

EVALUATE THE ENVIRONMENTAL EFFECTS OF OIL PLATFORM DISCHARGES IN THE NORWEGIAN SECTOR OF THE NORTH SEA

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Outline

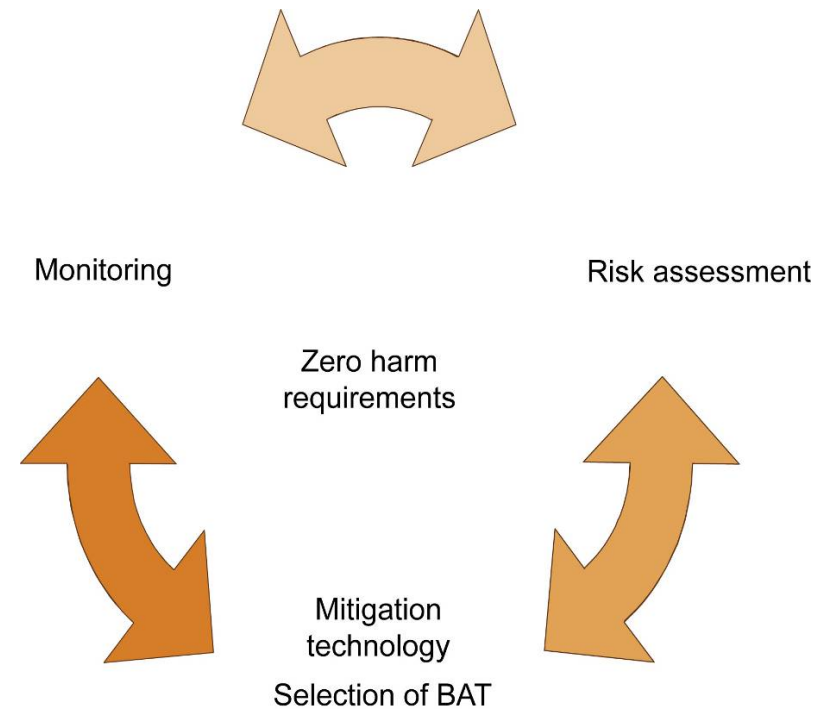
1. Statoil approach to environmental management
2. Integrated environmental monitoring
3. Applications
 - The Peregrino environmental monitoring project
 - Drilling discharges in the North sea
 - The LoVe ocean observatory
4. Summing up

Environmental management circle

Establish the context

- Gather sufficient knowledge to operate safely in the actual environment.
- Understand the potential impact of planned activities to the surrounding environment
- Understand and document other natural and man originating changes

The management circle



Paradigm shift



From “expeditionary”
offline sampling



To continuous
environmental monitoring

Licence to operate
demonstrating
prudent operations in sensitive areas

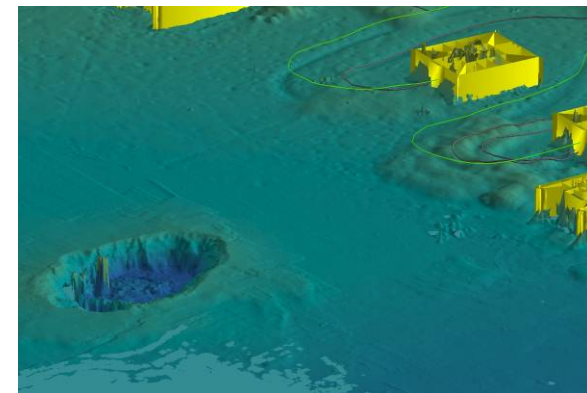
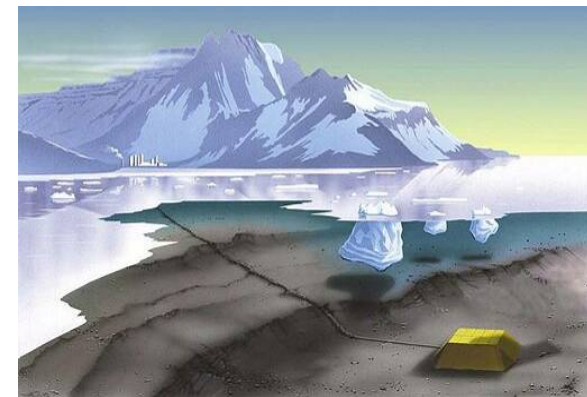
Business case examples

Monitoring in challenging areas

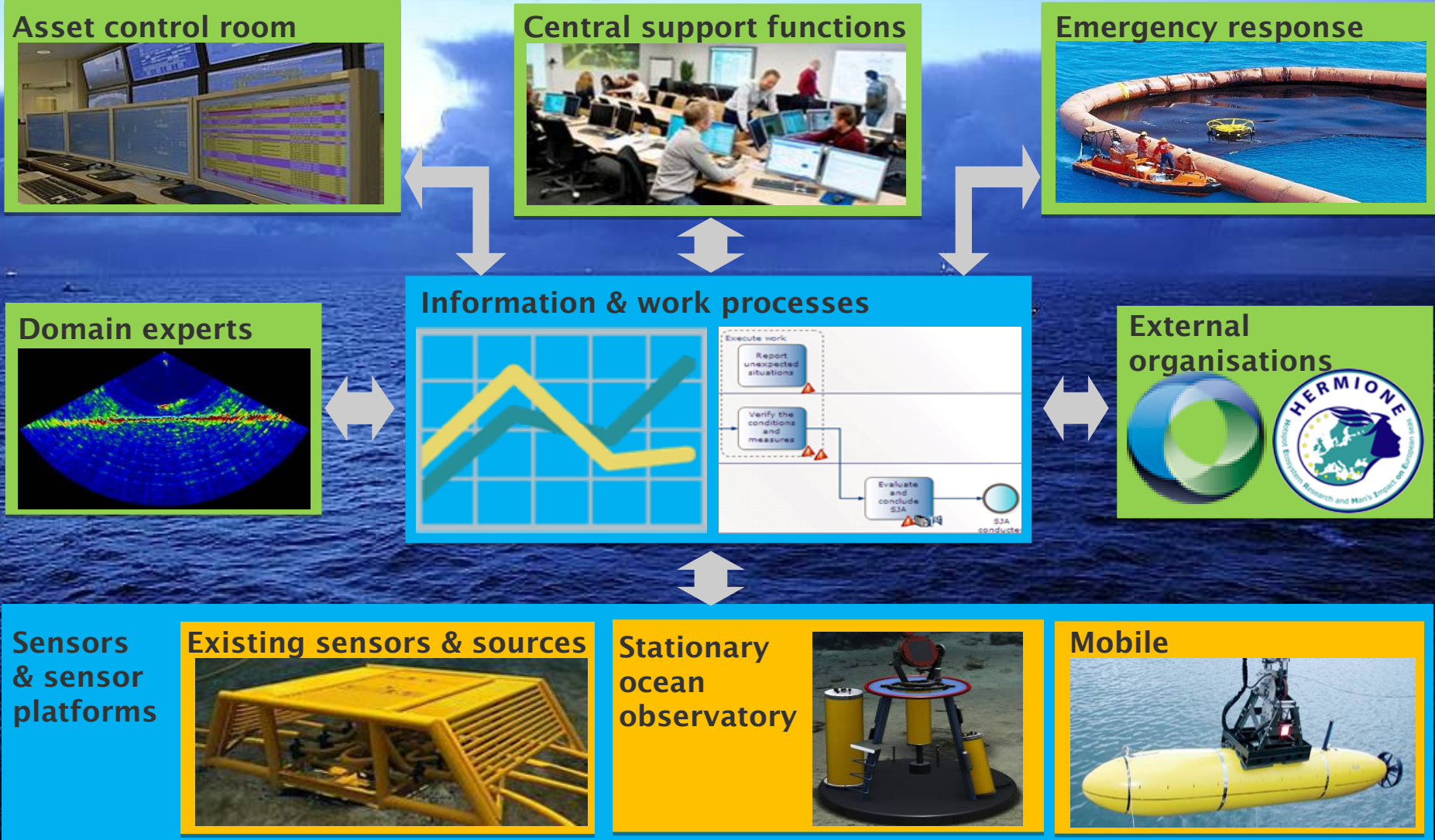
- Areas covered with ice
- Areas with activities restrictions parts of the year
 - Longer activity windows
- Sensitive areas
 - Surveillance of corals with respect to drill cuttings
 - Coastal areas e.g. Nordland VII
 - Calcareous algae Peregrino

Condition monitoring

- Production leaks (subsea and surface) and technical condition
- Verify containment of injected fluids (produced water, drill cuttings, CO₂)



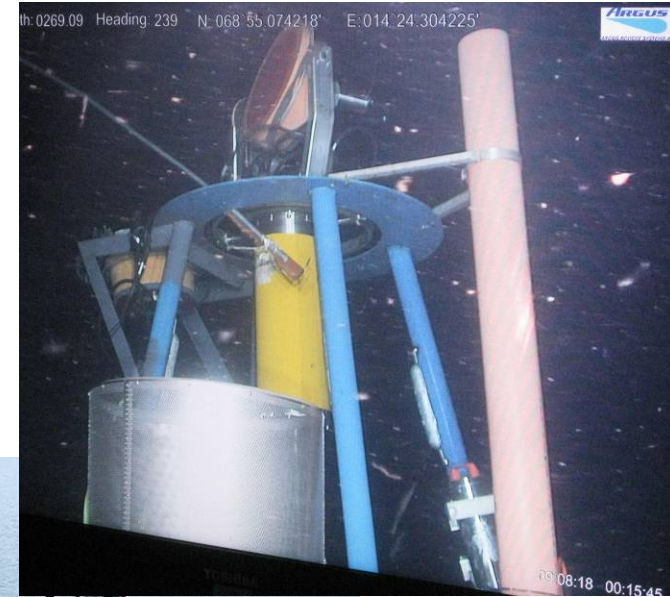
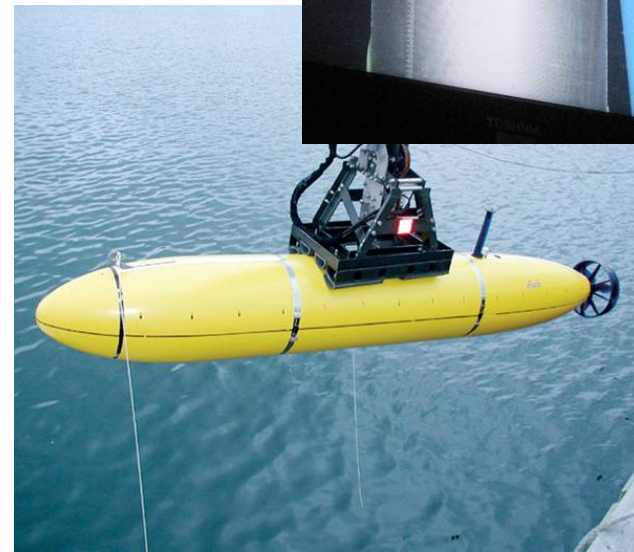
Integrated Environmental Monitoring



WP 0

Sensor technology and sensor platforms

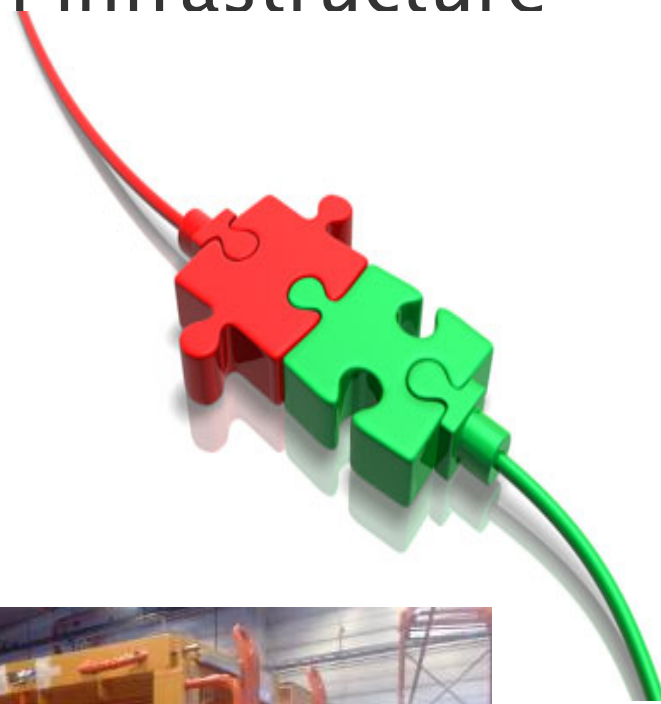
- Sensor technology
 - Off-the shelf equipment
 - Specific sensor development
 - Biosensors, condition parameters
 - Hyper spectral imaging
 - Leak detection
- Sensor platforms
 - Fixed on existing infrastructure
 - Stationary ocean observatories
 - Mobile



WP 1

Data capture and communication infrastructure

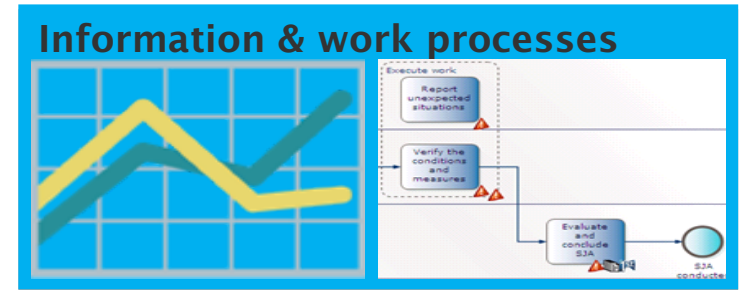
- **3 types of infrastructure**
 - Fibre
 - Existing fields without fibre
 - Areas without established infrastructure
- **Subsea hub for sensor connection**
- **Data access, transfer to top site**



WP 2

Information access, workspaces and sharing

- Framework for modeling, storing, managing and accessing environmental data
- Domain model for representing environmental data.
- Management and organization of real-time environmental data
- Work processes for integration of real time environmental monitoring data in operational management



Asset control room



Central support functions

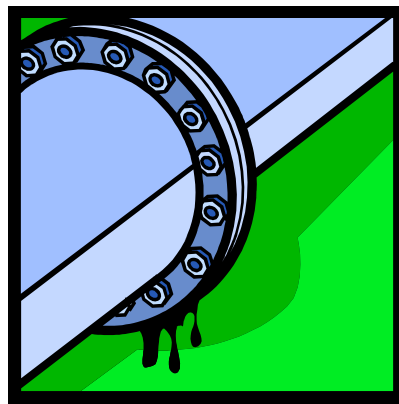


Emergency response



WP3 Extended Environmental Analysis

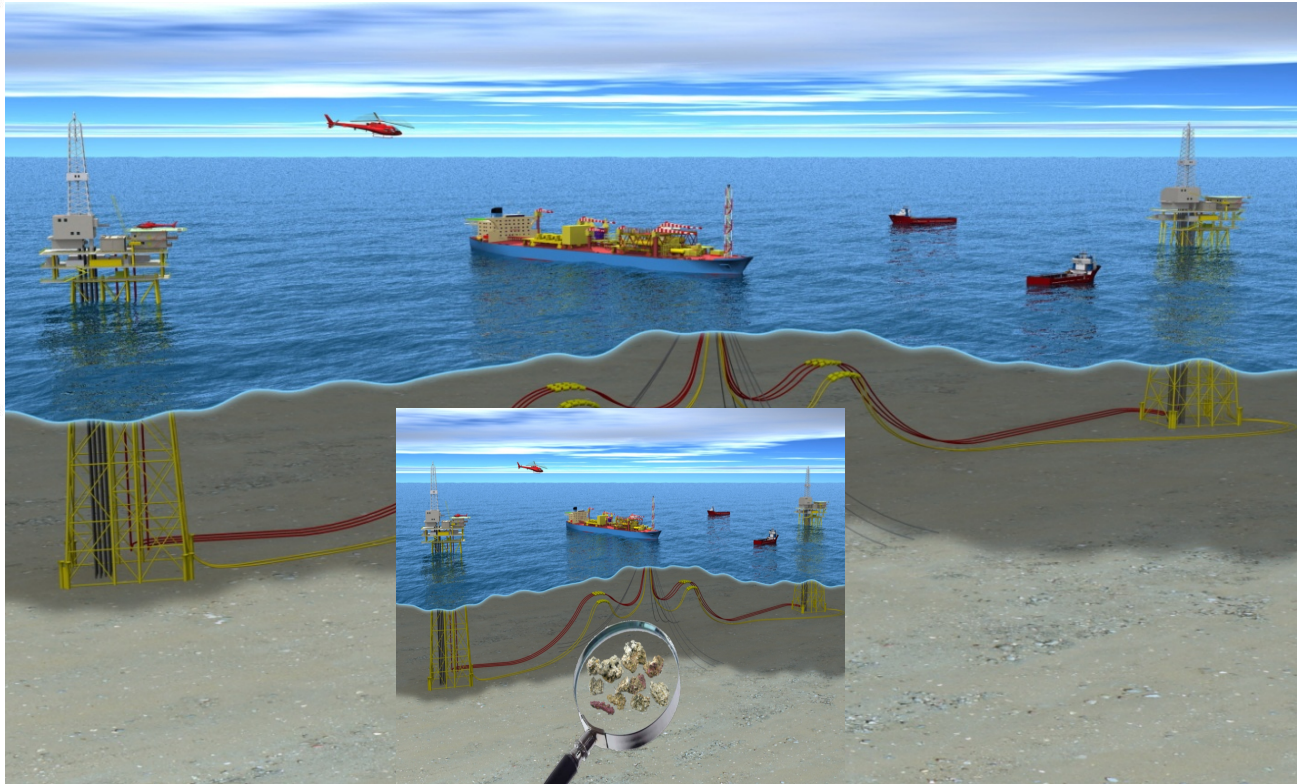
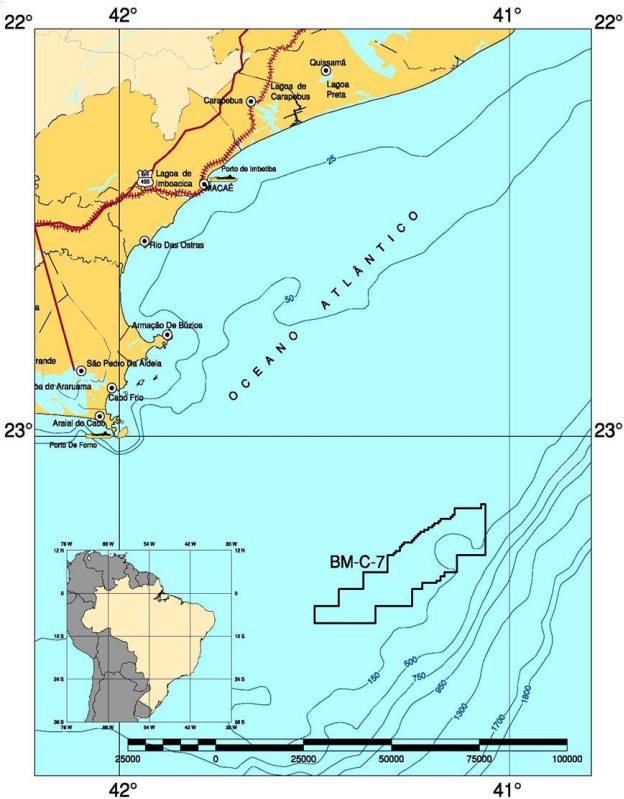
- Strategy established in Q1. Five core areas identified:
 - Image analysis
 - Real time modeling of discharge fate and environmental risk
 - Multi sensor data analysis
 - Leak detection
 - Environmental sound



PEMCA

Peregrino Environmental Monitoring of Calcareous Algae

- Sea bed too hard for traditional grab sampling
- Dredging of calcareous algae may harm the habitat



PEMCA – Peregrino environmental monitoring and calcareous algae projects

PEM

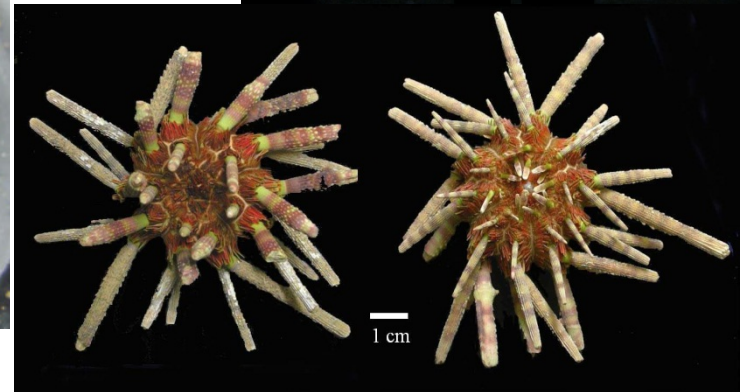
- Oceanographic institute, University of Sao Paulo
 - Field surveys
 - Technology development
 - Analysis and reporting
- Institute of Marine Research (IMR), Norway
 - Technology development and transfer
 - Field deployment
 - Data analysis and reporting

CA

- Federal university of Rio, Botanical garden
 - Basic biology, lab cultures
- Labtox, Rio
 - Toxicity tests
- SINTEF, Brazil/Norway
 - Design and build test system
- Naval base, Arraial do Cabo
 - Chronic toxicity tests

Taxonomy

- 4 field campaigns for sampling
- > 100 associated species identified
- 1 new specie identified
- 4 major groups of Calcareous algae identified



Toxicity tests

- Establish effect threshold levels
- Acute toxicity
 - Light intensity for CA
 - Drill cuttings for fauna
- Chronic toxicity
 - Mesocosm tests with light, sediment coverage and flow
 - Marginal growth and color change

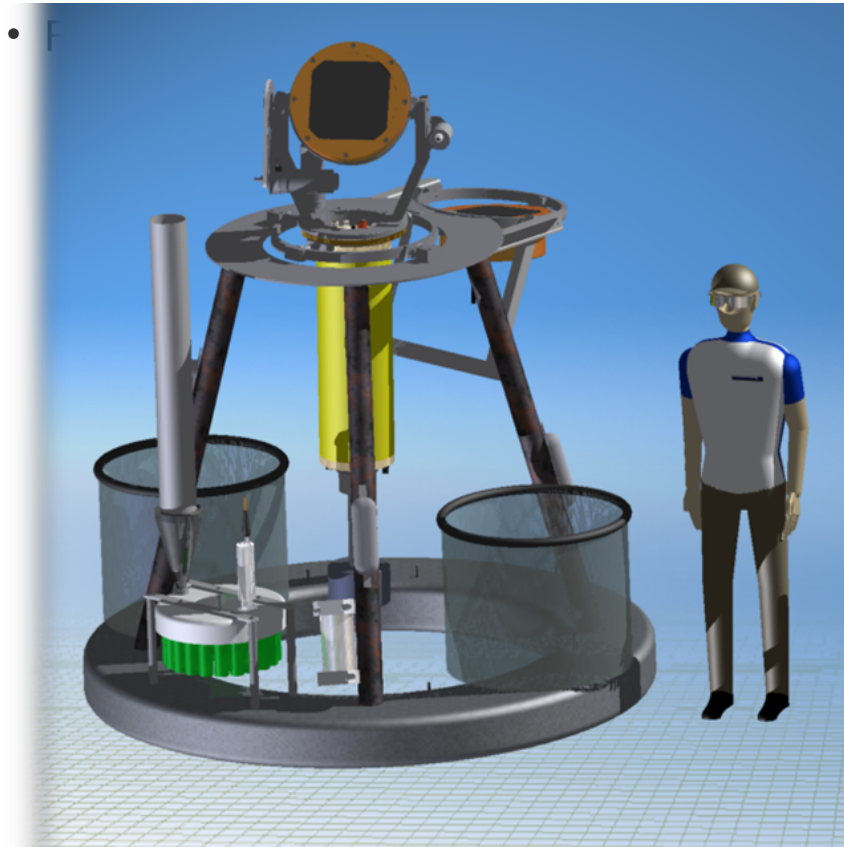


Monitoring

- Real time environmental monitoring
- Communication buoy for data transmission
- Lander with selected sensor systems



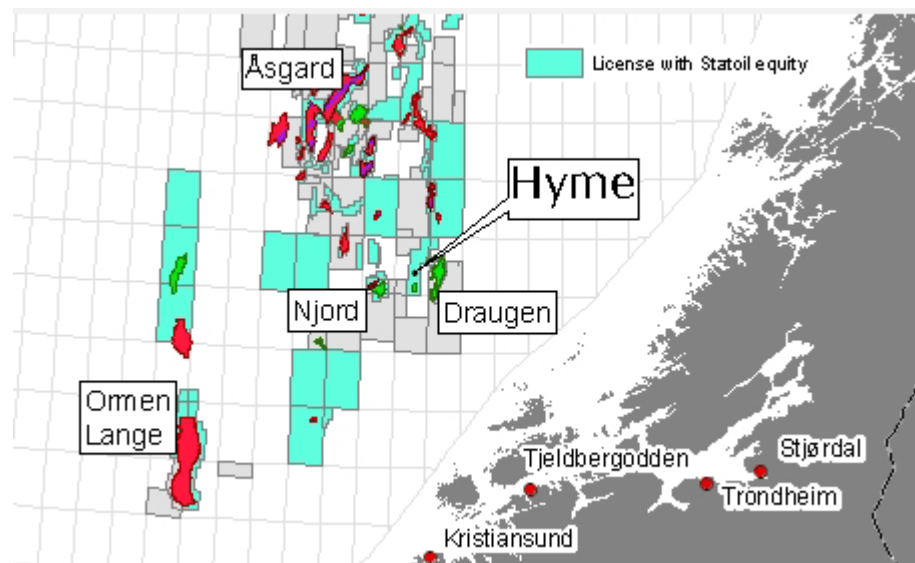
The Peregrino seabed observatory system



- Echosounder – sonar detection of particles
- Physical parameters (temperature, light, turbidity)
- Chemical parameters – sediment traps (inorganic and organic compounds)
- Oceanographic parameters
- Camera, still photos

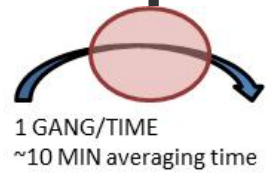
Hyme, Norway

- Located in the Norwegian sea
- Area with cold water coral structures
- Real time transfer of oceanographic data and discharge log
- Import data to risk modeling and report back to Hyme drilling
- Back-up solution using historical data and prognosis used
- Validation of models

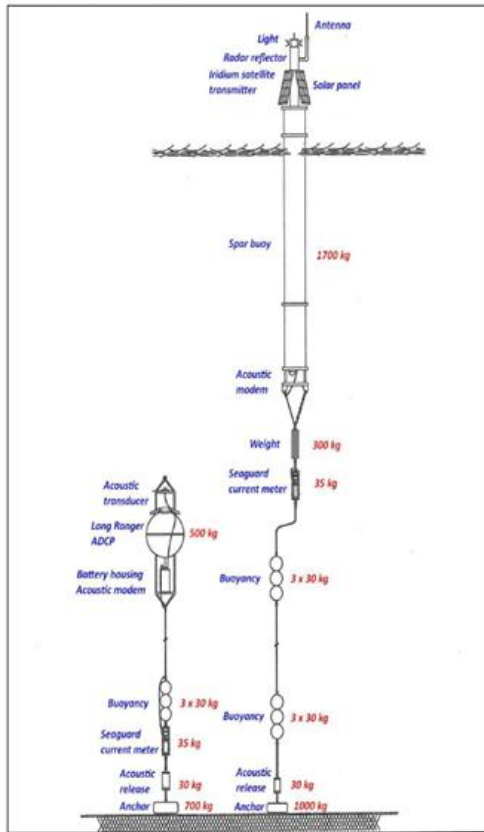


Real time dispersion modeling (DREAM) at Hyme

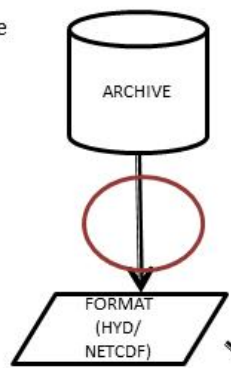
Data transfer via satellite
HYME



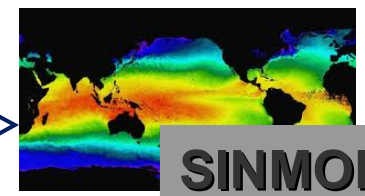
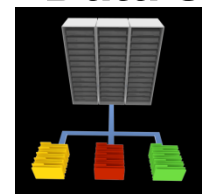
Mooring configuration real-time Hyme



SINTEF

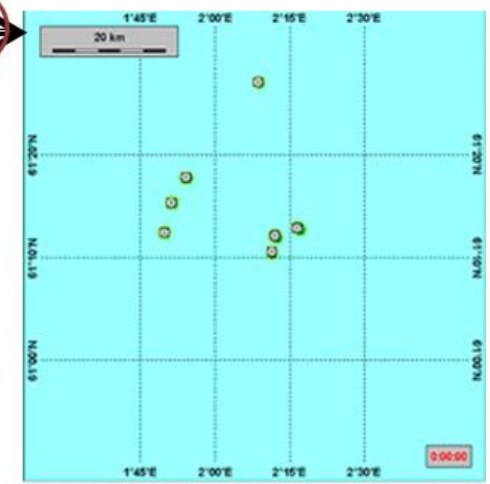
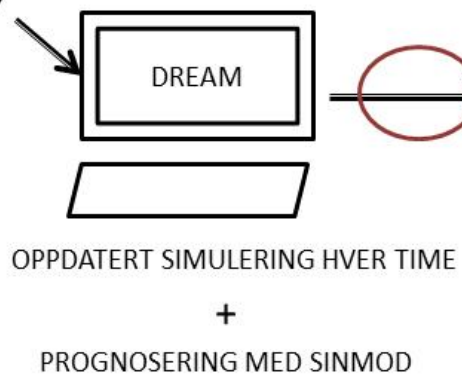


Data server



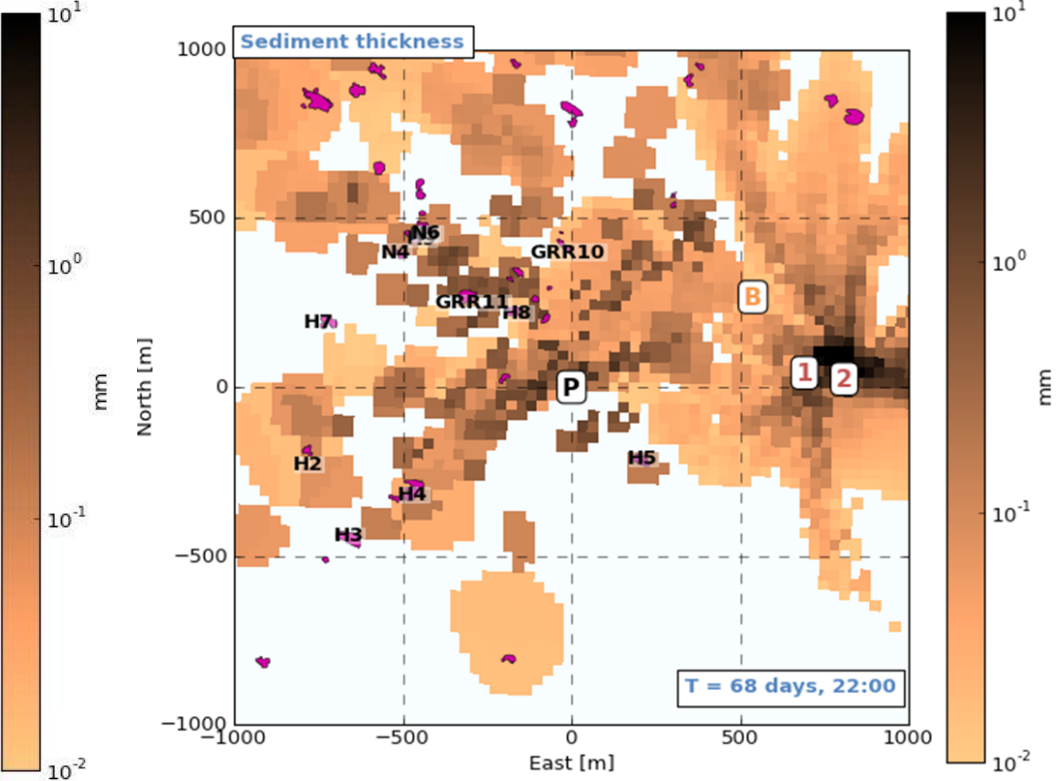
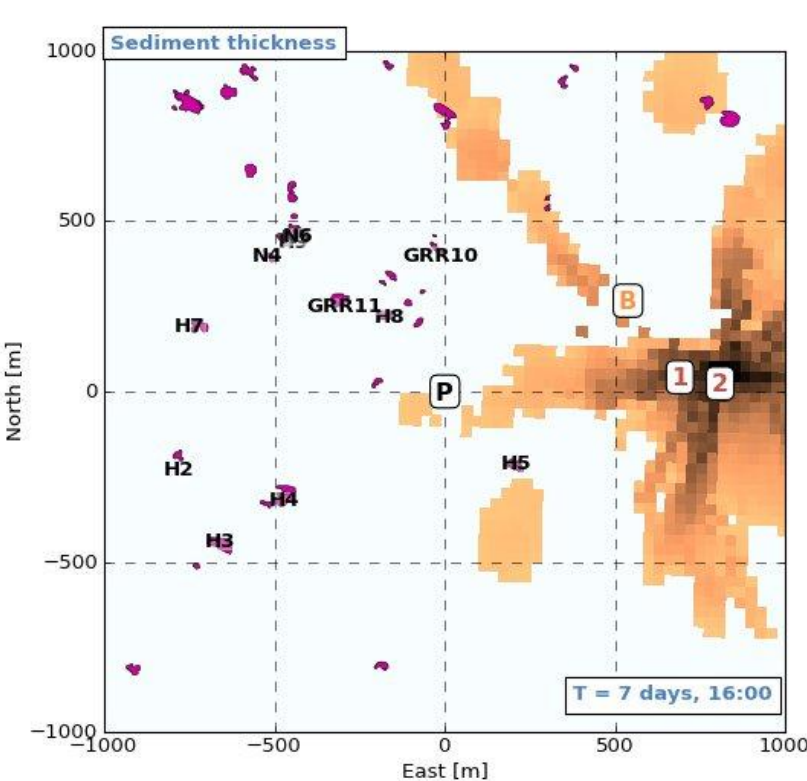
STATOIL

PRESENTASJON

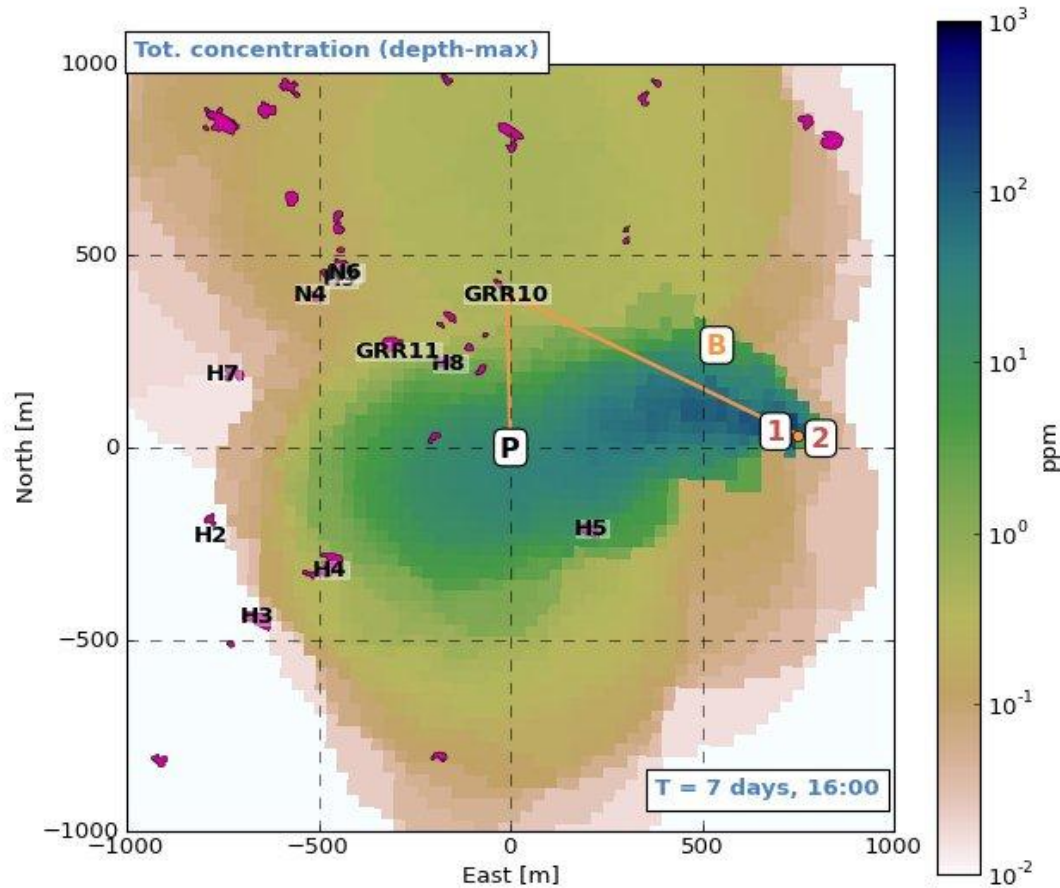


Sedimentation of cuttings/mud on the seabed (burial)

During (7 days) and past drilling operation (68 days)

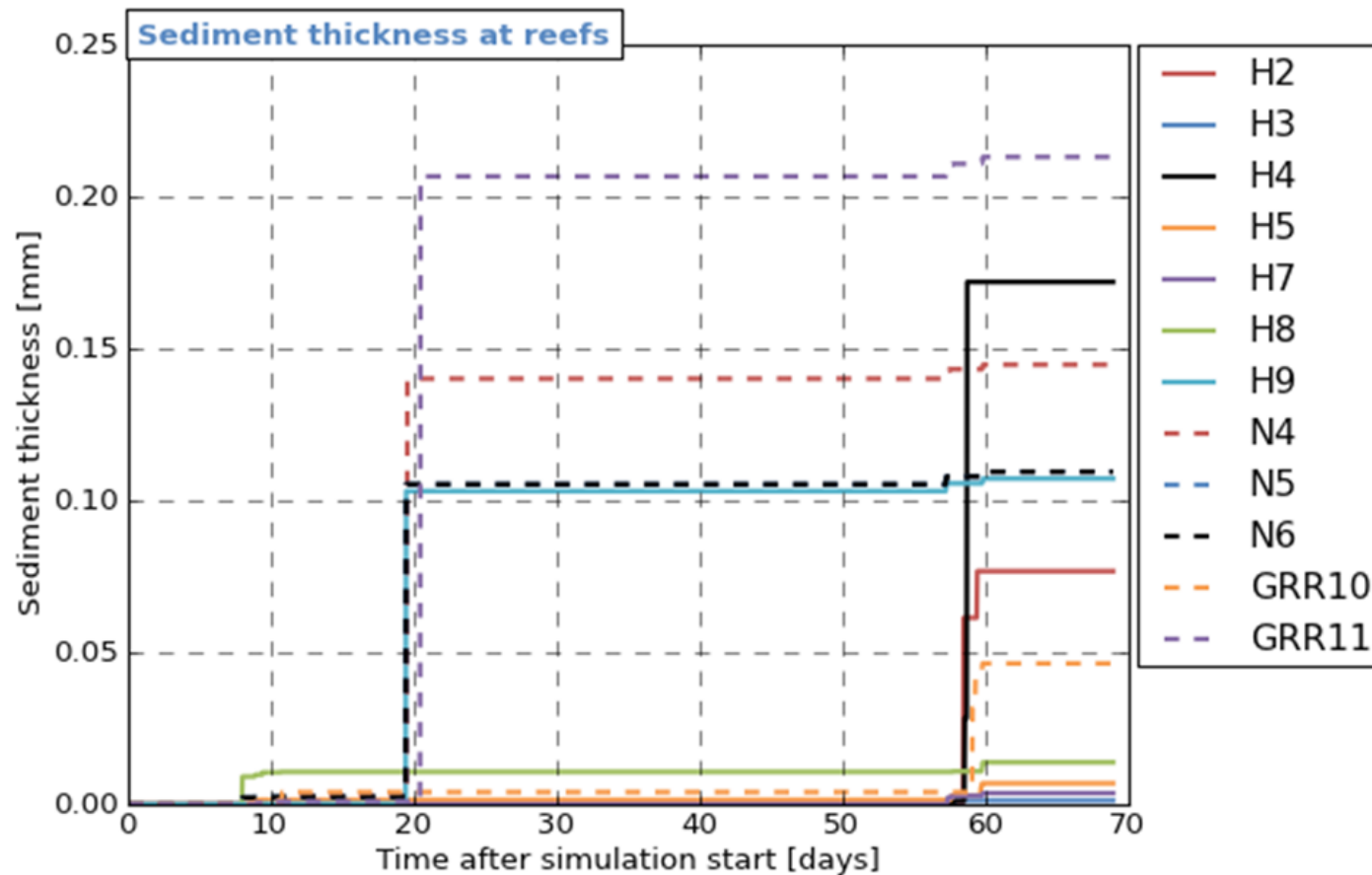


Maximum total concentration of suspended particles in the water column (coral exposure) during the drilling operation

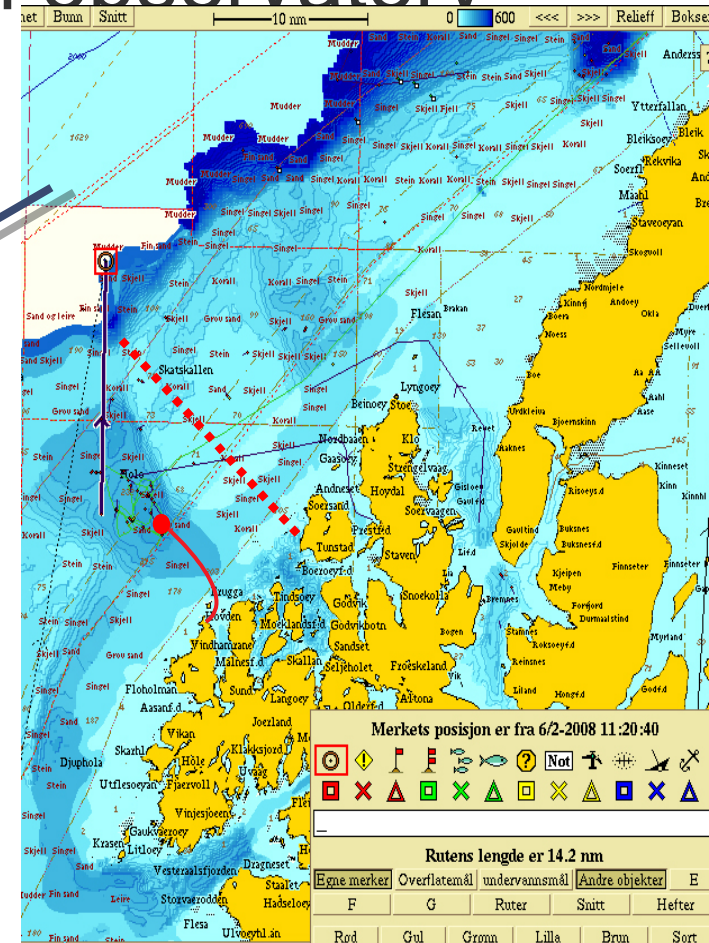


Sediment thickness (burial) at reefs

Past drilling operation



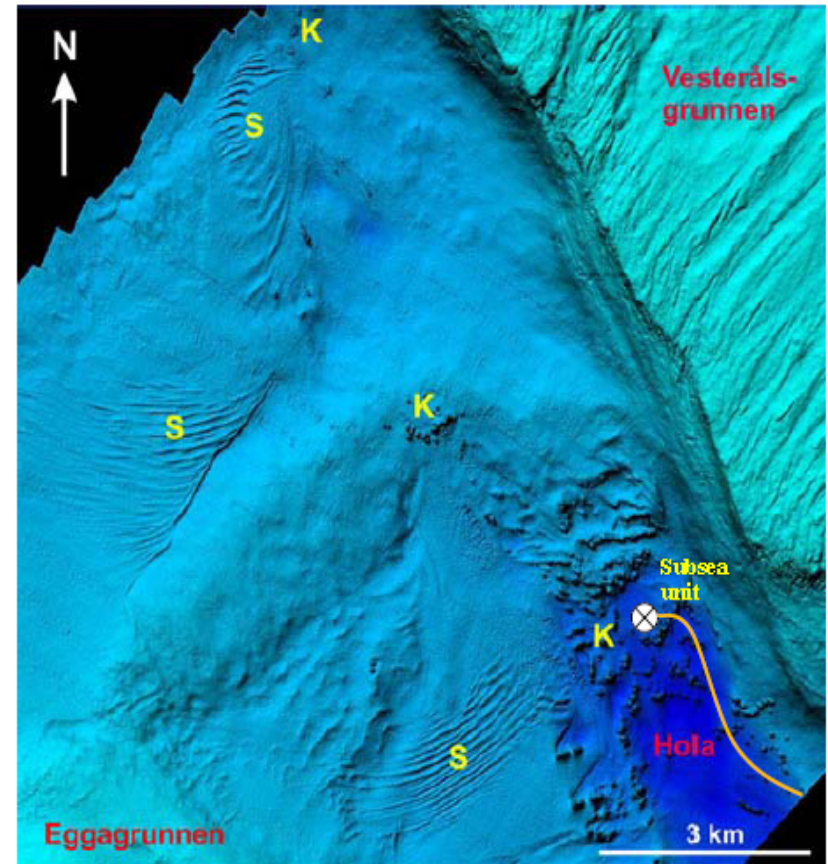
The Lofoten-Vesterålen Ocean observatory



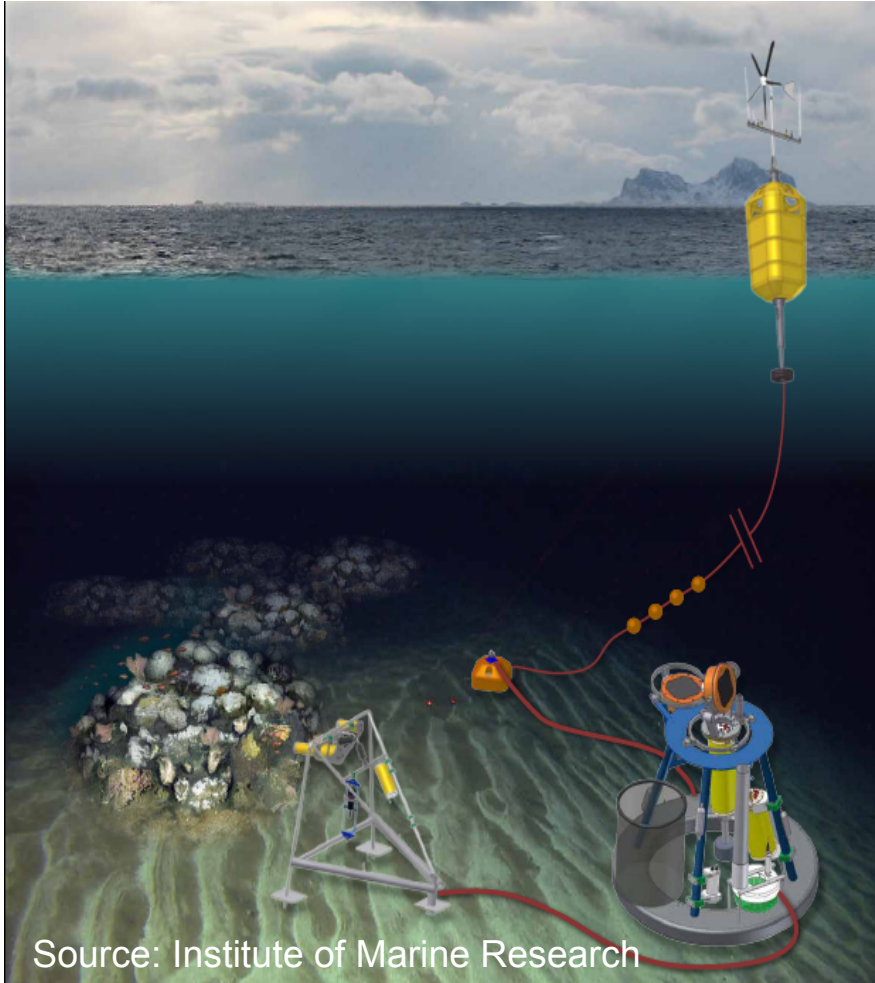
The LoVe Ocean Observatory – Background and History

Background and history:

- The area forms the ‘Gateway’ to the Barents Sea and Arctic
- Key area for spawning and transport of spawning products for fish
- Cooperation between Institute of Marine Research (IMR) and Statoil to increase knowledge about natural processes in the area
- Debate on opening of the area for oil and gas exploration



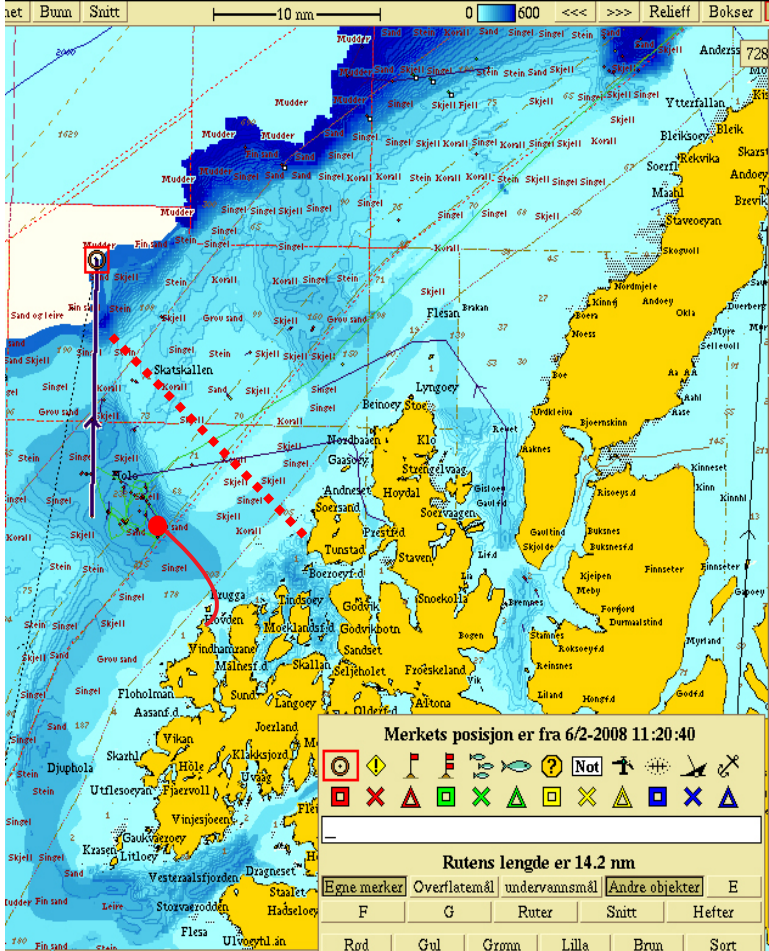
The LoVe Ocean Observatory 2010



- Deployment of a 'lander' outside Hovden (Bø in Vesterålen), 2010:
 - Continuous monitoring of biota and particles in water column
 - Monitoring of the Hola coral reef
 - Sound recording
 - Chemical, physical and oceanographic parameters
- Pelagic biota sampled in transect from coast to the Continental Shelf Edge to clarify presence, distribution and condition of cod eggs and larvae

LoVe Cabeled Ocean Observatory (2012-)

- Install a new ocean observatory at the same location as the previous
 - Fiber optic cable with power supply to Hovden
 - Potential for extension
 - Same sensor package as previous lander
 - Option for testing of new sensor systems



Summary

- Statoil will introduce real time data sampling as a basis for environmental monitoring of E&P activities
- The LoVe ocean observatory will be on line in 2013
- IEM technology is presently used in several operations to improve environmental performance
- The full IEM concept will be implemented for first use in 2016

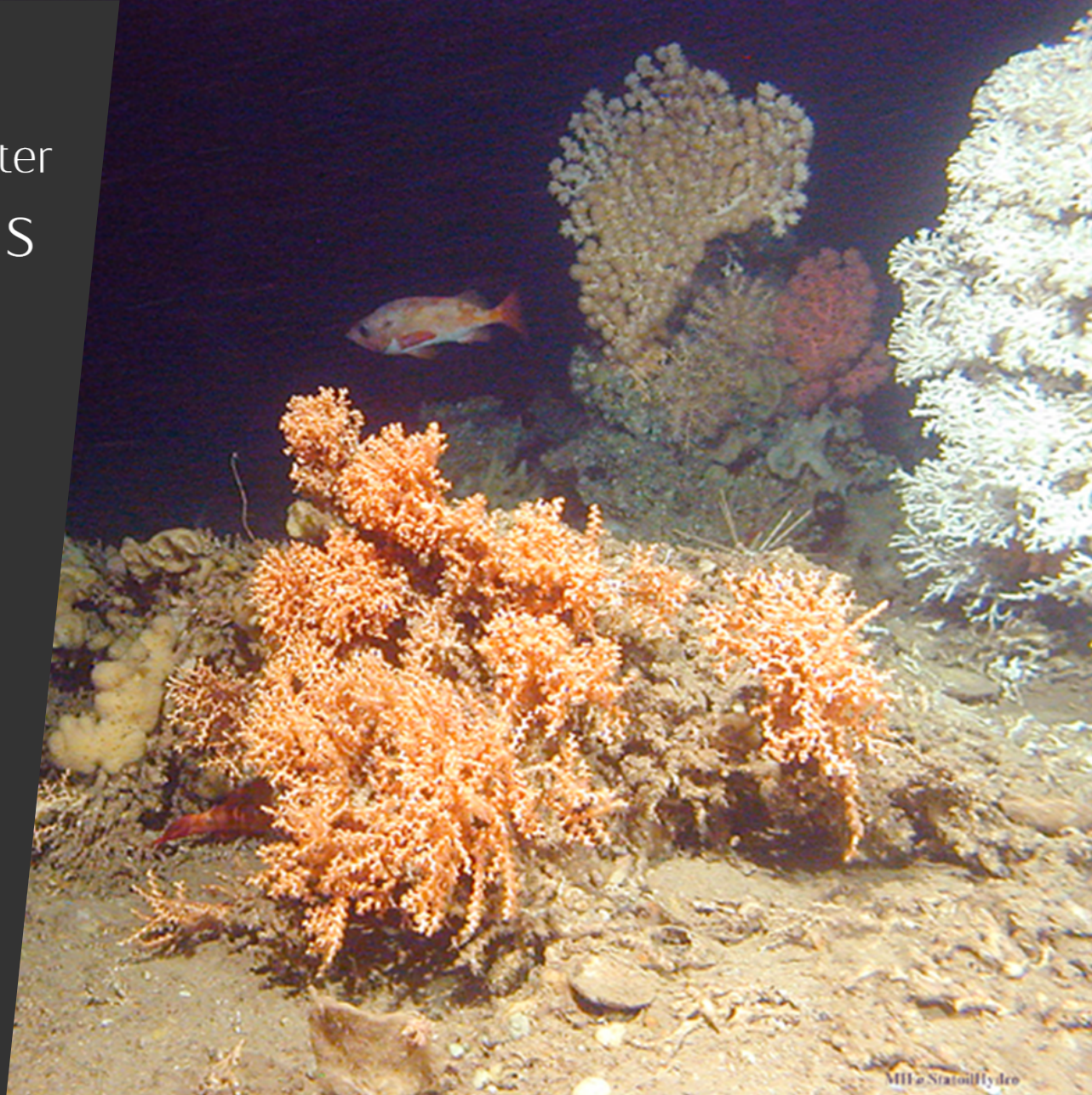


There's never been a better
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