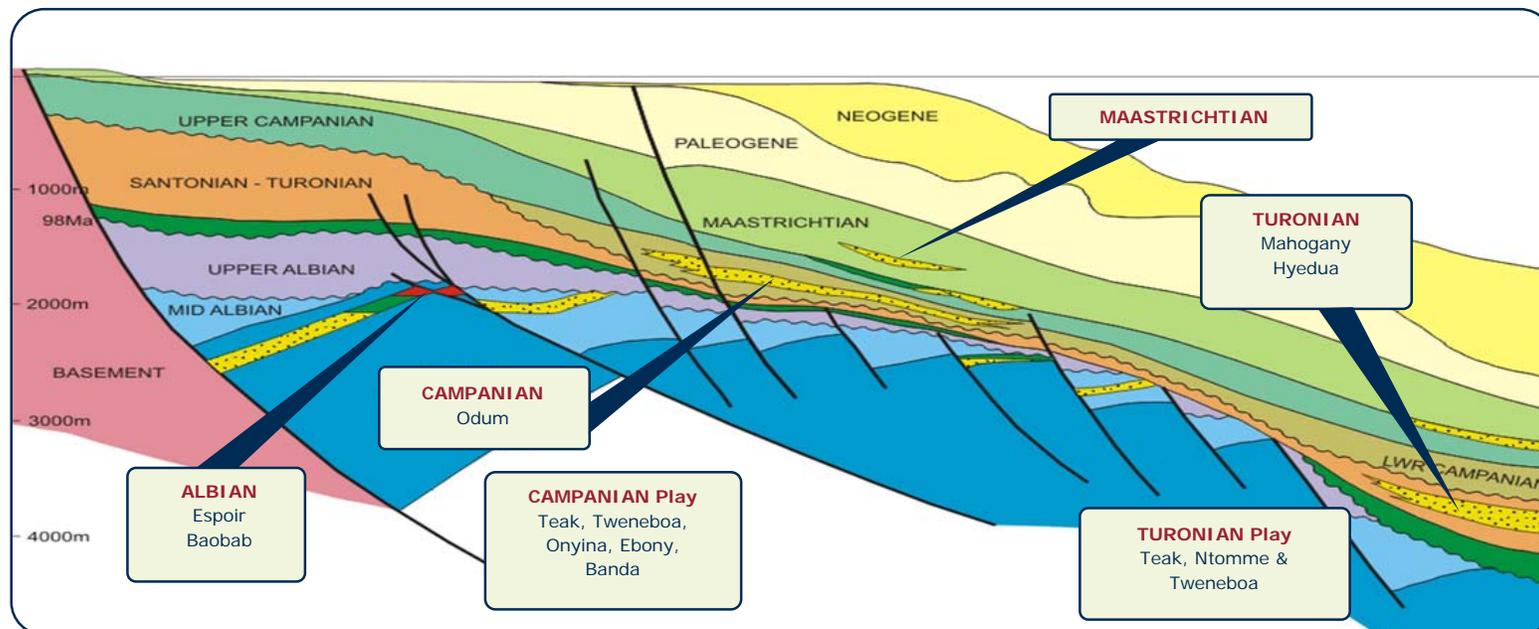
- A turbidity flow is a current of rapidly moving sand-laden water moving down a slope, underwater. The current moves because it has a higher density than the water through which it flows.
- A turbidite fan, such as at Jubilee, is a 'bird's foot' shaped deposit of sand dumped on the seabed by a turbidity flow



Water tank experiment simulates turbidity flow

# Regional geology - conclusions

- Exceptionally favourable coincidence of regional geological factors
- Rich source rocks deposited and matured for oil
- Tectonics and structural geology establish framework for focusing charge
- World class turbidite reservoirs deposited in giant stratigraphic traps
- Highly effective seals preserve oil and gas for discovery and development



## Exploration focus – Tano Basin

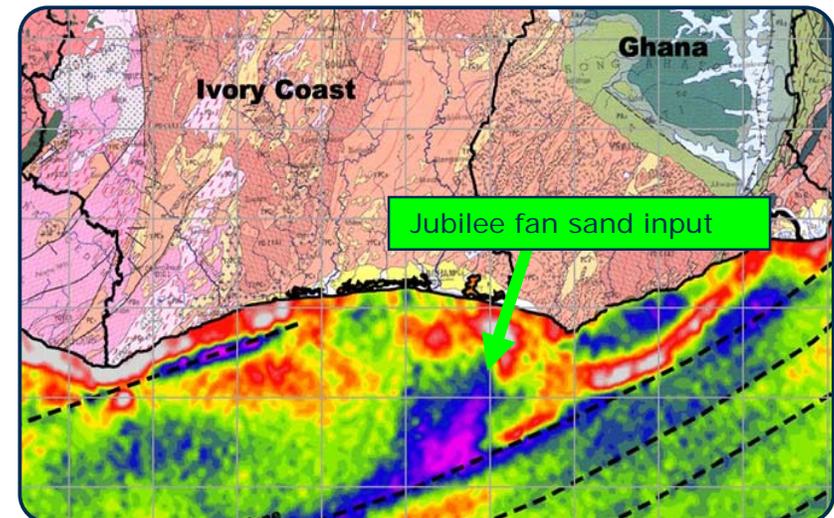
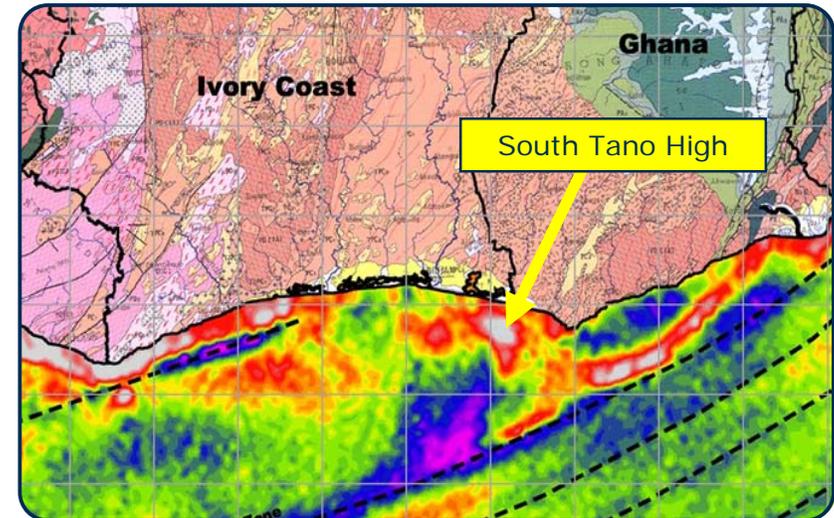


## West African Transform Margin geology

- Source rock buried sufficiently to generate oil
- Turbidite fan / channel systems create migration route and highly productive reservoir

## Prospectivity

- South Tano High creates focus of migration, concentrating oil generated in a large kitchen
- Jubilee fan drapes over high, on top of source rock and focuses charge up-dip
- Structure of South Tano High influenced deposition of Jubilee fan
- Thinner areas on the flanks, where the sands may not have been deposited, help form a trap



## Geological model incorporating well data constrains prospect risks

- Source rock – Cenomanian source modelled to be mature but unproven as previous wells likely accessed charge from older source rocks
- Migration route – sands interpreted from seismic and identified in offset wells. Interpreted to be low risk
- Reservoir – interpreted from seismic. Offset wells relatively poor quality but 3D seismic and facies analysis suggests Jubilee sands better developed
- Trap – A stratigraphic trap was postulated at Jubilee but was very high risk. A very thin sand can result in leakage of oil over geologic time

## Risk reduction through Seismic Analysis

- 3D Seismic interpretation, facies, attribute and Amplitude Variation with Offset (AVO) analysis are essential in de-risking a stratigraphic prospect
- Amplitude Variation with Offset (AVO) techniques widespread in the industry
- Uncalibrated AVO, where the seismic response is poorly understood due to lack of nearby well control, is a dangerous tool and can lead to very expensive mistakes
- Tullow's extensive database and experience in West Africa provide the key to unlocking this complicated seismic attribute and reducing the risk on stratigraphic traps such as Jubilee
- This analysis assists with optimally locating exploration and appraisal wells
- Following synthesis of this approach, a prudent investment decision was taken

## Building on Tullow strengths

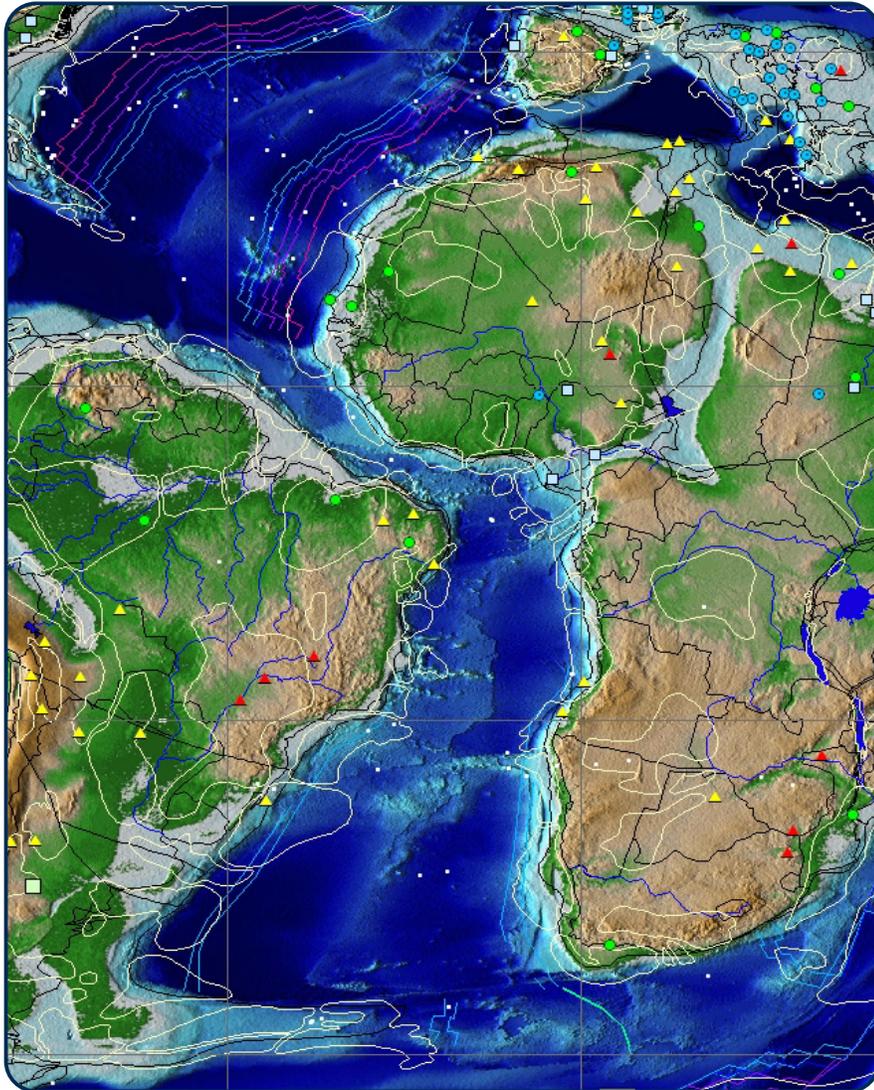
- Core Play – Stratigraphic Trap, a Tullow strength in West Africa
- Core Area – Material acreage position in West African Transform Margin

## Campaign area identified, then expand acreage position

- Secure high-grade acreage
- Acquire 3D data to evaluate a set of prospects
- Secure rig capacity for drilling campaign

## Deepwater Ghana

- Following success of Mahogany-1 in 2007, capital allocated to accelerate campaign
- Hyedua-1 well drilled and High Resolution 3D/4D survey acquired
- Turonian Jubilee analogues to be drilled – Tweneboa, Ntomme, Owo, Teak
- Campanian Odum analogues to be drilled – Tweneboa, Onyina, Walnut



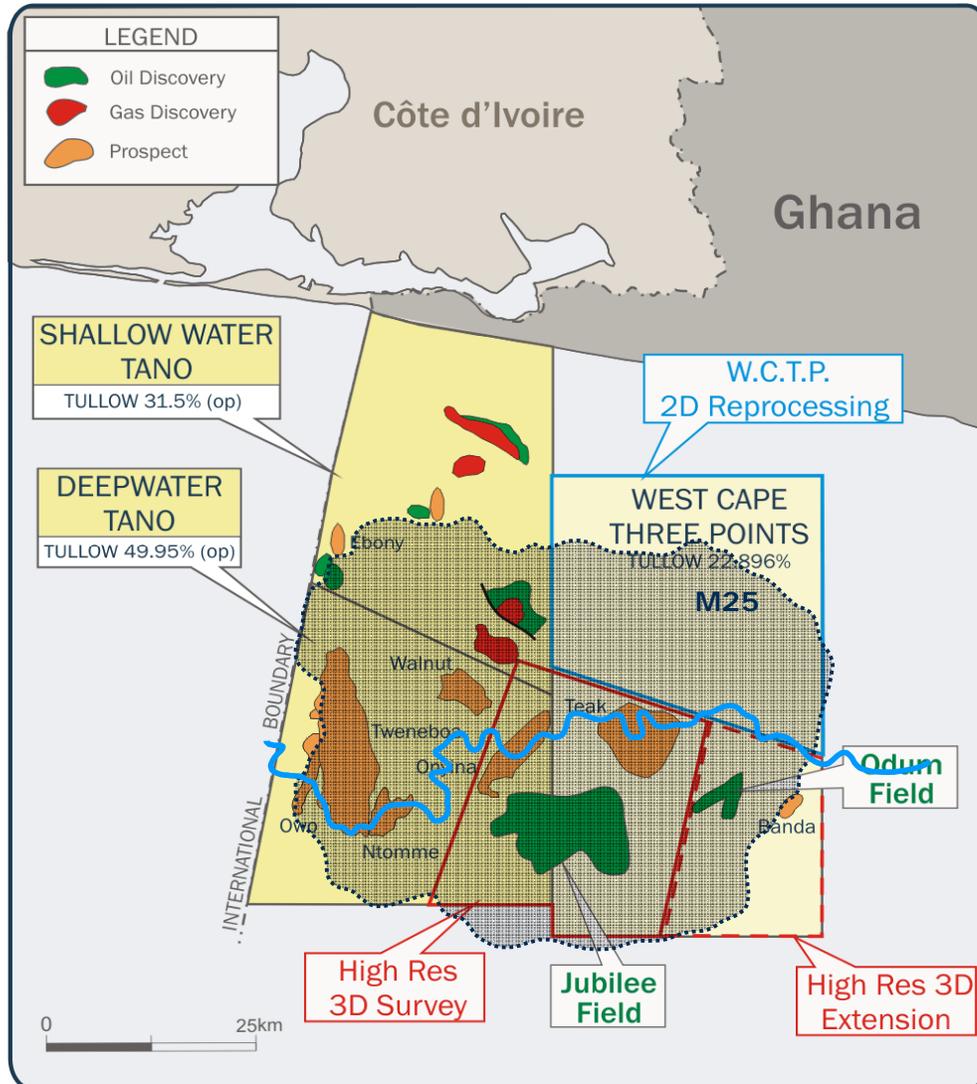
## Atlantic Twins

- Regional understanding extends across Atlantic
- Source rocks and reservoirs common to both sides
- Recognising that twin basins are seldom symmetrical
- South American acreage under review
- Applying African plays in South America and vice versa
- High-grading acreage opportunities
- Pursuing various farm-in opportunities

- Core capability identifies high impact potential of major new stratigraphic play in Tano Basin
- In-house seismic technology skills reduced risks to acceptable levels
- South Tano High and Jubilee fan create ideal hydrocarbon trap conditions
- Data gathered at Jubilee supports analogue opportunities in basin
- Expertise in region transferable to adjacent countries and across Atlantic
- Significant upside potential remaining

## Exploration upside potential – Justine Tinker

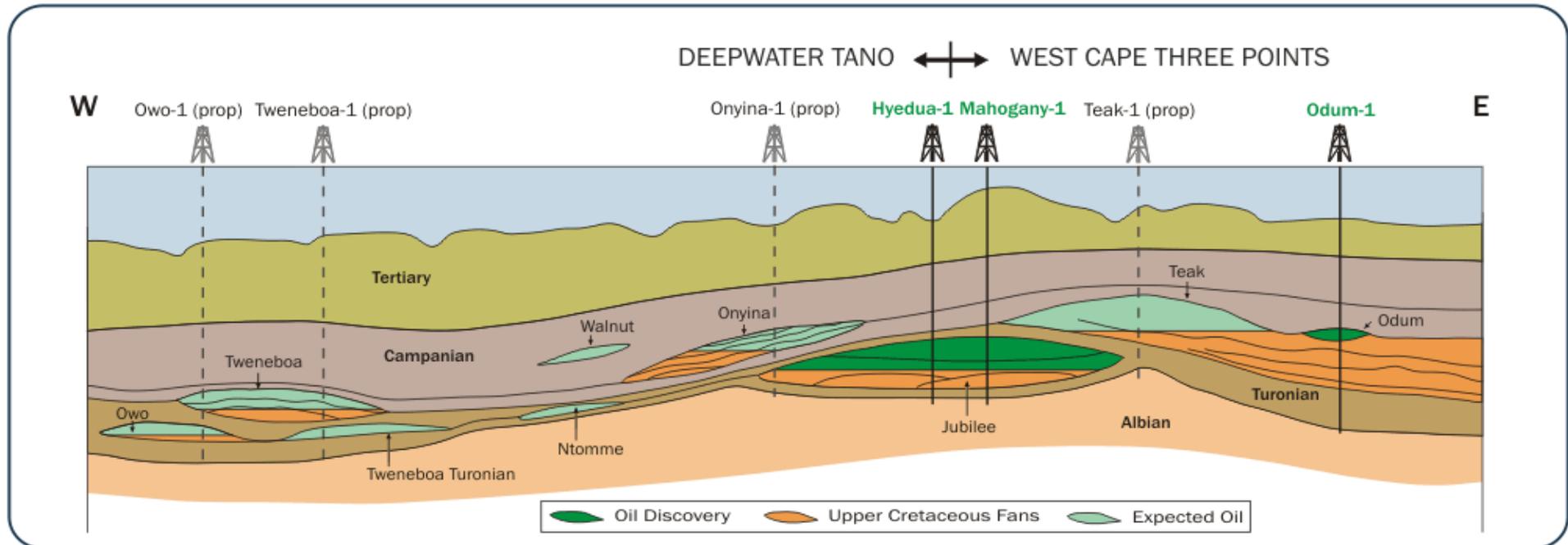




## New Play Fairways

- Jubilee Field – new Turonian play
  - Opens fairway for campaign follow up
    - Teak
    - Owo
    - Ntomme
- Odum discovery – new Campanian play
  - Opens second campaign fairway
    - Tweneboa
    - Teak
    - Onyina
    - Walnut
    - Banda
- Further potential
  - High Resolution 3D in south east of WCTP
  - Reprocessing of northern part of WCTP 3D

# Imminent High Impact Ghana Prospects

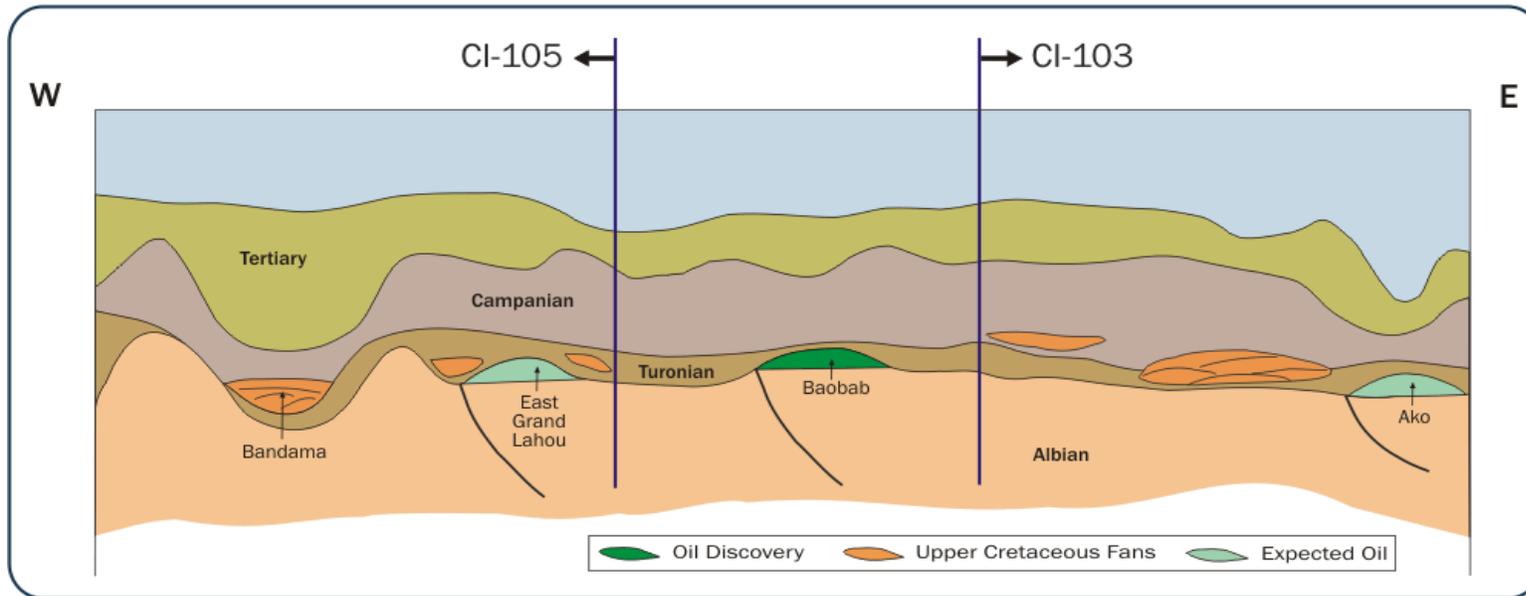


## Exploratory Appraisal

- Three to five wells aim to extend and define the limits of the Jubilee field
- Mahogany-3 will explore deeper fans below proven reservoirs

## Frontier Drilling

- Odum-1 (February 2008) successfully opens Campanian oil play
- Tweneboa-1 will explore a Jubilee-type fan in Deepwater Tano
- Teak-1 will explore the reservoirs up-dip from both Odum and Jubilee
- Onyina-1 will explore an Odum-type fan in Deepwater Tano
- Owo-1 will explore a prospective deep fan west of Tweneboa



## Tullow hold equity in three blocks

- CI-102 – reprocessing progressing - well in 2010
- CI-103 – New 3D acquired - well in 2010
- CI-105 – 3D reprocessed, 2D acquired - well in 2009

## CI-102

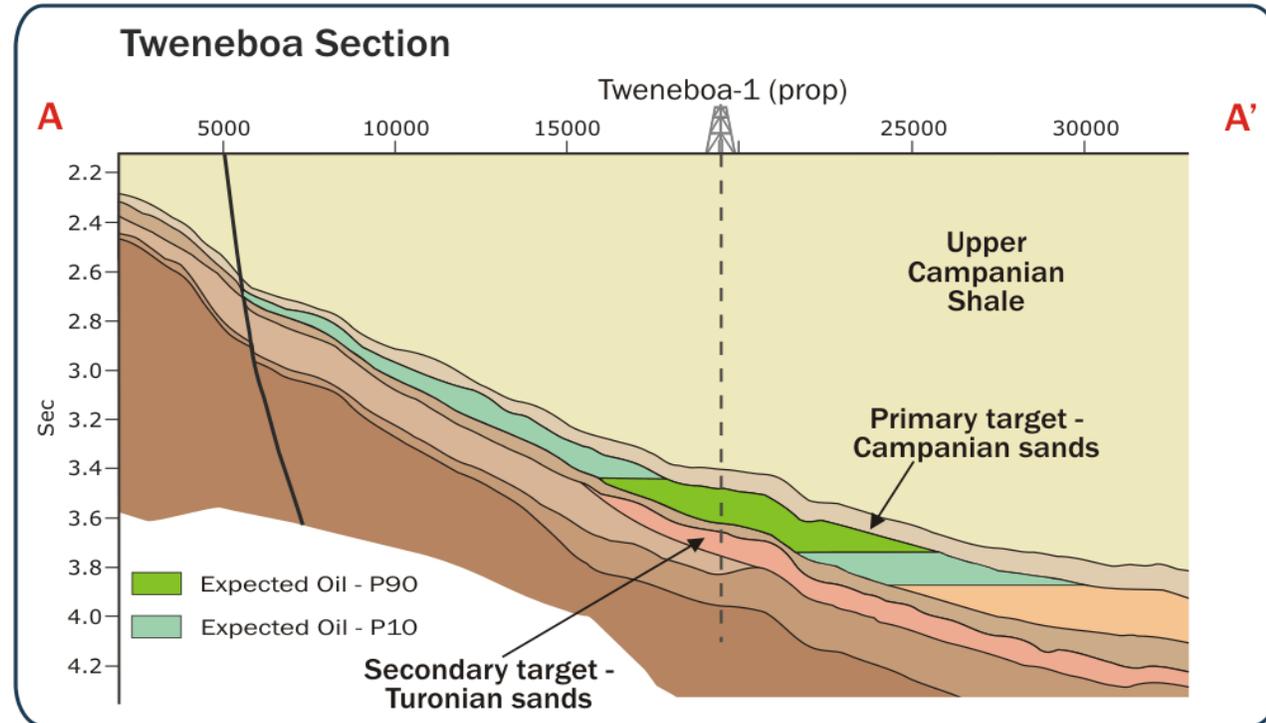
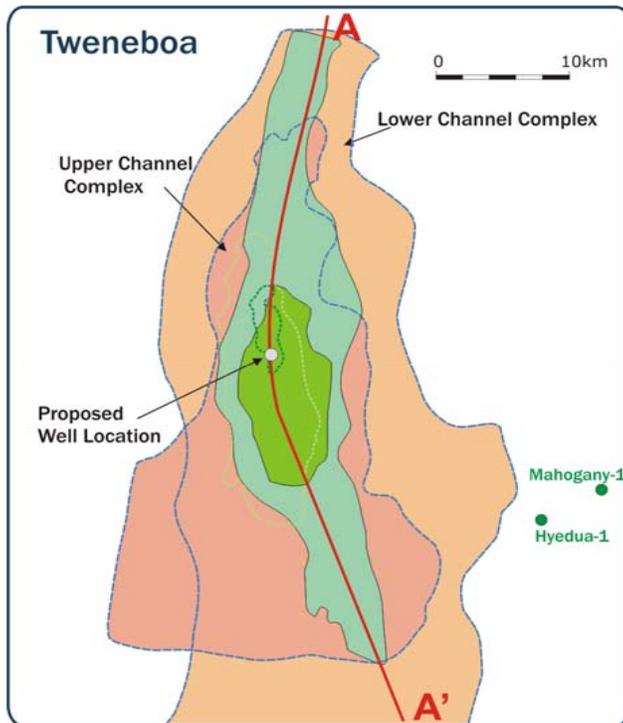
- Quebec high – traditional Albian play (Espoir)
- Additional potential in Upper Cretaceous channels
- Currently reprocessing 3D seismic survey
- Possible well in 2010

## CI-103

- 600 sqkm 3D acquired in 2007
- Processing to complete in 2008
- “Ako” Albian structure – Baobab analogue
- Significant potential in Jubilee analogues

## CI-105

- 3D reprocessed, 2D acquired beyond 3D limits
- East Grand Lahou prospect – Baobab analogue
- Bandama channel – Turonian to Tertiary systems
- First well planned for mid 2009

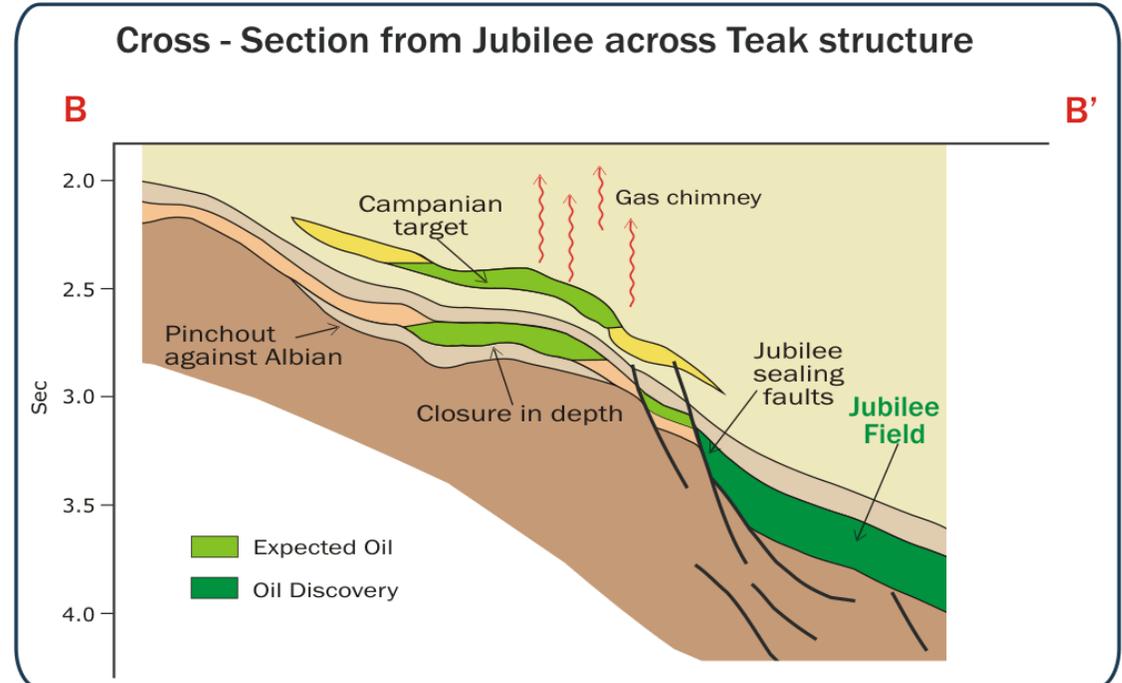
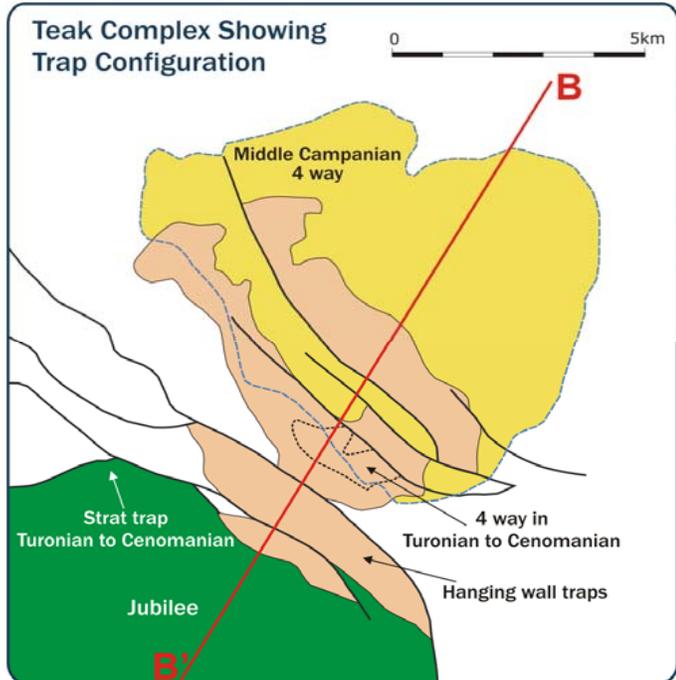


## Tweneboa Prospect

- Two campaign fairways- Campanian and Turonian
- Giant Campanian fan-channel system (585 Km<sup>2</sup>)
- Gross upside potential of 750 mmbbls
- Tullow equity 49.95%
- Scheduled on the Eirik Raude Q1 2009

## Tweneboa Geological summary

- Vertically stacked Campanian channel complexes
- Cenomanian-Turonian source, HC charge access risk mitigated by Odum success
- Stratigraphic trap
- Water depth 200m-1900m
- Good AVO support

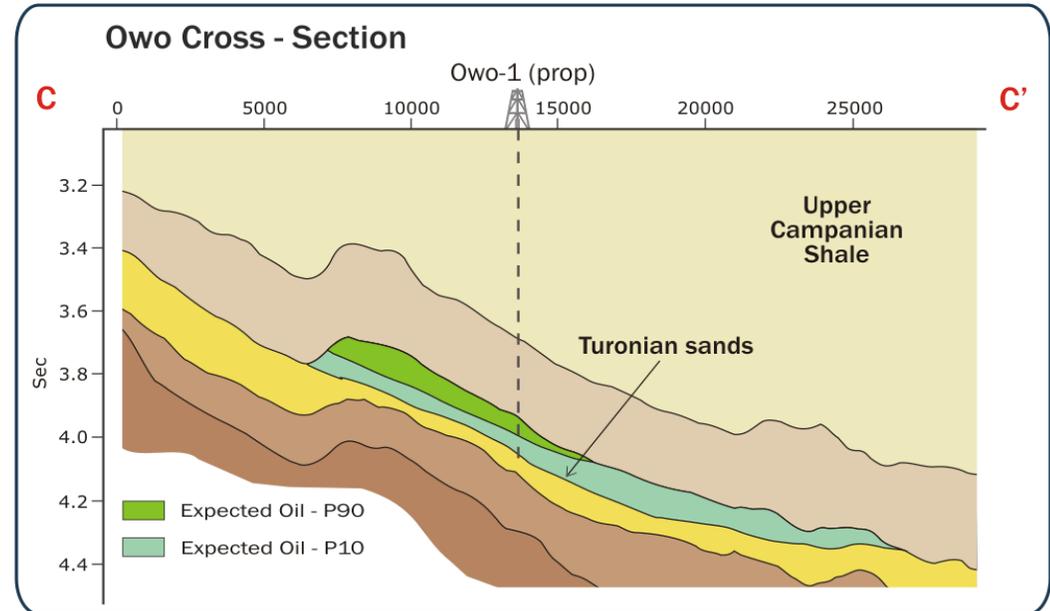
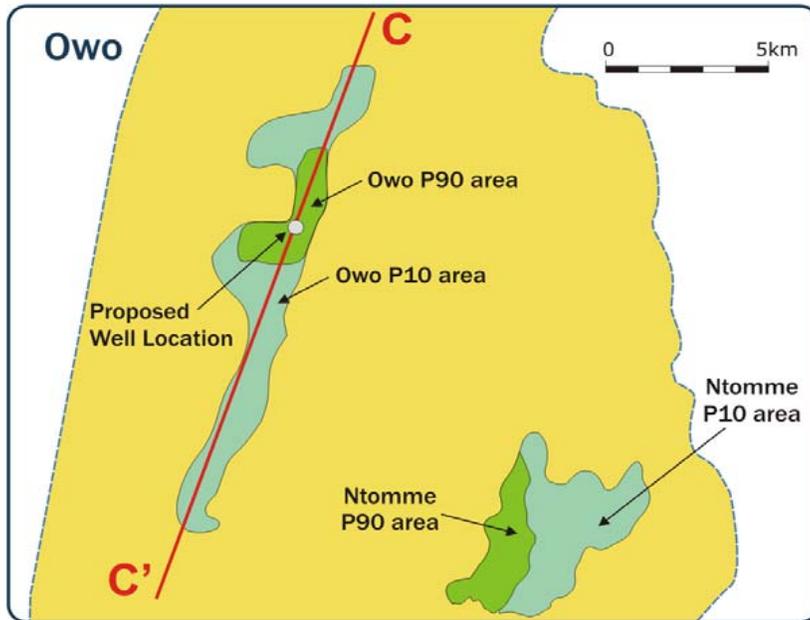


## Teak Prospect

- Stacked Turonian to Mid Campanian submarine channel systems
- Large 4 way dip closures
- Gross upside potential of 750 mmbbls
- Scheduled to be drilled by the Aban Abraham Q1 2009

## Teak Geological summary

- Up-dip of both Jubilee and Odum
- Potential up-dip extension of Turonian Jubilee
- Stacked structural and stratigraphic traps
- Gas chimney - data quality to be improved by new high resolution Jubilee 3D

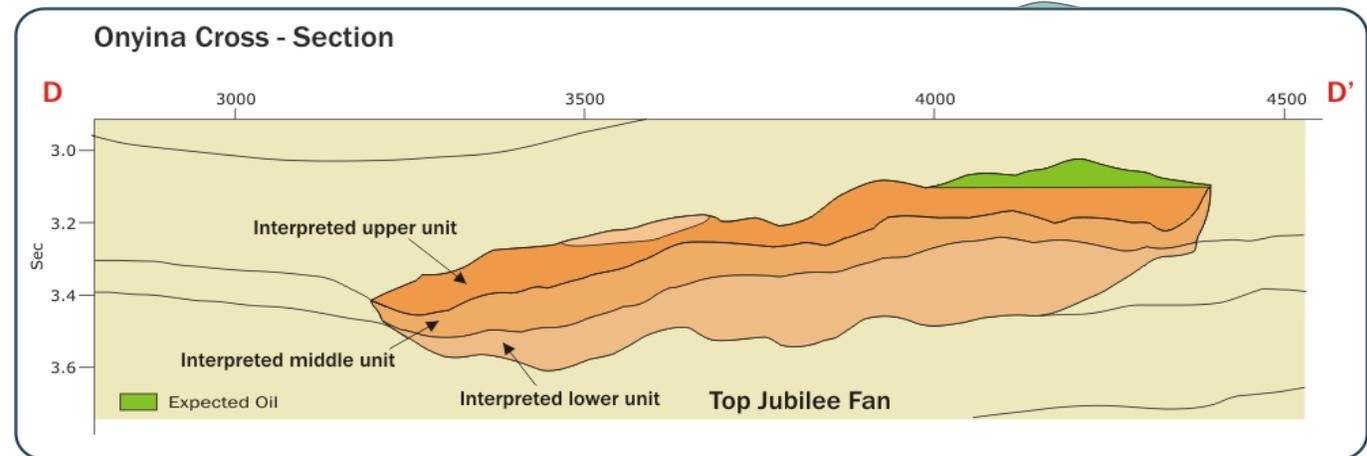
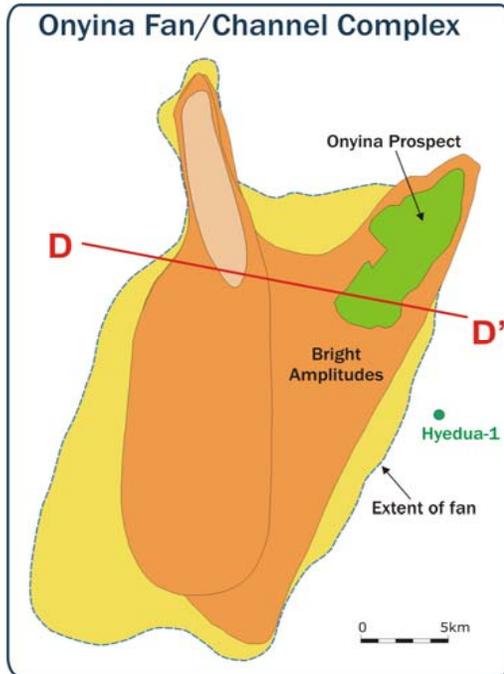


## Owo Prospect

- Turonian-aged stratigraphically trapped turbidite channel complex
- Sinuous, deep marine channel, equivalent in age to the Lower Jubilee fan complex
- Water depth 980m-1680m
- Excellent AVO support
- Gross upside 200 mmbbls
- Scheduled to be drilled Q2-Q3 2009

## Ntomme Prospect

- Turonian-aged, structural/stratigraphic trap
- Frontal splay of a fan complex
- Water depth 1500m-1700m
- Good AVO support
- Gross upside 120 mmbbls

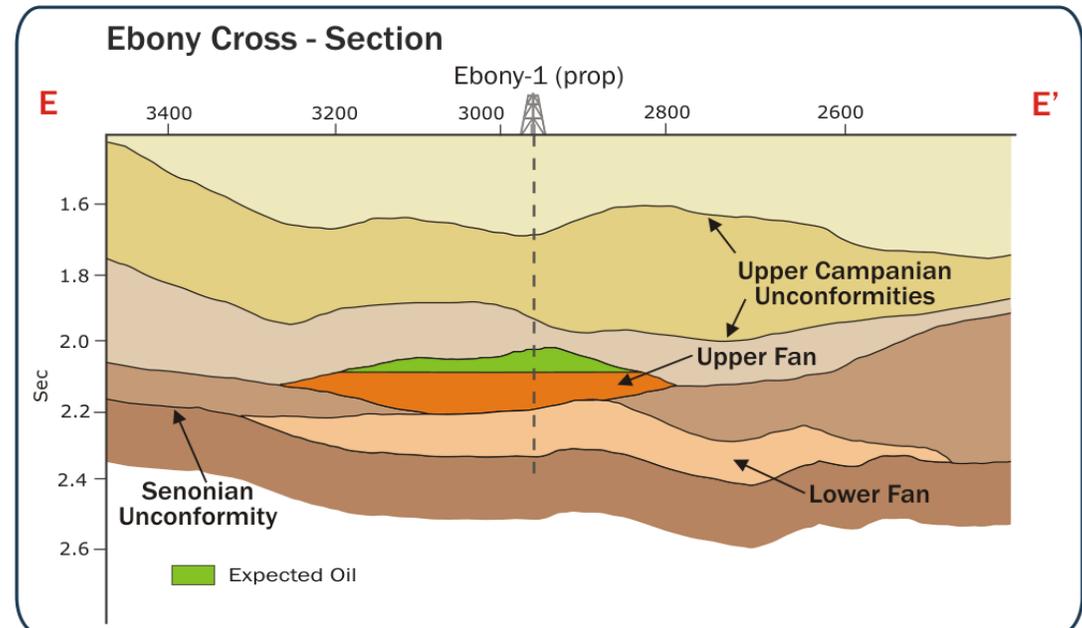
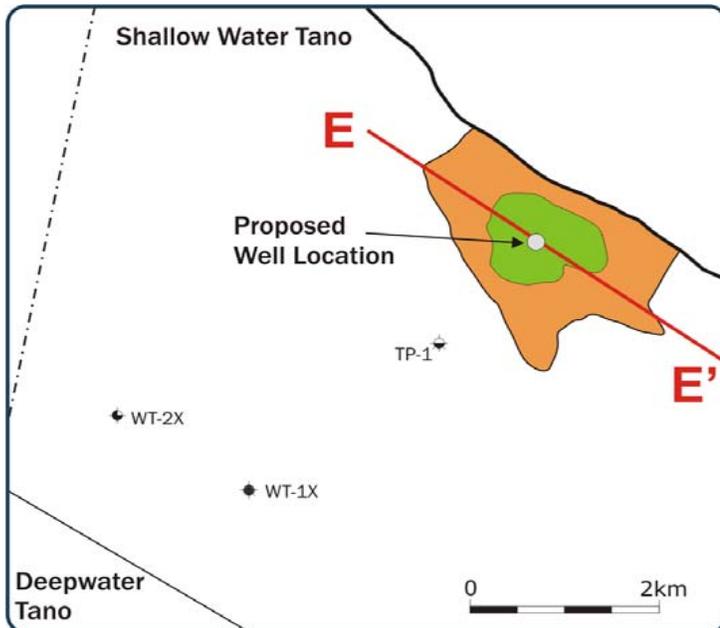


## Onyina Prospect

- Large upper Campanian submarine fan/channel system with two distinct feeder systems
- Volumes calculated for eastern feeder system
- Gross upside 200 mmbbls
- Water depth 600m-1050m
- Scheduled to be drilled Q2-Q3 2009

## Onyina Geological summary

- Stratigraphic trap
- Located on South Tano High, thus in good position to receive HC charge from the same Cenomanian-Turonian source that has charged the Jubilee fan
- Covered by new high resolution Jubilee 3D
- Good AVO support for up-dip eastern feeder



## Ebony Prospect

- Two vertically stacked Upper Cretaceous fans
- Up-dip of sands with oil and gas shows at TP-1 (drilled outside of closure)
- Gross upside potential of 35 mmbbls
- Tullow equity 31.5%
- Satisfies the second well commitment for the Tano Shallow Block
- Scheduled to be drilled by West Ceres Q4 2008

## Ebony Geological summary

- Upper Cretaceous stacked turbidite sandstones
- Cenomanian-Turonian source
- Stratigraphic trap
- Water depth 87m

# Gulf of Guinea – Current and potential Upside



	Block	Prospect/Campaign	Interest	Gross Upside	Date/Status
Ghana	Jubilee Field	Exploratory Appraisal	22.9-49.95%	>1,000 mmbo	Q3 08-Q3 09
Ghana	Deepwater Tano	Tweneboa/Onyina/Owo	49.95%	900 mmbo	Q4 08 – Q3 09
Ghana	West Cape Three Pts	Teak Prospect	22.9%	750 mmbo	Q1 09
Ghana	Shallow Water Tano	Ebony Prospect	31.5%	35 mmbo	Q4 08
Cote d'Ivoire	CI-105	Prospect	22.37%	200 mmbo	Q3 09
Ghana	West Cape Three Pts	Potential	22.9%	400 mmbo	3D Acquisition
Cote d'Ivoire	CI-102	Potential	31.5%	100 mmbo	3D Processing
Cote d'Ivoire	CI-103	Potential	85%	500 mmbo	3D Processing

## Total Upside

1Bbbls Exploratory Appraisal

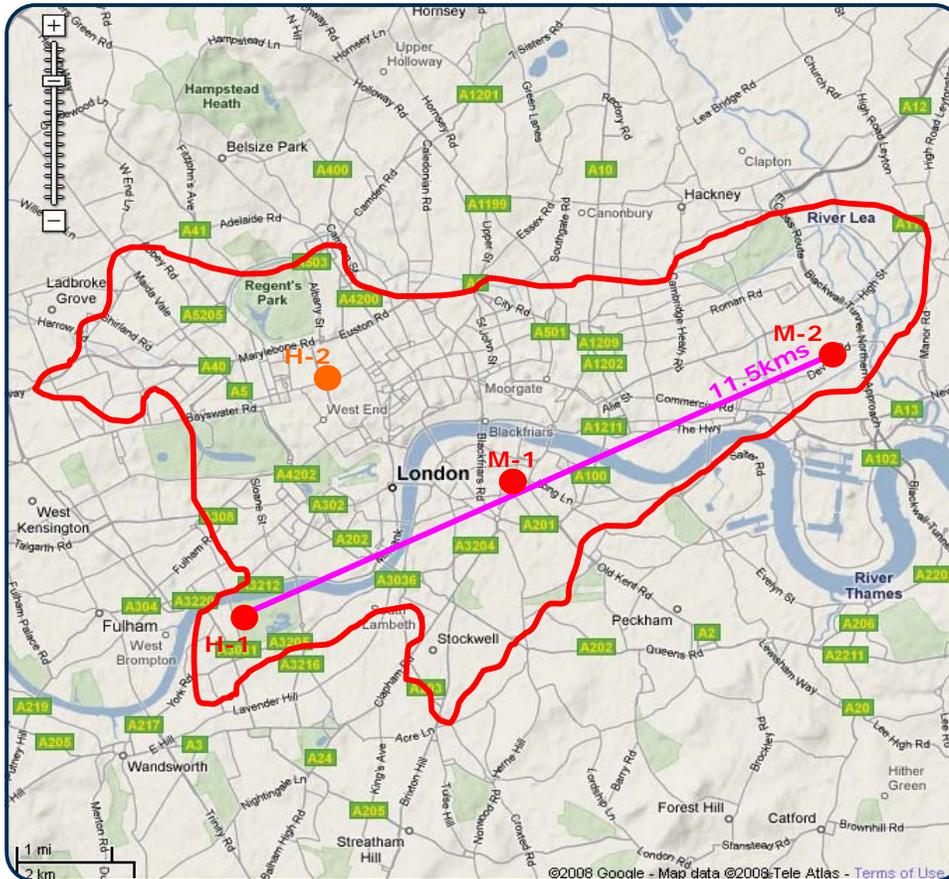
2Bbbls Prospects identified for drilling

1Bbbls Potential in existing acreage

## Jubilee field subsurface overview – Dave Hanley



# The Jubilee field is an extensive accumulation



## Location

- 60 km offshore in 1,250m of water
- Straddles the boundary between the Deepwater Tano and West Cape Three Points blocks

## Background

- Jubilee Field discovery – June 2007
- Tullow field Operator – February 2008

## Prior Activity

- 3 wells drilled to-date, all in central core of field
- Hi-res dedicated 3D survey acquired in mid-07, with exceptional data quality
- Conventional cores acquired in Hyedua-1 BP01 “bypass” wellbore and Mahogany-2 well
- Two drill stem tests (DSTs) conducted in the Mahogany-2 well

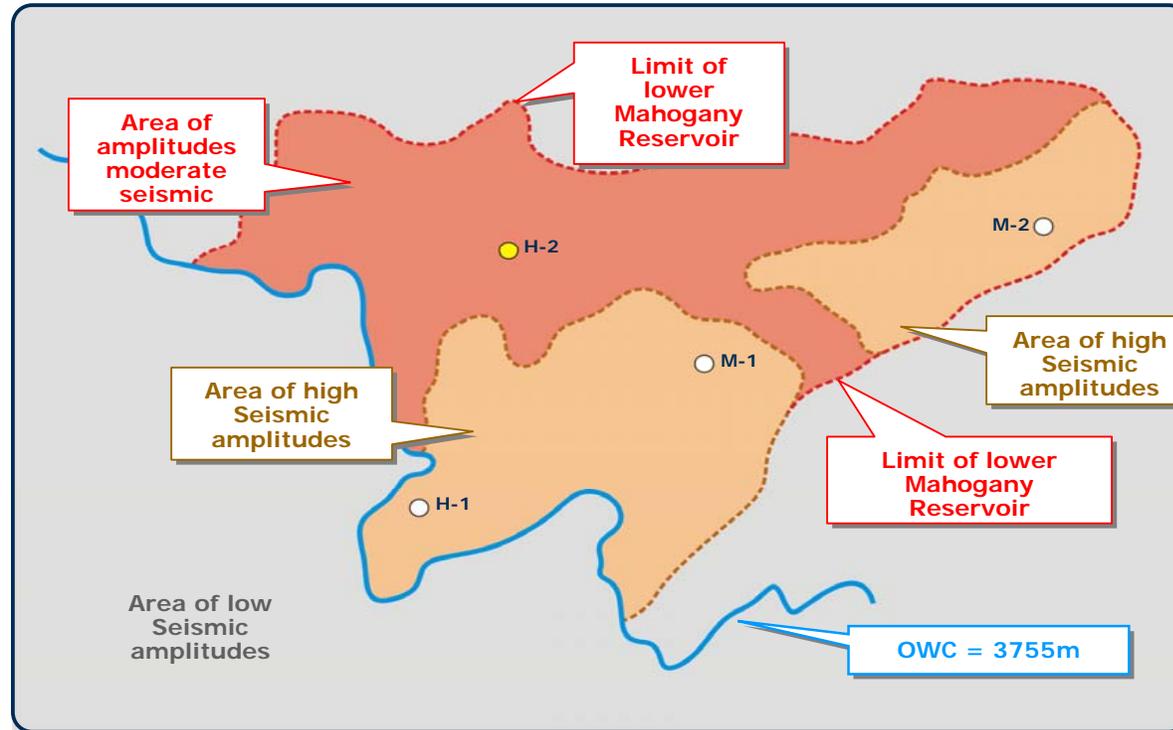
## Integrated Project Team (Dallas)

- 8 key personnel with an average of approx. 20 years experience
- Significant Anadarko GoM experience
- Subsurface Manager is ex-Hess Okume-Ceiba

## The Tullow team (London and Cape Town)

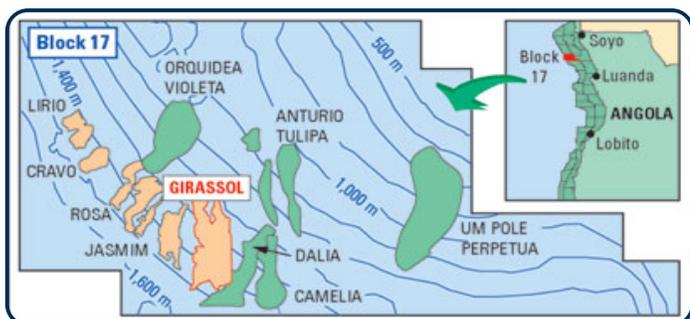
- Independent mapping and model build by Tullow team
- Exploration team (4-5) and Development team (8+) with 10-30 years relevant global experience
- Building capacity to take full subsurface management responsibility

Generally close alignment in results....



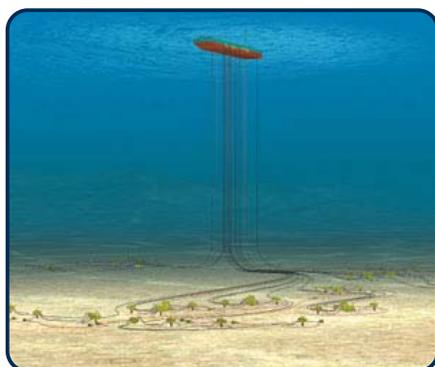
## Reservoir Architecture

- Aerially extensive accumulation – mapped from 3D seismic amplitude anomalies
  - Strong brightening of amplitudes due to sand presence and/or fluid content
- Stratigraphic trap with updip and lateral margins controlled by sand pinchouts
- Stacked, laterally continuous deepwater turbidite channel and fan sequences approaching 250m in thickness and of exceptional quality



## Girassol Complex (Angola)

- 150 kms offshore in 1,350m of water. Approx. 140 km<sup>2</sup>
- Tertiary sands with excellent properties & 32° API oil
- Original oil in place > 2,000 mmboe
- Recoverable reserves > 950 mmboe
- Expected ultimate recovery in the 40 – 50% range
- Three years from project sanction to first oil



## Agbami (Nigeria)

- 120 kms offshore in 1,500m of water. Approx. 60 km<sup>2</sup>
- Tertiary sands with excellent properties & 45° API oil
- Original oil in place > 2,200 mmboe
- Recoverable reserves > 1,000 mmboe
- Expected ultimate recovery in 40 – 50% range
- Four well appraisal program



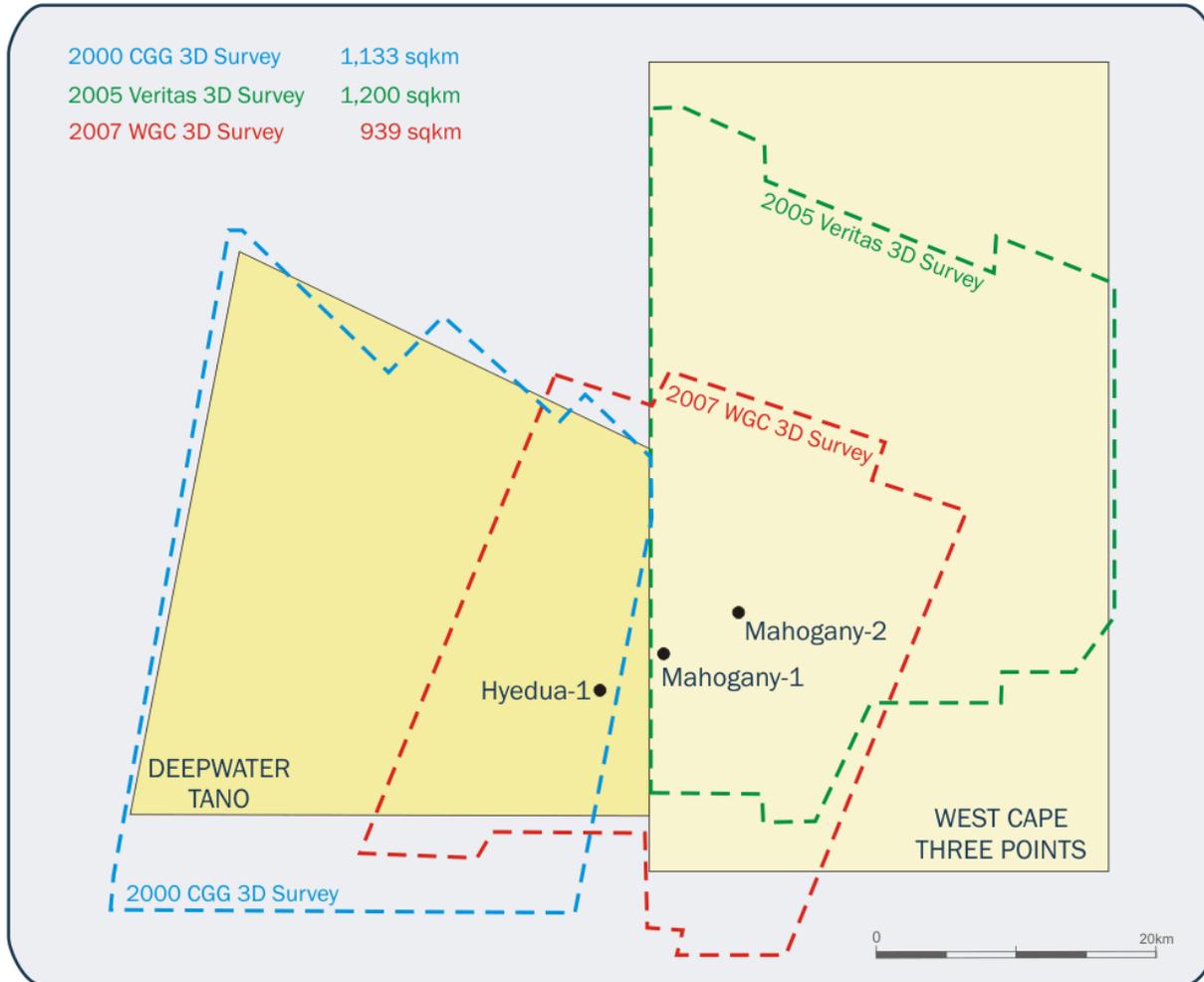
## Zafiro Complex (Equatorial Guinea)

- 120 kms offshore in 850m of water. Approx. 100 km<sup>2</sup>
- Tertiary sands with excellent properties & 30° API oil
- Original oil in place > 3,300 mmboe
- Recoverable reserves > 1,500 mmboe
- Expected ultimate recovery in the 40 – 50% range
- Fast track – 18 months from discovery to 1st oil

## Challenges

- Reservoir architecture
  - reservoir scale & extent
  - sand package continuity
  - internal compartmentalisation
- Reservoir recovery mechanisms
  - balance of water and gas injection strategies
  - Well location and completion strategy
- Defining development
  - Optimisation of phase 1
  - Strategy for further development phases

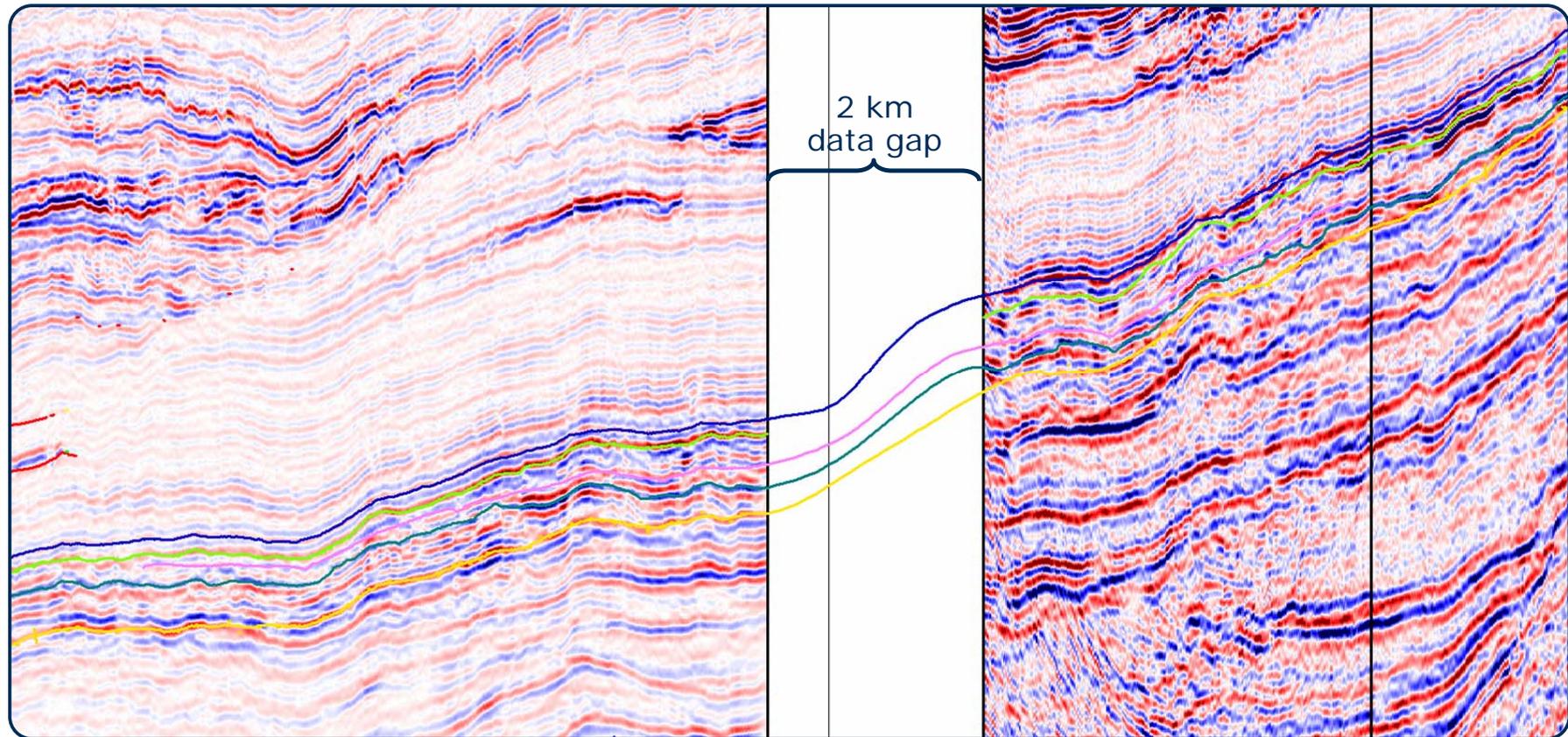




## Database

- 3 wells to date in core of field
  - 2 whole cores
  - sidewall cores
  - pressure data
  - fluid samples
  - 2 DSTs
- 3 vintages of 3D seismic data
- Significant “gap” up to 2 kms wide between CGG & Veritas surveys. Note coverage of dedicated Jubilee high resolution “Q-marine” 3D survey
- Strong likelihood of 4D (time-lapse) repeat survey 2+ years after first production

# 3D seismic comparison (old data)

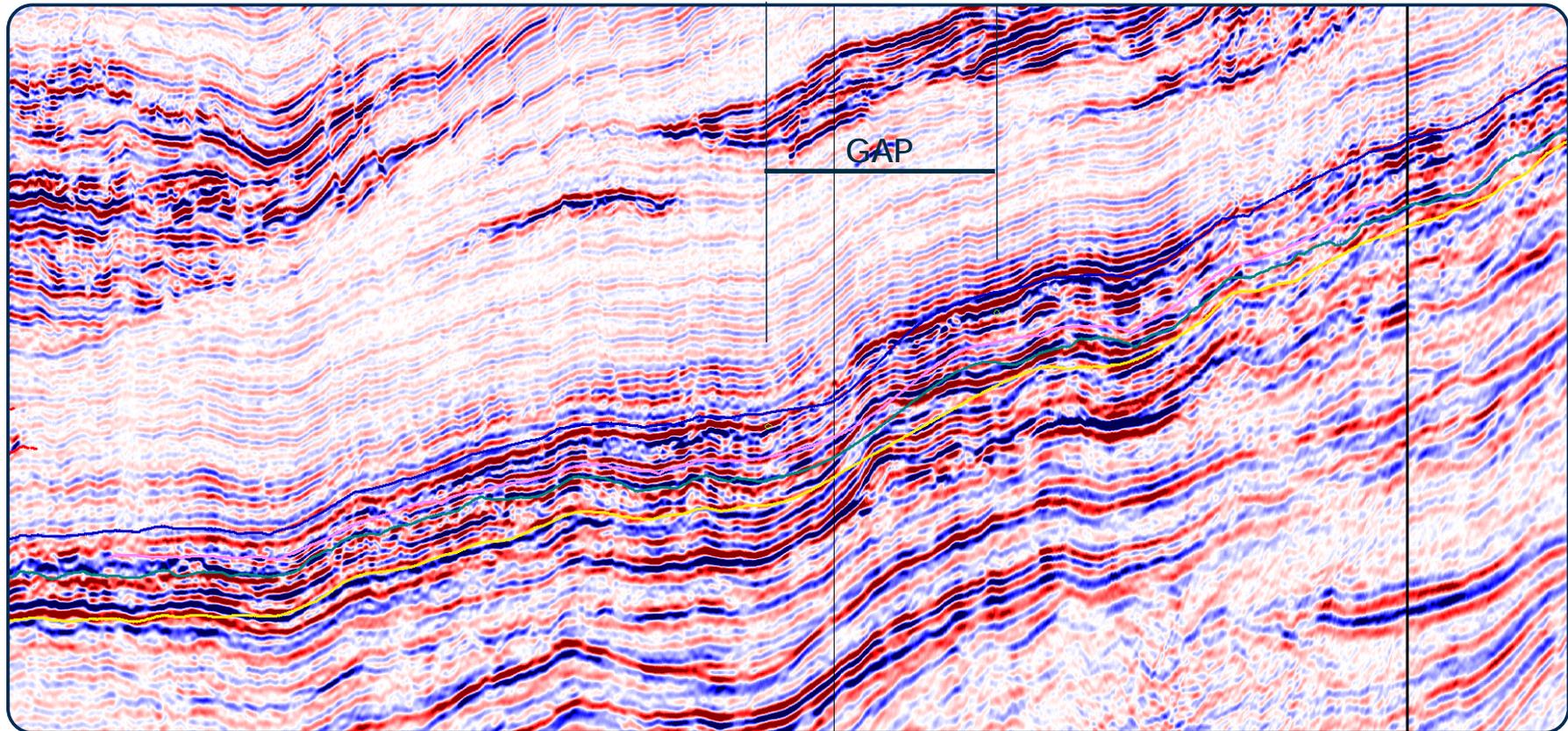


Original 2000 CGG Deepwater Tano 3D Survey

Original 2005 Veritas WCTP 3D Survey

## Issues

- Data "gap" between surveys of up to two kms
- Different acquisition and processing parameters
- Leading to inconsistent amplitude response and interpretation uncertainty

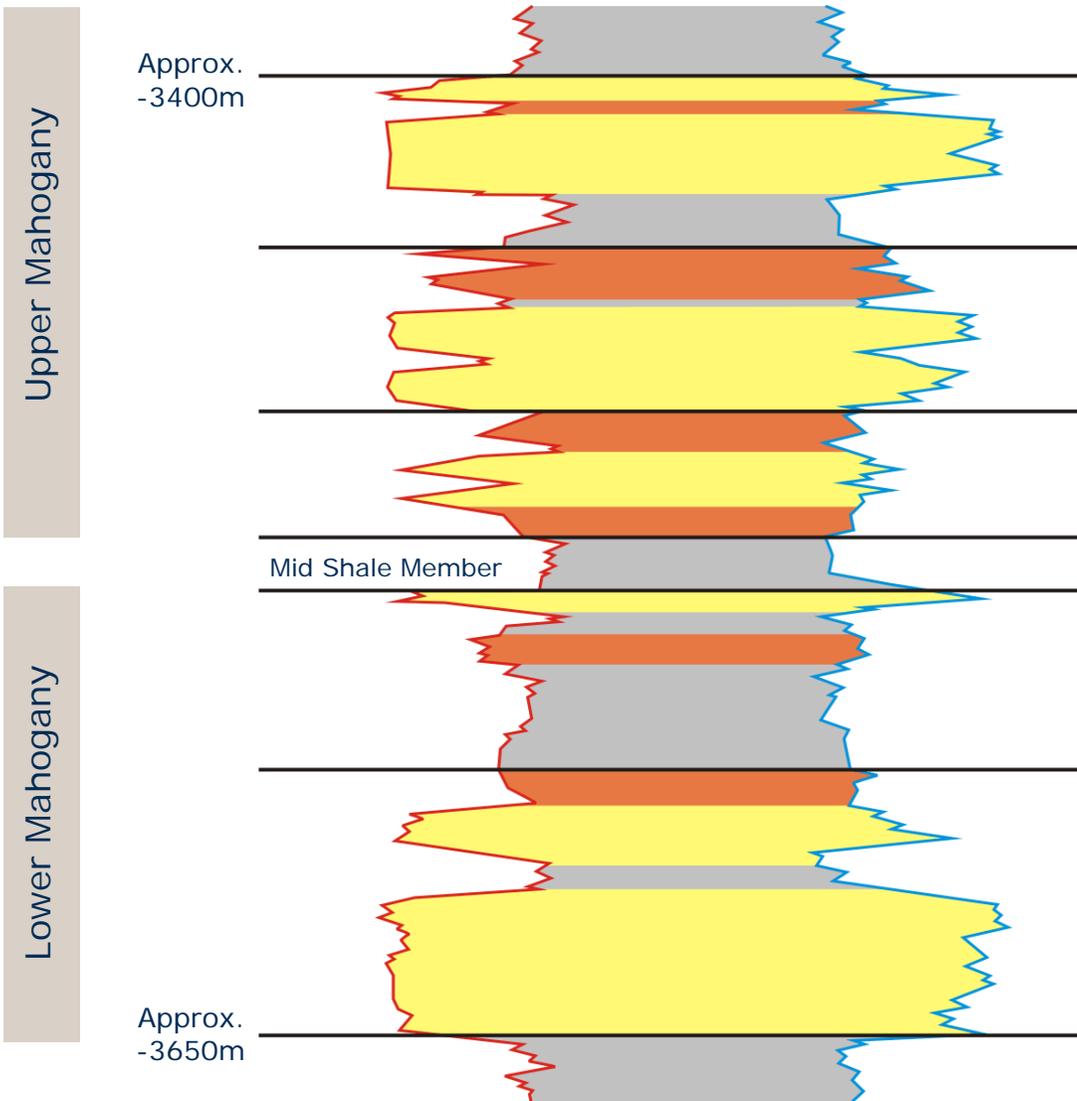


New 2007 WesternGeco Hi-Res "Q-marine" 3D Survey

## Step change improvement

- No data gap or acquisition/processing issues
- Consistent amplitude response across entire dataset
- Much higher resolution dataset with more structural/stratigraphic detail
- Ability to acquire 4D time-lapse dataset following 2+ years of production

# Jubilee field – Mahogany reservoir type log section

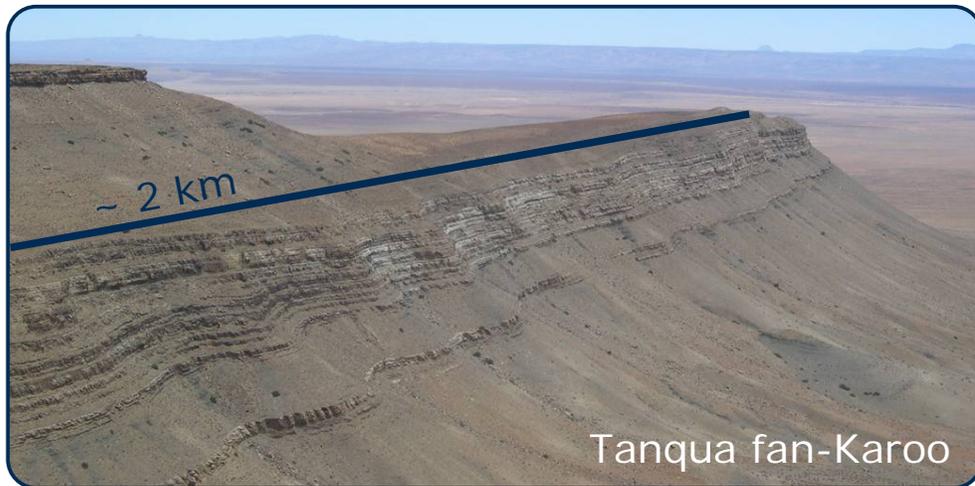


## Exceptional reservoir characteristics

- Large, mostly continuous stacked turbidite sand reservoirs of late Cretaceous age (c. 89 – 90 ma)
- Thick, good quality sands with 40 – 100m net oil pay
- Excellent rock properties, with 20%+ porosity and 200+ md permeability
- High potential well deliverability of 20,000+ bopd

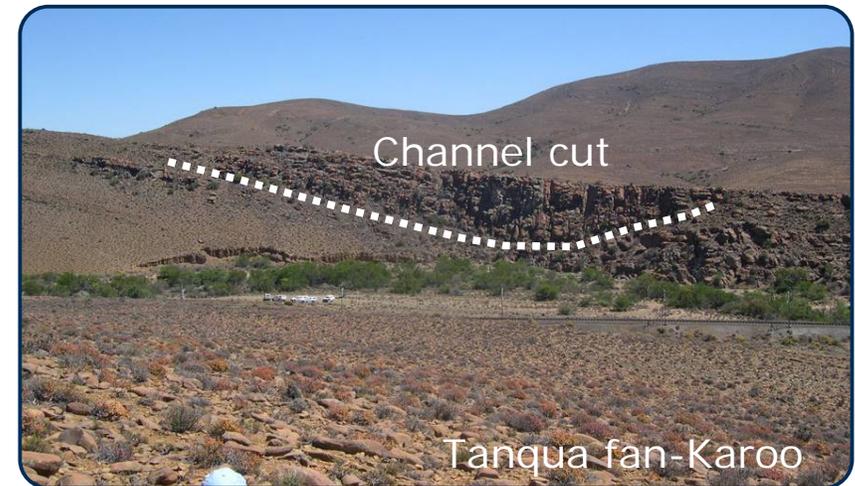
## Hyedua-1 Well Area

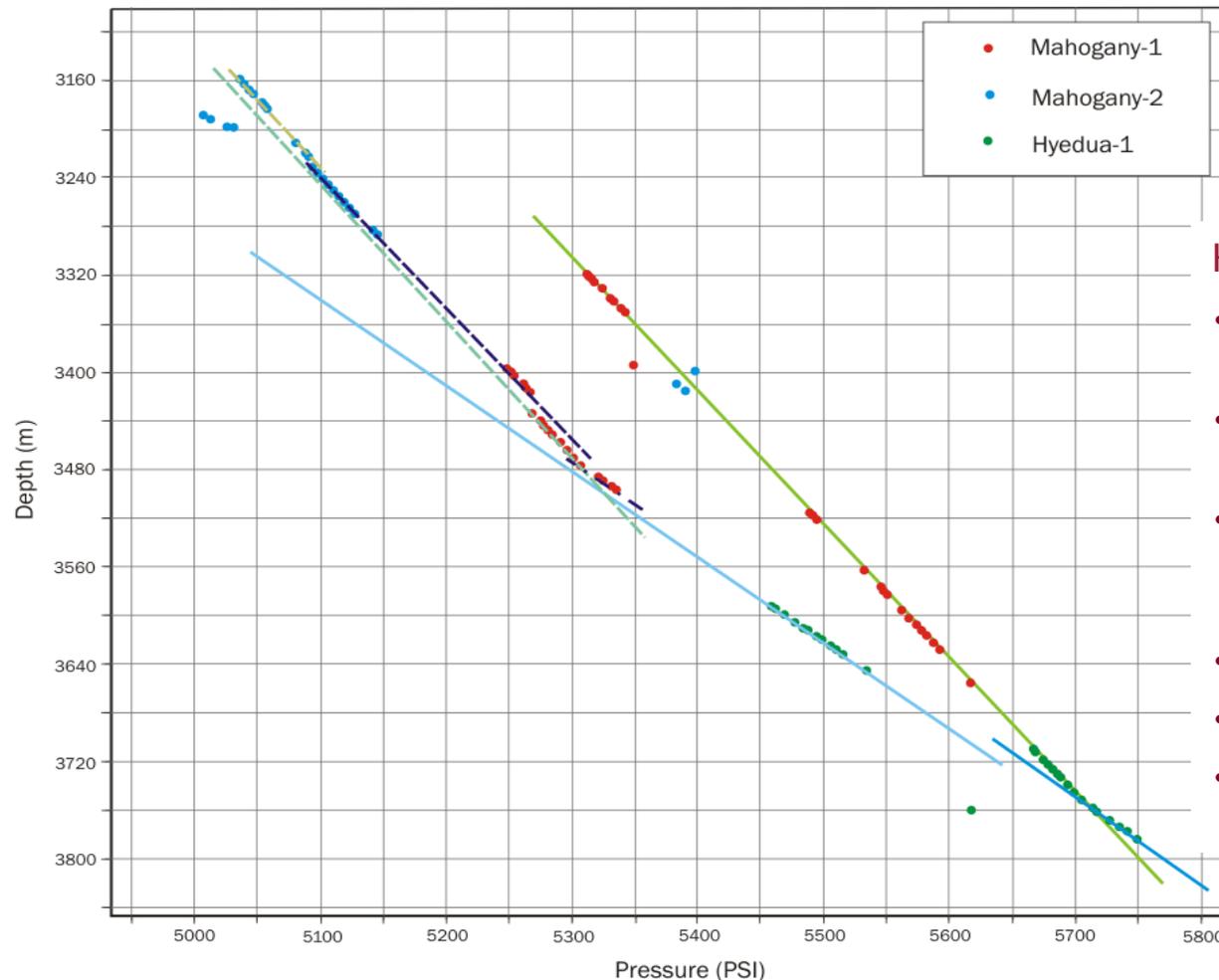
- Basin floor
- Unconfined sand sheets,
- Laterally continuous- as reflected in seismic
- Potentially amalgamated, high N:G



## Mahogany-2 Well Area

- Amalgamated channels
- Erosional features
- Potentially higher vertical connectivity and lower lateral connectivity
- Localised high net to gross

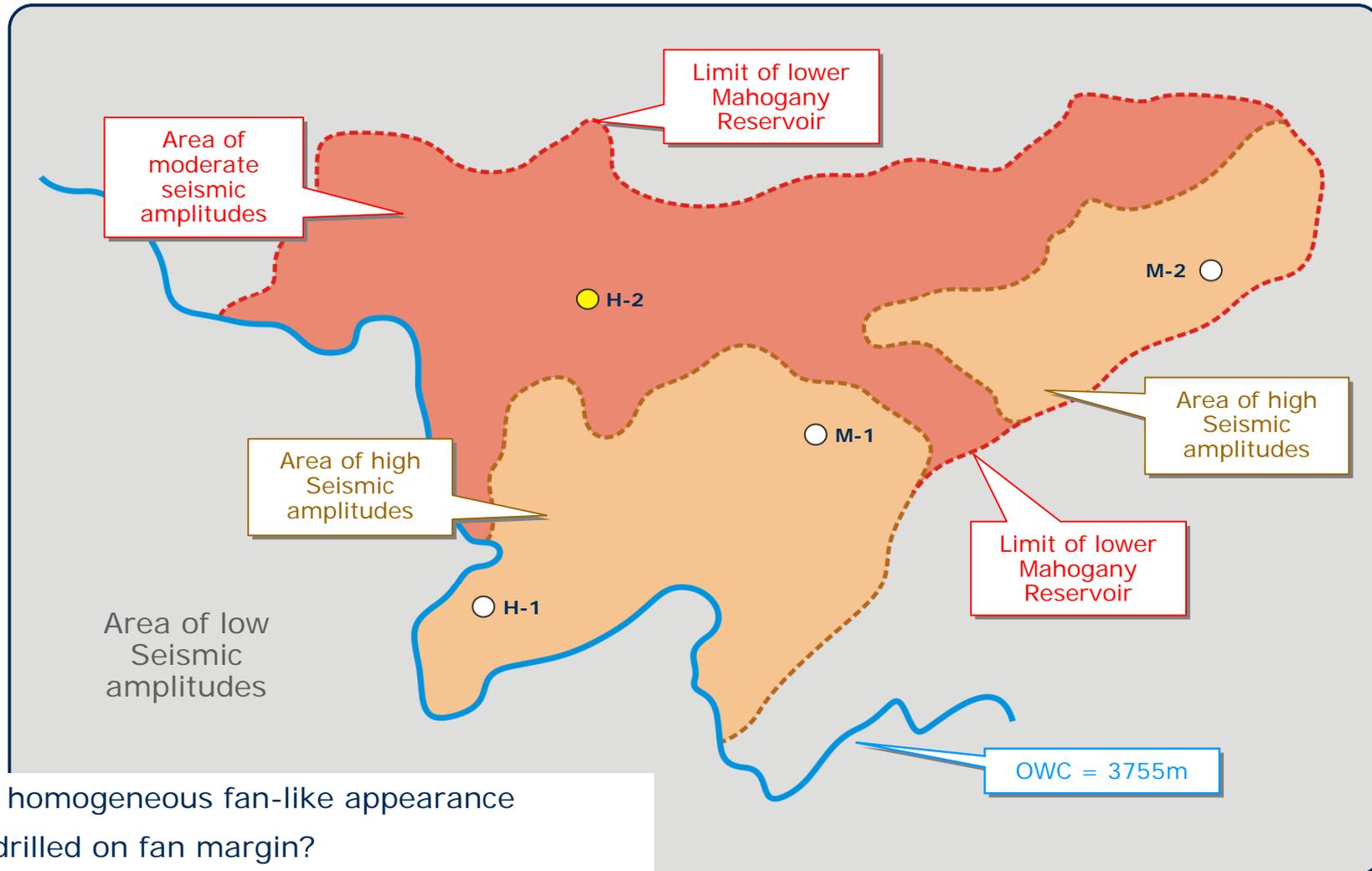




## Highlights

- Large vertical relief with continuous oil columns >400m.
- Reasonably steep reservoir dips, 3-5° on flanks & 10° at crest.
- Unique oil/water contacts for Upper & Lower Mahogany reservoirs.
- Light, low viscosity oil – 37° API.
- High gas/oil ratio – 1,200 scf/stb.
- Average LM reservoir pressure – 5,500 psi.

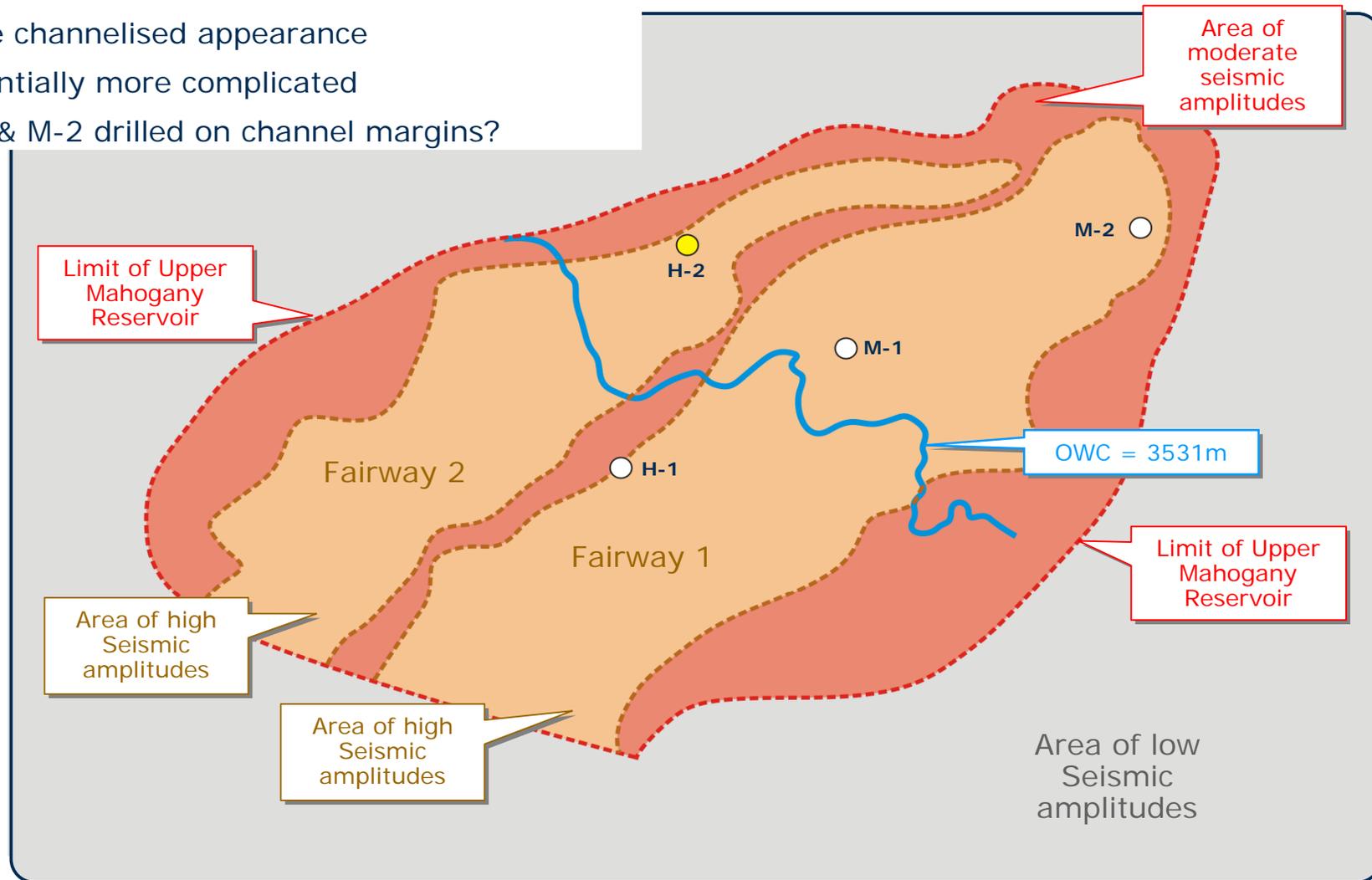
# Jubilee Field - Lower Mahogany amplitude map



- More homogeneous fan-like appearance
- M-2 drilled on fan margin?
- H-2 to test northern flank of fan

# Jubilee field - Upper Mahogany amplitude map

- More channelised appearance
- Potentially more complicated
- H-1 & M-2 drilled on channel margins?



## Reservoir/fluid advantages

- Excellent permeabilities (100 – 1000md)
- Homogenous sand in central core area
- Low viscosity oil (0.3 cP)
- Reasonably steep structural dip (c. 5%)
- Large oil columns (400m+)

## Reservoir/fluid challenges

- Reservoir pressure close to bubble point.
- Uncertainty over degree of well connectivity
- Water injection must commence at first oil to prevent gas breakout in the reservoir

## Typical recovery factors in fields of this type

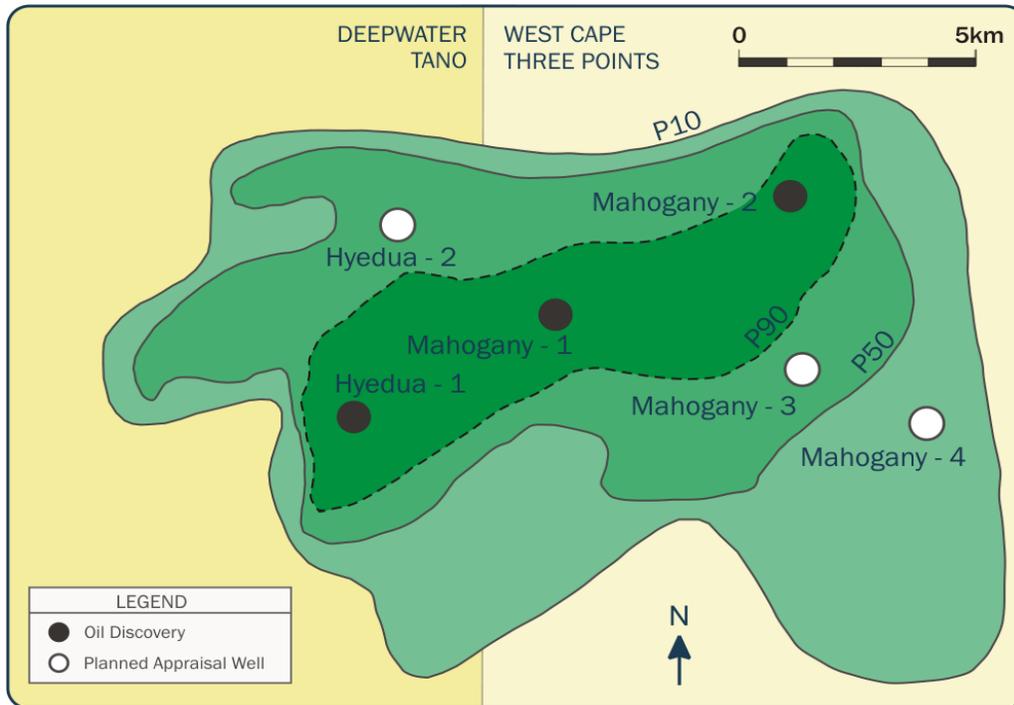
Recovery mechanism	Recovery Factor
Primary Depletion	5 – 15%
Waterflood	20 – 55%
Waterflood with gas injection	30 – 65%

Jubilee has excellent reservoir characteristics for achieving high recoveries utilising water and gas injection

## Appraisal continues to define potential

- At least three further Jubilee appraisal wells planned, coincident with development drilling
- Gross resource potential expected in the range of 500 – 1000 – 1800 mmbbl
- Significant associated gas resources ~ 800bcf

	STOOIP (mmbbls)	Recoverable Resources (mmbbls)
P90	1,255	588
P50	2,767	1,028
P10	6,293	1,829



Current resources 500-1000-1800MMbo

## Hyedua-2 (CoS ~80%)

- Low risk up-dip appraisal of amplitude anomaly
- Prove reservoir and connectivity to existing wells
- Intersect a possible younger channel system

## Mahogany-3 (CoS ~50%)

- Significant exploratory step-out
- Assess the eastern field limit and lateral extension of the Upper Jubilee sands
- Calibration of un-penetrated dim seismic reflectivity under Campanian fan
- Exploration upside in untested deepest part of Jubilee fan system above Lower Jubilee OWC

## Mahogany-4 (CoS ~25%)

- Success case follow up to increase proven resource in the south east
- Location contingent on success of Mahogany-3

- Highly experienced team in place
- World class “giant” field development opportunity
- Exceptional reservoir and fluid characteristics
- High recovery factors and offtake rates achievable
- Focused appraisal programme to gather critical data
- Phased development approach to mitigate remaining uncertainties
- Embarking on definition of next phases of development

# Jubilee development project phase 1 – Stuart Wheaton



- Initial well results indicated Jubilee discovery to be commercial
- Earliest first oil critical target for Ghana
- Potential scale likely to require multiple phases of development
- No existing onshore or offshore oil & gas infrastructure

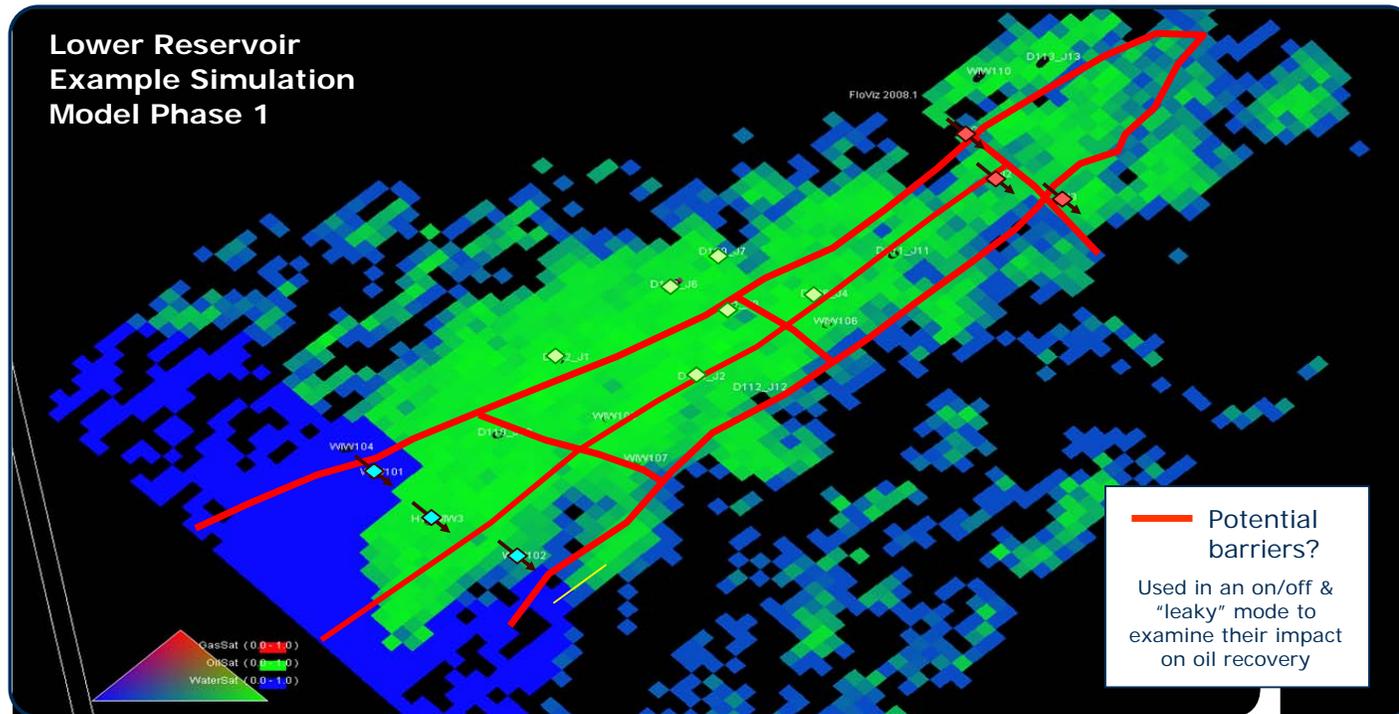
## Development Strategy

- Partnership agreed phased approach with target of 2010 first oil
- Appraisal to continue in parallel with Phase 1 development
- Phase 1 learnings to be used to optimise full field development
- All activities to focus on Phase 1 delivery and full field planning

- Tullow appointed as Unit Operator
- Joint Operating Committee (JOC)
  - Tullow chairs with representatives of all parties
  - Meets monthly to steer project on fast track basis
  - GNPC full member of JOC to ensure full alignment
- Kosmos appointed Technical Operator of Integrated Project Team (IPT)
  - Recognises Kosmos position as Operator of WCTP licence to deliver Plan of Development and production facility to Unit Operator
  - Dallas based and staffed mainly by Kosmos & Anadarko personnel
  - Enables Anadarko's deepwater project capabilities to be respected and leveraged
  - Sufficient Tullow personnel to ensure input by and close interface with Operator

- First oil schedule – deliver a sizeable but manageable project with a 2010 start-up
- Accommodate future phases and gas export/injection - no gas flaring
- Maximize reservoir learnings
- Manage facility design uncertainties and the need for flexibility
- Costs and market timing
  - A 2010 major contract (FPSO and subsea) opportunity “window” was seen early and was captured

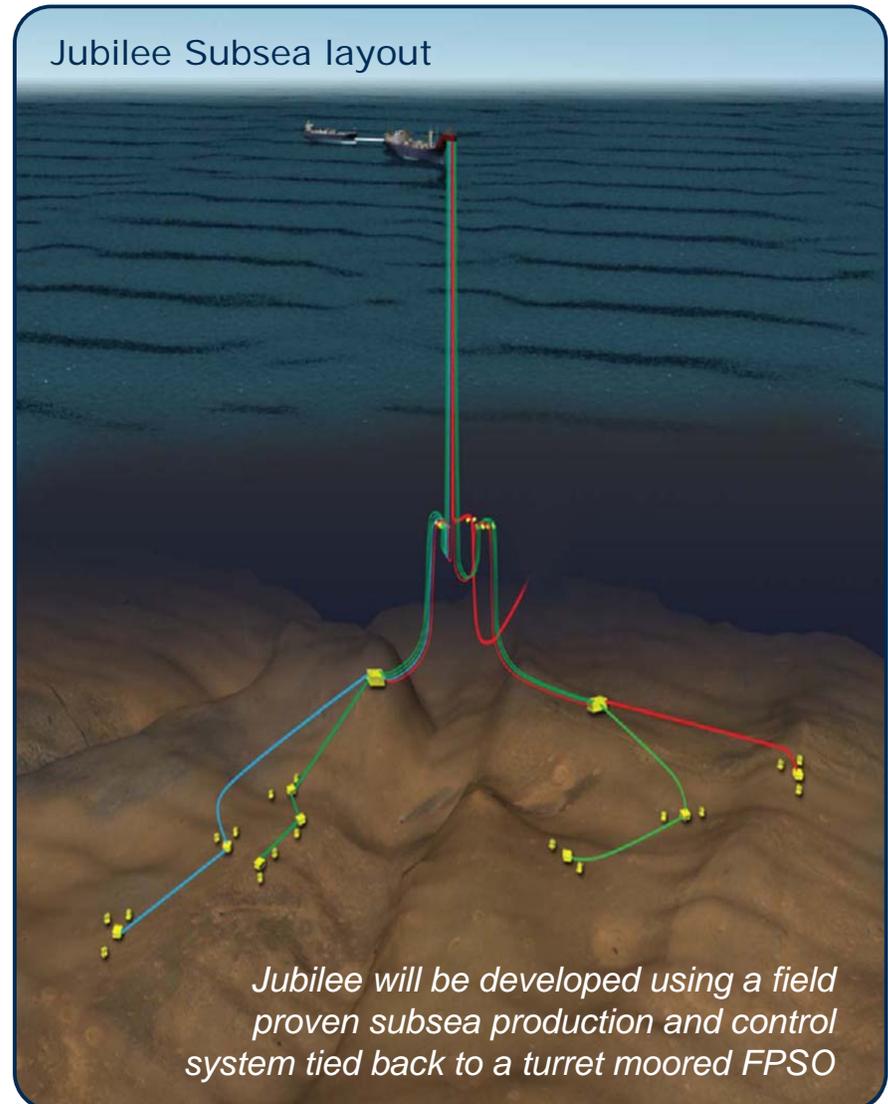




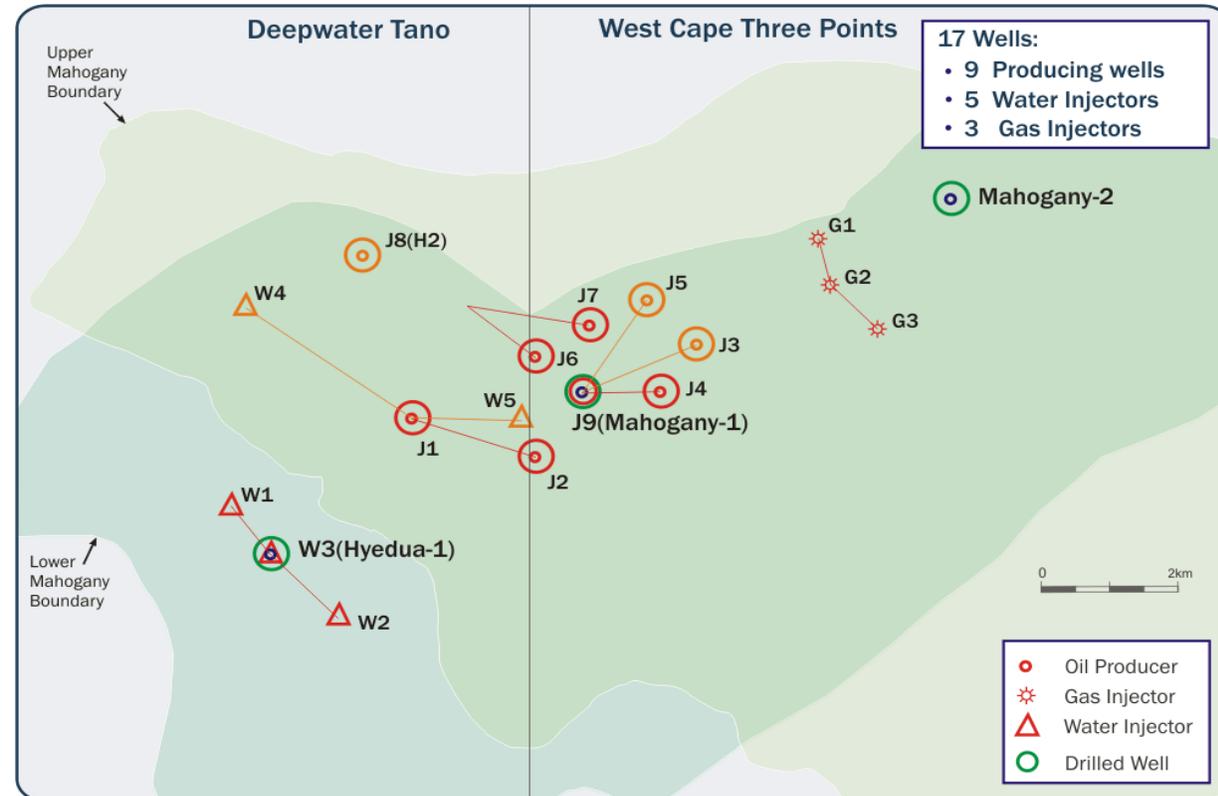
- Channel sand limits or faults may limit reservoir connectivity, but there are thick sands in the “core” area especially in the Lower Reservoir in this “giant” field
  - We have examined their potential impact on oil recovery
- By analogy to other fields, and given the early stage of reservoir appraisal, it is prudent to assume for now that “some” compartmentalisation may occur
  - Reservoir understanding will be gained from new well results, flow testing and ultimate production phase
- The development scheme and drilling program must be flexible and responsive

## Factors leading to FPSO and subsea solution

- Water Depth: 900 to 1700m
- Seabed temps: 3°C
- Long distances (11km M2 to H1)
- Shallow depth of reservoir: M1 well - reservoir is 2100m below seabed
- Seabed conditions: 2 broad seabed canyons with active currents and slumps
- Remote location: FPSO required for storage and offloading

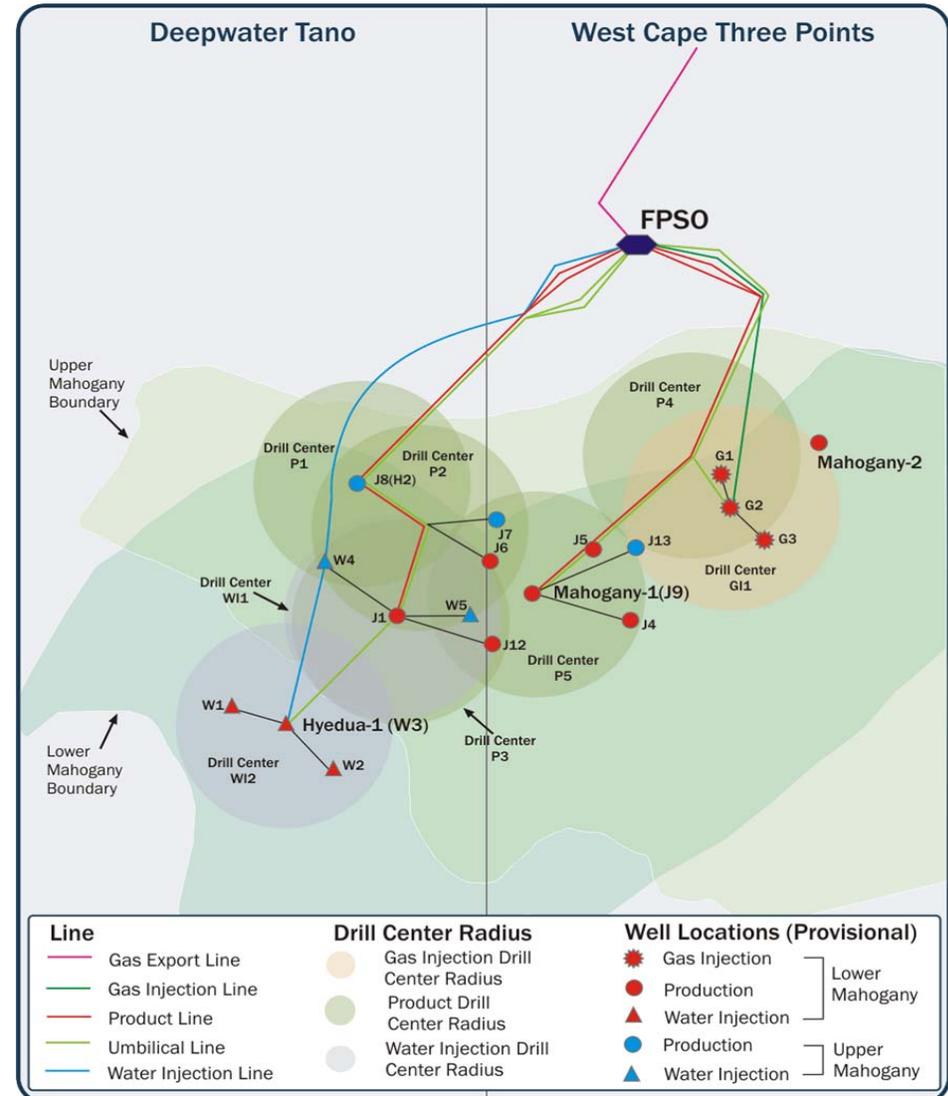


- Focus on oil-in-place delineated by current 3 well data and seismic in the “core” area
- 17 well plan (re-use 2 existing E&A wells) with start-up in 2010
- Immediate water injection support with gas injection & export
- Lower Reservoir “core” area (~M1 to ~H1) is the Phase 1 focus, plus initial Upper Reservoir development



Phase 1 – 17 well scheme; schematic reservoir outlines, initial well locations only

- Sub-sea canyon West Side
  - 3 prod manifolds; 12 well capacity (5 – Ph.1)
  - 2 water inj manifolds; 8 well capacity (5 – Ph.1)
  - 26 km flowlines
- Sub-sea canyon East Side
  - 2 prod manifolds; 8 well capacity (4 – Ph.1)
  - 1 Gas inj manifold; 4 well capacity (3 – Ph.1)
  - 17.5 km flowlines
- Typical deepwater flow assurance
  - cool sea-bed, some wax in oil adds pigging loops, hot oil circulation systems with line insulation
  - chemical inj for scale, hydrate, corrosion control
  - uphill flow to stabilise flow in lines
  - sand control in wells
  - sulphate reduced sea water inj to minimise well scaling and reservoir souring risks
- Major reservoir data gathering
  - well flow tests and flow tests between wells
  - further reservoir coring
  - full telemetry of well and facility performance to shore during production phase



# Jubilee field – Phase 1 summary project status

- Limited availability of subsurface and engineering data managed by
  - design/capacity ranges for wells, subsea layout and FPSO
- Significant pre-sanction commitments to mitigate schedule risk (>\$200 million gross)
- Contractual certainty on major requirements
  - Rigs (Eirik Raude & Blackford Dolphin)
  - FPSO (MODEC)
  - URF installation vessels (tba - imminent)
  - Subsea equipment (FMC, tba - imminent)

Ohdoh tanker prior to move to yard end Sept 2008



Major subsea pipelay vessel



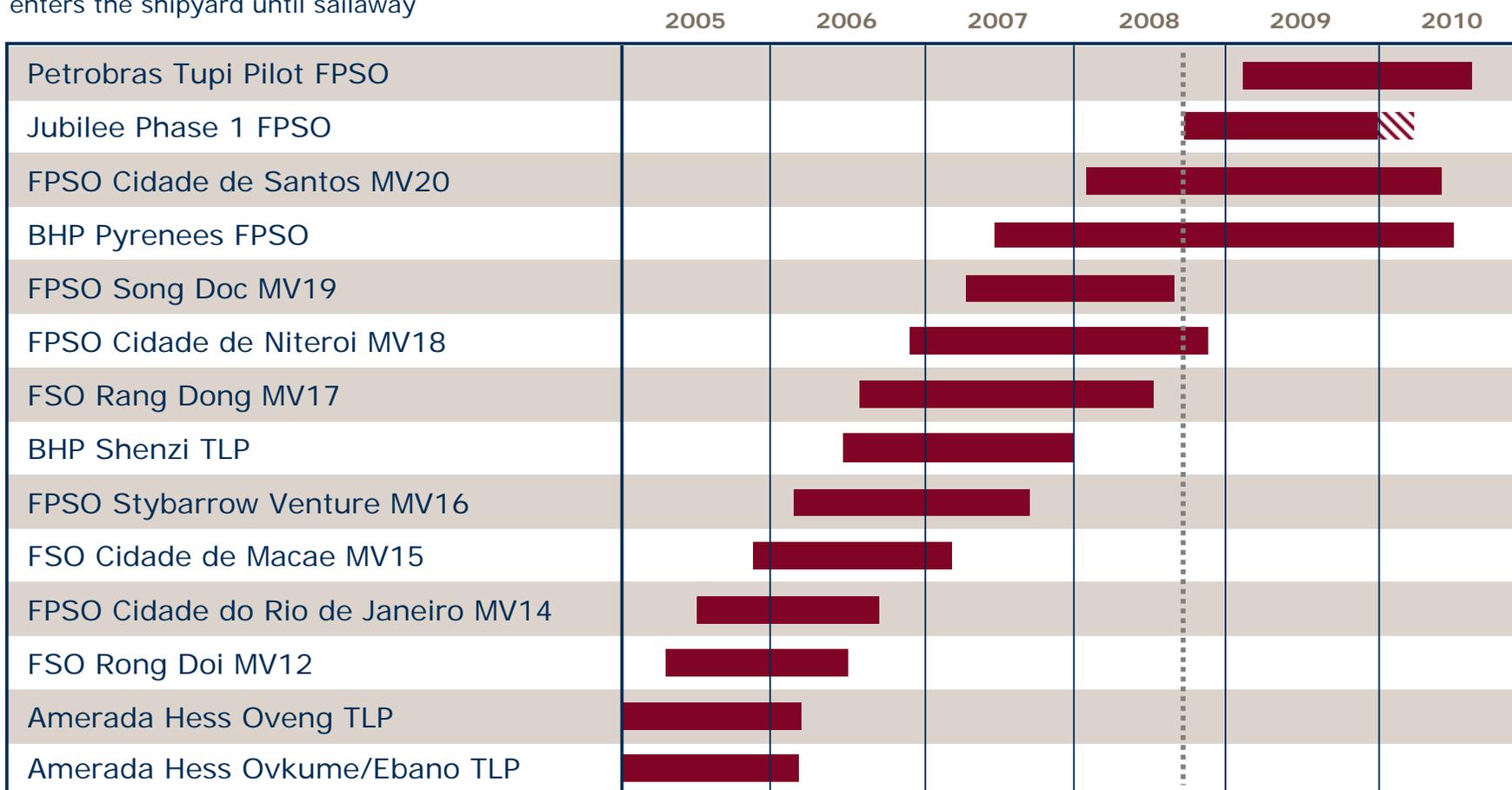
# Jubilee field – FPSO execution and status

- Phase I FPSO
  - Oil: 120,000 BOPD - Total fluids: 160,000 BFPD - Water injection: 232,000 BWPD
  - Gas: 160MMSCFD to export up to 3,000 psi AND 160MMSCFD to injection up to 5,500 psi
  - ~ 1.8MMBbls oil storage
  - Turret capacity for at least 15 risers
- Target FPSO arrival at Jubilee in Q2 2010 or earlier
- Chose MODEC as Phase I FPSO Contractor;
  - Technically “best” (hull, design, sparing, schedule, track-record, commitment) and commercially most attractive. Chinese based yard and topsides solution is proven for MODEC supply.
  - High grade approach to EHS
  - Long lead items already ordered, e.g. power generation. Detailed engineering commenced.



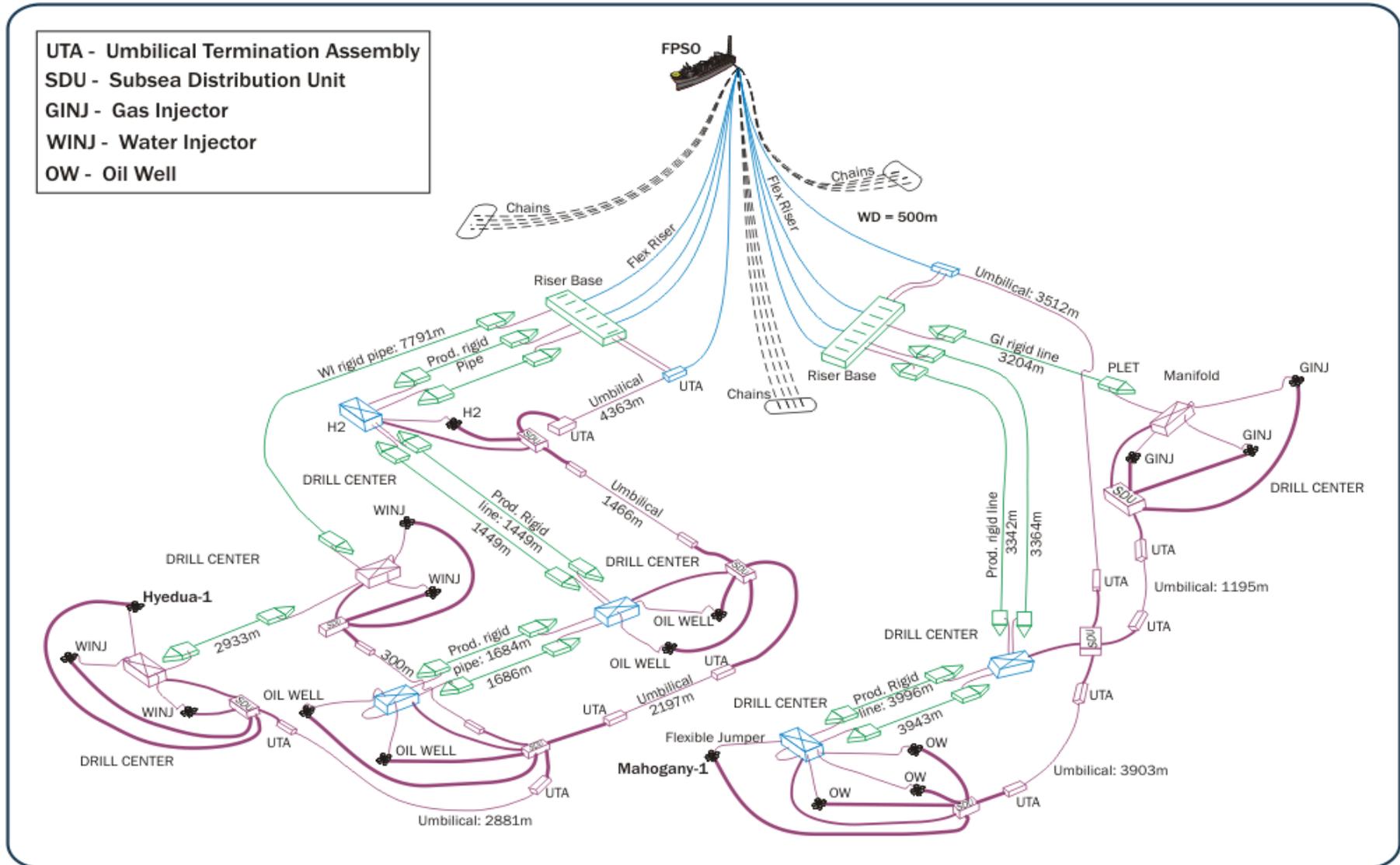
## EPC Phase of the Indicative Projects

Dates are shown for when the tanker enters the shipyard until sailaway



MODEC typical capacity of 4-5 major parallel projects

# Jubilee field – Phase 1 SURF installation challenge



# Jubilee Field – fixing the subsea installation schedule/windows

example schedule and vessel availabilities



	2009		2010						
	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
FPSO ready to receive risers					●				
Pipelay (Reel & Jlay), piles and riser bases		■							
Riser Lay (flexibles and dyn umbilicals)						■			
Touchdown mon, jumpers, static umbilicals & subsea distribution		■							



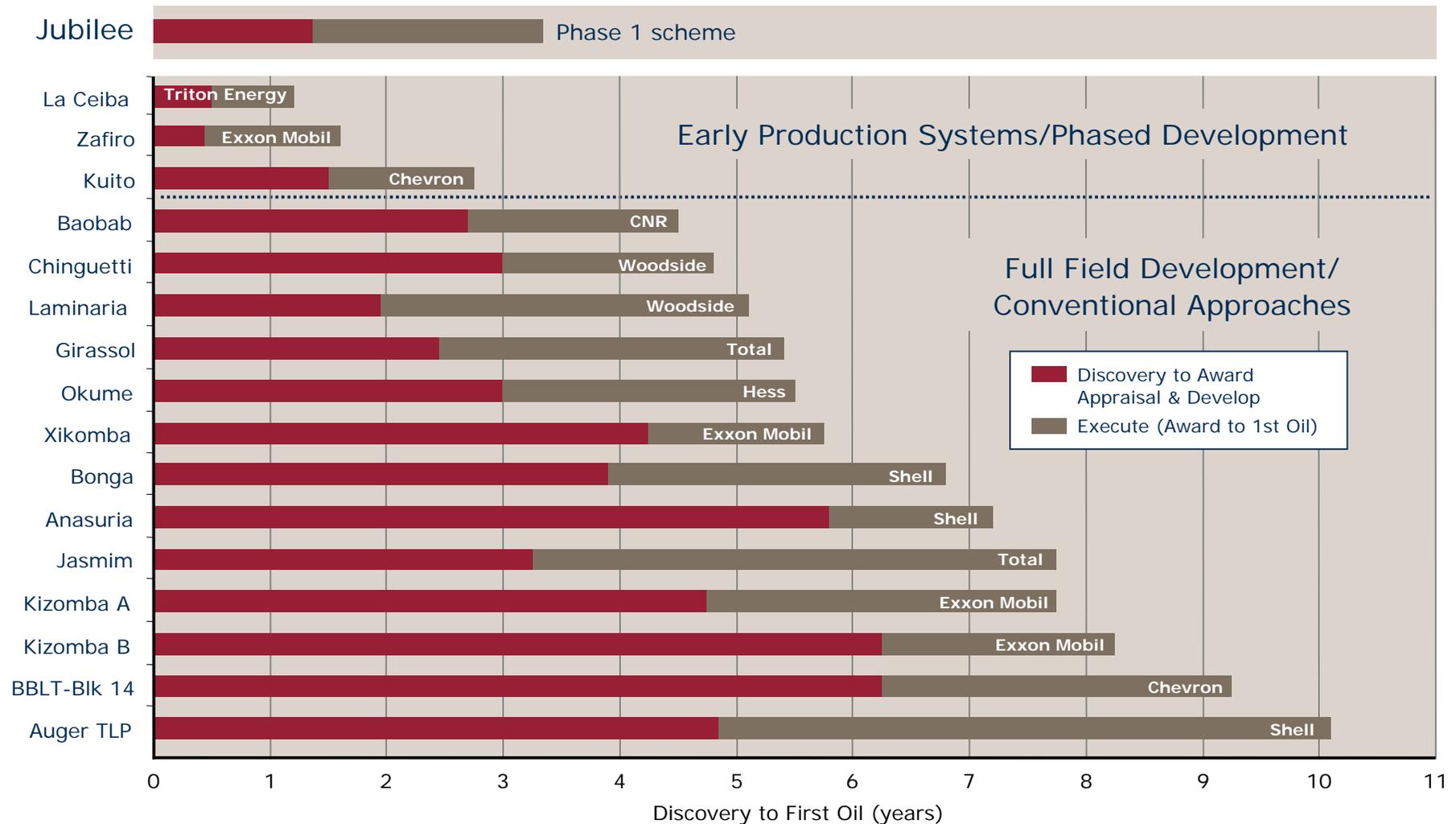
Major subsea pipelay vessel at pool yard



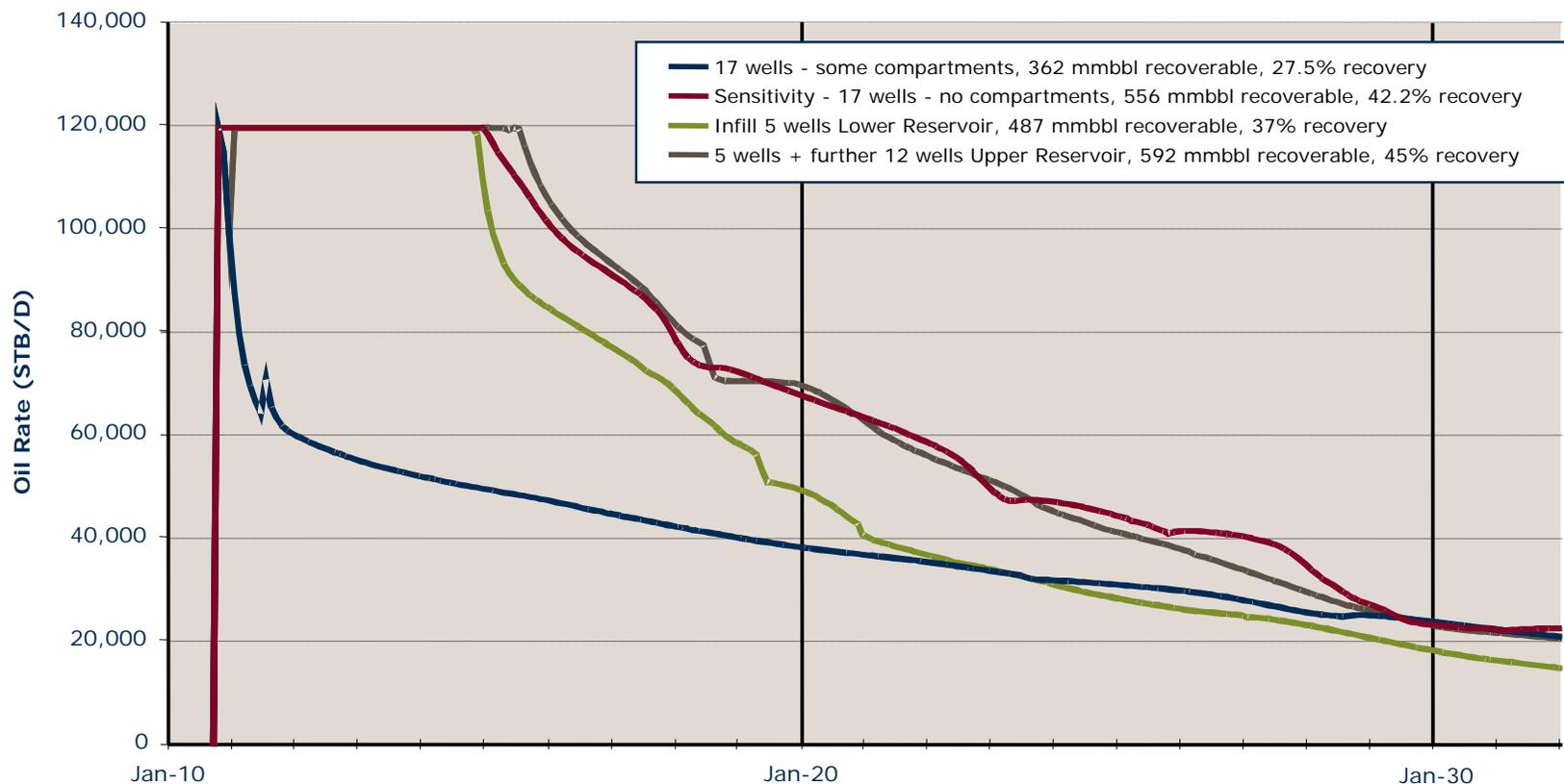
Subsea installation vessel; flexibles, risers, umbilicals



# Jubilee Field – Phase 1 schedule benchmarking



# Jubilee field – Phase 1 production profile expectation



- Key: if compartmentalisation, re-locating and/or adding wells as reservoir data is obtained
  - some compartments assumed now is a prudent investment test case
- The Phase 1 investment may require supplementary infill programs to maintain plateau
  - example infill impact programs shown – the facility and drilling programs are flexible to respond
- Analogue published field oil recoveries
  - Girassol (Angola) 45%, Marlim (Brazil) 33%, Schiehallion (UK) 55%, Bonga (Nigeria) 40%+, Mars (USA) 25%, Okhume (EG) 35%; we have compared the development and performance of these fields

# Jubilee Field – Phase 1 Capital sanction case cost estimate

*assumes FPSO lease initially then later potential purchase*



- Phase 1 capital sanction estimate \$3.1 billion

Wells 1.5\*

Facilities and subsea 1.0

*N.B. FPSO not purchased up-front*

Pre-operations, Ghana infra-structure, G&A 0.3

Contingency 0.3

- Phasing
 

	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>
	13%	45%	35%	7%

Majority (>70%) of estimate set by rates in major contracts such as drill rig, FPSO and subsea which are already awarded.

All long lead orders are now placed.

Contingency at 15-20% of not yet fixed prices or time sensitive categories results in ~10% level going forward.

\*17 wells (including up to 3 gas injectors) + 1 contingent well + 2 cores + multiple flow tests and inter-well interference tests

## CAPITAL

Unit capex Phase 1 <i>(362 mmbbl case)</i>	~9	\$/ bbl
if purchase FPSO in Year 1-2	~2	\$/bbl
Total	~11	\$/bbl

- Decision to exercise FPSO purchase pending reservoir and FPSO performance
- If infill drilling required typically incremental ~5 \$/bbl initial rising to ~10 \$/bbl

## OPERATING

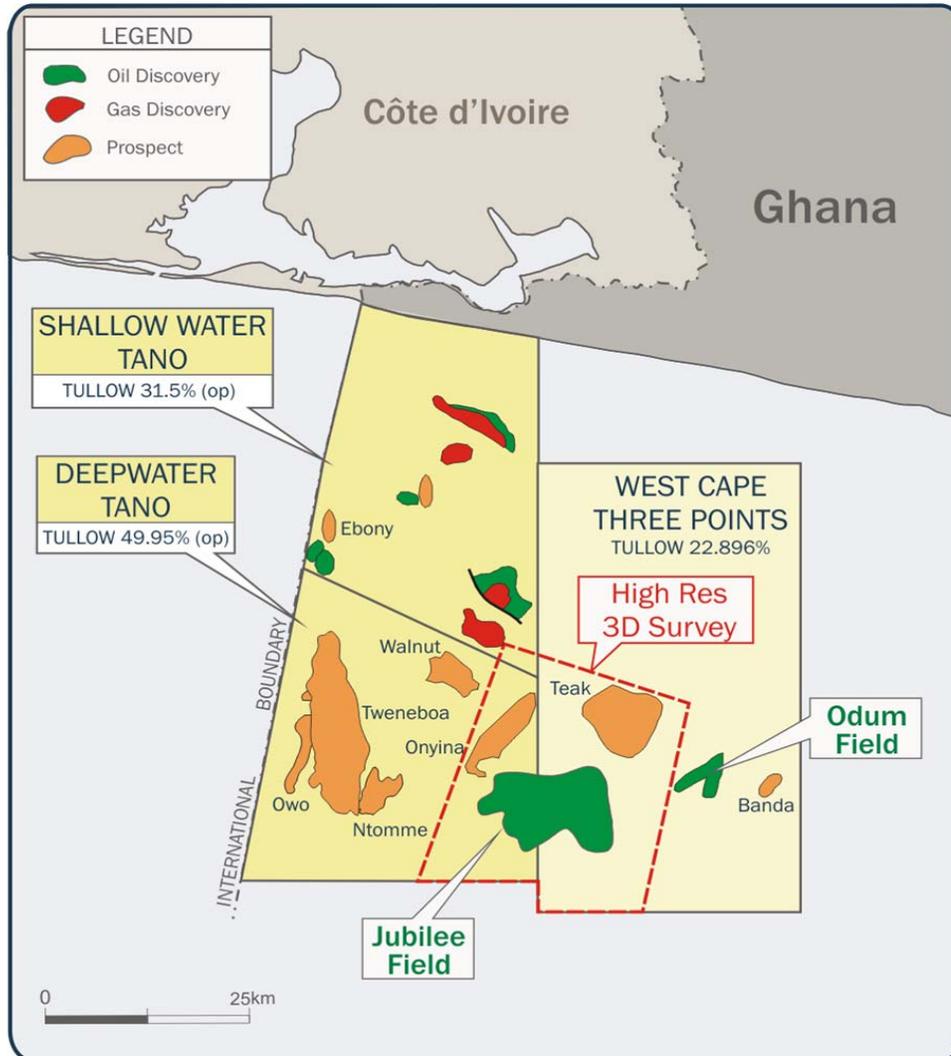
Year 1-2 opex + G&A	~7	\$/bbl
		<i>incl. ~2.5 \$/bbl FPSO lease</i>
		<i>incl. ~1.5 \$/bbl G&amp;A</i>
Year 3-7 opex + G&A	~7.5	\$/bbl
		<i>no lease cost assumed</i>

- Year 7+ unit opex may escalate dependent on production and/or later phases
- Operating cost estimates are driven mainly by reliability assumptions of the subsea system and wells, and logistics cost management in Ghana – shore bases, marine and aviation

- Project execution is under way for first oil in 2H 2010
  - A conventional FPSO-subsea scheme has been selected with appropriate technical mitigations
  - Critical path currently sits in subsea fabrication and lay
  - All major facility contracts awarded providing good confidence in cost estimation and schedule
- The facility scheme and drilling program is flexible and responsive to reservoir outcome
  - Phase 1 sanction cost estimate contains extensive early well data gathering to improve confidence and indicate if new locations and/or extra well investment may be required, or otherwise
- The Joint Venture fully understands that there are significant challenges to execute a major deepwater scheme in a new upstream location

## Ghana well operations – Mike Williams/Alan Dowokpor





## Delivery Scope

- Exploration - Tweneboa, Teak etc
- Appraisal – Jubilee and new discoveries
- Development – 17 Jubilee Phase 1 wells
- Jubilee Phase 2 – unknown no. of wells

## Main Challenges

- Fast track start-up
- Building a capable team
- Getting the right rigs and materials
- Balance immediate requirements with future strategy and plans
- Setting up in-country infrastructure
- Attracting vendors and service providers
- Planning for future growth



## RIGS

Secure appropriate deepwater capacity



## PEOPLE

Build a world-class team



## EXECUTION

Clear strategy and continuous improvement



## RIGS

Secure appropriate deepwater capacity



## PEOPLE

Build a world-class team

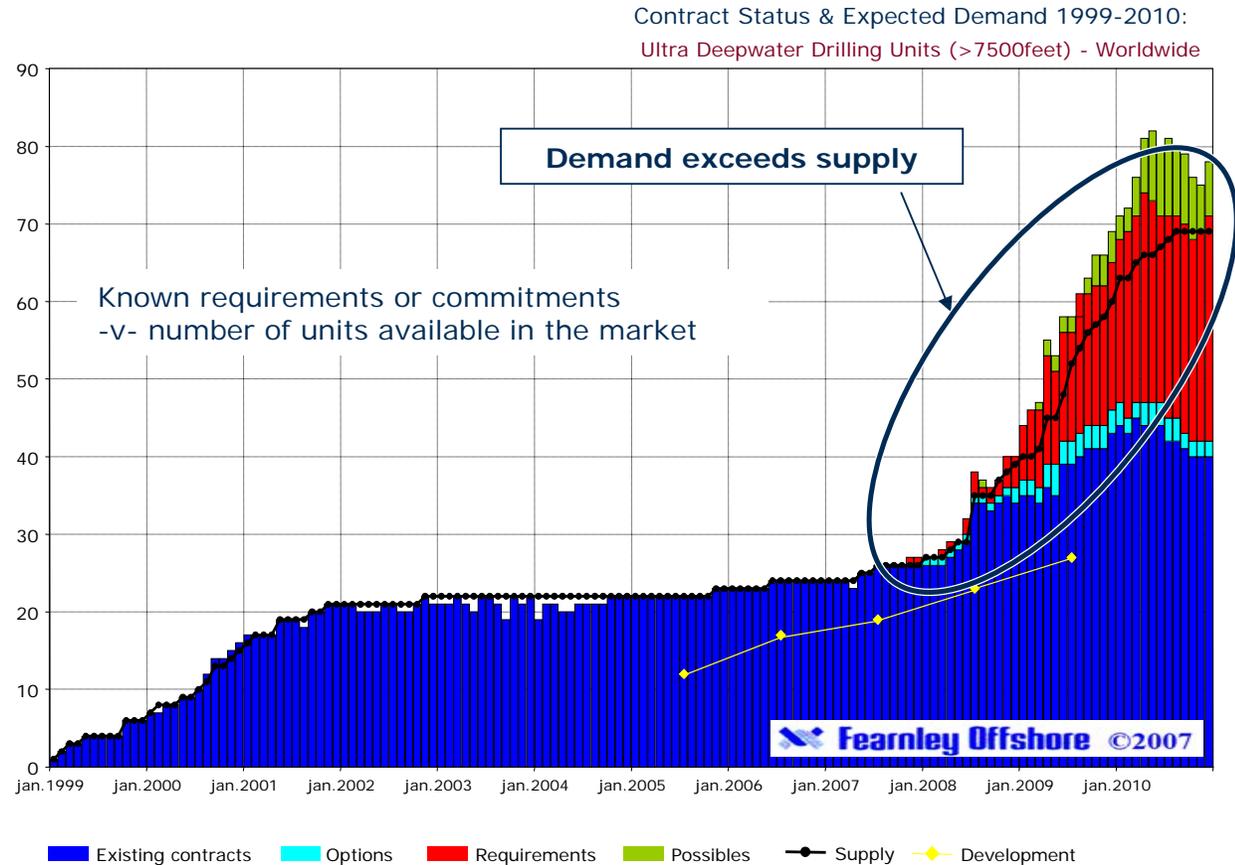


## EXECUTION

Clear strategy and continuous improvement

# Deepwater rig supply/demand – a tight market

- Visible demand exceeds supply into 2011
- Excess demand will be re-distributed when new rigs become available (post 2011)
- Rig rates driven upwards by medium term under-supply and oil price
- Historically, rates track oil price curve shape with a six-month lag
- Current average availability lead time is 2 years (both existing and new units)
- 75% of new-builds already contracted – but competition hot for the remainder



## Requirement

- Early appraisal activity identified in August-07 (after Hyedua-1 well)
- Short-term contract to drill and test 3 - 5 wells

## Delivered

- Blackford Dolphin - Dolphin Drilling - Fred Olsen
- In-depth market knowledge and industry contacts identified availability window
- Rapid execution of LOI on 24 August 2007; secured 220 day contract (maximum available)
- 6,000ft water-depth capable moored semi-submersible – ideal for appraisal/testing activities
- Extensive re-build/enhancement – completely new drilling package and equipment (engines, cranes, anchor winches etc.) – Tullow managed acceptance



## Anchor Handler / Supply Boats secured to support Blackford operations

Gulf Offshore  
M.V. HIGHLAND COURAGE  
(2002)  
UT722L 16,320 BHP AHTSV



Gulf Offshore  
M.V. "HIGHLAND VALOUR"  
(2003)  
UT722L - 16,320 BHP AHTSV



## Requirement

- Long-term contract on a dynamically positioned rig suitable for a dispersed subsea development
- Flexibility in the contract term to avoid initial over-commitment

## Delivered

- Eirik Raude – Ocean Rig
- 10,000 ft water depth, dynamically positioned (DP) Semi-submersible
- High end, working rig
- Min 3-yr Contract
- 1 or 2-yr options

EIRIK RAUDE (2002)

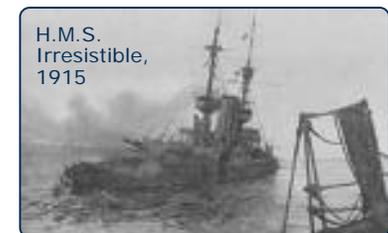


## Supply Boats secured to support Eirik Raude operations

Swire Pacific Offshore  
AURORA (2008)  
UT755L3 A-Class PSV



Fratelli D'Amato  
FD IRRESISTIBLE (2008)  
(No Photo Available)



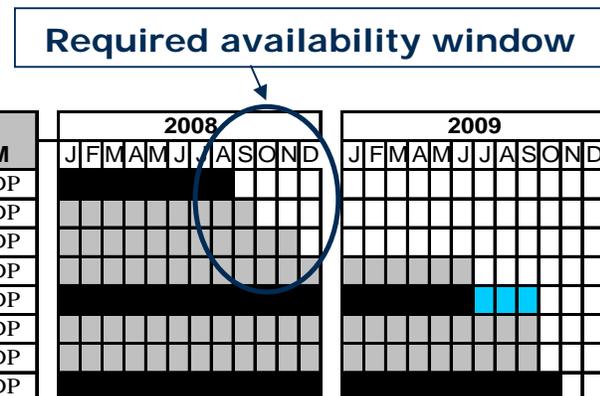
# Rationale behind Eirik Raude commitment (1)



- Post securing the Blackford Dolphin, Tullow anticipated the requirement for further rig time and undertook further market analysis and an availability enquiry 4Q 2007
- Only eight dynamically positioned rigs available in the period to end 2009
  - Balance of new rigs already contracted
  - Limited number of older moored rigs available (no new-builds)
- Initial appraisal / development programme confirmed by JV Partners in January 2008
- Pro-active planning and nimbleness enabled Tullow to secure the Eirik Raude to beat fierce competition ensuring opportunity to meet schedule for first oil in 2010
- Rig secured in only 3 weeks and contract signed on 15th February 2008

Available DP Rigs, WD > 6,000 ft, 2008 – 2009

RIG	OPERATOR	AREA	CONTRACTOR	TYPE	WD	Dual	M
EIRIK RAUDE	EXM	GOM/CAN	Ocean Rig	SS	10,000	N	DP
WEST EMINENCE (ED 2)	YARD/AVAILABLE	SEA	Sadrill	SS	4,100	Y	DP
WEST TAURUS (S9)	YARD /AVAILABLE	SEA	Sadrill	SS	10,000	N	DP
MPF	YARD/AVAILABLE	SEA/SPA	MPF	DS	12,000	N	DP
GSF EXPLORER	BP	WAFR	GSF	DS	7,800	N	DP
SCARABEO 9	YARD /AVAILABLE	SEA	Saipem	SS	12,000	Y	DP
DEEPWATER PACIFIC II	YARD /AVAILABLE	SEA	Tanker Pacific	DS	10,000	N	DP
LEIV EIRIKSSON	TOTAL/SHELL	WAFR/UK	Ocean Rig	SS	8,200	N	DP



FIRM CONTRACT  
 OPTION  
 CONSTRUCTION/YARD  
 FARM-OUT POSSIBILITY



Fearnley Offshore ©2007

# Rationale behind Eirik Raude commitment (2)



## Deep Water Rig Contract fixtures in Six Months prior to Eirik Raude Commitment

Date	Rig	Operator	Contractor	SS/DS	DP/M	UDW	HE	WD	Country	Region	Rate	Start Date	Lead Time	Duration (mths)	Type
jul.07	West Aquarius	ExxonMobil	Seadrill	SS/6	DP	Y		7500	Indonesia	SEA	\$520,000	nov.08	28	36	N
jul.07	Saipem 12000	Total	Saipem	DS	DP	Y		12000	Angola	WAFR	\$450,000	mar.10	32	60	N
jul.07	ENSCO 8502	Nexen	ENSCO	SS/5	DP	Y		8500	USA	GoM	\$460,000	jan.10	30	24	N
sep.07	Stena Drillmax III	Hess	Stena	DS	DP	Y	Y	10000	USA	GoM	\$525,000	jul.09	22	60	N
okt.07	Frontier Bully 1	Shell	Frontier Drilling	DS	DP	Y		8000	Worldwide	Worldwide	\$390,000	feb.10	28	60	N
okt.07	Deepwater Pacific I	Reliance Energy	Transocean	DS	DP	Y		12000	India	Indian Sub	\$525,000	jul.09	20	48	N
okt.07	Deepwater Pathfind	KNOC	Transocean	DS	DP	Y		10000	Nigeria	WAFR	\$600,000	jul.09	21	5	N
nov.07	Belford Dolphin	Anadarko	Fred Olsen	DS	DP	Y		10000	USA	GOM	\$525,000	apr.10	29	36	E
nov.07	Scarabeo 9	ENI	Saipem	SS/6	DP	Y		10000	USA	GOM	\$455,000	nov.09	24	60	N
nov.07	Discoverer Spirit	Anadarko	Transocean	DS	DP	Y		10000	USA	GOM	\$520,000	jan.11	37	36	E
des.07	Frontier Bully 2	Shell	Frontier Drilling	DS	DP	Y		8000	USA	GOM	\$390,000	aug.10	32	60	N
jan.08	Pride TBA III	Petrobras	Pride	DS	DP	Y		10000	Brazil	SAM	\$502,000	jun.11	41	60	N
jan.08	Pride TBA I	BP	Pride	DS	DP	Y		10000	USA	GOM	\$480,000	aug.10	31	60	N

Source: Fearnley Offshore

- Average lead-time from contract fixture to expected commencement is 2½ years
- Eirik Raude lead time: 5 months
- Over 50% of contracts are for minimum 5 year term
- Eirik Raude contract term is minimum 3 years with a 1-yr or 2-yr option
- Prior market rate pushing \$525,000 (subsequent rates in high \$600k's)
- Thirteen of the fifteen rigs are new builds

# Additional committed rigs

- Tullow has in addition gained access to two rigs committed by JV Partner Kosmos
- Using the synergy of the JV partnership



## Aban Abraham

- 6,600ft Water Depth Dynamically Positioned Drillship
- Total 4 slots available



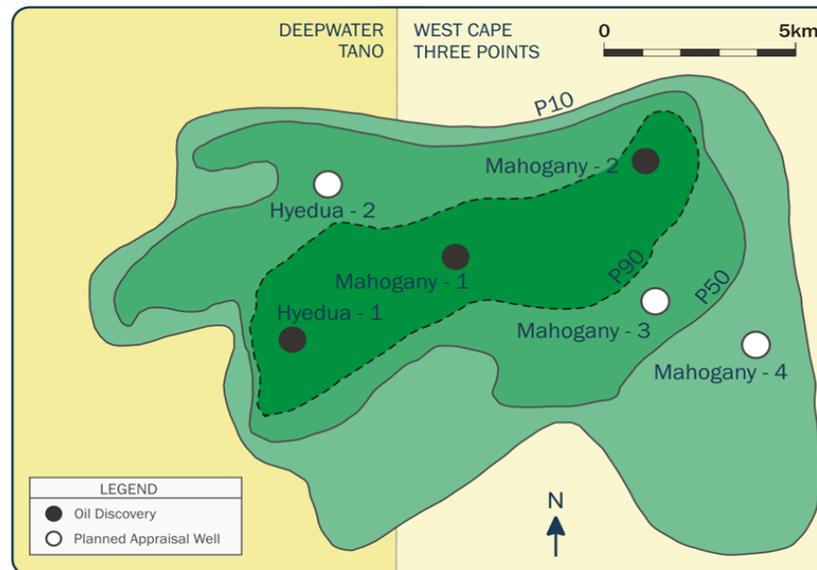
## Atwood Hunter

- 5,000 ft Water Depth conventionally Moored Semi-submersible
- 3 x 9 months available

## Strategy for further rig commitments

- Prepare and issue enquiry for a 2<sup>nd</sup> long-term DP rig (October)
- Award 3-5 yr contract once results of Hyedua-2/Mahogany-3 known (confirms Phase II), or Tweneboa-1 (confirms new hub)
- Likely commencement 1H 2011
- Short term; attempt to secure more time on Blackford Dolphin

## Jubilee Appraisal Programme



## Near-term Ghana Drilling Programme

RIG	2008				2009					
	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
Blackford Dolphin	Mobilisation			Hyedua-2	+ DST		M-1 DST	2 x Jubilee		
Eirik Raude		Mobilisation			Mahogany-3		Tweneboa	Multiple Jubilee wells		
Aban Abraham							Teak			
Atwood Hunter								Mahogany-4		Onyina

Appraisal  
  DST  
  Development  
  Exploration  
  Mobilisation

# Key requirements for success



## RIGS

Secure appropriate deepwater capacity



## PEOPLE

Build a world-class team



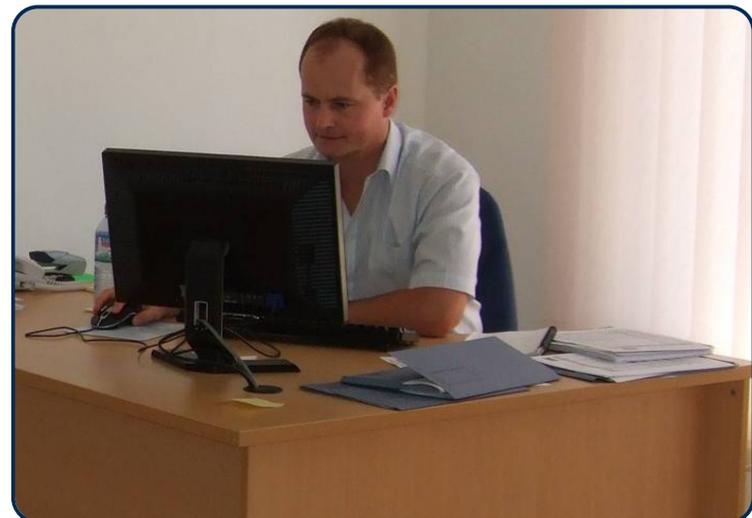
## EXECUTION

Clear strategy and continuous improvement

- Why has Tullow been able to recruit and establish a top Well Engineering team in only 4 months?
  - Excellent Company reputation: Tullow Culture, nimble organisation, environment
  - Long-term major project with growth and development opportunities
  - Recruitment of a few key personnel early-on had a cascade effect through personal contacts – ability to further cherry-pick the best talent
  - Remuneration package in top quartile, team responsible for total spread rate of over £1,000,000 per day
  - Top talent team will easily leverage value – one day of operations saved is equivalent to 40 days of team wages!

# World class well delivery team created

- Highly successful recruitment campaign completed in four months – all key positions filled
- Average individual level of experience = 19 years
- Good balance of Tullow staff with contractor/consultants in Tullow positions
- Experience from leading deepwater developments in West Africa, GOM, Brazil and Australia
- Experience in subsea operations, DP and moored rigs, completions with sand-control etc.
- Created Performance Manager position (JV Secondee – Anadarko)
- Long term plan to build local Ghanaian drilling engineering capability



# Key requirements for success



## RIGS

Secure appropriate deepwater capacity



## PEOPLE

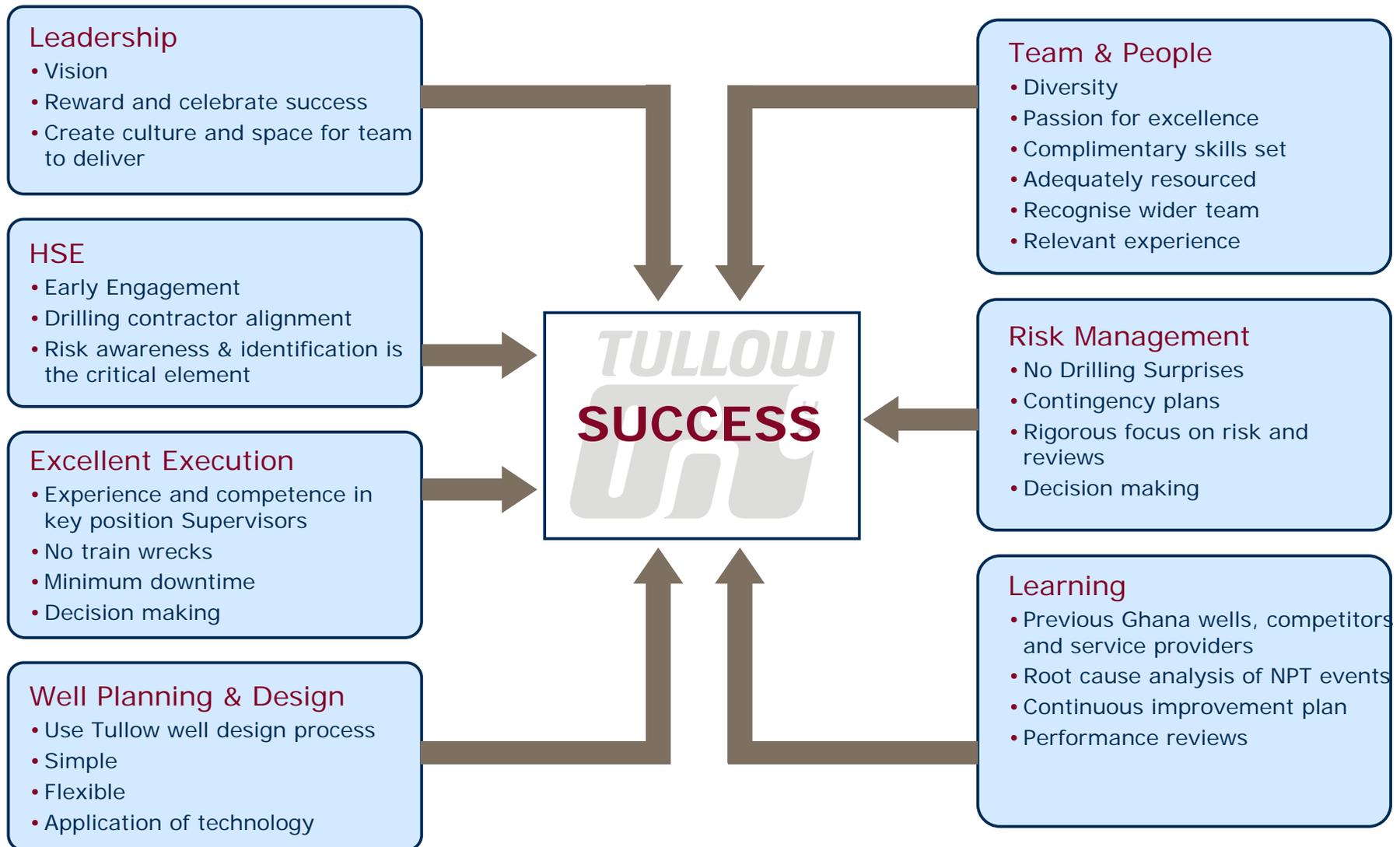
Build a world-class team



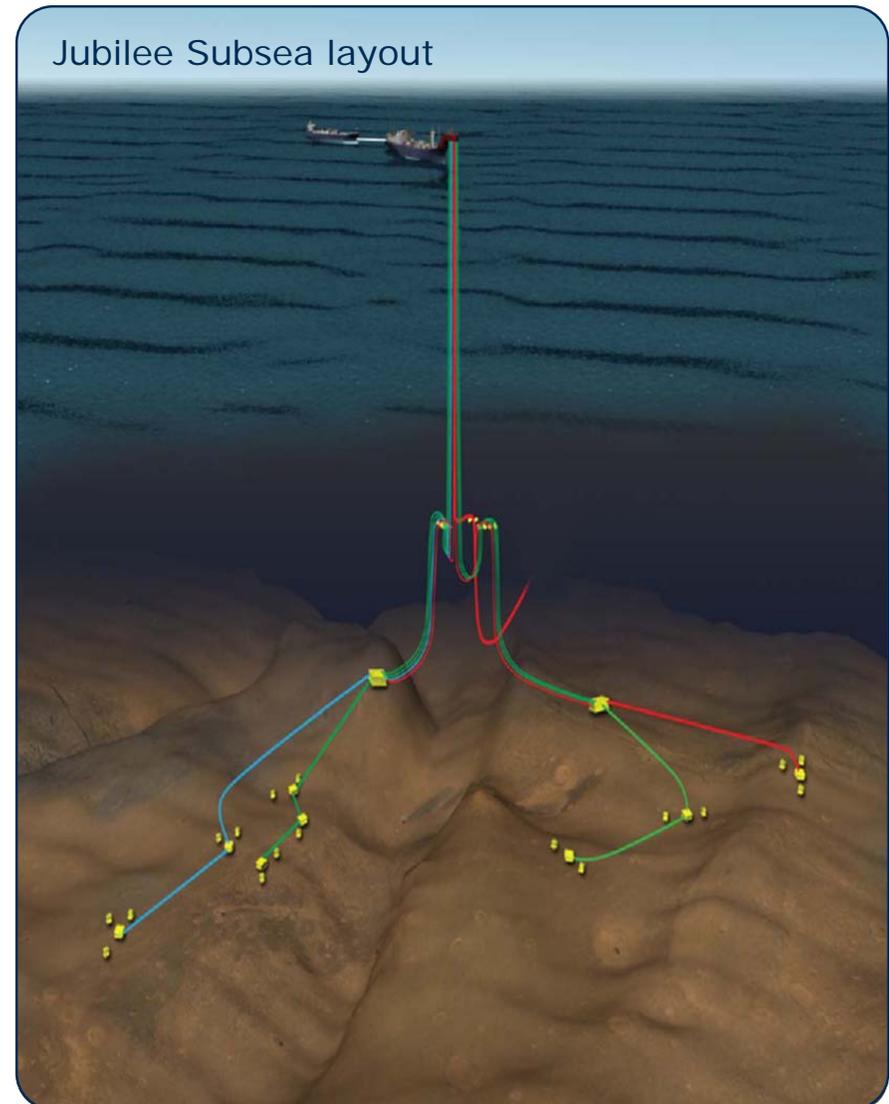
## EXECUTION

Clear strategy and continuous improvement

# Key execution success factors



- Jubilee is a “classic” West African deepwater development (average 1300m water)
- Metocean conditions are relatively benign
- Infrastructure: FPSO, risers, umbilicals, controls, subsea pipelines etc, 17 wells
- Total Phase-1 development budget: \$3.2 billion
- Wells budget is \$1.5 billion i.e. nearly 50%
- Average completed well cost \$88 mln

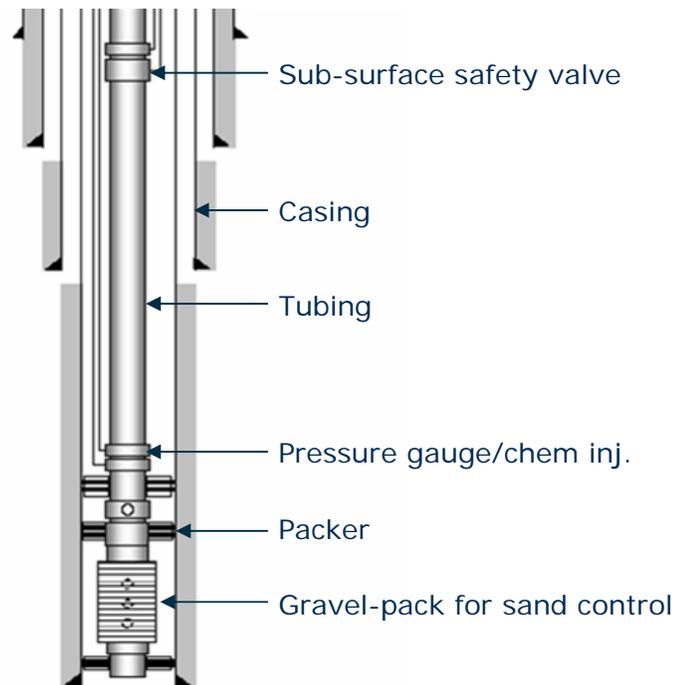


# Jubilee Phase-1 Scope - Wells

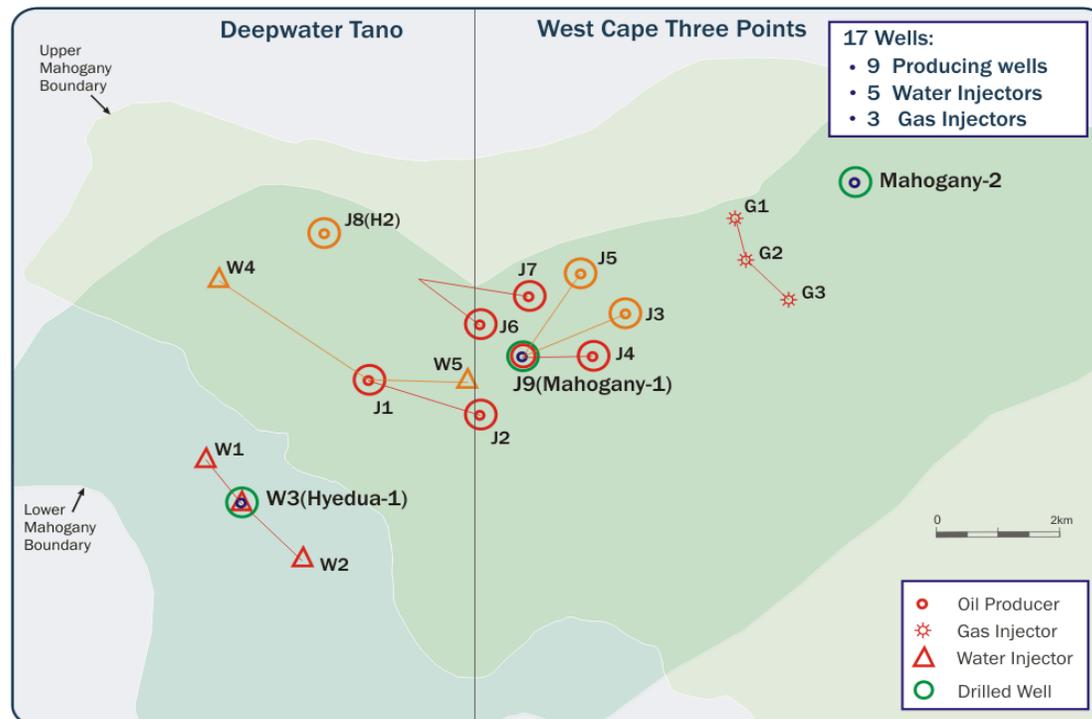


FMC horizontal Subsea tree

Producer:  
typical completion schematic



Planned well locations



# Product selection philosophy: Subsea-tree example

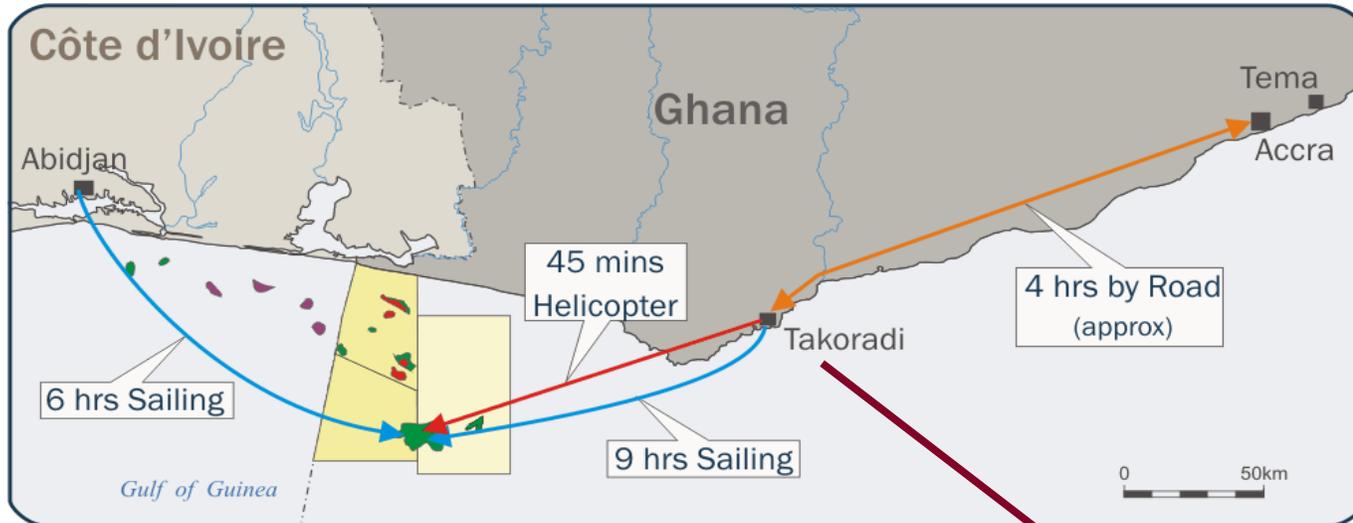


- Subsea trees are a critical component in the development
- FMC 10-15KEHXT<sup>®</sup> selected as high performing/reliable field proven unit, >130 constructed
- Supply leveraged through Tullow JV partner Anadarko long-term relationship with FMC
- Configurable modular design ensures sufficient stock available; short lead-time to delivery
- Philosophy is to deliver repeatable performance

Operator	Location	Project	Max WD (ft)	No. of Trees	First Installation
Anadarko	GoM	Green Canyon 518	4280	4	2004
Anadarko	GoM	Independence Hub	9000	13	2006
Anadarko	GoM	Power Play (15K)	2500	1	2008*
Anadarko	GoM	K2 Expansion (15K)	4000	1	2008*
BP	GoM	Atlantis	6760	22	2005
Callon	GoM	Midway	3700	1	2006
Chevron	Nigeria	Agbami	6000	19	2006
Chevron	GoM	Blind Faith (15K)	7000	4	2007
ENI (Dominion)	GoM	San Jacinto	8000	2	2006
Hess	GoM	Penn St (15K)	4000	1	2007
Hess	GoM	Conger (15K)	3500	1	2008*
ERT - Helix	GoM	Devils Island (15K)	4000	1	2007
ERT - Helix	GoM	Noonan	2400	2	2006
Hydro	GoM	Q (Ind Hub)	8000	1	2006
Kosmos	Ghana	Jubilee	3600	4	2009*
APC (Kerr-McGee)	GoM	Nansen	4260	3	2002
APC (Kerr-McGee)	GoM	Boomvang	4260	4	2002
APC (Kerr-McGee)	GoM	Durango/Gunnison	3120	3	2003
APC (Kerr-McGee)	GoM	Navajo/Gunnison	4100	2	2003
APC (Kerr-McGee)	GoM	Red Hawk	5300	2	2003
APC (Kerr-McGee)	GoM	East Boomvang	3940	1	2003
APC (Kerr-McGee)	GoM	Hack Wilson	3020	1	2003
APC (Kerr-McGee)	GoM	Lou Gehrig	3280	1	2003
APC (Kerr-McGee)	GoM	Joe Jackson	3940	1	2003
APC (Kerr-McGee)	GoM	Nile	2700	1	2004
APC (Kerr-McGee)	GoM	Various Additional		7	2005
APC (Kerr-McGee)	GoM	Merganser (Ind Hub)	8000	2	2006
LLOG	GoM	Green Canyon 50	1000	1	2004
LLOG	GoM	Bellis	2614	3	2004
LLOG	GoM	Various Additional		15	2005
Petrobras	GoM	Cottonwood (15K)	2200	3	2006
Petrobras	GoM	Cascade (15K)	8000	4	2009*
<b>TOTAL</b>				<b>131</b>	

\*Scheduled





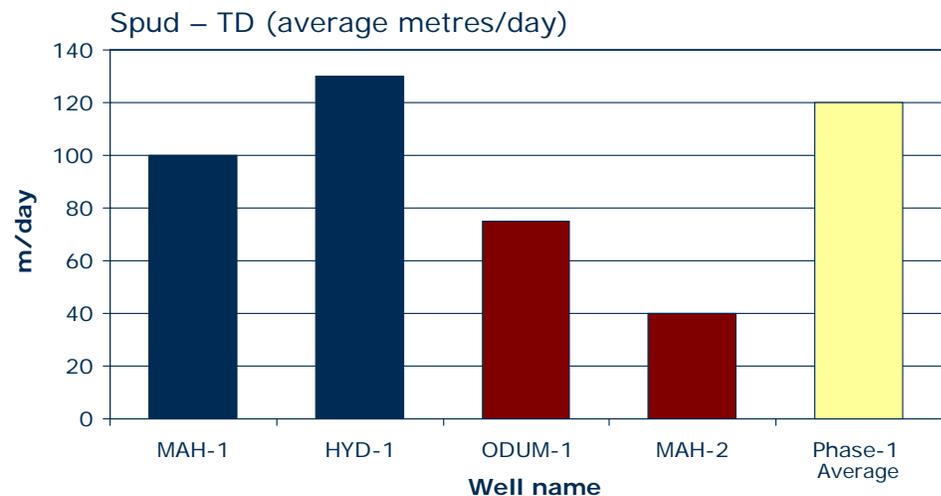
- Offshore Supply Base in Takoradi; capability being upgraded (4-5hrs drive from Accra)
- Initial phase: supplementary support from Abidjan (established Service Companies)
- Jubilee is approx 9hrs by boat and 45 minutes by helicopter from Takoradi

# Jubilee wells comparison

- Jubilee wells are “typical” West Africa deepwater development wells (many analogues)
- 1100 – 1500m water, 2500m formation, normal pressures and temperatures
- Drilling relatively straightforward with completions that require sand-control
- Equipment and techniques well proven – no new technology development required, BUT, recognise that deepwater is a high cost, technically demanding environment so management of technical risk to minimise chance of “train-wrecks” is key
- Focus will be on consistent delivery with emphasis on performance improvement (Measure – Assess Opportunity Gap – Improve)

## Well performance comparison, drilling phase

Rig	Well	Water Depth m	Total Depth m	Days Spud-TD	Average m/day
Belford Dolphin	Mah-1	1320	3820	24	104
Belford Dolphin	Hyd-1	1530	4002	18	137
Songa Saturn	Odum-1	980	3386	30	80
Songa Saturn	Mah-2	1091	3443	53	44
Eirik Raude	Average Phase-1	1300	4130	23.5	123



- Tracking and understanding market and a nimble organisation allowed early commitment to Eirik Raude as backbone for Jubilee Phase I
- Clear strategy to add additional 3-5yrs rig capacity, leveraging off JV position in short-term (Aban Abraham, Atwood Hunter)
- In-country logistics in place with plans being developed for longer-term expansion to create dedicated offshore base
- Key service contracts in place with local infrastructure support being developed
- Pro-active drive to maximise local content and development of Ghanaians
- Ease of importation of goods and services facilitates efficiency
- Tullow Well Engineering has the experience, capacity and capability to deliver in Ghana deepwater

## Jubilee gas commercialisation – Mike Simpson



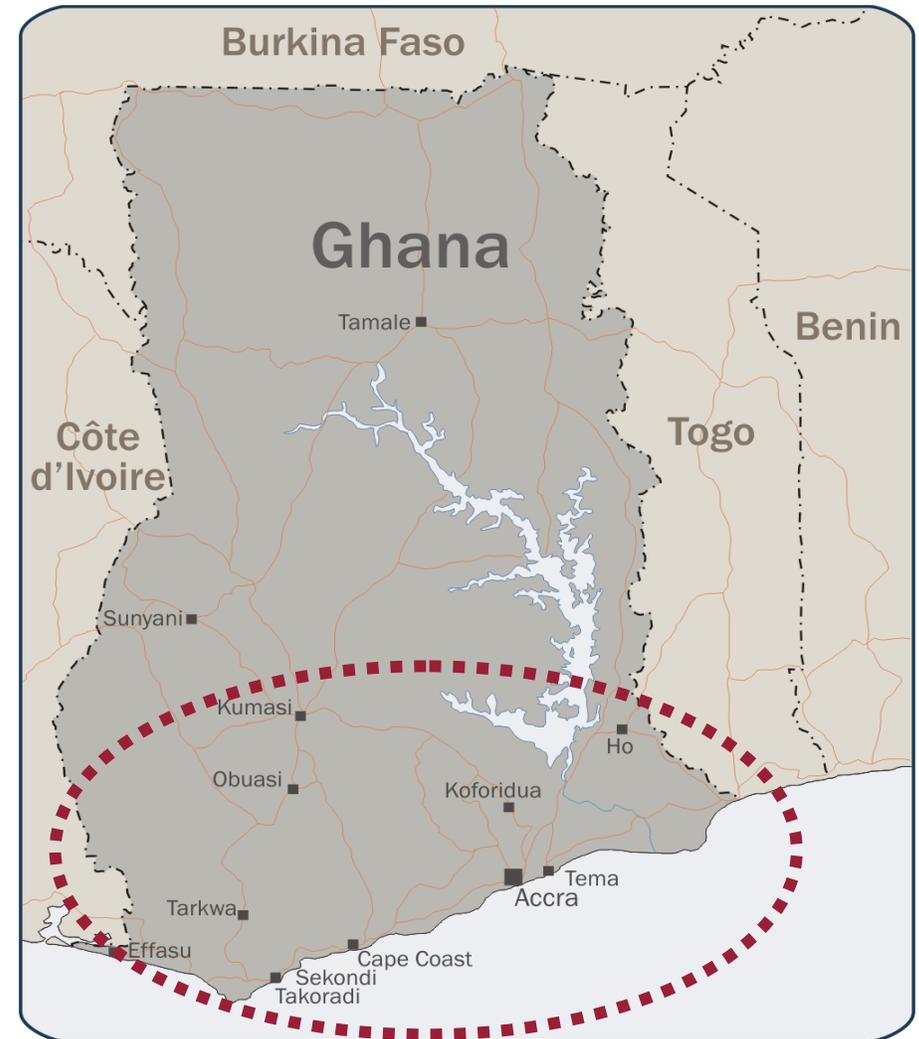
## Phase 1

- Jubilee gas is associated with oil
- FPSO designed for 100% gas re-injection (secures oil production)
- Peak rate oil production of 120kb/d yields ~120 MMcfd
- Gas available for both reservoir pressure support and export (optimum mix under consideration)
- Also yielding up to 3-5 kbd of liquids

## Future phases

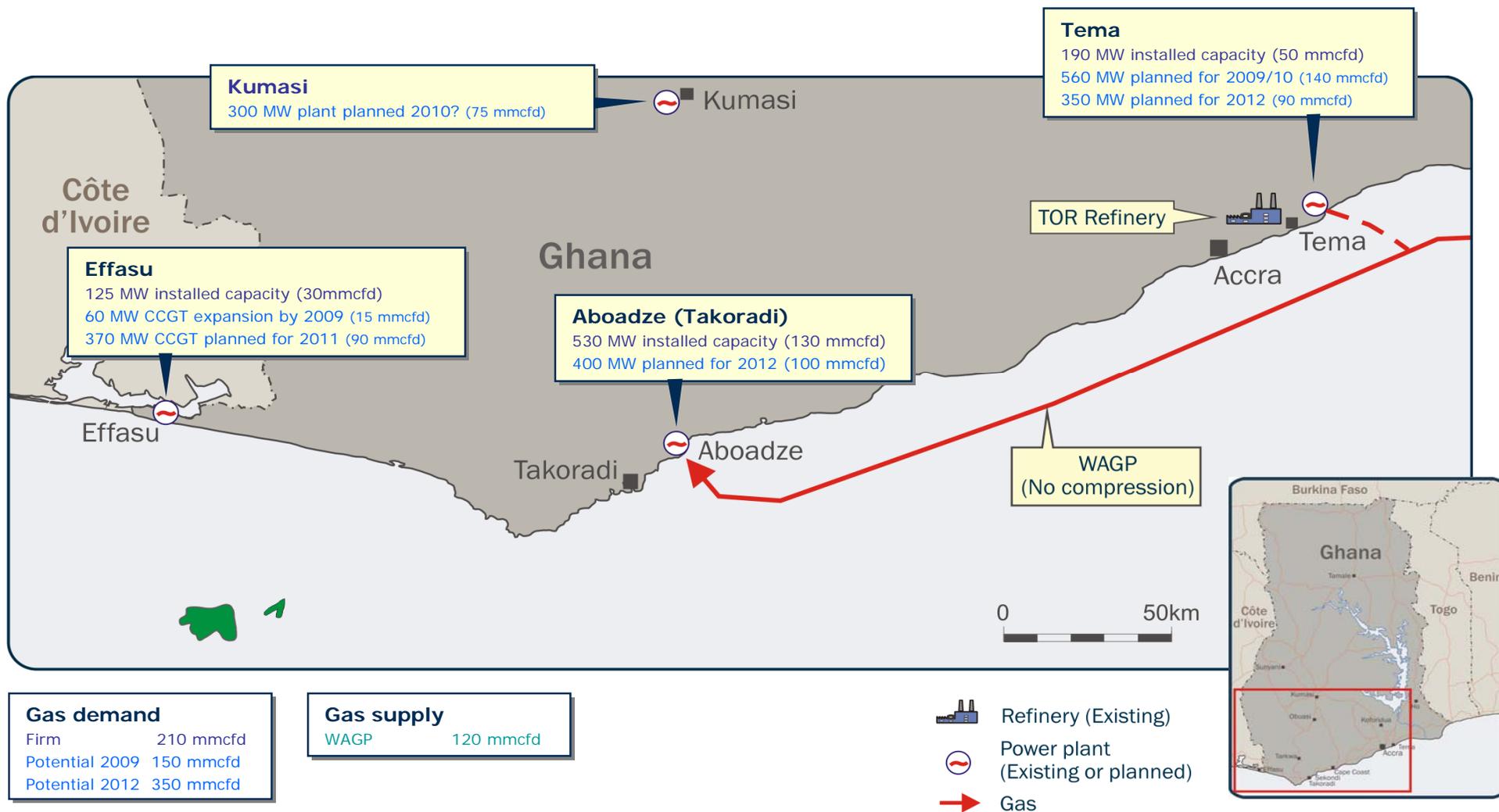
- FPSO sizes 120-240 kbd yield 120-240 mmcfd
- Potential liquids export 10-15+ kbd

- Electricity supplied from Hydro and new build dual fuel CCGT (currently Crude oil fired)
- Shallow Water Tano marginal gas discoveries
- Government imperative to develop gas market and infrastructure (e.g. WAGP)
- Jubilee field characteristics support onshore utilisation of gas
  - Planning and Interaction with Phase 1 work
- Potential for major offshore gas province
- Building on Tullow's expertise in gas commercialisation



***Area of Major Gas Demand***

# Markets – location of gas supply and demand



# West African Gas Pipeline

## Shareholders:

- ChevronTexaco – operator: 36.7%
- NNPC: 25%
- Shell Overseas Holdings: 18%
- Takoradi Power Company: 16.3%
- SoBeGaz (Benin): 2%
- SoToGaz (Togo): 2%

## Foundation Customers: long term take-or-pay contracts

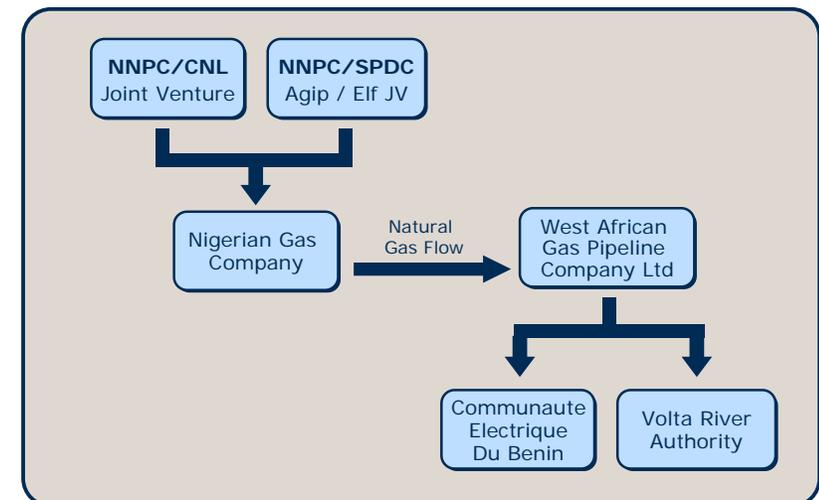
- Volta River Authority: 123 MMscfd
- Communauté Electrique du Bénin: 17 MMscfd

## Contracting Company:

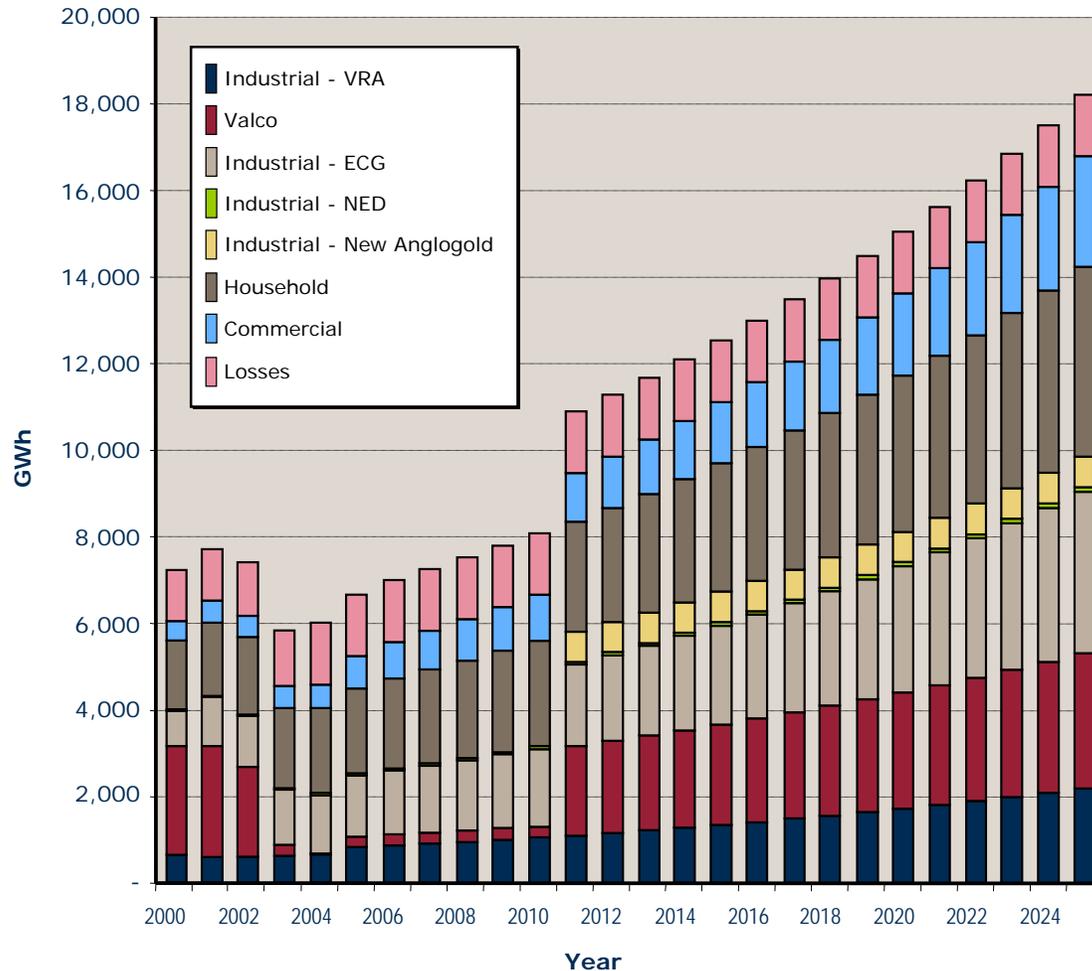
- N-Gas: Owned 62.35% by NNPC, 20% by ChevronTexaco, 17.65% by Shell

## Sources of Gas

- NNPC/Chevron Nigeria joint venture
- NNPC/SPDC/Agip joint venture
- To be sold under long term agreements to N Gas



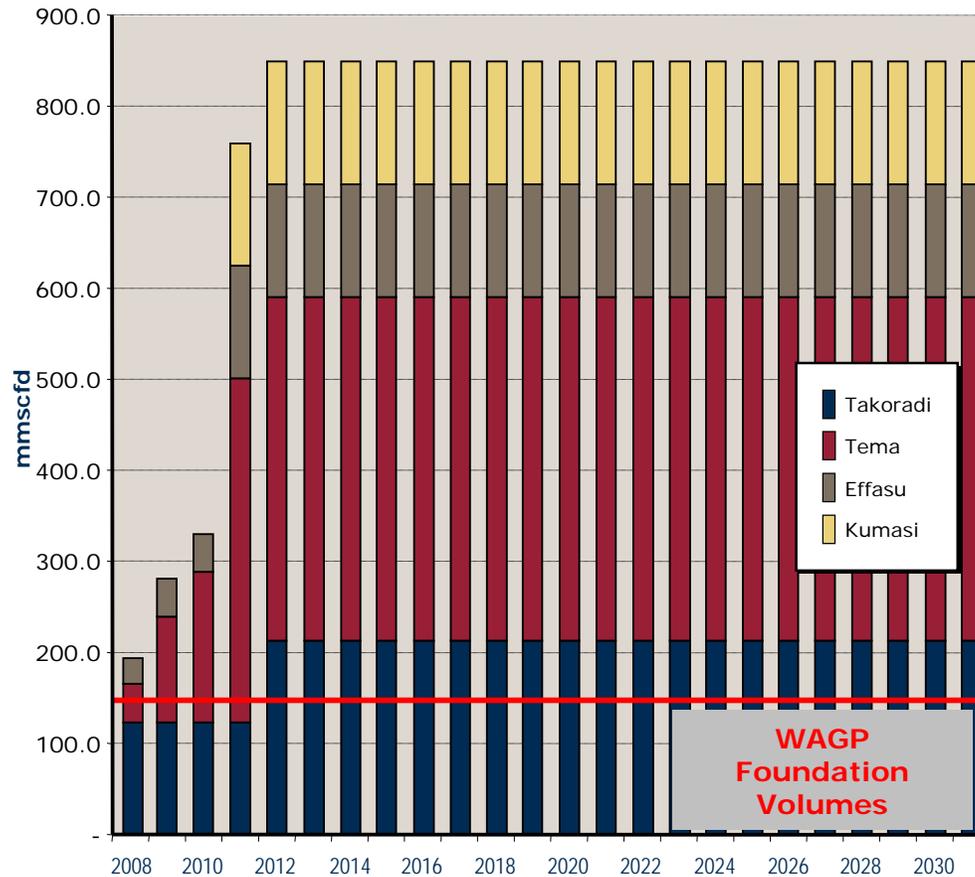
# Ghana power demand forecast 2000 - 2025



- Significant energy shortages
  - 2007 demand estimated at 10,152 GWh; actual available power of 6,611 GWh.
- Low points in 2002/03, due to very low rainfall
  - Valco (Aluminium smelter) shut in from 2002 onwards
- 2008 forwards is forecast demand, suppressed through to 2010/11 due to insufficient generation
- 2011 Valco demand is assumed to kick in again

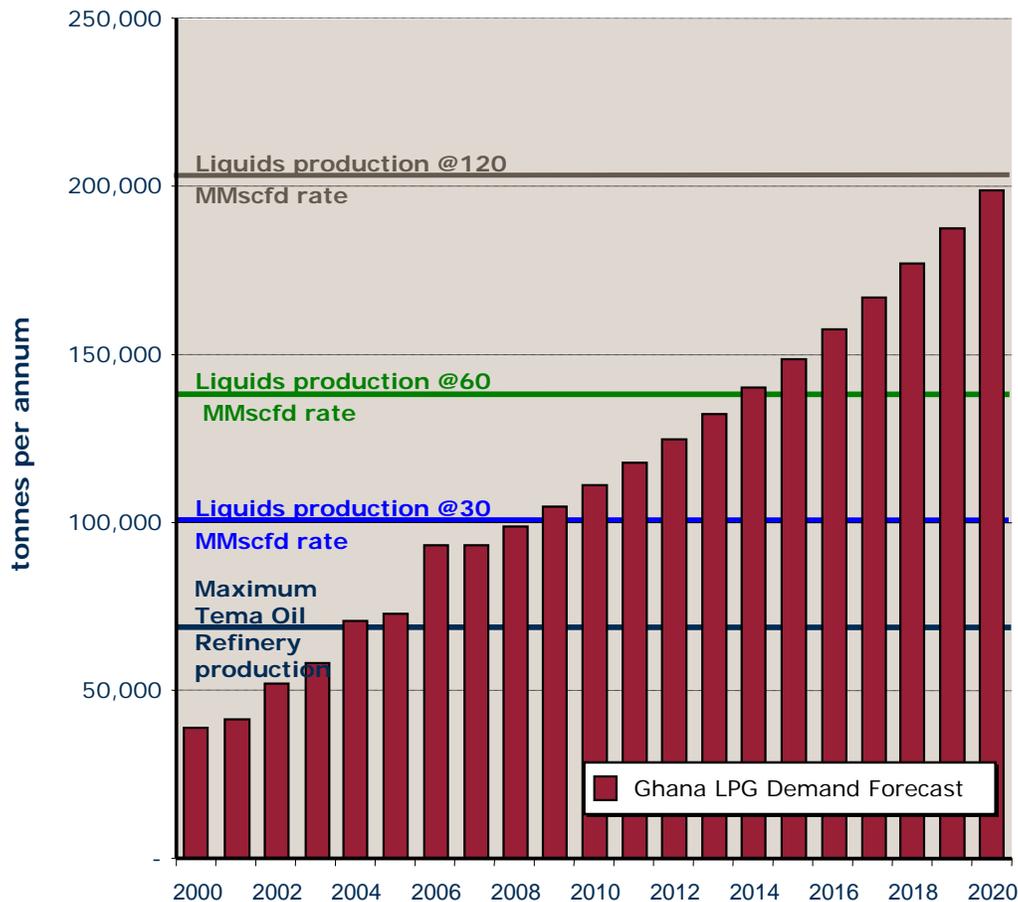


# Current maximum IPP gas demand in Ghana by location



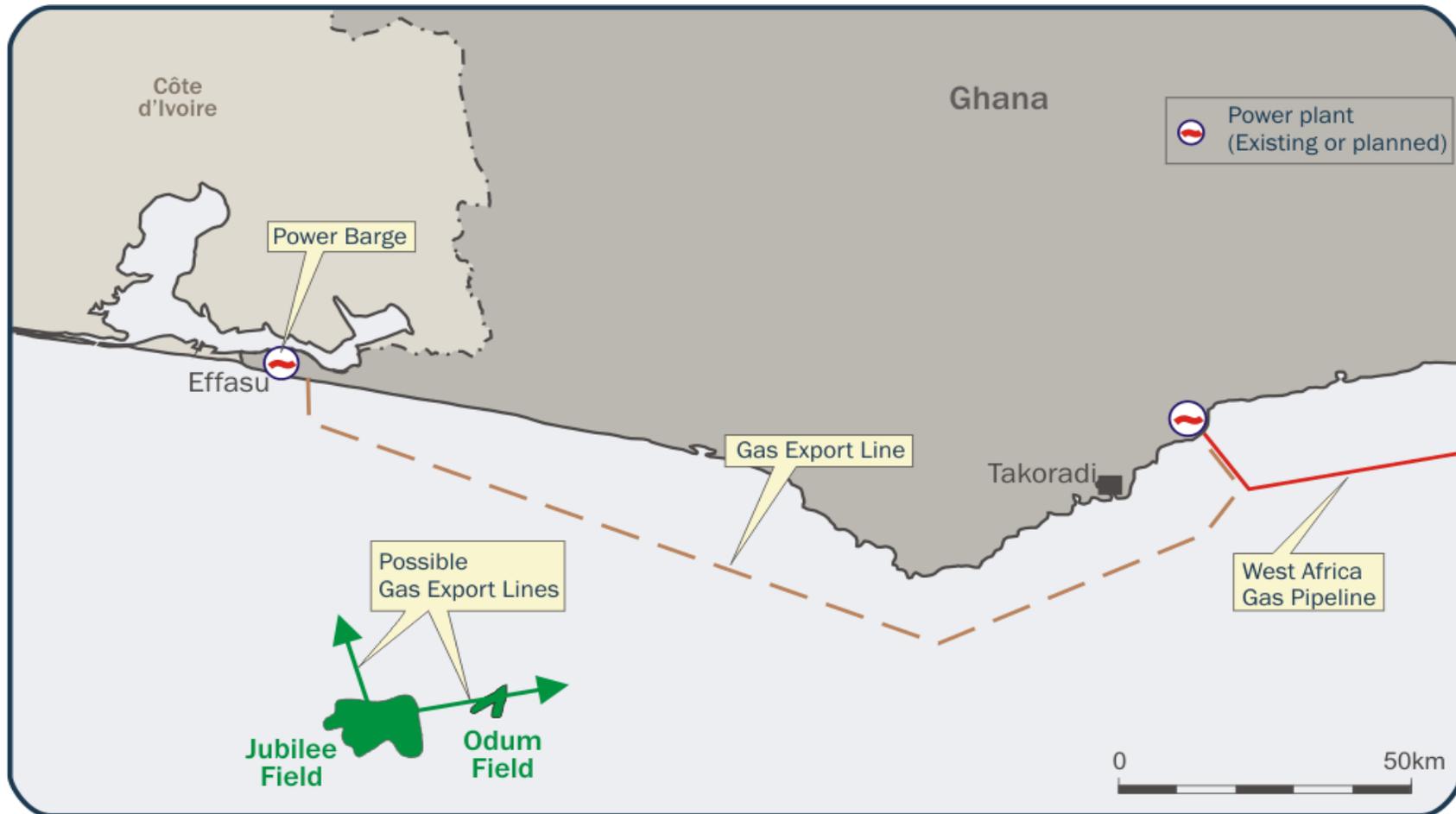
- Phase I Jubilee exports ~30mmscfd
- WAGP foundation volumes for Takoradi VRA plant – no deliveries assumed in near term
- Projected IPP capacity will absorb large volumes from Ghana offshore

# Ghana LPG demand forecast - 6% pa growth



- TEMA oil refinery produces ca 65k tonnes of LPG pa
- Imports currently ~ 30k tonnes pa
- Jubilee Phase I will displace imports
- Future phases will require export facilities as production may rapidly exceed demand

# Potential Ghana gas infrastructure development



## Next steps

- Commercial Negotiations (by year end)
  - Secure access to pipeline capacity
  - Market prices for gas and liquids
  - Export facilities commercial & ownership structure
- Gas export facilities sanction end 2009
- Delivery 2011

## Strategic drivers

- Tullow aspiration to build long term business in GoG
- Recognise potential for significant gas province
  - Jubilee future phases
  - Exploration upside (e.g. Teak/Tweneboa)
  - Third Party upside
- Opportunity to take equity in infrastructure
- Control and operation of export facilities

- Commercial Framework for gas evolving in tandem with project
- Potential for significant gas and liquids business
- Local and regional market constrained by lack of gas
- Work with Govt/local stakeholders to develop market & infrastructure
  - Investment tailored to market development
  - Phased approach to gain reservoir knowledge

## Operational philosophy and infrastructure – Stuart Wheaton



- Major high cost deepwater development scheme
  - new to Ghana
  - new to Tullow
- Geographical spread of project execution and JV partners
- Tight personnel market
- Tight service company/contractor market
- Building for Phase 1 and planning for future phases
- Significant enthusiasm and talent in Ghana

Takoradi airbase pipeyard



supply vessel working at Takoradi naval port



## Near Term

- Deliver all in-country operations and support in a safe, timely, cost effective and reliable manner for the production phase
- Support the project's facility implementation and handover/commissioning
- Execute a major deepwater drilling campaign (~50% of development capex)
- Commercialise gas reserves
- Co-ordinate all HSE, accounting, supply chain, in-country HR and external relations
- Conduct reservoir surveillance and operations, and future integrated reservoir management following transition from the project's sub-surface team in 2010
- Ensure we have world class operations and maintenance team to run facilities

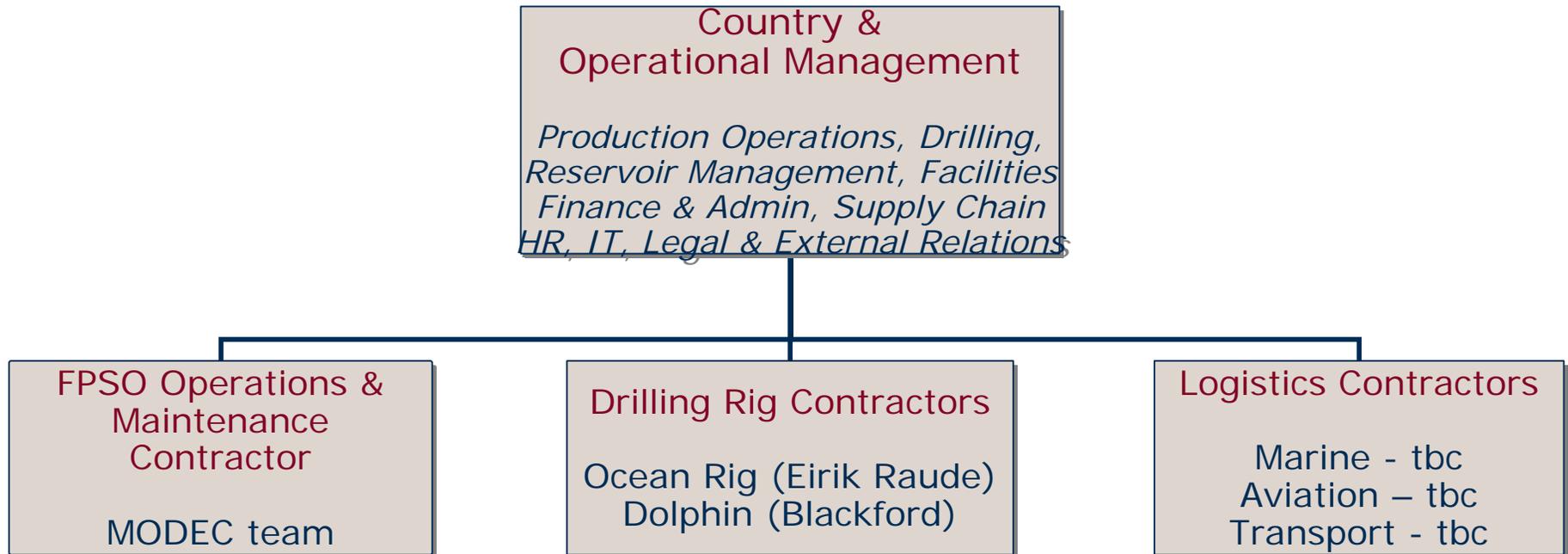
## Medium Term

- Prepare for later phases of development

The Tullow Ghana Unit Operator organisation has set targets which focus on high standards in EHS (industry top performance) and production uptime (e.g. 95% minimum, including both planned + unplanned downtime).

To do this;

- Accountable leadership and front-line supervision of an integrated team of contract and employee personnel in Ghana
- Build a fully capable and sustainable operating company with a reputation for delivering a quality operation. Majority of upstream disciplines included.
- A clear and transparent contracting strategy that optimises local content and employment wherever possible
- Providing immediate opportunities for national staff, combined with a program of training and mentoring to develop the long-term human resources of Ghana's oil industry
- Establishment, from an early stage, of full in-country emergency response capability, and related oil spill response.



- Tullow Ghana operating organisation being built
  - Sustainable/long term Ghanaian company with a drive to national employment and content (including contractors)
  - Training and development of personnel is a 10 year+ commitment
- Major contractor component to achieving project objectives

# Jubilee field – organisational scale



FPSO 50-80 POB  
max 120



Tanker handling  
Tug ~15

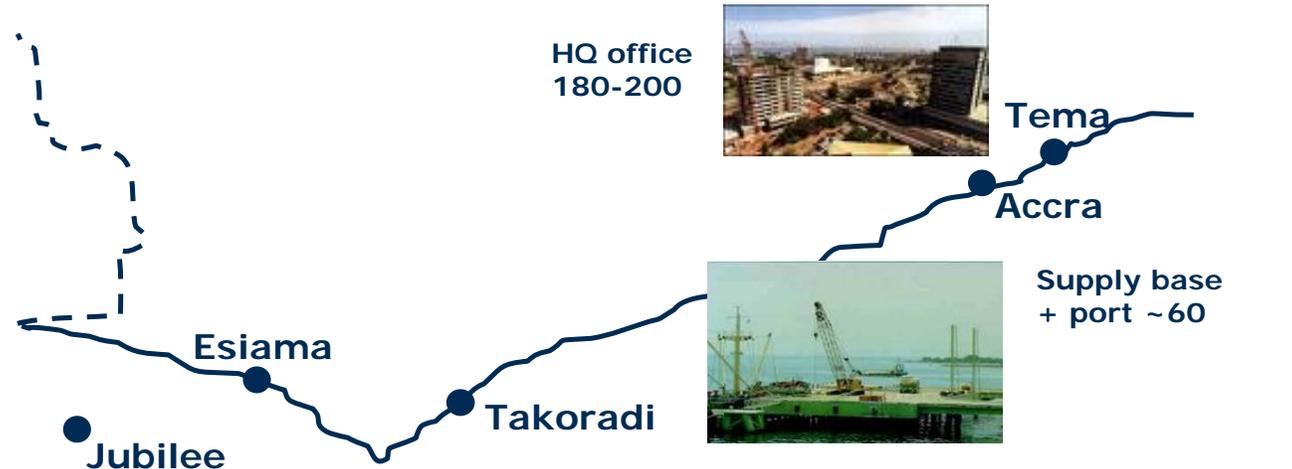
Rig 1  
80-110



Rig 2  
80-110



3-5 supply vessels  
45-75



Aviation; Accra-  
Takoradi –  
offshore 30 - 40

## Initial Estimate (Phase 1)

~ 180-200 Tullow Ghana positions

600-800 in-country total

300-500 rotational positions

**Total personnel ~ 1000-1300**

+ project HUC offshore 100-500?

+ infra-structure construction 100's?

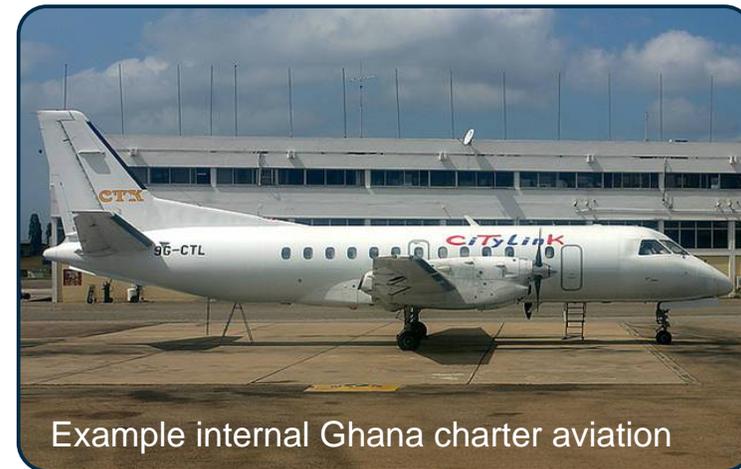
+ potential gas plant construction and operation?

- London based Asset team established across all disciplines
  - Excellent recruitment successes in deepwater experience; drilling, prodn operations, sub-surface
  - Majority will transition to Ghana over next 1-3 years
- Personnel in-country now ~40 both national and expatriate
- Established Accra interim office for up to 60 persons
  - Near term drilling rig support
- Planning underway for up to 200 person Accra office from 1H 2009
- Established Takoradi airport shorebase up to 40,000m<sup>2</sup> includes pipeyard, warehouse, offices etc..
- Established presence in Takoradi commercial port (first for upstream in Ghana)



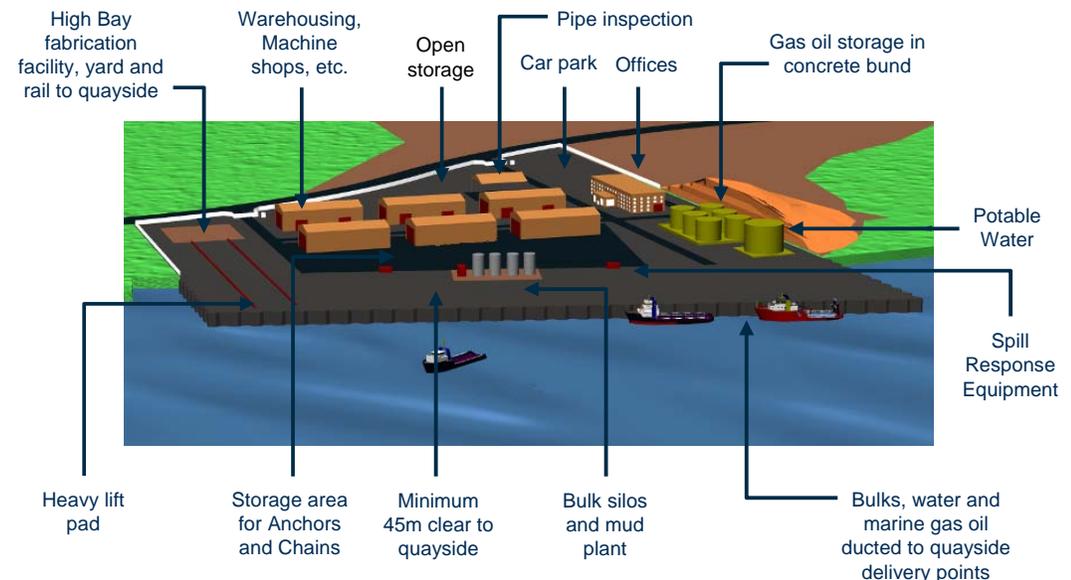
- Organisation

- Full scale recruitment thru' 2008-2010
- A highly talented and enthusiastic skills pool in Ghana
- Training and development of upstream staff is a long term commitment we will make
- Contractor commitment also key



Example internal Ghana charter aviation

- Integration with project's facility delivery requirements
- Large scale transportation contracts
- Development of port facilities as long term scale increases



Example new port dedicated facility; schematic

- Clear vision of operation philosophy
- Organisation build on track despite tight market
- Significant progress on local infrastructure
- Well engineering teams ready to receive rigs
- Production operations on schedule to receive FPSO in 2010
- Significant short term progress however focus is on building a world class Ghanaian oil and gas operation



# Environment, Health and Safety in Ghana – Graham Brunton

## Ghana – New Oil Region

- Oil & Gas legislation developing
- Immature EHS regulation
- Some environmental legislation in place from mining sector
- External influence important

## Tullow Working with Ghana to set Standards

- Positive work with GNPC to shape legislation
- Staff experience essential
- Policies and existing company standards in lieu of regulation
- Use established international standards such as OGP



## EHS & CSR Policies

- Strong leadership commitment demonstrated by Senior Management
  - EHS Equal but priority in conflict
  - Resourcing support

## Leading Environmental Performance

- ISO14001 certification of EMS
- Environmental & Social Impact Assessments
- Improved external reporting and data assurance
- Climate Change - BitC 'Big Tick' Award for CO<sub>2</sub> emissions reduction.

## Safety Performance

- Good health and safety performance with steadily improving trend
- Lost Time Incident turnaround in 2008
- Improved processes and procedures
- Risk assessment established



ISO14001 Certification



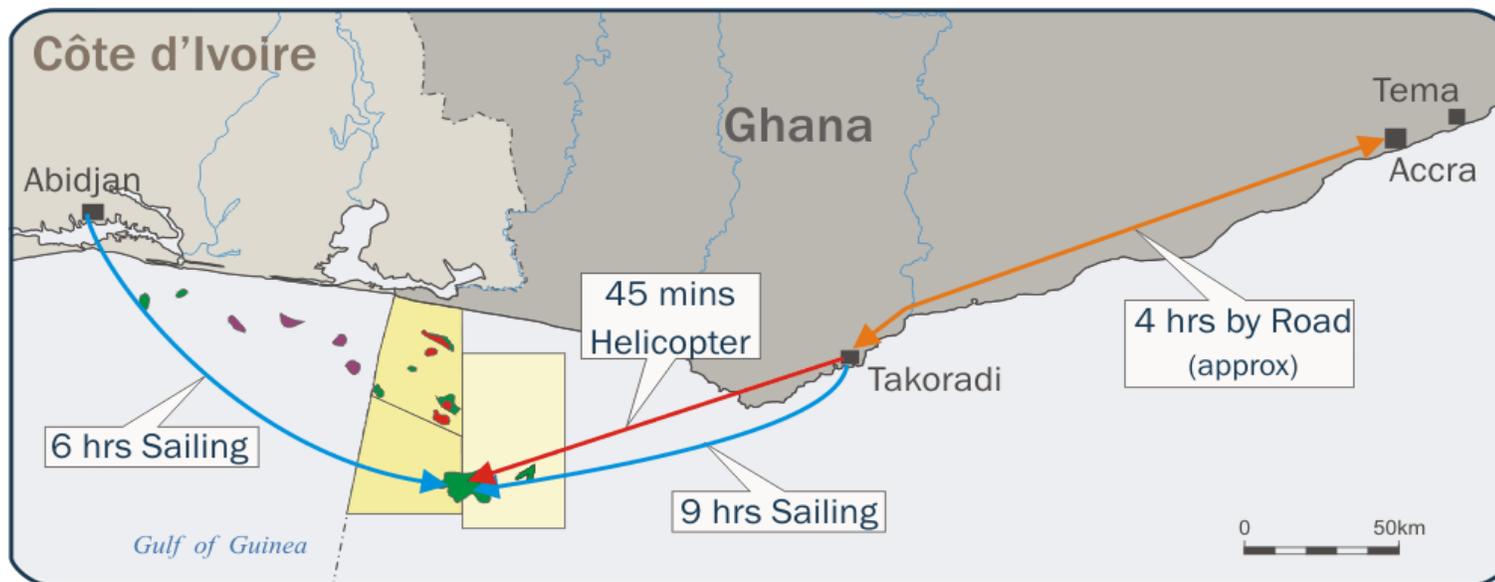
Environmental Big Tick  
for Bacton Compressor



RoSPA Gold Safety Award  
2005, 2006, 2007

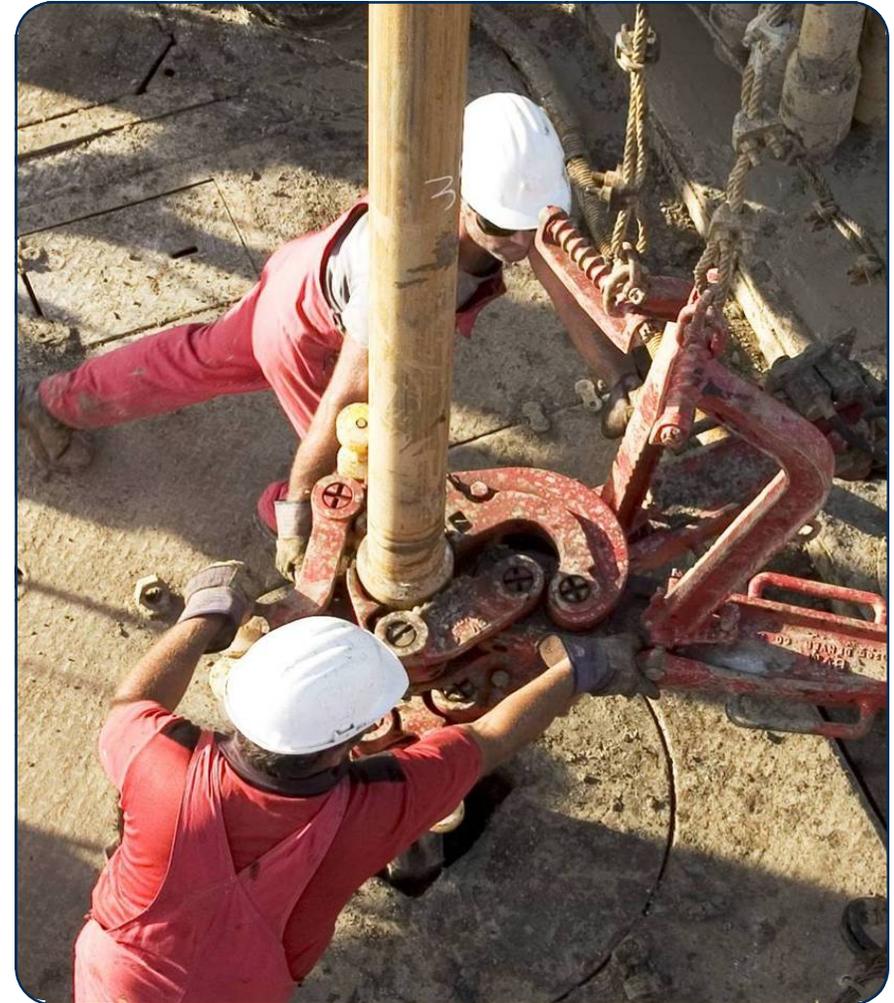
## Working to Fully Understand EHS Risks

- Transport
  - Travel risks for land, sea and air
- Drilling operations and construction activity
- FPSO activity and onshore Operations
  - Fishing community
  - Asset integrity
  - EHS Case
- Oil spill risk
  - Oil spill plans
  - Appropriate oil spill equipment
- Cranes, lifting and slinging
  - Certification and training



## EHS at Heart of Development

- Jubilee is not a unique project
- Tullow gearing up early enough to manage operations effectively
- Integration of EHS into project delivery teams & activities
- A tried & tested development solution – EHS risks understood
- Appointment of an experienced & competent Contractors
  - EHS performance evaluated
  - Oversight and compliance plan developed
- Project and Drilling EHS plans are in place



## Pre ops

- Environmental Issues
- Tendering

## Design

- Technical Safety
- Standardisation
- Hook up and Commissioning

## Well Eng

- Bridging
- Audit
- Oil Spill Response

## Operations

- Asset integrity
- Operational safety

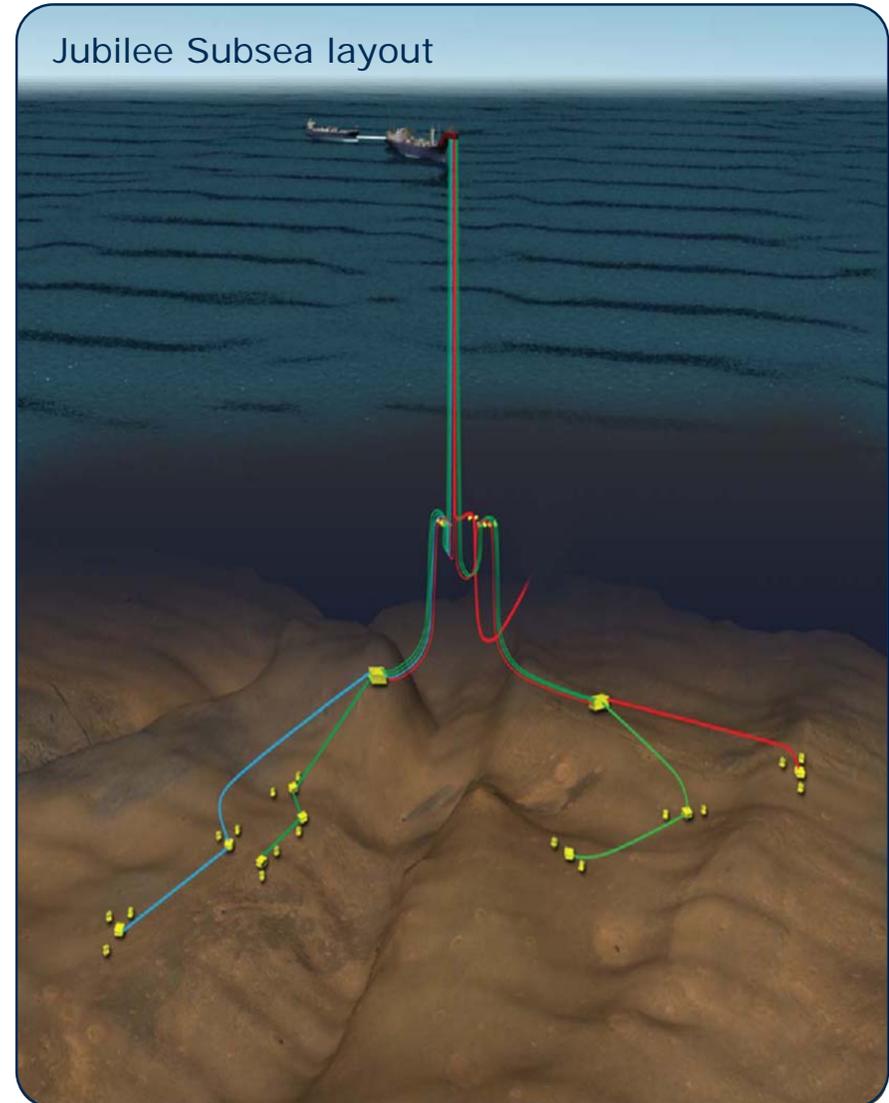
## Protecting the Environment

- Environmental legislation and permitting regime in place
- EIA carried out and requires Govt. Approval
- Project taking prudent & responsible approach to key issues:
  - Atmospheric emissions
  - Aqueous discharges
  - Waste management
  - Drilling fluid selection
  - Oil spill response arrangements



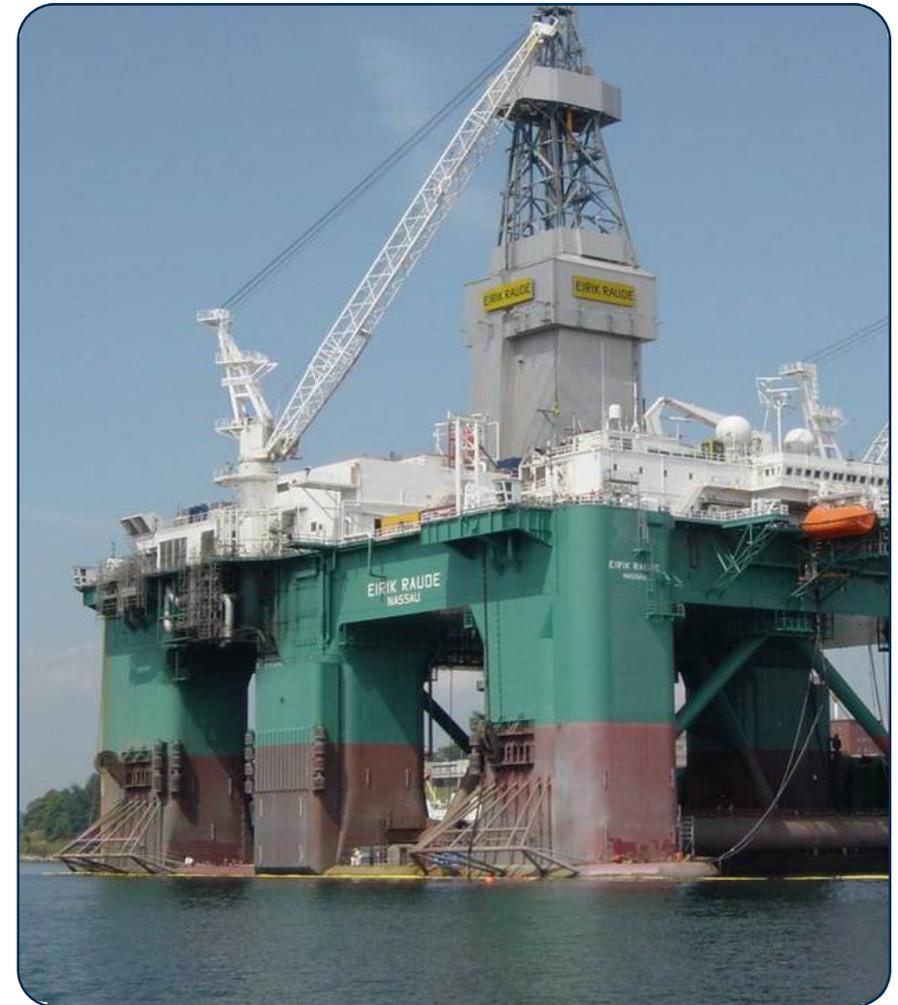
## Building EHS into the facilities

- The functional spec approach & “minimal tweaking”
- Contractor will deliver a Safety Case for the FPSO
- A programme of formal safety assessments & design phase reviews will underpin the Safety Case
- Subsea infrastructure will also be subject to design safety work as will the integrated facilities
- Manage EHS during hook up and commissioning
- Tullow has an EHS Activities & Deliverables Matrix for tracking project



## EHS on Eirik Raude

- EHS assessment part of tendering process
- After contract award
  - EHS meeting convened
  - Bridging process established
- EHS audit and inspection programme
- EHS Advisors on board
- Ongoing EHS assessment and feedback
- 3 year contract brings long term benefits to risk management



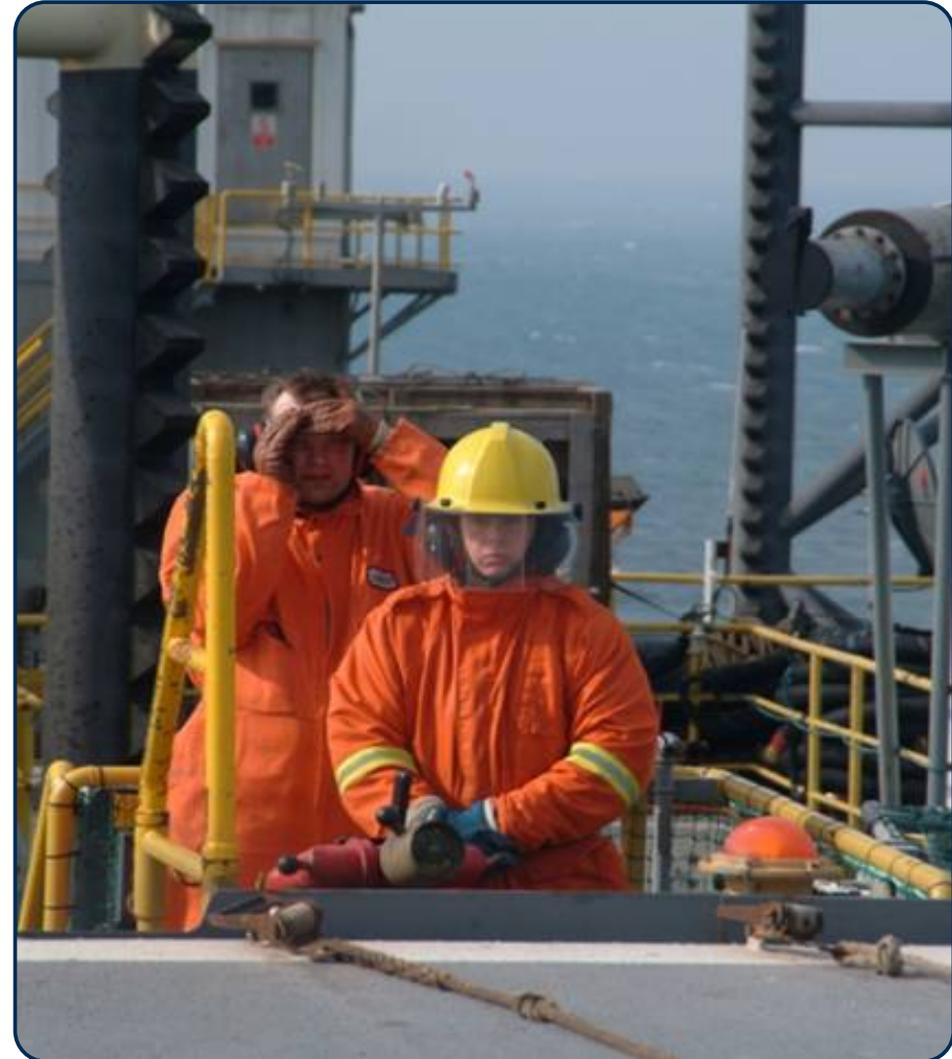
## Preparation for First Production

- Suitable EHS arrangements for future operations phase are being progressed
- Focus on constructability, operability and maintainability of facilities
- EHS systems are in place to deal with immediate levels of activity
- Set up to accommodate planned business growth
- Tullow Managers monitor EHS performance and intervene to correct deviations



## EHS is Important to Tullow

- Ghana has a great opportunity as it embraces the oil industry
- Getting the right Ghanaian legislative structure is important
- Tullow Ghana has a great opportunity to get EHS right in a large offshore project
- Tullow Team organised and prepared to deliver high EHS standards
- Partnership with key contractors is a key part of preparation
- Tullow has geared up early enough to manage operations effectively



## Community development in Ghana – Kofi Esson



- Introduction
- Group Strategy and Approach
- Existing Programmes in Ghana
- Long Term CSR Strategy for Ghana
- Conclusion



## Active leadership from Senior Management

- Groupwide budget and project selection/monitoring
  - CEO, CFO, COO involvement
- In country visits and clear strategy
- Identification of possible solutions
- Enables Tullow Team to deliver



## Stakeholder engagement

- Active engagement with local communities, local & regional government, NGO's, charities, and contractors & staff
- Seek clear linkage to projects on a regional basis wherever possible
- Engagement process underpins all social investment



## Tullow 'Working with Communities' initiative

- Basic needs, Health & Hygiene
- Children & Education
- Development of local enterprise
- Conservation



## Guidance for Identifying Suitable Projects

- Balance of short and long term commitments
  - Nature and Phase of Tullow's activity
  - Sustainability of projects
- Operated or non operated activity and level of licence commitment
- Spend relative to value for Tullow
- Use of visible and reputable NGOs when necessary

## Maintaining Successful Projects

- Establish metrics to measure success & maintain projects
- Continue support of existing projects
- Managing growth and societal expectations

## Ghana - Identifying and addressing material issues

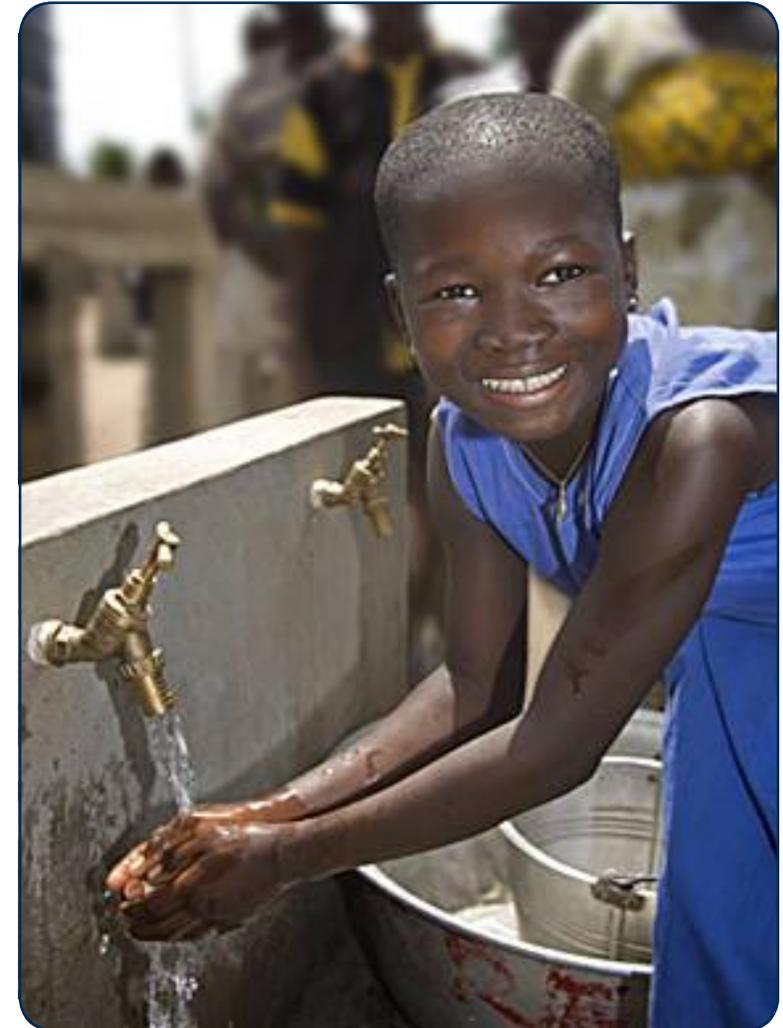
- 3.1% HIV/Aids adult prevalence in local communities. (Source: USAID)
- Majority without access to regular & clean water source. Sanitation coverage only 18%.
- 5.7% infant mortality rates (Source: United Nations)
- “Millennium Development Goals” for Ghana – debt relief allows investment in health, education, infrastructure, environment

## Tullow - Developing for the long term

- 2006/7 - One-off/Regional projects concentrating on basic needs
  - Clean and safe drinking water
  - Improving education standards
  - Improving ophthalmic standards
- 2008+ Building a programme in line with the growth of our business
  - CSR Office in Takoradi
  - Involvement of JV partners
  - Focus on Fishing Communities in Central/Western Regions
  - 5 year plan in preparation
- Strategy complements existing NGO and Governmental MDG (Millennium Development Goals) Initiatives

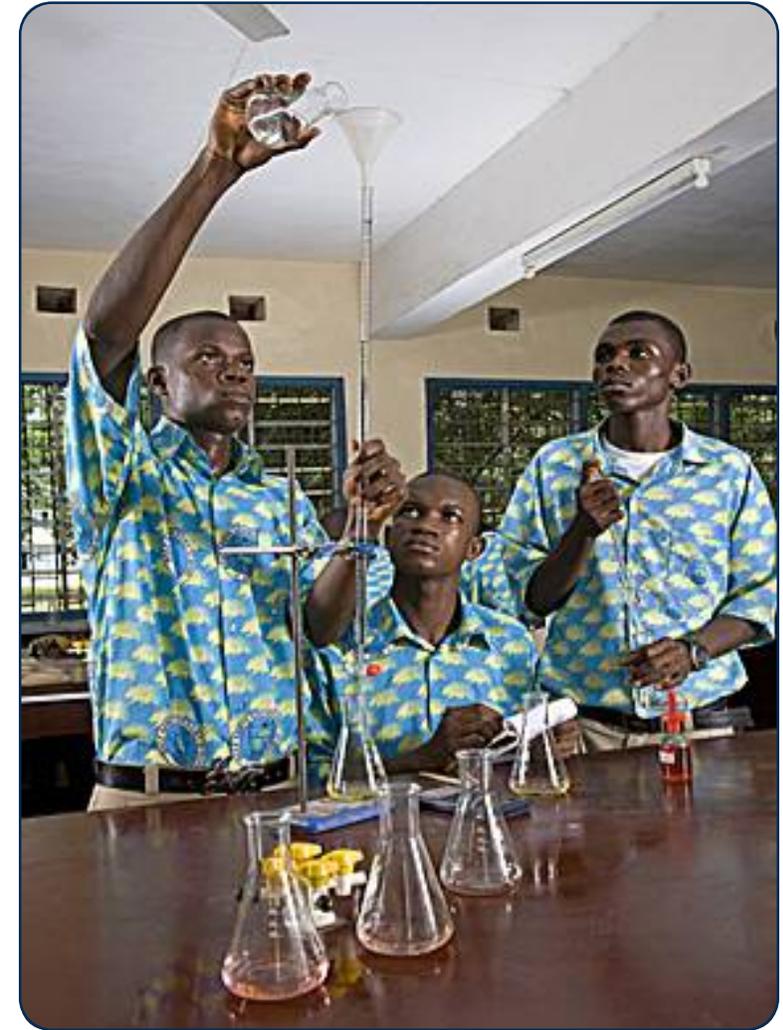


- Provision of mechanised and hand pumped water wells across the Jomoro district some with storage tanks
- Using local contractors - wells support 13,000 people
- 2008 – 14 water wells serving approximately 16,420 community members
- Community awareness and education programmes carried out. Villages take ownership of wells
- Partnership with Community Water and Sanitation Agency (Government department) ensures wells are maintained and water-quality tested
- Minimal dependency on Tullow but still receive widespread recognition
- Wider health benefits - Safe drinking water has reduced prevalence of Cholera, Guinea Worm, and Diarrhoea
- Initial programmes now incorporated in longer term regional project



## The Half Assini Secondary School, Jomoro Western Region

- Half Assini Secondary School is the principal high school in the region.
- Engagement and collaboration with the Director of Education for the Western Region. Project aligned with the District Assembly's Development Plan
- Initial phase of refurbishment/re-equipment is the science laboratory (Physics and Chemistry).
- Unveiling ceremony and handover due October 2008 – Longer term Support via Integrated project approach



Tullow is Partnered with Sightsavers International and the Ministry of Health.



## River Blindness Programme

- Raises awareness of blindness and treatment programme amongst local communities
- Distributors and community health workers trained to take on responsibilities of eye health education and the detection and referral of eye disease within their communities
- Controlled distribution of Mectizan® tablets which are used to control the condition and prevent blindness



## Training Ophthalmic Nurses

- Tullow funding permits experienced nurses to receive a year's specialist ophthalmic training. In 2008, 35 new students attended
- Trained nurses then divided into fieldwork groups in Bawku, Sunyani, Kumasi, Agogo, Breman Asikuma and Accra



## Jubilee project Guarantees Tullow's Long Term Future in Ghana

- Allows formulation of 5 year plan 2009-14 for Western Region
- Cooperation and Support of Indigenous Agencies
  - Ghana Health Service
  - Ghana Education Service
  - Community Water and Sanitation Agency

## Why Western Region

- 10% of Ghana Land Area
- 17 Separate Administrative Districts
- Geology/Hydrogeology/Topography challenges - drinking water scarce
- Low levels of Education and literacy
- Challenges of Malaria, HIV/AIDs, Buruli Ulcer
- Aligned with Tullow and Partner Acreage, includes major base at Takoradi

# Why is CSR important for Tullow?

## Tullow's 'Social Licence to Operate'

- Reputation as a good neighbour to the local community
- Reputation as a responsible operator with the Government/ Partners
- Clear demonstration of long term commitment to a region
- Increase local content as we become established in a new region
- Improves staff morale and motivation
- Benefits shareholders
- Key issue is the support for the Ghana communities



## Sustainable Development

- Tullow is making a major difference in local communities
- Sustainable initiatives that can continue with minimal Tullow involvement
- Commitment of time and some money can help communities to thrive
- Properly planned CSR benefits business and should not be viewed as PR



## Conclusions – Andrew Fisher



- World-class discoveries, commanding acreage position in Ghana
- Development, appraisal and testing of exploration upside proceeding at pace
- Initial organisation, infrastructure, equipment in place
- Developing a business and infrastructure for the long term
- Aligned and effective partnership, supportive Government
- Step-change for Tullow, as expression of long-term regional and corporate strategy and extension of capabilities
- Platform for future growth in Ghana and beyond

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