Universität Bremen

marum

Deepwater robotic platforms at Marum, Universität Bremen

Volker Ratmeyer, G. Meinecke, C. Waldmann, T. Freudenthal

Marum – Facility installations

2 Technology Halls

Test Basin

Workshop

Marum – Facility installations

High Pressure Test Facility

730 bar

780 l Volume

Marum – Facility installations

500 kVA Diesel Generator

ca. 50 Containers

Termination Boxes

(div. Special-Container)

Marum – Facility installations

15t Fork Lift

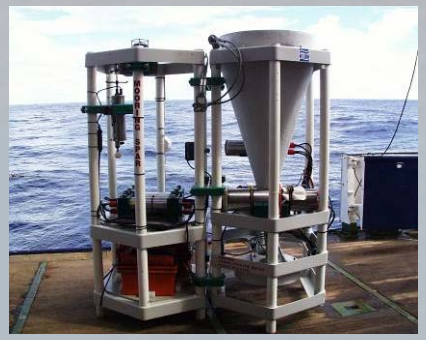
3t Fork Lift

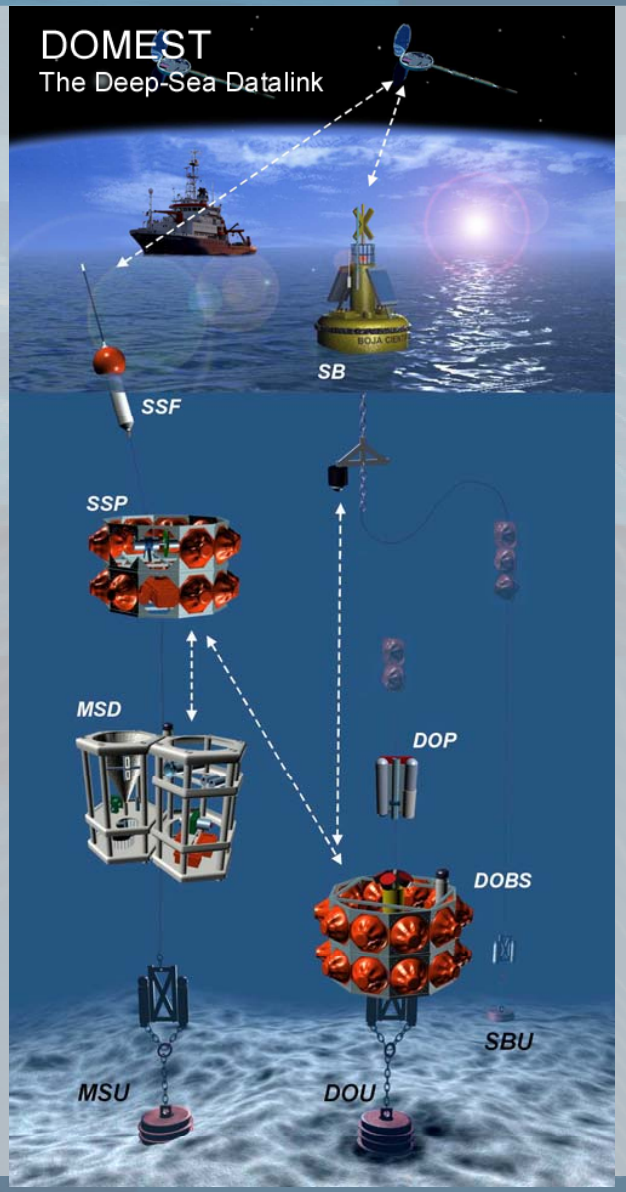
div. Handling Gear

Technology: Scientific moorings

DOMEST / DOLAN mooring

with online data access, 1996 - 2008





Remotely Operated Vehicles (ROVs)

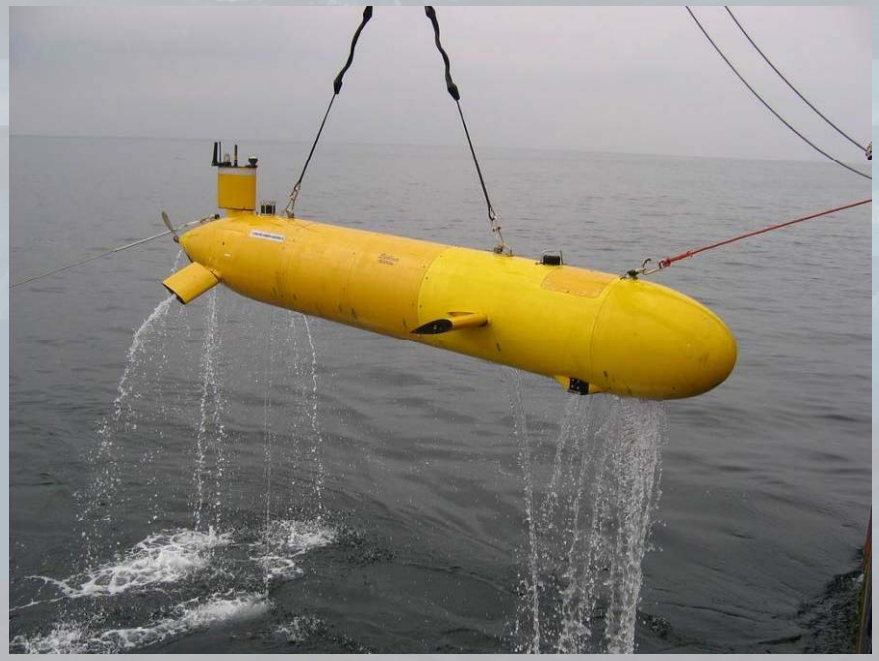
CHEROKEE

1000 m, inspection class ROV
2001 - present
(N. Nowald)

QUEST 4000

4000 m heavy workclass ROV
2003 - present
(V. Ratmeyer)

Autonomous Underwater Vehicles (AUVs)

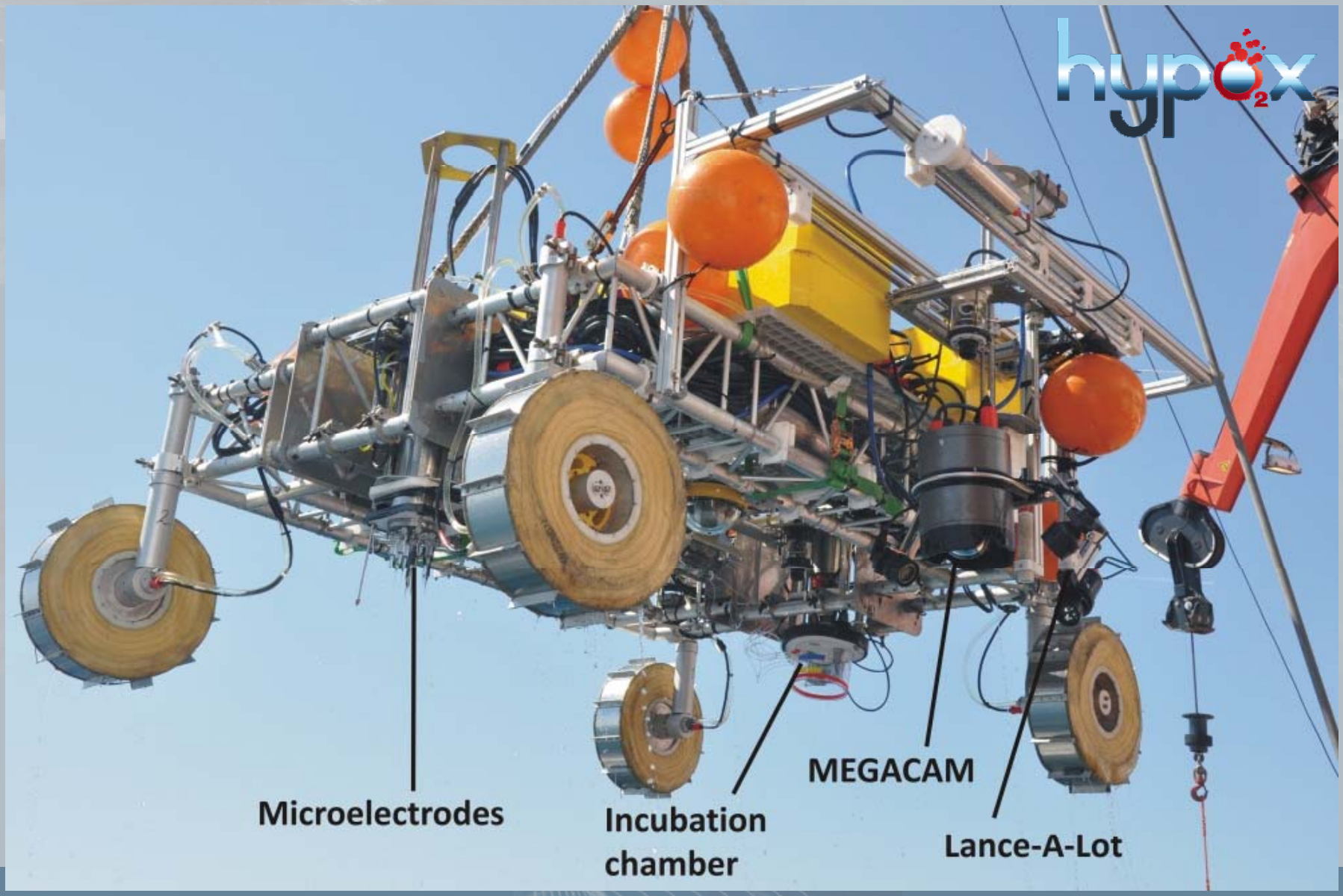


Bremen – SEAL 5000 m

Long range mapping AUV
2007 - present
(G. Meinecke)

MOVE moving lander

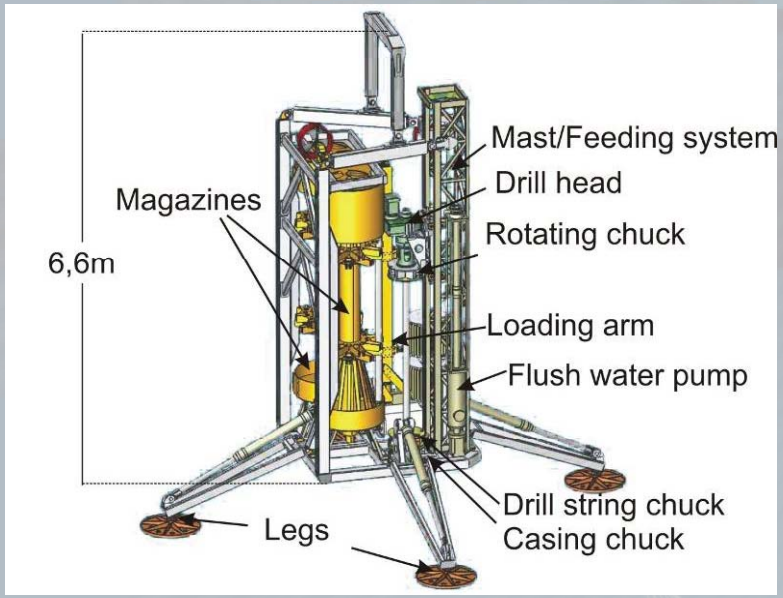
In-house development, 6000 m
2000 - present
(C. Waldmann)

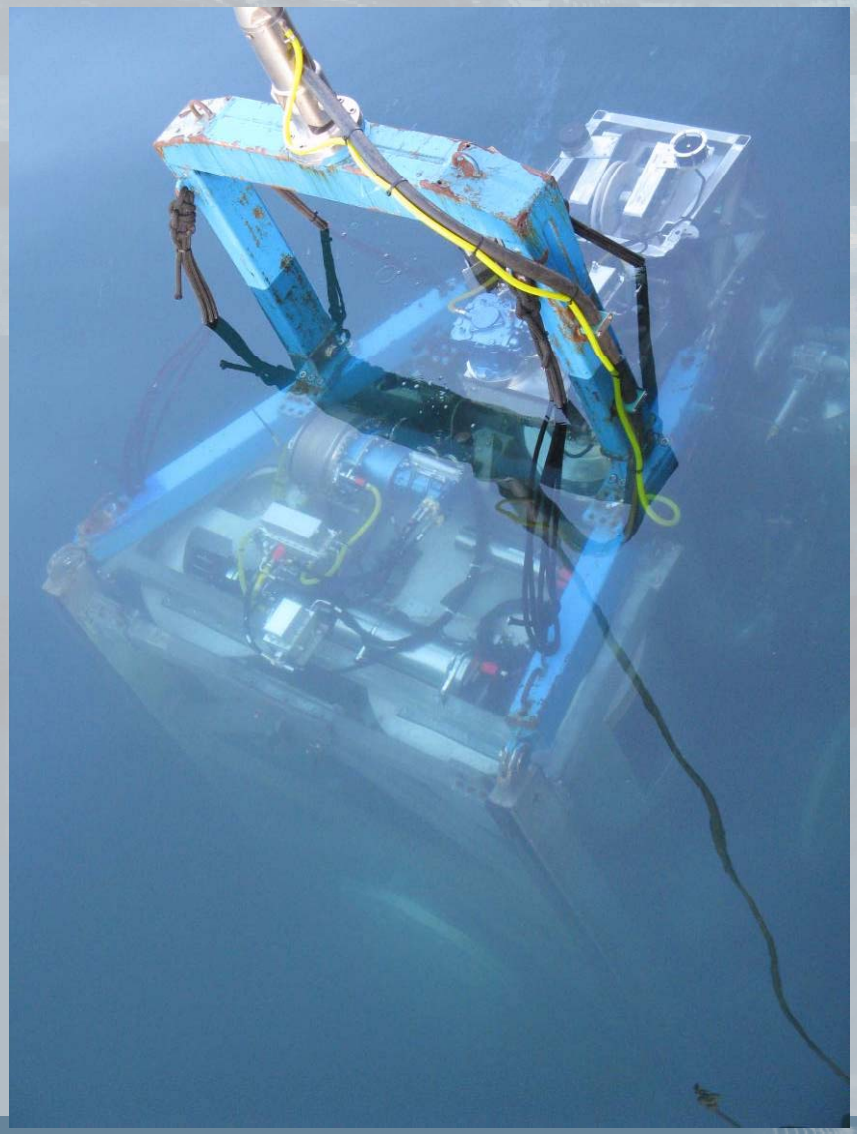

hypox
Microelectrodes
Incubation chamber
MEGACAM
Lance-A-Lot

Remotely Operated Drill

MeBo
„MeeresBodenBohrgerät“

2000 m heavy seafloor drill
2005 - present
(T. Freudenthal)





Marum SD (K. Huhn)

MSM15/3: off Sicily

Hiev: Tirpitzhafen

SO211 ChiMeBo (D. Hebbeln)

SO211: off Chile

MeBo - Remotely Operated Drill

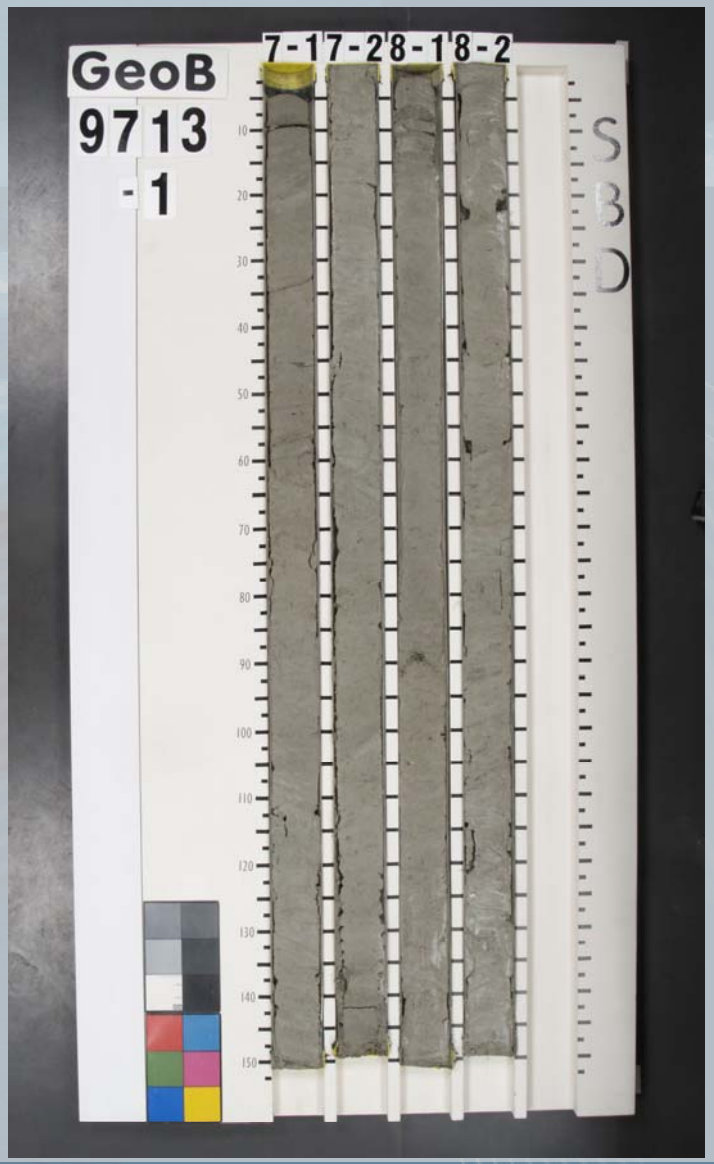
Specifications

- deployment depth up to 2000 m
- drill depth 70 m
- core diameter 55/63 mm
- sampling of soft sediment and hard rock
- transport in 20‘ container; weight 9.5 t

Expeditions

- 06/2005: Ponton, Baltic Sea
- 08/2005: RV METEOR, NW Afrika
- 12/2005: RV CELTIC EXPLORER, Baltic Sea
- 07/2006: RV CELTIC EXPLORER, NE Atlantic
- 02/2007: RV MARIA S. MERIAN, NW Africa
- 05/2008: RV METEOR, off Namibia
- 08/2008: RV CELTIC EXPLORER North Atlantic

- 06/2009: RV METEOR, western South Atlantic
- 2010: RV M.S. MERIAN Black Sea



Operational Availability

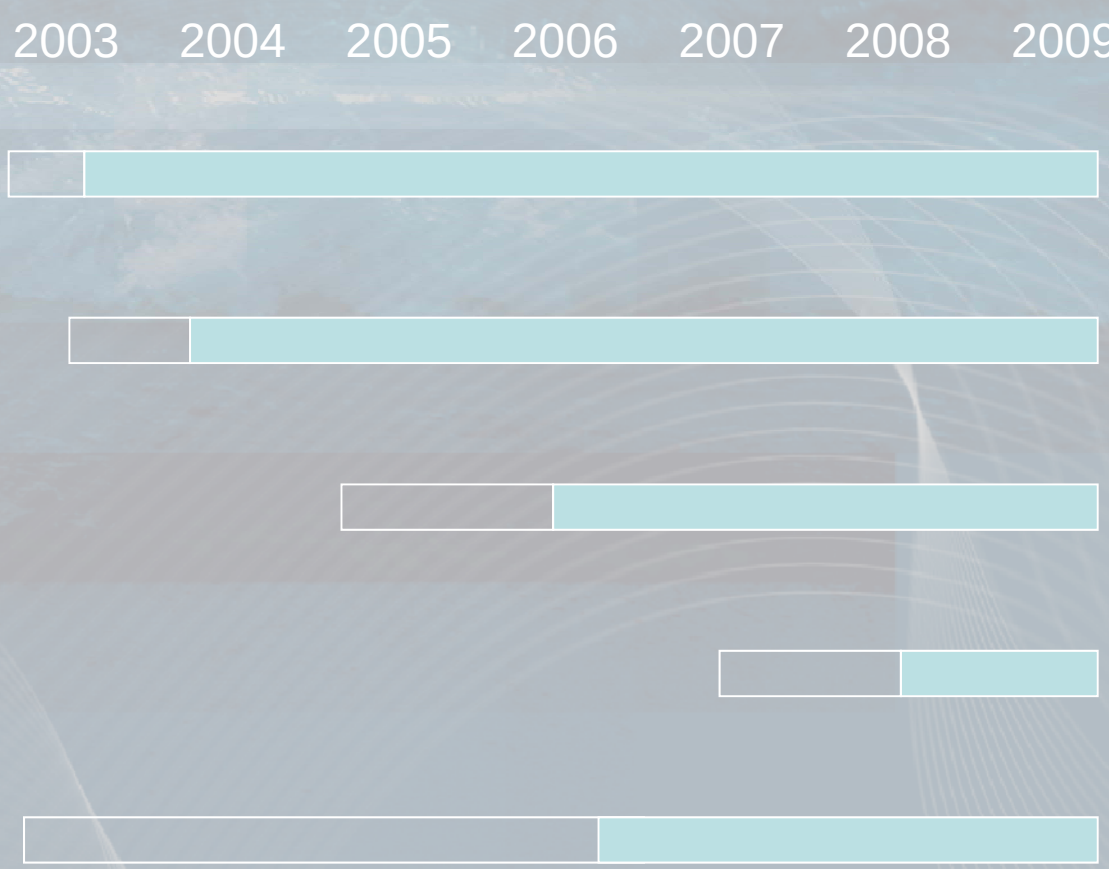

Cherokee

Quest

MeBo

SEAL

MOVE



Research Vessels

i.e. 96 m research vessel RV METEOR
worldwide operation and logistics

QUEST System aboard german vessels

Adapted
to german science vessels:
RV Meteor
RV Polarstern
2008: RV Sonne
2009: RV M. S. Merian

„only“ 45t gross weight

deployed in free flying mode

Operational Team:
8 Persons

Operational Requirements

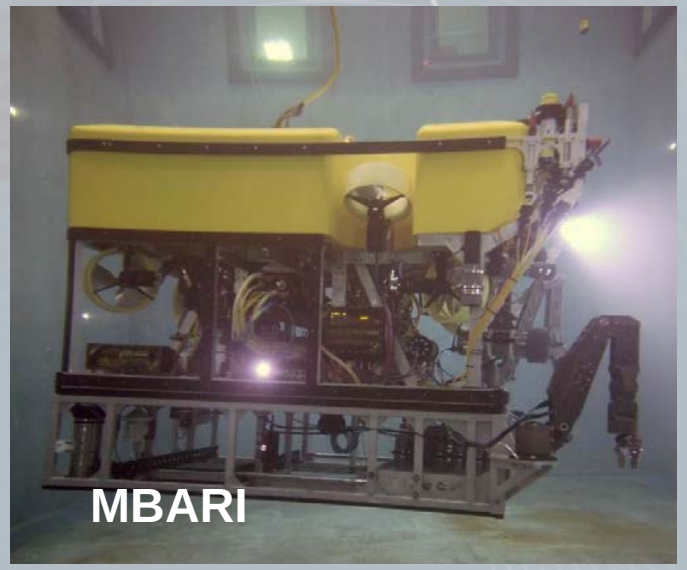
Operational Requirements

A-frame operation:

- **even on large vessels „turn of AUV necessary, due to lack of A-frame high“**
- **more security for AUV instead side-operation**

Today: adapted industrial ROVs

Others planned:
Spain
Greece



QUEST: Electric power and propulsion

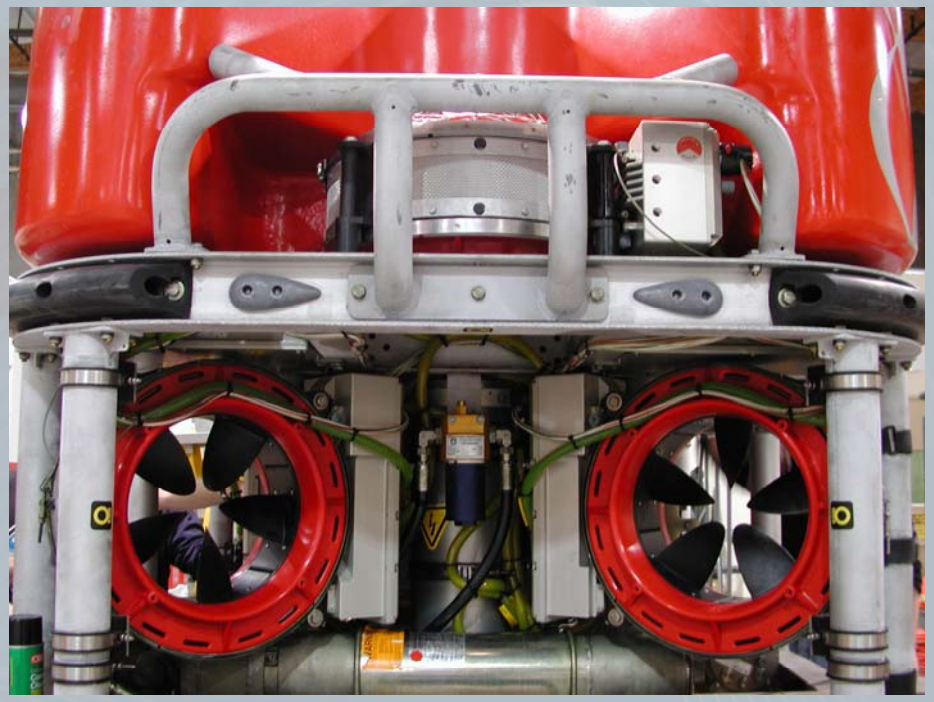
7x 11 kW ring motor,
500lbs @ 600 VDC

Vector matrix arrangement
Precise control

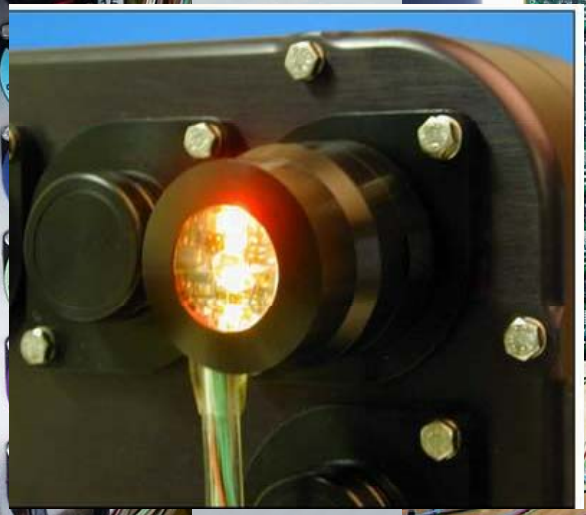
Power transmission:

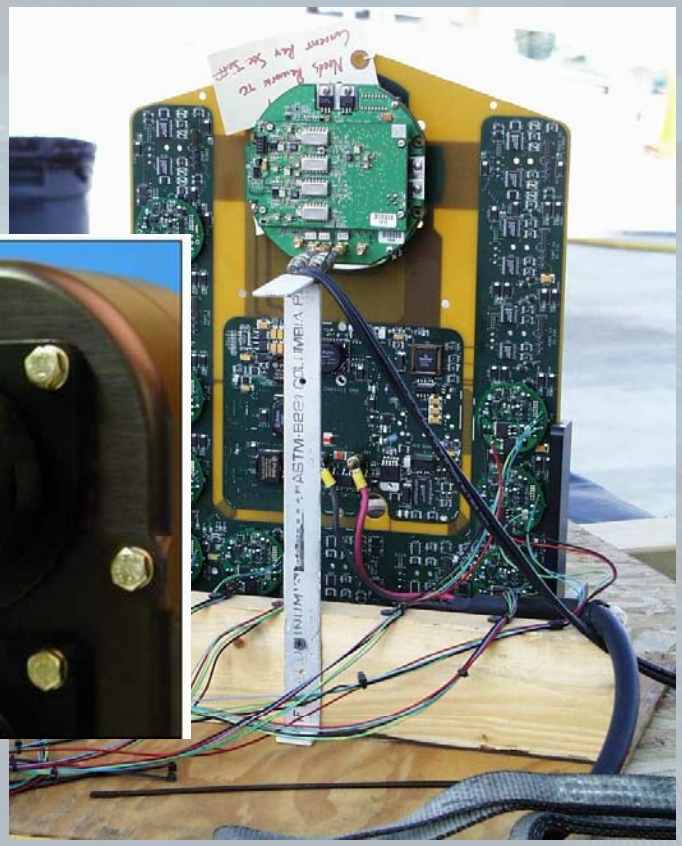
60 kW
3300VAC @ 400 Hz

downside small dimension



Schilling telemetry and control





Telemetry via 1 SM fibre
4 SeaNet Nodes provide
64 transparent data channels
16 simultan. video channels

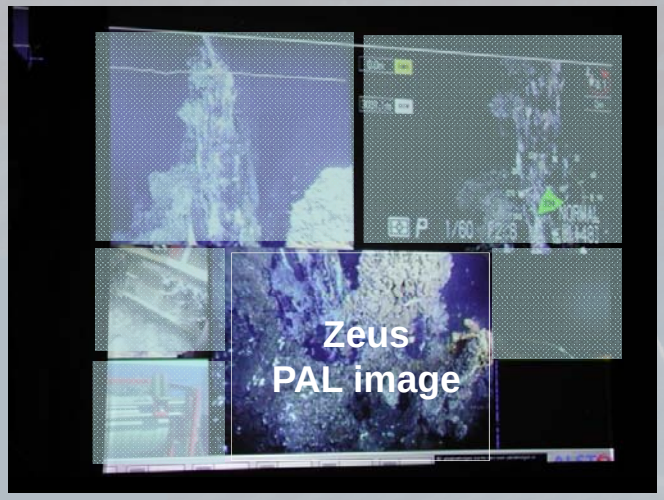
Reduction of complexity:
only 4 unique PCBs, almost no internal wiring, seperately pressure compensated

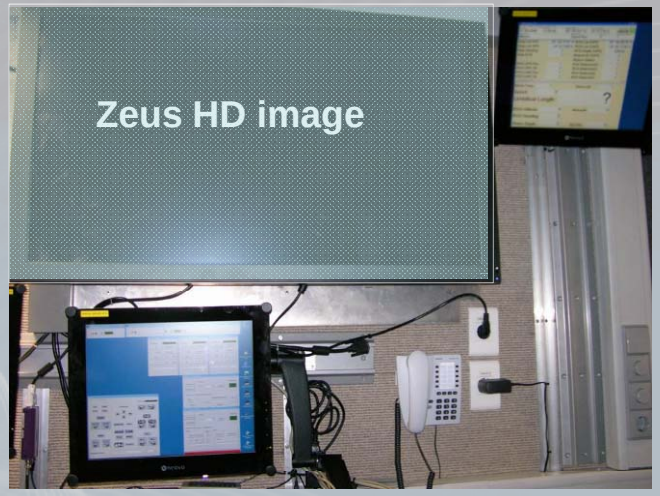
High Quality Imaging: HDTV

-3CCD HDTV Zeus camera

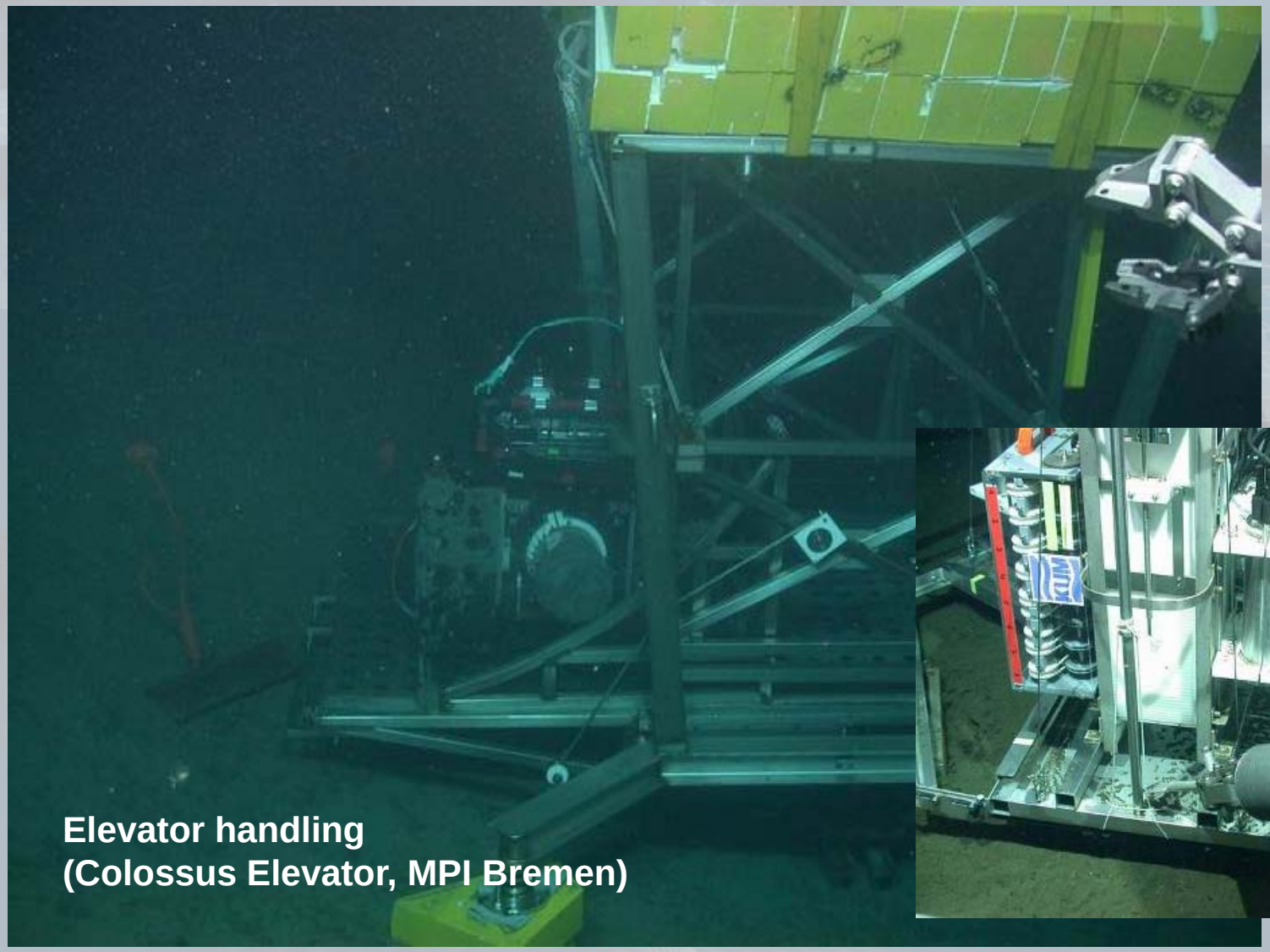
- 1st deployment during M70-1
- ultrahigh video resolution 1920 x 1080 Pixel @ 59.94 Hz interlaced, 16:9 widescreen

- *„expensive camera / lighting setup“*
- **Low backscatter, crisp imagery**





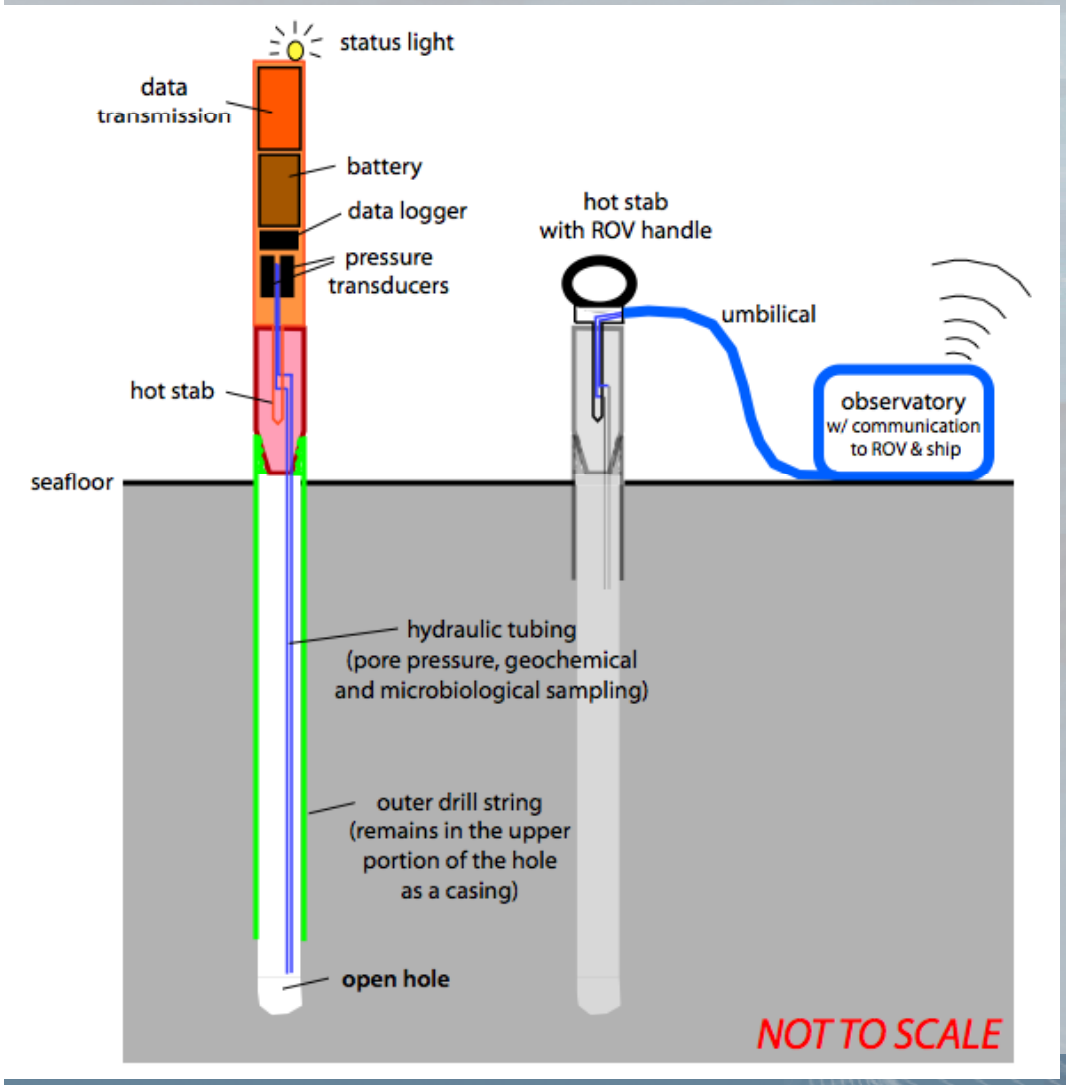
ROV Applications: „Scientific Intervention“



Elevator handling
(Colossus Elevator, MPI Bremen)

Instrument deployment and control

Construction and deployment of a MeBo CORK observatory



- design and build simple observatories w/ pore P and T measurement for deployment in landslide-prone areas (e.g. Mediterranean, Japan, gas hydrate-bearing margins, e.g. Fram strait, etc.)

- develop solutions for pore water sampling, osmo-driven microbiology chambers, and other extensions to collaborate with research area GB

- develop communication means to allow data retrieval from ships of opportunity

Needs for training and innovative control

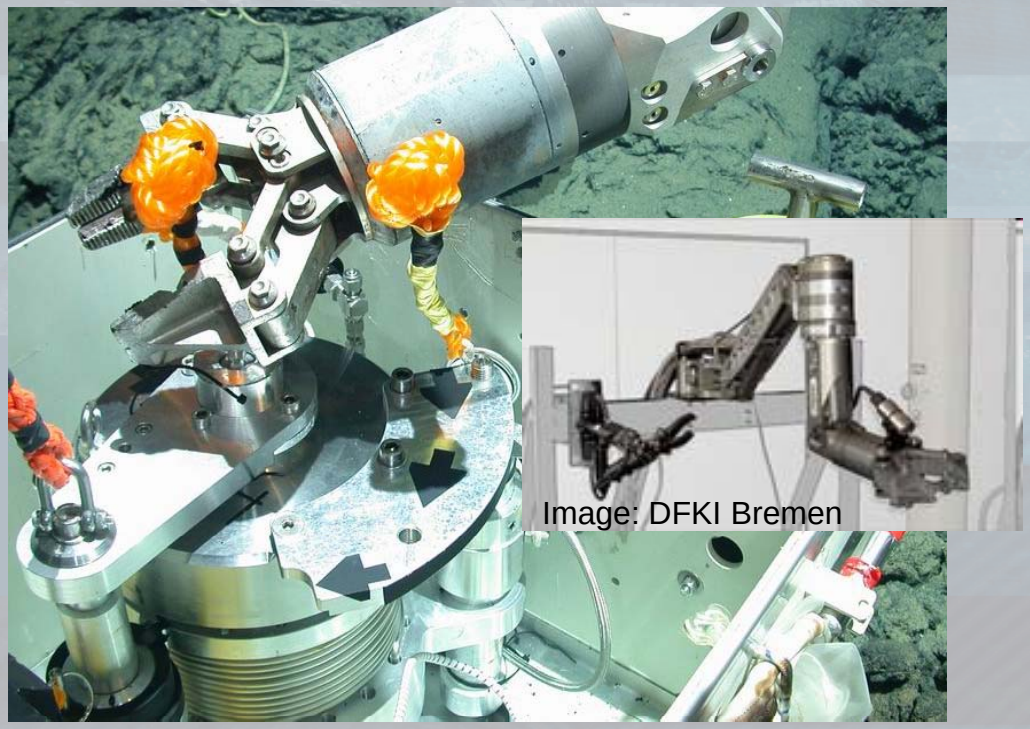


Image: DFKI Bremen

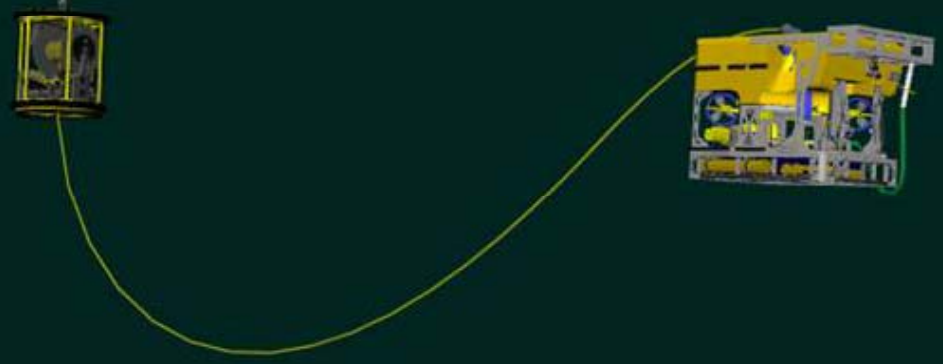
„Augmented“ control of ROV tools
(i.e., utilize C-Manip? for defined environments)

Setup dry training facilities
(for pilots, scientists and engineers)

Simulation

- Develop and test oprational procedures

- Test 3D models of deployments in advance of expeditions



- scientists training: sonar, orientation, handling of instruments, dive planning