SPC-EU EDF10
Deep Sea Minerals (DSM) Project

Dr. John Feenan
IHC Mining B.V.

Tanoa International Hotel
Nadi, Fiji

16 August 2012

The technology innovator.

Presentation Outline

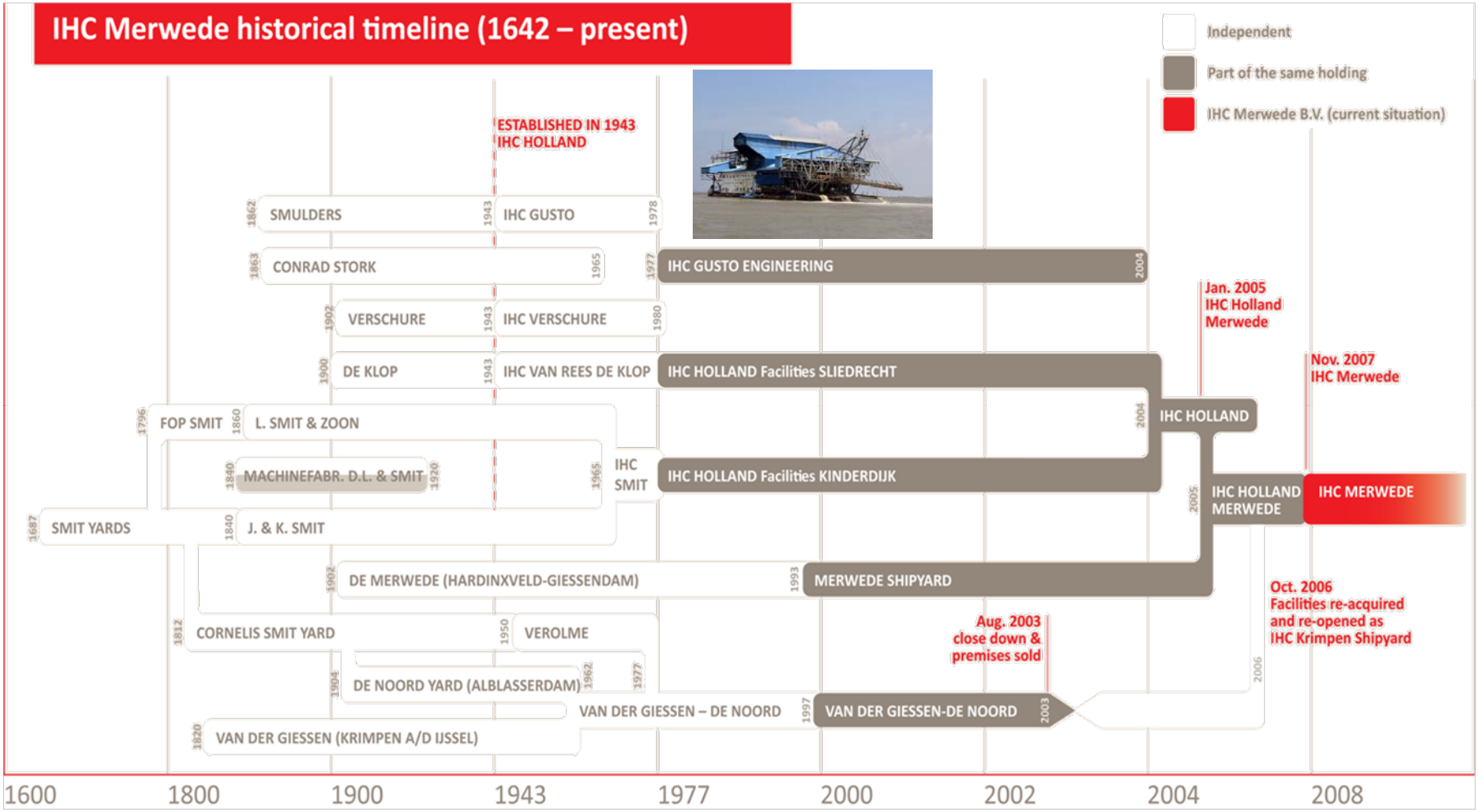
1. IHC Merwede & IHC Mining Background
2. My Background & History of Neptune Minerals
3. What Drives Mineral Explorers?
4. Review of the Mining Technology Cycle
5. Introduction to Calculating Exploration Value
6. Overview of Deep Sea Mineral Exploration Risks
7. Focus on Resource Definition Risk & Sampling
8. The Implications for the Minerals Industry & Investors
9. Q&A

If it is innovative technology, IHC builds it!

IHC Merwede facts & figures:

- Financial turnover in 2011: EUR 1,1 billion
- Staff in 2011: 3500
- 5 Shipyards in The Netherlands, 1 shipyard in China
- In-house research centres, MTI, MAS and OTI (60 employees)
- 3-4% of turnover for **R&D** (300-350 employees)
- World wide services and manufacturing locations

IHC Merwede History



Responsibilities in sphere of influence

Sustainable development

Assess to prevent

- Prediction tools
- Risk assessments

Engineer to mitigate

- Safety
- Reduce environmental impact

Monitor to optimize

- Optimize equipment performance
- Environment

Collaborate to complete

- Community

IHC Merwede Mining Division

Reliable partner for efficient mining life cycles

Mining services

Market segments

Product groups

Life-cycle support

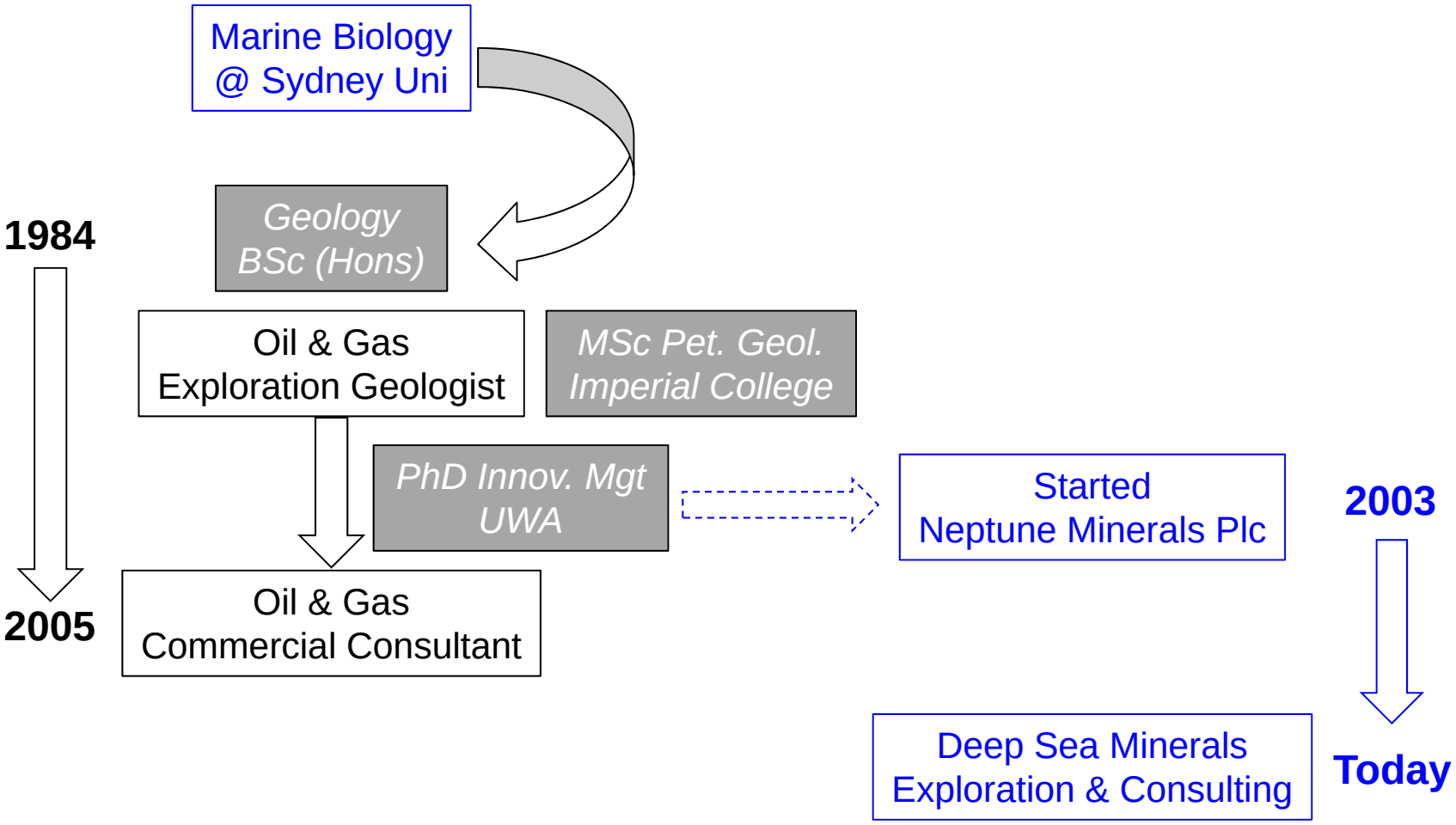
Innovative vessels

Advanced equipment

Life-cycle support

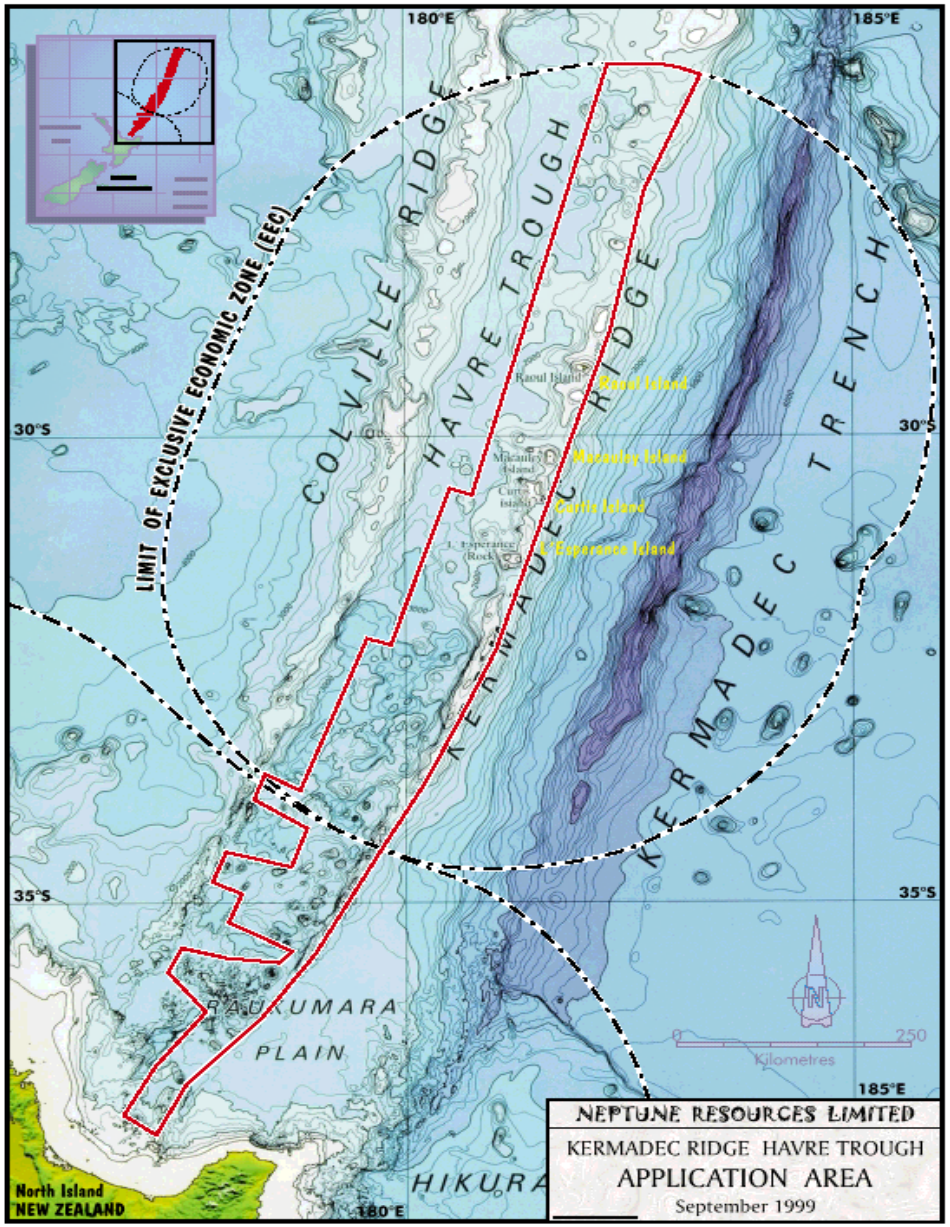
The technology innovator.

My Background



Neptune Minerals History

1999	Neptune Resources application
2000-02	NZ Oceans Policy Review
2002	(Oct.) **PL39 195 @ 30,000km²**
2003	(Feb.) Start funding roadshows
2004	(Dec.) **$1million seed funding**
2005	(May) Neptune Minerals, Plc
2005	(Oct.) **AIM LSX listing £9.3M**
2005	(Dec.) **K05** drillship Brothers
2007	(May-July) **K07** & **CM07**
2007	(Aug.) **RV Meteor**, Mediterranean
2008	(April) **IHC-Technip Mining Study**
2009	(Feb.) GFC Slow-down
2010	(Dec.) US investor discussions
2011	(Mar.-May) **K11** Dorado Discovery
2011	(Dec.) Neptune Minerals, Inc.
2012	Private exploration company



What drives mineral explorers?

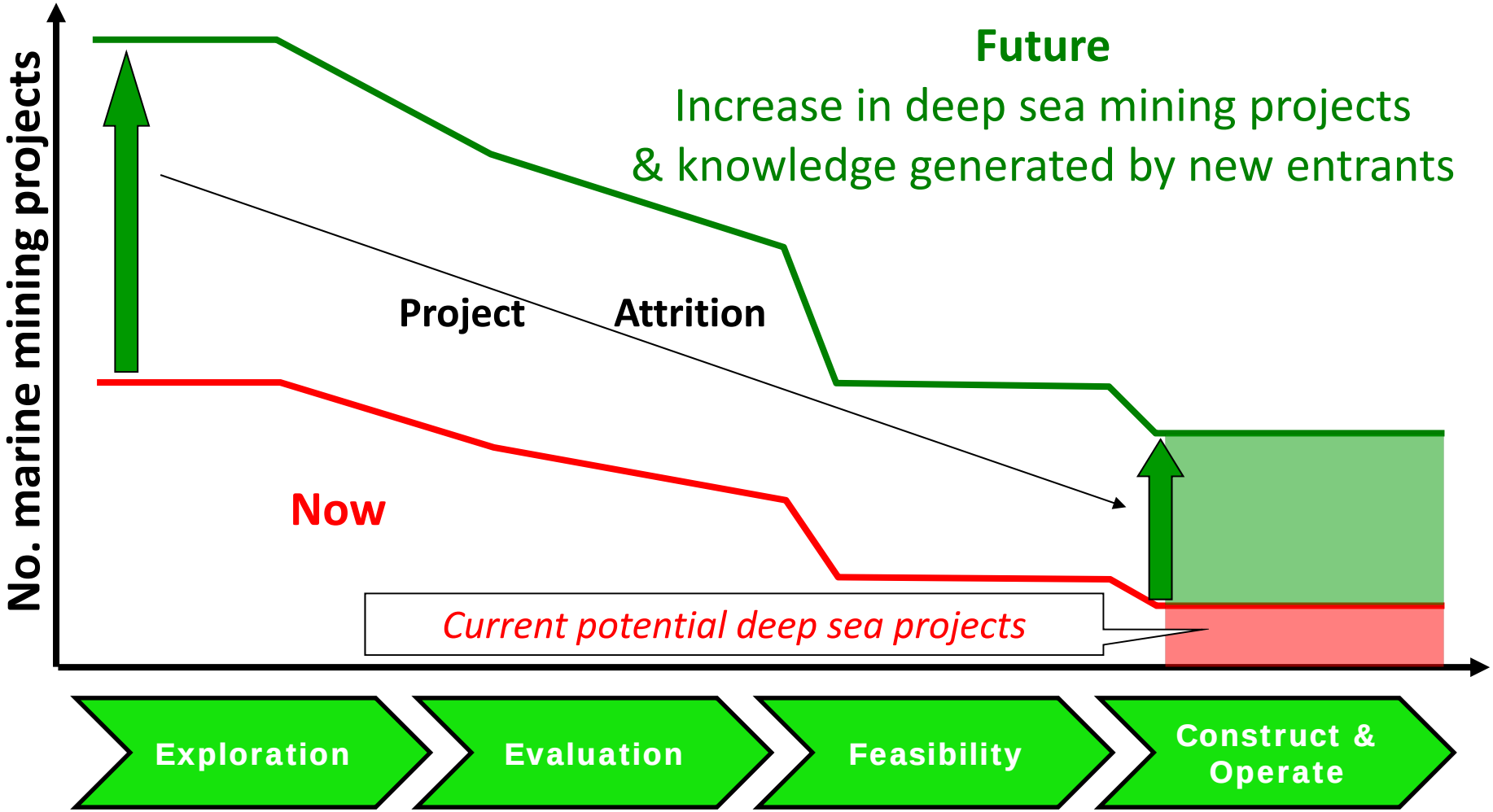
EXPLORATION & MINING Co's

- Growing company asset value & shareholder returns
- Reserves replacement & growth
- Having a successful "hit rate" from exploration vs competitors
- Avoiding exploration failures
- $$$

NATIONAL / GOVERNMENT Co's

- Resource & supply security to sustain national industries
- Technology & skills development to assist industrial growth
- Geopolitical presence & influence

The need to educate “dry” mineral explorers



Overview of Mining Cycle

Exploration

- Initial discovery
- Inferred mineral resource
- Economic viability
- Start EIA baseline

Evaluation

- A “bankable” resource
- Refined costs
- Engage stakeholders
- Improve EIA

Feasibility

- Market report of ore reserves
- Detailed costs
- Stakeholders support
- Full EIA

Construct & Operate

- Best practice project performance
- Stakeholder communications
- EIA monitoring

Exploration Licence term

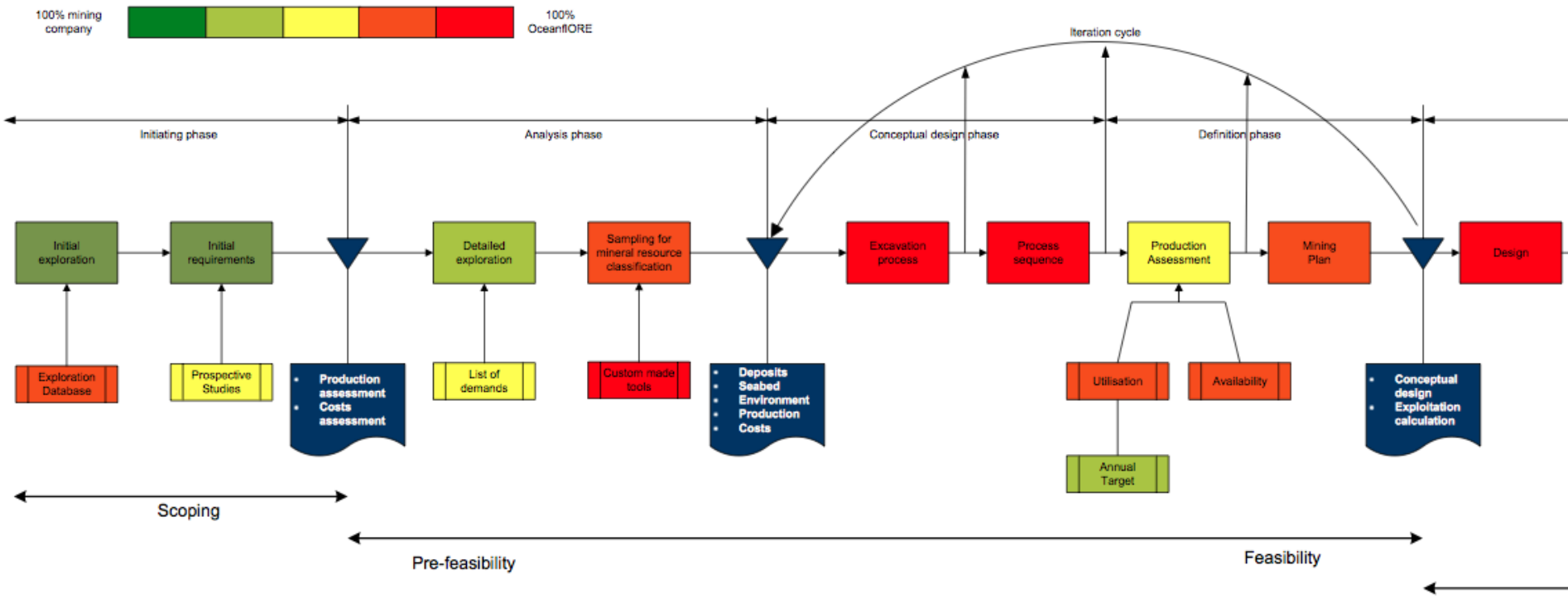
8 – 15 years

Mining Licence term

20 – 30 years

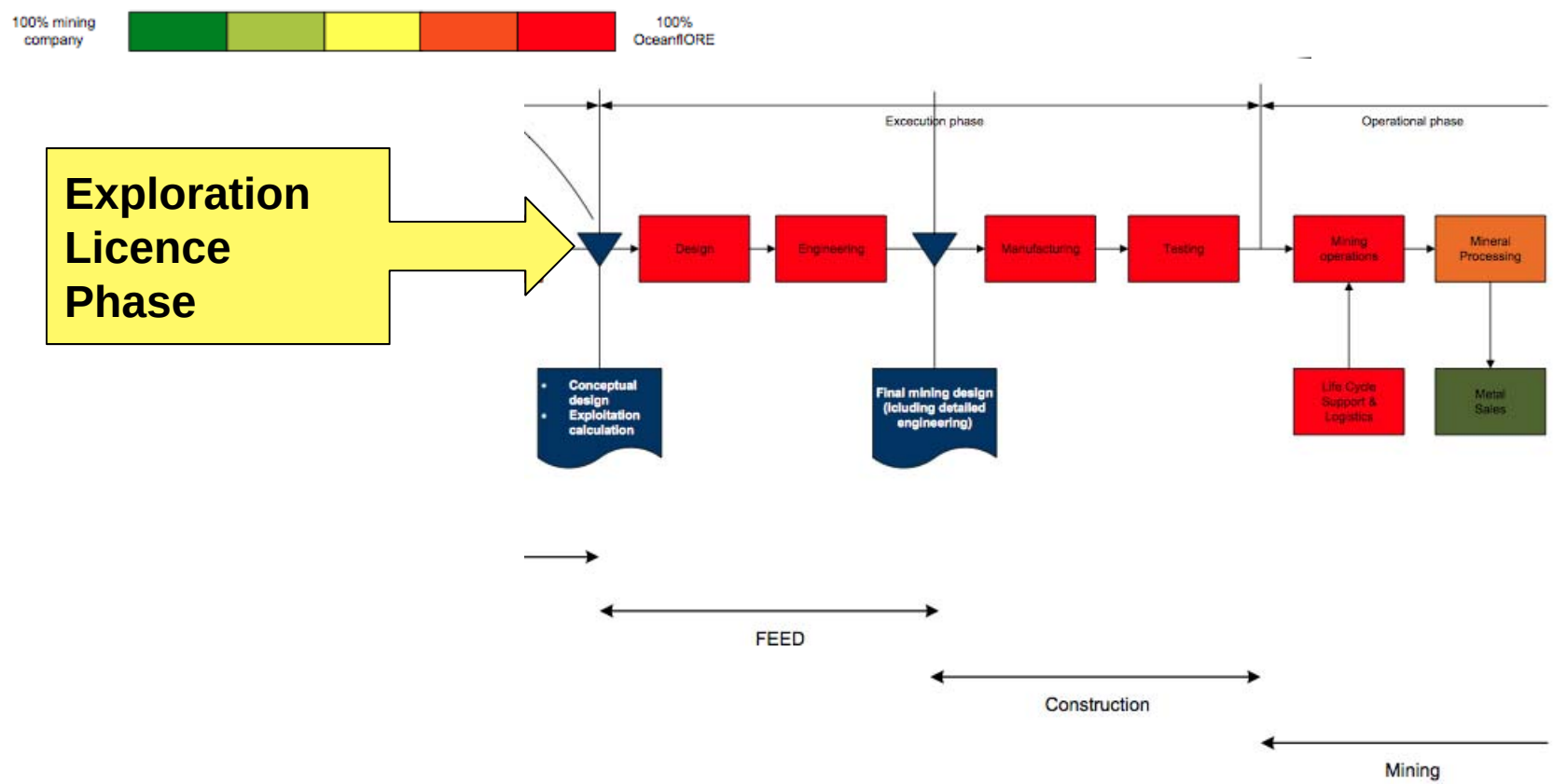
Technology Partnering – Exploration Licence Phase

Project Development: From customers expectations to realization.



Technology Partnering – Mining Licence Phase

Project Development: From customers expectations to realization



Exploration Licence Phase

Introduction to Calculating Exploration Value

"It is a truth very certain that when it is not in our power to determine what is true we ought to follow what is most probable." *Descartes*

Decision making under uncertainty, how to manage?

In an uncertain world:

RISK

$ we start here!

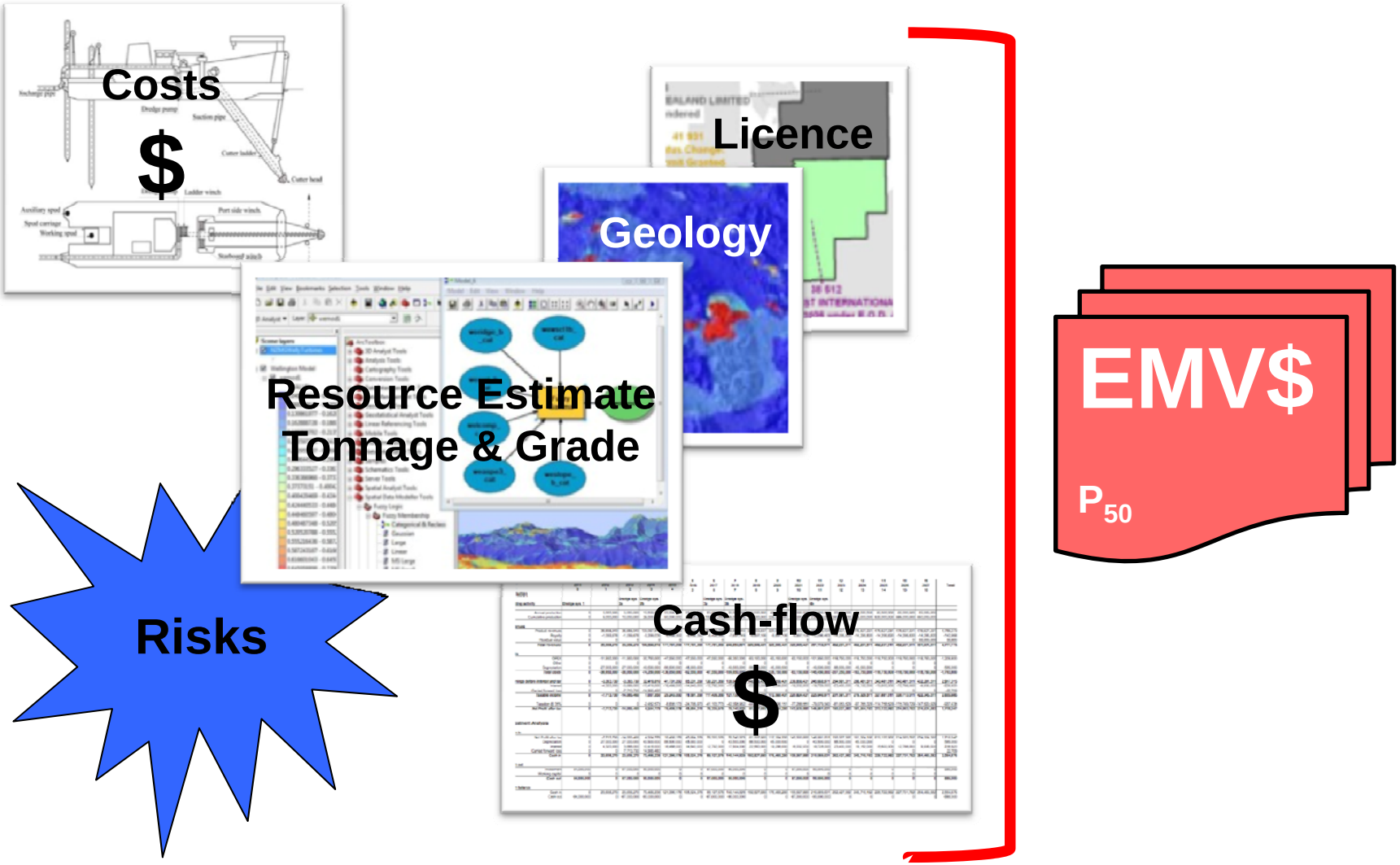
EMV$

With total project certainty:

$ we get full project value

NPV$

Geology, technology, economics and risk combine to create project value EMV$ per mineral deposit



What is Expected Monetary Value (EMV)?

- The probability or risk weighted value of an investment.
- The methodology:
  - Identify a potential marine mineral resource
  - Estimate the costs of successful development (+/- 25% accuracy)
  - Estimate the production rate and revenue stream
  - Calculate discounted after-tax cashflows for a hypothetical success
  - Use monte carlo simulation of a range (low-med-high) of input parameters to generate a probabilistic range of project value NPV$
  - Identify key risks to determine the total Probability of Success (PoS%)
  - Multiply/reduce the mean NPV$ by the PoS% to calculate the EMV$
- If the EMV$ less exploration capital cost$ is calculated to be positive, then the decision should be to commit to the investment.

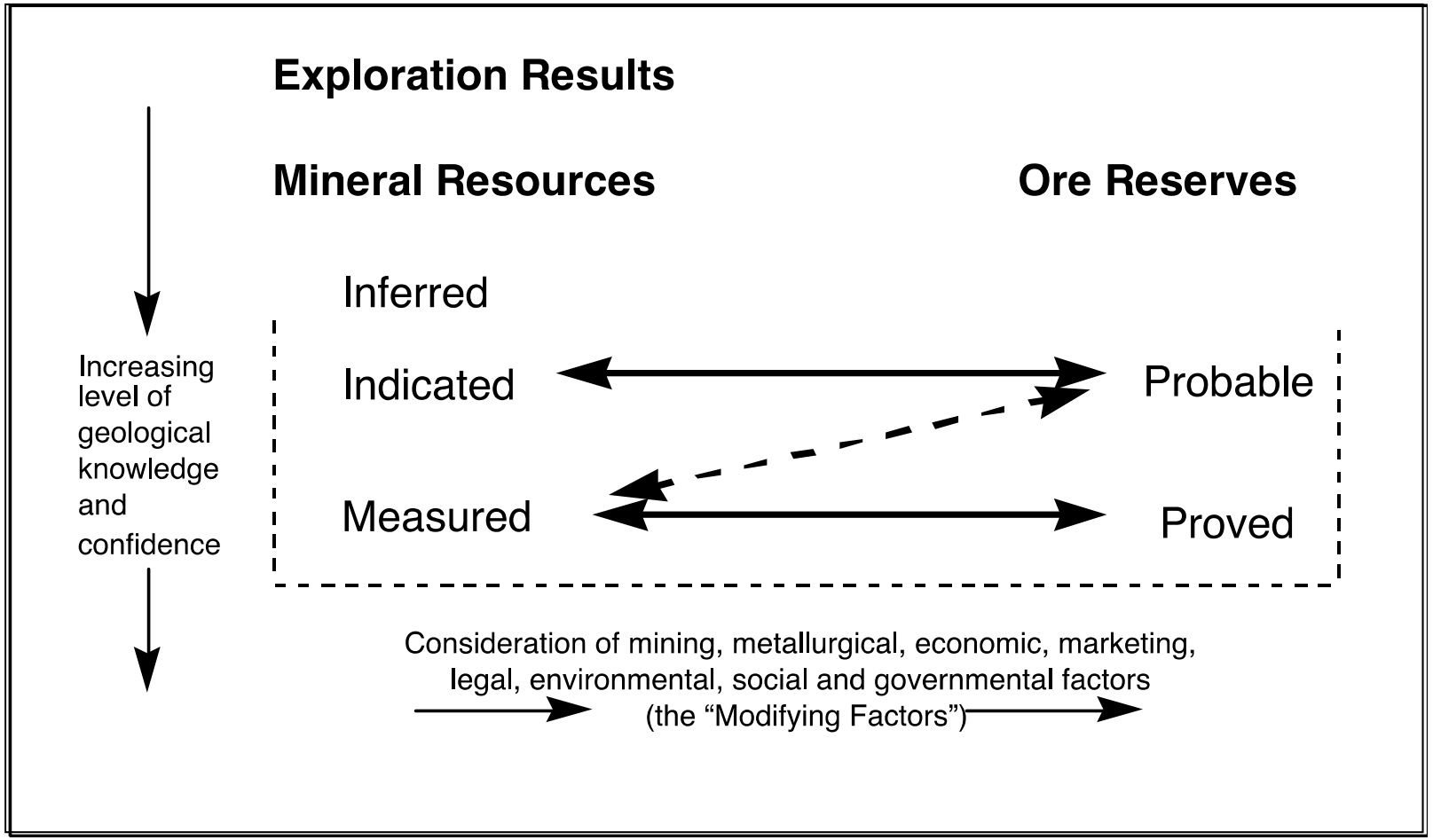
The higher the positive EMV$ the more attractive the investment.

An Overview of Deep Sea Exploration Risks

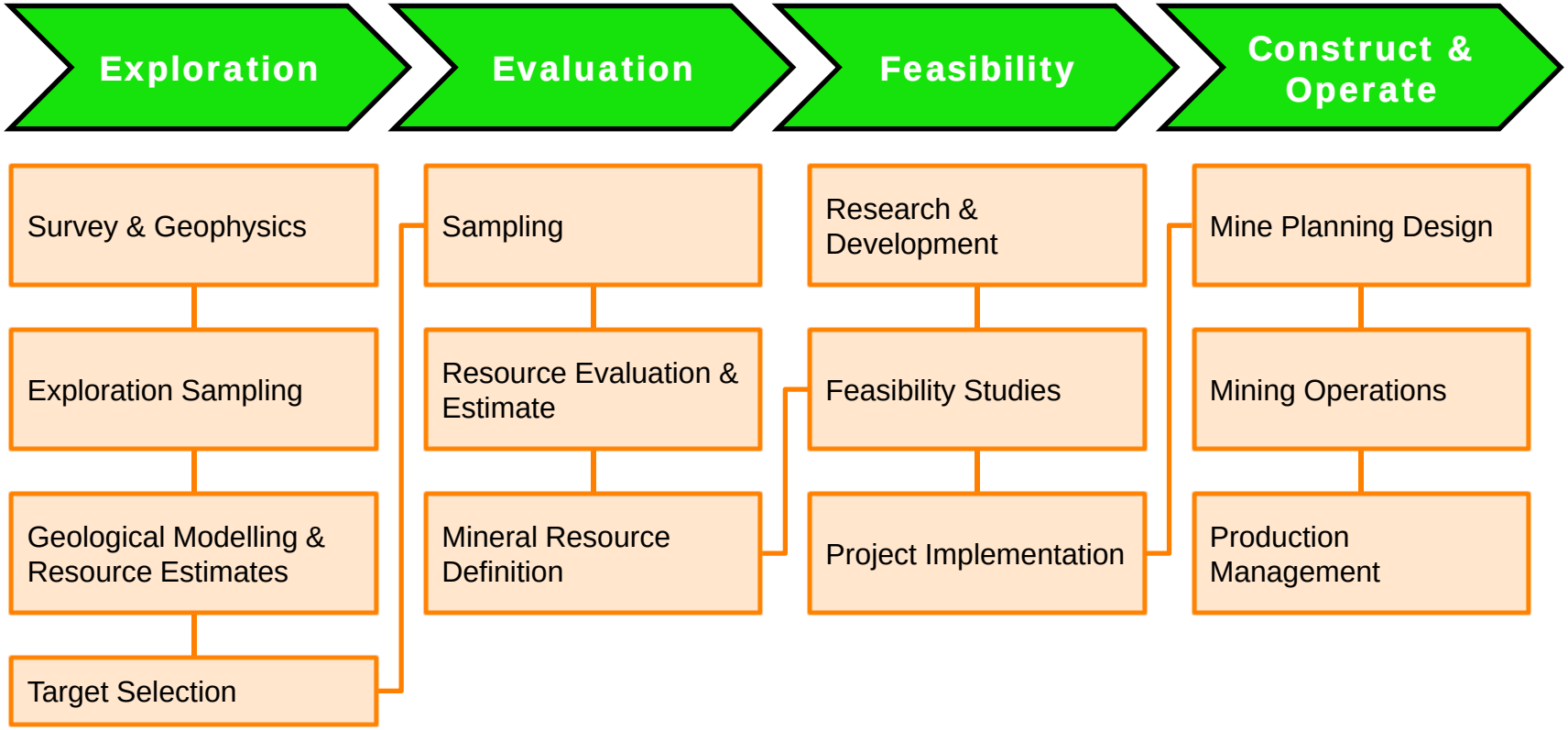
Risk Category	Implied Impact Severity – Key Issue(s)
Resource Definition Risk	HIGH – tonnage & grade poorly constrained
Environmental Risk	HIGH – seabed plume & water column contamination
Geotechnical Engineering Risk	MEDIUM – negligible in situ data
Ore Processing Management Risk	MEDIUM – absence of working data
DSDM Operations Management Risk	LOW – absence of working data
DSDM Project Management Risk	LOW – absence of working data
Regulatory Risk	LOW – EEZ regulatory reforms ongoing

Resource Definition Risk is considered one of the highest risks to manage for investment confidence.

JORC Reporting for Resource Definition

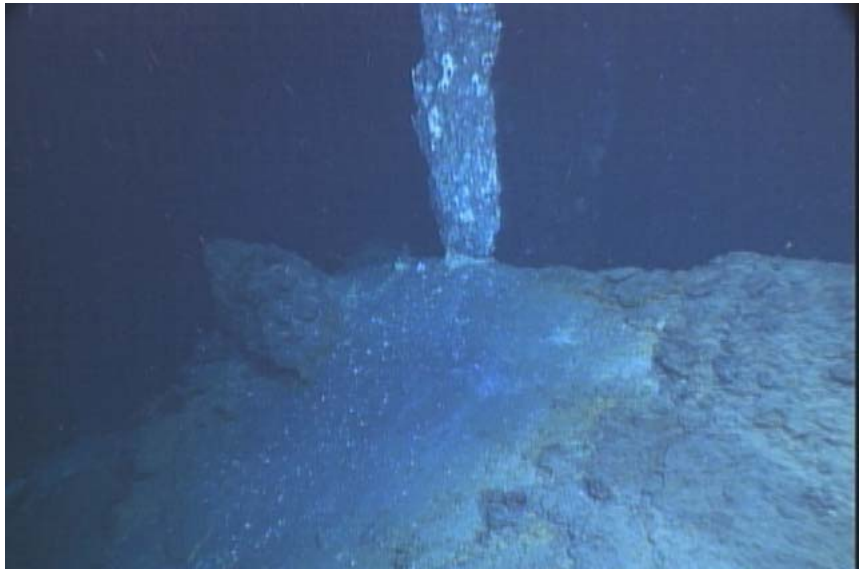


Background and Purpose of Sampling



Sampling Program Objectives

- Three dimensional delineation of the extent of the resource
- Information to select the minable target area
- The grade and grade variability of the resource
- In-situ geotechnical criteria for mining tool design
- Nature and characteristics of the target minerals
- The presence of beneficial or problematic associated minerals
- Baseline environmental data



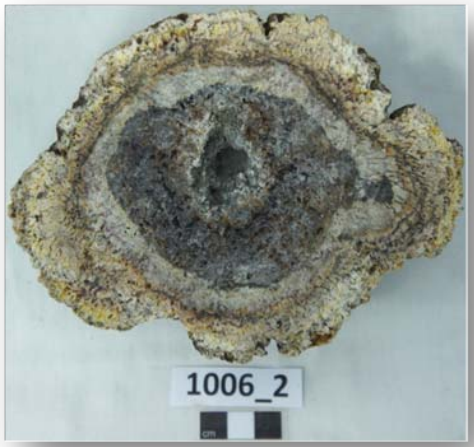
Sampling Processes

Exploration → **Evaluation** → **Feasibility** → **Construct & Operate**

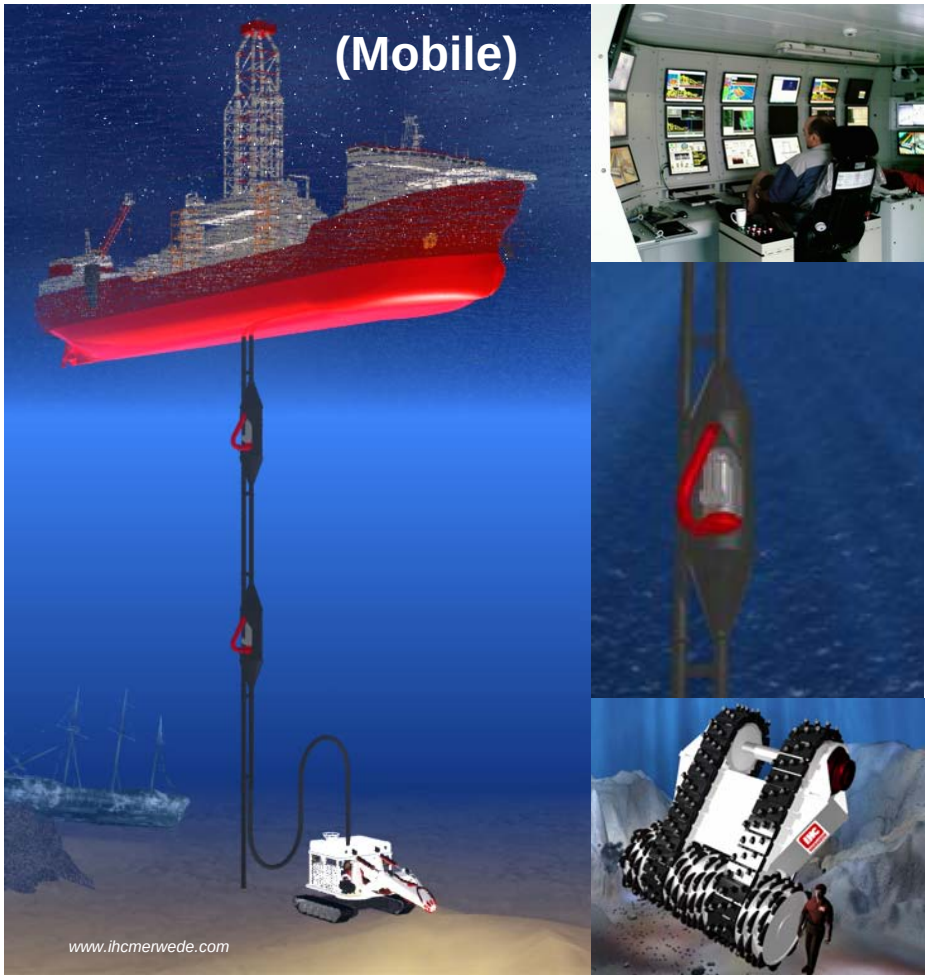
1. Exploration Sampling
2. Resource Definition Sampling
3. Test Mining / Bulk Sampling

Increasing Resource Confidence

Reduced uncertainty in the economic viability and geo-technical characteristics of mining →

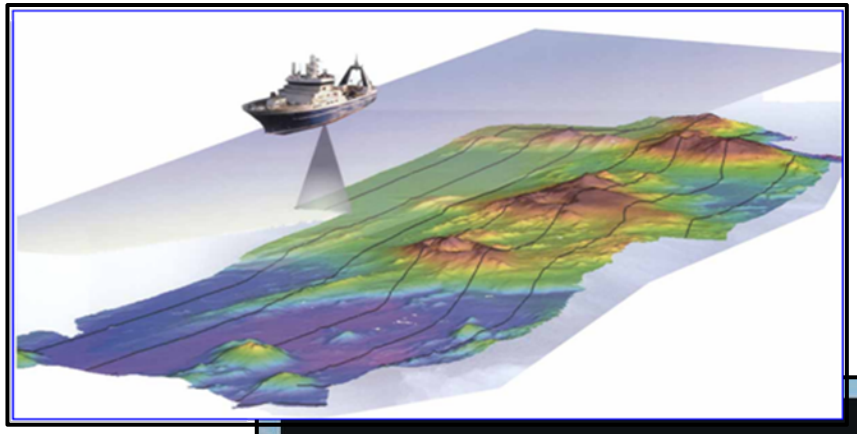


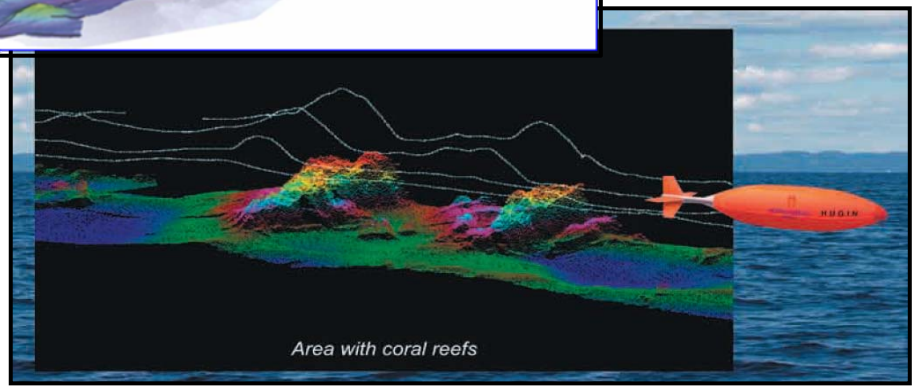
Contrast Onshore vs Subsea Mining



Prospecting Exploration Mapping & Sampling

First phase is a “light touch” of seabed…





Drill Sampling (SMS)

How deep is mineralisation?

- Multiple options (>30 suppliers)
- Scientific & oil industry heritage
- Exploration sampling stage focus
- Varying logistics to deploy
- Variable tool limitations & sample standards
- No “silver bullet” solution

Sea bed drilling rig “MEBO”

Bulk & Grab Sampling (SMS, nodules & crusts)

How continuous is mineralisation?

- Grid of sample stations across resource area
- Identify “ore sweetspots” and understand why
- Rock on deck for tonnage & grade
- Volumes for metallurgical processing evaluation
- Improve geotechnical understanding
- Capture biota for biological data

Sampling Challenges

- Availability of suitable sampling technology
- Availability and cost of suitable vessels & LARS (Launch & Recovery System)
- Availability of geoscientists to process and evaluate samples
- Gaining access to material
- Obtaining representative samples
- Undisturbed in-situ seabed characteristics
- Seastate operating limits

…requires innovation!

The sea walker drill platform is drilling the surf zone. The platform is accesible via an aerial ropeway and is the first stage in the development of a larger drill platform

De Beers Marine – Alluvial Diamonds

- First offshore West Africa diamonds recovered in 1961
- De Beers Marine production c. 1.5 million carats p.a
- Five mining vessels in operation, including:
  - *Peace in Africa* – mining vessel & crawler to 200m water depth
  - *Debmar Atlantic* – mining vessel using a large 8m diameter drill
  - *Douglas Bay* – dedicated exploration sampling vessel
- Ore reserve is developed on a "rolling basis"
  - Survey & sampling conducted in parallel with mining
  - Sampling for reserve replacement + new target identification
  - Deposit lacks homogeneity
  - Sampling 2-3 years ahead of mine plan
    (Grabs, drilling & vibracoring)

(Ref. Richardson, K., 2007; www.debeersgroup.com)

De Beers Marine – Alluvial Diamonds

Nautilus Minerals – Massive Sulphides

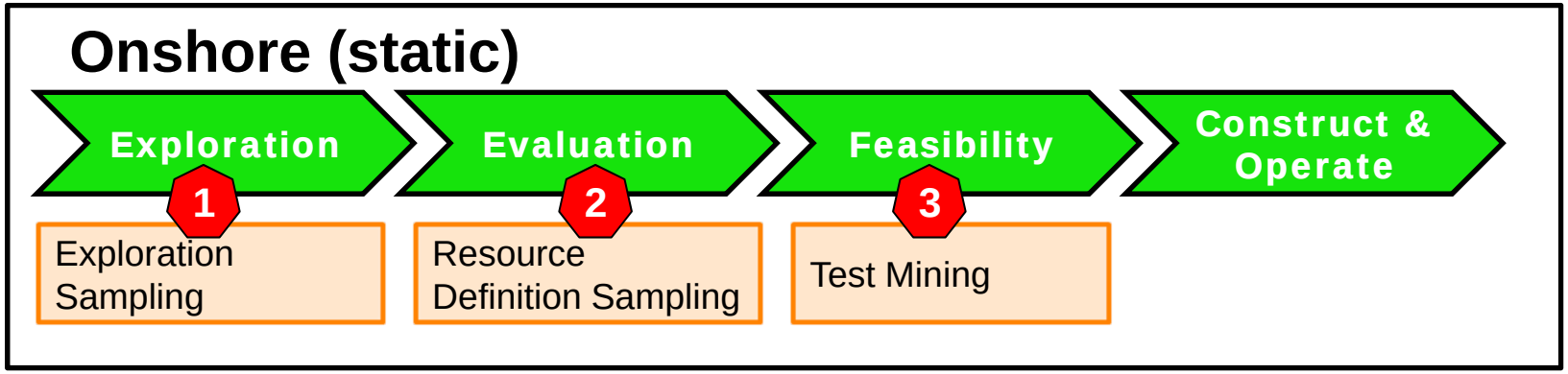
Solwara 1

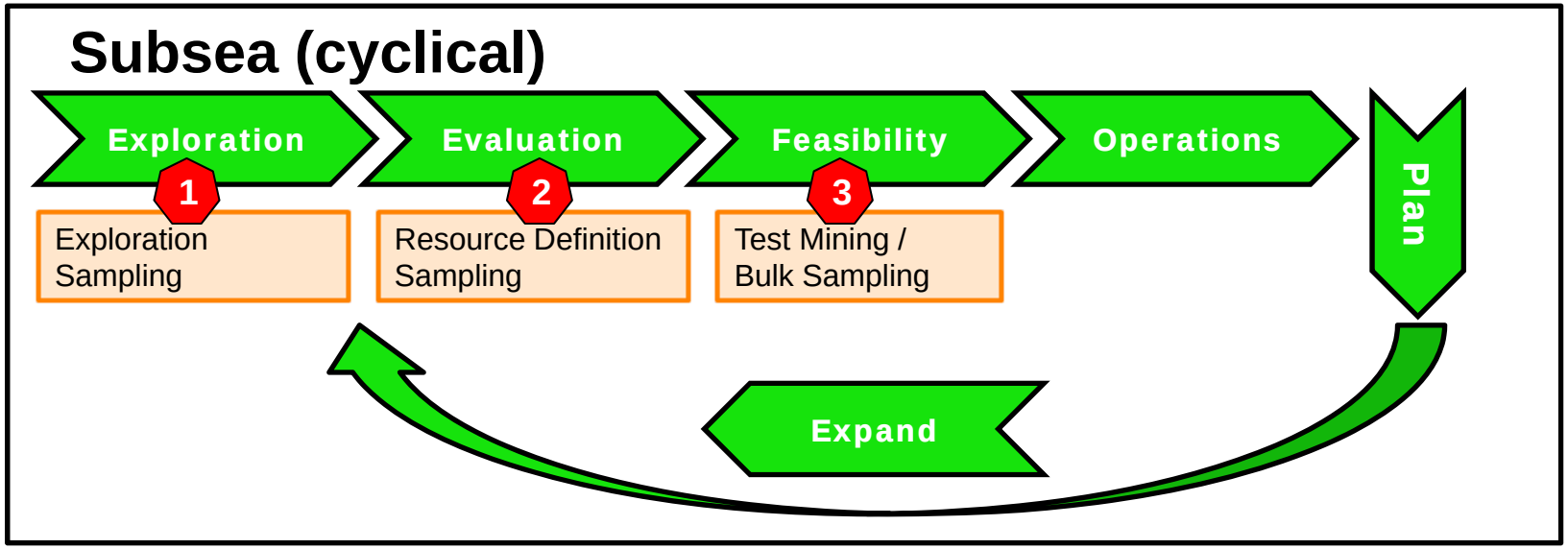
Est. Resources 2.5Mt

Production @ 1.3Mtpa

Requires ongoing cycle of resource development to justify a 10, 20 or 30 year project life for the mining investment.

Subsea Sampling – A New Paradigm?

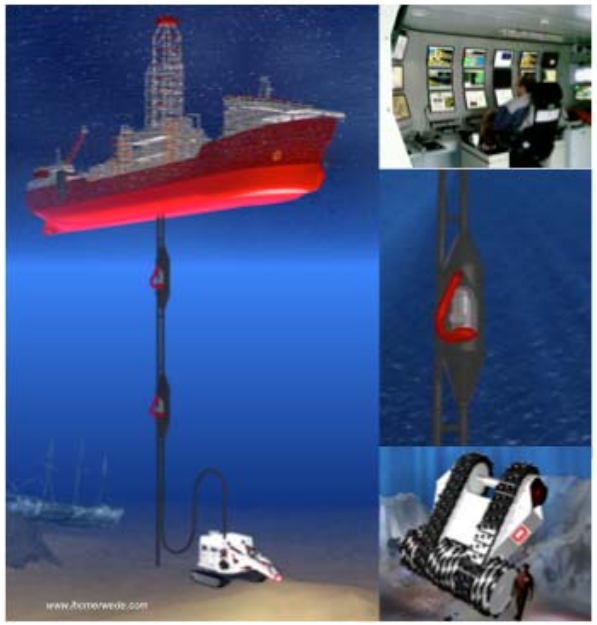




Industry Implications

- Market reporting for investors
- Challenging the Code constraints – JORC & NI43-101
- Developing stakeholder confidence
- Re-thinking project management

≠



Questions and Answers