SAGE

Middle East to India Deepwater Gas Pipeline

13th Annual Middle Gas Summit

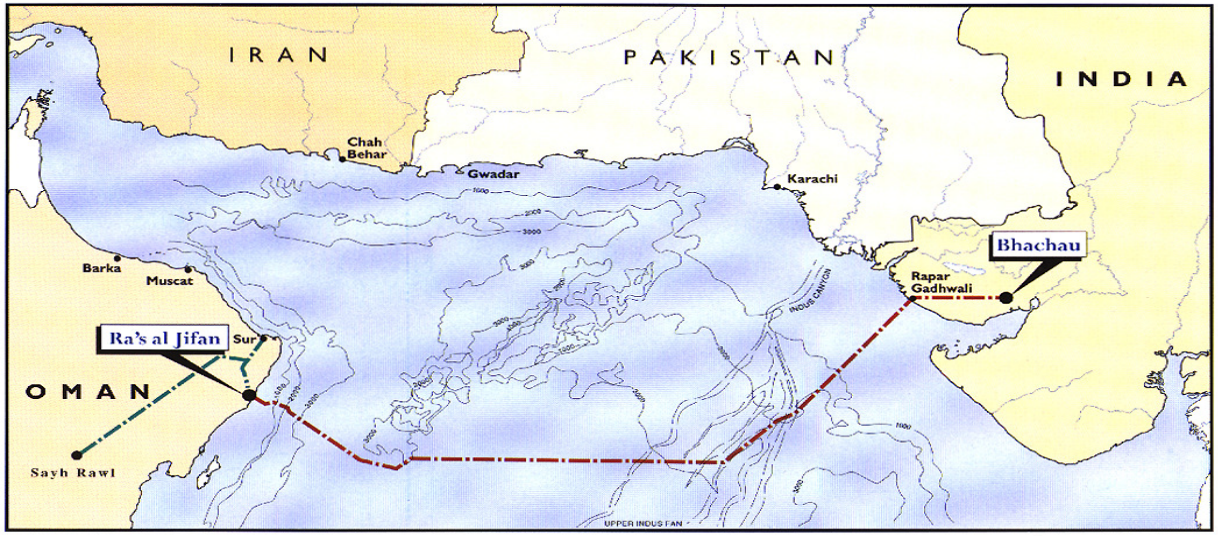
Doha (Qatar)

March 2008

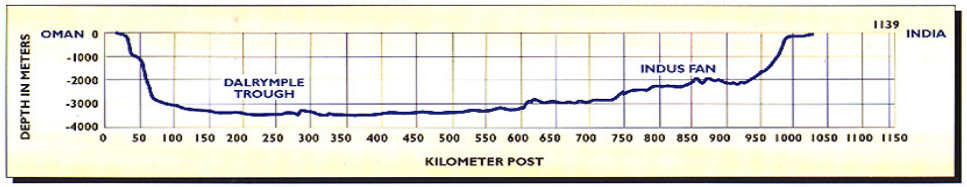
History

SAGE

Deepwater pipeline technology was first developed over 10 years ago on the Oman-India project……..



Subsea Route and Sea Bottom Profile



……and has now matured

Technical Issues facing the project in 1995:

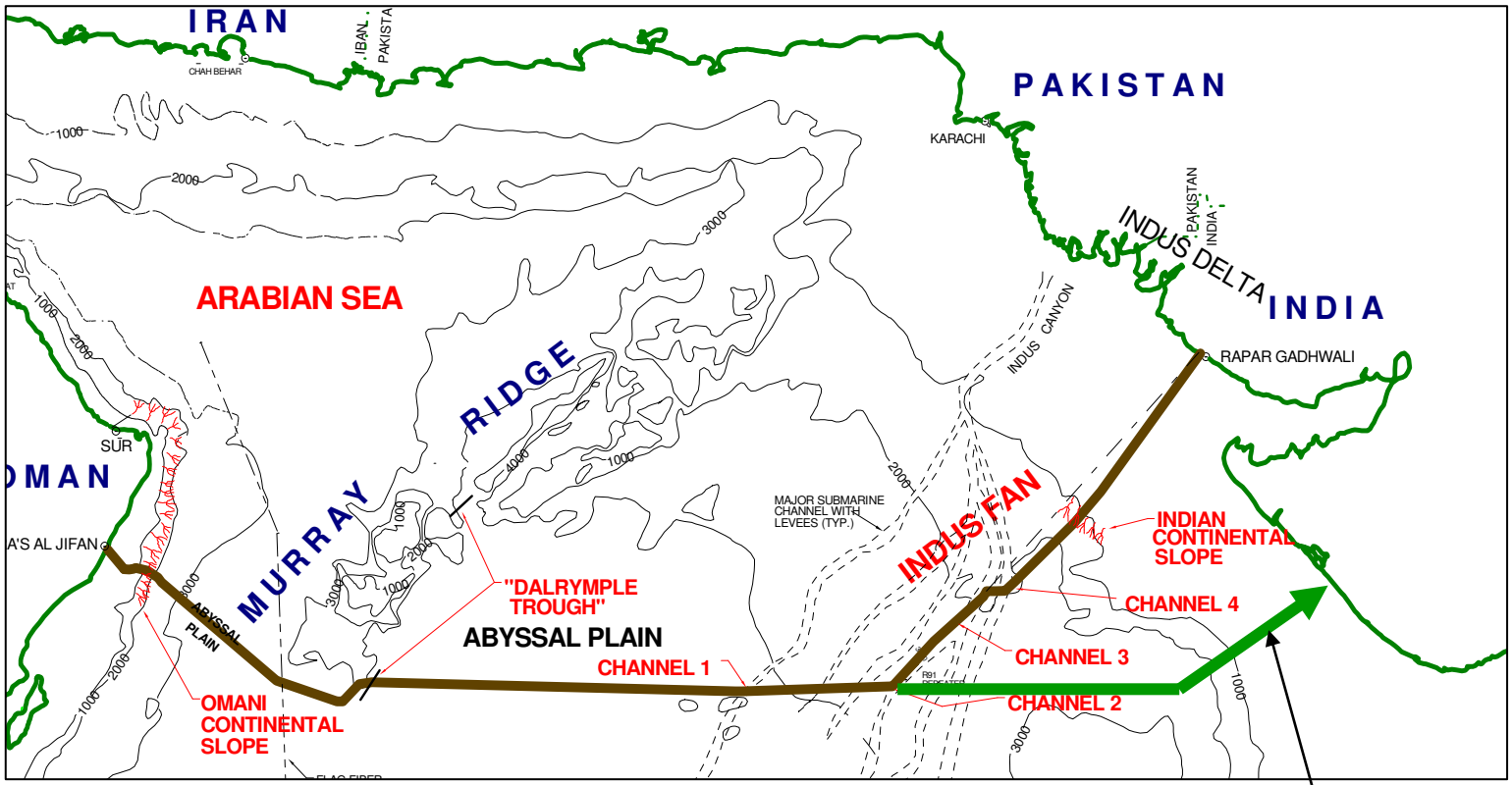
- Pipe mill upgrades needed to manufacture linepipe to specification.
- Lack of lay vessel with enough tension capability. Conversion work needed to lay pipe to 3,500m water depth.
- Incomplete understanding of seismic activities and mitigation methods – mudflows, fault lines, slope failures, etc.
-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

What makes SAGE possible now?

- New generation, large Heerema lay vessel.
- Several mills are capable of manufacturing pipe.
- 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 28-inch pipe.
- Exceptional Feasibility/QRA foundation as commissioned by SAGE and from the literature.

Building on Previous Experience

SAGE



Possible re-route suggested by INTEC Engineering to minimize mud flow exposure in Channel 4 (also shorter)

Project Features - Technical

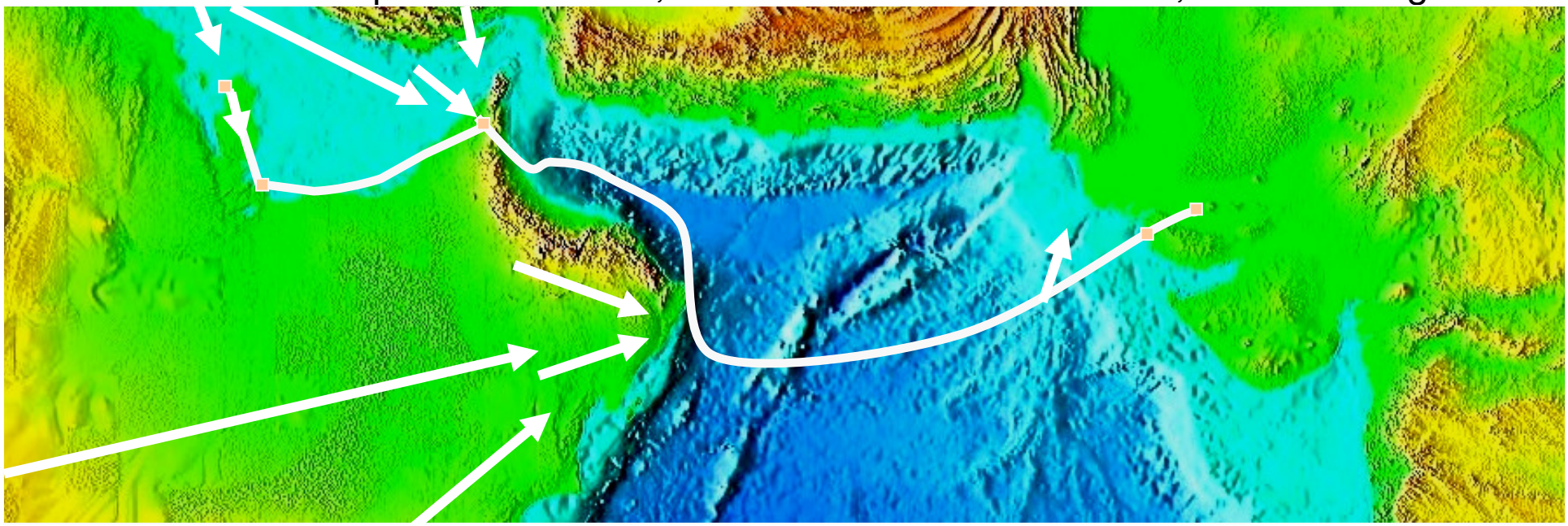
SAGE

- The pipelay industry has continued to reach into ever deeper water until today, Heerema's new pipelay barge is specified 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.
- 31.5 Million Standard Cubic Meters per day from each line (1.3BCFD).
- Western Indian gas markets are as close to Middle East as to new gas reservoirs off the Indian East Coast.

Building on Previous Experience

SAGE

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. SAGE will reach water depths of around 3,500 meters and will be over 1,000km in length.



All technically possible gas sources have been conceptually addressed, which will form a gas gathering network across the Gulf region, subject of course to the then current security and political conditions. Final landfall locations for this "Gas Bridge" are subject to future gas supply, compression station and gas purchase agreements.

Project Features - Commercial

SAGE

- Deep sea gas pipeline infrastructure project.
- Middle East to India with geo-political neutrality.
- Common carrier – tariff based. Buyers and Sellers deal direct with each other.
- Attractive opportunities for Indian and Gulf region investors.
- Market price for gas at custody transfer point.
- World class development team including the Heerema Group ensures confident execution.
- SAGE is open to association with existing regional gas transportation/distribution companies.
- Huge local content opportunity for Engineering companies across India and pipe mills in Gujarat.

The Opportunity for Investors

SAGE

DEMAND:

- India needs gas. Prices are rising: currently around $5-6 per MMBTU for domestic use; up to $12/MMBTU for fertiliser.

SUPPLY:

- Over 2000 TCF gas reserves reported to be available in the Middle East. Only 8 TCF required for SAGE.

SAGE:

- Project cost of $2.1 – 3.4 Billion for first line from Oman Coast to India requires tariff of around $1.1 to $1.8 per MMBTU. “Learning Curve” savings for subsequent lines.
- First Gas 2012 or earlier

Resulting BENEFITS to Investors:

- Tariff share and secure alternative gas sales route, but also investment opportunity in Downstream Power, City Gas Distribution, Fertilizer Projects and CNG systems.

Key success factors

SAGE

SAGE has economic and technical viability:

- World class design and build consortium; low project risk.
- Route outside of Straits of Hormuz and neighbours' EEZs gives SAGE a desirable low political risk profile.
- Non-volatile, long-term bi-partisan pricing un-correlated with and complementary to LNG "spot-market" price volatility for superior financial risk profile.
- Replaces wasteful use of Naphtha for fertiliser production
- "Green Energy" and carbon reduction benefits.
- Opportunity to "swap" ME gas for Indian-owned global gas.
- SAGE provides an historic opportunity for convergence of West and South Asian regional economic interests.
- Rupee strong against the dollar. Further 15% gain expected.

The SAGE Project – Key team members

SAGE

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 ▪ Director: VerdErg Ltd, London ▪ Former Project Director of original Oman-India Pipeline
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
John Stearns	▪ Vice-President, Marine Pipeline Systems, INTEC Engineering Inc., Houston ▪ Former Project Director, Mardi Gras Transportation System ▪ Former Project Manager, Canyon Express Project
Rob Narold	▪ HMC Project Manager for new barge design and construction ▪ HMC Strategic Development Advisor ▪ Sr. Proposals Manager - Manager New Product Development ▪ HMC Deep Water Product Manager
Dr Alastair Walker	▪ 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
Richard Freeman	▪ Manager, Business and Sales Development, Corus Tubes (Energy), UK.

Recent Developments

SAGE

High-level meetings with interested parties on the Indian side have been held. Some highlights are:

- A very positive meeting was held between SAGE and Indian Ministry of Power on 25th February 2008.
- SAGE was resented to the Indian Government Ministry of Petroleum & Natural Gas, Ministry of Power and Ministry of Fertilizer in early December 2007.
- Presentations were also made to GAIL, EIL and IOC. Earlier presentations were given to the TATA Group, NTPC and the Indian Fertilizer Industry.

Energy Economics

SAGE

The Government of India is recognizing the importance of private sector participation, and independent regulation in the energy sector. The future holds a lot of opportunities for international and domestic private participation.

The Government has awarded "infrastructure status" to gas pipelines, offering them tax holidays on profits for up to 10 years. The exemption has also been applied to storage facilities integrated to the gas pipeline network.

Reported by livemint.com, New Delhi, 1st March 2007

Demand for natural gas (more than 120 MMscmd) in the country has far outstripped supply (about 66 MMscmd), and there is an increasing trend of new NG demand emerging as well as conversion from existing fuels to NG[22].

However, unless significant finds are made (similar to KG basin) the country will still have to deal with a domestic shortage of gas.

Source: KPMG

The Indian energy Marketplace is increasingly open to investment AND….
recent domestic gas finds are insufficient for India's future needs.

The Ministry of Petroleum and Natural Gas announced a doubling of the domestic gas distribution infrastructure on March 30th 2007:

"Expressions of Interest in 5 new natural gas pipelines on a "common carrier" basis will be invited soon. The total length..will be around 5000 km…estimated investment Rs. 18,000 crore (US $4 billion)….and add to the existing network of over 5600 km.

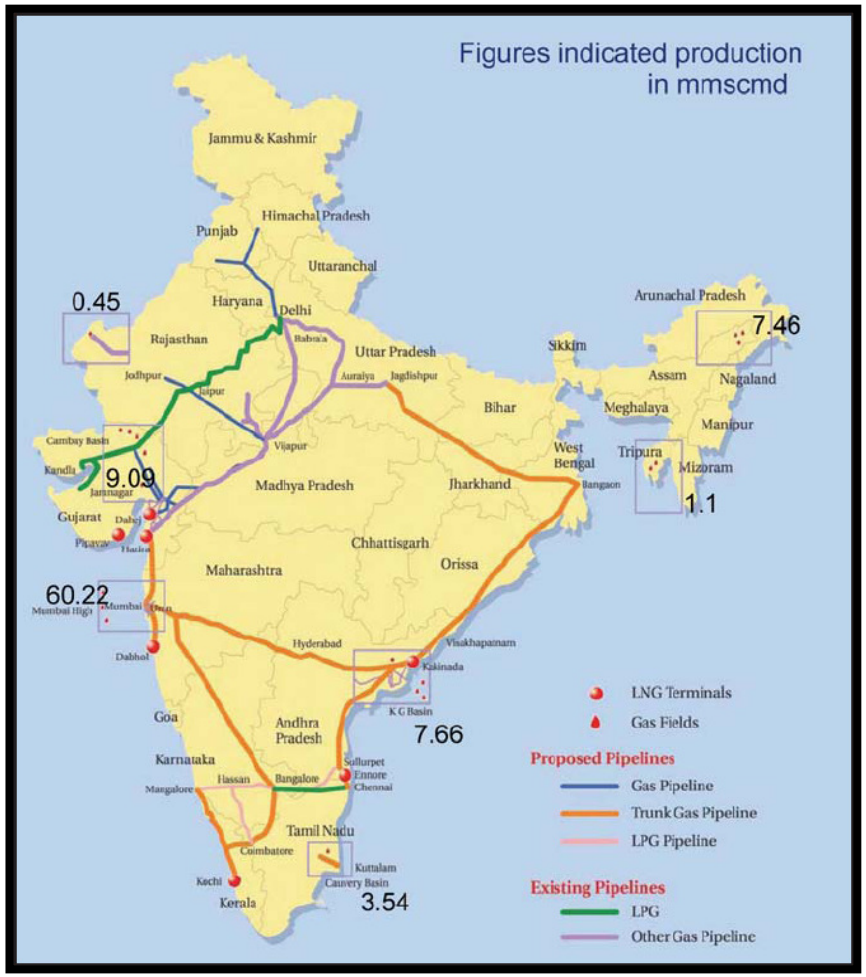
When commissioned, capacity is expected to increase from 140 MMscmd at present to around 280 MMscmd."

Reported by indianpetro.com 2nd April 2007

Dr. U. D. Choubey, Chairman and MD of GAIL, commented on 21st Feb. 2008 that upcoming investment in the gas supply chain could be $40bn to $50bn!

31.5 MMscmd can be absorbed in Gujarat / Maharashtra even without new downstream investment…..

There will be no problem selling SAGE gas!



Source: KPMG

Indian Power Industry

SAGE

- The Indian Power Ministry wants 77 MMscmd gas but gets only 39 MMscmd.
- NTPC is investing $40bn in next 5 years to lift capacity from 28,000 to 50,000 MW.
- India plans its power capacity to rise from 135,000 to 200,000 MW by 2012: 20% will be from gas - more than twice figure now.
- A gas shortfall is expected for many years.
- By 2030, India may need 224 MMtoe/yr of gas, requiring over 150 TCF recoverable reserves - twice what may be available indigenously.

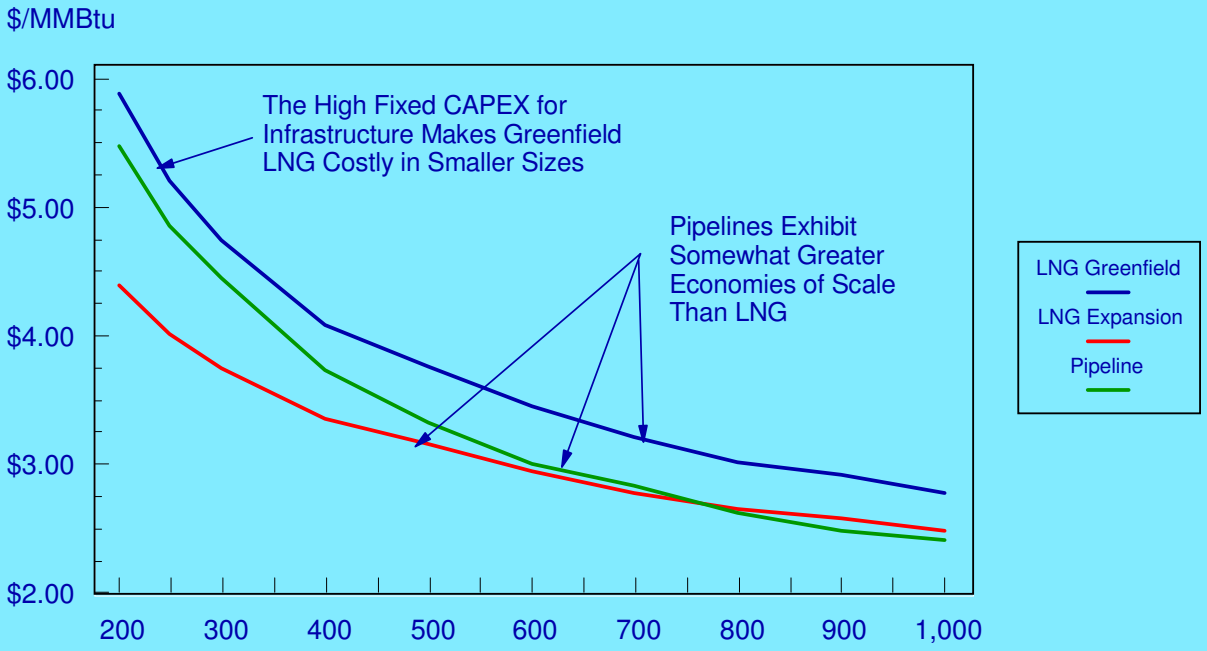
Indian Fertilizer Industry

SAGE

- Expected Urea production in India will need 95 MMscmd of gas by 2017.
- The gas deficit of the Indian Fertiliser Industry is reported to be 20 to 30 MMscm per day.
- This deficit is currently met from LNG and naphtha.
- Dow Jones reported on 21 November 2007:
  - "We are now substituting almost 20% of our gas needs with naphtha….we are talking to gas suppliers, but the gas just isn't there." (attributed to a senior executive at Indian Farmers Fertiliser Cooperative).
  - "Naphtha consumption may cross 3.2 million tonnes in the year to March 2008 compared with less than 2.7 million tonnes in the last fiscal year." (attributed to a senior official in the Ministry of Chemicals and Fertilisers.)

Figure 2

THE SCALE EFFECT - THE COSTS OF MOVING GAS OVER 1,200 MILES BY PIPELINE AND AS LNG (GREENFIELD AND EXPANSION PROJECTS)



Source: JAMES T. JENSEN
Jensen Associates
49 Crescent Street; Weston, MA 02493 U.S.A.
Website JAI-Energy.com

Energy Economics

SAGE

THE INFLATIONARY PRESSURES HAVE A SIGNIFICANT EFFECT ON THE COMPETITION

- The Past Three Years Has Seen a Dramatic Increase in Construction Costs
- While the Costs of Pipeline Construction Have Risen Substantially, Those of LNG Liquefaction and Regasification Have Been Especially Hard Hit
- At the Turn of the Decade, LNG Plant Construction Costs Were Approaching $200/Ton of Capacity
- But Current Costs are a Multiple of That Level and There Have Been Several "Problem Trains" That Have Been Quoted at $1,200 and Above

Source: JAMES T. JENSEN
Jensen Associates
49 Crescent Street; Weston, MA 02493 U.S.A.
Website JAI-Energy.com

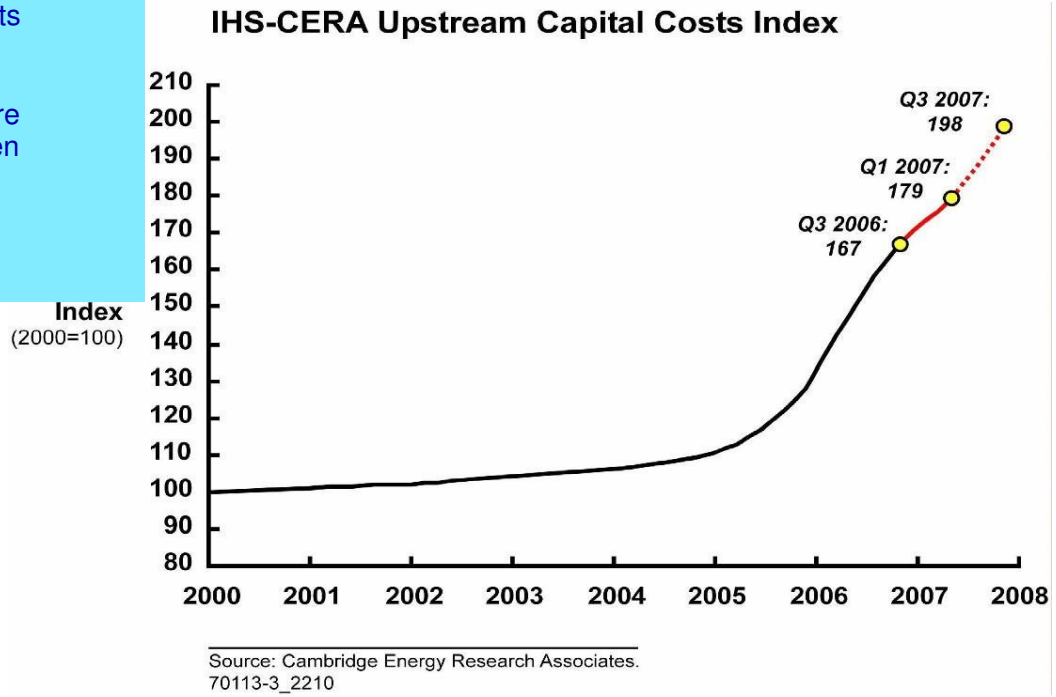
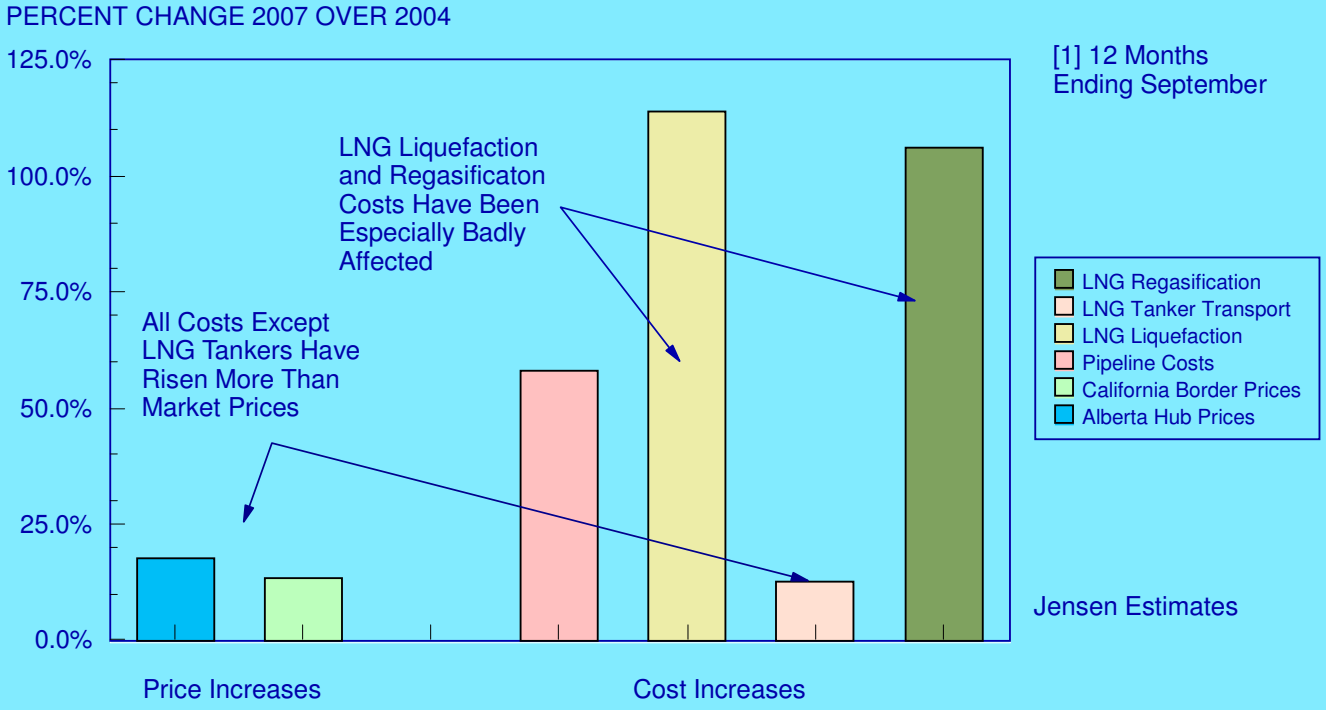


Figure 3
RECENT INFLATIONARY PRESSURES ON THE SYSTEM
2007 [1] VERSUS 2004 RELATIONSHIPS

Source: JAMES T. JENSEN
Jensen Associates
49 Crescent Street; Weston, MA 02493 U.S.A.
Website JAI-Energy.com

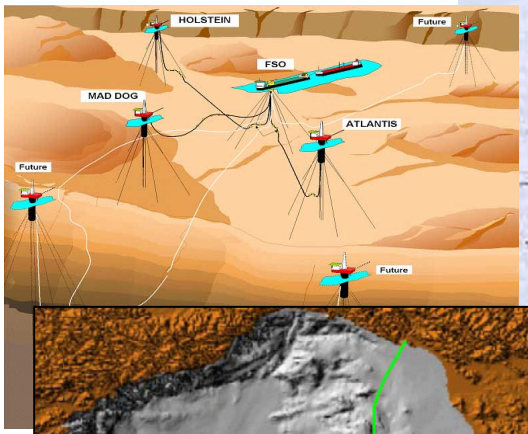


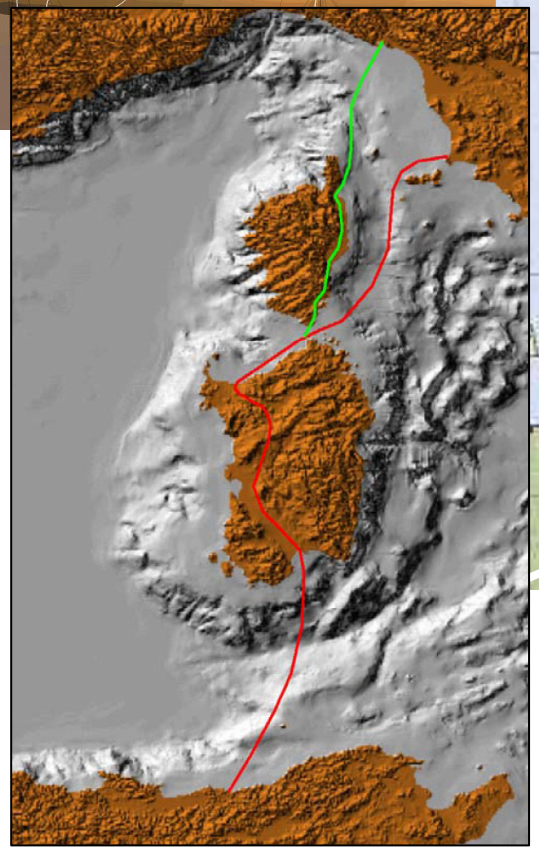
SUMMARY

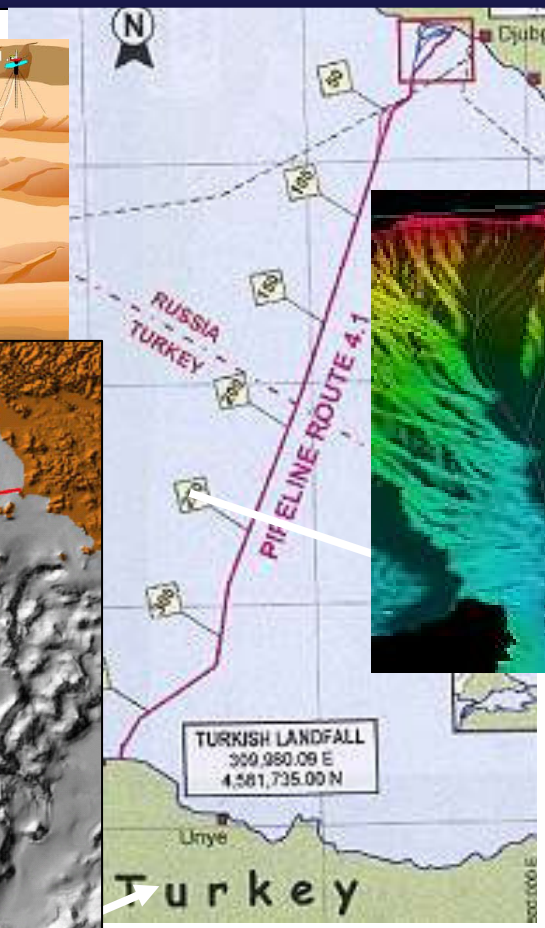
- Indian LNG import prices around $5.50 -$6.00 per MMBTU are being reported in the Indian press.
- Naptha prices of $12 per MMBTU are reported being paid in India for fertiliser feedstock.
- SAGE will seek a tariff expected not to exceed $1.80 per MMBTU for the first line, falling thereafter towards $1.10 per MMBTU as the system grows.
- The SAGE tariff will be set by its owners, which can be the gas Sellers and/or Buyers.
- Buyers can therefore have $3.70 to $4.80 available for gas gathering & purchase after paying the SAGE tariff
- There is an unsatisfied demand for natural Gas in India able to immediately absorb all of the 31.5 MMSCM per day delivered by each SAGE pipeline.
- SAGE is expected to be competitive with and complementary to indigenous gas and LNG imports.

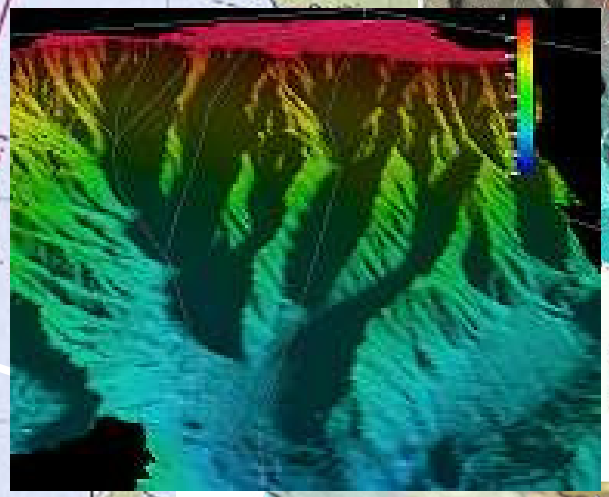
Technical Issues - INTEC experience

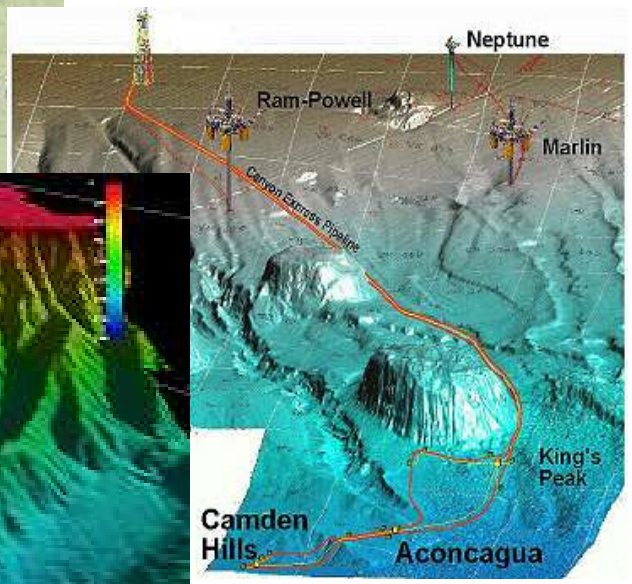
SAGE

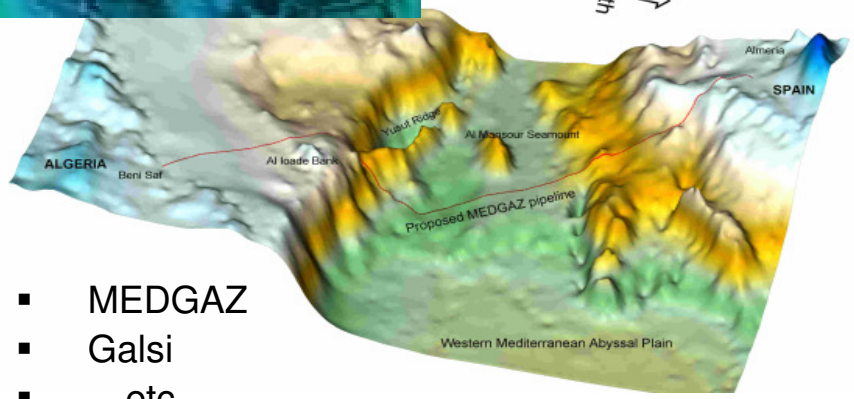








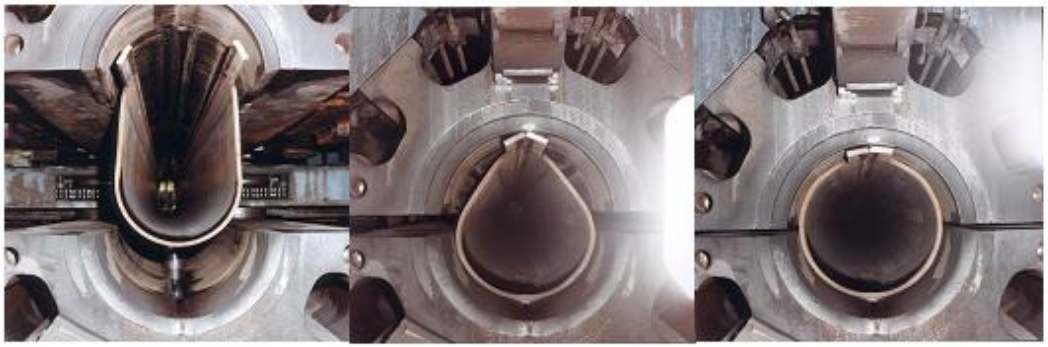




- Bluestream
- Canyon Express
- Mardi Gras

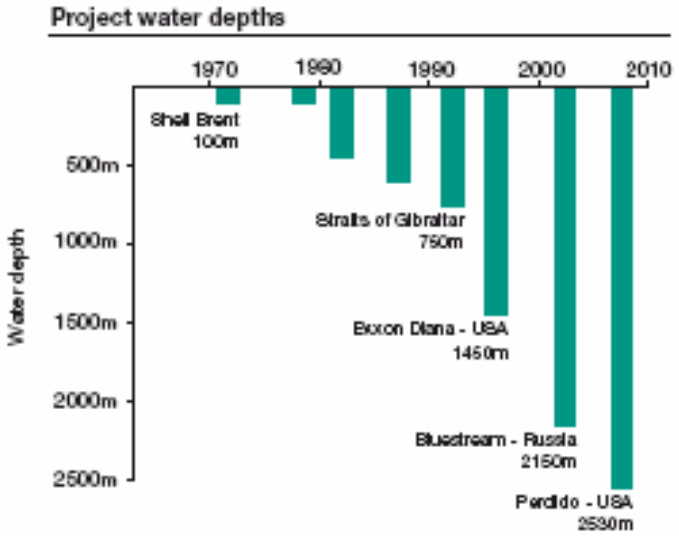
- MEDGAZ
- Galsi
- …etc
- SAGE

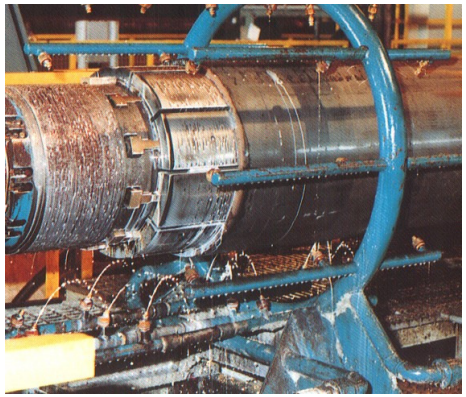
Corus Tubes – Deepwater Track record



World Strongest : "O" Press

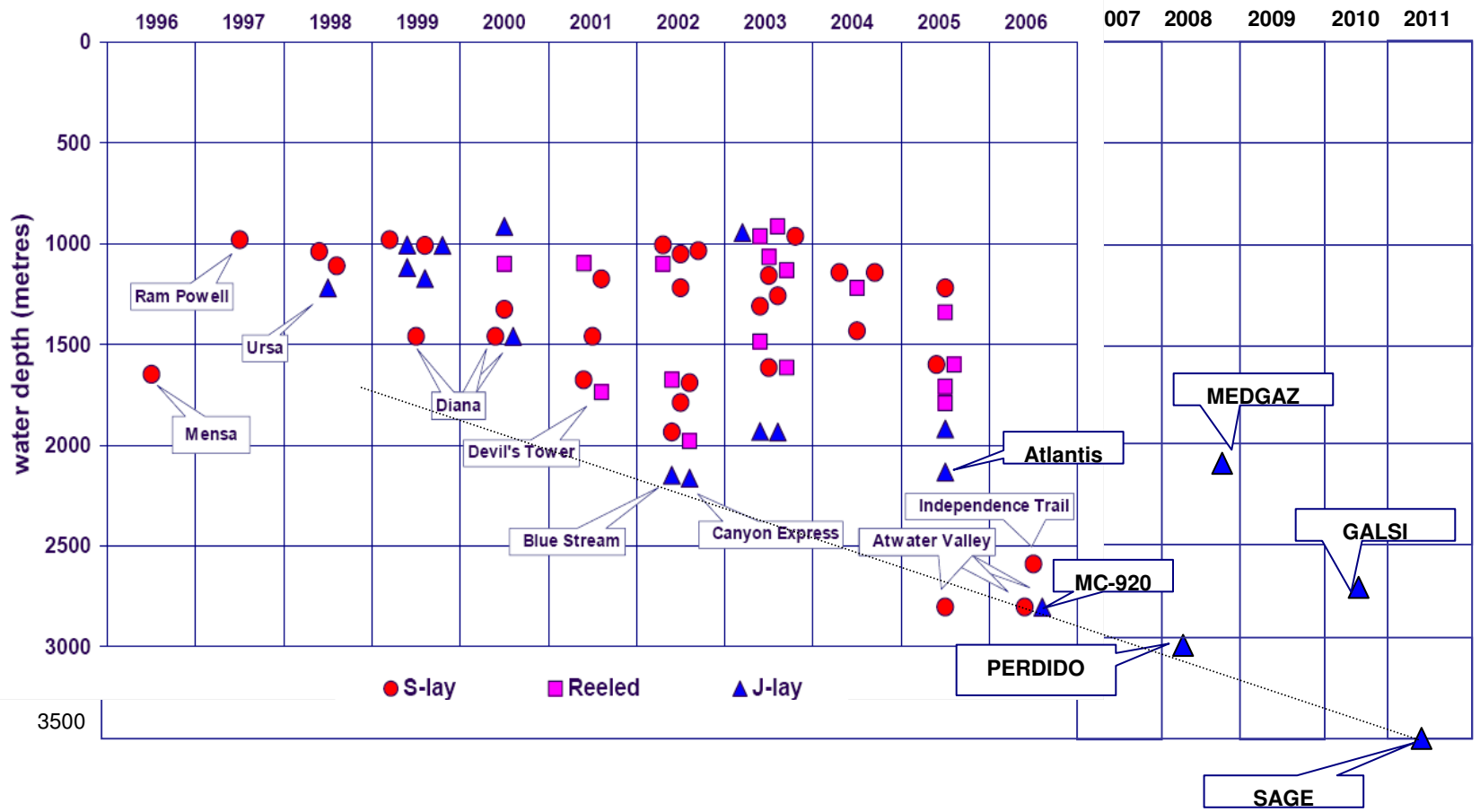
Max Pressure force : 50,000t





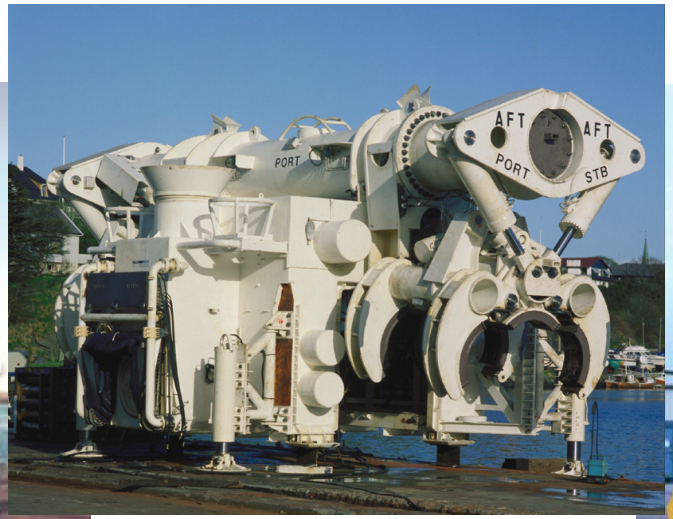
Corus Tubes UK UOE Mill has the strongest tooling in the world ensuring the required roundness and material compressive strength necessary for ultra-deepwater line-pipes

Deepwater trend towards SAGE

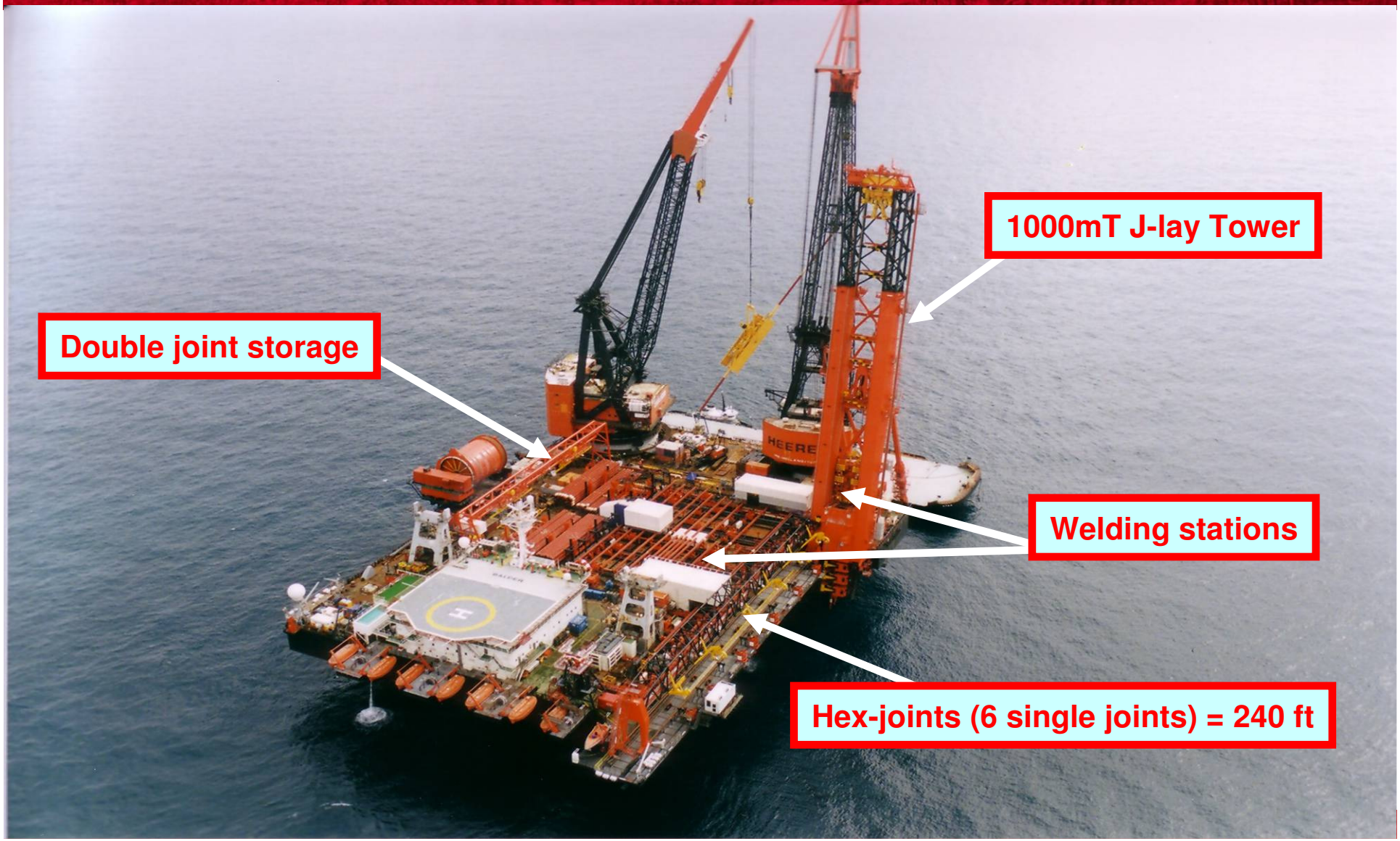


Repair

- No deepwater large diameter pipeline has ever required in-situ repair, nor is it statistically likely that a repair will be required during the lifetime of the pipeline
- However, within the last 5 years, deepwater pipeline repair systems have been designed, constructed, tested and commissioned for operational use for large diameter, high pressure gas pipelines
- Diameter range available today for large diameter is 16-inch to 28-inch OD
- Water depth rating available today is 3,050 m (10,000 ft)
- The use of advanced diverless remote equipment to repair a line takes time, and leads to consideration of redundancy such as multiple SAGE lines will provide.

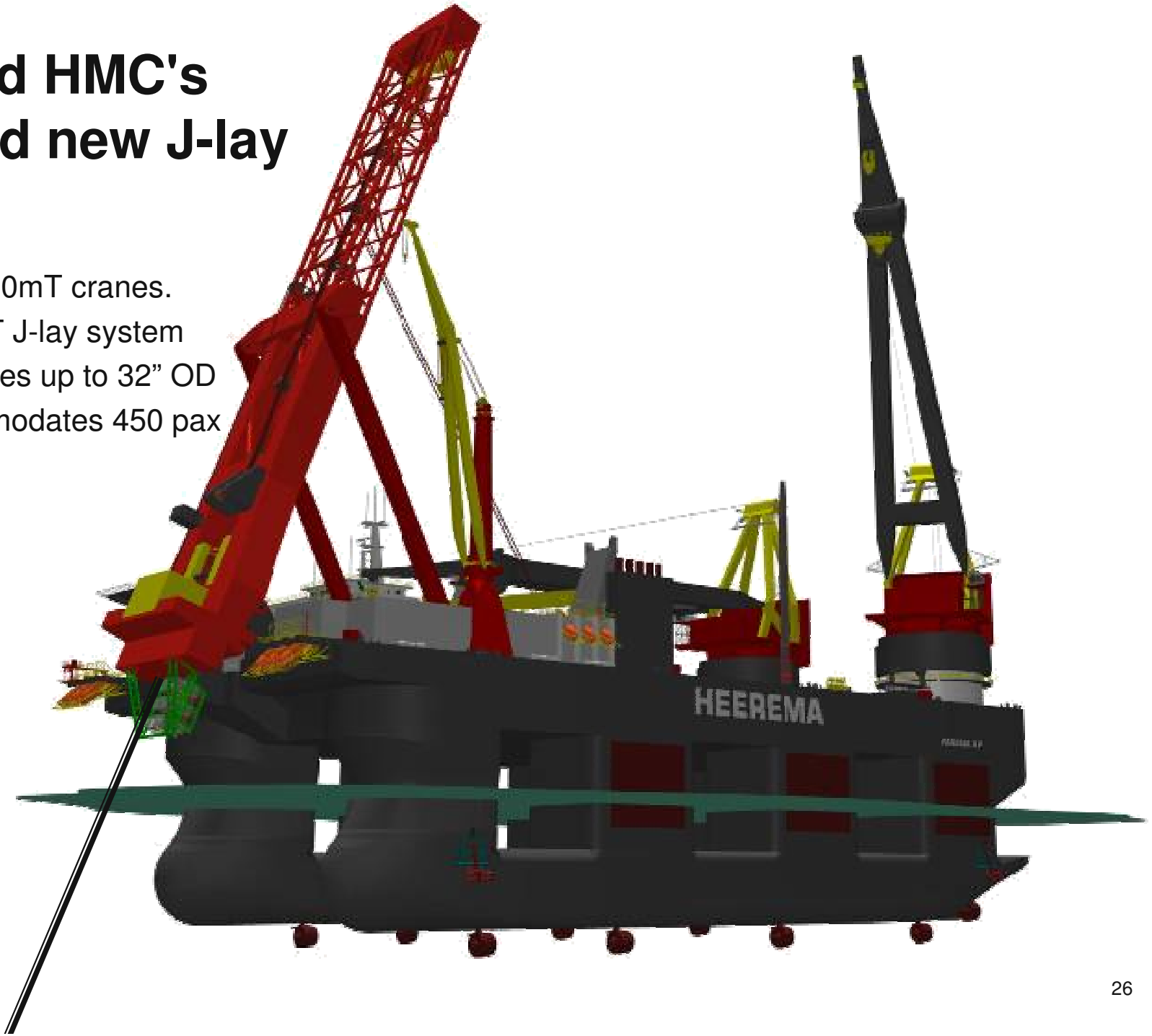


Existing J-lay vessel "BALDER".....



……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



Intended Selling Points New Vessel

- Next Generation Semi Submersible Crane Vessel
- Highly Competitive Sailing Speed (14 knots)
- Fully redundant Dynamic Positioning System (DP Class 3)
- Optimized for operations in long ocean swells
- Large deck for (e.g.)
  - Pipe Storage
  - Multi joint preparation (72m or 96m lengths)
- Vessel cranes capacity 5,500 mT
- J-lay Speed Optimized (up to 6 or 8 km/d)
- Low emissions by clean design

Heerema Commitment to SAGE

- HMC Mission clearly states:

  By any measure, to be and to be recognized as the best offshore contractor in the world

  - For our Clients this means the best value for SAGE
  - For our Shareholder this means that SAGE needs to deliver a project return, in line with our commercial alternatives.

- Our new vessel is being designed:
  - For deepest water pipelay
  - For highest payload leading to long distance logistic efficiency
  - For operational safety
  - For entering the market in 2011

- HMC is prepared to undertake the prestigious SAGE project assuming the commercial conditions justify the commitment.

INTEC's commitment to SAGE

SAGE

INTEC has over 10 years of industry-leading experience in engineering pipelines for installation in progressively deeper water

SAGE is technically feasible.

There are no "show-stoppers" given today's technology in engineering and construction.

Risk Levels are directly related to:

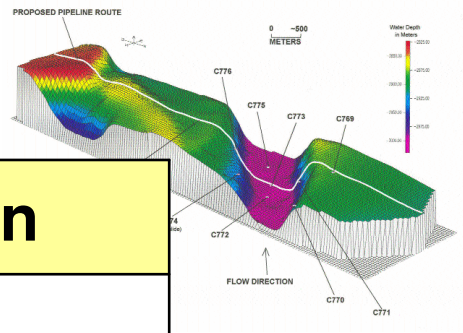
- the route and conditions along the route
- the design operating life of the pipeline
- the hazards to the pipeline identified along the route
- the calculations of the likely frequency of occurrence of the hazards
- the evaluation of the consequences to the “limit states” of the pipeline due to the occurrence of each specific hazard
- the evaluation of the frequency of failure of the pipeline due to each specific hazard
- the comparison with internationally accepted levels of frequency of failure

Assessment of Risk Levels during Operation

SAGE

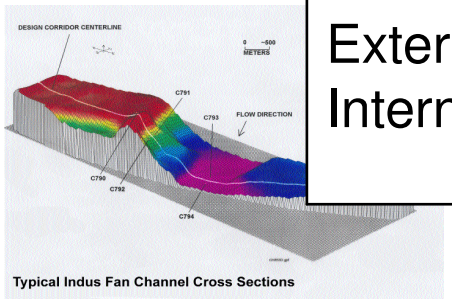
The first stage is to identify the hazards that impinge on the operating pipeline.

These are shown in the table.



List of Hazards during Operation

Earthquake	Off-specification Gas
Transverse Landslides	Sabotage
Landslides-Spans	Anchor Dragging
Axial Landslides	Dropped Objects
Channel Movement	Vessel Accidents
Currents	Third-party Construction
Storm/Wave	Military Action
External Corrosion	Latent Construction
Internal Corrosion	defects



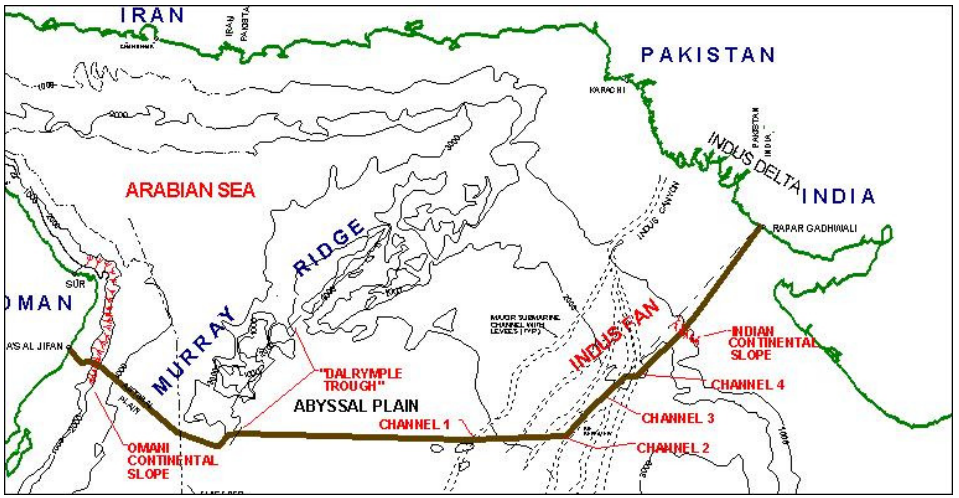
Typical Indus Fan Channel Cross Sections

Assessment of Risk Levels during Operation

SAGE

The various hazards are likely to be more relevant to some parts of the pipeline route than to others. For this reason the pipeline route was subdivided into appropriate segments as shown in the table.

Zone	Kilometer Point Range	Length of Zone (km)	Water depth (m)
Oman Shelf	0-27	27	0-100
Oman Shelf Break	27-30.5	3.5	100-300
Upper Oman Slope	30.5-45	14.5	300-1100
Lower Oman Slope	45-65	20	1100-2440
Abyssal Plain (Oman Side)	65-80	15	2440-2920
Murray Ridge	80-220	140	2920-3430
Dalrymple Trough	220-285	65	3430-3540
Abyssal Plain (Indian Side)	285-600	315	3540-3230
Indus Fan (Excl. Ch. 1, 2, 4)	600-925	325	3230-2140
Indus Fan Channel 1	612-613	1	2900-2890
Indus Fan Channel 2	745-751	6	2450-2700
Indus Fan Channel 4	855-865	10	1990-2180
Lower Indian Slope	925-973	48	2180-1200
Upper Indian Slope	973-985	12	1200-500
Indian Shelf Break	986-1014	28	500-100
Indian Shelf	1014-1139	125	100-0



Assessment of Risk Levels during Operation

SAGE

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, like on any other pipeline, where trenching and rock-dumping is conventionally applied. This protects the line against anchors and fishing activity.
- The risk from Sabotage is insignificant.

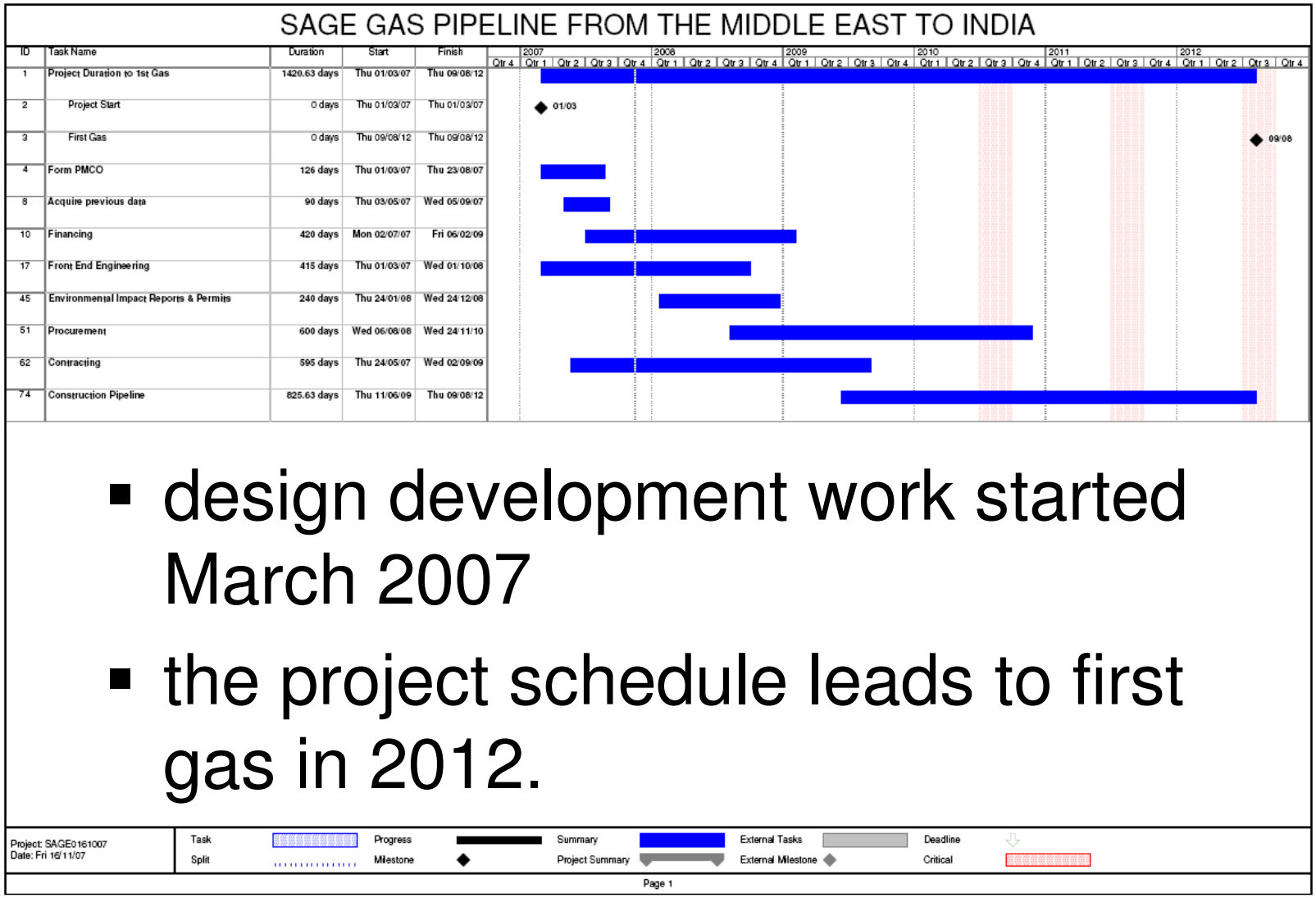
The SAGE Project – Key Features

SAGE

- Geopolitically neutral, historic regional development.
- High project local content makes SAGE truly pioneering.
- Offers investment opportunity in Indian gas use projects.
- No Major Oil Company role – SAGE is a Common Carrier.
- Blue-Chip, World-Leading design & construction “A-Team”:
  - Heerema Marine Contractors and INTEC; key Partners from Day 1
  - DnV
  - SAGE Project key team members
- Long-term, High-Integrity Infrastructure Project attracting low-cost Debt.
- Equity opportunity for Gulf gas sellers and Indian buyer-side beneficiaries at high Debt to Equity ratio.
- Complementary to LNG and local Indian gas sources.

Schedule

SAGE



- design development work started March 2007
- the project schedule leads to first gas in 2012.

The SAGE Project – Why now?

SAGE

- SAGE has become commercially viable as Indian gas buying price has risen towards World levels.
- Pressing need for energy in India - gas can be absorbed.
- Technical viability as HMC builds huge new barge with twice existing capacity.
- Several pipe mills can manufacture the pipe.
- Geopolitical supply risk managed by "Outside Hormuz" route without incursion into Iranian or Pakistani waters or Economic Exclusion Zones.
- LNG global price volatility and "spot market" risks mitigated by long-term gas pipeline supply contracts.
- Unsatisfied regional appetite for large-scale investment in regional infrastructure; lack of "good projects" like SAGE.
- Feasibility Report in preparation for potential Investors.