Seabed mining: field testing of a nodule mining crawler

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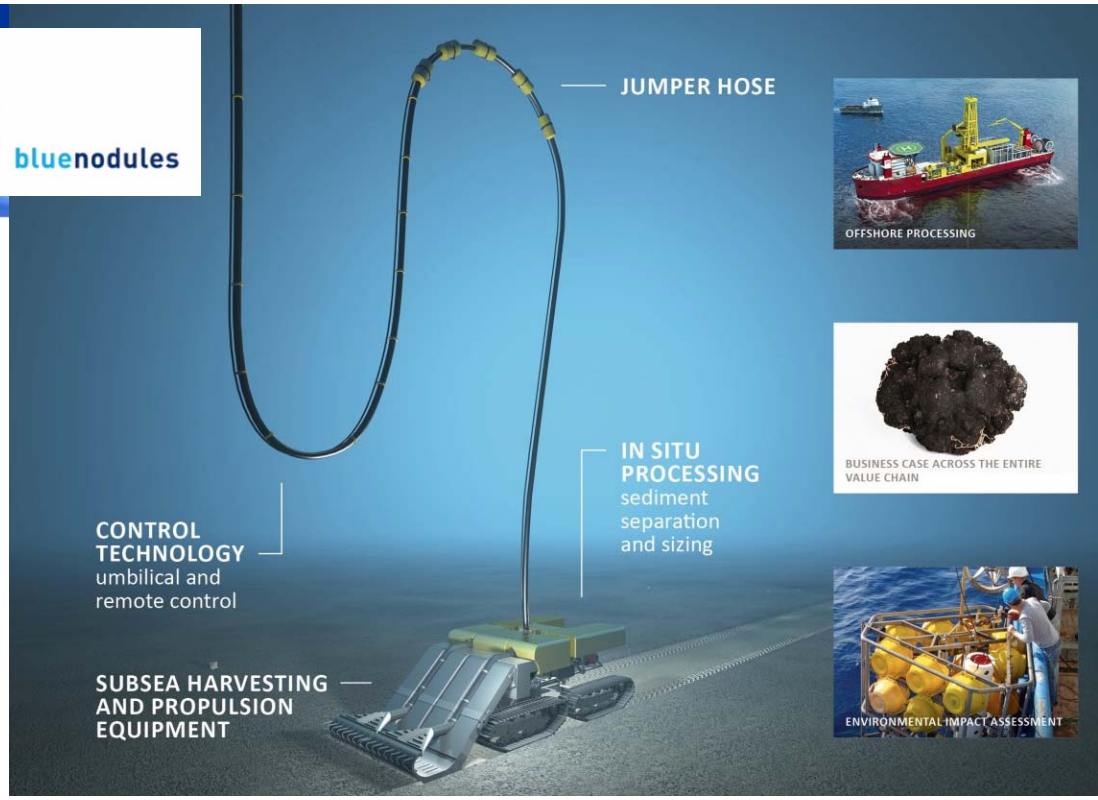
Polymetallic nodules in the Pacific. Picture: ROV Kiel6000, GEOMAR

Blue Nodules project

bluenodules



Objectives

- Harvesting of polymetallic nodules from the sea floor
- Depth 3,000 to 6,000 meters
- Develop the technology
- Minimize the environmental impact!

Project partners

Industry

IHC, IHC MTI, Dredging International, Continental, DE REGT MARINE CABLES

Research Institutes

NTNU, NIOZ, RWTH AACHEN UNIVERSITY, LAB, AARHUS UNIVERSITY

Service Supplier

seascape consultants ltd, BUREAU VERITAS, GSR, UNIRESEARCH

In collaboration with

VLIZ, CSIC, UTM

Funding by the EU Horizon2020 program

Focus on the recent test cruise

Location

- Not too deep
- Soft sediment
- Relatively flat
- Not too strong currents
- Good operational weather expectance

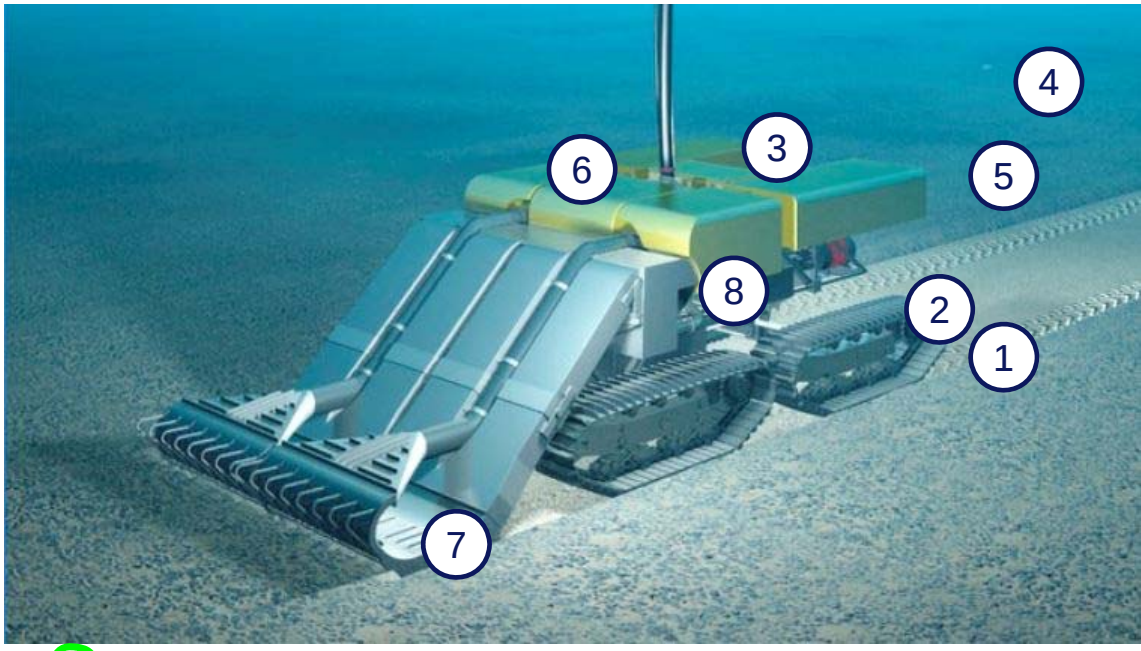
= = > Alboran Sea (Mediterranean)

Research vessel: *Sarmiento de Gamboa*, CSIC (Spanish Research Council)

Major goals field tests

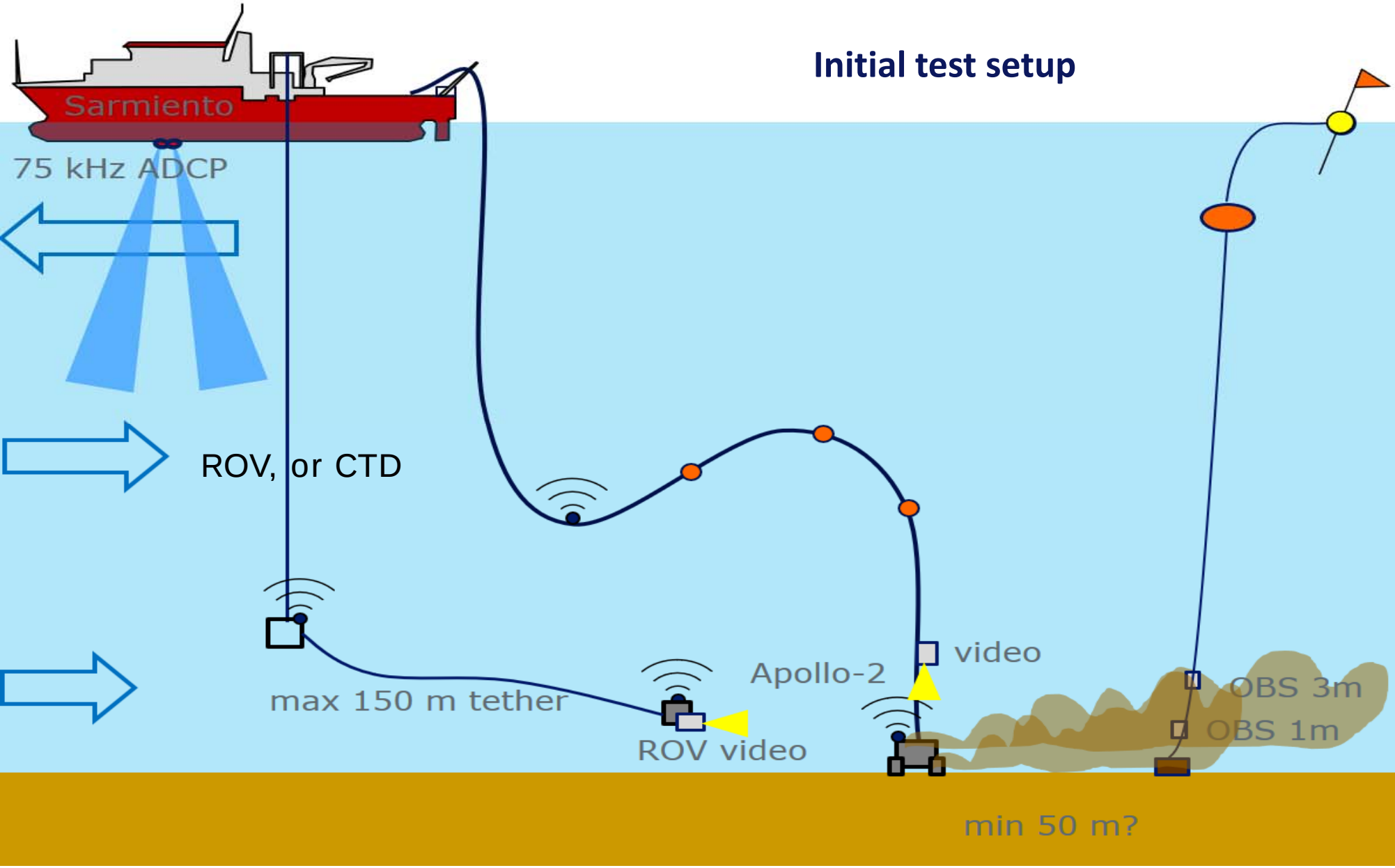
- Field testing of the mining crawler
  - Nodule collector, and
  - Propulsion system
  - Scale model!
- Measurements
  - Environmental impact
  - Sediment plume - - > size, shape, particle density
  - Tracks: compaction of sediment
  - Seabed: geotechnical parameters, vane shear test, bearing capacity/penetrometer, grainsize

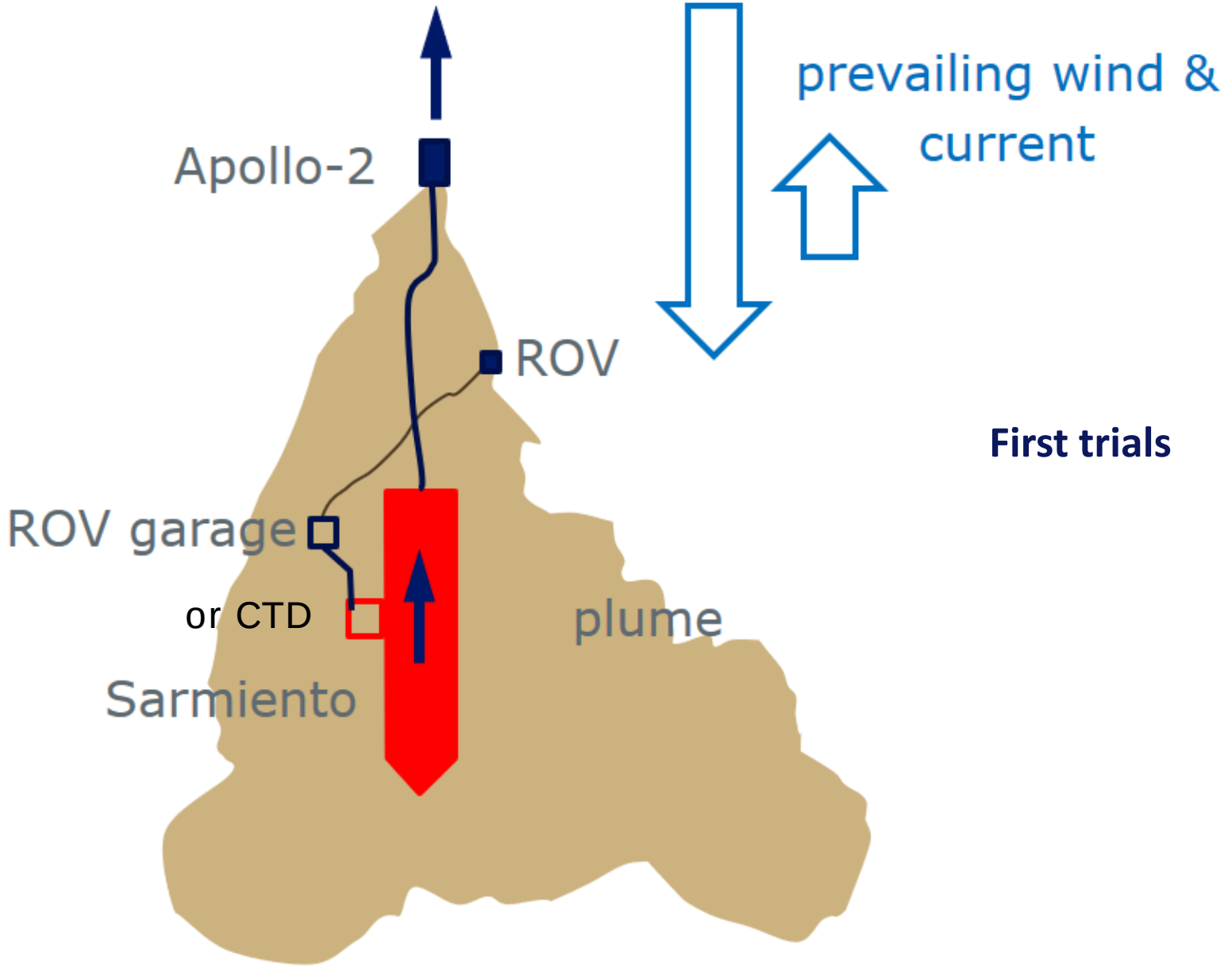
Environmental impact: the full picture



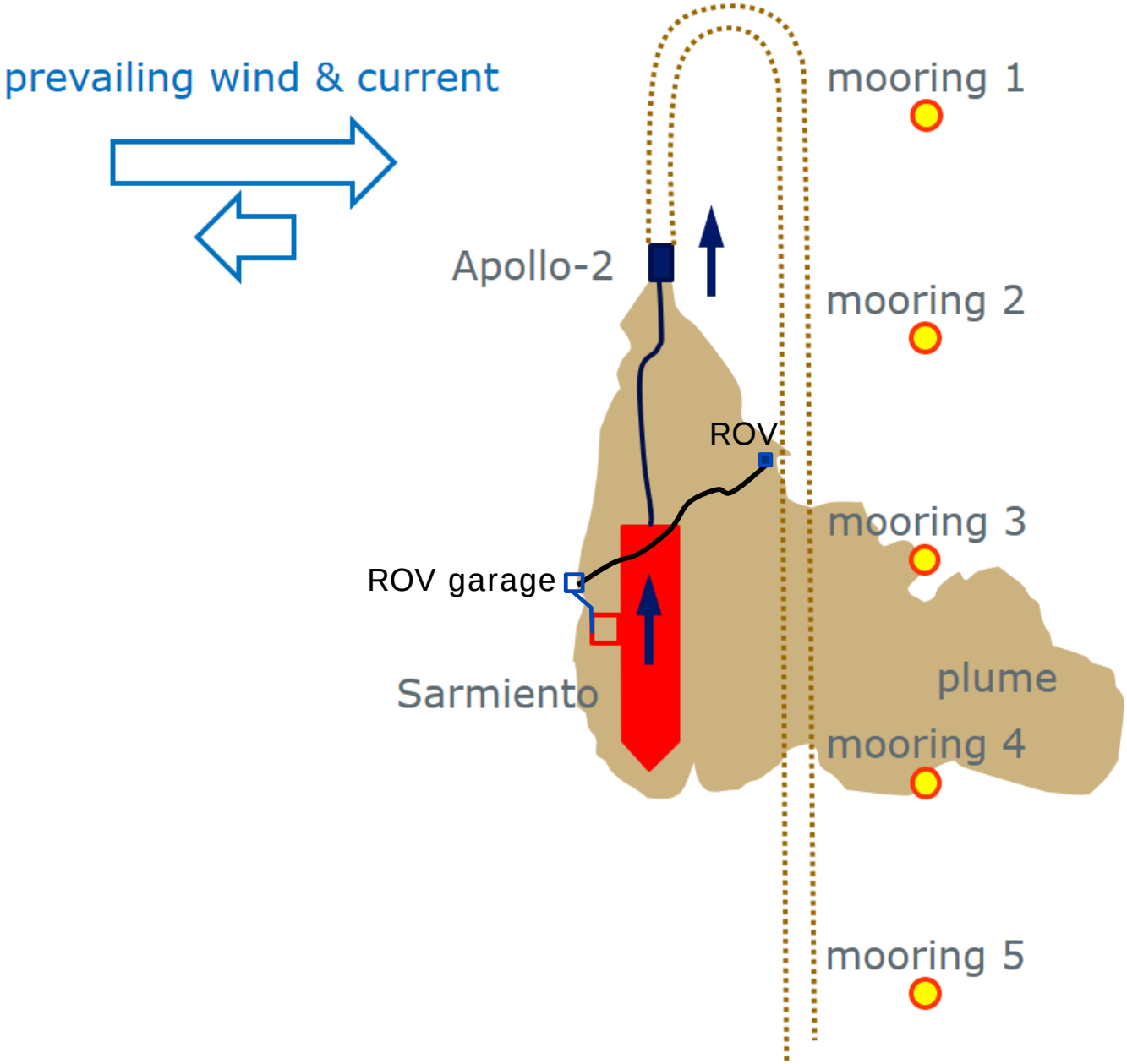
1. Sediment compaction
2. Plume by driving
3. Plume by separation
4. Plume by tailings
5. Smothering
6. Underwater noise
7. Removal of hard substrate
8. Risk of oil leakage

Initial test setup

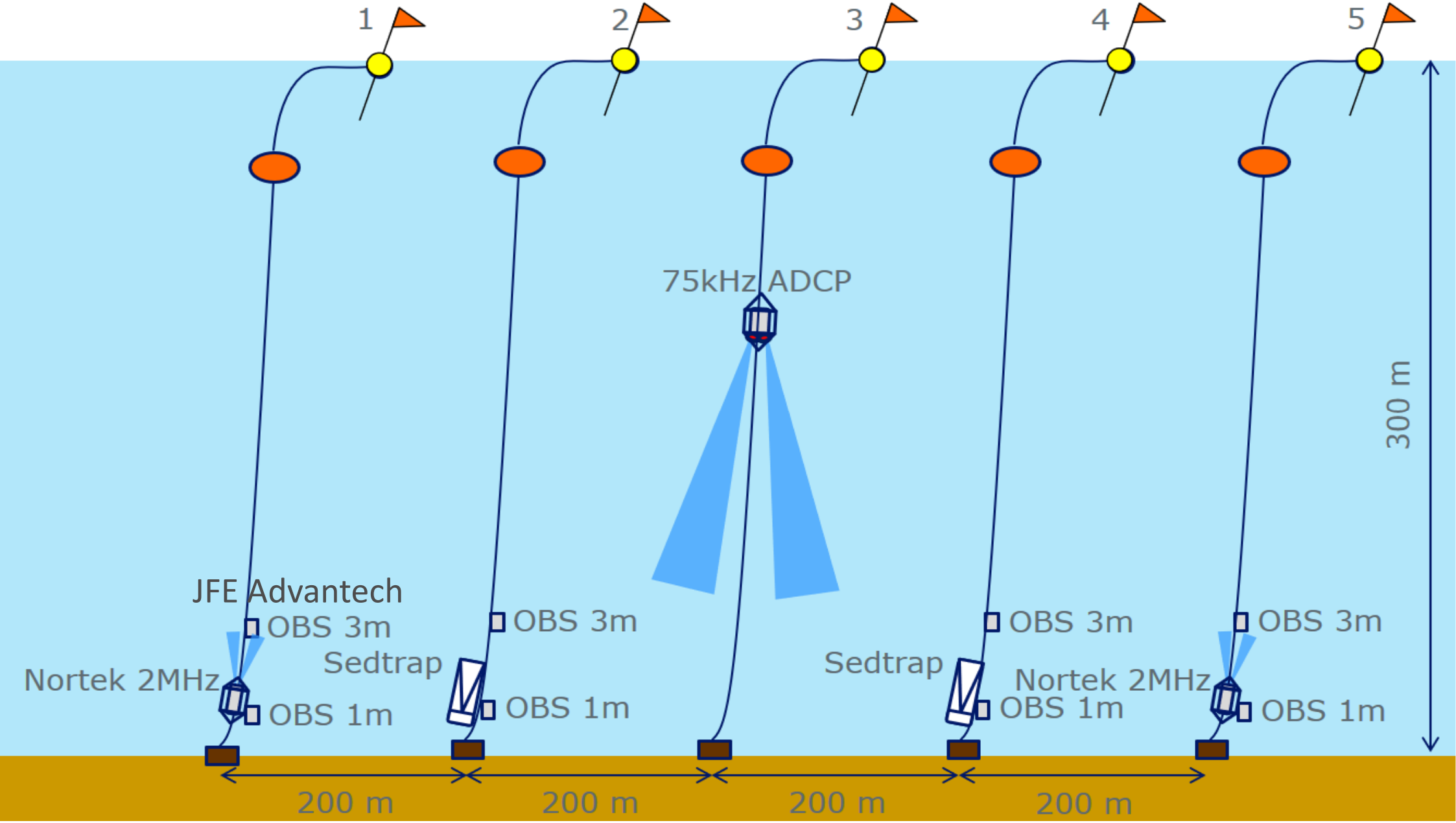




First trials



Final test setup


1
2
3
4
5
75kHz ADCP
300 m
JFE Advantech
OBS 3m
Nortek 2MHz
OBS 1m
Sedtrap
OBS 3m
OBS 1m
Sedtrap
OBS 3m
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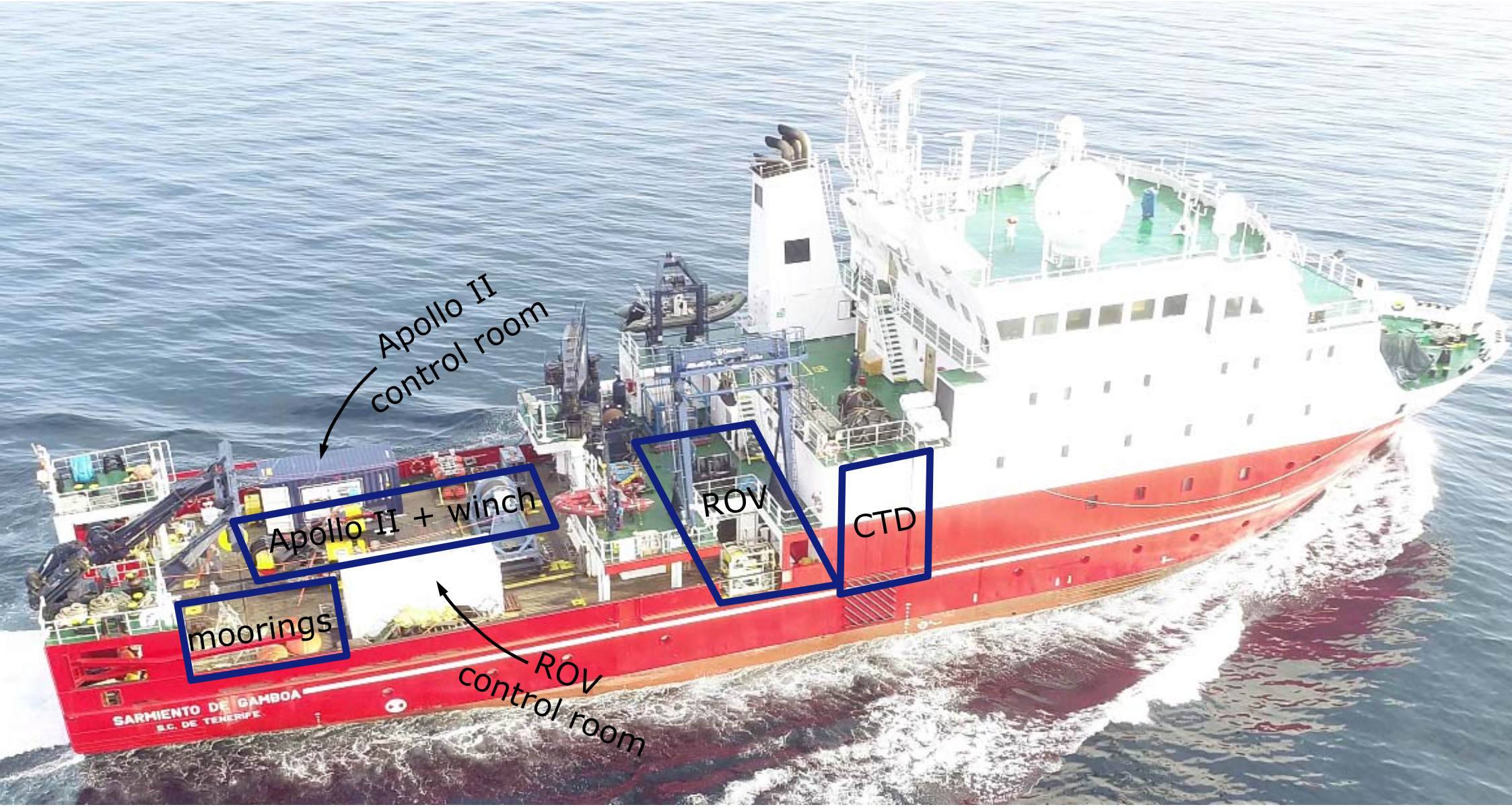
Apollo II
control room
Apollo II + winch
moorings
ROV
CTD
ROV
control room
SARMIENTO DE GAMBOA
S.C. DE TENERIFE

Moorings

- Precise location
- Anchor first
- Recovery including anchor

- Video guided box coring
- Bearing capacity (penetrometer)
- Vane shear test
- Grain size distribution

- Lessons learned
  - Working with the ROV, Apollo and the moorings together went very well
  - Spatial awareness is key, and needs continuous attention
  - Need for many USBL beacons
  - Redundant systems
  - Use of an ROV was indispensable
- Next trial: use of an AUV

VIDEO

- **Question to you**: ideas or suggestions for alternative approaches?

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