

Dredging Processes

Dr.ir. Sape A. Miedema

1. Introduction

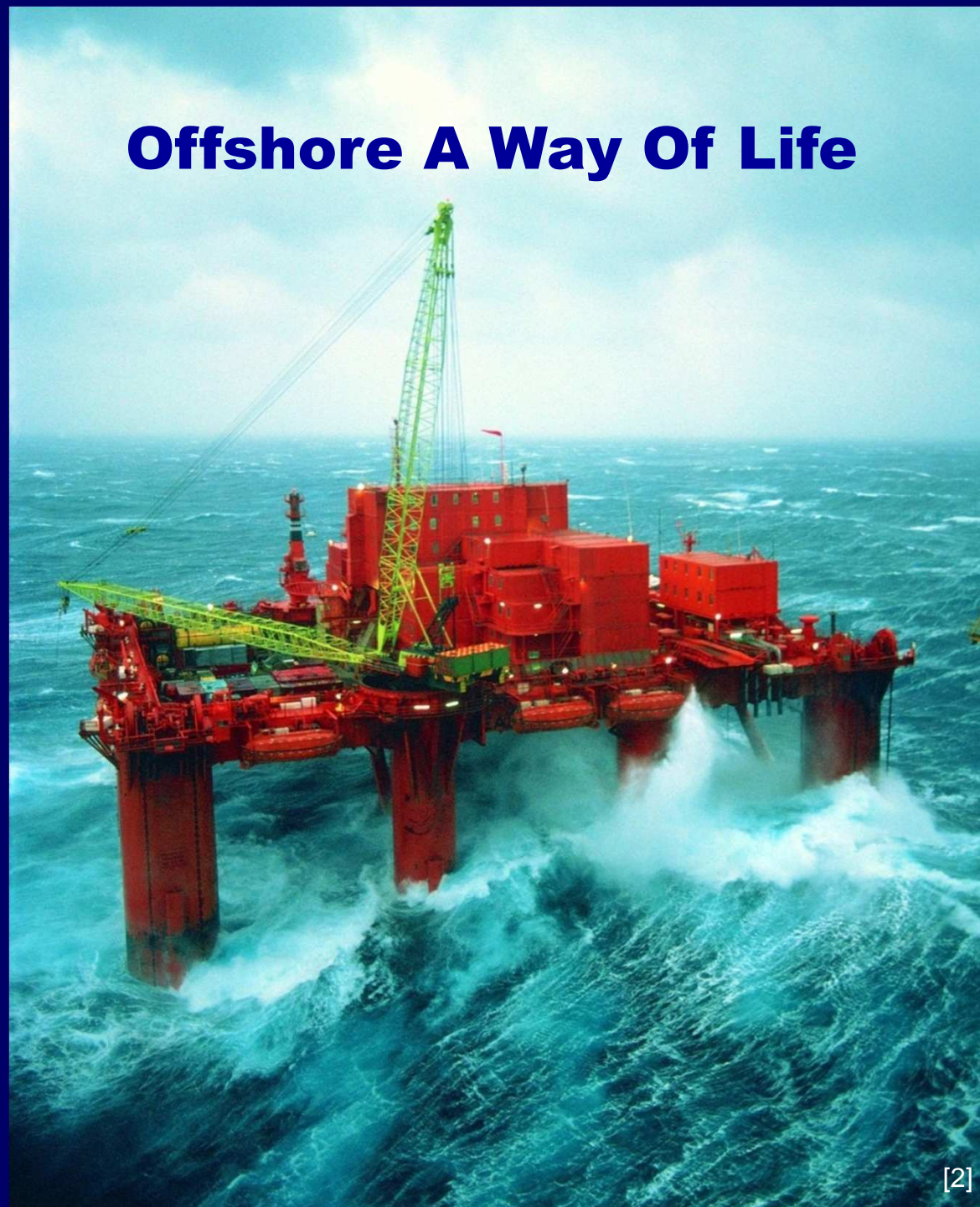




Dredging A Way Of Life



[1]



[2]

Offshore A Way Of Life

Offshore & Dredging Engineering

Dr.ir. Sape A. Miedema
Educational Director



What is Offshore & Dredging Engineering?

Offshore & Dredging Engineering covers everything at sea that does not have the purpose of transporting goods & people and no fishery.



Schedule OE4626 2012/2013

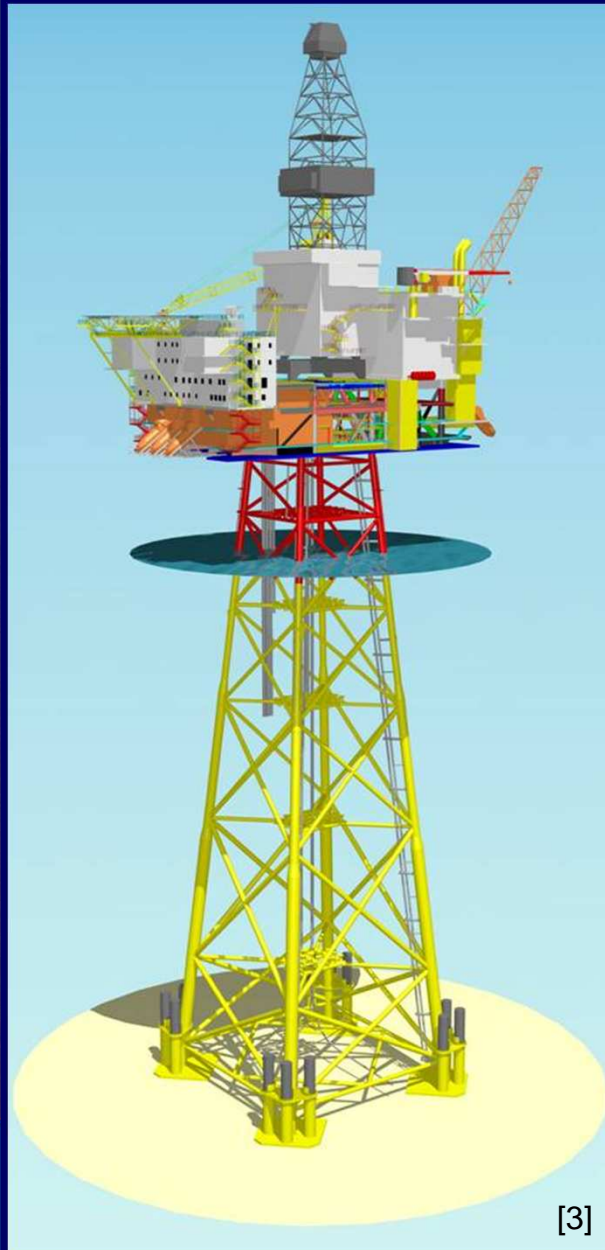
Date	Teacher	Subject
November 14 th 2012	Dr.ir. S.A. Miedema	Introduction
November 15 th 2012	Dr.ir. S.A. Miedema	Soil Mechanics
November 21 st 2012	Dr.ir. S.A. Miedema	Sand Cutting
November 22 nd 2012	Dr.ir. S.A. Miedema	Sand Cutting
November 28 th 2012	Dr.ir. S.A. Miedema	Specific Energy
November 29 th 2012	Dr.ir. S.A. Miedema	Clay Cutting
December 5 th 2012	Dr.ir. S.A. Miedema	Clay/Rock Cutting
December 6 th 2012	Dr.ir. S.A. Miedema	Rock Cutting
December 12 th 2012	Dr.ir. S.A. Miedema	Production Estimation
December 13 th 2012	Dr.ir. S.A. Miedema	Initiation of Motion
December 19 th 2012	Prof.dr.ir. C. van Rhee	TSHD
December 20 th 2012	Prof.dr.ir. C. van Rhee	TSHD
January 9 th 2013	Prof.dr.ir. C. van Rhee	Breaching
January 10 th 2013	Dr.ir. S.A. Miedema	Exercises & questions





Fields of Interest

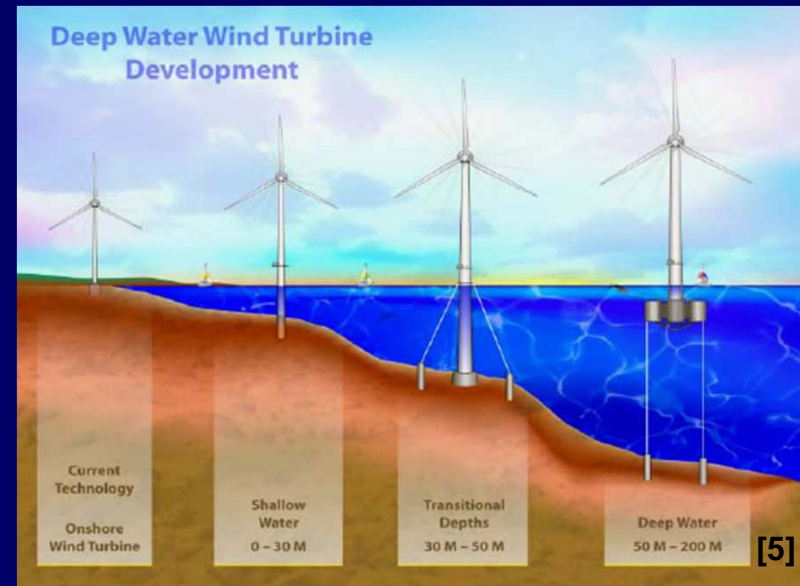
Bottom Founded Structures



[3]

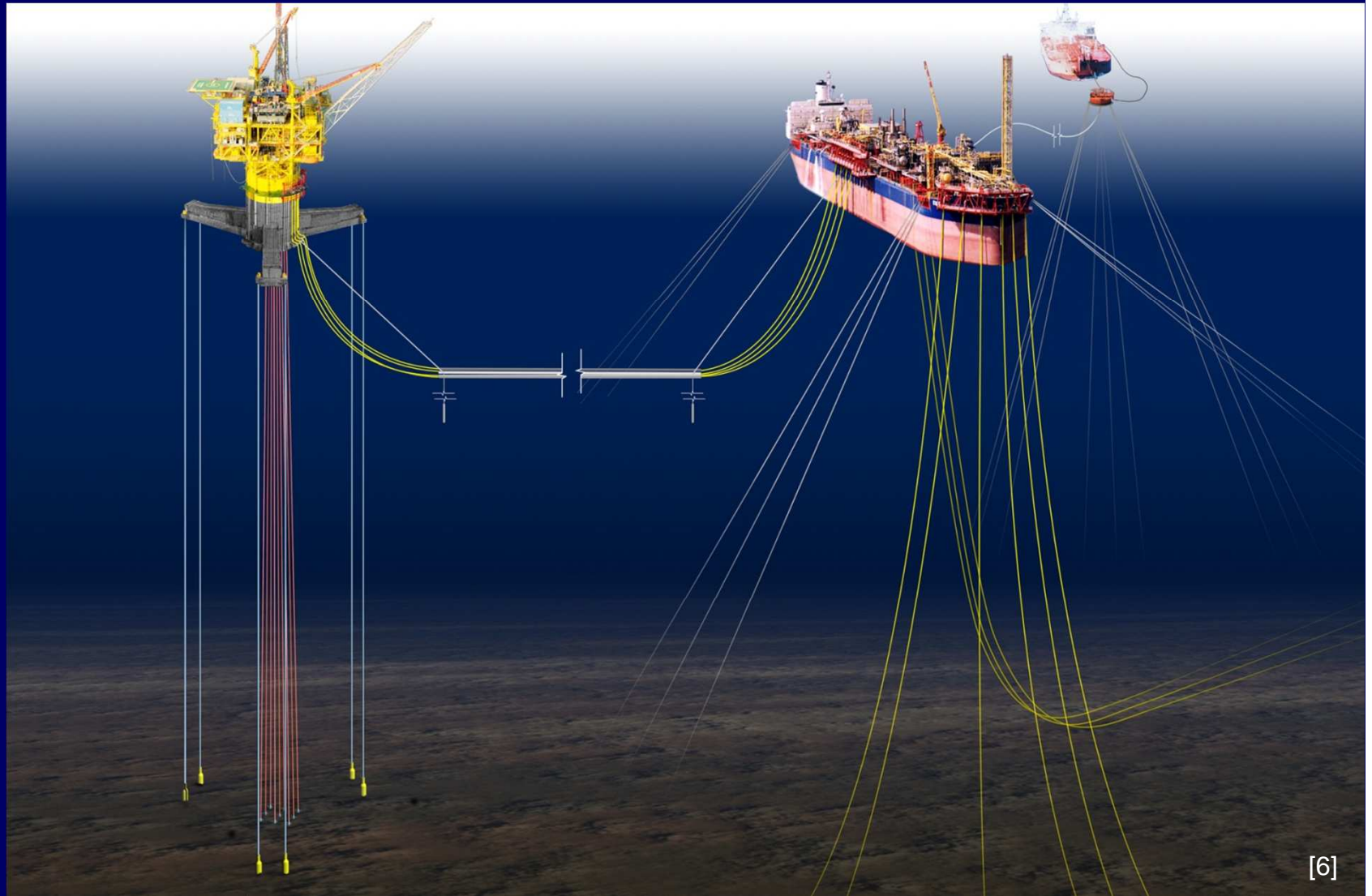


[4]



[5]

Floating Structures

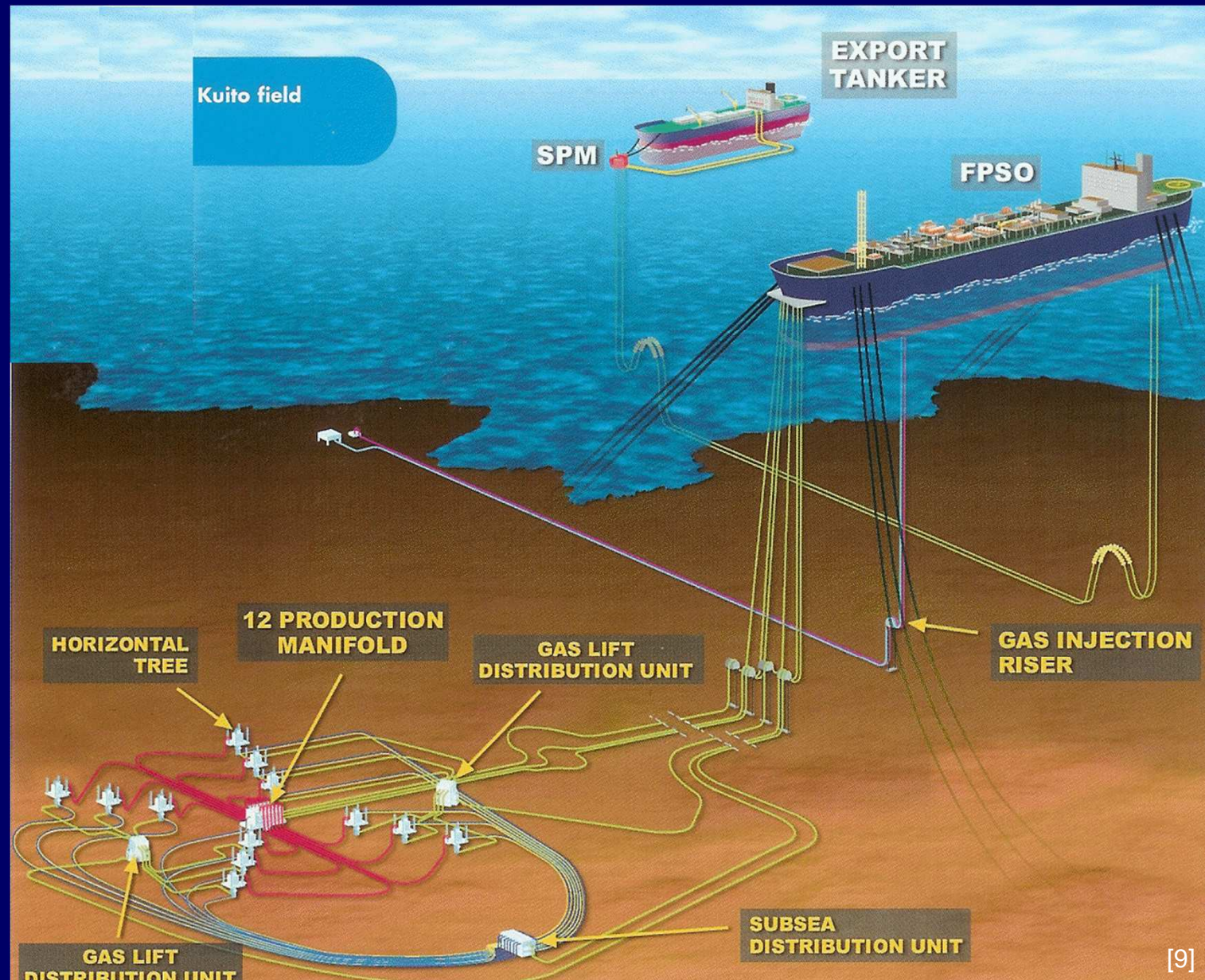


Dredging Engineering

Dredging, Deep Sea Mining & Trenching



Subsea Engineering



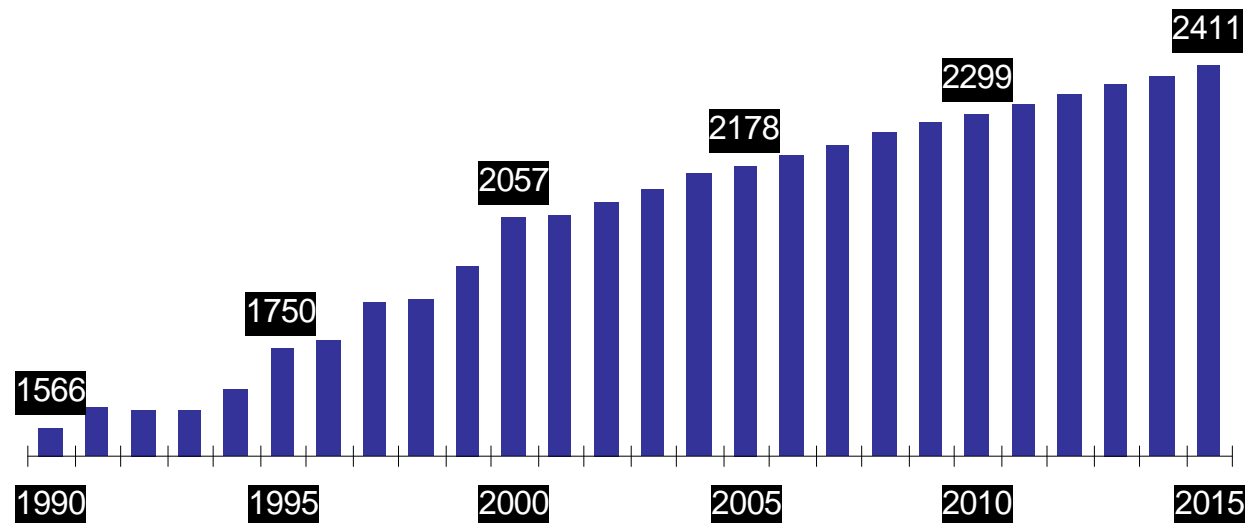
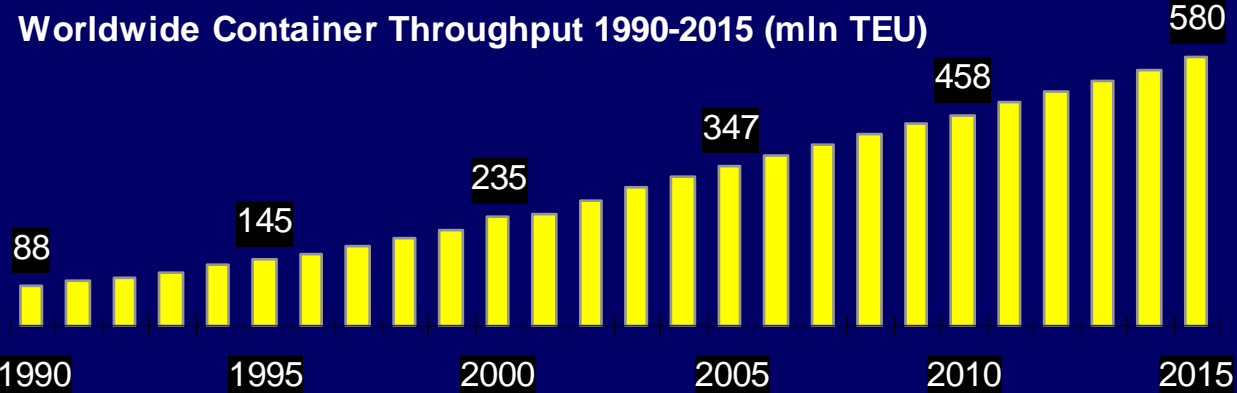
[9]



Global Market Drivers

Developments, World Trade

Ports & waterways: recurring maintenance, deepening & extension & capital works

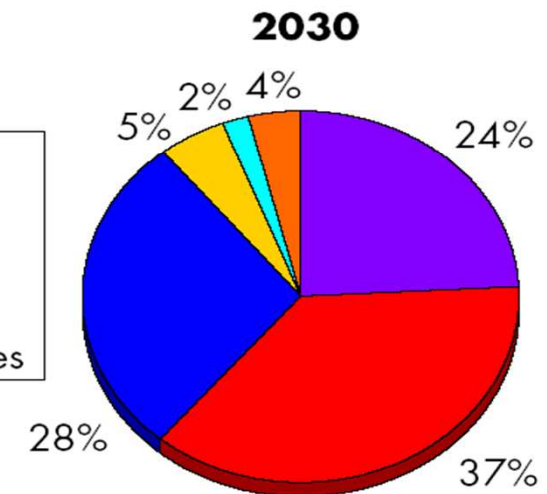
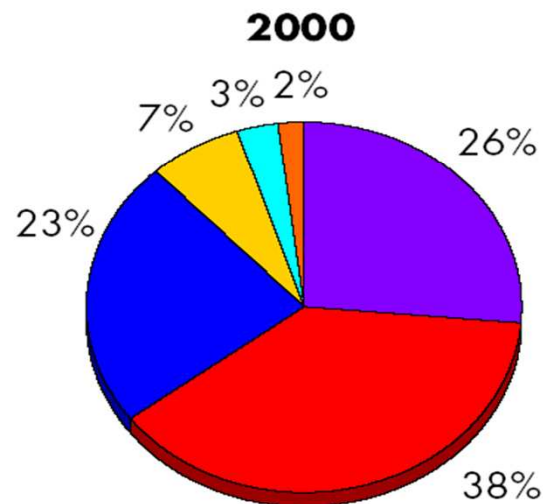
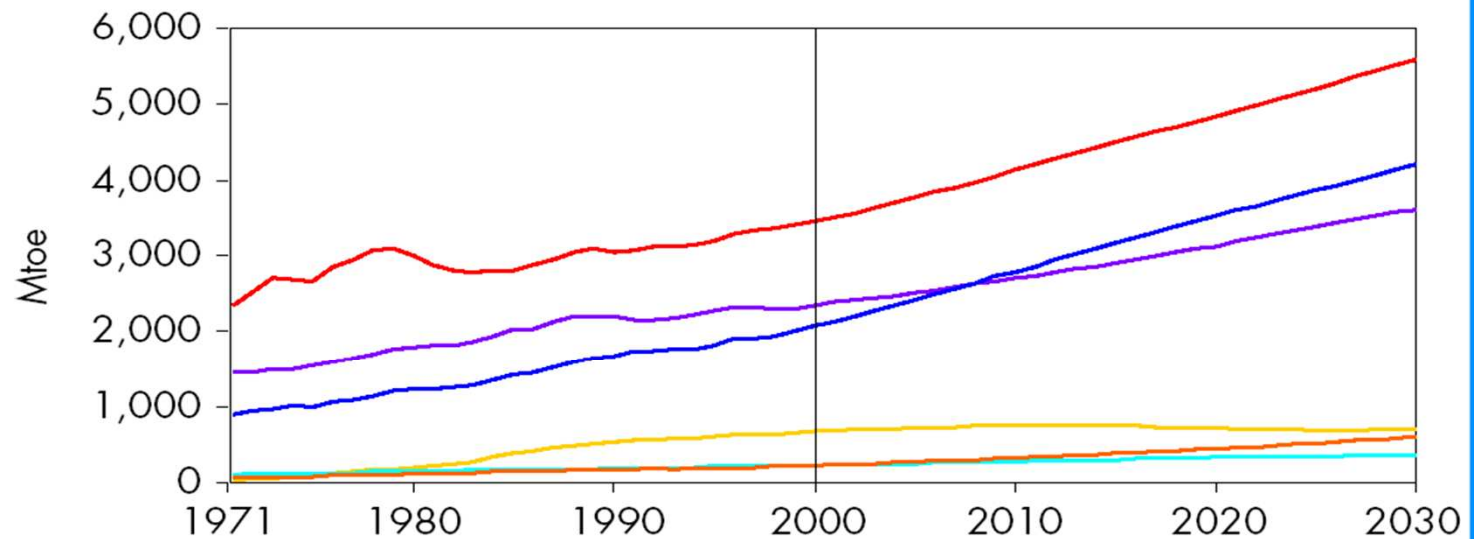


Developments, World Trade



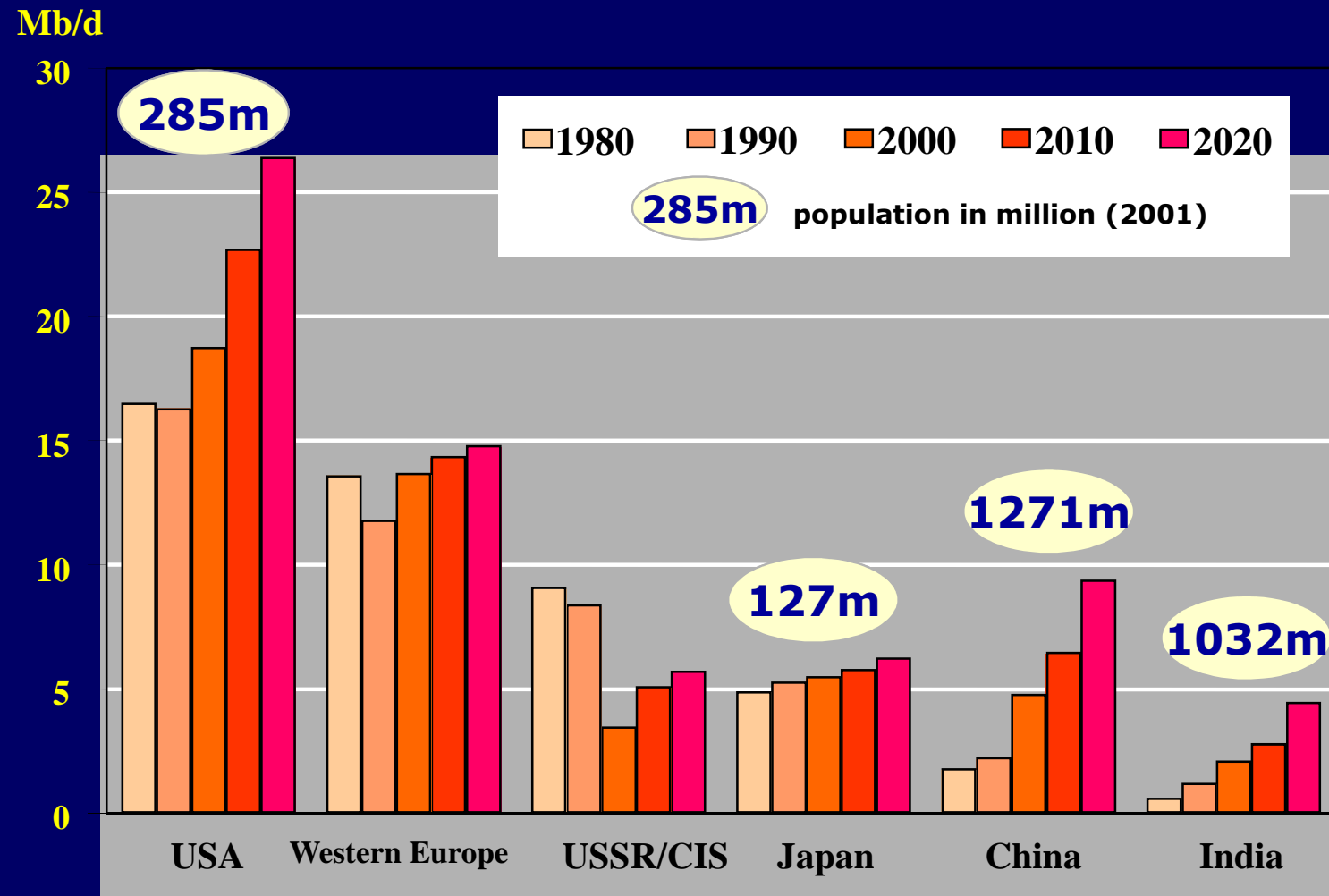
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Developments, Energy



Source IEA 2002

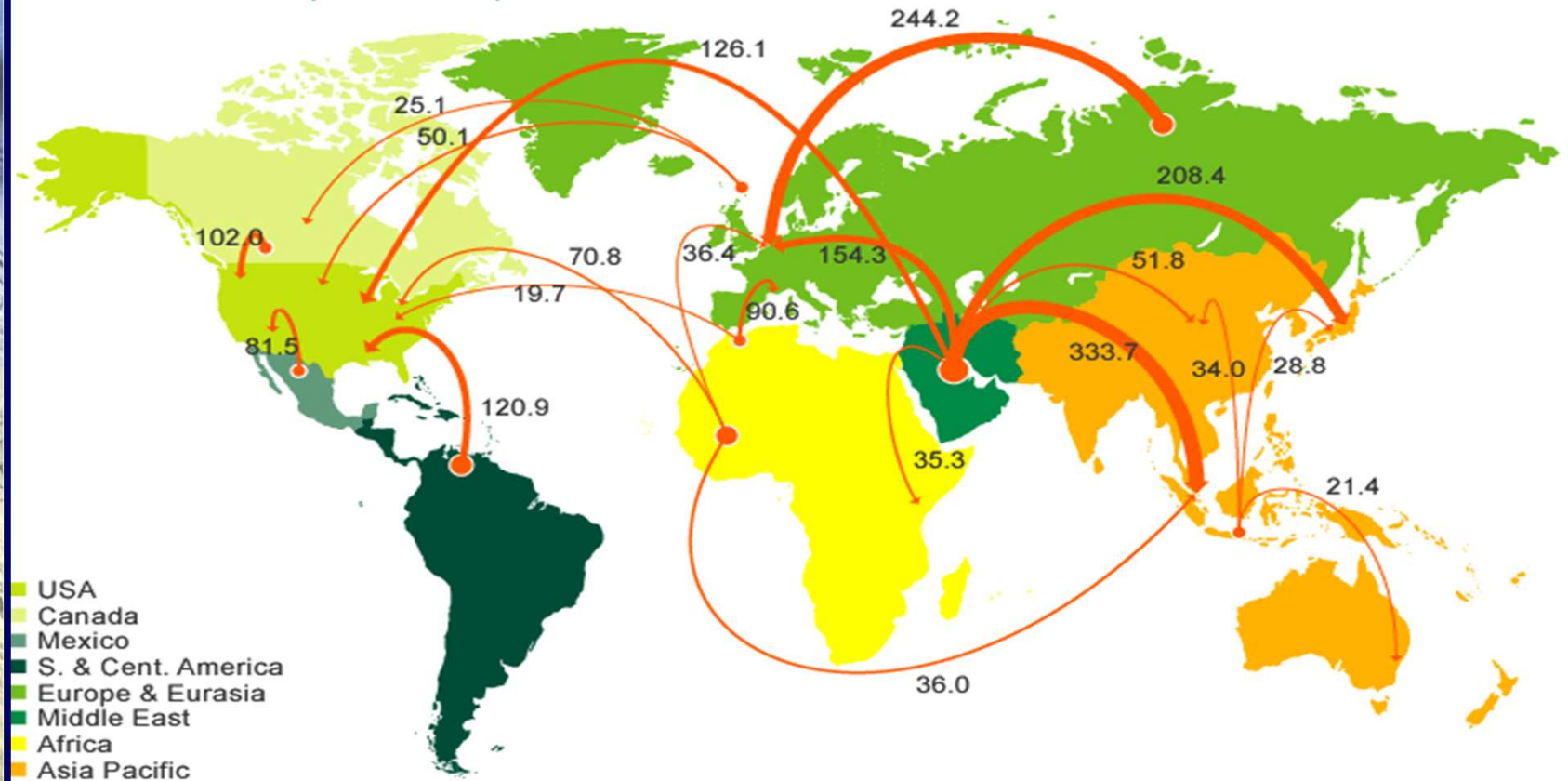
Developments, Energy



Sources: BGR-database, EIA 2004 (Reference Oil Price)

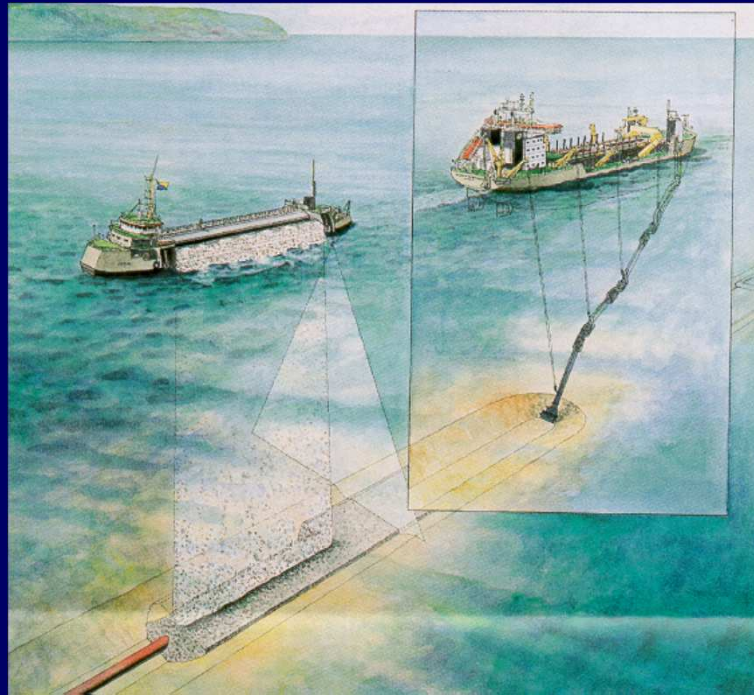
Developments, Energy (Oil)

Trade flows worldwide (million tonnes)



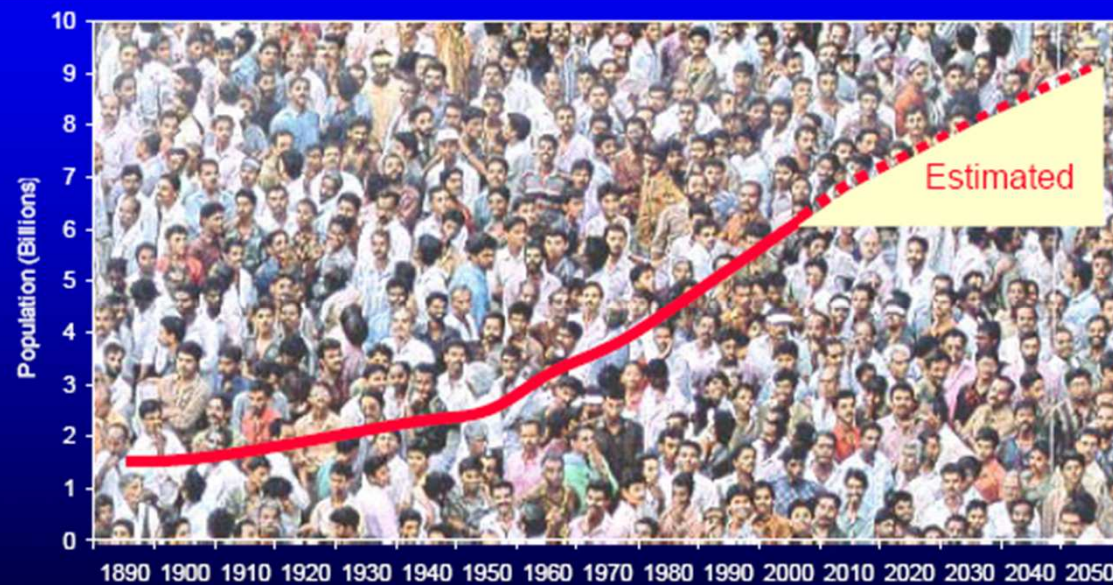
Source: BP Statistical review of world energy 2004

Developments, Energy



[11]

Developments, Urban Development



Developments, Urban Development



[12]

Developments, Urban Development

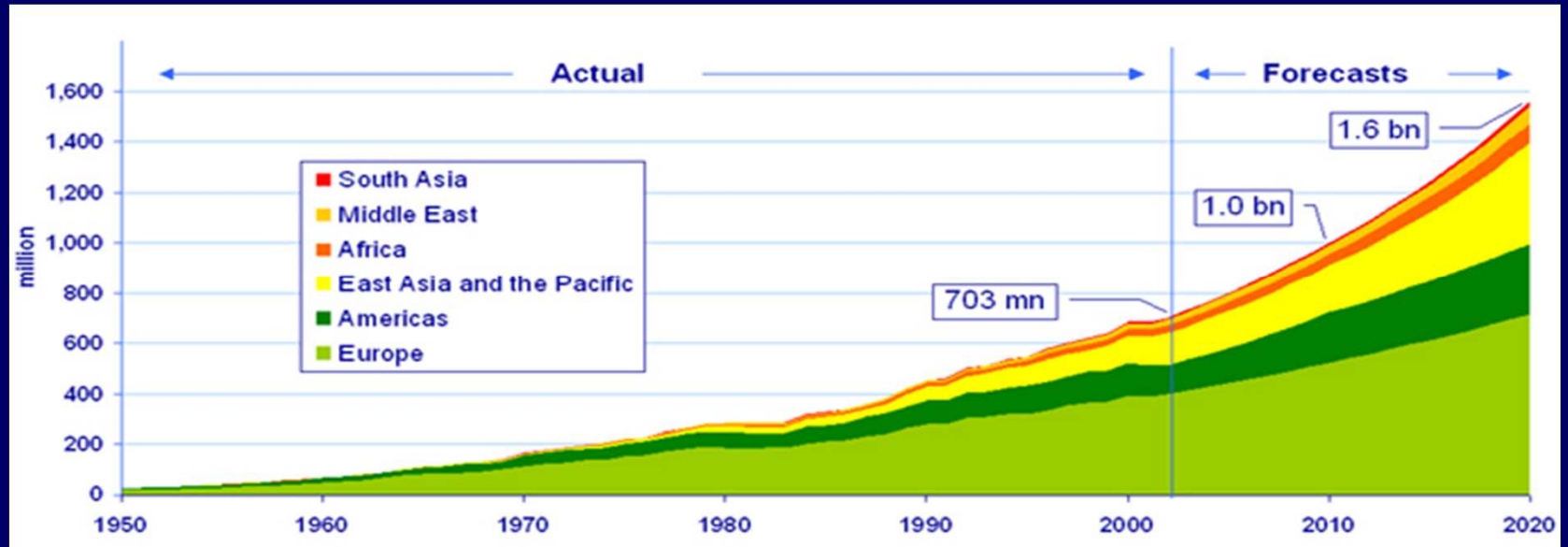
- *Creation of new land in sea*
- *Coastal and riverbank protection*



Jurong Island & Tuas,
Singapore

[13]

Developments, Tourism



[14]

- *Creation of new land in sea*
- *Beach extension & replenishment*
- *Cruise terminals*



[15]

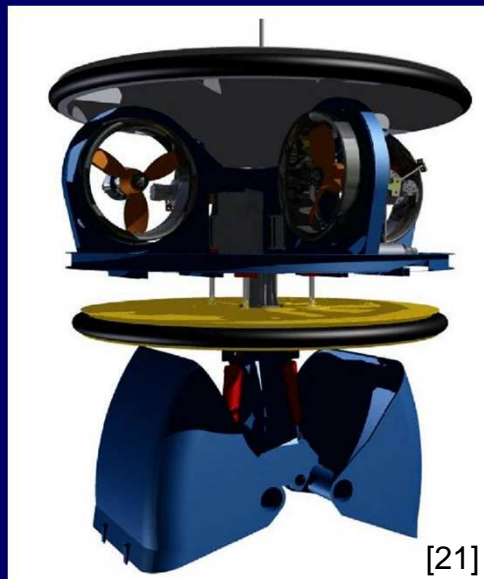
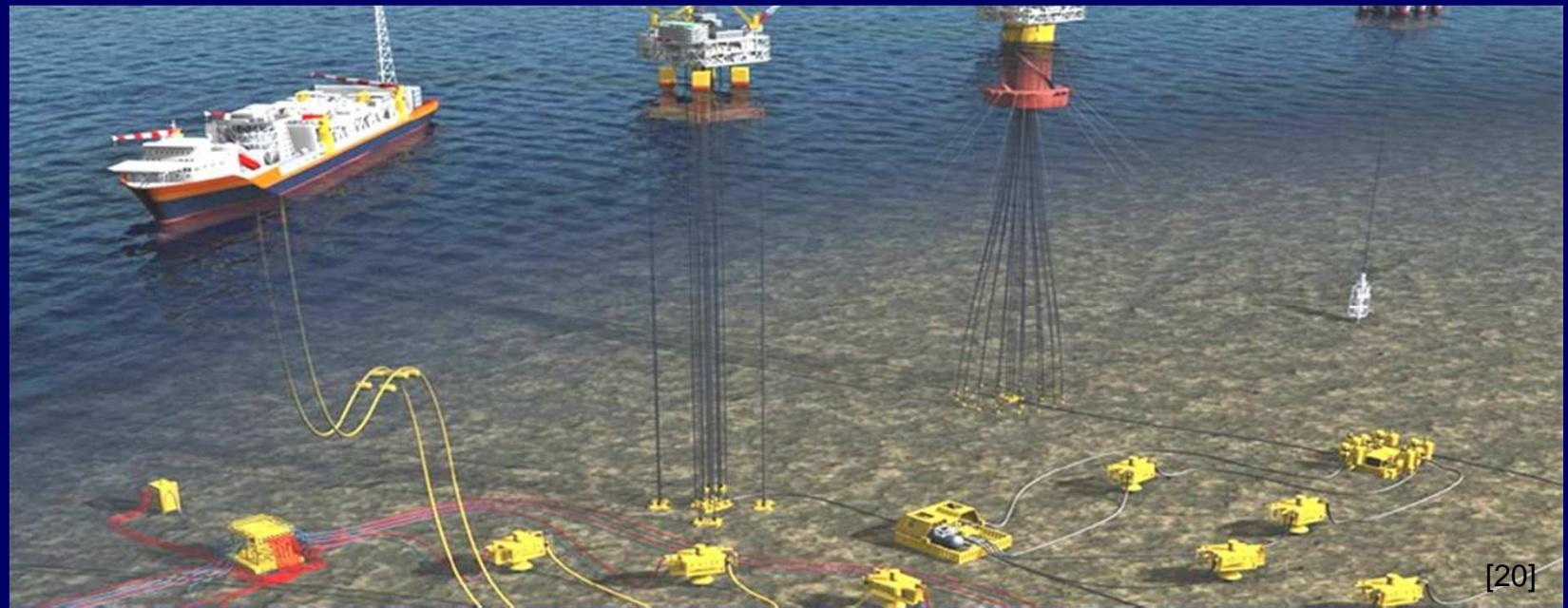
Developments, Tourism



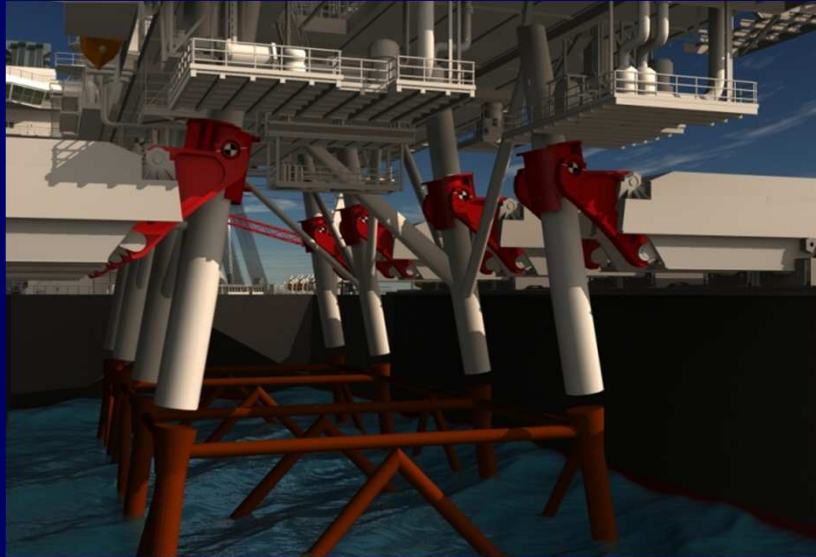
Offshore Moorings



Subsea Engineering



Pieter Schelte Allseas



Pieter Schelte Allseas



Decommisioning

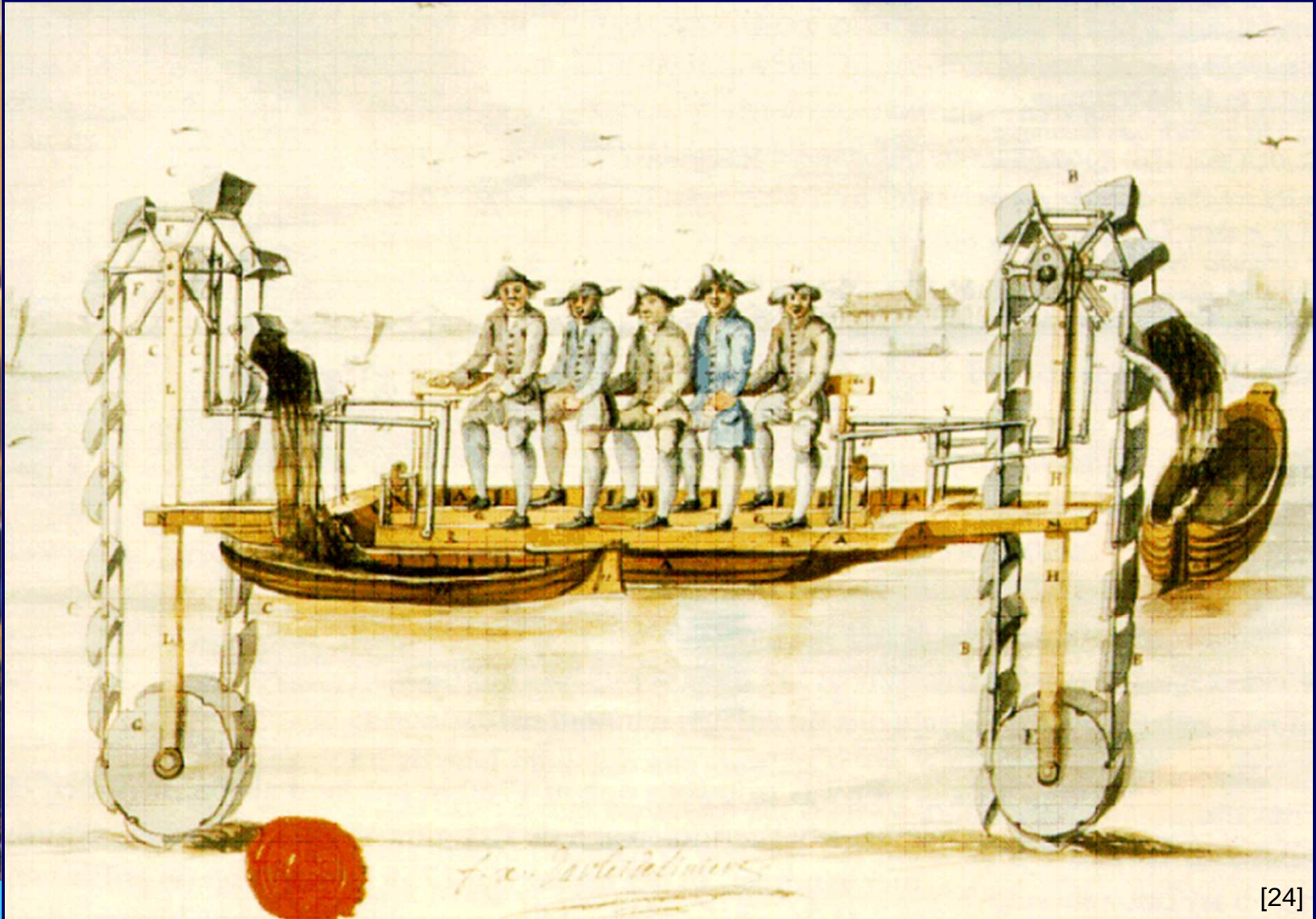


[23]



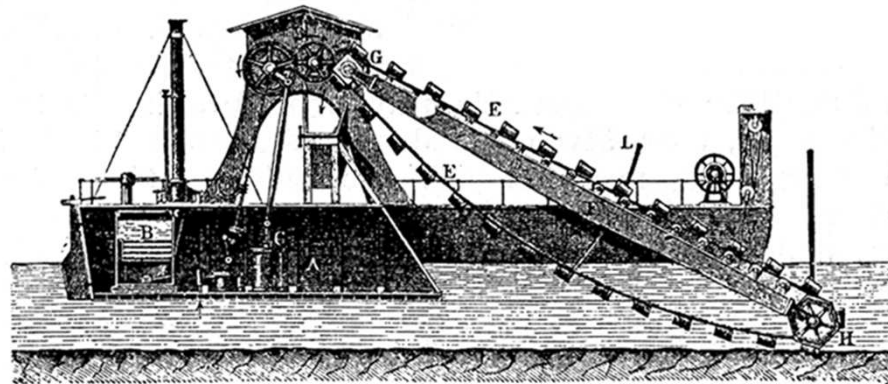
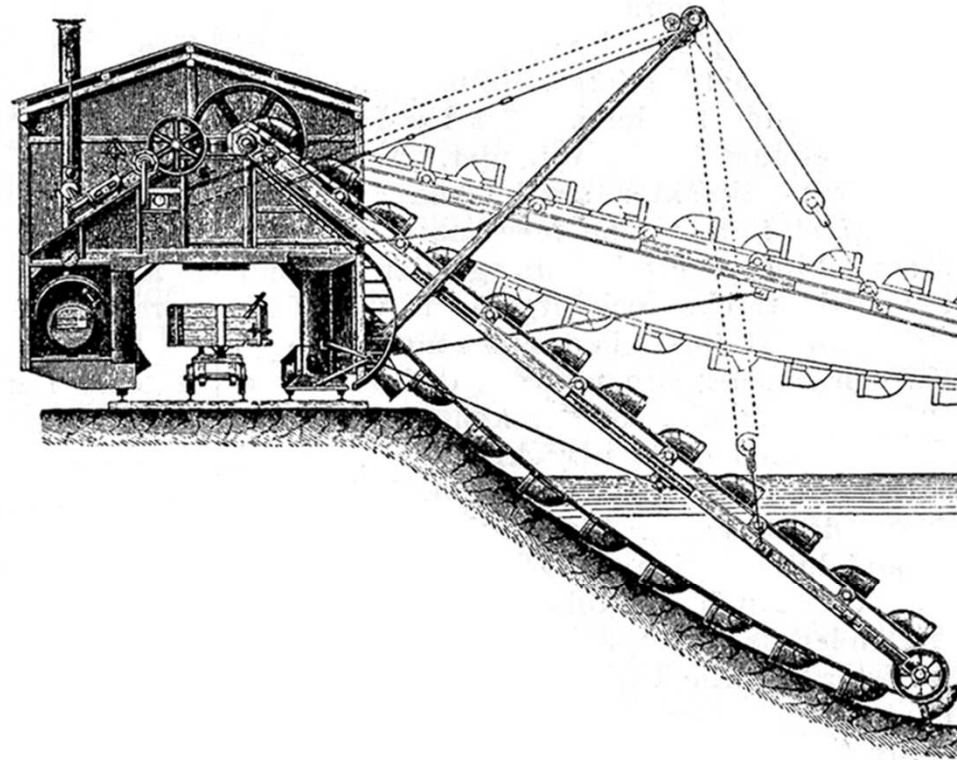
Equipment

The Past



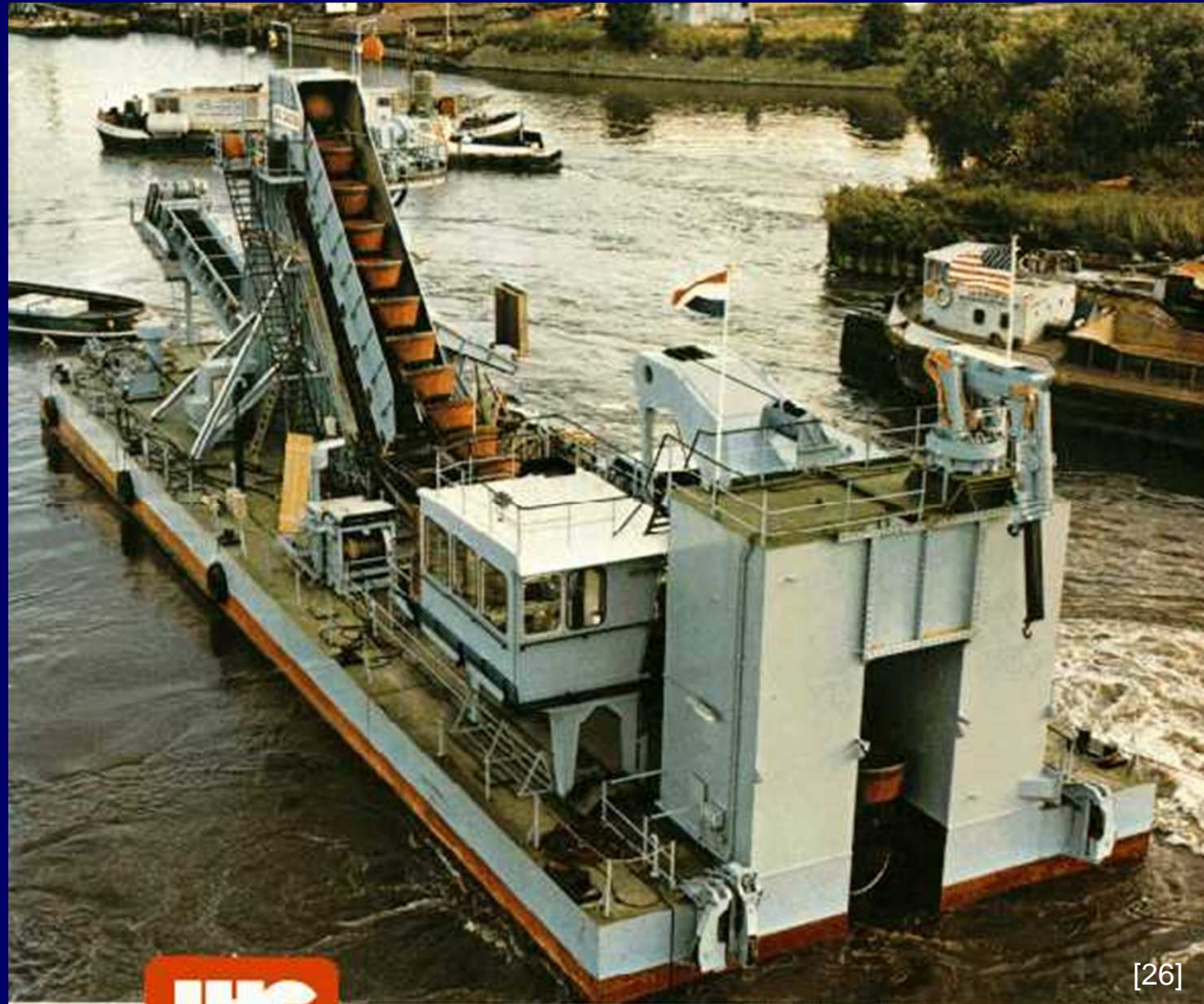
[24]

The Past



[25]

The Past/The Present



The Present (The Mashour, Suez Canal P.A.)



[27]

D'Artagnan (28.200 kW, 6000 KW)



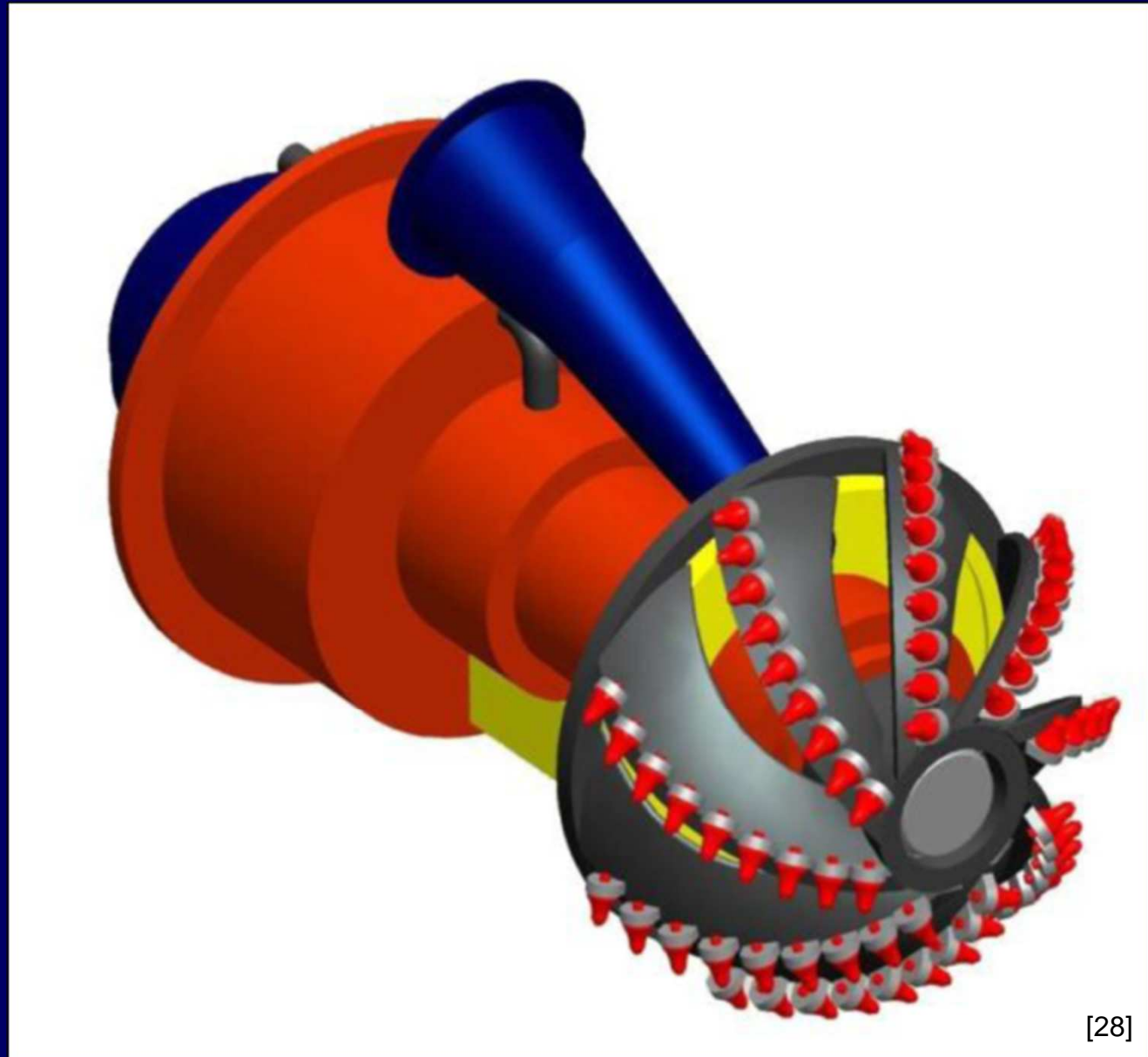
[8]

A Rock Cutter Head



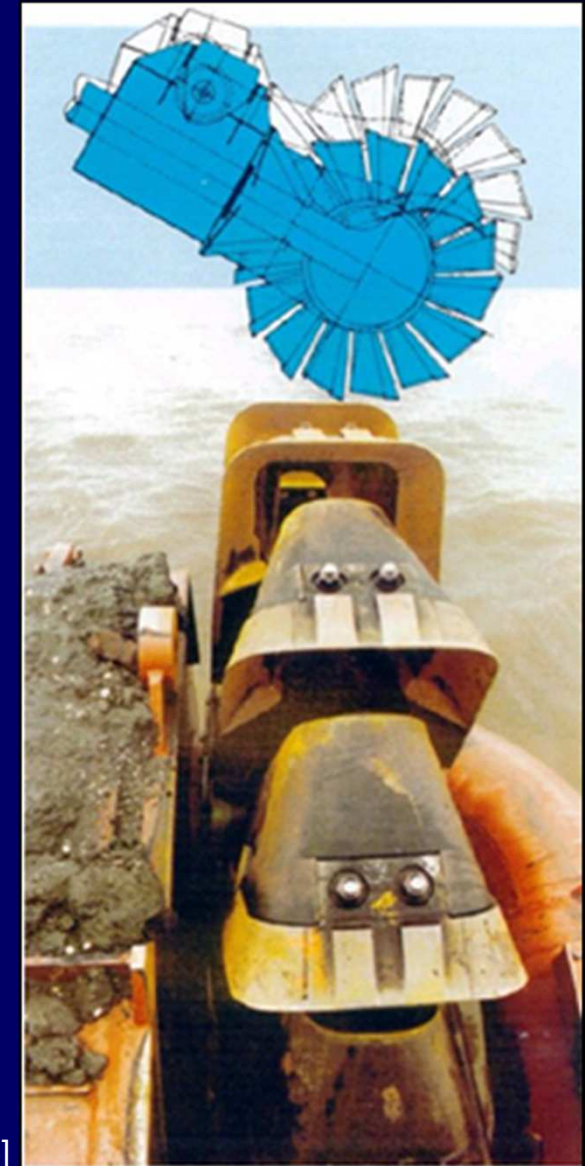
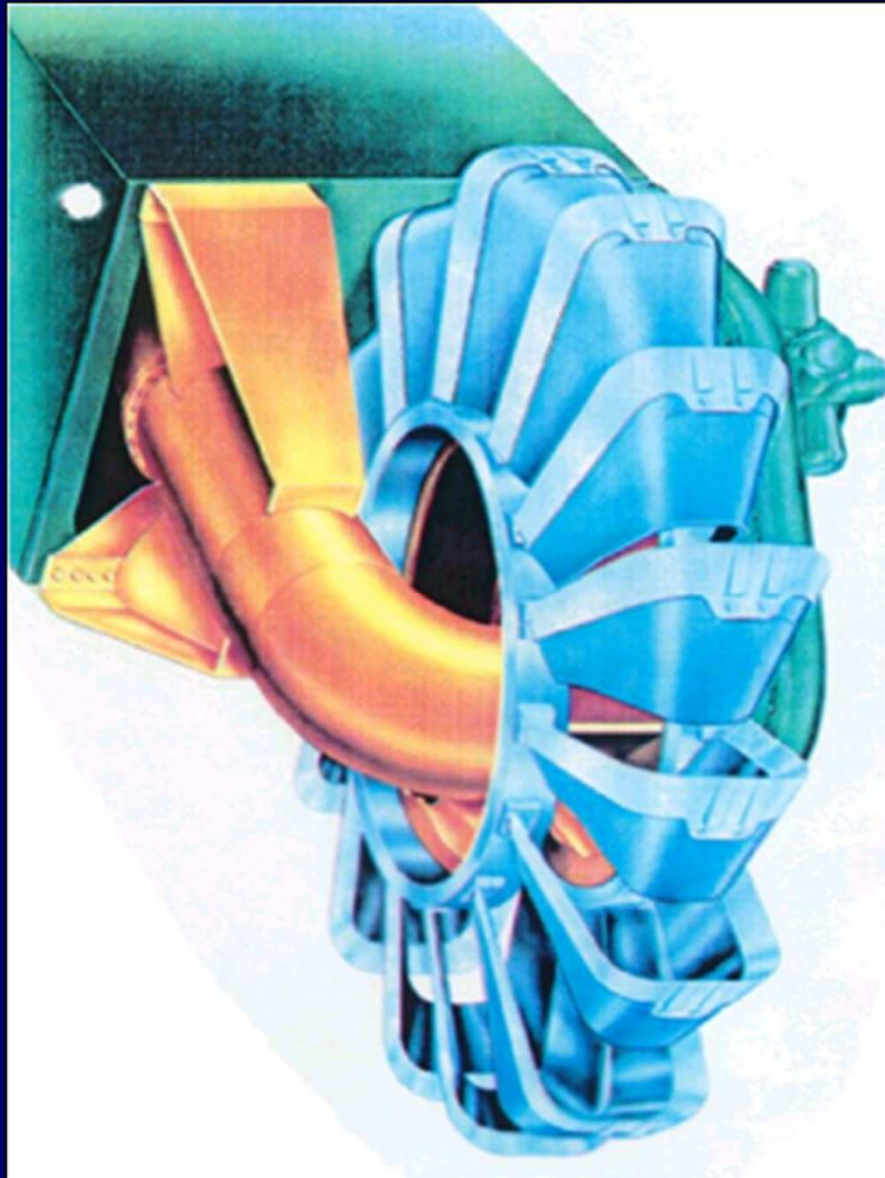
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A Rock Cutterhead



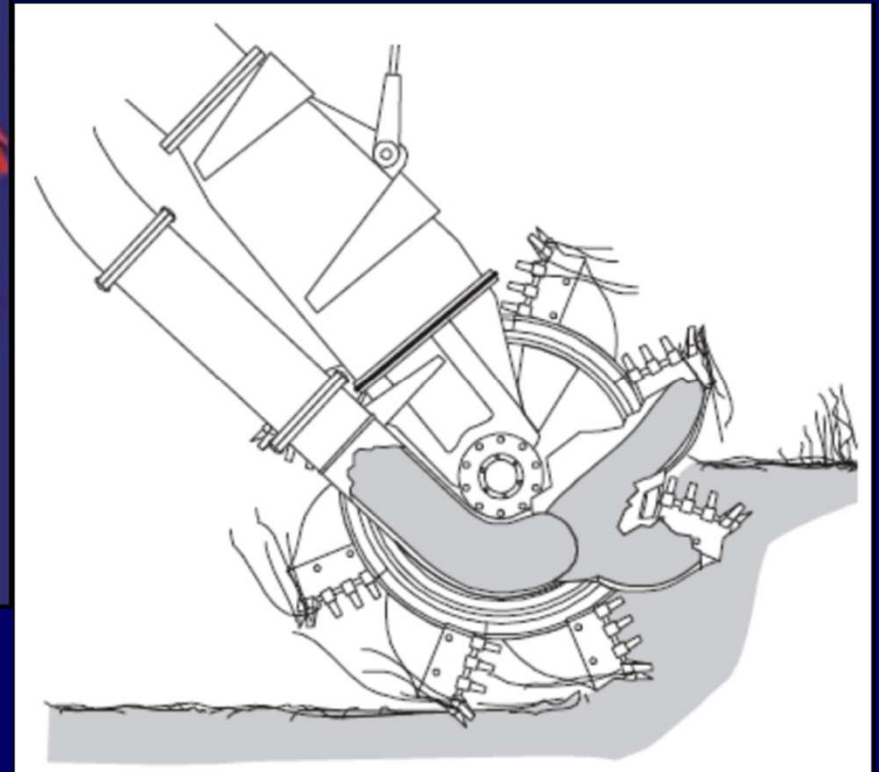
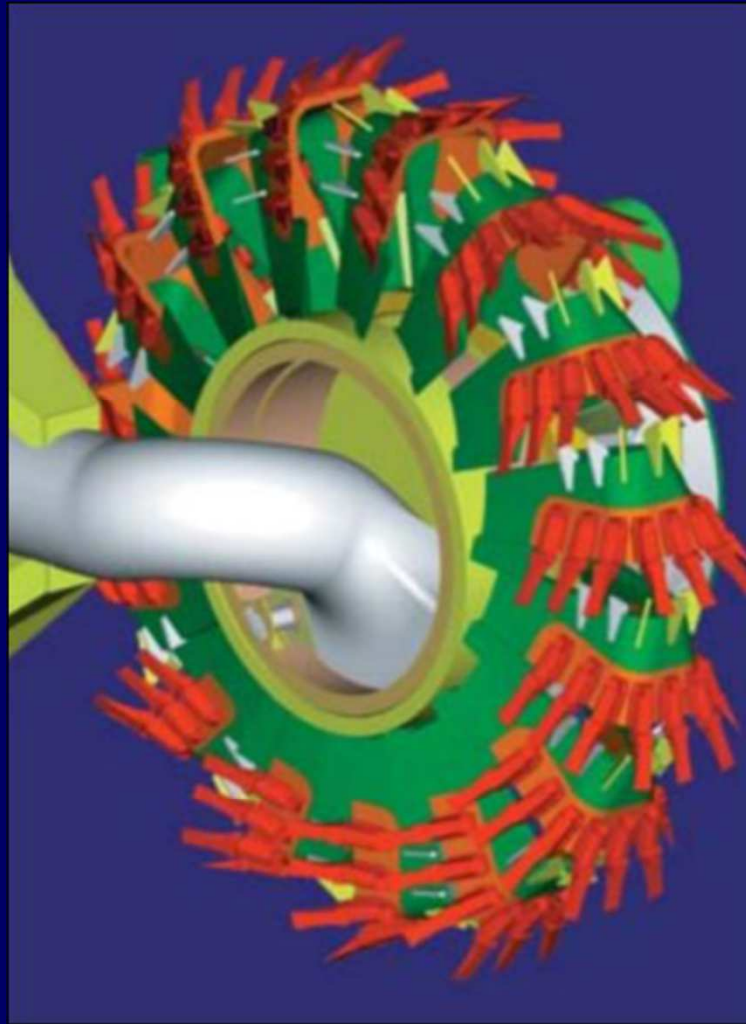
[28]

A Bucket Wheel Dredge



[26]

A Bucket Wheel Dredge



[26]

The Present (Gerardus Mercator, Jan de Nul)



[29]

The Christobal Colon (46000 m³)



The Volvox Terranova Rainbowing



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A Drag Head



[31]



The Present, A Backhoe

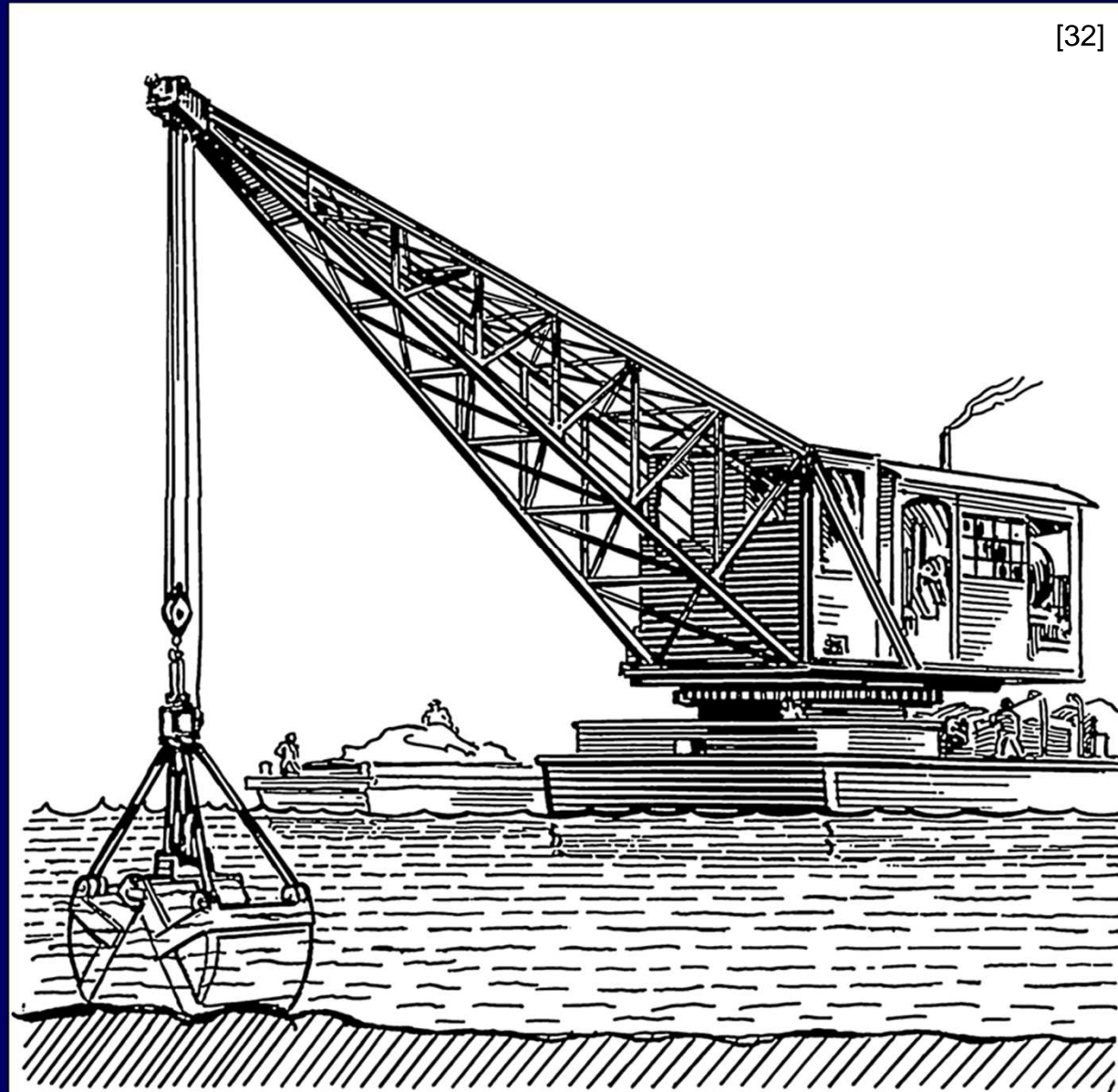


The New York (Great Lakes)



A Clamshell Dredge

[32]



The Present (The Chicago, Great Lakes)



The Chicago

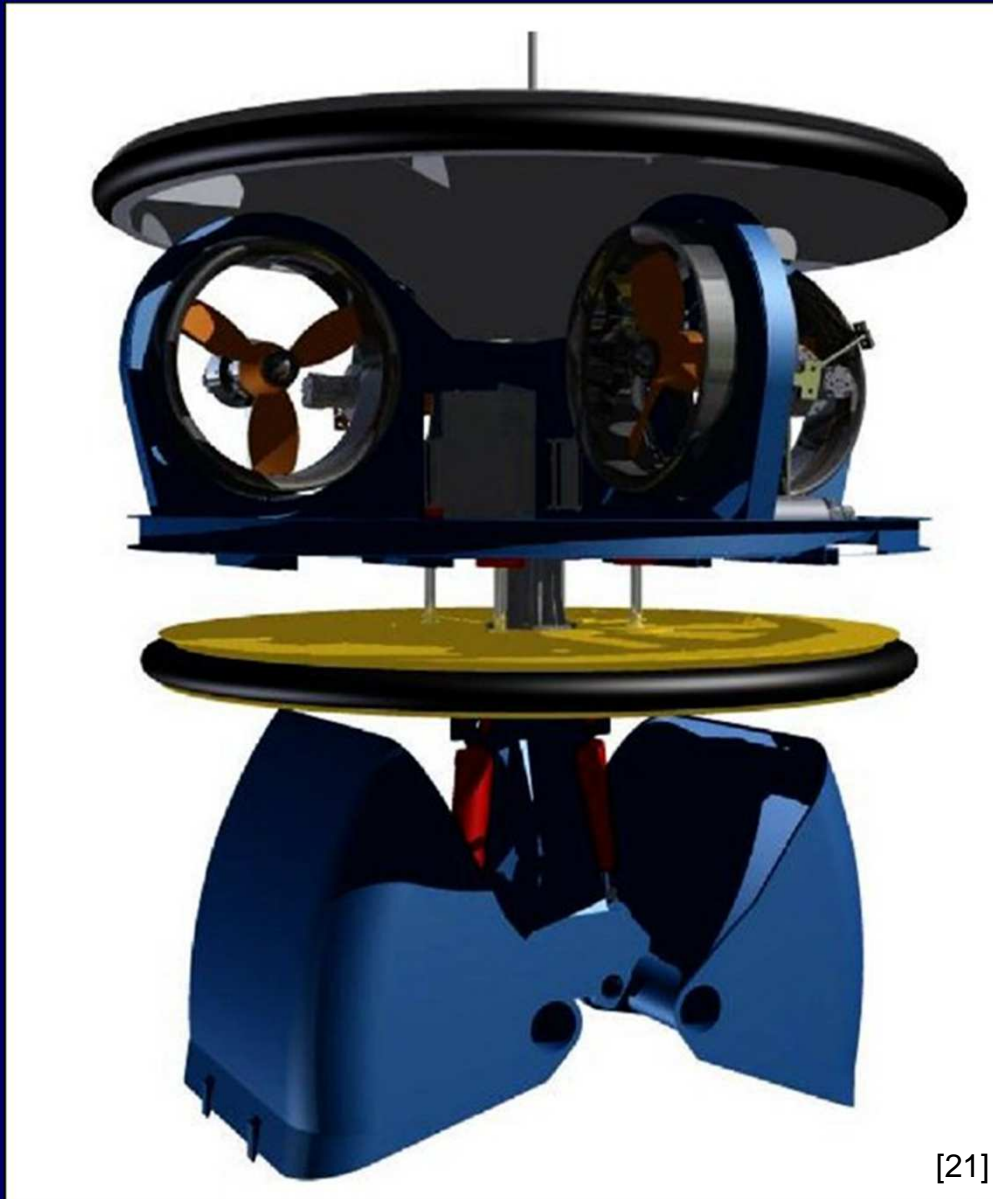


[33]

A 45 m³ Clamshell

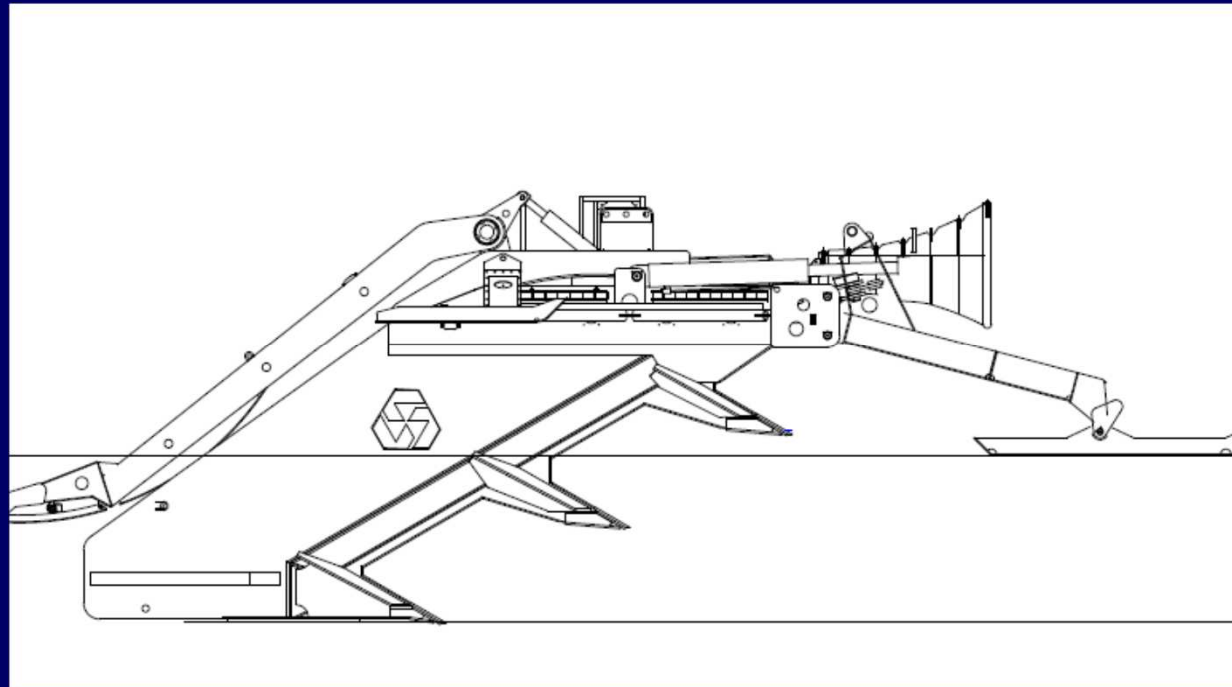


A Hydraulic Clamshell

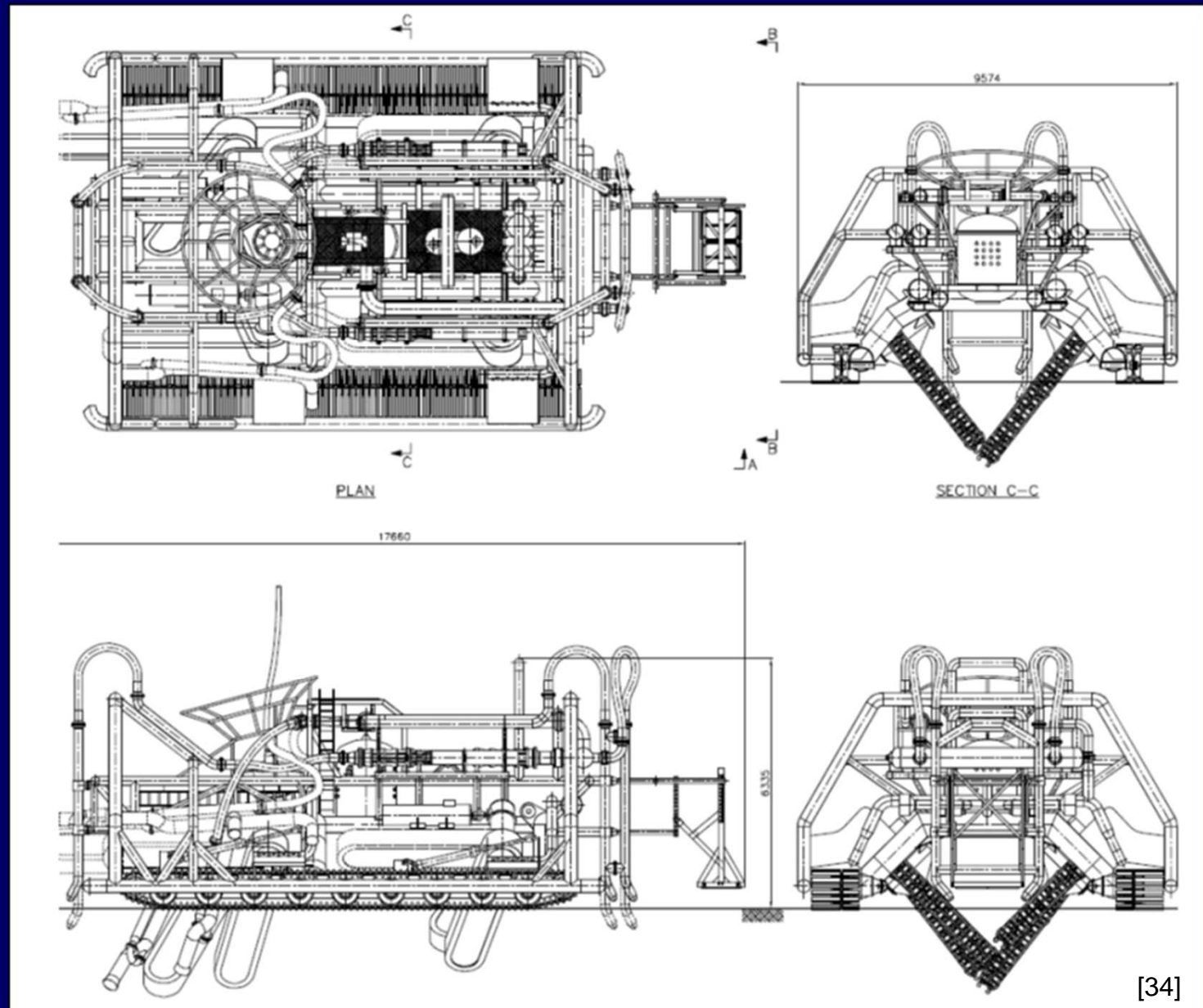


[21]

Cable Trenching



The Digging Donald



A Rock Trencher



[35]

A Set of PDC Cutters



[36]

PDC Bits

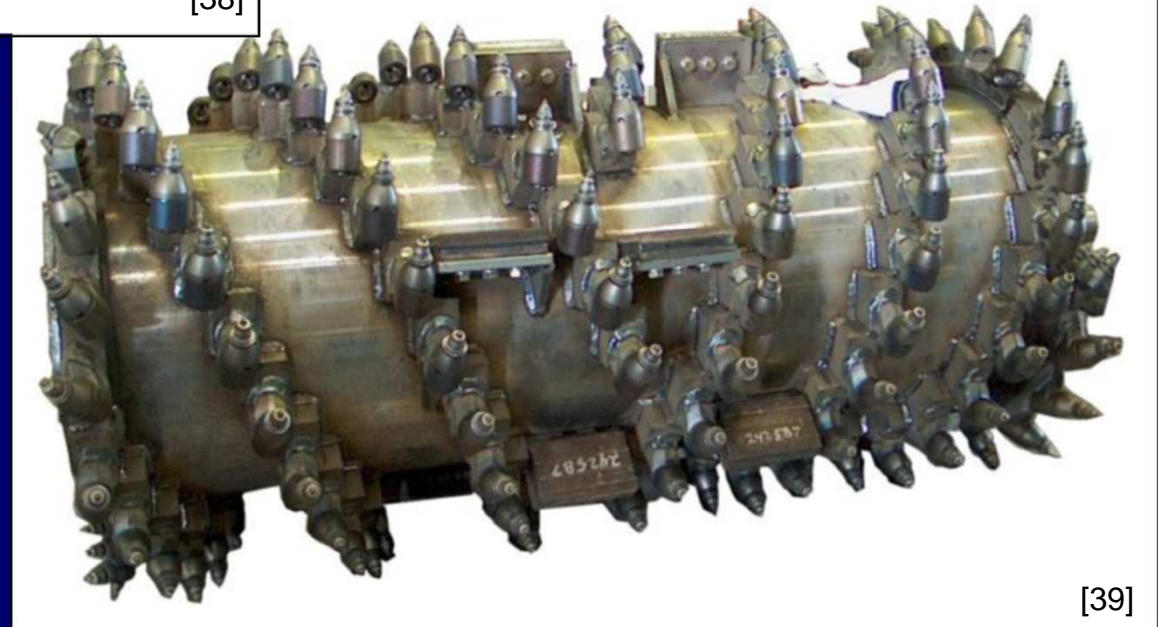


[37]

Dry Mining

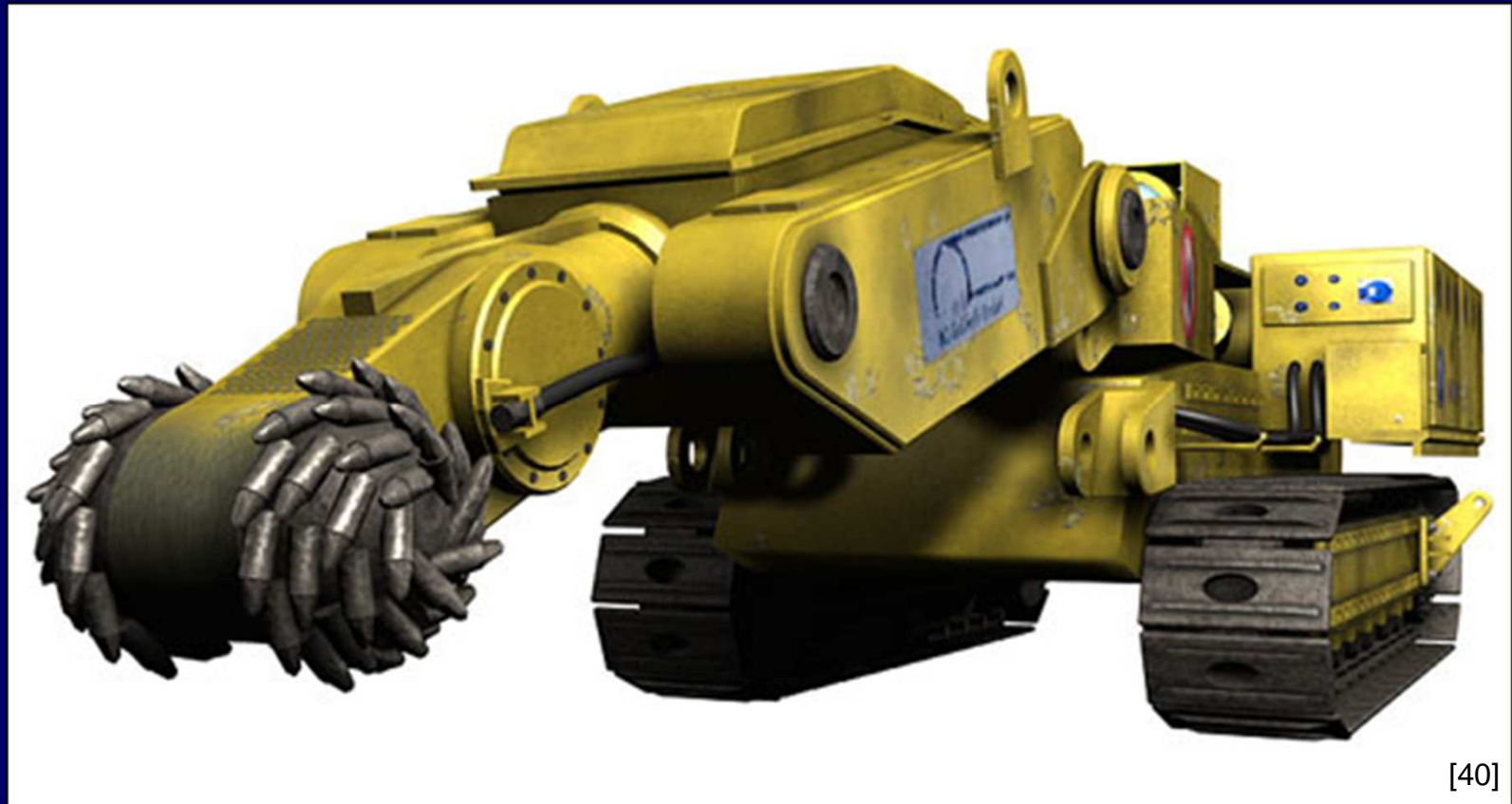


[38]



[39]

A Tunnel Boring Machine

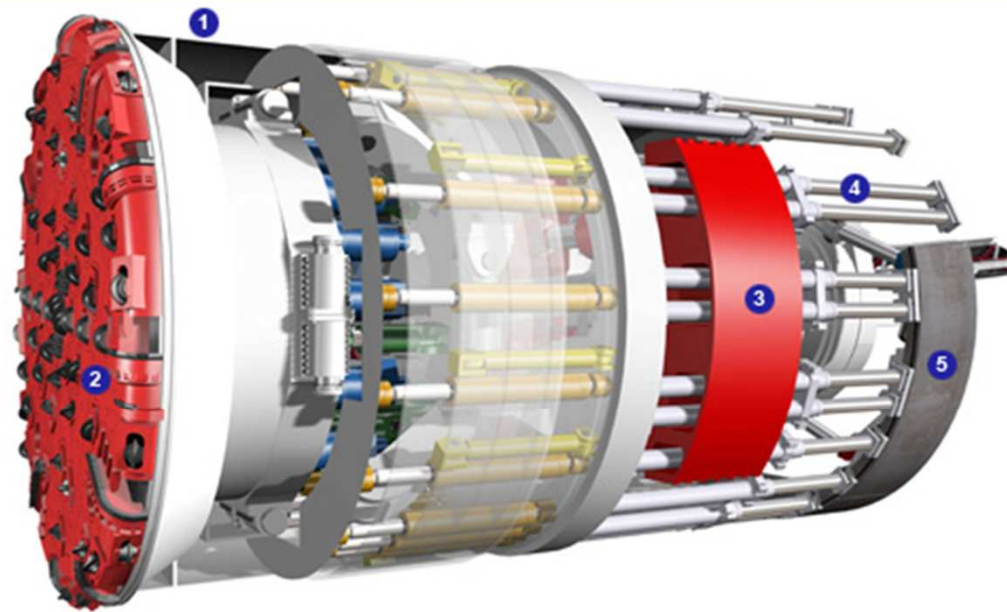


[40]

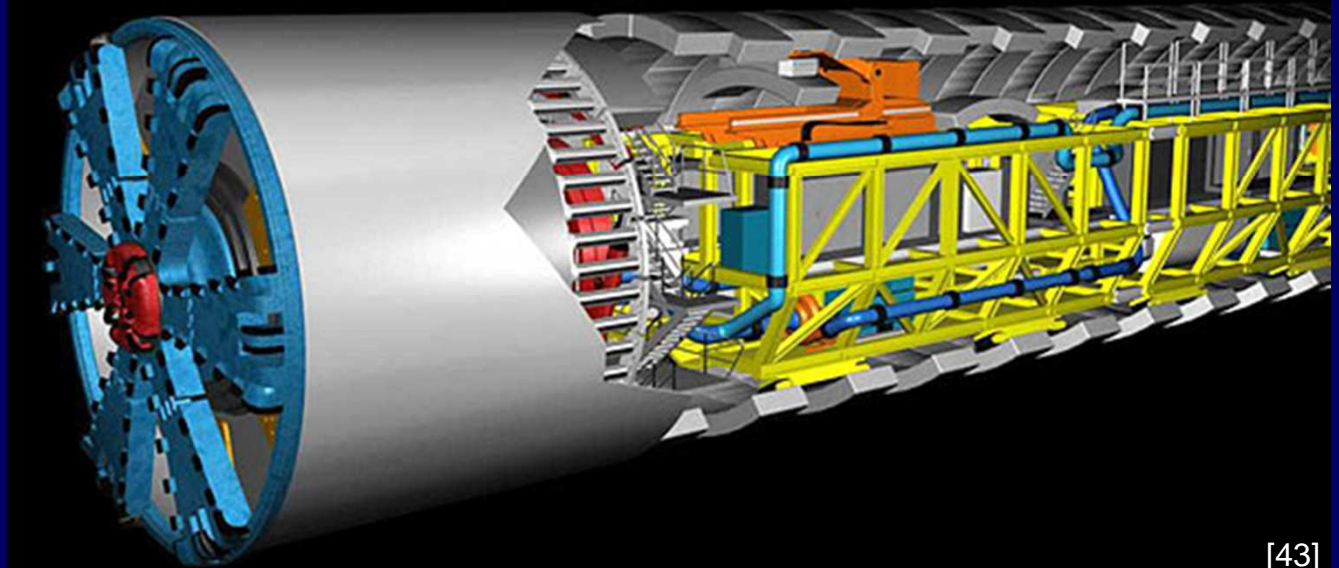
An Integrated TBM



An Integrated TBM



[42]



[43]

The World's Largest Digging Machine



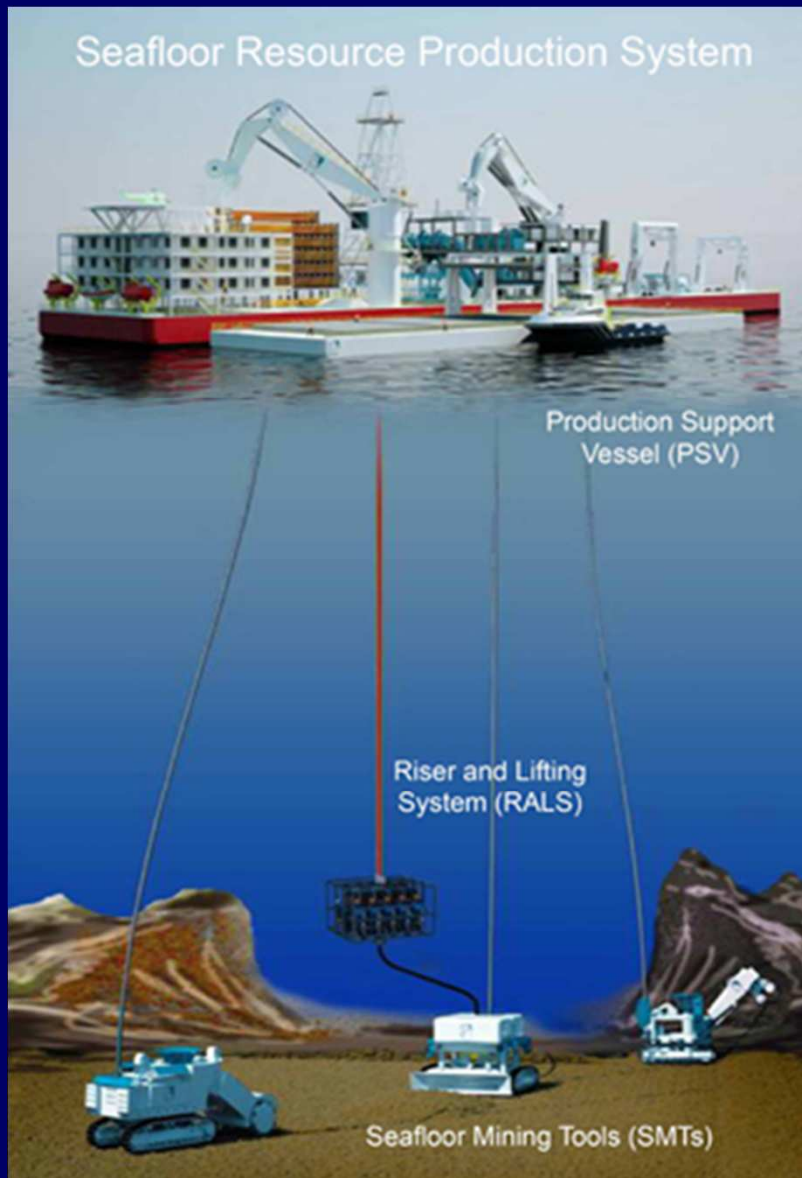
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Deep Sea Mining

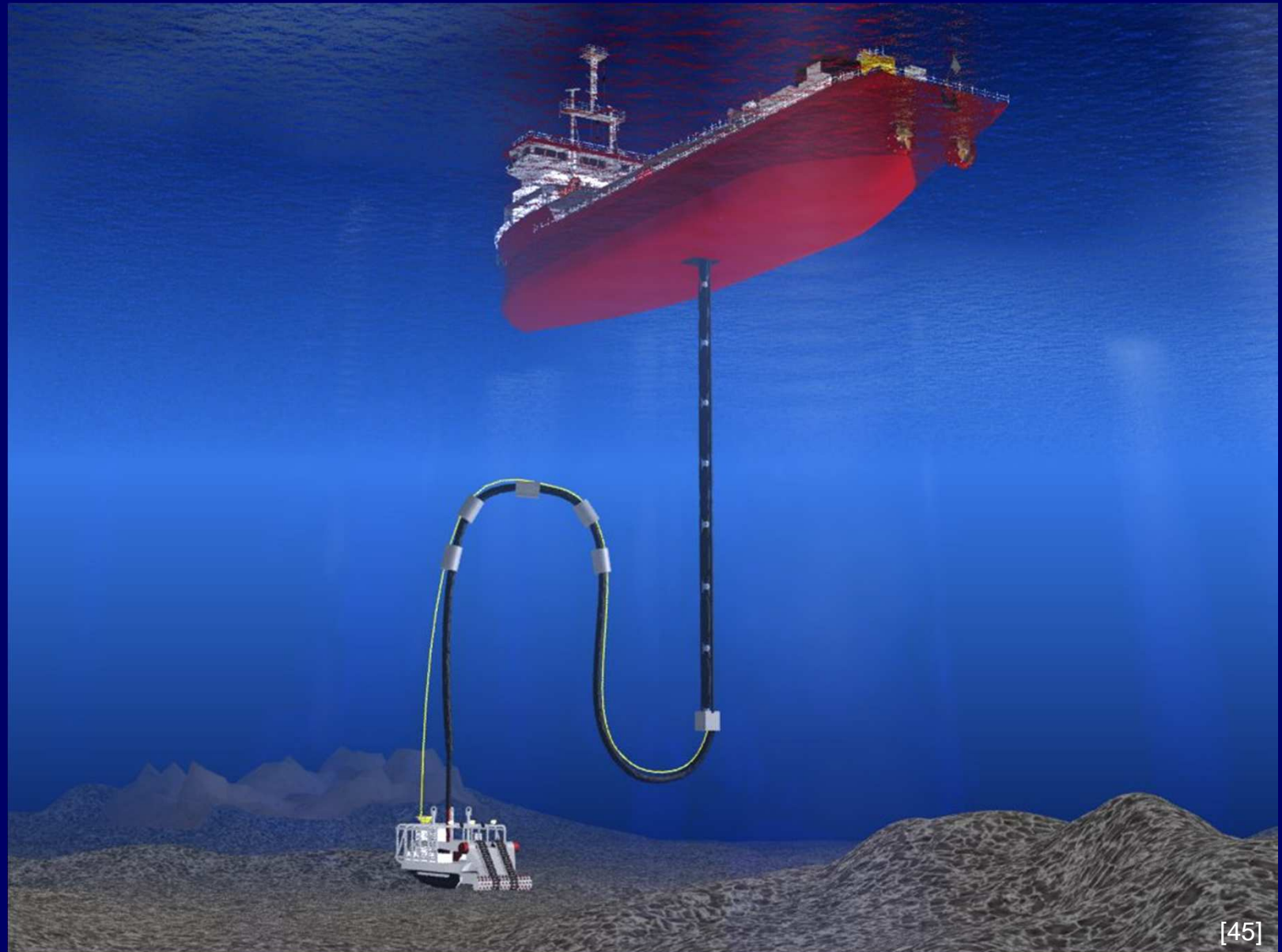
Deep Sea Mining

Seafloor Resource Production System



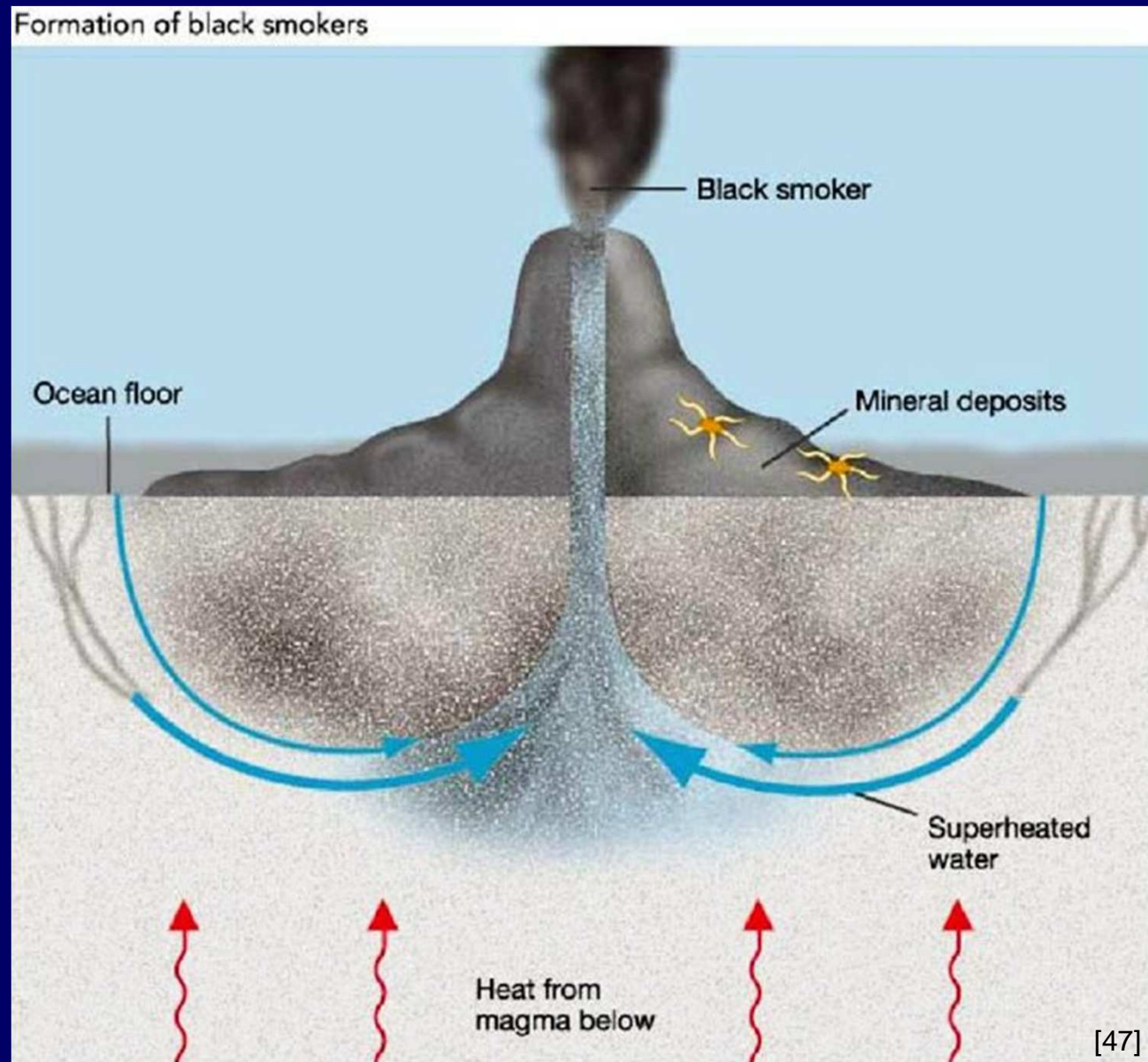
© Nautilus Minerals Inc.

Deep Sea Mining

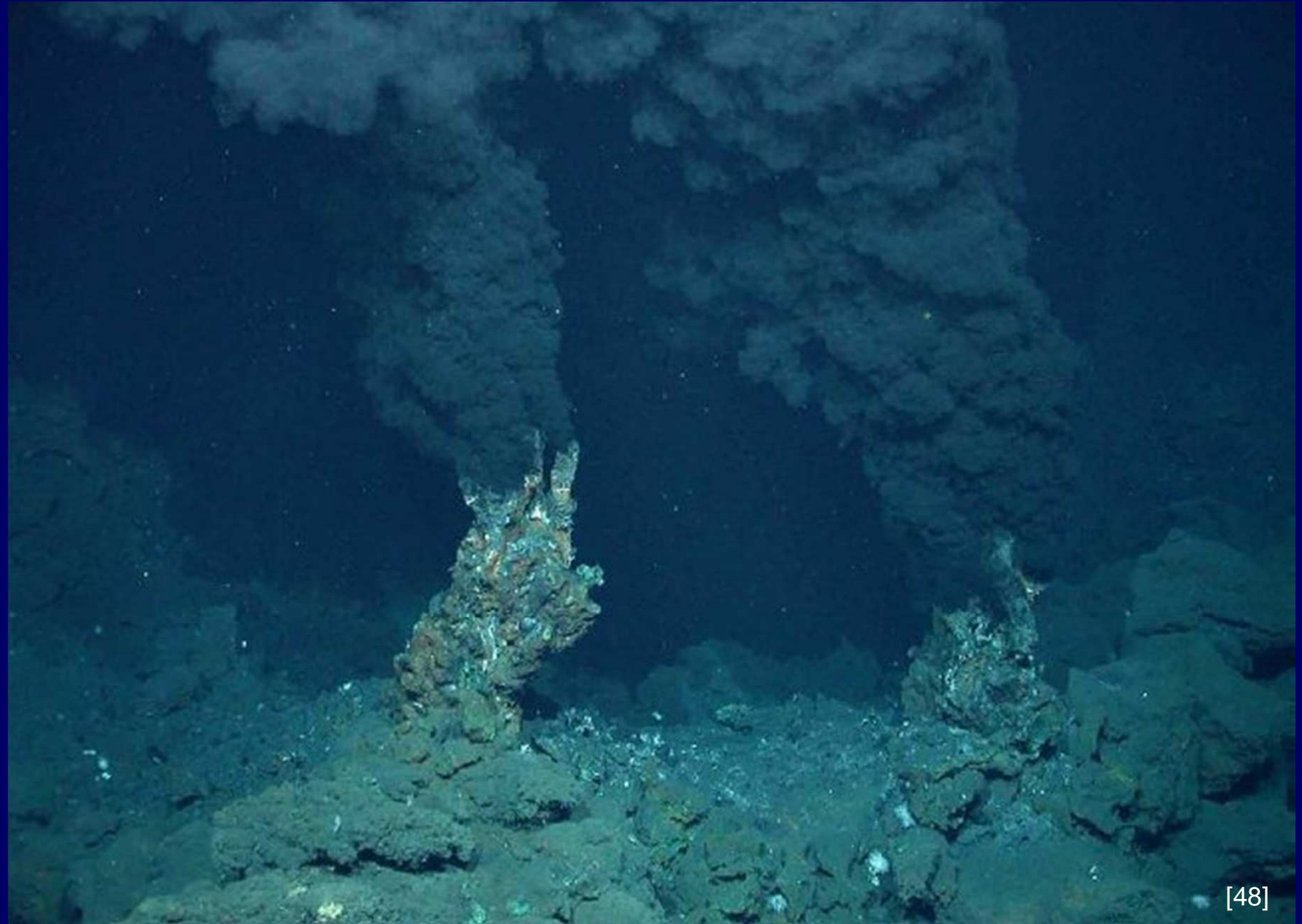


A world map showing the global distribution of mid-ocean ridges and seamounts. The map is centered on the Atlantic Ocean and includes labels for various geological features such as the Explorer Ridge, Middle Valley, Endeavour, S. Juan de Fuca, Escanaba Trough, Izu-Bonin Arc, Mariana, Manus Basin, N. Fiji Basin, Woodlark Basin, Lau Basin, Komadoc Arc, Galapagos, TAG, Lucky Strike, Menez Green, Rainbow, Snakepit, Lost City, Broken Spur, Rod Sea, Central Indian Ridge, Rodrigues T.J., S.E. Indian Ridge, and S.W. Indian Ridge. The map also shows latitude and longitude lines, with latitude ranging from 60°N to 60°S and longitude from 120°W to 90°E.

Deep Sea Mining

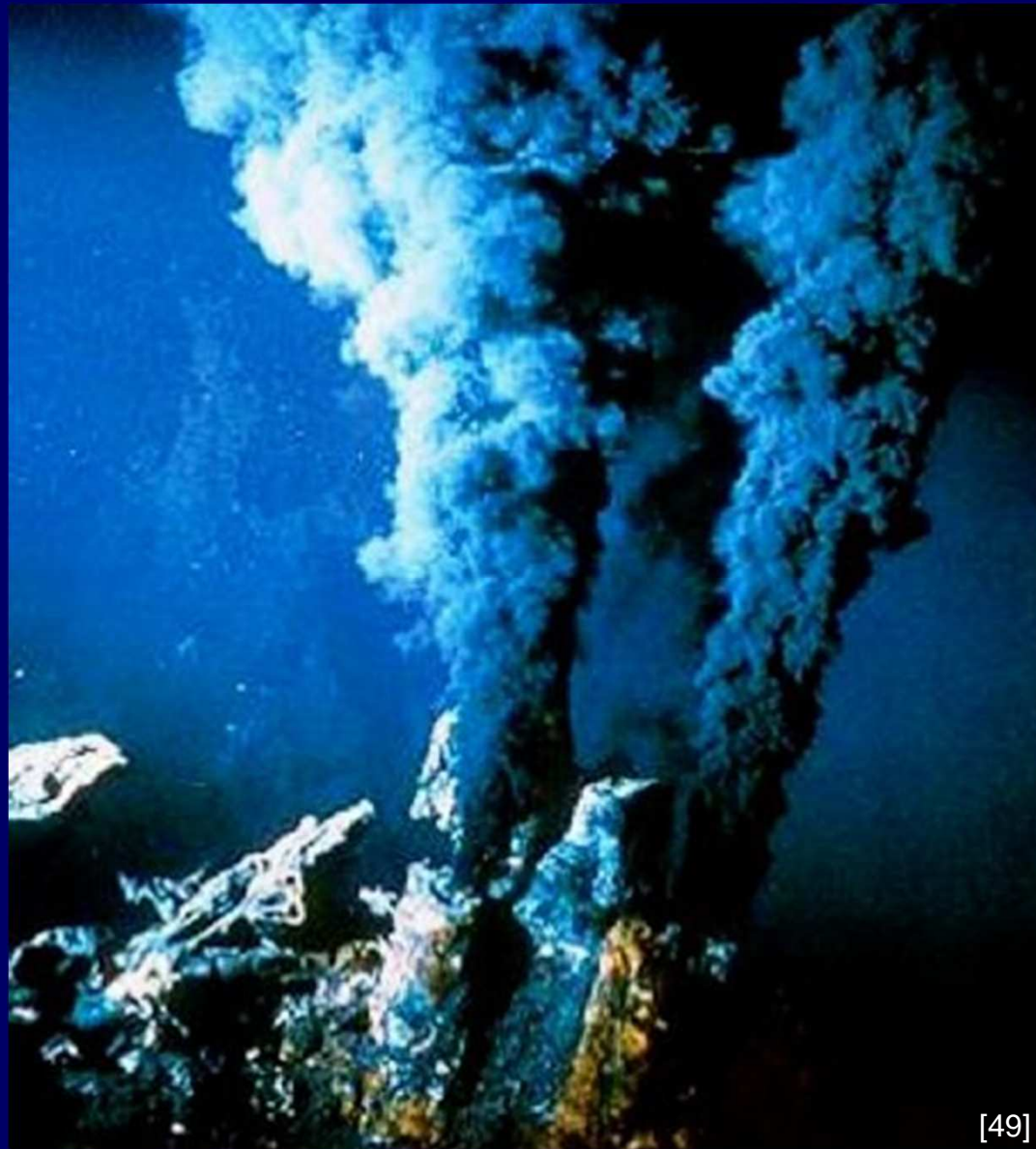


Deep Sea Mining



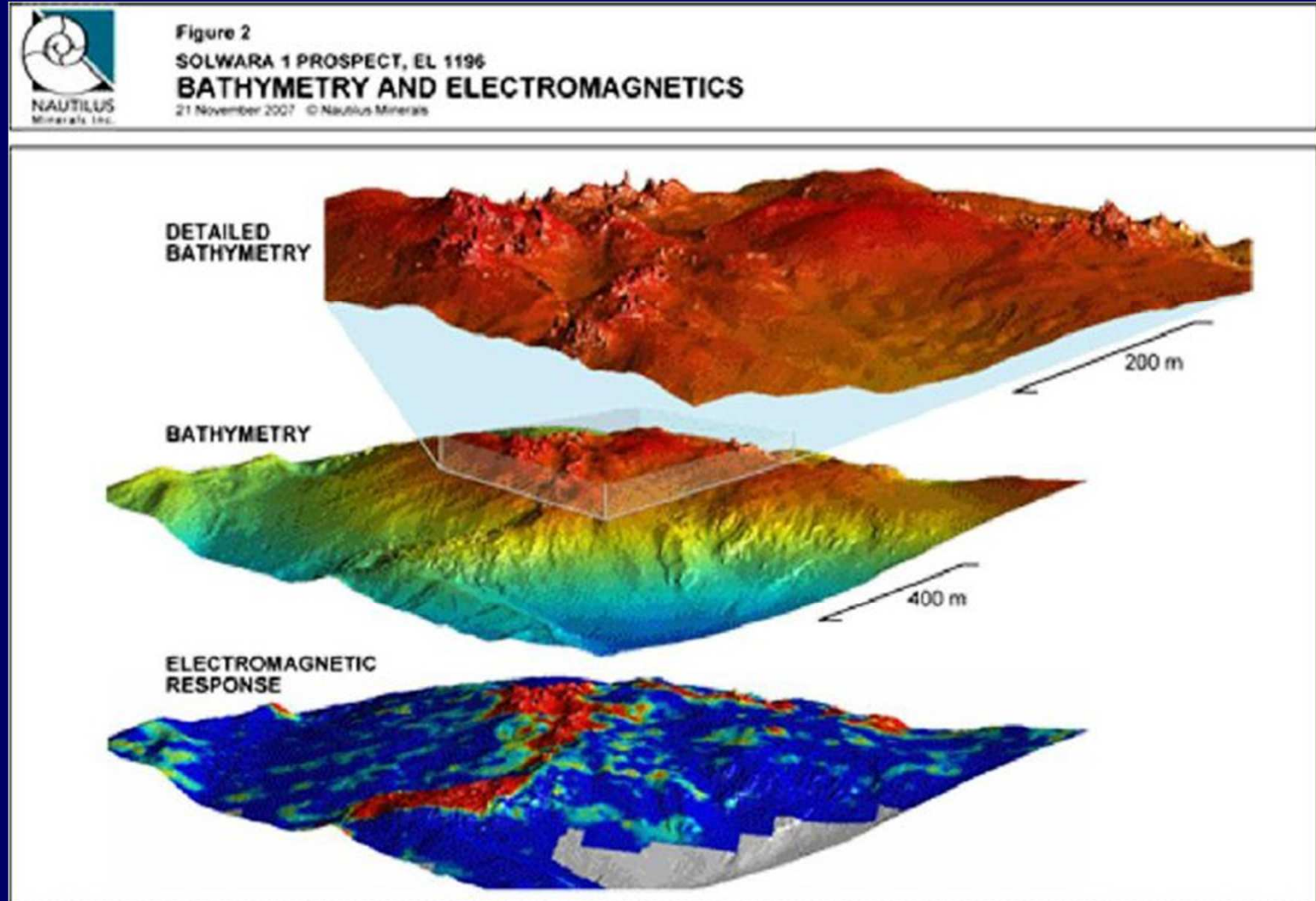
[48]

Deep Sea Mining



[49]

Deep Sea Mining



Deep Sea Mining



Deep Sea Mining

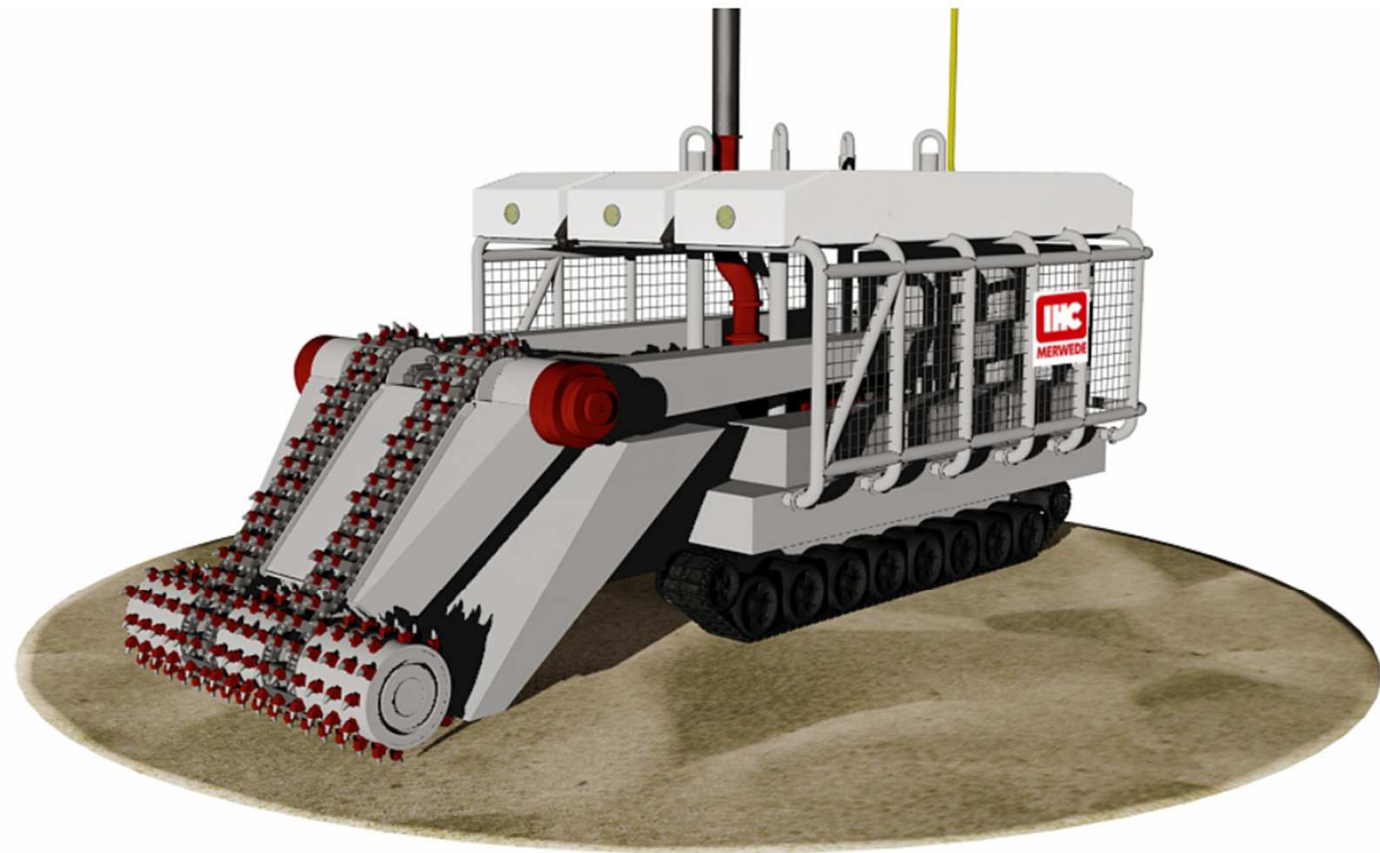


Deep Sea Mining



[23]

Deep Sea Mining



[23]

Deep Sea Mining



[3]

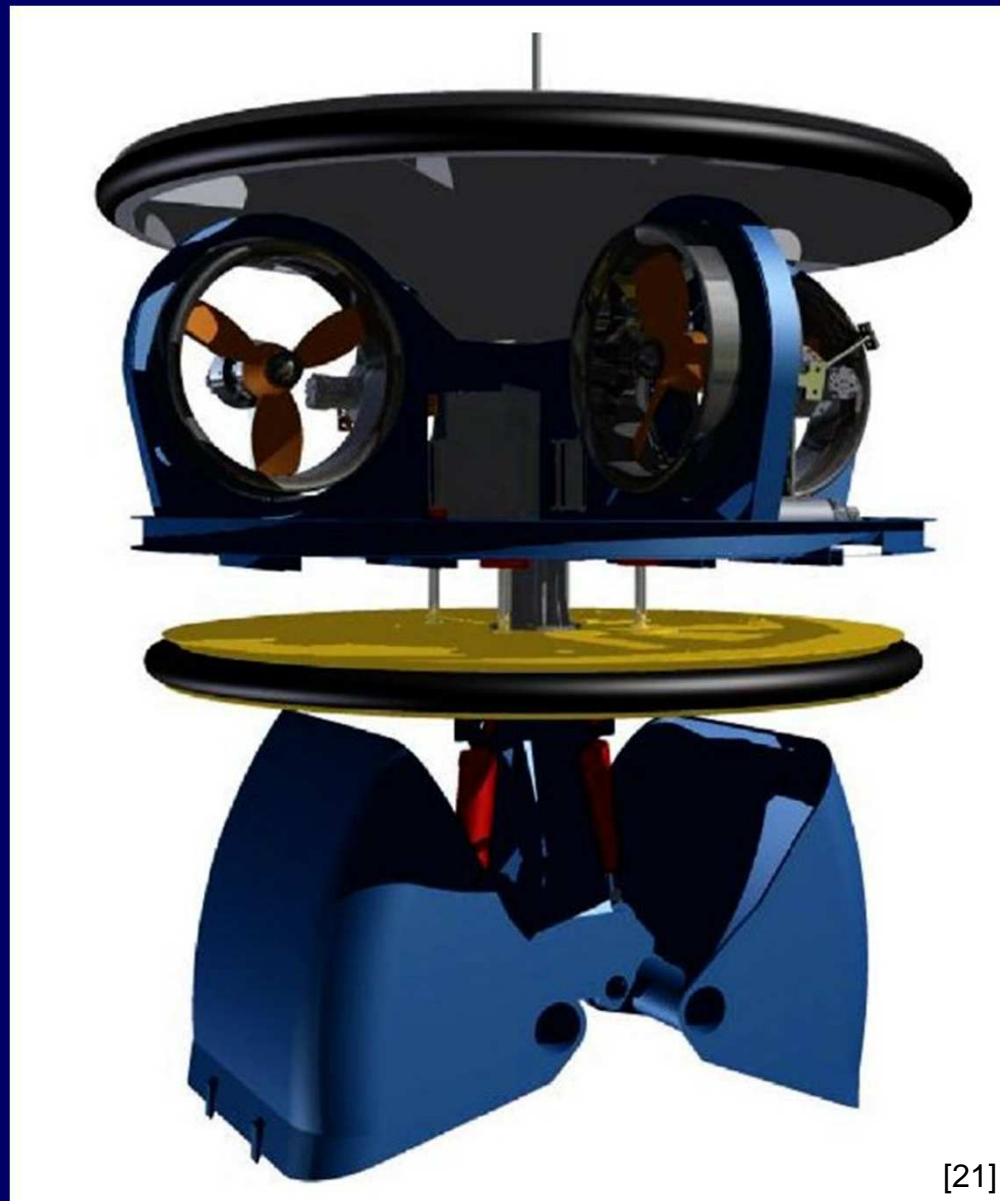
Deep Sea Mining



Deep Sea Mining



Deep Sea Mining



[21]



Questions?

Sources images

- [1] Off shore platform, source: Castrol (Switzerland) AG
- [2] Off shore platform, source: <http://www.wireropetraining.com>
- [3] Source: unknown
- [4] Concrete island drilling system (CIDS), Beaufort Sea. Credit: BOEMRE.
- [5] Types of Turbine Foundations, source: NREL.
- [6] Pipeline and Riser Capabilities, source: Offshore Pipelines and Risers (OPR).
- [7] How deep sea mining works, source: Nautilus Minerals.
- [8] Cutter suction dredger "d'Artagnan", source: SDI/DEME.
- [9] Chevron's Kuito field, courtesy: Chevron Overseas.
- [10] Container terminal Singapore, source: unknown.
- [11] Arctic engineering, source: Royal Boskalis Westminster.
- [12] Hong Kong's Chek Lap Kok Airport, source: ReoCities.com.
- [13] Jurong Island and Tuas, Singapore. Source: Google Earth.
- [14] Source: World Tourism Organization.
- [15] Cruise ship, source: JD cruises & Tours.
- [16] Dubai Water Front, source: Al Fara'a Properties.
- [17] Dubai's The World, source: TEN Real Estate.
- [18] Palm Island Dubai, source: unknown.
- [19] Offshore moorings, source: LOC Marine & Engineering Consultants
- [20] Subsea engineering, source: SBS International Ltd.
- [21] Hydraulic clamshell with propellers, source: IHC Holland.
- [22] Subsea mining, source: IHC Holland.
- [23] Source: IHC Holland
- [24] Manual dredger, F.X. d'Arles de Linière, 6 april 1761. Source: National Archive, archive 'Staten van Holland'
- [25] Bucket wheel, source: Fröleens konversationslexikon vol. II, p. 780-781 (Stockholm 1914)
- [26] BLD Bucket dredger, source: IHC Beaver Dredgers.
- [27] Cutter-suction dredger Mashour, source: IHC Beaver Dredgers.
- [28] An artist impression of a rock cutter head, source: IHC.

Sources images cont'd

- [29] Hopper dredge, source: Jan de Nul Group.
- [30] Biggest hopper dredge "Cristobal Colon", source: Jan de Nul Group.
- [31] Drag heads, source: Vosta LMG India Ltd.
- [32] Line art drawing of a dredge, source: Pearson Scott Foresman/Wikimedia Foundation.
- [33] Clamshell dredger, source: Marmaray.
- [34] Digging Donald, source: Allseas.
- [35] Rock trencher, source: Rocksaw Atlantic NL Inc.
- [36] PDC bits, source: HeJianShi FuLiang Dril Manufactory.
- [37] PDC cutters, source: unknown.
- [38] Continuous miner, source: Sandvik.
- [39] Asphalt milling machine cutting drum, source: unknown.
- [40] Tunnel boring machine, source: DM Multimedia.
- [41] Integrated Tunnel Boring Machine of D.U.M.B., source: unknown.
- [42] Double shield TBM, source: Herrenknecht.
- [43] The Westerschelde tunnel boring machines (TBM), source: roadtraffic-technology.com.
- [44] Bagger 288 by Krupp, the world's largest excavator. Source: unknown.
- [45] Deep sea mining, source: TUDelft/IHC Merwede.
- [46] Deep sea vents map, source: Tivey, Oceanogr. magazine, Vol. 20, No. 1, 2007.
- [47] Formation of Black Smokers, source: Bergensis University.
- [48] Hydrothermal vents, source: Woods Hole Oceanographic Institution (WHOI).
- [49] Black smoker, source: Woods Hole Oceanographic Institution (WHOI).