Middle East to India Deepwater Pipeline

NIGEC Progress Update Meeting

September 2011

NIGEC Progress Update FEB 2011

AGENDA

1. Introductions
2. Progress of Conceptual design studies
   I. Completed studies
   II. Ongoing and Planned Studies for 2011
   III. Schedule for 2011 Activities
   IV. Project Schedule
3. Example Study Results
4. Castorone Visit
5. AOB

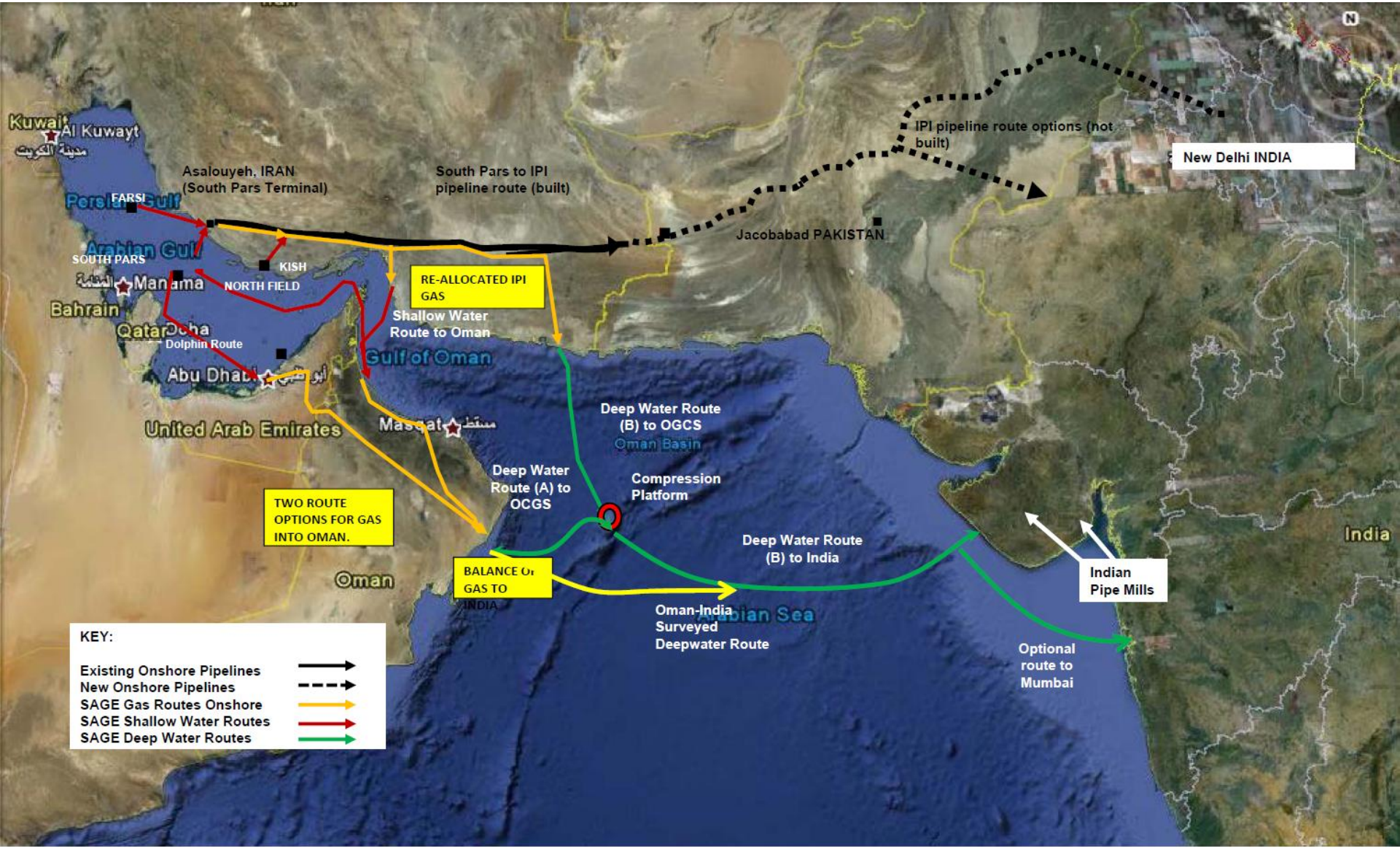
The SAGE Project – Key team members

Mr. T.N.R. Rao	▪ Former Petroleum Secretary, Govt. of India and "Architect of the Oman-India Pipeline" ▪ Chairman of the SAGE Advisory Board ▪ Founder Chairman, Hydrocarbons Education & Research Society, Indian School of Petroleum ▪ Founder Chairman – University of Petroleum & Energy Studies
Subodh Jain	▪ Director: INOX-AIR PRODUCTS Ltd. ▪ Director: South Asia Gas Enterprise PVT Ltd ▪ Director: Siddho Mal & Sons, New Delhi ▪ Former Senior Advisor to original Oman-India Pipeline team
Peter M Roberts	▪ Director: South Asia Gas Enterprise PVT Ltd ▪ Managing Director: VerdErg Ltd, London ▪ Former Project Director of original Oman-India Pipeline ▪ Former Director Project & Construction Services at JP Kenny and Managing Director INTEC (UK)
Dr Herman Franssen	▪ Senior Consultant to SAGE ▪ Member of the SAGE Advisory Board. ▪ President, International Energy Associates, USA ▪ Former Economic Advisor to the Oman-India Pipeline project ▪ Former Economic Advisor to the Sultanate of Oman, Ministry of Petroleum
Ian Nash	▪ Business Acquisition and Operations Director, Peritus International (UK) Ltd. ▪ Managing Director INTECSEA (UK) Ltd. ▪ Engineering Manager for MEDGAZ FEED. ▪ Engineering Manager (Saipem Inc) for Canyon Express design EPIC. ▪ Project Manager (SASP UK) for Europipe 2, 42-inch 650 Km Gas Trunkline detailed design.
Dr Alastair Walker FRS	▪ Leading International Expert on Marine Pipeline Engineering ▪ Senior Consultant to SAGE ▪ Member of the SAGE Advisory Board ▪ Professor Emeritus, University of Surrey UK ▪ Visiting Professor, University College London

MOUs/Agreements to Co-operate in developing SAGE have been signed with:

- Indian Oil Corporation
- Oman Ministry of Oil and Gas
- GAIL
- NIGEC
- Peritus International Ltd.
- Engineers India Ltd.
- Intecsea (UK) Ltd.
- Saipem SpA
- Heerema Marine Contractors
- Tata (CORUS) steel
- Welspun
- JindalSAW
- FUGRO GeoConsulting Ltd.
- Det Norske Veritas
- EGS Survey Pvt Ltd

Gas Routes to India



Completed studies

- Design Basis definition
- Flow Assurance Studies
- Mechanical Design
- Onshore Compression Station Definition
- Onshore Compression Station review
- Offshore Compression Station
- Offshore Layout Optimisation
- Quantified Risk Assessment - OIP Update
- Geohazard and Fault Crossing Assessment Oman Route
- Metocean data Oman Route
- Emergency Repair Equipment
- GIS Data collection Oman Route
- Riser and Subsea By-Pass definition
- Pipeline Intervention Review
- Vessel & Equipment Capabilities review

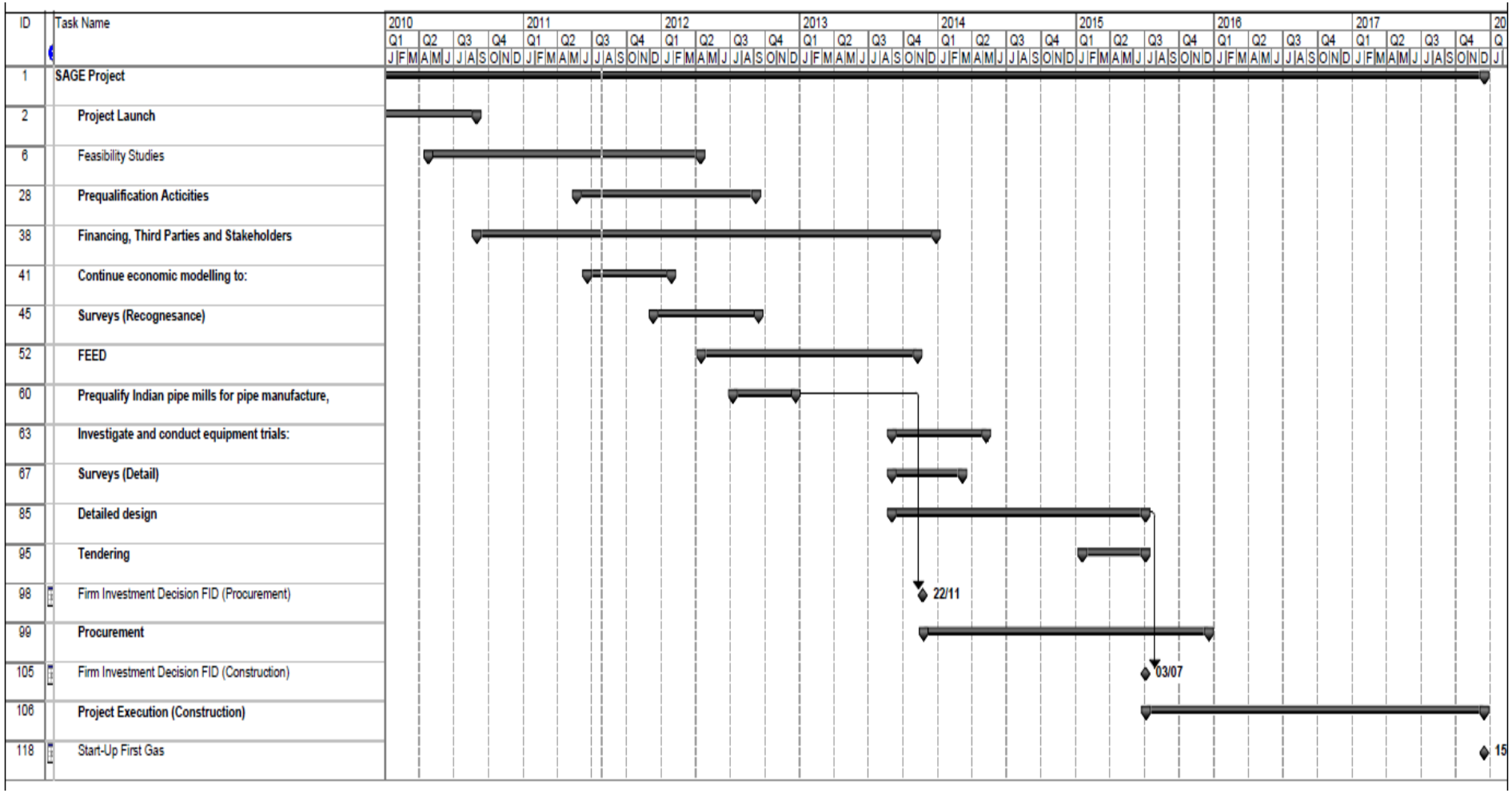
Ongoing and planned 2011 studies

- Geohazard and Fault Crossing Assessment Iran Leg (Ongoing)
- Metocean data Iran Leg (Ongoing)
- GIS data collection Iran Leg(Ongoing)
- Reconnaissance Survey definition and scope of work (Ongoing)
- Alternative Integrity Verification (Establish no hydrotest principle – Ongoing)
- Mill qualification and ring testing program (Ongoing)
- Cost Estimate Update (Ongoing)
- Master Project Schedule (Ongoing)
- Environmental Statement (Planned)
- Survey ITT and tender (Planned)

Schedule for 2011

Development Activities 2010-2011																					
No.	***Activity***	***Who***	***Status***	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
1	Project Management	Peritus	Ongoing																		
2	Route Study Oversight	Peritus	Ongoing																		
3	QRA Update	Peritus	**Complete**																		
4	Pipeline Intervention Review	Peritus	**Complete**																		
5	Installation Capabilities Review	Peritus	**Complete**																		
6	Riser and Subsea By-Pass Definition	Peritus	**Complete**																		
7	EPRS Status Update	Peritus	**Complete**																		
8	Mill Qualification and Rin Testing program	Peritus, Welspun, JindalSAW	Ongoing																		
9	Cost Estimate	Peritus	Ongoing																		
10	Construction Schedule Definition	Peritus	Ongoing																		
11	Prepare Survey ITT and Tender	Peritus	Ongoing																		
12	Prepare Scope of Work for FEED Contracts and Tender	Peritus	Planned																		
13	Reconnaisance Survey	Tender	Planned																		
14	Route Corridor Desk Study Oman Leg	Fugro	**Complete**																		
15	Route Corridor Desk Study Iran Leg	Fugro	Ongoing																		
16	Geohazard Assessment Oman Leg	Fugro	**Complete**																		
17	Geohazard Assessment Iran Leg	D'Appolonia	Ongoing																		
18	Alternative Integrity Verification Study (No Hydrotest)	Peritus	Ongoing																		
19	Continue Economic Modelling	SAGE	Ongoing																		
20	Environmental Baseline Survey	Fugro/Metoc	Planned																		
21	Preliminary Environmental Statement	Fugro/Metoc	Planned																		
22	Onshore Compression Station Verification	Petrofac	**Complete**																		
23	Offshore Layout Optimisation	Petrofac	**Complete**																		
24	Receiving Terminal Definition	Petrofac	**Complete**																		

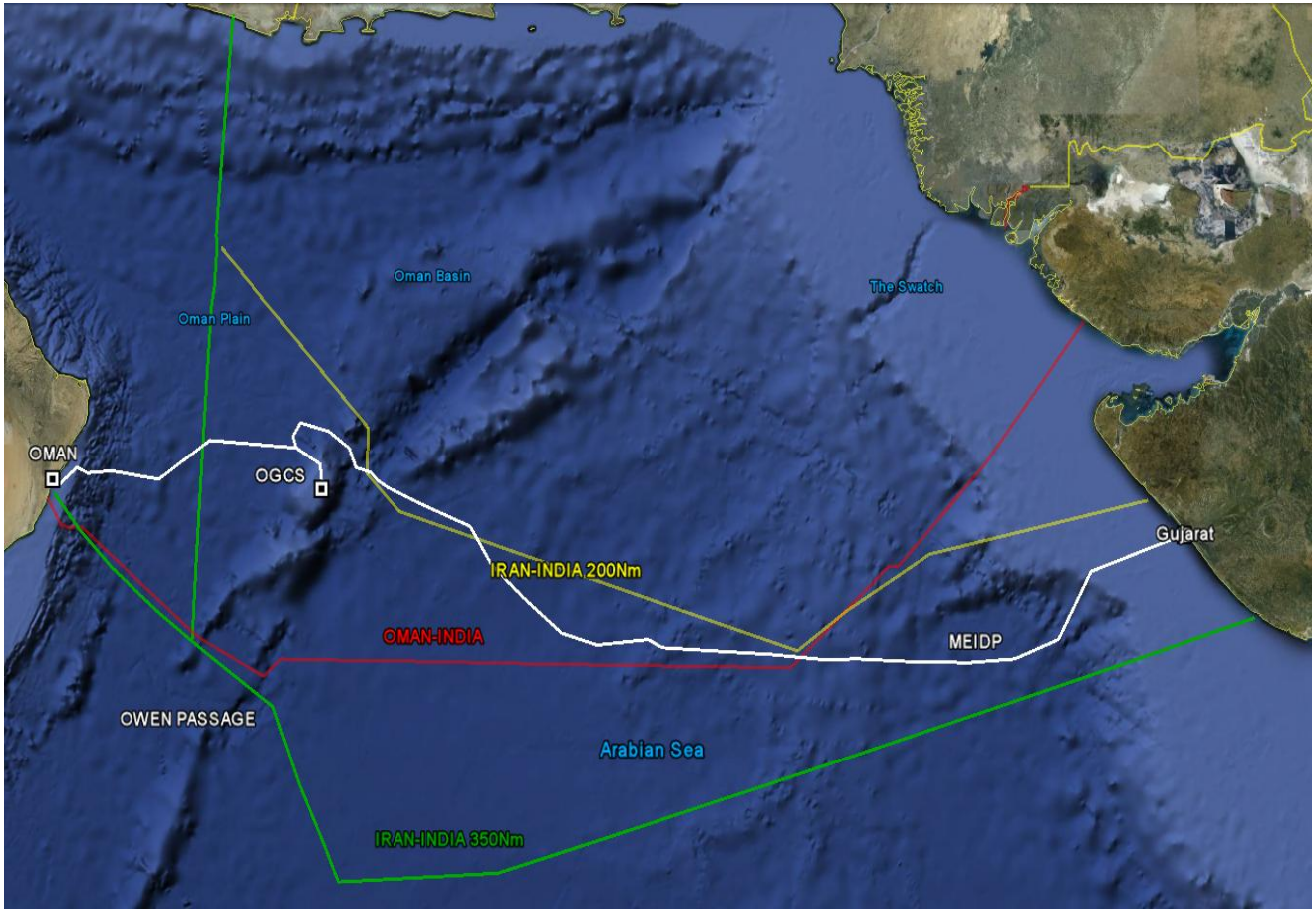
Project Development Schedule



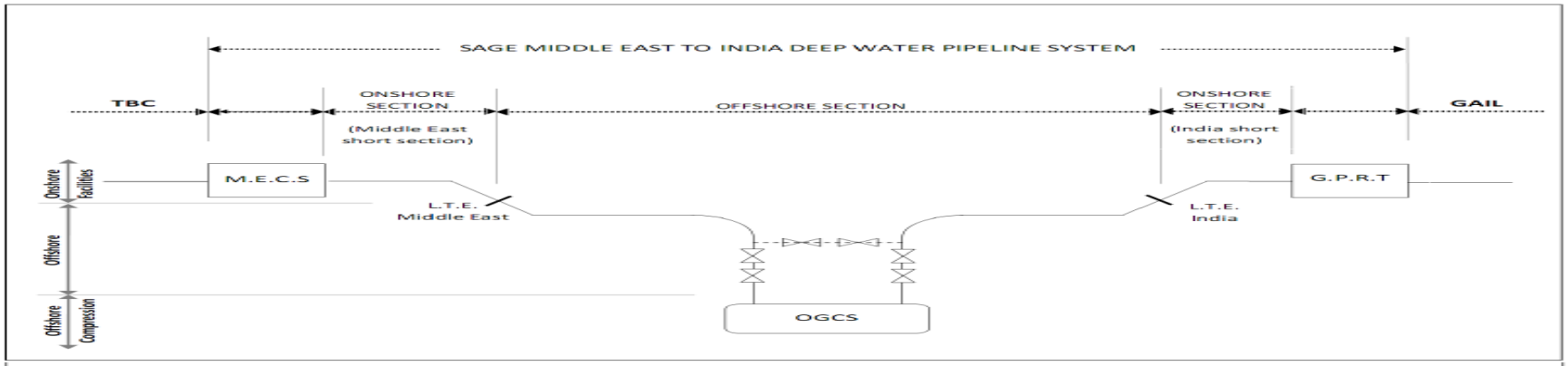
Example Study Results

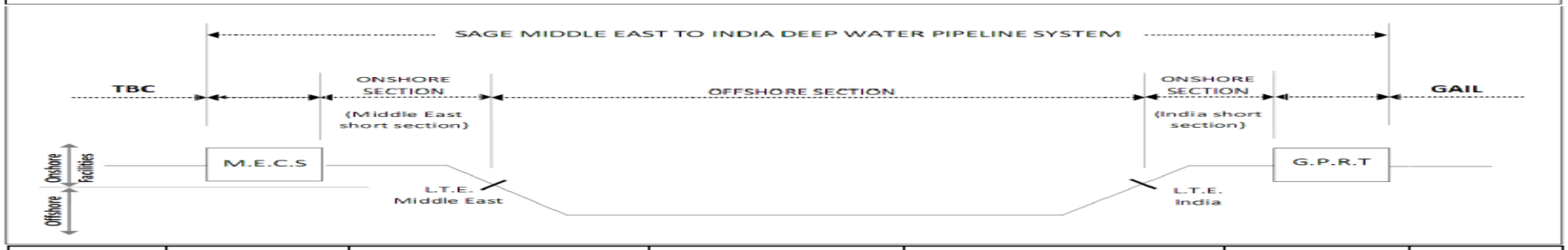
orical Route Options

- Historically many routes have been considered
  - Oman-India 1995
  - Iran-India 1997
  - Iran-India (200NM) 2003
  - Iran-India (350NM) 2003
  - MEIDP 2010
- All were considered to be Installable



Completed studies – Design Basis

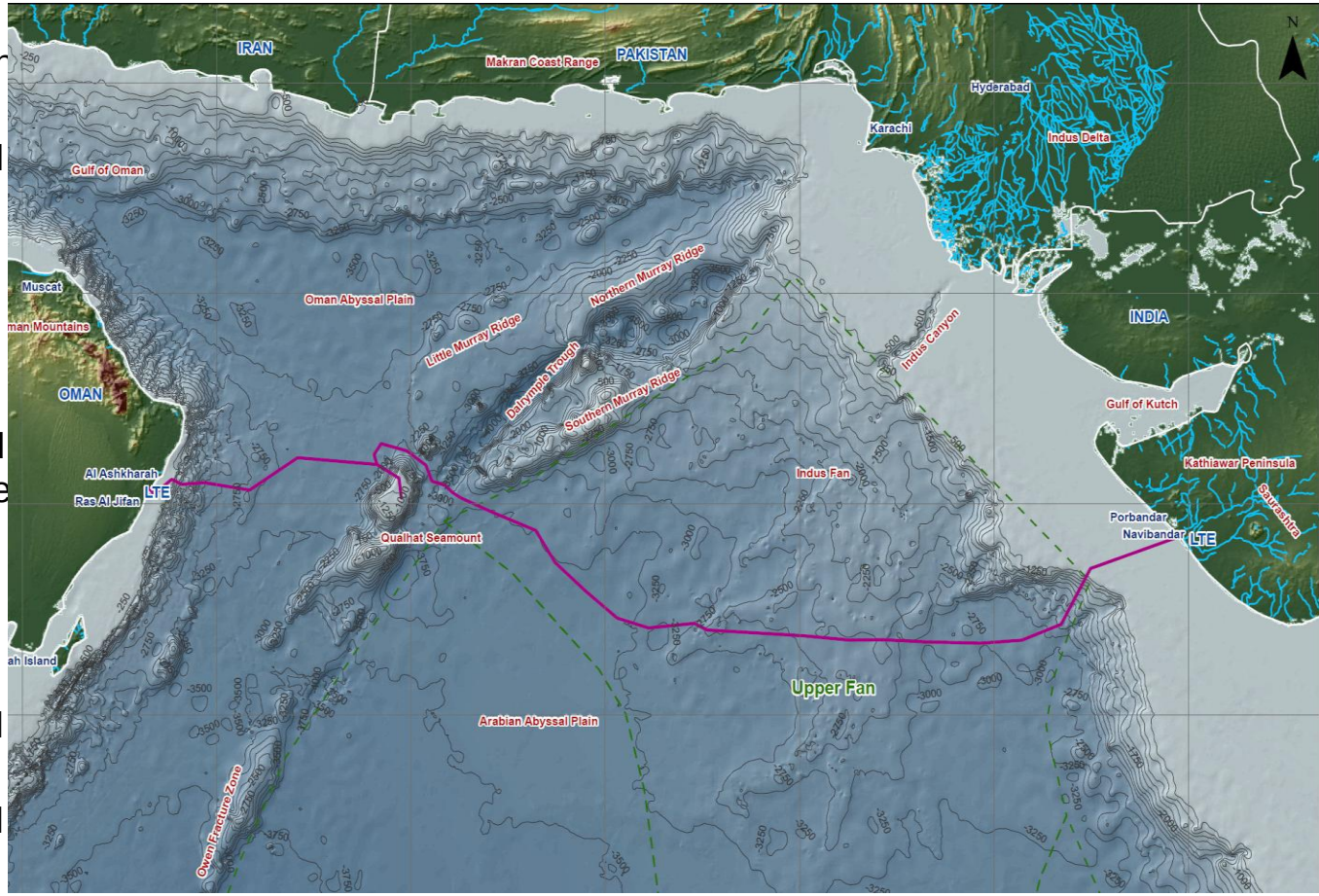




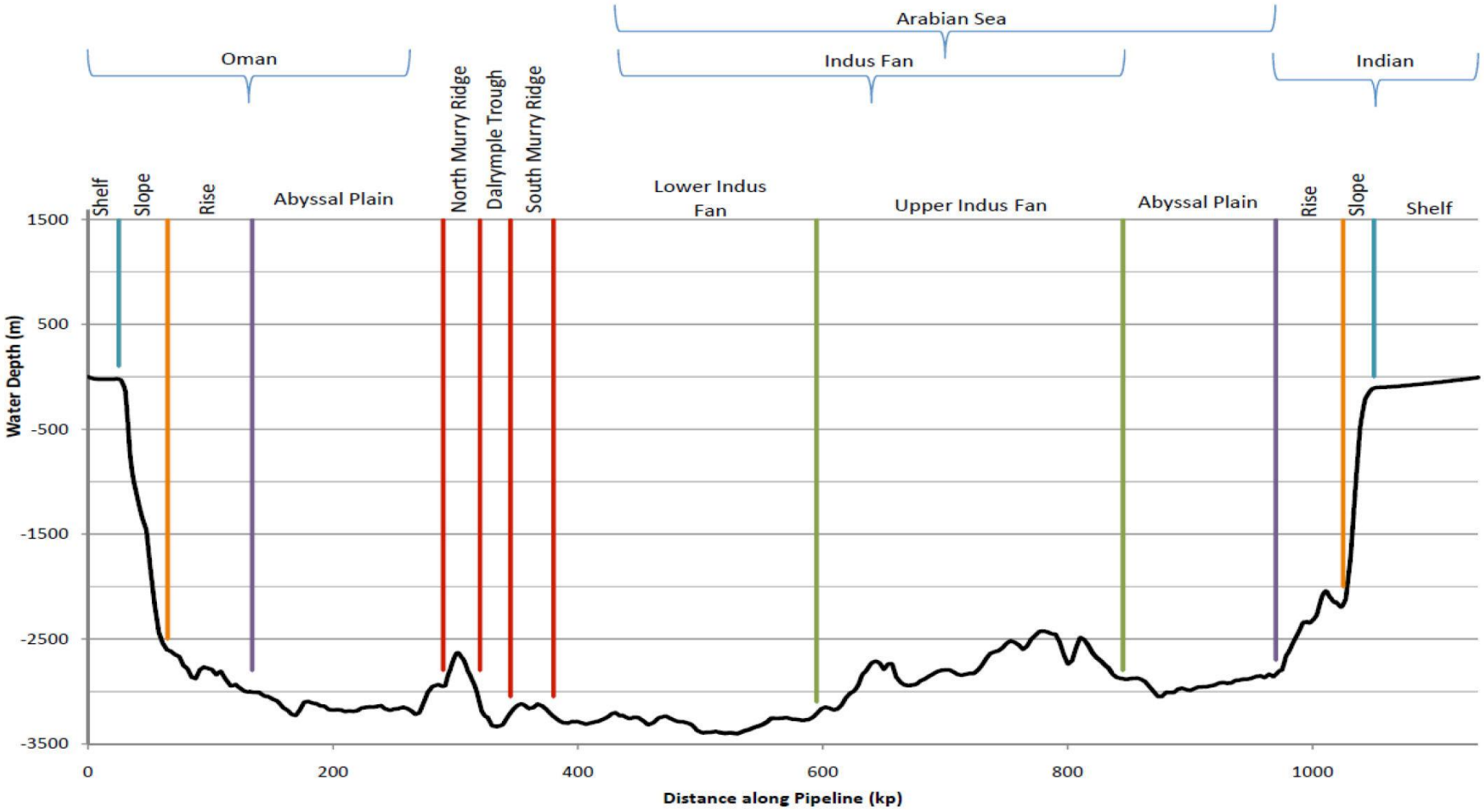
50barg →	M.E.C.S.	400barg → 50barg	OGCS	400barg → 50barg	G.P.R.T. (India)	TBD →
50barg →	M.E.C.S	400barg → 200barg	OGCS	400barg → 50barg	G.P.R.T. (India)	TBD →
50barg →	M.E.C.S.	400barg → 50barg			G.P.R.T. (India)	TBD →
50barg →	M.E.C.S.	400barg	OGCS	Reduced pressure &	G.P.R.T. (India)	TBD →
50barg →	M.E.C.S.	400barg → 200barg	OGCS	400barg → 50barg	G.P.R.T. (India)	TBD →
				400barg → 50barg	Mumbai (India)	TBD →

Pipeline Route (Oman Option)

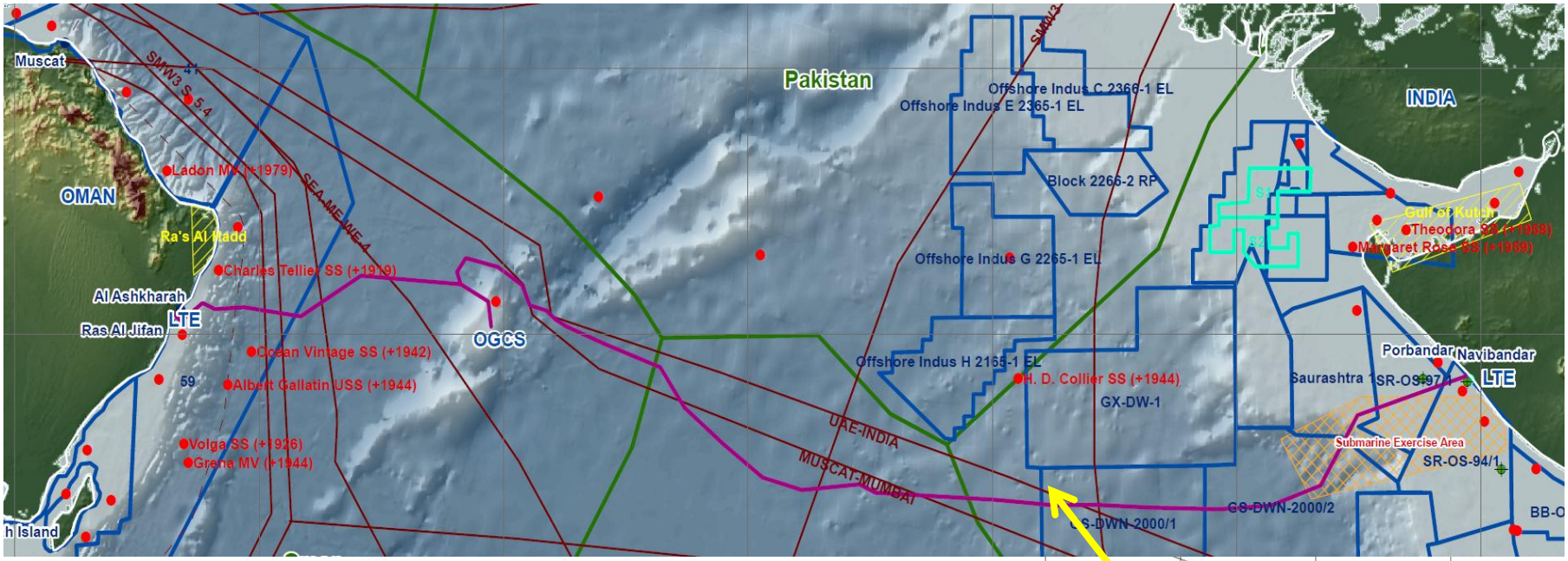
- Routing from Central Oman East coast near Ras Al Jifan and Ghudayran
- Crossing Oman Continental Shelf/Slope/Rise due west
- Crossing Central Oman Abyssal Plain
- Passing North of the Qualhat Seamount
- Crossing the Dalrymple and Arabian Abyssal Plain to the South East
- Crossing lower reaches of the Upper Indus Fan due East
- Crossing Indian Continental Rise & Slope to North East
- Crossing Indian Continental Shelf due East



eline route Profile (direct)

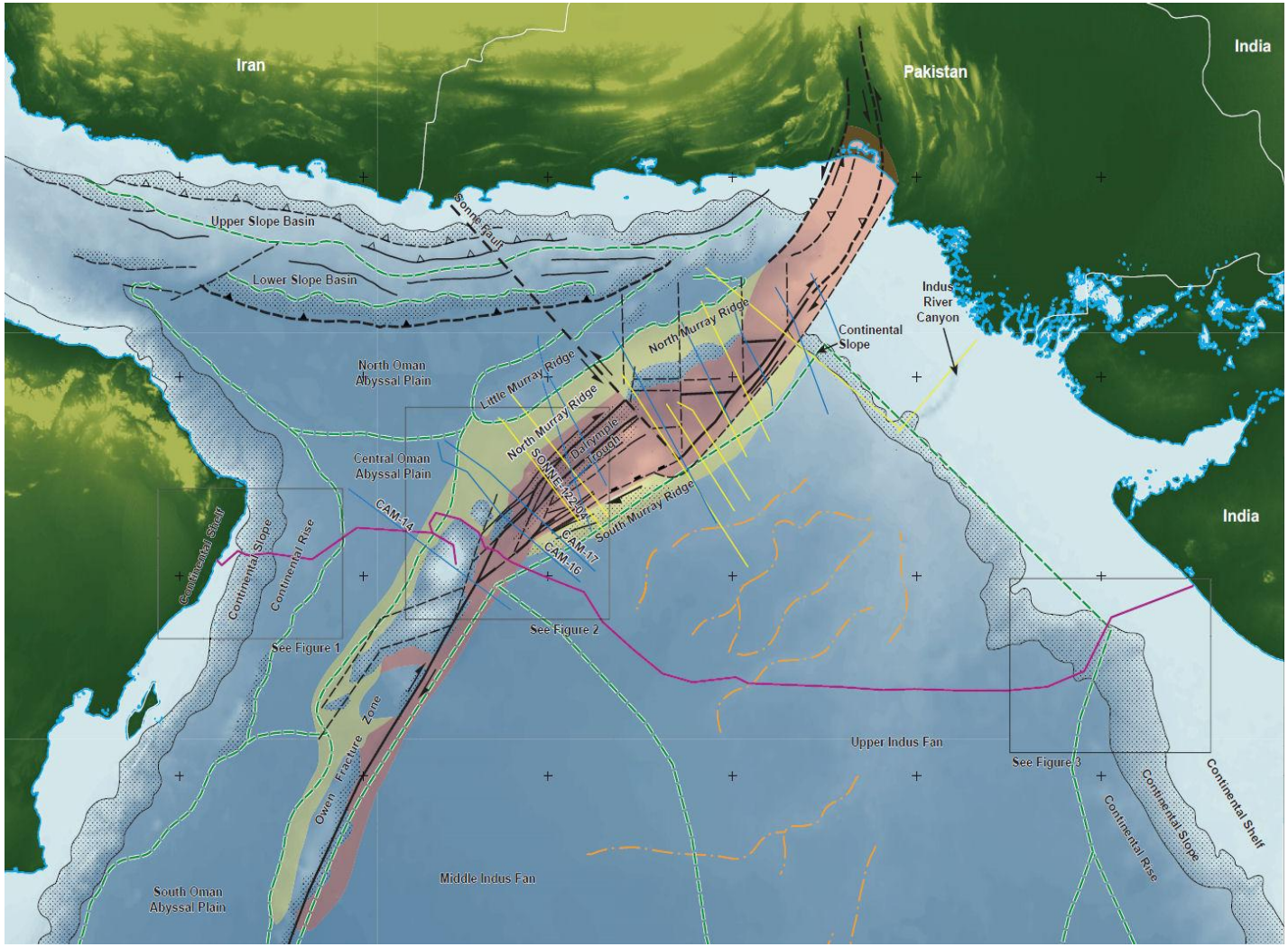


Cable Crossings Along Route



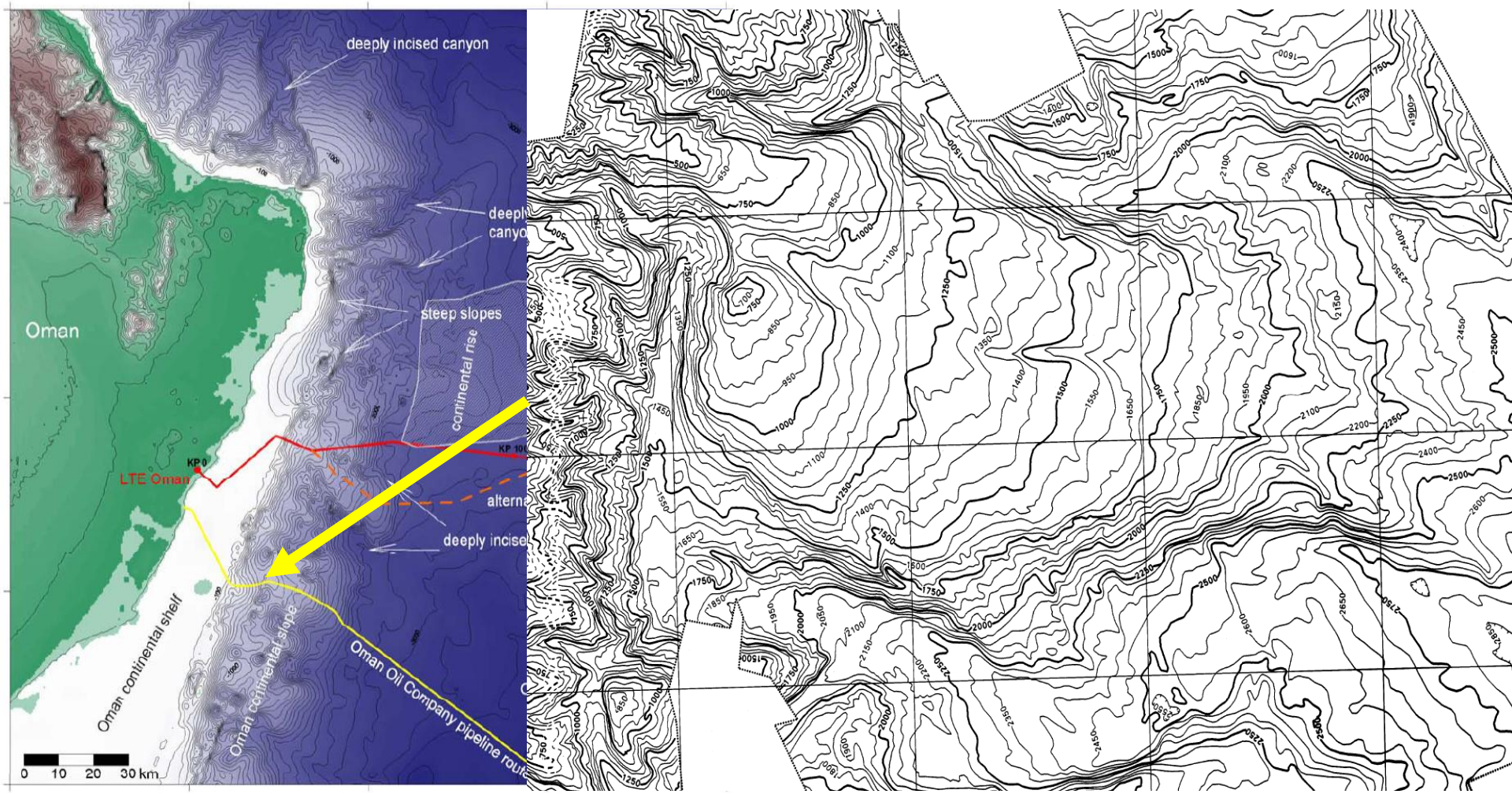
Name	Status
ADEN-BOMBAY 2	Proposed
ADEN-BOMBAY 3	Proposed
ADEN-BOMBAY 4	Proposed
FLAG Seg H and J	Existing
FLAG Seg G and I	Proposed
SEAMEWE3 Segments 5.2, 5.3 and 5.4	Existing
SEAMEWE4	Existing
ADEN-MUSCAT	Proposed
SALALAH-MUSCAT	Existing
MUSCAT-MUMBAI	Existing
UAE-INDIA	Existing
UAE-PAKISTAN	Existing
KARACHI-MUSCAT	Proposed

Morpho-Techtonic Features I

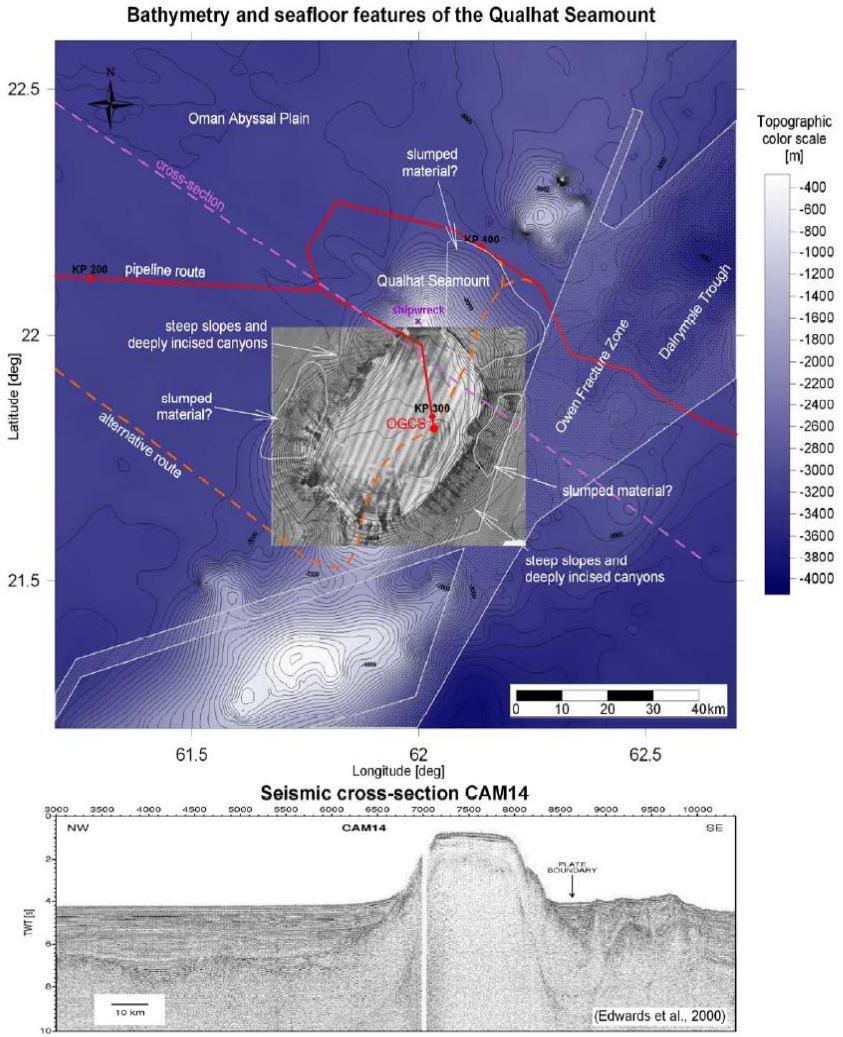


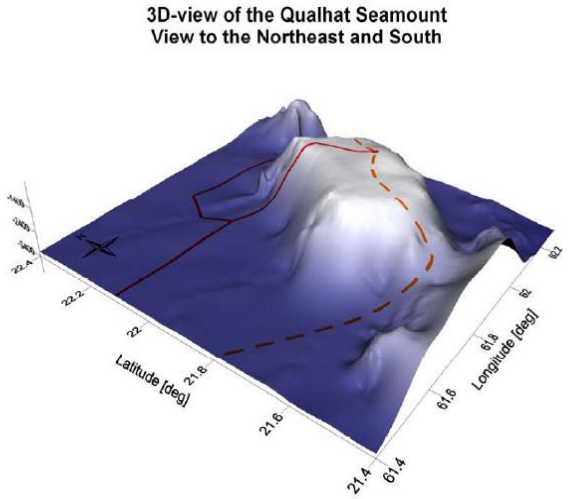
Geohazards and Features

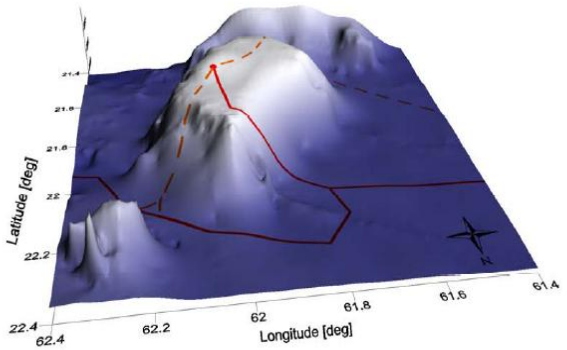
Bathymetry and seafloor features of the Oman Continental Shelf and Slope



Murray Ridge and Qualhat Seamount

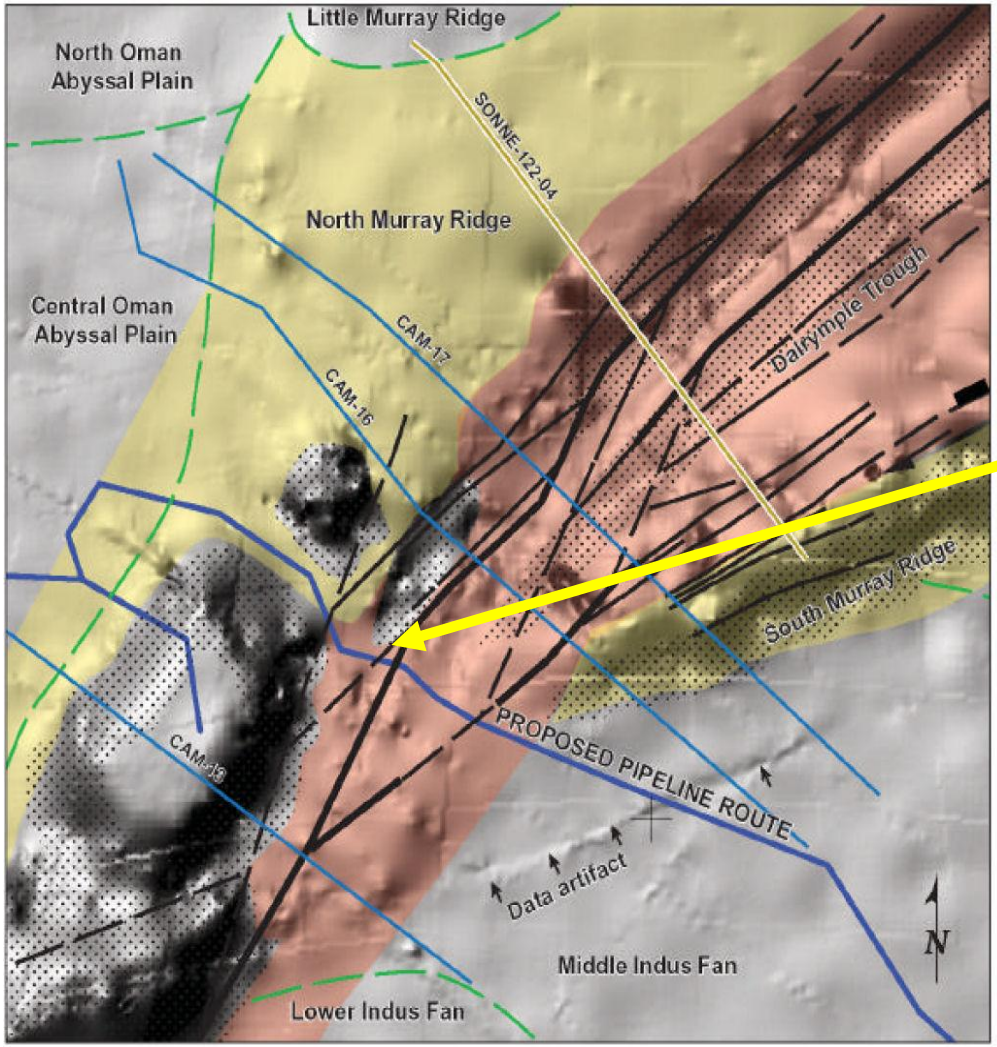


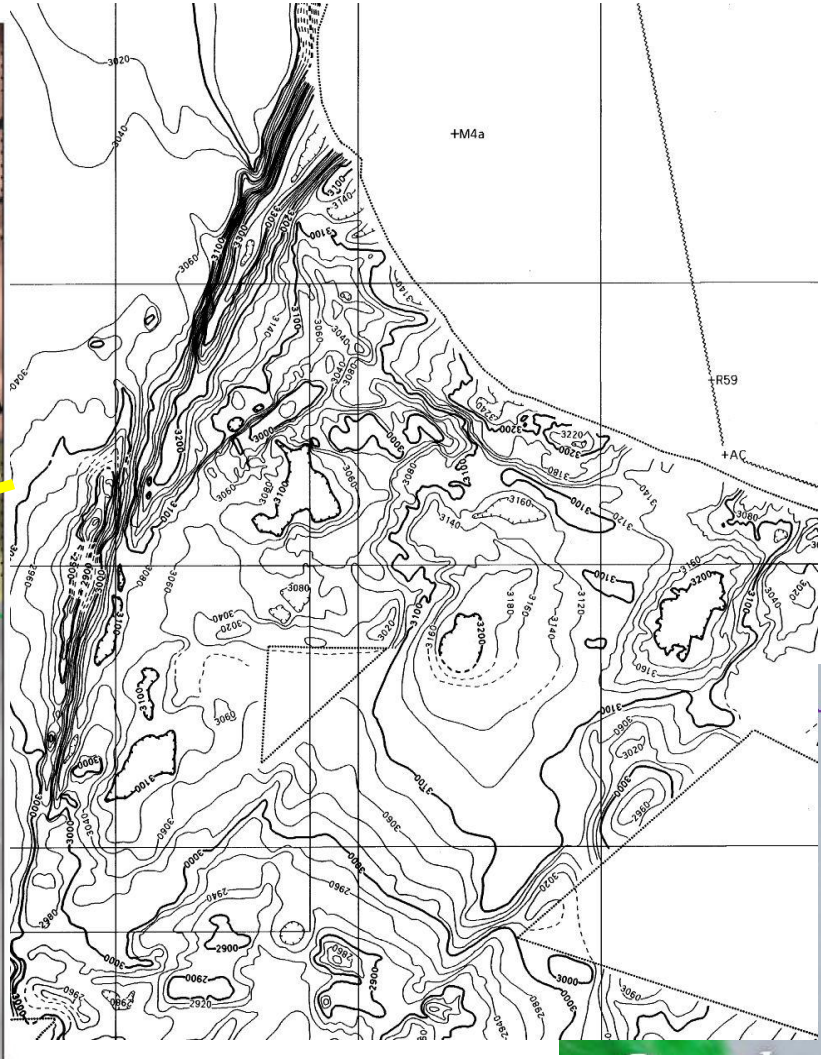




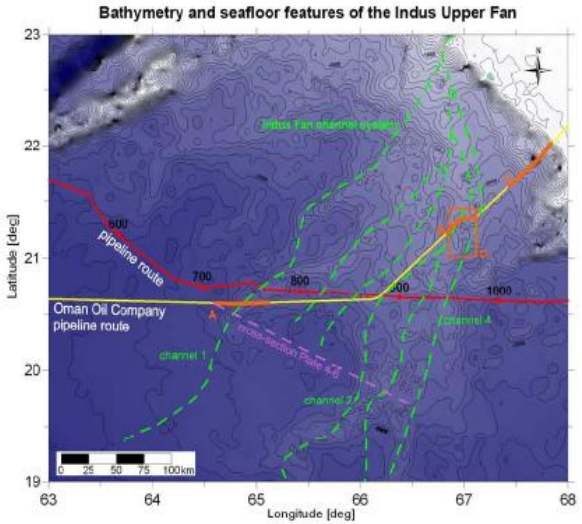
Notes: - Image on map is a multibeam sonar mosaic of the Qualhat Seamount (IFREMER, MARABIE cruises 2000 and 2001)
- Contour interval of bathymetry is 100 metres (derived from GEBCO gridded bathymetry).

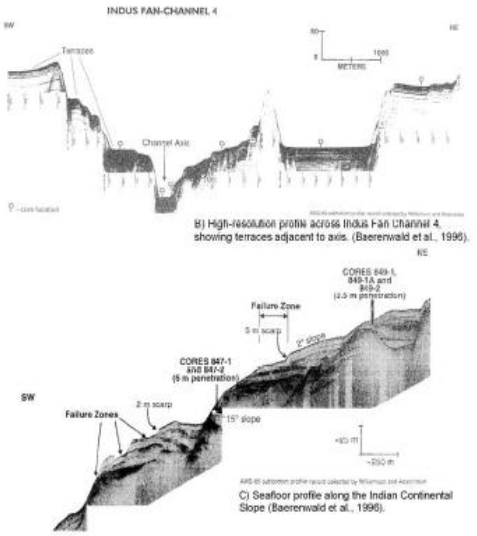
Dalrymple Trough/Owen Fracture





Indus Fan crossing

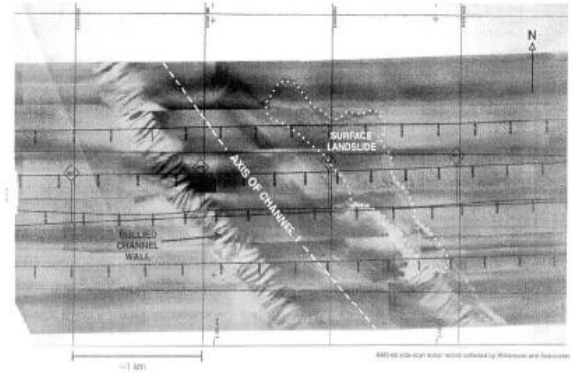




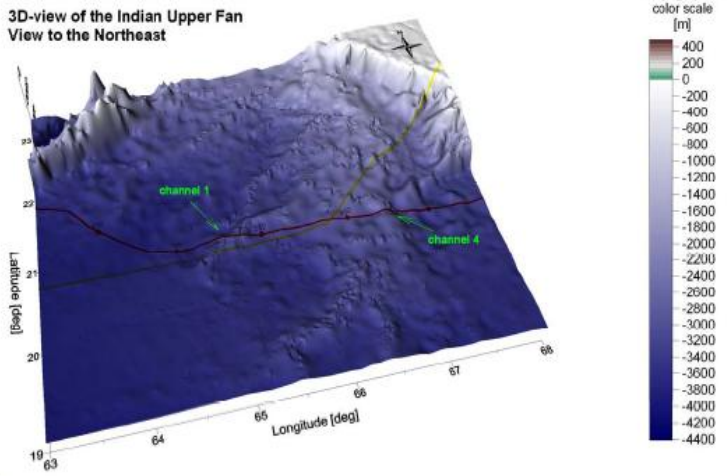
B) High-resolution profile across Indus Fan Channel 4 showing terraces adjacent to axis. (Baerenwald et al., 1996).

C) Seafloor profile along the Indian Continental Slope (Baerenwald et al., 1996).

D) Detailed bathymetry of meandering Indus Fan Channel 4 (Mullee, 1995).



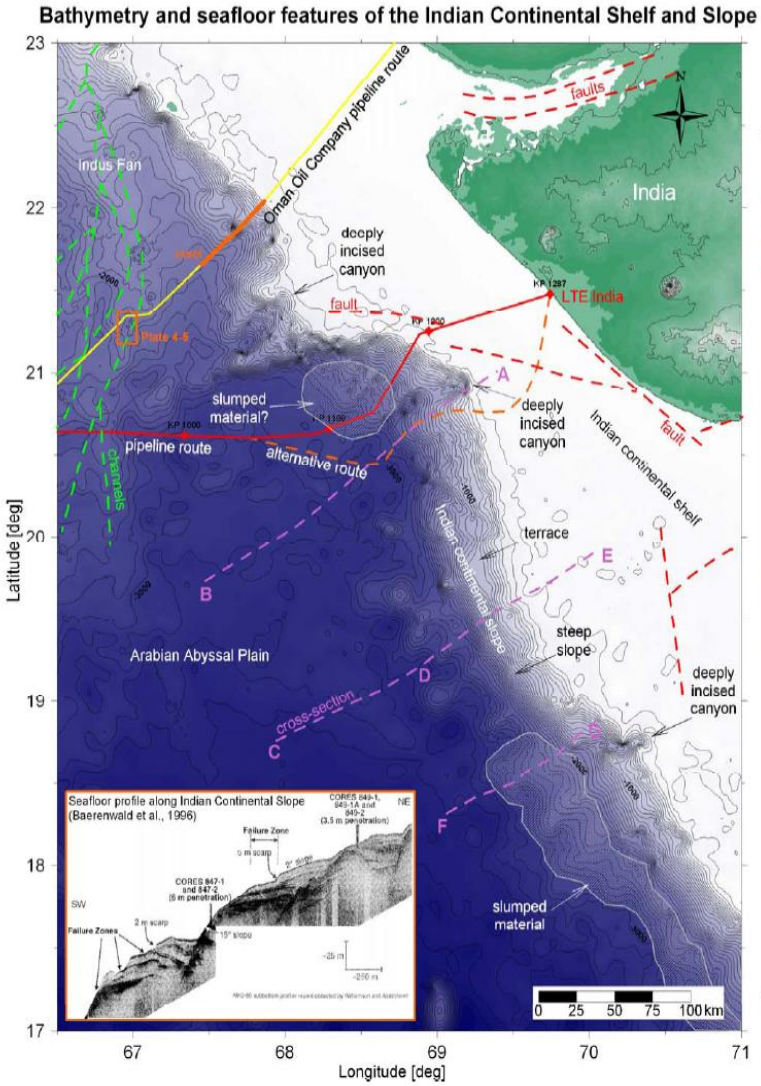
A) Side-scan sonar mosaic of Indus Fan Channel 1 (Baerenwald et al., 1996).

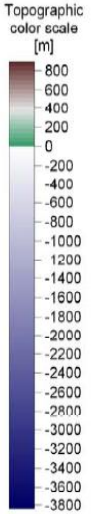


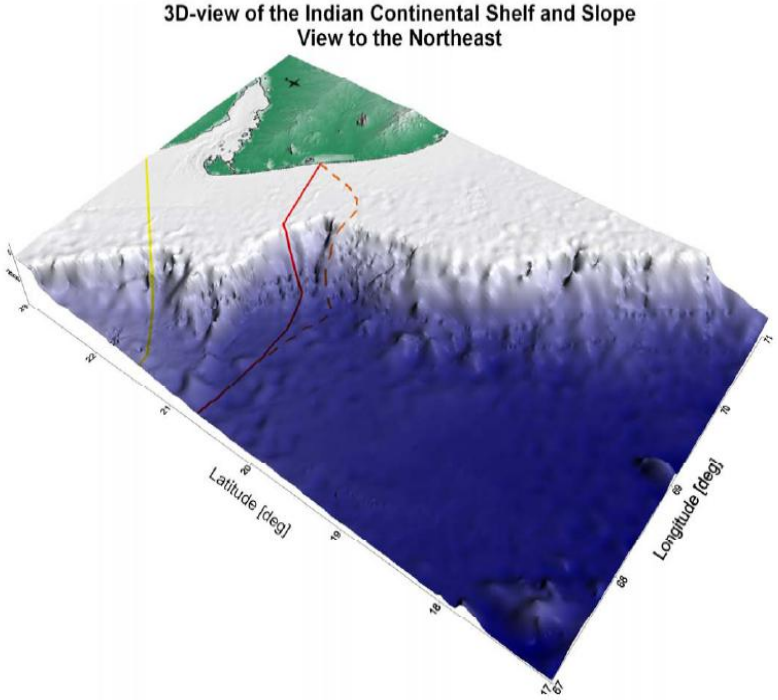
Note: - Contour interval of bathymetry map is 100 metres (derived from GEBCO gridded bathymetry).

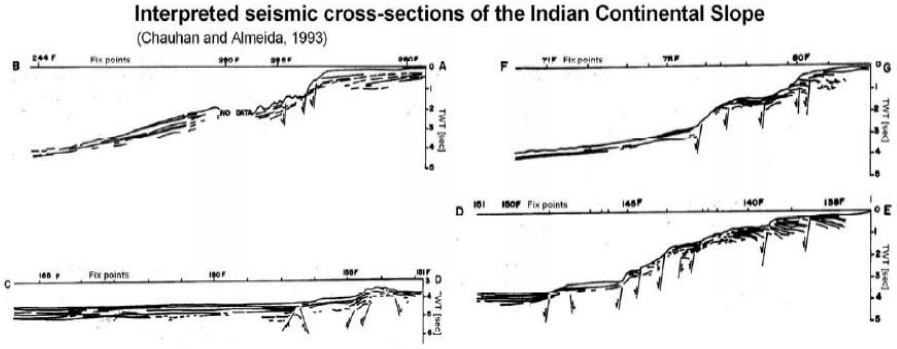
Bathymetry and Seafloor Features of the Arabian Abyssal Plain and Indus Fan
SOUTH ASIA GAS ENTERPRISE (SAGE) PIPELINE – OMAN TO INDIA

Indian Continental Slope

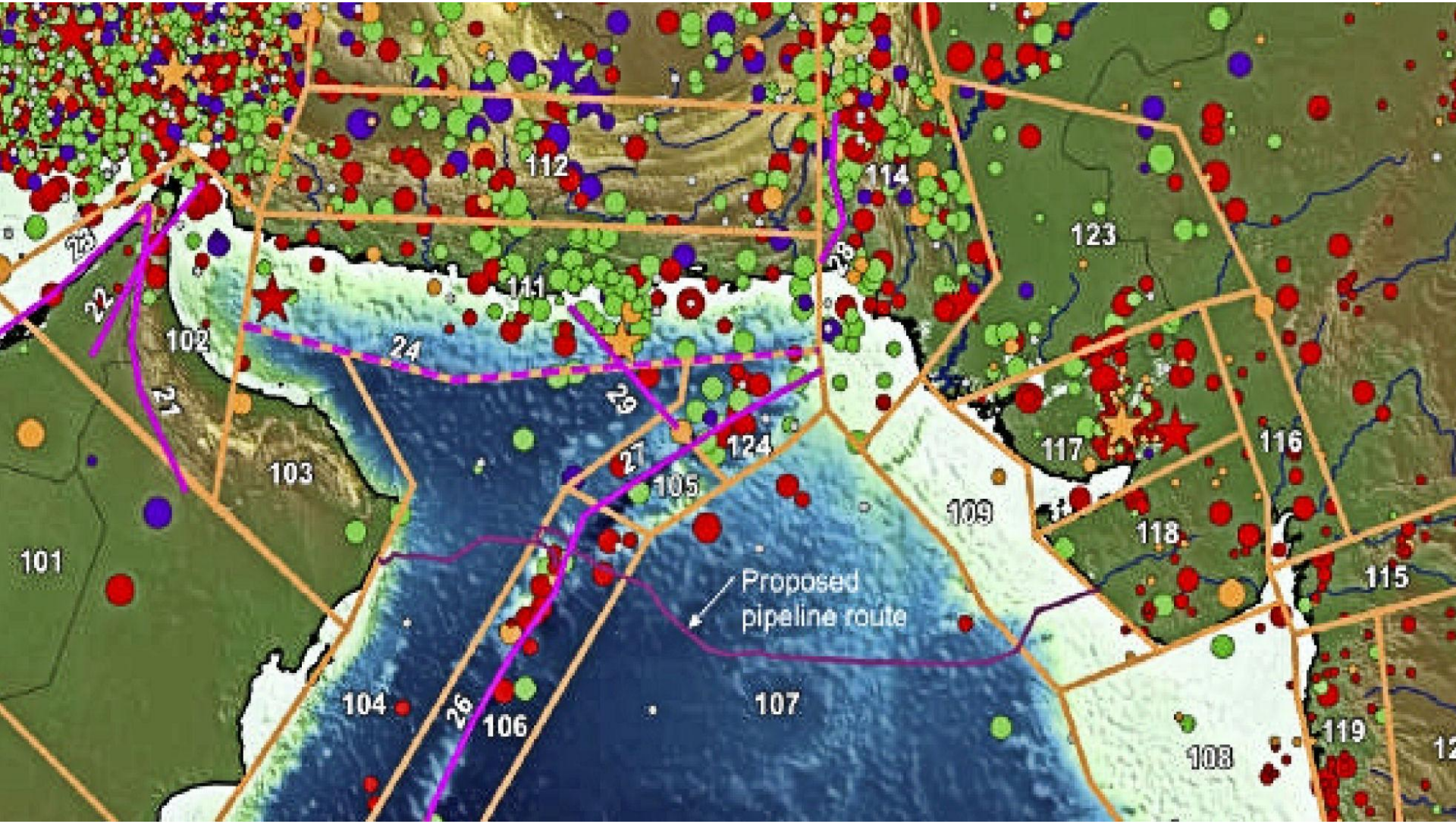




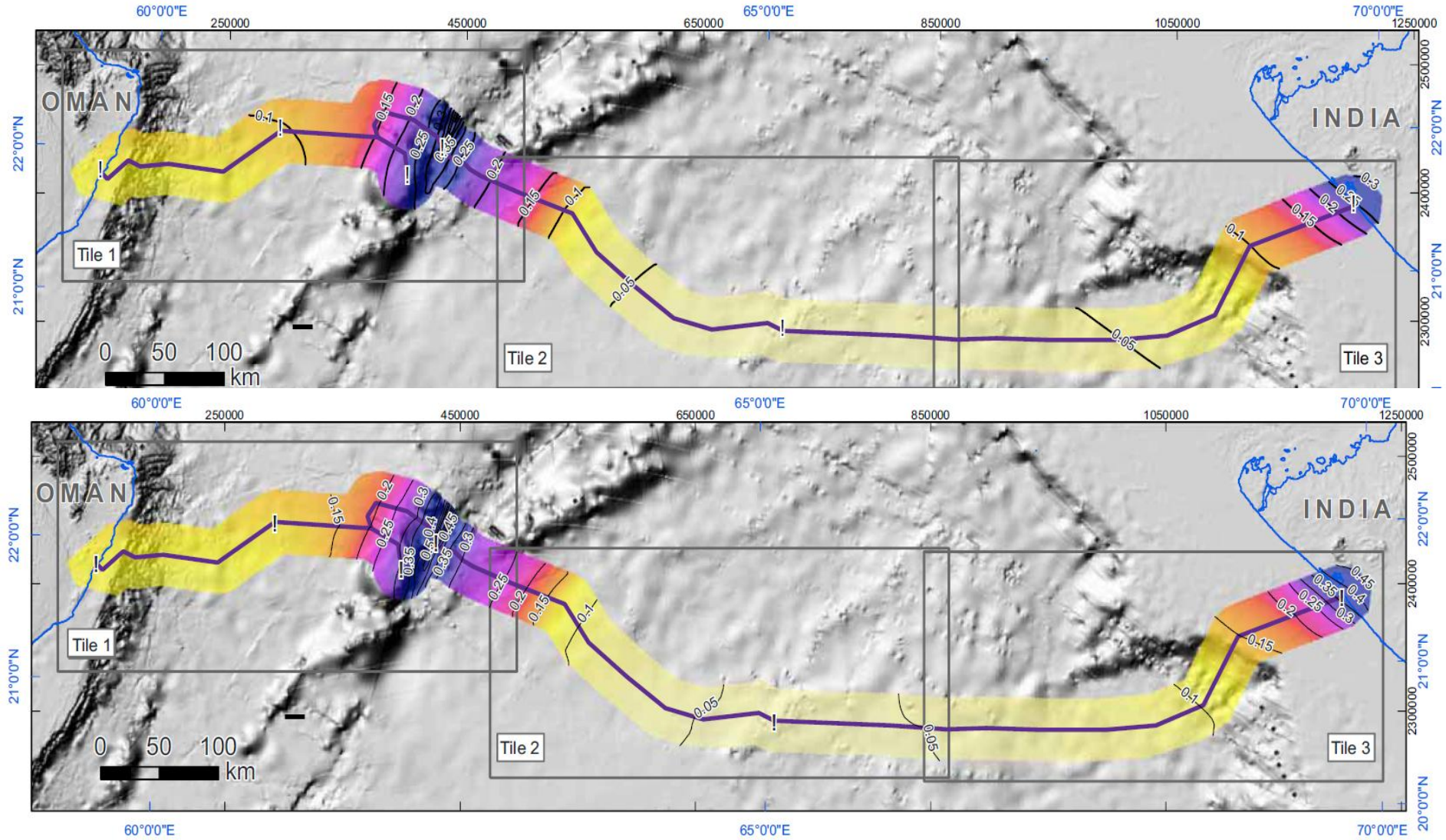




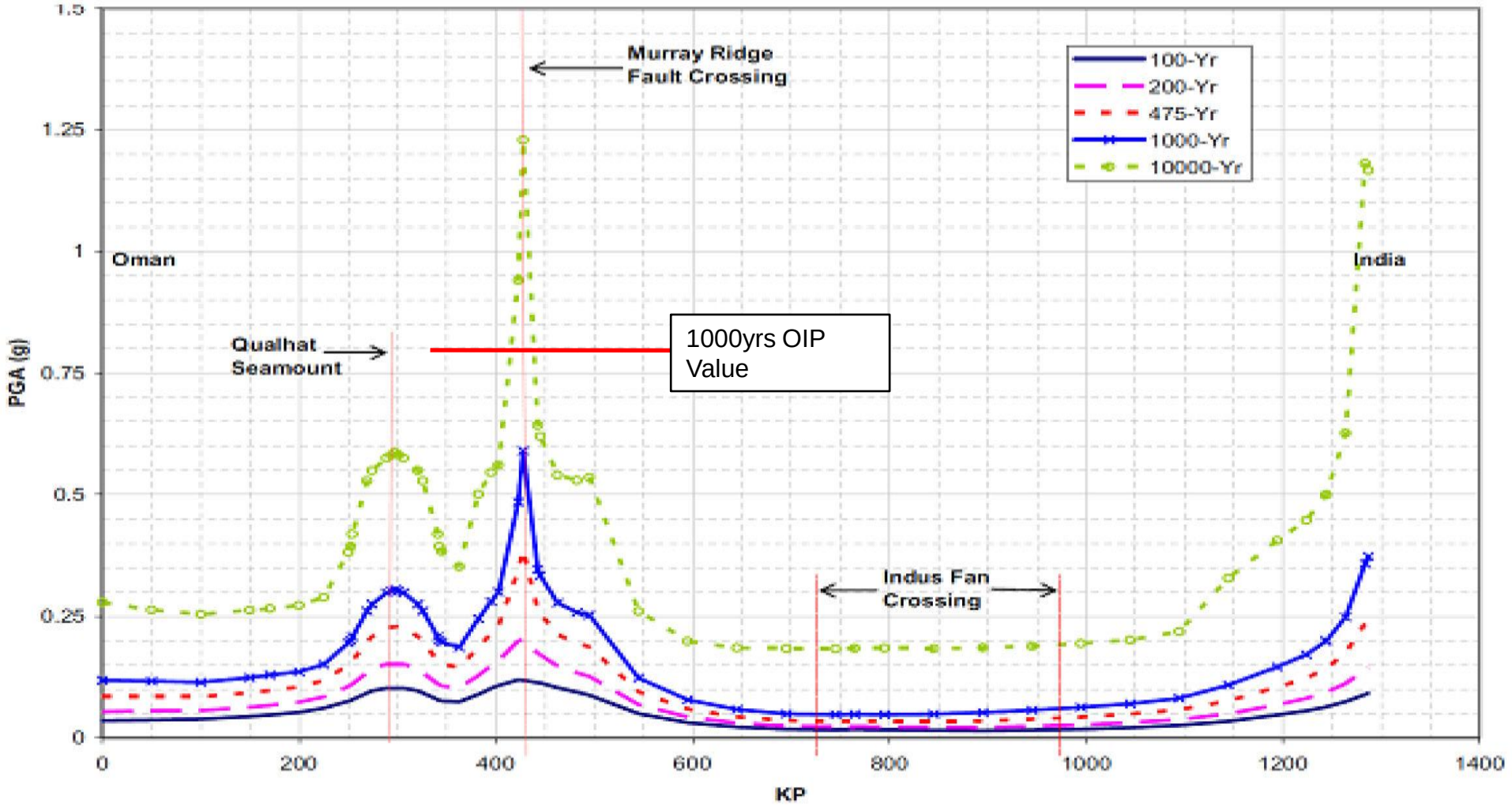
Seismic Events Near MEIDP



PGA Maps (475yrs & 1000yrs)



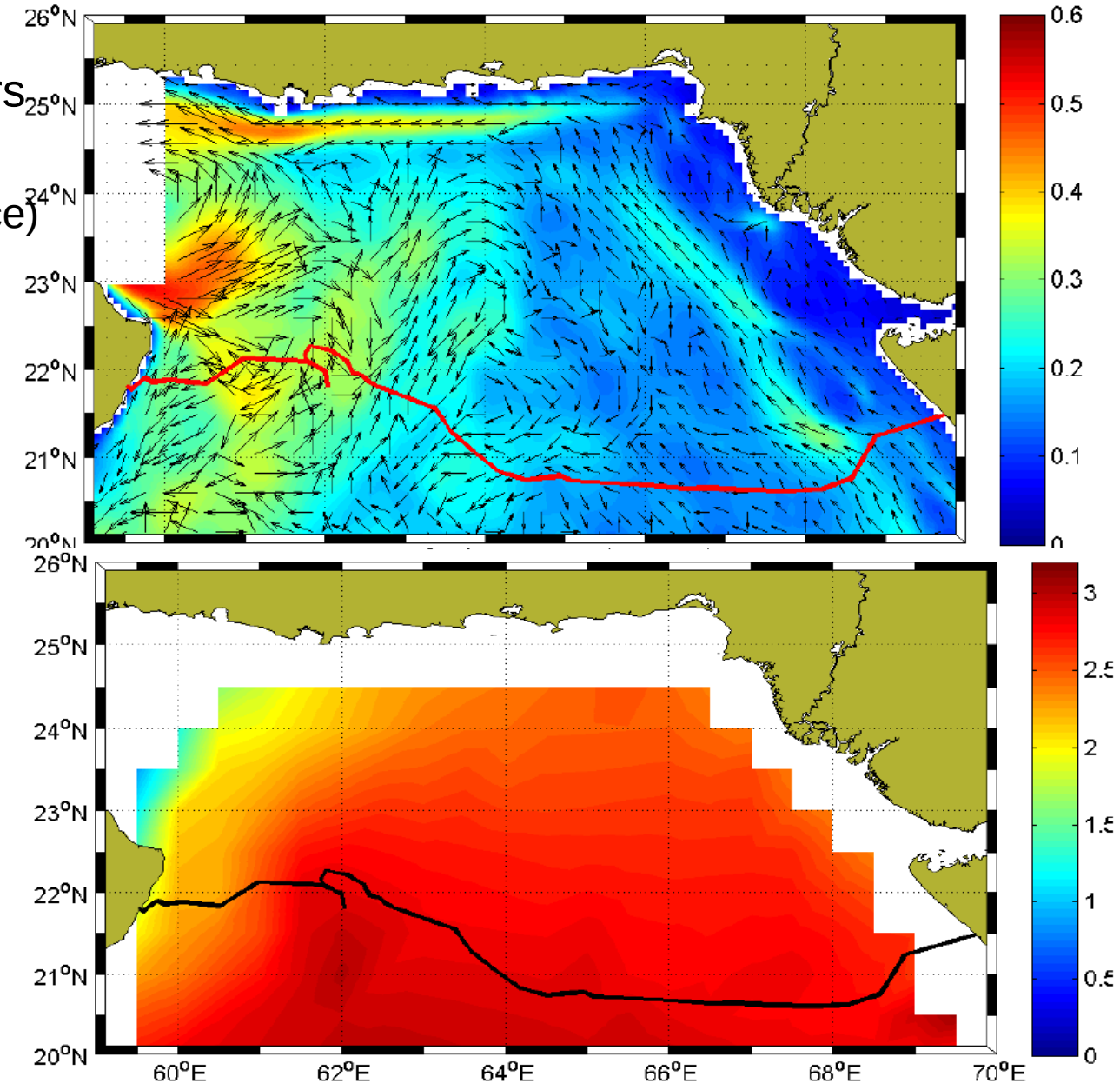
PGA Profiles Along Route



Completed Studies – Metocean Phase 1

Environmental Parameters

- Wave Heights
- Currents (Seabed-Surface)
- Temperatures
- Winds



Flow Assurance Results (1)

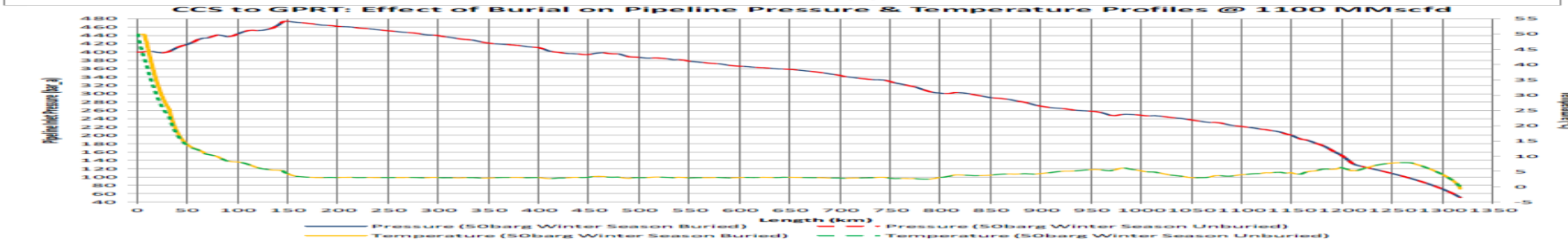
The following line sizes have been selected for the various options considered for the Middle East to India deepwater pipeline from Chabahar to Gujarat for an export (sizing case) flowrate of 1100 MMscfd or 31.1 MMSCMD :

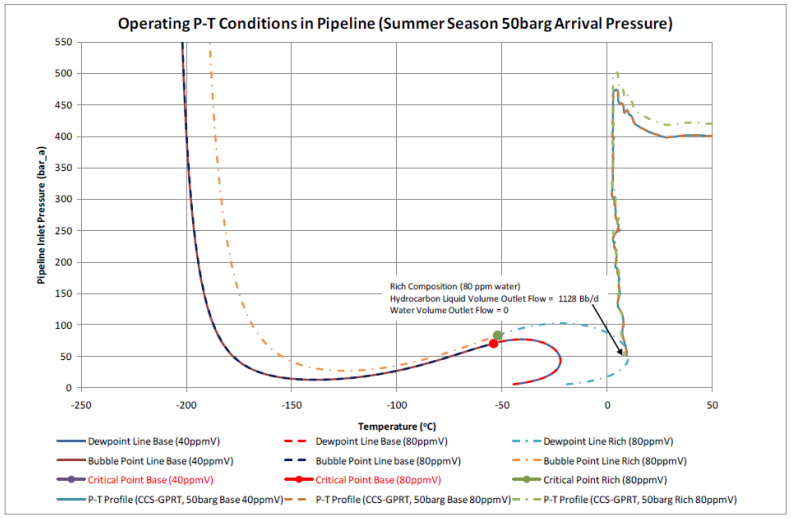
- CCS to OGCS, 400barg-50barg, ID=487mm
- CCS to OGCS, 400barg-200barg, ID=530mm
- OGCS to GPRT, 400barg-50barg, ID=579mm
- CCS to GPRT, 400barg-50barg, ID=610mm

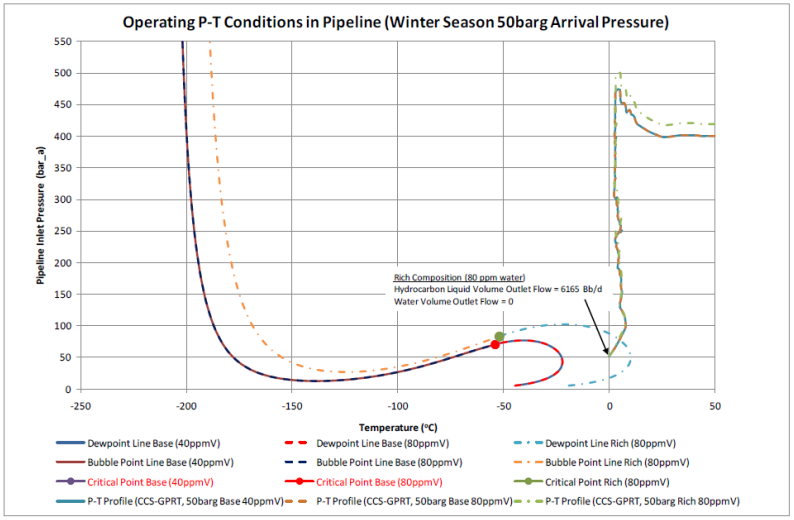
- Of the two OGCS arrival pressures considered in Option 1, the high arrival pressure case is the preferred option for the following reasons:
  - By operating in dense phase, the velocities are manageable (6 m/s).
  - By operating at lower velocities the gas arrival temperature at the offshore station is approximately 7°C which is manageable.
  - By operating in Dense Phase a larger pipeline (530 mm ID) will be required.

Completed studies – Flow Assurance

Seabed Profiles, Temperatures and Pressures (MECS to GPRT)







Rich-Upset (Summer)

Rich-Upset (Winter)

Completed Studies – Mechanical Design

The wall thickness design is performed in accordance with DNV-OS-F101 using DNV 485 DSAW linepipe

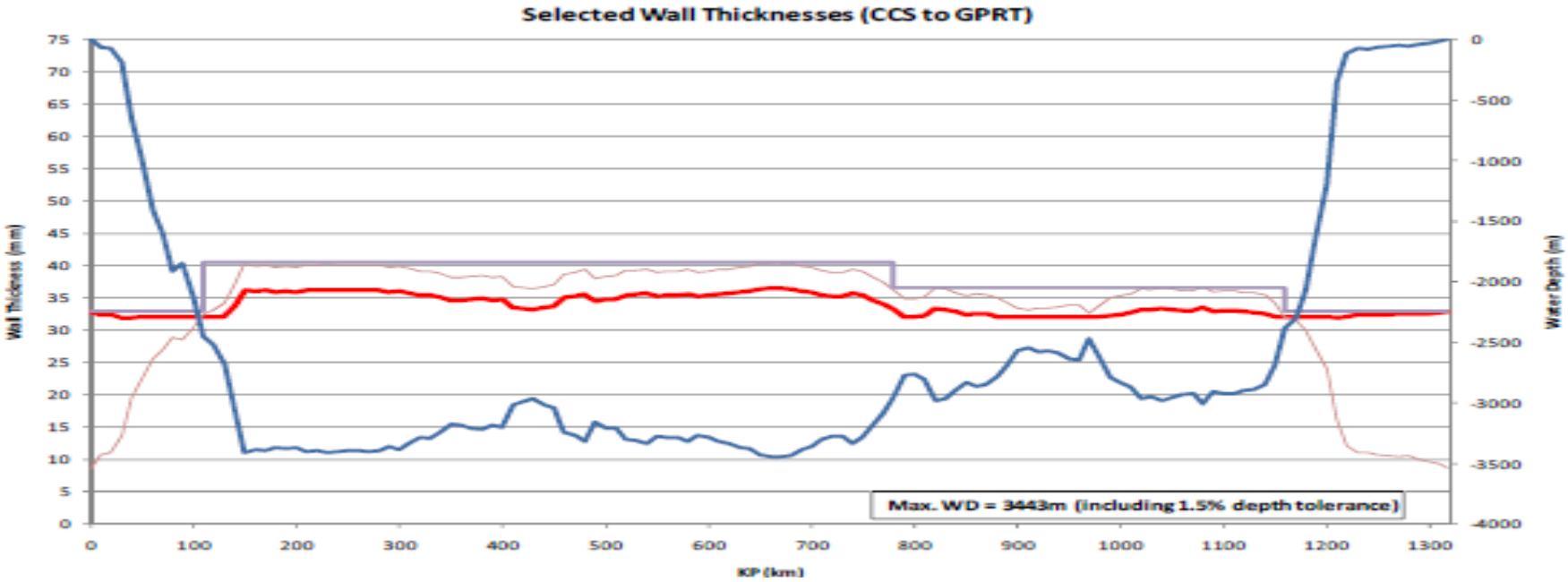
For long distance deep water gas transmission pipelines, linepipe material and installation costs are significant parts of the overall project cost. The base case has assumed that all possible DNV Quality Control (QC) factors have been set to their maximum criteria.

These QC criteria are described below:

- Supplementary requirement U material strength factor
- Fabrication factor for UOE pipe (afab) = 1.0, based on the conclusion made in the DNV technical report that a modest heat treatment during the pipe coating application can increase fabrication factor for UOE from the default value of 0.85 to 1.0.
- Ovality = 0.5%

Completed Studies

- Mechanical Design

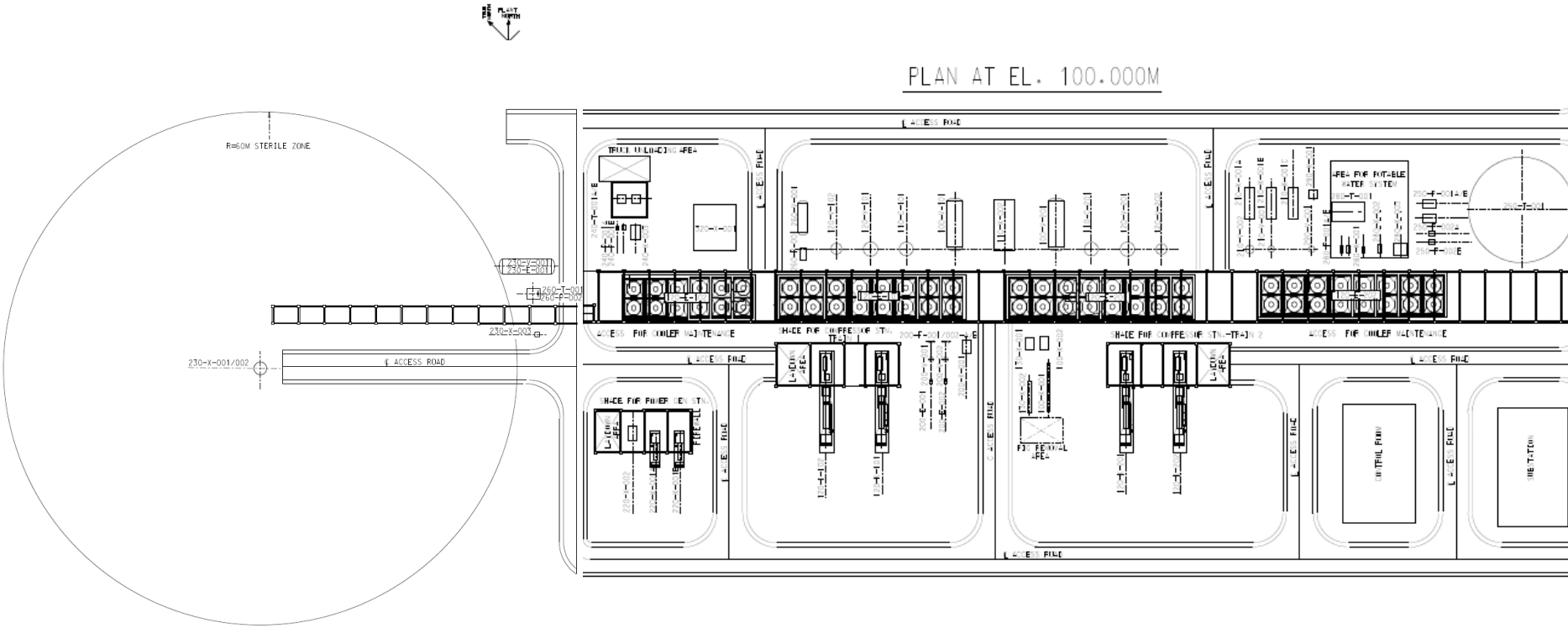


KP Range (km)	WD Range (m)	Section Length (km)	Pipe ID (mm)	Selected Wall Thickness (mm)	Buckle Arrestor Required	Tonnage of Steel Required for Line Pipe (Tonne)
0 – 6.8	-82 - 8.8	6.8	610	40.5	No	4,418
6.8 - 40	8.8 - 659	33.2	610	32.9	No	17,318
40 - 110	659 - 2448	70	610	32.9	Yes	36,514
110 - 770	2448 - 3084	660	610	40.5	Yes	428,811
770 - 1150	3084 - 2690	380	610	36.6	Yes	221,779
1150 - 1210	2690 – 361	60	610	32.9	Yes	31,298
1210 - 1317.5	361 – 1.5	107.5	610	32.9	No	56,075
1317.5 - 1318	1.5 - 0	0.5	610	40.5	No	325
					Total	**796,537**

Completed studies – Onshore Terminal

Concept Definition

- Equipment Lists
- PFD's
- UFD's
- Weight Take-off
- Layouts
- Cost Estimate



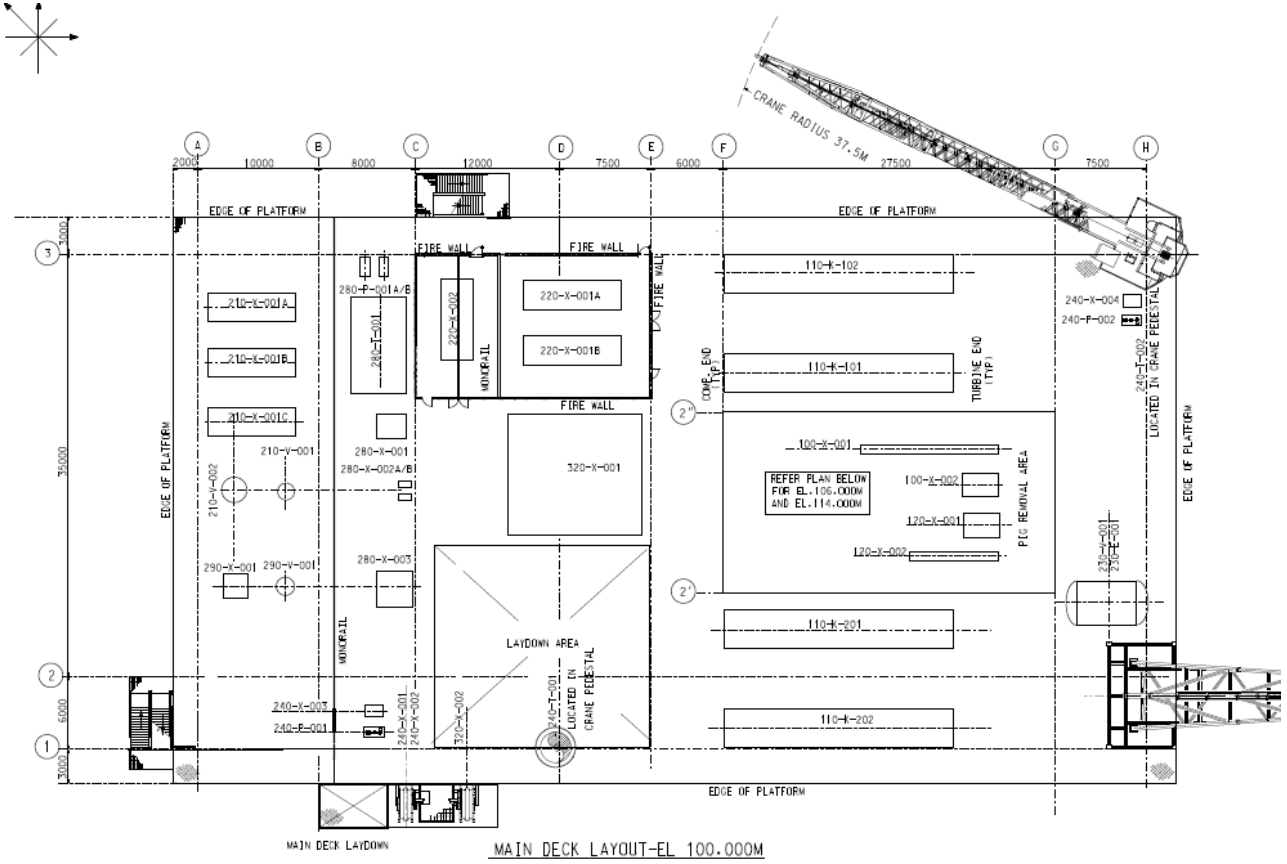
Onshore Equipment

EQUIPMENT NO.	DESCRIPTION	SIZE(LXWXH OR IDXT/T)
100-X-001	PIG RECEIVER	0.7M X 11.40M
100-X-002	NATURAL GAS METERING PKG.	3.0M X 2.0M X 1.0M
100-V-101/201	INLET SEPARATOR	3.7M X 11.0M
130-X-001	EXPORT GAS METERING PKG.	3.0M X 2.0M X 1.0M
130-X-002	PIG LAUNCHER	0.8M X 7.3M
110-C-101/201	TEG CONTRACTOR	3.25M X 9.0M
110-X-002	TEG REGENERATION PACKAGE	12.0M X 5.0M
120-V-101/201	IST STAGE COMP. SUCTION DRUM	3.4M X 5.1M
120-K-101/201	IST STAGE COMPRESSOR	24.0M X 3.2M X 3.8M
120-E-101/201	IST STAGE COMP. AFTERCOOLER	44.8M X 12.0M
120-V-102/202	2ND STAGE COMP. SUCTION DRUM	2.6M X 4.1M
120-K-102/202	2ND STAGE COMPRESSOR	24.0M X 3.2M X 3.8M
120-E-102/202	2ND STAGE COMP. AFTERCOOLER	31.8M X 12.0M
200-X-001	FUEL GAS METERING PKG.	3.0M X 2.0M X 1.0M
200-V-001	LP FUEL GAS K.O. DRUM	1.2M X 2.6M
200-V-002	HP FUEL GAS K.O. DRUM	0.86M X 2.5M
200-E-001	LP FUEL GAS HEATER	0.74M X 1.4M
200-E-002	HP FUEL GAS HEATER	0.74M X 1.4M
200-F-001A/B	LP FUEL GAS FILTER	0.5M X 1.0M
200-F-002A/B	HP FUEL GAS FILTER	0.5M X 1.0M
210-X-001A/B/C	INSTRUMENT AIR COMP. PKG	2.3M X 7.3M X2.0M
210-V-001	INST. AIR RECEIVER	1.4M X 4.2M
210-V-002	PLANT AIR RECEIVER	2.1M X 6.5M
220-X-001A/B	GAS TURBINE POWER GEN PKG.	8.5M X 2.5M X 3.0M
220-X-002	EMER. POWER DIESEL GEN PKG.	3.4M X 2.0M X 2.1M
230-X-001	FLARE STACK	HOLD
230-X-002	FLARE TIP	HOLD
230-X-003	FLARE IGNITION SYSTEM	HOLD
230-V-001	FLARE K.D.DRUM	HOLD
230-E-001	FLARE K.D.DRUM HEATER	HOLD
240-T-001A/B	DIESEL BULK STORAGE TANK	2.0M X 2.0M X 1.5M
240-X-003	DIESEL FILTR./COALESCER PKG	HOLD
240-P-001A/B	DIESEL TRANSFER PUMP	1.0M X 0.8M X 0.8M
250-T-001	FIRE WATER TANK	25.0M X 10.0M
250-P-002A/B	FIRE WATER JOCKEY PUMP	1.2M X 1.4M X 0.4M
250-P-001A/B	FIRE WATER PUMP	1.3M X 3.1M X 1.4M
260-V-001	CLOSED DRAINS DRUM	2.3M X 6.9M
260-P-001	CLOSED DRAINS DRUM PUMP	3.0M X 1.5M X 1.5M
260-T-001	HAZARDOUS OPEN DRAIN TANK	3.0M X 2.5M X 1.5M
260-P-002	HAZARD. OPEN DRAIN TK. PUMP	3.0M X 1.5M X 1.5M
280-X-001	POTABLE WATER MAKER PKG.	HOLD
280-T-001	POTABLE WATER TANK	HOLD
280-P-001A/B	POTABLE WATER PUMP	HOLD
280-X-002	POTABLE WTR STERILLI. PKG	HOLD
280-X-003	HOT WTR CALORIFI. PKG	HOLD
290-X-001	NITROGEN GENERATION PKG	2.0M X 2.0M X 3.0M
290-V-001	NITROGEN RECEIVER	1.5M X 4.6M
320-X-001	METHANOL INJECTION PACKAGE	10.0M X 11.0M X 3.0M

Completed studies – Offshore Compression

Concept Definition

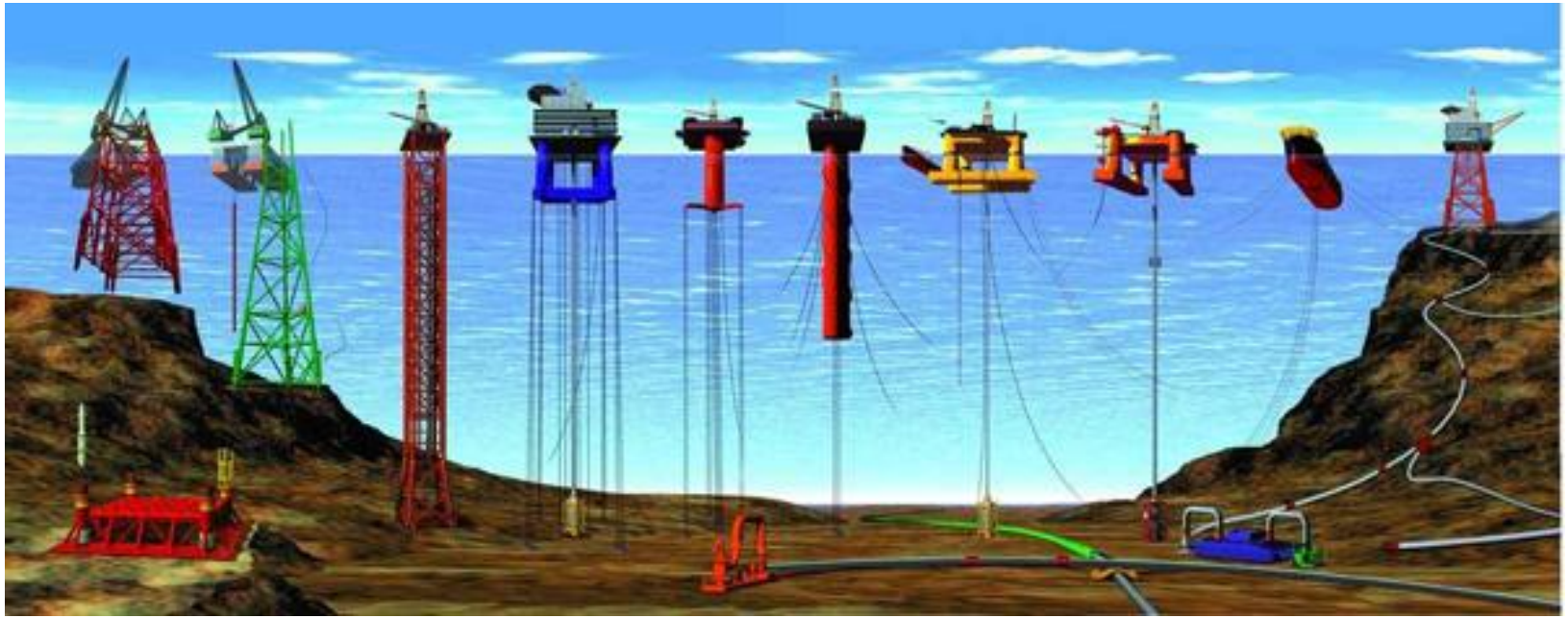
- Equipment Lists
- PFD's
- UFD's
- Weight Take-off
- Layouts
- Cost Estimate



Offshore Equipment

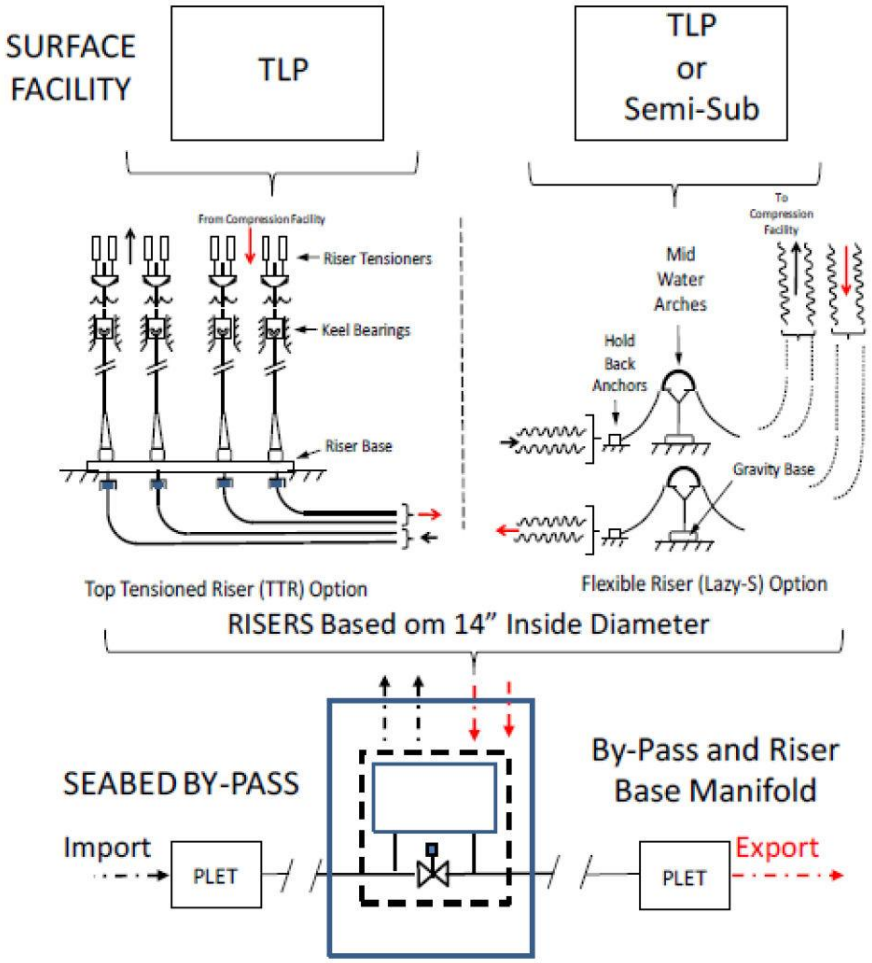
EQUIPMENT LIST		
EQUIPMENT NO.	DESCRIPTION	SIZE(LXWXH OR [DXT/T)
100-X-001	PIG RECEIVER	0.7 X 11.40
100-X-002	INLET GAS METERING PKG.	3.0 X 2.0 X 1.0
100-V-101/201	INLET SEPERATOR	3.66 X 11.00
120-X-001	EXPORT GAS METERING PKG.	3.0 X 2.0 X 1.0
120-X-002	PIG LAUNCHER	0.8 X 7.30
110-V-101/201	IST STAGE COMP. SUCTION DRUM	3.35 X 5.10
110-K-101/201	IST STAGE COMPRESSOR	19.0 X 3.2 X 3.8
110-K-102/202	2ND STAGE COMPRESSOR	19.0 X 3.2 X 3.8
110-E-101/201	IST STAGE COMP. DISCH. COOLER	1.91X 8.0
110-V-102/202	2ND STAGE COMP. SUCTION DRUM	2.59 X 4.10
110-E-102/202	2ND STAGE COMP. DISCH. COOLER	2.2 X 8.0
200-X-001	FUEL GAS METERING PKG.	3.0 X 2.0 X 1.0
200-V-001	LP FUEL GAS K.O. DRUM	1.22 X 2.60
200-V-002	HP FUEL GAS K.O. DRUM	0.86 X 2.50
200-E-001	LP FUEL GAS HEATER	0.74 X 1.35
200-E-002	HP FUEL GAS HEATER	0.74 X 1.40
200-F-001A/B	LP FUEL GAS FILTER	0.5 X 1.0
200-F-002A/B	HP FUEL GAS FILTER	0.5 X 1.0
210-X-001A/B/C	INST. AIR COMP. PKG	2.3 X 7.3 X 2.0
210-V-001	INST. AIR RECEIVER	1.4 X 4.2
210-V-002	PLANT AIR RECEIVER	2.1 X 6.5
220-X-001A/B	GAS TURBINE POWER GEN PKG.	8.10 X 2.45 X 4.0
220-X-002	DIESEL GENERATOR PKG.	6.7 X 2.7 X 2.6
230-X-001	FLARE BOOM	HOLD
230-X-002	FLARE TIP	HOLD
230-X-003	FLARE IGNITION SYSTEM	HOLD
230-V-001	FLARE K.O.DRUM	HOLD
230-E-001	FLARE K.O.DRUM HEATER	2.75 X 0.5
240-X-001	BUNKERING HOSE STATION	3.2 X 3.2 X 3.4
240-X-002	DIESEL LOADING HOSE	INCLUDED
240-T-001/002	DIESEL BULK STORAGE TANK	IN CRANE PEDESTAL
240-P-001/002	DIESEL TRANSFER PUMP	1.6 X 0.8 X 0.8
240-X-003/004	DIESEL FILTR./COALESCER PKG	1.5 X 1.0 X 1.0
250-X-001A/B	FIRE WATER PUMP PKG	1.8 X 6.8 X 2.8
250-C-001A/B	FIRE WATER PUMP CAISSON	HOLD
260-V-001	CLOSED DRAINS DRUM	1.6 X 4.80
260-P-001	CLOSED DRAINS DRUM PUMP	2.0 X 1.2 X 1.0
260-T-001	HAZARDOUS OPEN DRAIN TANK	5.0 X 1.75 X 1.45
260-P-003	HAZARD. OPEN DRAIN TK. PUMP	0.6 X 1.0
260-C-002	HAZARD. OPEN DRAIN CAISSON	HOLD
260-P-004	HAZ. OPEN DRN CAISSON PUMP	0.6 X 1.0
260-C-001	NON HAZARD. OPEN DR. CAISSON	HOLD
260-P-002	NON HAZ. OP DRN CAISSON PUMP	0.6 X 1.0
270-P-001A/B/C	SEAWATER LIFT PUMP	3.0 X 0.5
270-C-001A/B/C	SEAWATER LIFT PUMP CAISSON	HOLD
270-C-002	SEAWATER OUTFALL CAISSON	HOLD
270-X-001	SEAWATER FILTRATION PKG	7.6 X 5.4 X 3.6
270-X-002A/B/C	HYPOCHLORIDE GENERATION PKG	2.5 X 1.2 X 2.5
280-X-001	POTABLE WATER MAKER	2.45 X 2.1 X 2.4
280-T-001	POTABLE WATER STORAGE TANK	8.0 X 4.6 X 3.0
280-P-001A/B	POTABLE WATER PUMP	1.6 X 0.8 X 0.8
280-X-002A/B	POTABLE WTR STERILLI. PKG	1.1 X 0.5 X 2.5
280-X-003	POTABLE WTR CALORIFI. PKG	3.0 X 3.0 X 2.0
290-X-001	NITROGEN GENERATION PKG	2.0 X 2.0 X 3.0
290-V-001	NITROGEN RECEIVER	1.55 X 4.6
320-X-001	METHANOL INJECTION SKID	10.0 X 11.0 X 3.0
320-X-002	METHANOL BUNKERING HOSE STN.	7.0 X 3.15 X 3.35
–	PEDESTAL CRANES(2 NOS)	HOLD
–	SEWAGE DISPOSAL CAISSON (1NO)	HOLD

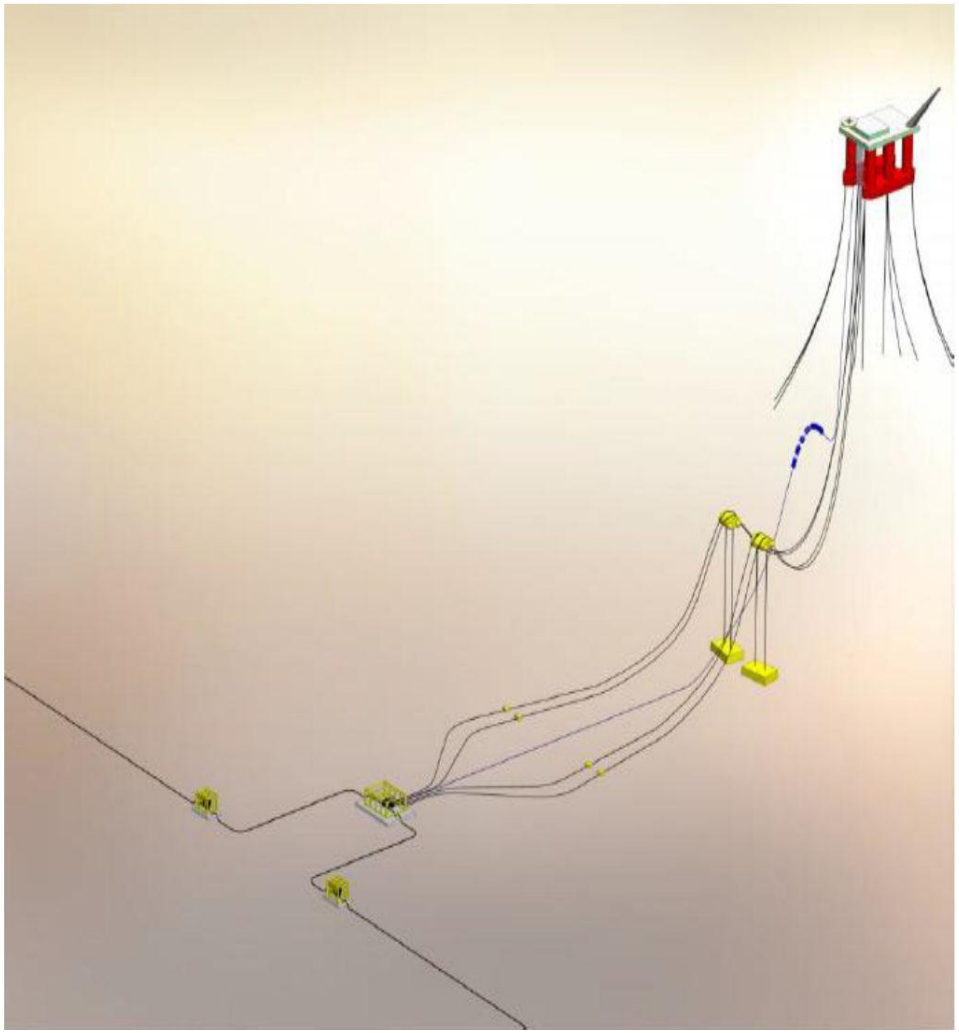
Completed Studies – Substructure Options



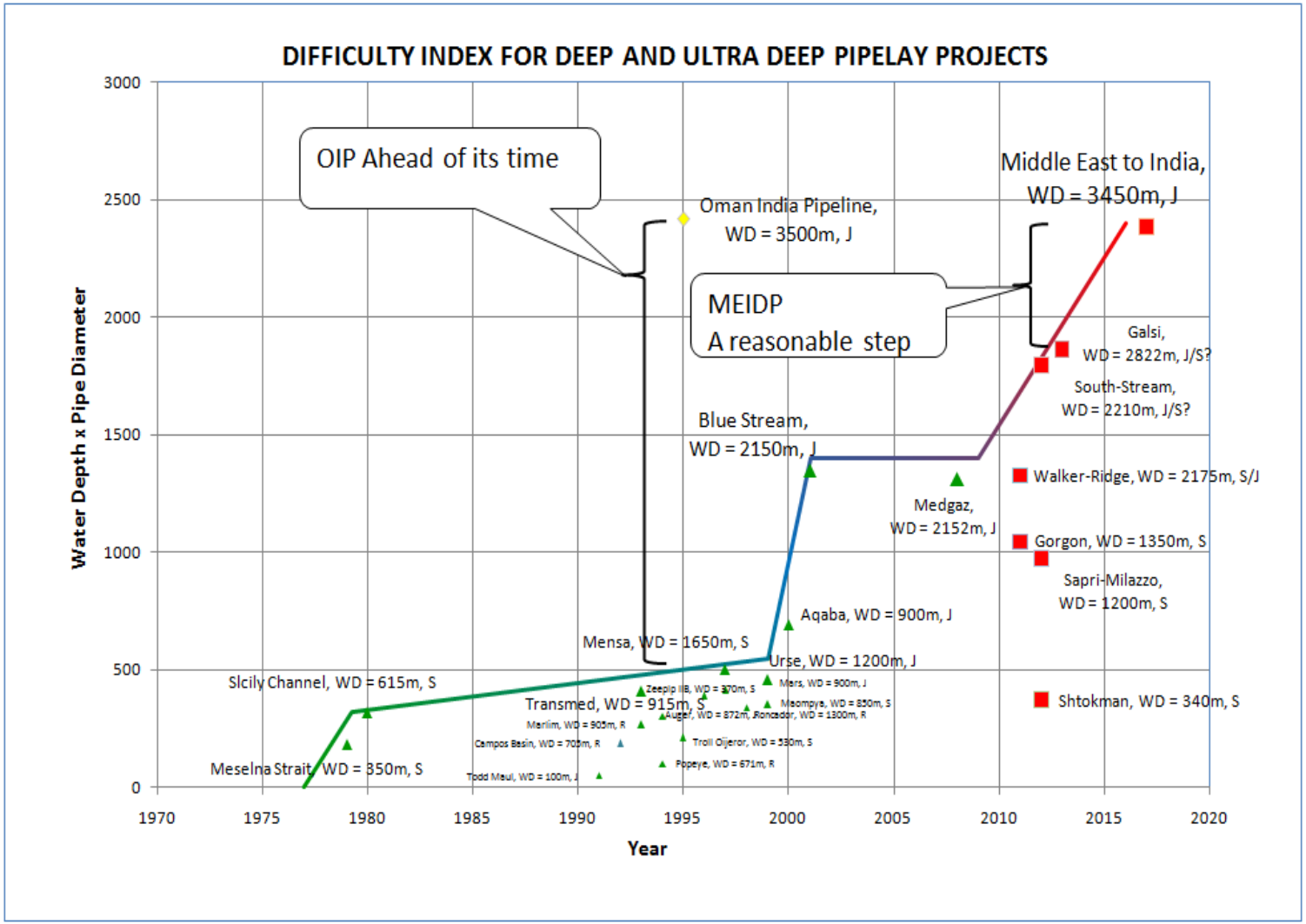
Substructure Type	Technical Drivers								Commercial Drivers					Overall	
	Water Depth Range	Payload	Metocean - Environment	Riser Feasibility	Offshore Integration	Active Seismic Region	Score	Ranking	Reuse of Existing	Maximise Indian Content	Flexibility for Future Expansion	Score	Ranking	Score	Ranking
Semi Submersible	3	3	3	2	3	3	17	2	3	2	2	7	**1**	24	1
Tension Leg Platform	3	3	3	3	3	3	18	**1**	1	2	1	4	2	22	2
Fixed Jacket	3	3	3	3	1	2	15	4	1	3	3	7	**1**	22	2
Spar	3	3	3	3	1	3	16	3	1	1	1	3	3	19	3
Compliant Tower	2	3	3	3	1	3	15	4	1	1	1	3	3	19	3

Riser and Subsea By-Pass at Seamount





Difficulty Index for Deep Pipelay



Existing Pipelay Vessels in Operation

Saipem S7000 (operational since 1999)

- Carrying capacity of 15,000t, Full dynamic positioning
- Layrate of up to 5km a day.
- Deepwater pipelay record of 2,200m (7,218').
- Holding capacity force of 2,000tonnes

HMC Balder (operational since 2001)

- Carrying capacity of 8,000t, Full dynamic positioning
- Layrate of up to 4km a day.
- Deepwater pipelay record of 2,743m (9,000').
- Holding capacity force of 1,210 tonnes

Allseas Solitaire (operational since 1998)

- Carrying capacity of 22000 t, Full dynamic positioning
- Layrate of up to 9 km a day with in-house Phoenix automatic welding system.
- Deepwater pipelay record of 2775 m (9100').
- Holding capacity force of 1050 tonnes

New Pipelay Vessels under Construction

Saipem SpA new laybarge CastorONE

- Under construction in Singapore
- Ready for offshore operations early in 2012. Saipem has confirmed that the MEIDP is feasible and can be installed in a water depth of 3500m

HMC new Build vessel Aegir

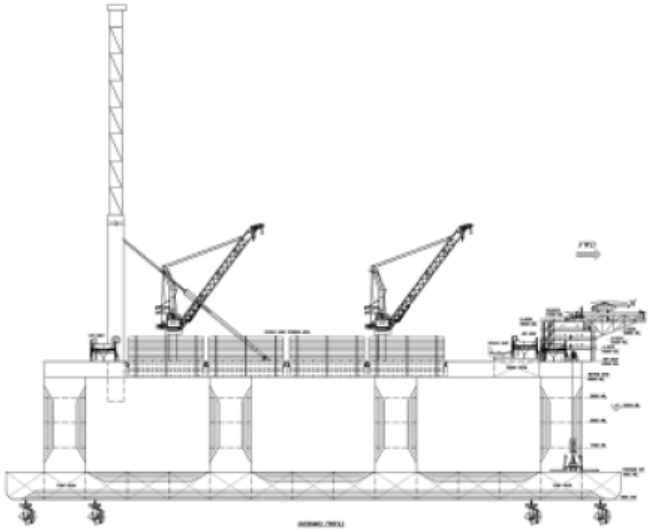
- Under construction in S. Korea
- proposed to be complete by mid 2013, ready for offshore operations early in 2014

Allseas new build vessel Pieter Schelte

- Under construction in S. Korea
- Proposed to be complete by end 2013, ready for offshore operations in 2014

SAGE Pipelay Vessel (No Large Cranes)

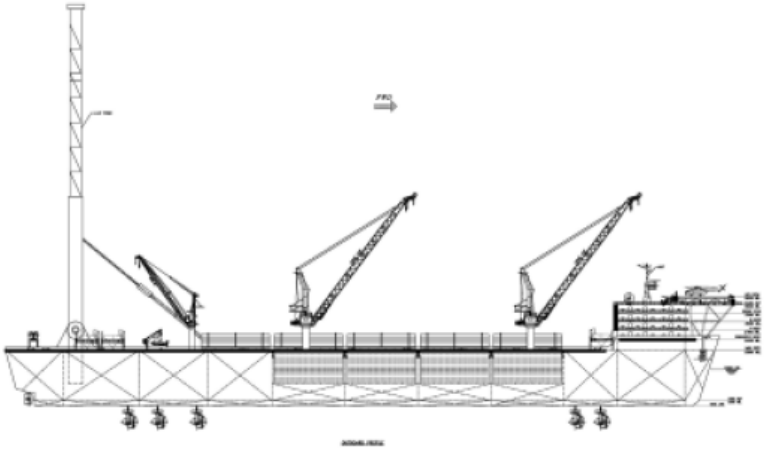
Dimensions & Displacements (Semi Hull)



DECK BOX

Length of main deck	175 m
Width of main deck	90 m
Depth of deck box	5 m

Dimensions & Displacements (Ship Shape)



Length Overall	254m
Breadth molded	44m
Breadth Extreme	46.5m
Depth	20m

CAPEX for any such barge is around $850m.

SAGE would need to set up full PMC team - but multiple lines possible for a corridor.

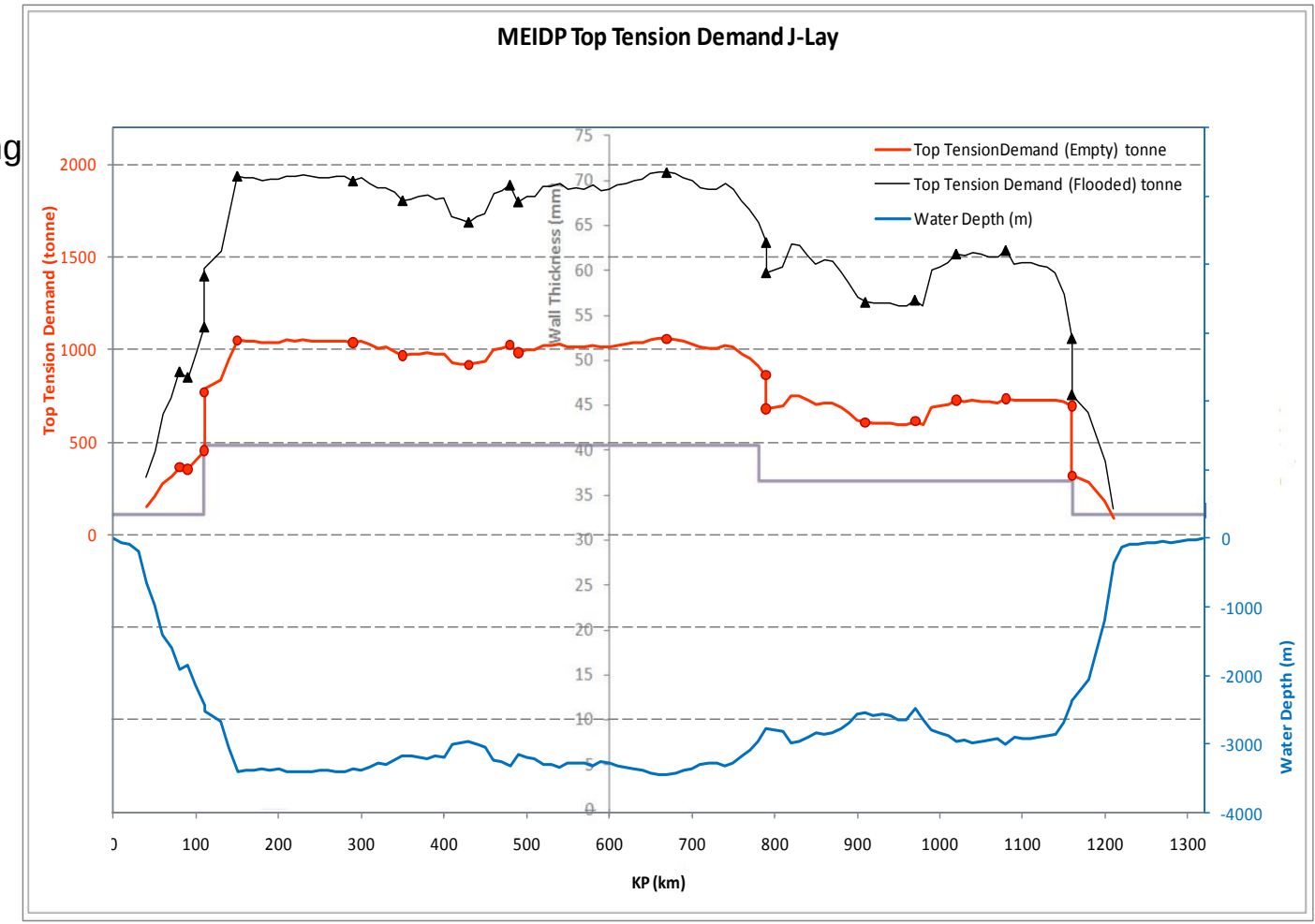
Installation Vessel Requirements

- J-Lay Vessel Demand
  - 1060tonne normal laying
  - 2000tonne flooded and abandonment

$T_{cr}=T_d.S_f.S_d$

T_d = Tension Demand
T_{cr} = Tension Capacity Required
S_f = Safety Factor (1.15)
S_d = Dynamic Amplication (1.3)

- J-Lay Vessel Capacity Required
  - 1600tonne normal Laying
  - 2500tonne flooded and abandonment



Vessel Capability to meet MEIDP

Empty Pipe

Contractor	Pipe-lay Mode	Vessel Name	MEIDP Size OD Requirement in	Vessel Maximum Size OD in	Demand Top Tension tonne	Vessel Capacity Requirement tonne	Vessel Capacity tonne
Saipem	J-Lay	7000	27.2	32	1075	1607	2000
		CastorOne	27.2	36			2000
HMC		Balder	27.2	32			1210
		Aegir	27.2	32			1500
Saipem	S-Lay	CastorOne	27.2	36	1288	1925	750
Allseas		Pieter Schelte	27.2	68			2000
		Solitaire	27.2	60			1050

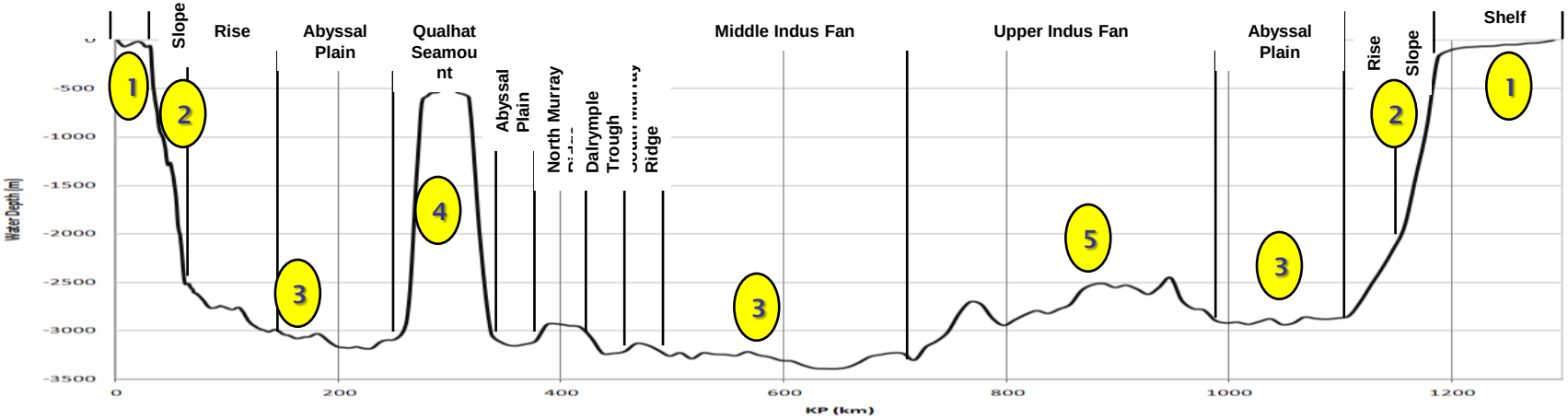
Flooded Pipe

Contractor	Pipe-lay Mode	Vessel Name	Demand Top Tension tonne	Vessel Capacity Requirement (DTT*1.3) tonne	Vessel Capacity[1] tonne	Assumed Vessel Capacity tonne
Saipem	J-Lay	7000	1993	2591	2000	2000
		CastorOne			2500	2500
HMC		Balder			N/A	1500
		Aegir			N/A	1875
Saipem	S-Lay	CastorOne	2781	3615	975	975
Allseas		Pieter Schelte			2000	2500
		Solitaire			N/A	1300

Intervention Zones

The route has been divided into five different intervention requirement zones.

1) Shallow Water Zone (0 to 150m WD)
2) Continental Slope Zone (150m to 2500m WD)
3) Deep Water Section (2500m to 3500m WD)
4) Remote Seamount Section (300m to 3000m WD)
5) Indus Fan Section (2500m to 3000m WD)



Intervention Zones Seabed Conditions

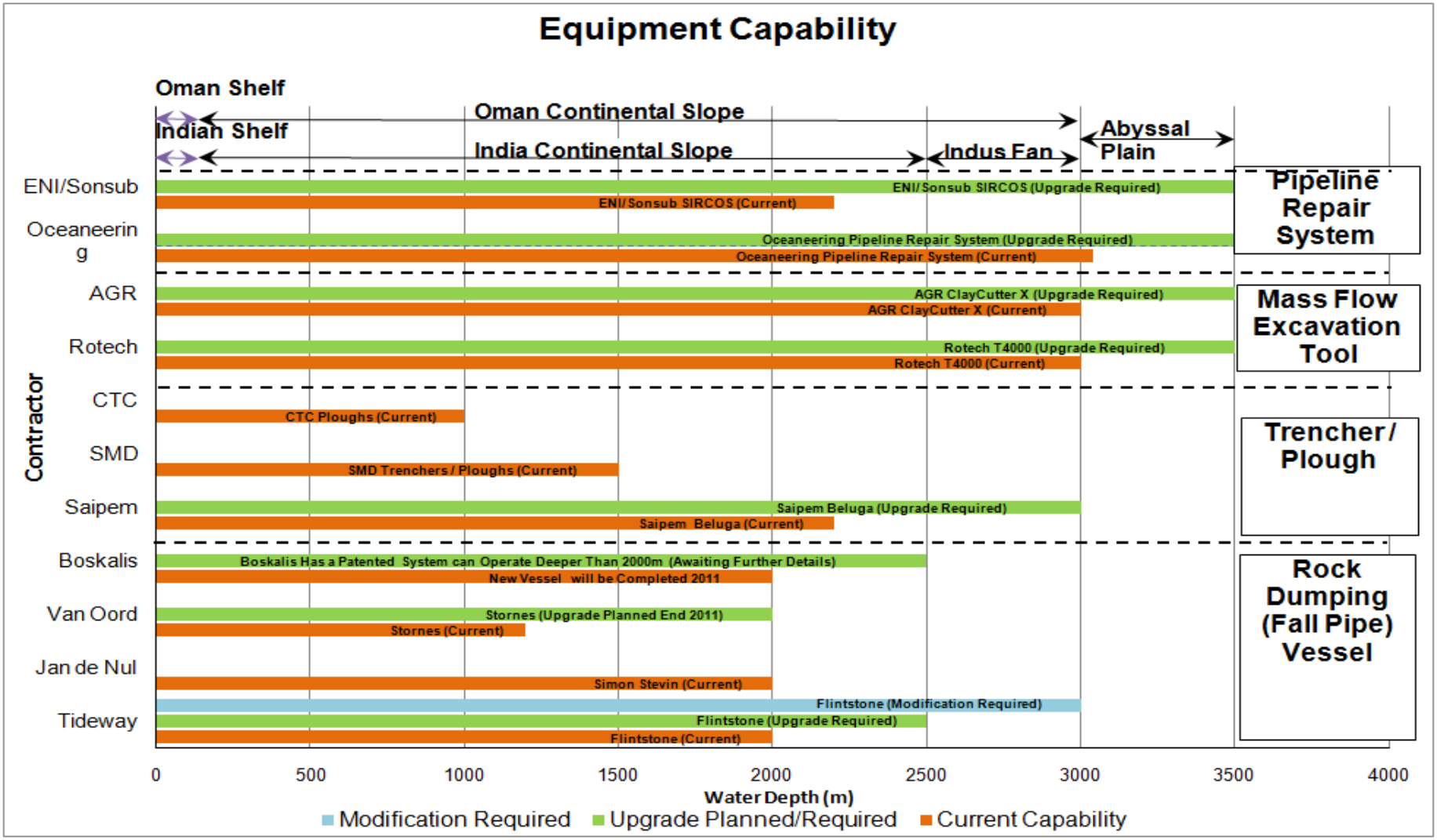
Zone	Location	Soil Properties Summary
1	Oman Continental Shelf	Sands, gravel, reefs and outcrops of limestone, igneous/metamorphic rocks, calcareous silts and well-sorted sands
	India Continental Shelf	Quartz and heavy mineral sands, dark yellowish brown to olive grey silt, clay with shell fragments, light olive grey carbonate sand (oolitic sand) and algal and oolite limestones (or calcarenites)
2	Oman Continental Slope	Olive brown to olive grey very soft to soft pelagic silt and clay
	India Continental Slope	Dark yellowish brown to olive grey fine grained cohesive soils, i.e. silts and clays with shell fragments
3a	Abyssal Plain and Lower Indus Fan	Pelagic sediment of greenish grey to olive grey very soft to soft clay and silt
3b	Owen Fracture	Dark yellowish brown to greenish grey to olive grey very soft to soft pelagic clay and silt
4	Remote Seamount	Dark yellowish brown to greenish grey to olive grey very soft to soft pelagic clay and silt
5	Indus Fan	Yellowish brown to olive grey very soft to soft clay and silt

Intervention Equipment Capability

The results of an initial study based on a limited survey of potential contractors indicates that the following capabilities apply now and potentially in the future

Equipment Type	Depth Requirement	Survey Results	Equipment Modification Plan
Dredging Vessel	Up to 30m	Variety of dredgers available in the market can dredge up to 30m WD	Not Required
Rock Dumping (Fall Pipe) Vessel	Up to 3500m	Current max. working depth is 2000m. Following are currently most capable vessels in the market can work up to 2000m. Simon Stevin (Jan de Nul) Flintstone (Tideway) – new vessel, to be operational from May 2011 Unknown Name (Boskalis) – new vessel, to be completed in 2011 Stornes (Van Oord) – new vessel, to be operational from March 2011 with depth limit of 1200m. Upgrade is planned to bring the working depth to 2000m by end of 2011.	Tideway indicates modification to bring working limit to 3500m is possible and that could be planned and ready for 2015. Jan de Nul and Van Oord indicate major issues of extending the working depth to 3500m is the vessel structure must be adequate to support the increased fall pipe weight; vessel must also have enough space to store the extra fall pipes. These issues shall be looked at and qualification may be required to verify the design as this is a major step change.
Plough (Trenching)	Up to 3000m	Most ploughs currently only able to work up to 1000m	Cannot be upgraded to 3000m as it is too deep for this mode of trenching technique.
Trenching Machine		Most trenchers are rated up to 1500m. However, Saipem's Beluga can work up to 2200m.	Saipem indicates Beluga can be upgraded for higher water depth
Mass Flow Excavation Tool (Trenching)		Rotech and AGR indicate their excavation tools are rated up to 3000m. T4000 (Rotech) & ClayCutterX (AGR)	Both Rotech and AGR indicate modification to bring the working depth to 3500m is possible (if required), though design and deployment will need to be looked at.

Intervention Vessels & Equipment Capabilities



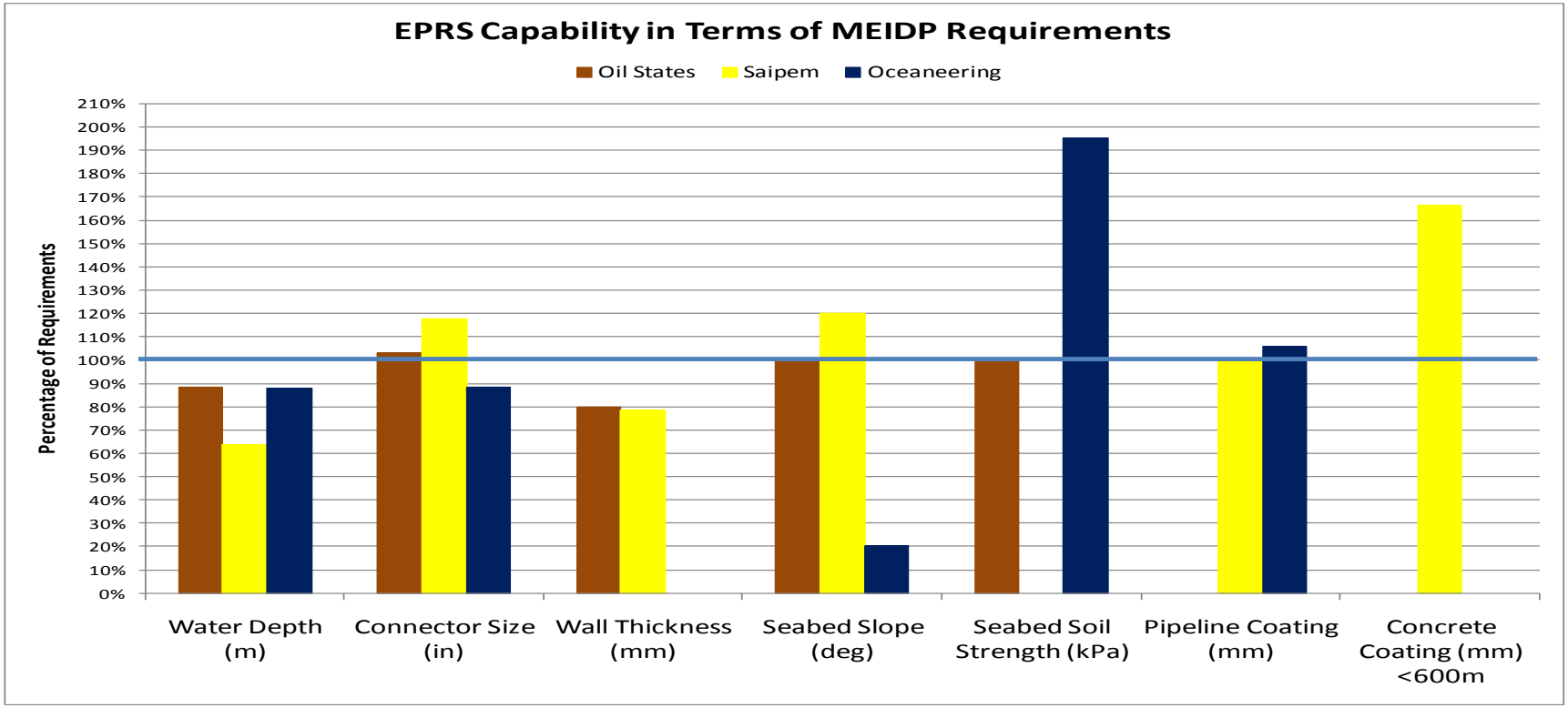
45

Repair Systems and Clubs

Equipment Name	Main Contractor / Operator
Bespoke Systems	
Chevron Petronius Repair System	Oil States / Chevron
BP Mardi Gras Pipeline Repair System	**Oil States / BP**
SiRCoS	**ENI / Saipem**
Pipeline Connection and Repair Systems (PCRS)	**Oceaneering**
Total Girassol Pipeline Repair System	Subsea 7
Repair Clubs	
Shell Deepwater Pipeline Repair System	Shell HOLD (there are two version of the Shell club?)
DW RUPE	DW RUPE
Pipeline Repair System Pool	Technip (Norway), Deep Ocean, Statoil
Newly Founded Repair Clubs	
Emergency Pipeline Repair Equipment Sharing (EPRES)	South East Asia Pipeline Operators Group (SEAPOG)
	Pipeline Repair Operators Forum Australasia (PROFA)

Candidate Systems Capability

Pipeline Repair Systems	Up to 3500m	Sonsub's SIRCOS currently can work up to 2200m Deepwater Pipeline Repair System from Oceaneering and Oil States currently rated to about 3000m.	Saipem indicates it can be upgraded for higher water depths Oceaneering indicates depth requirement of 3500m can be designed and manufactured Oil States indicates further tests are required to re-qualify their system for 3500m rating



Castorone Visit

- A visit to see Saipems new Ultra deepwater Installation Vessel the CastorOne in Singapore took place in May.

CLASSIFICATION
ABS +A1 (E), pipelaying vessel, +ACCU, +DPS3, CRC, TCM, CM, ice class A0 (IA Baltic)

DIMENSIONS
Length (o.a.): 330 m excluding ramp/stinger and helideck
Moulded breadth: 39 m
Operational draft: min. 7 m, max.10 m
Transit draft: 8 m approx.
Displacement: 100,000 t at max. operational draft

PERFORMANCE
Transit speed: 13 knots
Fuel consumption (transit): 80 t/day
Fuel consumption (DP mode, max.): 130 t/day
Bollard pull (with main propellers): 180 t
Pipelaying capacity: triple joint 12 m or double joint 18 m; pipe size up to 48" (60" including coating)

CARGO/TANK CAPACITY
Clear deck area: 4,300 sq.m
Fuel oil: 6,500 cu.m
Fresh water: 1,500 cu.m
Ballast water: 36,000 cu.m
15,000 t pipe storage in cargo holds

DECK EQUIPMENT
Main crane: 600 t @ 30 m, 350 t @ 46 m
Pipe handling cranes: 2 x gantry cranes 52 t @ 35 m
Pedestal crane: 30 t @ 30m
S-Lay stern ramp: 120 m long hinged stinger composed of 3 articulated and adjustable sections
Tensioners: 3 x 250 t
A/R winch: 750 t
Working stations: 3 welding + 4 completion
Triple joint fabriction shop below deck
ROVs: 2 Work Class ROVs rated for 3,000 m of water depth

PROPULSION SYSTEM
Main gensets: 8 x 8,400 kW at 600 rpm each
Emergency generator: 1 x 1,200 kW
Power distribution: 2 separate switchboards 11 kV
Main shafts: 2 x 8,000 kW
Azimuthal thrusters: 6 x 92 t
Bow tunnel thrusters: 2 x 35 t
Stern tunnel thrusters: 35 t

ACCOMMODATION
702 persons
Mess room; offices; crew lifts; meeting rooms; gymnasium/recreation; television rooms

DYNAMIC POSITIONING SYSTEM
DP system: fully redundant, class 3
Reference system: 2 x Hipap 500 for 3,000 m of water depth; 2 x DGPS
Taut wire

HELIDECK
Suitable for Sikorsky S-61 N

J-LAY TOWER
Features for future installation of a fixed tower for pipe laying in J mode through the centre moon pool

- Saipem spa has confirmed that the SAGE deepwater pipeline is feasible and can be installed into water 3500m deep using its new laybarge CastorONE, currently in construction at Keppel in Singapore.
- An MOU under which Saipem will join the SAGE Consortium has been signed.

CastorOne Visit

A visit to see Saipems new Ultra deepwater Installation Vessel the CastorOne in Singapore took place in May and included representatives from GAIL; EIL; Peritus & SAGE.

AOB