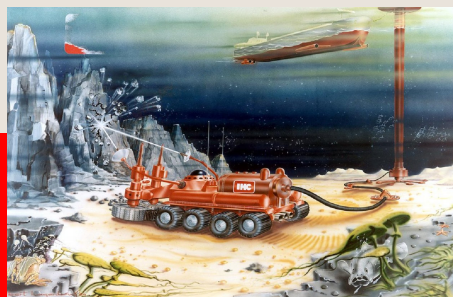




Deep Sea Mining Introduction & (technical) challenges

Ir. Rick Lotman
Manager R&D
Deep Sea Dredging & Mining

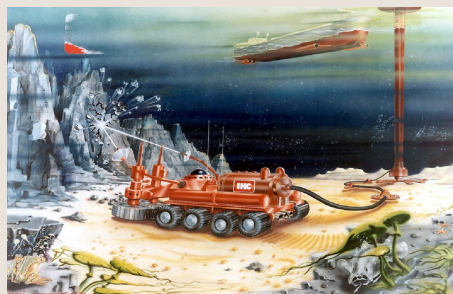


The technology innovator.



Contents

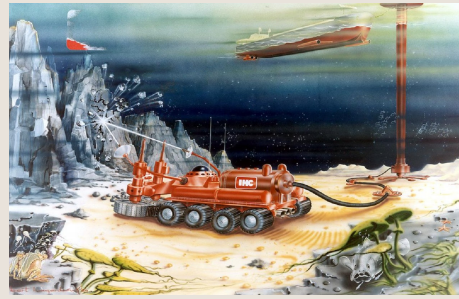
- Introduction to IHC Merwede
- History & current deep sea mining
- Deep sea business drivers & system
- Challenges





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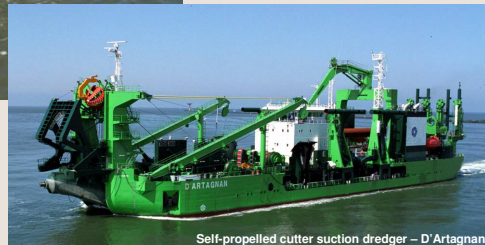


Innovative vessels: **Dredging**

- Proud to set the world standard for 'hoppers' and 'cutters'



Custom-built tralling suction hopper dredger: VOX MAXIMA



Self-propelled cutter suction dredger – D'Artagnan



Innovative vessels: **Offshore**



Innovative vessels: **Mining**

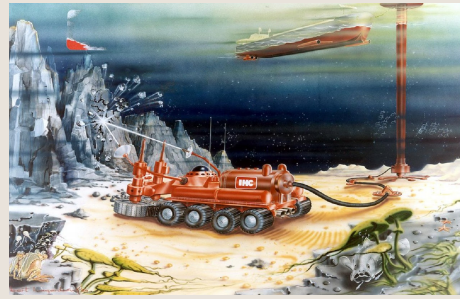
- Dredge mining including mineral processing



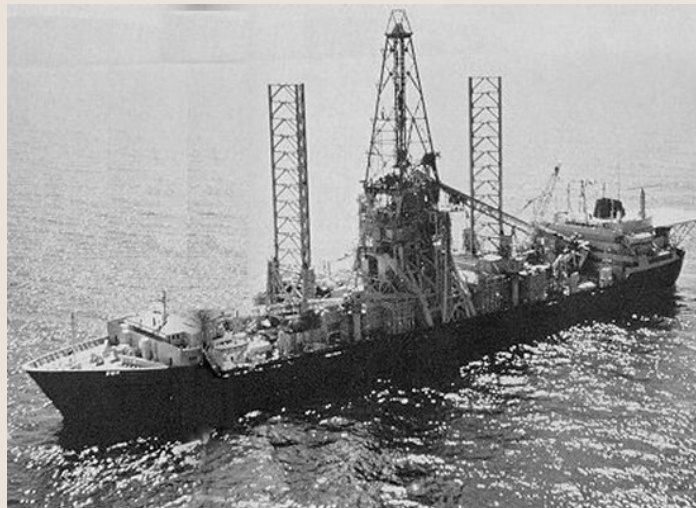


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History of deep sea mining





Current deep sea mining

- 260 ton crawler
- Max 300m depth
- 2400kW pump drive
- Total electric power 3500kW
- Total hydraulic power 500 kW



'Peace in Africa'



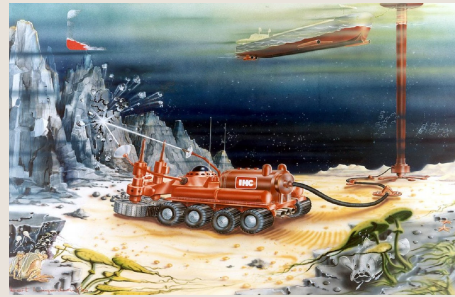
Current deep sea mining





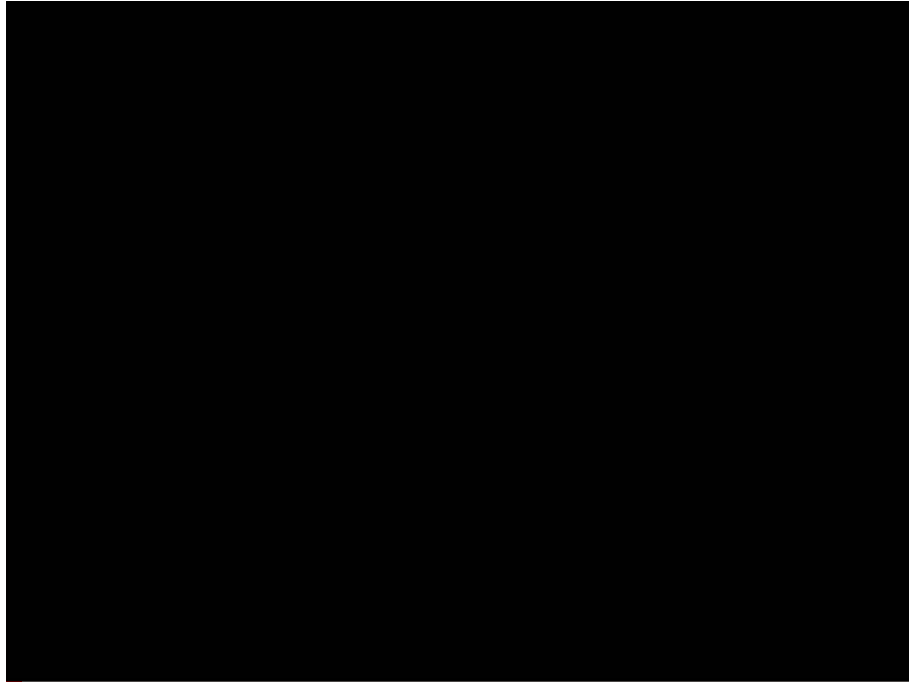
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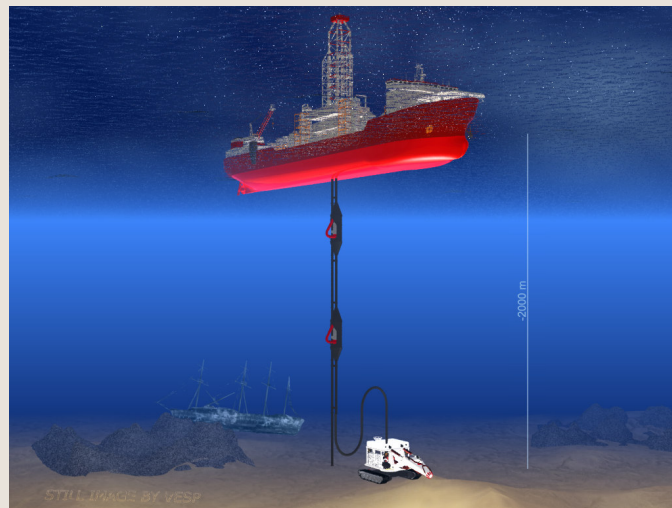


Deep sea mining business drivers





'Typical' mining system





IHC Marine and Mineral Projects



De Beers Marine – offshore diamond mining



Water depth 300 meter



Marine mining crawler



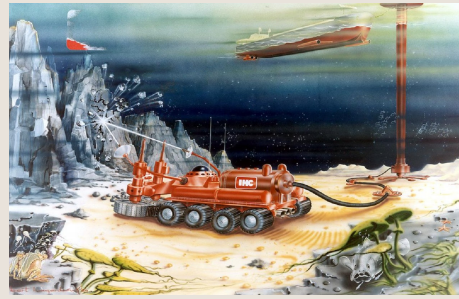
IHC Marine and Mineral Projects





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- Introduction to IHC Merwede
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- Deep sea business drivers & system
- **Challenges**



Challenges

- Corporate social responsibility
- Environment
- Financial
- Deepsea power supply
- Deepsea excavation
- Vertical transport





Corporate social responsibility

- Transparency & accountability
 - Ethical behaviour
 - Stakeholders interests
 - Environmental interests
 - Rule of law & norms of behaviour
 - Human rights
-
- Some guidelines exist
 - Relevance, applicability?



Environment

- No rules & regulations yet
- Use of offshore / dredging / mining rules
- Focus for now (mining related)
 - Habitat removal
 - Re-population areas
 - Relocation
 - Sediment plumes
 - Dredging practice
 - Waste water disposal
 - Return to origin
 - Treatment





Financial challenges

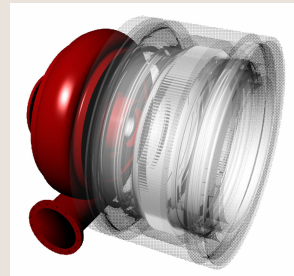
- Total system: large investment required
- High risk for client
- Joint venture
 - IHC Merwede – subsea equipment, risers
 - DEME – vessels, operations
 - € / tonnes



Deepsea power supply

Large power (MW's) motors in oil & gas, but

- Dredge processes require low rpm's
- High torque motors
- Additional attention for environment



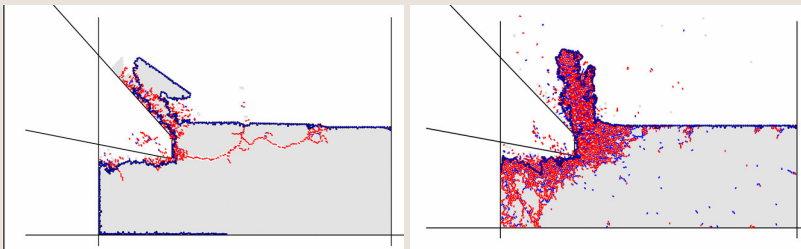


Deep sea excavation

- **Dredge excavation & O&G drilling, but**
 - Drilling = low productions, 'job' oriented
 - Excavation process subject to hyperbaric effect



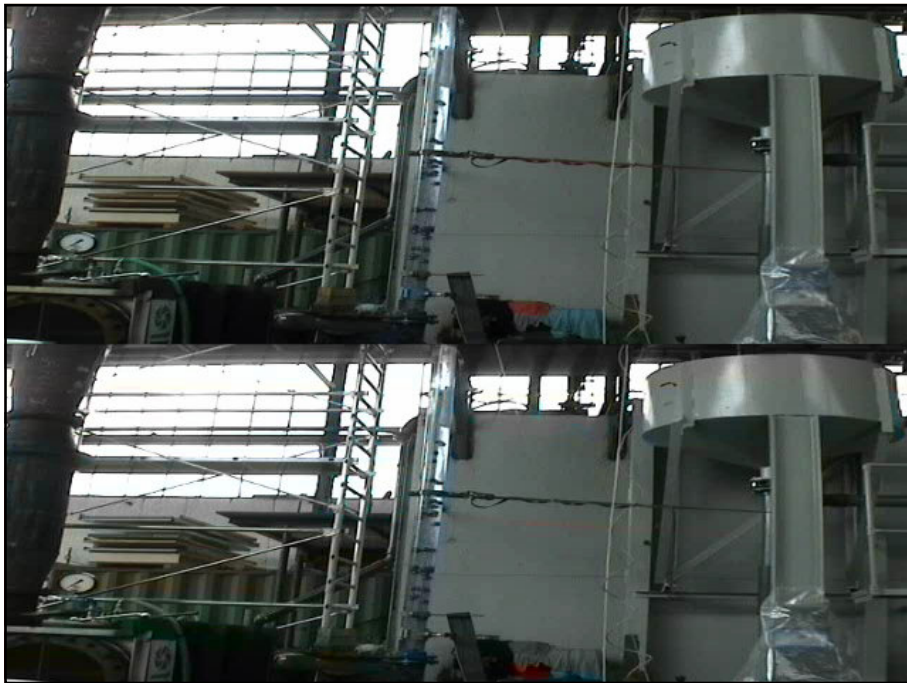
Deepsea excavation



Shallow water
Brittle process

Deep water
Ductile process

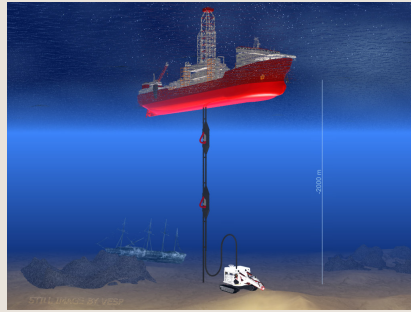
Specific energy ($\text{J/m}^3 \rightarrow \text{kW}$) increases by factors!





Conclusion

- Very, very large amount of deposits
- Proven technology available
- Challenges remain:
 - Environmental impact
 - Large flow vertical transport
 - Excavation
 - Power supply



Thank you for your attention

