



**CAUTION**  
Work in progress

# Exploitation Appraisal System

Systematically Converting the Deep Sea Mining Installation  
into Proven Technology

Avans conferentie 'Hoe diep wil je gaan?'

25<sup>th</sup> of November, 2010

**The technology innovator.**

# Introduction

- Exploitation Appraisal System business plan
- Project done in 5 months
- Project members
  - 3 engineers
  - 1 marketer
  - 1 consultant

## **Harm Stoffers**

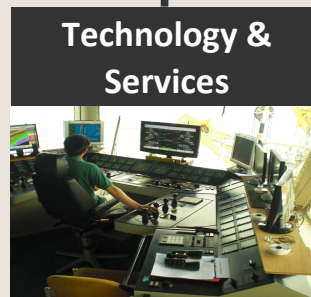
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Business Development & Project  
Management  
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# Introduction



**Innovation - Growth - Cooperation**

## Life cycle deep sea mines

Prospecting  
for deposits

Exploration  
of resources

Exploitation  
of reserves

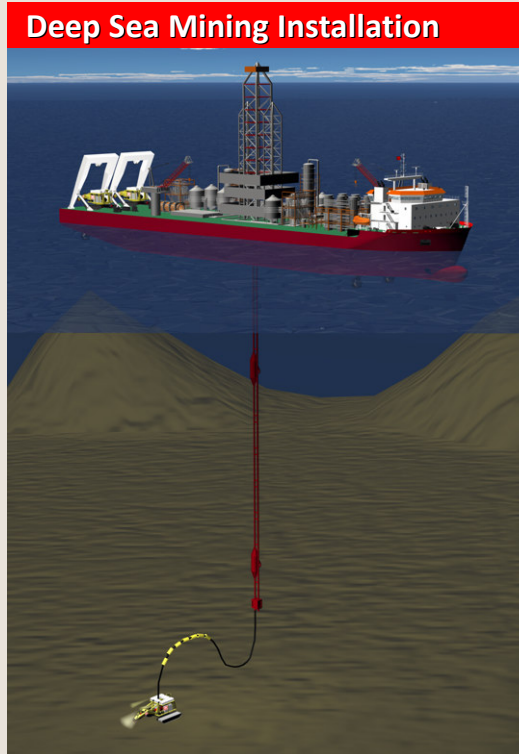
Marketing of  
commodities

Reclamation  
of mine



## Feasibility of full scale mining depends on:

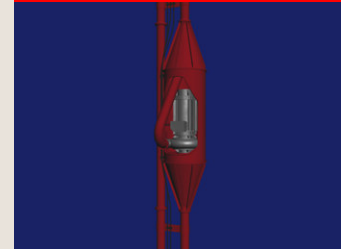
- Economical
- Environmental
- Technical
- Processing



Deep Sea Mining Support Vessel



Vertical Transport System

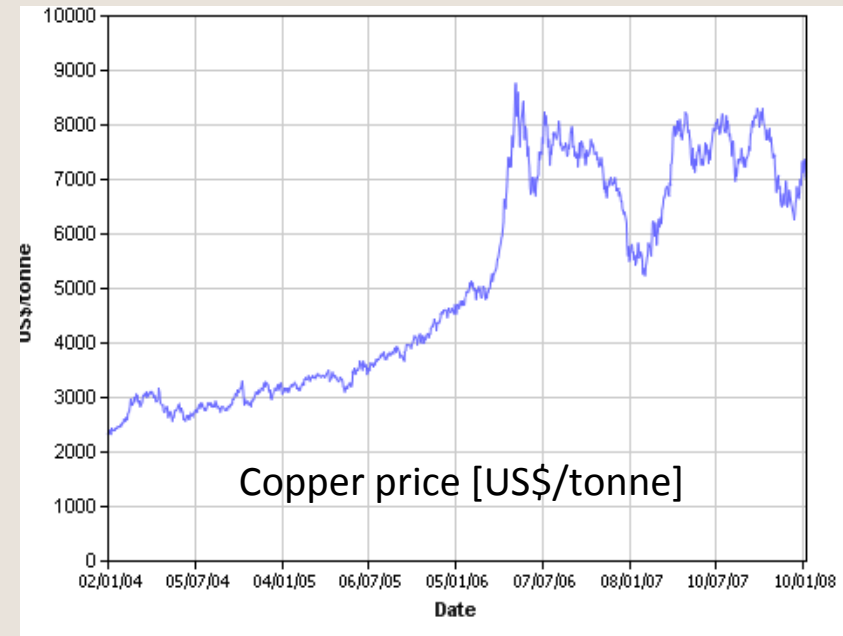


Seafloor Mining Tool



# Economical

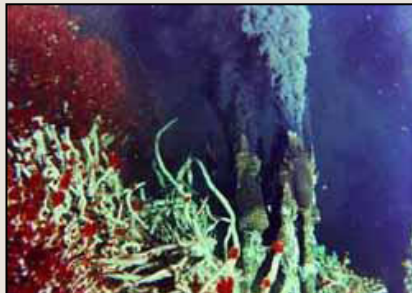
- Amount of deposits on seafloor
- Mineral grades in deposits
- Processing of minerals
- Commodity prices



Element	Mid-Ocean Ridges at Divergent Plate Boundaries	Volcanic Island Chains at Convergent Plate Boundaries (range of composition)
Lead (weight percent)	0.1	0.4 - 11.8
Iron	26.4	6.2 - 13
Zinc	8.5	16.5 - 20.2
Copper	4.8	3.3 - 4.0
Barium	1.8	7.2 - 12.6
Arsenic (parts per million)	235	845 - 17,500
Antimony	46	106 - 6,710
Silver	113	217 - 2,304
Gold	1.2	4.5 - 3.1
Number of samples analyzed	1,259	613

Grades Seafloor Massive Sulphides





## Obtain sustainable mining methods

- Development of rules and regulations
- Mining in non living areas
- Cooperate with environmental organizations and local authorities
- Technical solutions can be:
  - Turbidity control
  - Waste water return





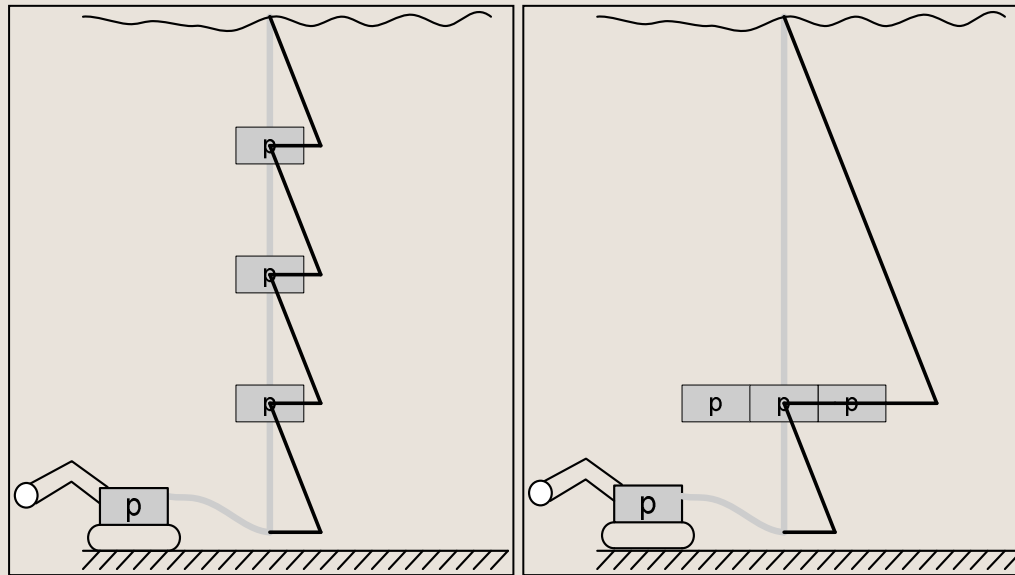
**DEEP SEA  
MINING**

**CHALLENGES:**

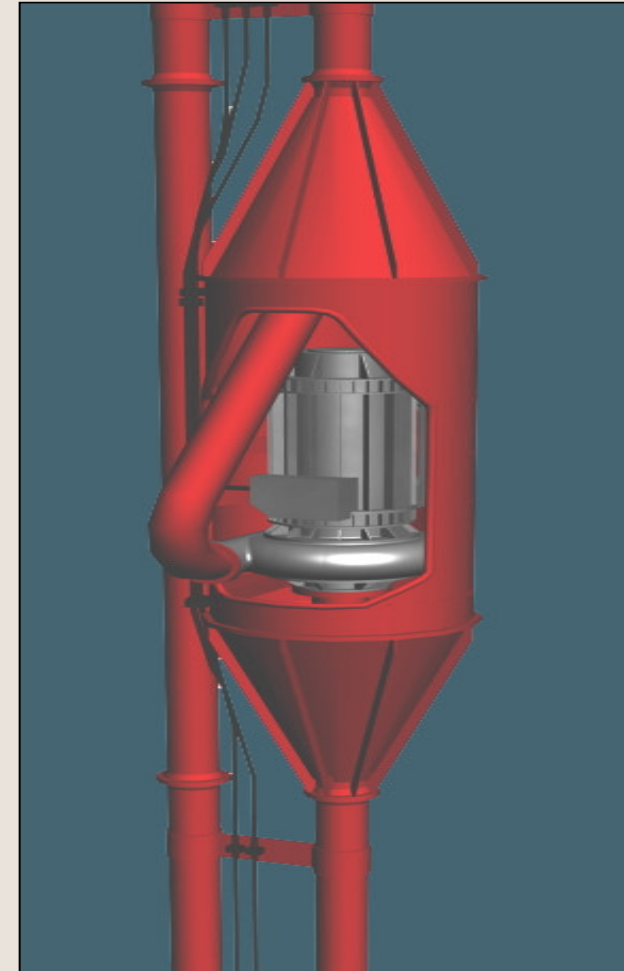
**Deep sea excavation**

**Vertical Transport System**

## Vertical transport system



- Handling of system
- Dynamic behavior of system
- Large flows combined with high pressures
- Power supply



# Recent Experiments and Pilot Projects

## *Nodule Mining*

			Exploratory dredging for manganese nodules	
MESEDA	Germany	Red Sea	1979	-
DOMES	OMI, OMA, NOAA, USA	Eastern Pacific Ocean	1972-1981	4300 -5100
DISCOL/ ATESEPP	TUSCH Research Group, BMBF, Germany	Deep South Pacific (Peru Bassin)	1988-1989	4135
NOAA-BIE	NOAA, USA	CCFZ	1991-1993	4800
JET	MMAJ, Japan	CCFZ	1994-1997	5300
IOM-BIE	Inter-Ocean Metal Consortium	CCFZ	1995	4400
INDEX	National Institute of Oceanography, India	Central Indian Ocean Basin	1995-2002	5120-5400
Diets	MMAJ, Japan	Near Minami-Tori-Shima Islands	1998-2002	2200
	KORDI, Korea	Pacific	1995-2015	5000

## *Tin Mining*

PT Timah	OERC, Indonesia	EEZ Indonesia	1995	> 100
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## *Metaliferous Mud Mining*

Atlantis II Deep	Preussag, Germany	Red Sea	1994 - today	2000
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## *Seafloor Massive Sulphides Mining*

Solwara	Placer Dome, Nautilus	Australia	1994 - 1998	1700
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# Summarized



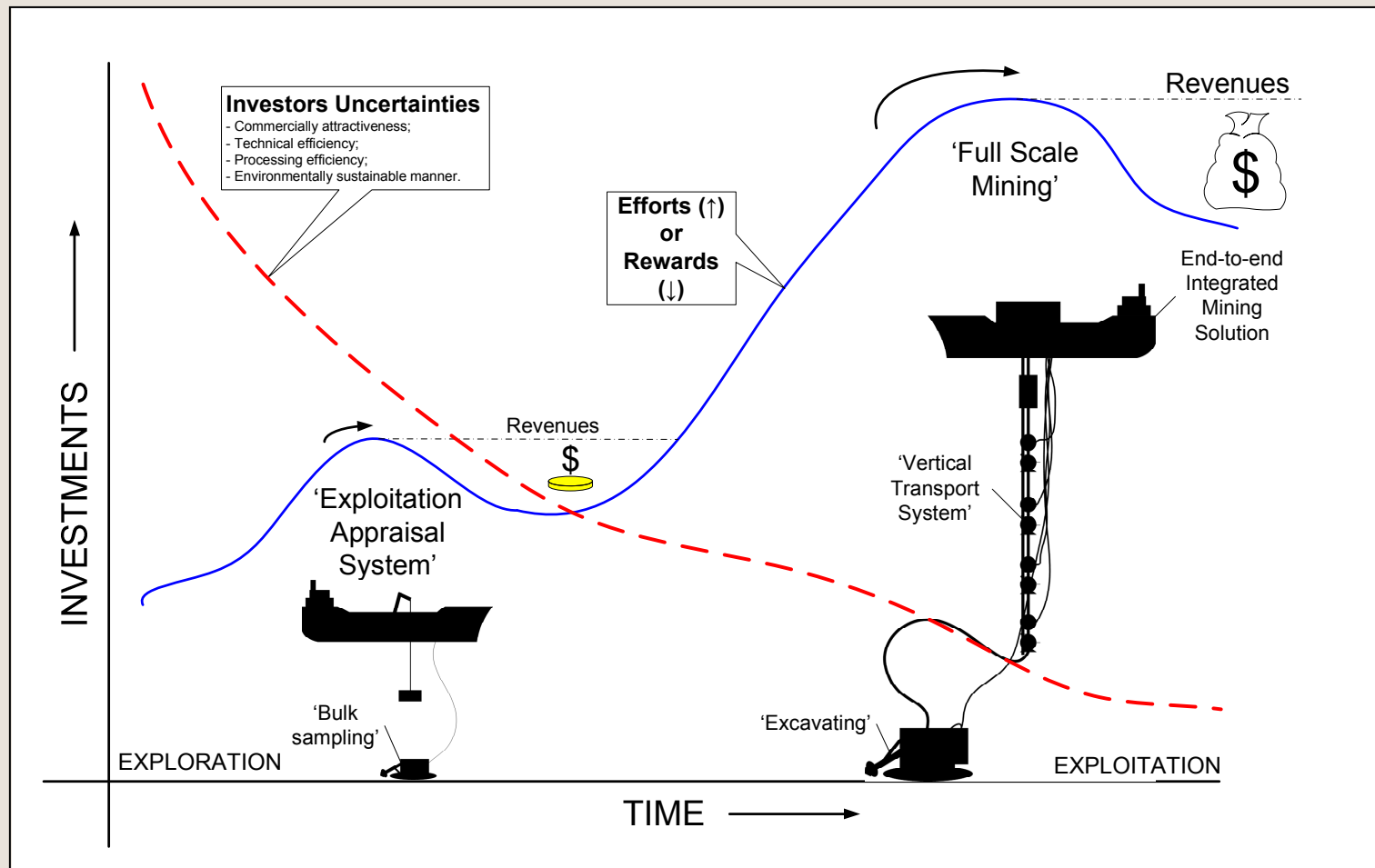
Uncertainties on  
**economical,**  
**environmental** and  
**technical** matters

## Development of EASy

# Exploitation **A**ppraisal **S**ystem

**“To create an accessible deep sea mining market for customers by using proven technology in cooperation with our partners.”**

## Systematically converting the deep sea mining installation from **academic** to **industrial technology**



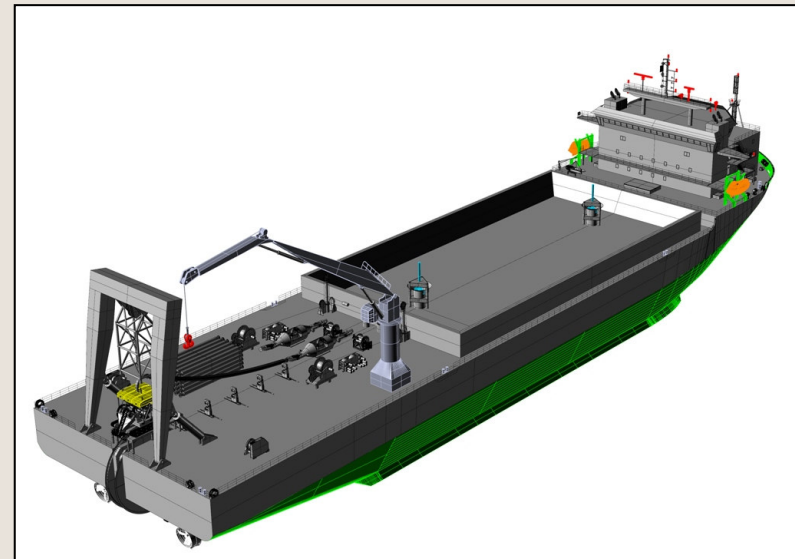
# EASy Technology

- **Develop mining system lay-out**
- **Develop technology**
- **Develop mining method**
  - Type of excavation
  - Type of seafloor mining tool
  - Type of vertical transport system
- **Collect bulk samples**
- **Based on rental construction**



# EASy Technology

- All in one self supporting solution
- One vessel
- Several tonnes of ore
- Modular Seafloor Mining Tool
- Containerized modules





## Conclusions

An Exploitation Appraisal System will systematically converting the deep sea mining installation from academic to industrial technology.

