

Presentation for

2nd India-Oman Working Group Meeting

Saturday, 4th April 2009

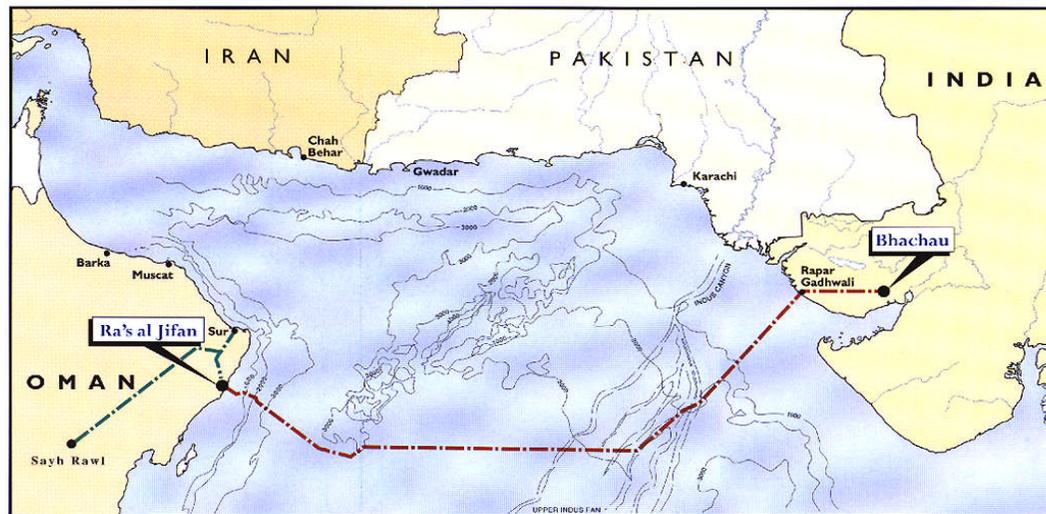
Muscat



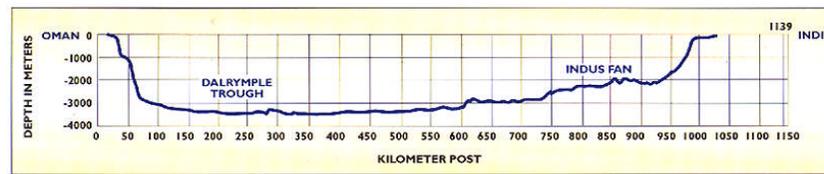
History



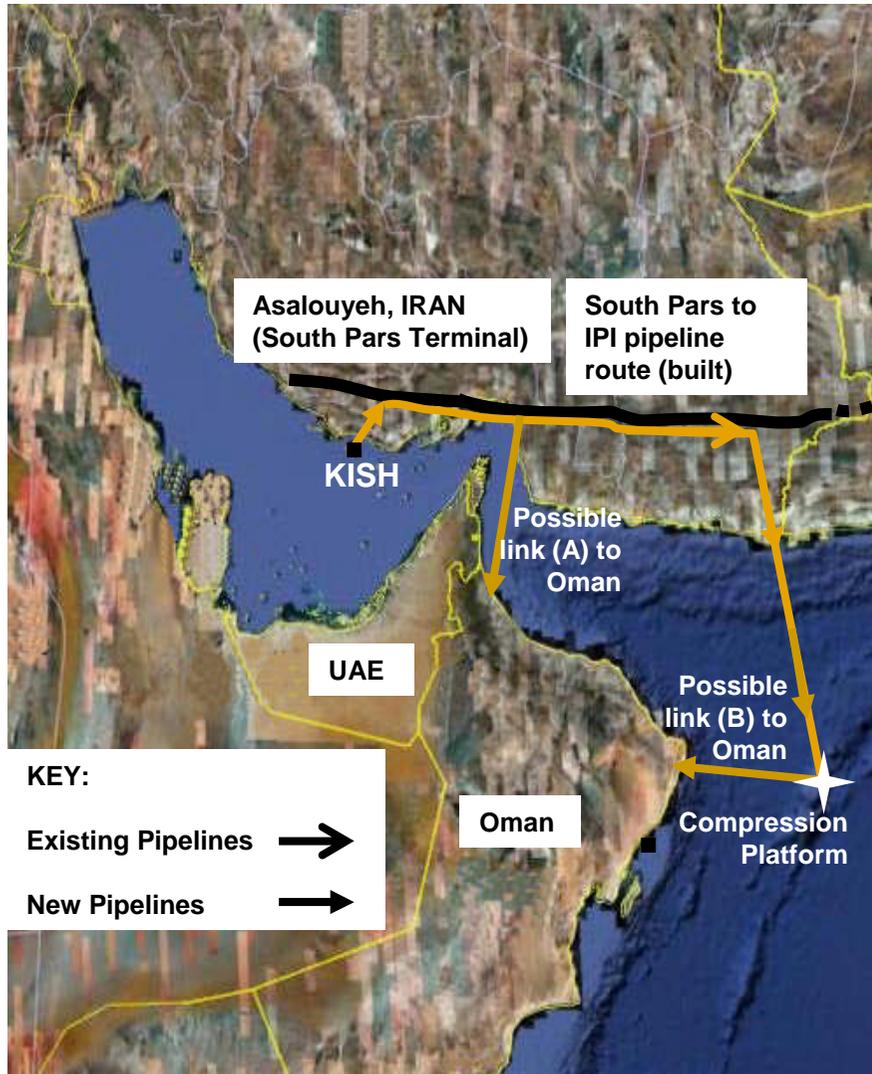
SAGE will build on the extensive study of the deepwater route started during the mid 1990's, strengthened by the development work now undertaken by SAGE and the major body of industrial deepwater pipelay experience over the last decade. The deep water section will reach down to 3,500 meters and will be over 1,000km in length.



Subsea Route and Sea Bottom Profile



Pipeline Routes to Oman for gas from Kish

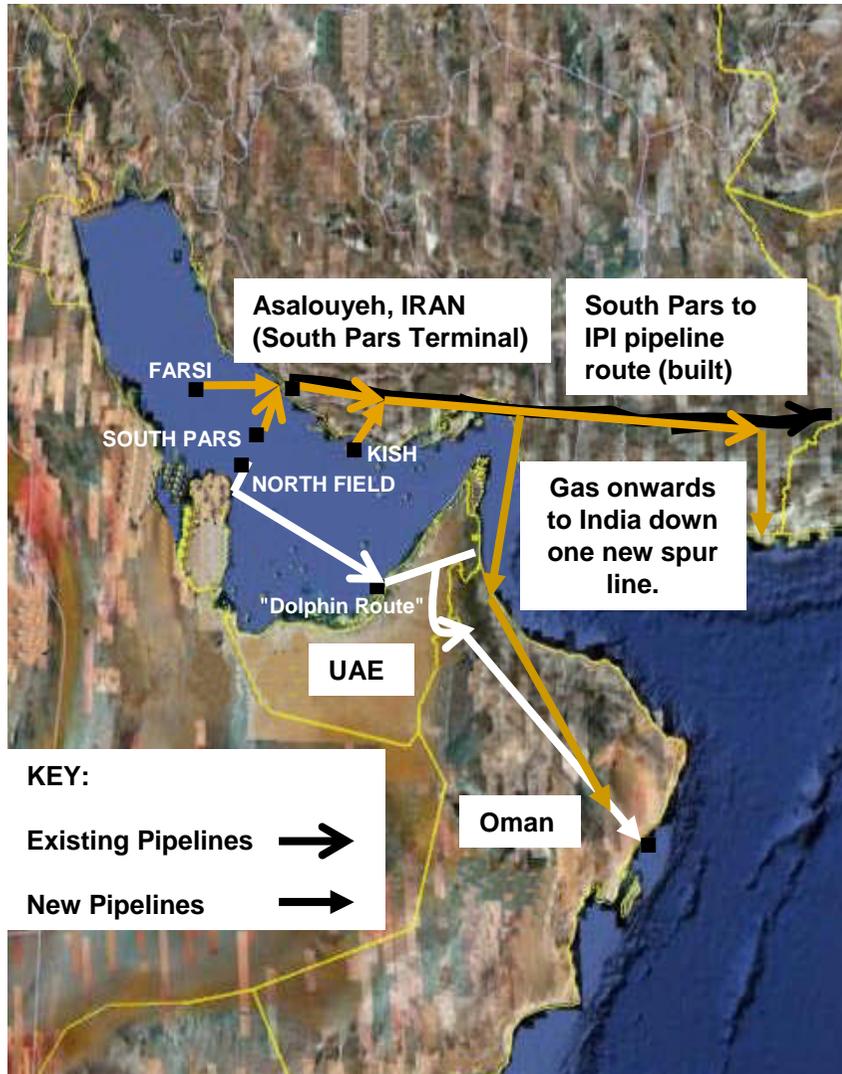


January 2009

Proprietary to South Asia Gas
Enterprise PVT Ltd (SAGE)

- The Gold coloured route for gas from Kish initially runs inside Iran and there are two delivery options for the link to Oman that avoid transit across the UAE.
- The shortest route (A) to Oman requires a short export line from Kish to the West-East pipeline believed to already run from Asalouyeh to near the Pakistan border. A second short new line then connects a suitable offtake point on the Iranian coast to Northern Oman across the shallow Continental Shelf.
- The longer route (B) shares the SAGE delivery system up to the offshore Compression Platform from where a short export line will be needed to the Oman coast.
- Link (A) passes close to the coast of the UAE.
- Link (A) could supply gas to Musandam.
- Link (B) delivers gas to a more Southerly point in Oman.

Possible Upstream Routes for gas to India

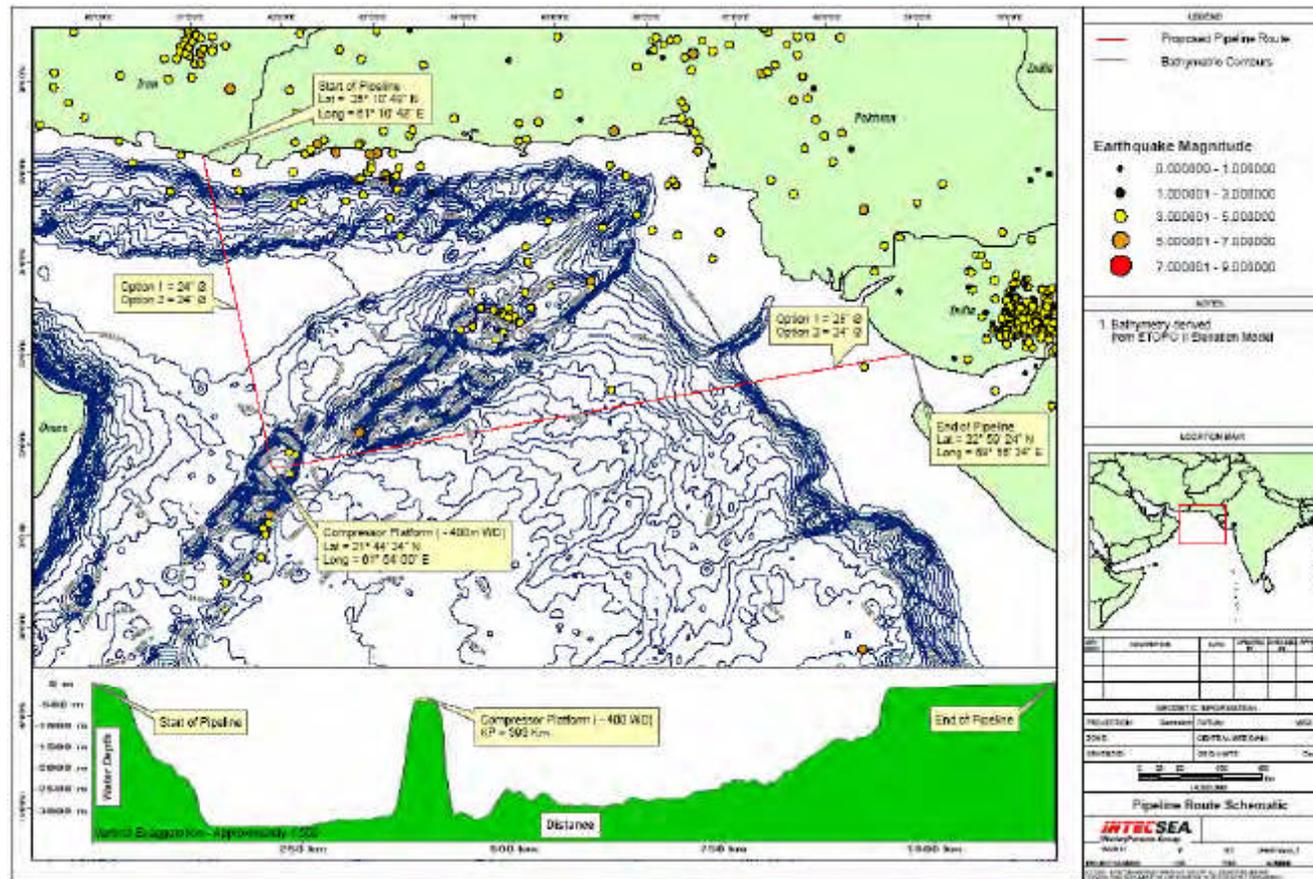


- The Gold coloured route for Iranian gas initially follows the Asalouyeh-Pakistan line, believed to be substantially complete. This connects to the South Pars field which is the supply source for the "IPI" gas already allocated to India. A new spur line down to the coast completes the delivery system for gas onwards to India. Alternatively, a route to Northern Oman and then South to the deepwater compression terminal can be adopted. Gas from FARSI and/or KISH can also feed into this system.
- The white route option for gas sourced in Qatar is based generally on the route of the existing Dolphin pipeline as far as the Oman border. A new transit pipeline to the coast is then needed.
- Access to an extended or duplicated Dolphin pipeline would be a matter for negotiation, but might have economic advantages.

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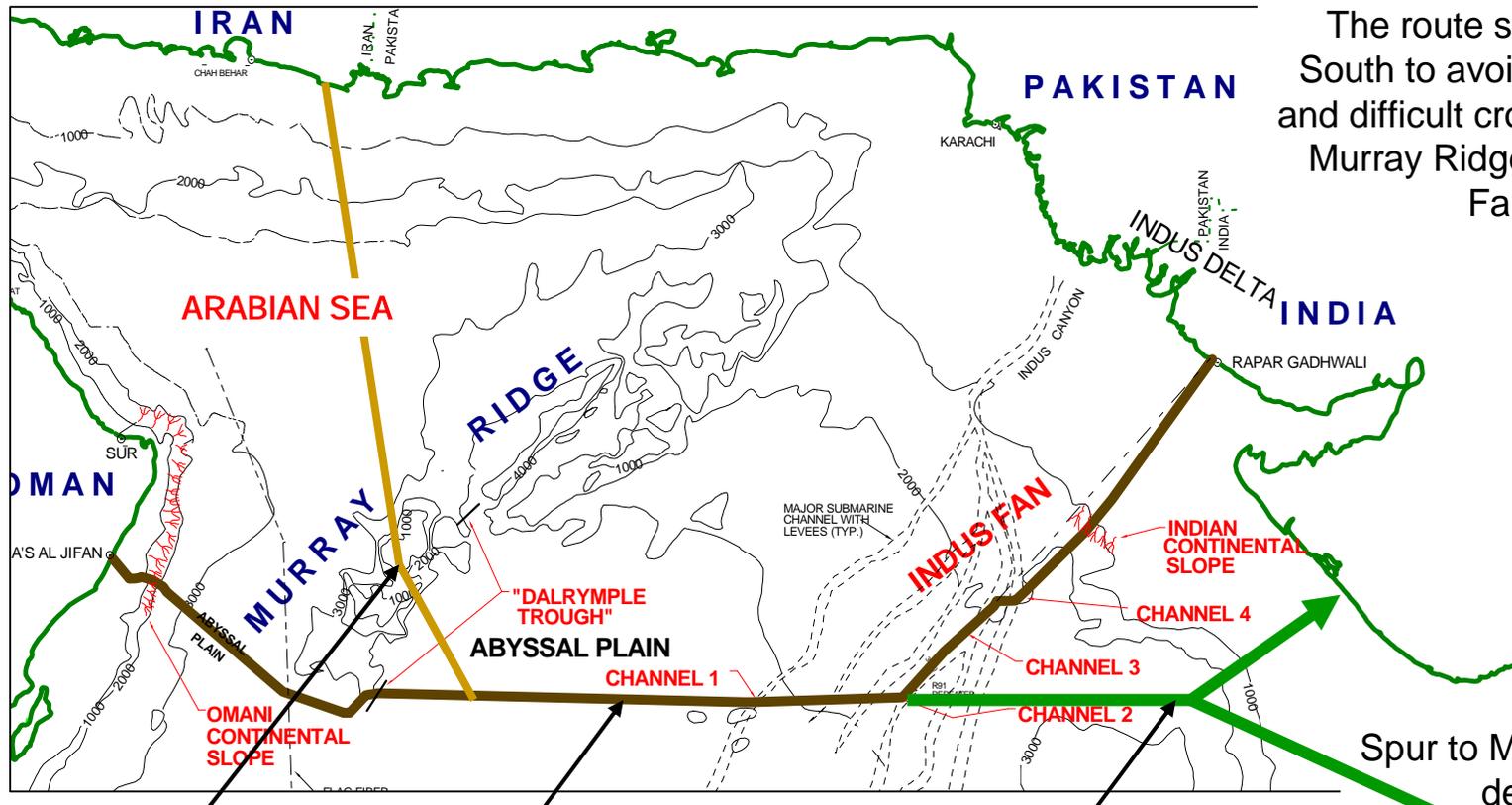
Proprietary to South Asia Gas
Enterprise PVT Ltd (SAGE)

Seamount Location for In-line Compression



- The seamounts at the South-West end of the Murray Ridge present an ideal location for an in-line Compression Platform.
- These remarkable features reach to within a few hundred metres of Sea Level, as shown above.
- Several examples of platforms in this water depth exist.
- The slopes are exaggerated - they are quite suitable for pipelay up to the platform.
- The Compression Platform will be outside of all Territorial Waters but within helicopter supply range.

Possible Deepwater Routes for gas to India



The route stays to the South to avoid expensive and difficult crossings of the Murray Ridge and Indus Fan.

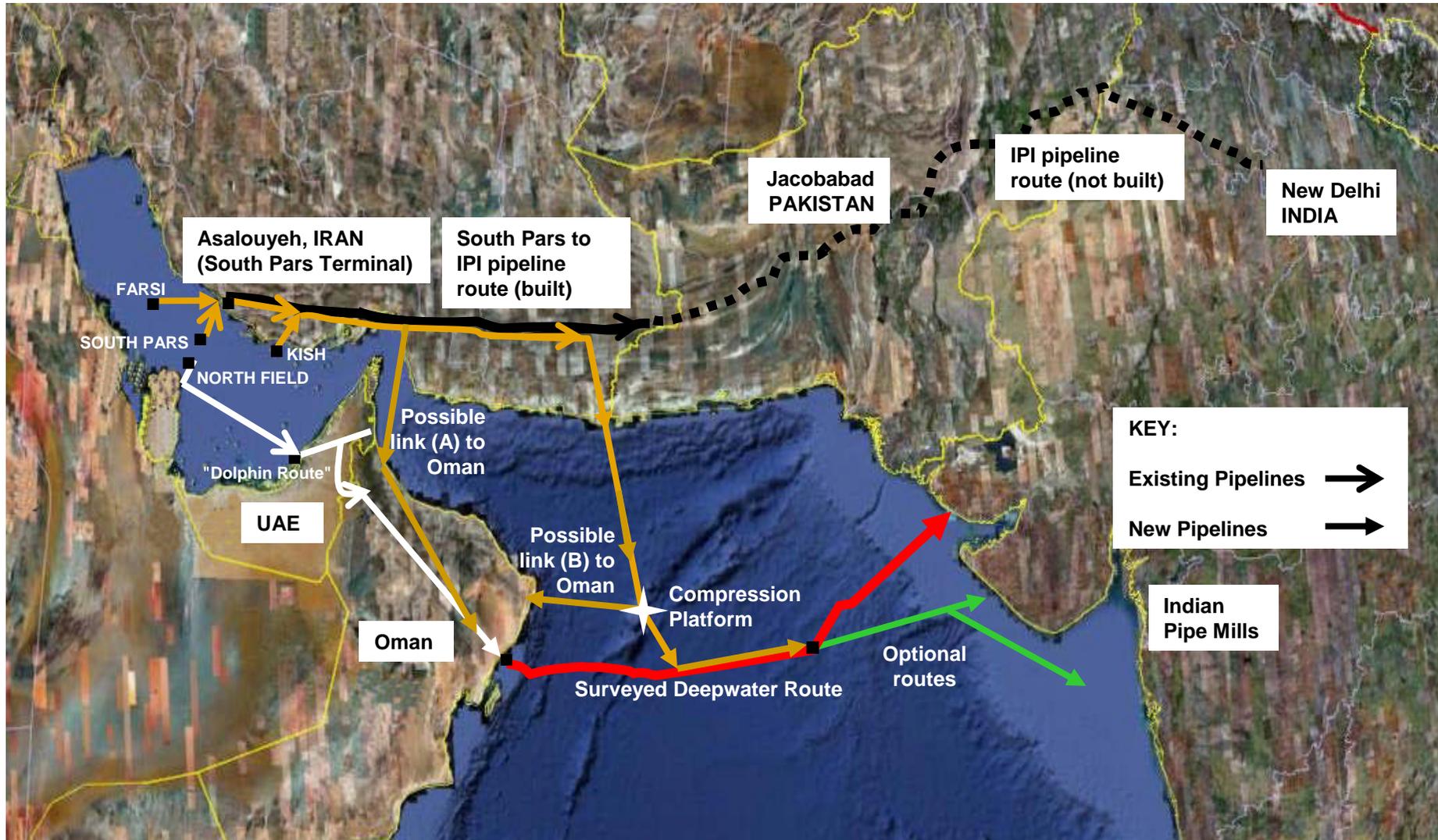
Possible route direct from gas export landfall via Compression Platform on Sea Mount. No 3rd Party Jurisdiction crossing.

Possible re-route suggested by INTECSEA to minimize mud flow exposure in Channel 4; the revised route is also shorter

Spur to Maharashtra if desired

Original surveyed route

Summary of Possible Pipeline Routes



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Proprietary to South Asia Gas Enterprise PVT Ltd (SAGE)

- The currently known Iranian gas sources are FARSI, KISH and South PARS. South PARS already feeds into the Iranian West-East pipeline believed to run from Asalouyeh to near the Pakistan border. FARSI and KISH appear well placed for tie-in to this same pipeline.
- Technically, Gas from these Iranian fields could be taken South to Qatar or UAE and from there to Oman along, for example, the Dolphin pipeline route. This would incur permitting and tariff penalties and is not proposed at the present time.
- Gas from the North Field, Qatar, can follow the Dolphin route to Oman, subject to negotiation.
- Supplies to both Oman and India can be pooled as far as Oman to gain economies of scale for both Parties.
- Subsequent gas sources are expected from across the Gulf region and Middle East
- A Middle East Gas Gathering network will therefore grow, for onwards supply of gas to the Indian Sub-Continent, with its “Hub” ideally located in Oman.
- Landfall locations will be set in by reference to Gas routing requirements and Environmental considerations. The locations shown are indicative.
- For the deepwater sections across the Arabian Ocean, the fully surveyed and evaluated route from the 1990s project has been used as a "base case" for costings.
- Any Compression Platform on the peak of one of the Sea Mounts on the Murray Ridge will be comparable to the Bullwinkle platform installed in the Gulf of Mexico.

Technical Risk Issues facing the project in 1995:

- Pipe mill upgrades needed to manufacture linepipe.
- Lack of lay vessel with enough tension capability.
Conversion work needed to lay pipe to 3,500m water depth.
- Incomplete understanding of seismic activities and mitigation methods – mudflows, fault lines & slope failures.
- No qualified deepwater pipeline repair system was available.

HOWEVER:

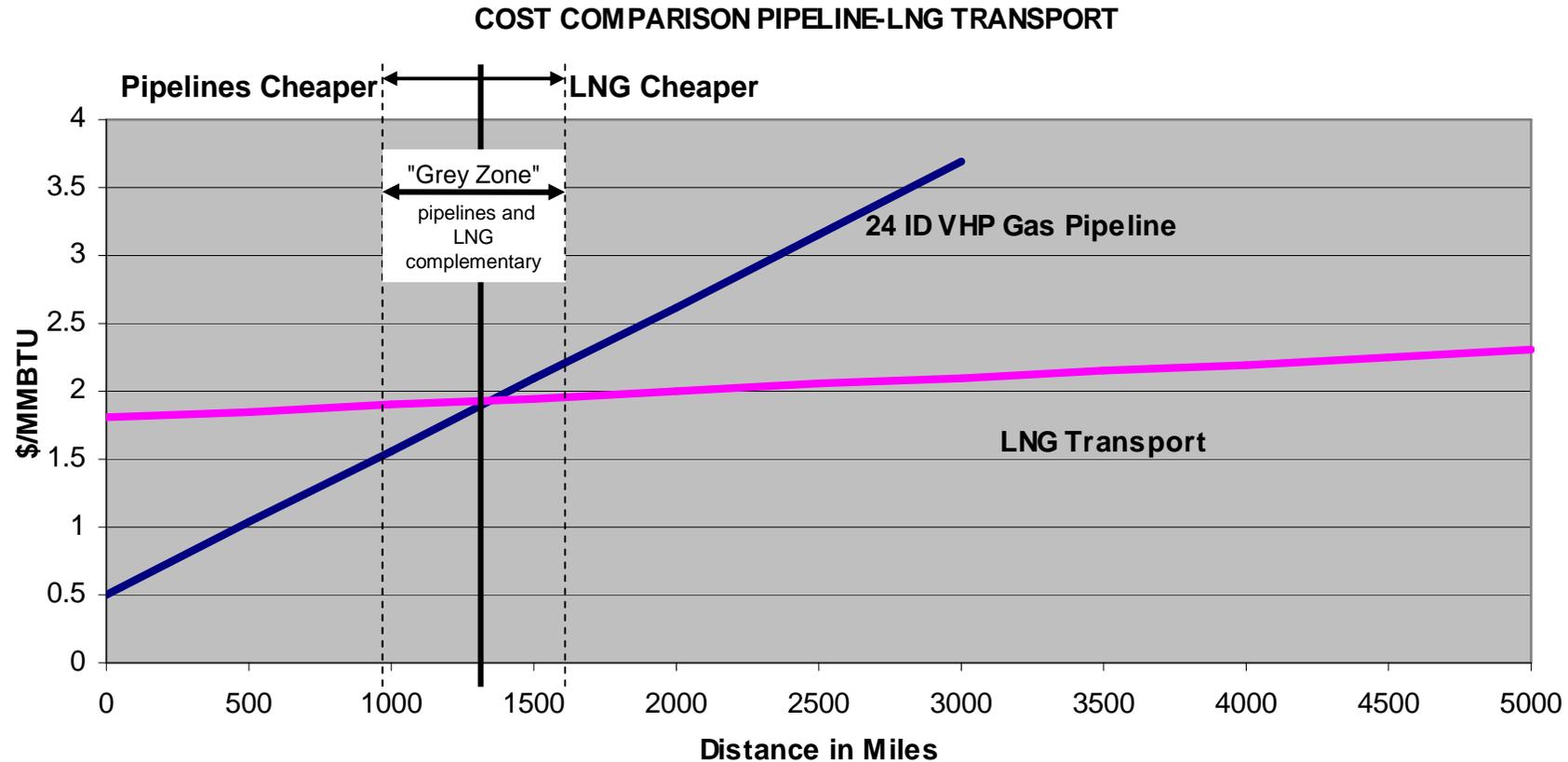
- These were not considered to be fatal impediments by the industry and three competitive bids were received and evaluated before the gas was re-assigned elsewhere.

What makes SAGE's Risk Profile lower now?

- New generation, large lay vessels ready to build.
- Several mills can manufacture pipe (also in India).
- Era of damaging cost escalation appears to be over.
- New and improved design methods for free-spanning and geo-hazards.
- Better positioning capabilities during pipelay to avoid seabed hazards.
- Deepwater repair systems available.
- New testing and commissioning philosophies developed by SAGE with DnV permits use of 28-inch pipe:

The work has shown that it is possible to document that a 28" OD pipeline with a 42mm nominal wall thickness made of DNV-SAWL-450 F (steel having a SMYS of 450MPa) exposed to light heat treatment to have sufficient safety level.

- The pipelay industry has continued to reach into ever deeper water until today, the new pipelay barges are being specified and built to work beyond 3500m.
- SAGE has a conservative design, well inside current technology guidelines.
- SAGE establishes a natural gas “Energy Corridor” to form a new and politically neutral energy route infrastructure as additional lines are subsequently installed.
- 31.1 Million Standard Cubic Meters per day from each line (1.1BCFD).
- Western Indian gas markets are as close to Middle East as to new gas reservoirs off the Indian East Coast.



Pipelines are generally more economic than LNG for transportation distances below 1300 miles (2100 Km), which is around the distance from Qatar to Gujarat, India. Pipelines and LNG will therefore be complementary.

DEMAND:

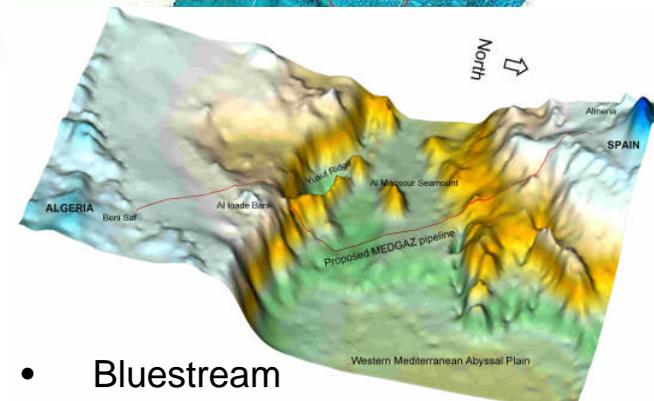
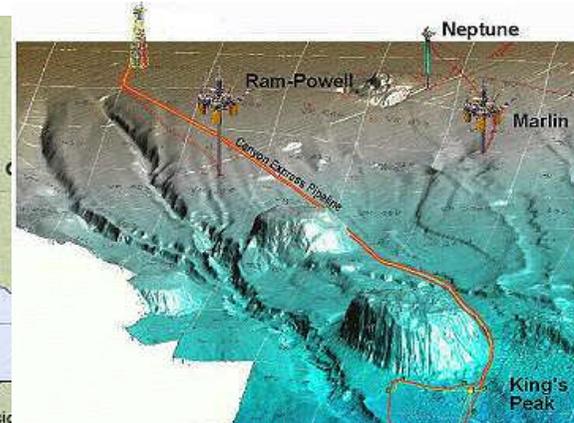
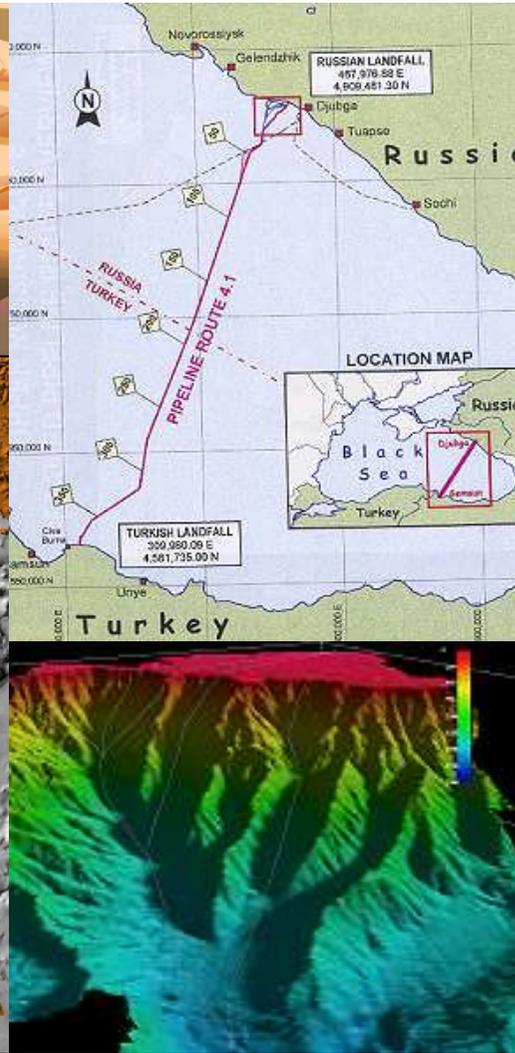
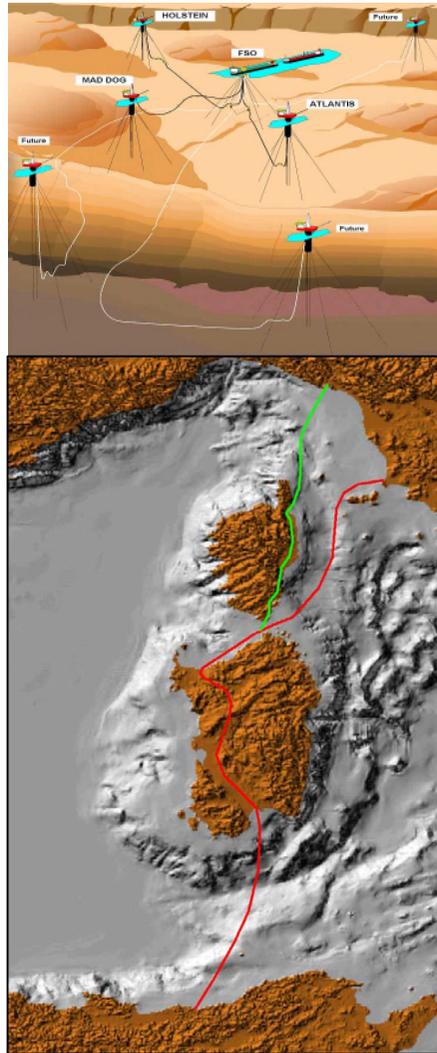
- India will continue to need more gas by LNG and pipeline. Spot LNG price is now low but India was paying \$18/MMBTU recently. Pipelines provide complementary long-term supply.

SUPPLY:

- Over 2000 TCF gas reserves possibly available in the Middle East. Only 8 TCF required for each SAGE line.

SAGE: Independent feasibility study by **CRISIL** estimates:

- Project cost of \$3.5 Billion for first line from Oman Coast to India requires a tariff of **\$1.8 per MMBTU**.
- Bringing the gas from Qatar to the Oman deepwater pipeline compression station adds **\$1.7/MMBTU**.
- Tariff from Iran via Compression Platform \approx **\$2.0 per MMBTU**
- NOTE: GOI wellhead price for KG gas is \$4.20/MMBTU.



- Bluestream
- Canyon Express
- Mardi Gras
- MEDGAZ
- Galsi
- SAGE etc

Data from Oman India

Zone	Calculated Failure Probability	'Safety' Level
Oman Shelf	9.81×10^{-2}	0.04
Oman Shelf Break	2.87×10^{-4}	14.0
Upper Oman Slope	9.18×10^{-4}	4.4
Lower Oman Slope	1.44×10^{-3}	27.8
Abyssal Plain (Oman Side)	1.56×10^{-4}	25.6
Murray Ridge*	2.69×10^{-3}	14.9
Dalrymple Trough*	5.37×10^{-3}	7.4
Abyssal Plain (Indian Side)	6.60×10^{-4}	6.1
Indus Fan (Excl. Ch. 1, 2, 4)	4.27×10^{-4}	9.4
Indus Fan Channel 1	2.17×10^{-4}	18.4
Indus Fan Channel 2	3.09×10^{-4}	12.9
Indus Fan Channel 4	7.27×10^{-4}	5.5
Lower Indian Slope	1.96×10^{-4}	20.4
Upper Indian Slope	3.22×10^{-4}	12.4
Indian Shelf Break	1.15×10^{-3}	3.5
Indian Shelf	9.86×10^{-2}	0.04

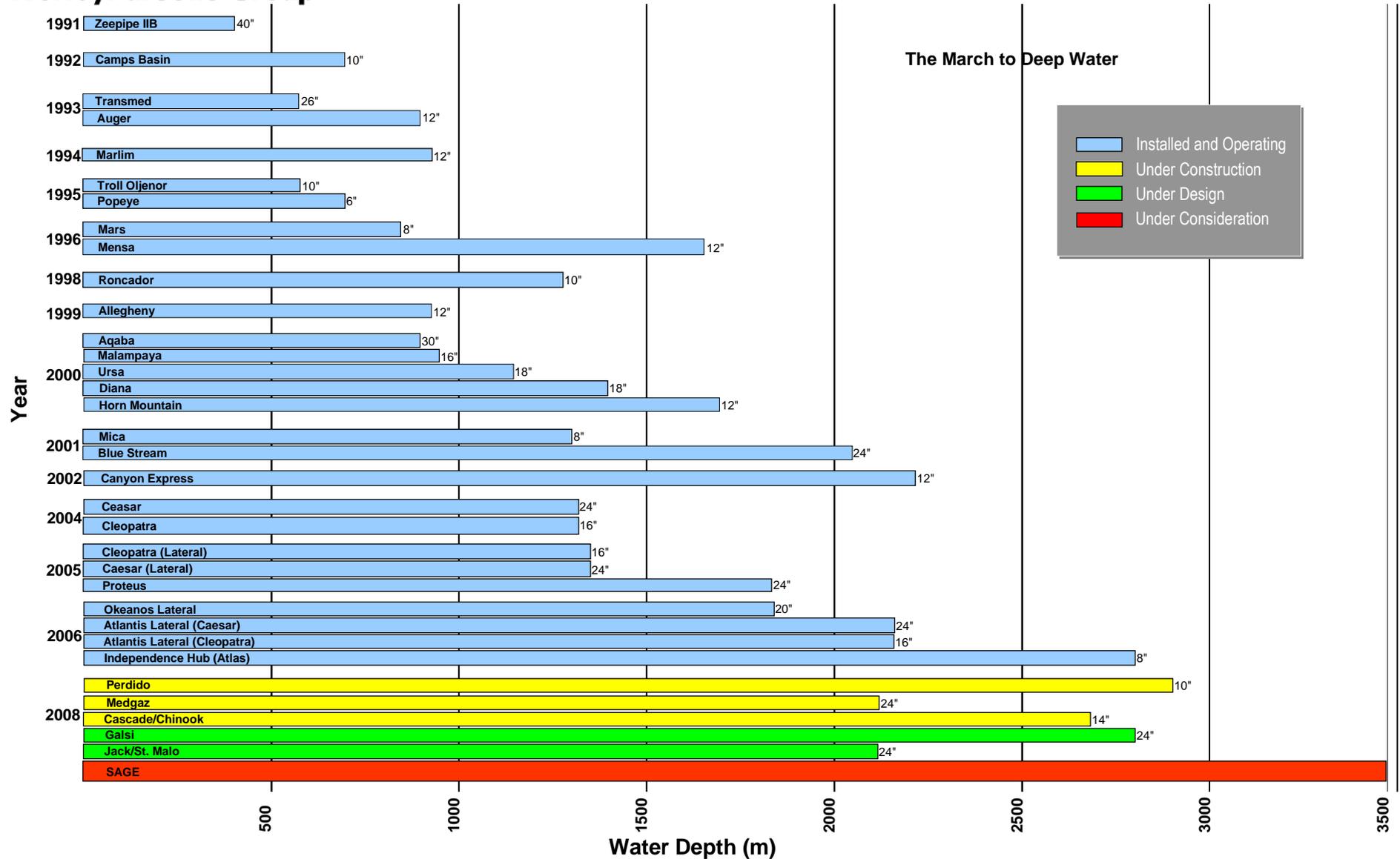
Note:

"Safety" Level means "how much safer than acceptable is it?"

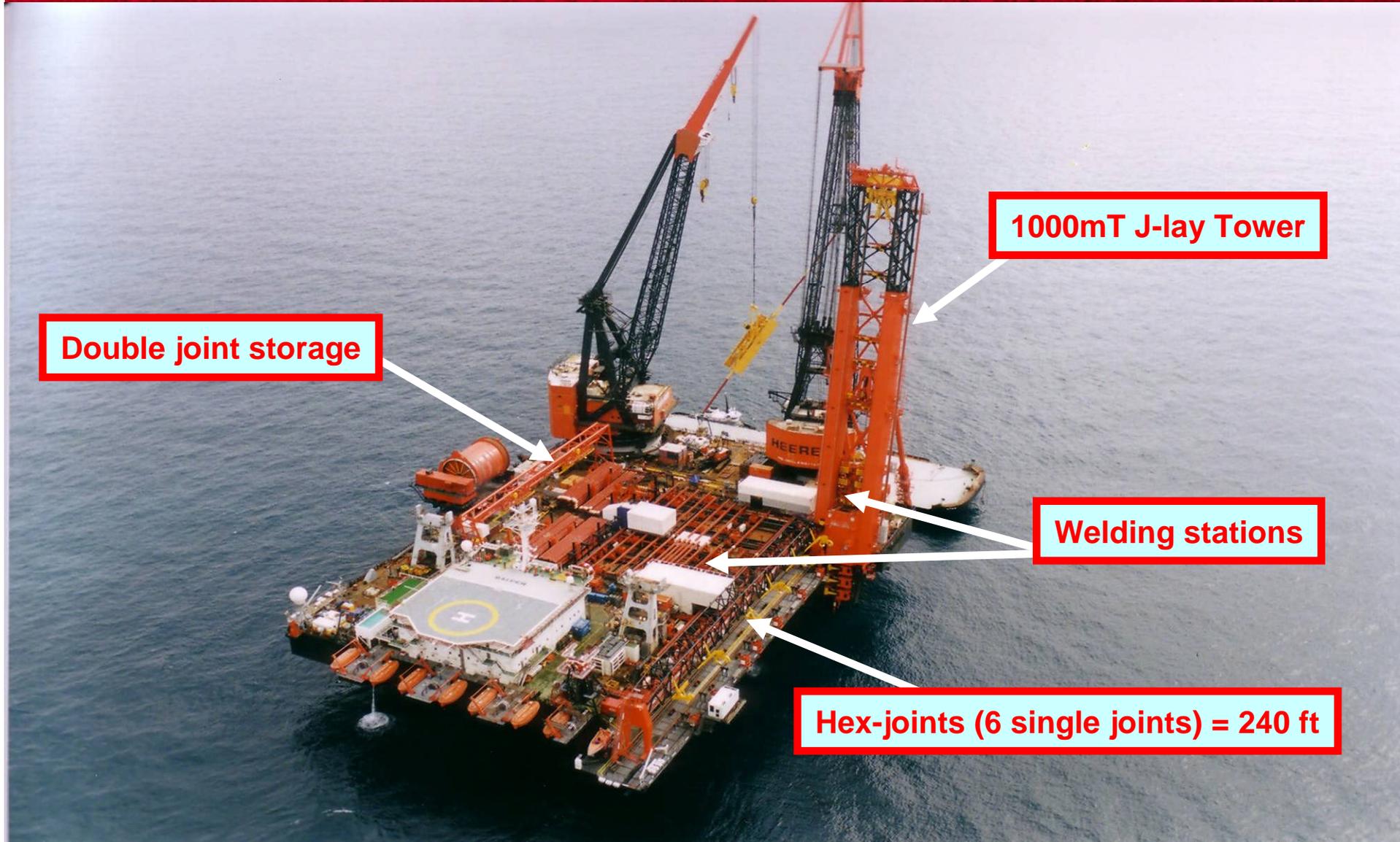
What does this tell us?

- The deepwater environment is an outstandingly safe, protective and benign location for a gas pipeline.
- The only areas requiring mitigation are the conventional shallow sections near the beach at each end, similar to any other pipeline, where trenching and rock-dumping are conventionally applied. This protects the pipeline against anchors and fishing activity.
- The risk from Sabotage is insignificant.

Deepwater Pipelay Progression



Existing J-lay vessel “BALDER”



Double joint storage

1000mT J-lay Tower

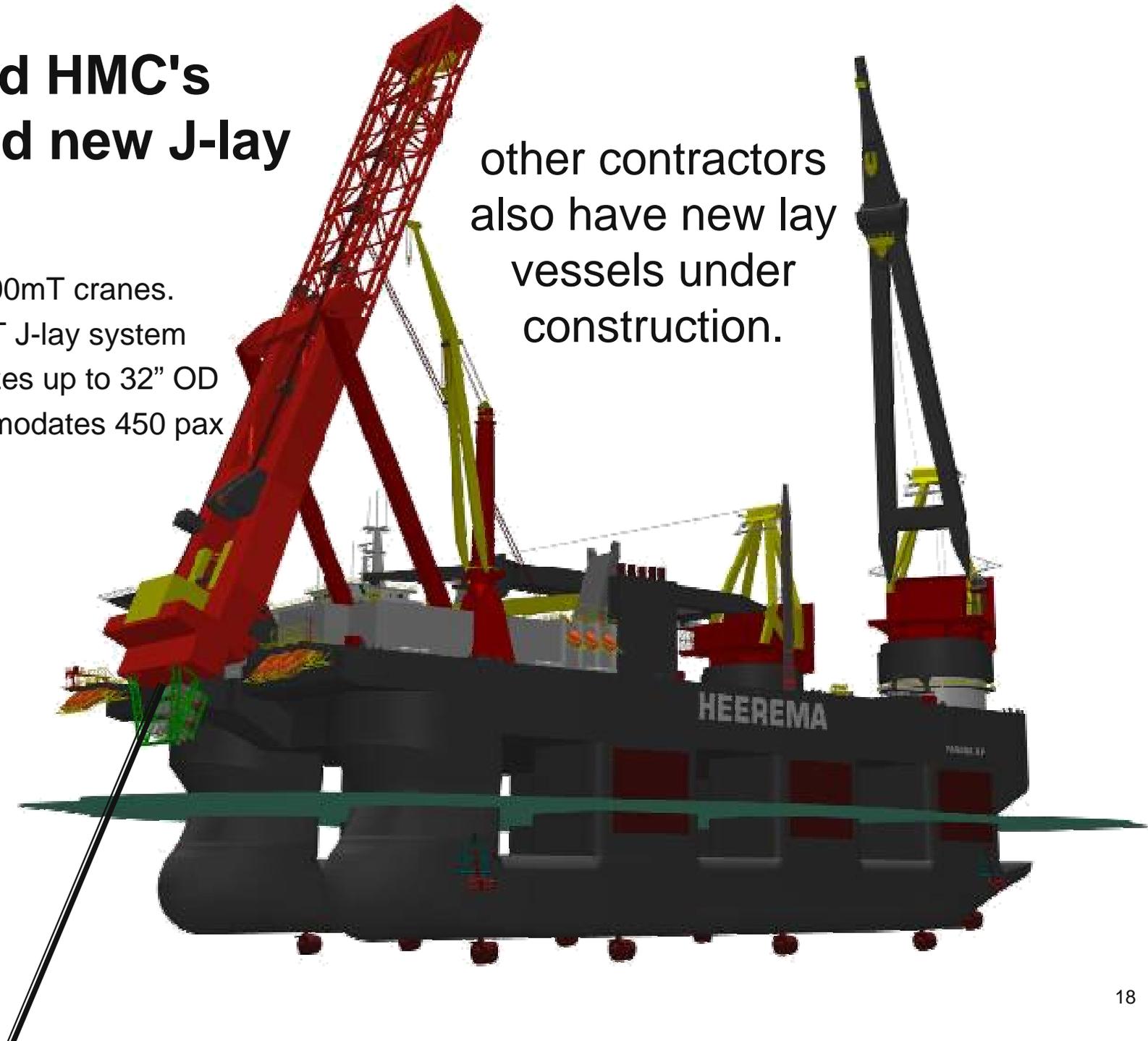
Welding stations

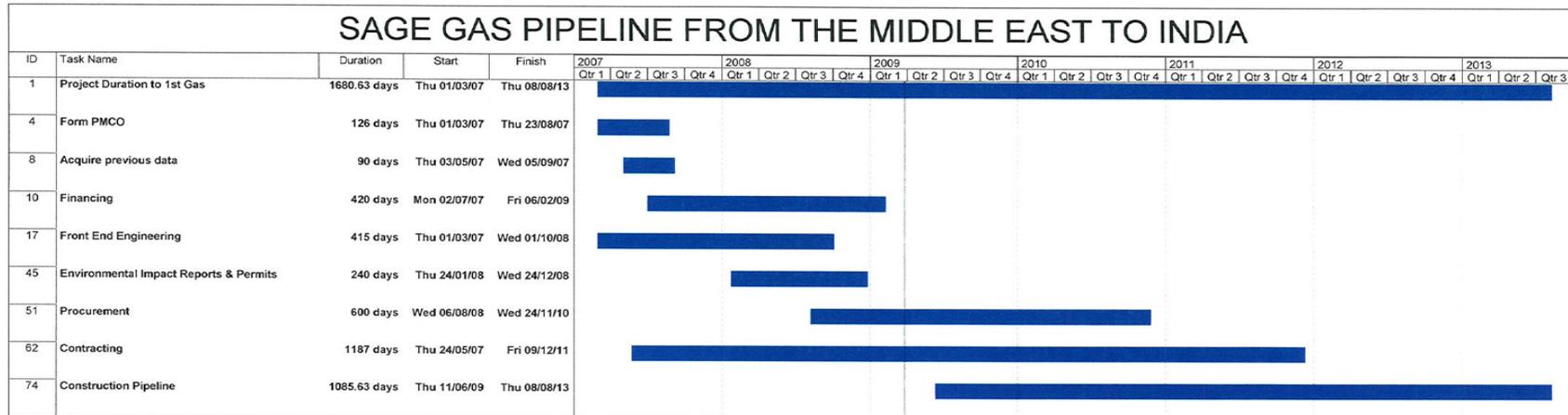
Hex-joints (6 single joints) = 240 ft

.....and HMC's planned new J-lay vessel

- < 2 x 5,500mT cranes.
- < 2000mT J-lay system
- < Pipe sizes up to 32" OD
- < Accommodates 450 pax

other contractors also have new lay vessels under construction.





- design development work started March 2007
- the project schedule leads to first gas in 2013

- DnV input - SAGE **economic upgrade** by introducing **heat treatment** into pipe mill Quality Control techniques.
- **INTECSEA** Inc. (a WorleyParsons company) has completed **cost/route study** of onshore Gas Gathering system and is now appointed as the SAGE Project Development Consultant. Feasibility Study and Risk Assessment under way.
- CRISIL (leading Indian Rating and Financial Research agency) has completed **Feasibility Study** for Indian and Gulf Investors/Private Equity in response to interest shown.
- SAGE **technology being shared** with Indian & UK Pipe Mills. Mills are enthusiastically implementing test programs.
- Middle Eastern **Pipeline and Upstream Companies** are being encouraged to join SAGE Consortium.
- Ongoing contact with **Indian entities** (GAIL/ONGC/IOC/NTPC) MOU with GAIL is under discussion with signature imminent.

- Large quantities of gas can readily be sold at the Indian landfall for \$6-8/MMBTU, producing a substantial volume of gas transiting Oman to India through multiple SAGE lines.
- The cost of importing gas into Oman from KISH or Qatar can be significantly reduced by the addition of at least 31MMBCM per day per SAGE line in transit to India.
- Oman has substantial LNG business with little complementary pipeline activity. SAGE can help offset this dependence.
- Balancing the dependence on LNG with diversification into pipeline business may be particularly useful during periods of global economic downturn, such as that expected over the coming years when the LNG market is weak.
- Access to the gas provides added incentive for the Indian side to help develop the KISH field in partnership with Oman.