Scientific Ocean Drilling
with **Mission-Specific Platforms** and **Chikyu**

ECORD Science Operator

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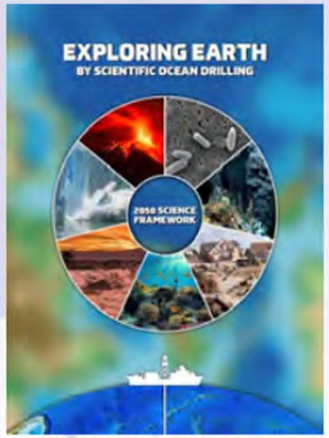
Operational options for offshore drilling: mission-specific platforms

British Geological Survey · marum · University of Bremen · EPC European Petrophysics Consortium · University of Leicester · Université de Montpellier · Géosciences Montpellier

2024 | 2025 | 2026 | 2027 | 2028 | 2029

IODP
INTERNATIONAL OCEAN DISCOVERY PROGRAM



USA

Globally-ranging 'fixed' platform

?

Globally-ranging platforms operated on an MSP mode

ECORD

ECORD
EUROPEAN CONSORTIUM FOR OCEAN RESEARCH DRILLING

JAPAN

CHINA

ANZIC

INDIA

IODP Mission Specific Platforms 2004-2023

Greatship Manisha
X347, 2013
Baltic Sea

Vidar Viking
X302, 2004
Central Arctic

L/B Kayd
X313, 2009
New Jersey Shelf

TBD, X406, 2024
New England Shelf

Dina Polaris
X377 (cancelled, 2022)
Central Arctic

TBD
X389, 2023
Hawaii

L/B Myrtle
X364, 2016
Gulf of Mexico (Chicxulub)

RRS James Cook
X357, 2015, Central North Atlantic

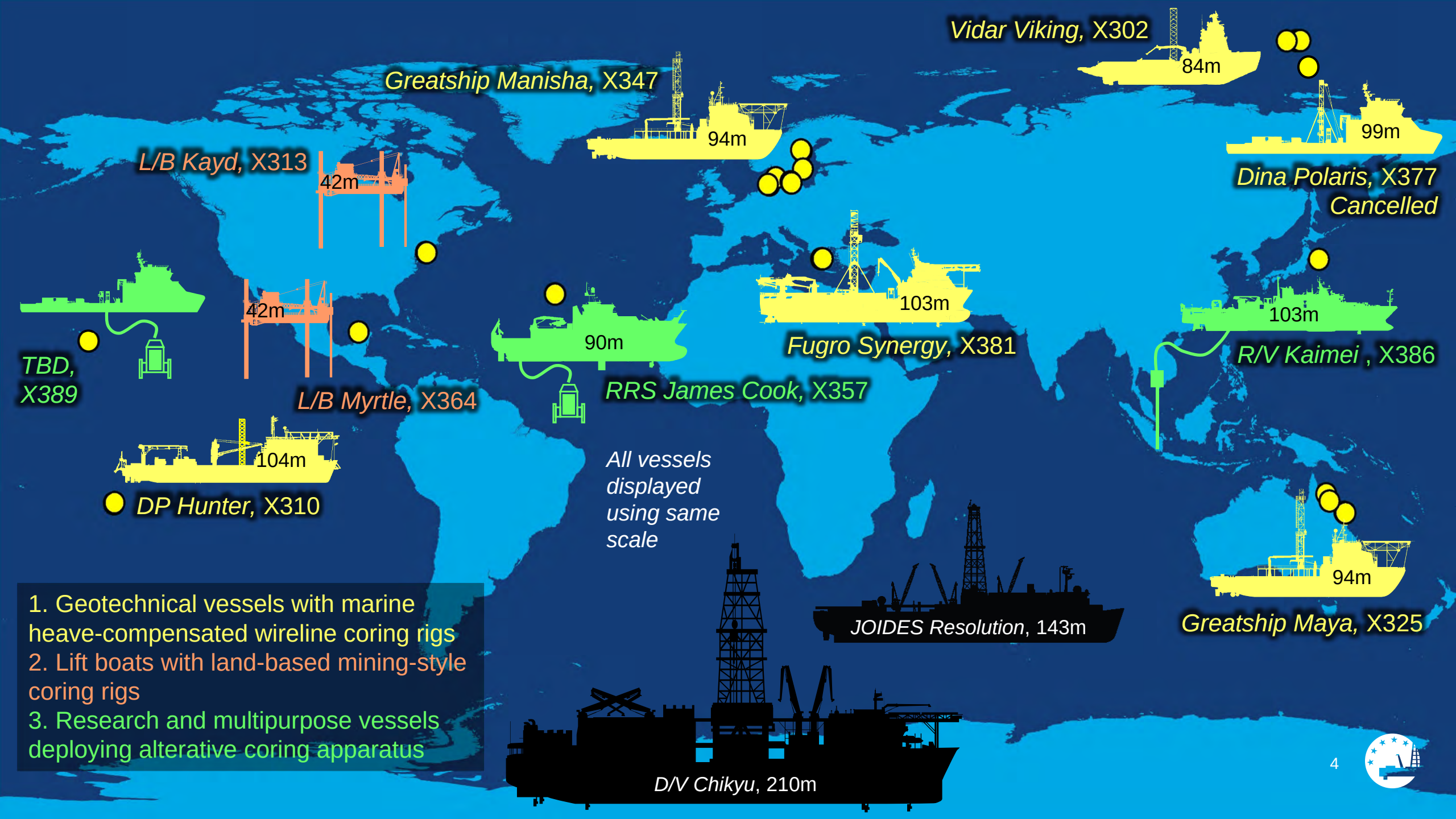
Fugro Synergy
X381, 2017
Gulf of Corinth

R/V Kaimei, X386, 2020 - 2022
Japan Trench

DP Hunter
X310, 2005
Tahiti

Greatship Maya
X325, 2010
Great Barrier Reef

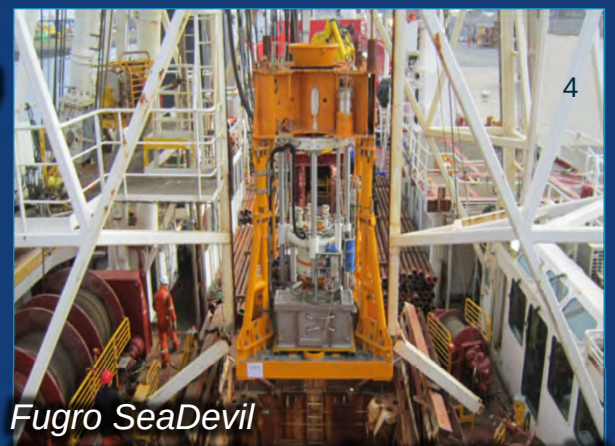
Photo credits: 1 Eileen Gillespie / 2 David McInroy / 3 Chris Lowery / 4 NOC / 5 Michael Rubis, Fugro Marine Services / 6 JAMSTEC / 7 ECORD-IODP / 8 David Smith / 9 Geoquip Marine. 1-3 & 8 also ECORD-IODP.


Vidar Viking, X302
84m
Greatship Manisha, X347
94m
99m
Dina Polaris, X377
Cancelled
L/B Kayd, X313
42m
42m
103m
103m
90m
Fugro Synergy, X381
R/V Kaimei , X386
TBD,
X389
L/B Myrtle, X364
RRS James Cook, X357
104m
DP Hunter, X310
All vessels displayed using same scale
94m
Greatship Maya, X325
JOIDES Resolution, 143m
D/V Chikyu, 210m
1. Geotechnical vessels with marine heave-compensated wireline coring rigs
2. Lift boats with land-based mining-style coring rigs
3. Research and multipurpose vessels deploying alterative coring apparatus

Geotechnical / multipurpose vessel deploying marine heave-compensated wireline coring

- Min water depth: ~20 m (determined by platform)
- Typical pipe deployment (water + penetration):
  - 2000 m typical (determined by coring apparatus) ($)
  - 3000 m for larger geotechnical vessels ($$)
  - 10-11 km for deep-water drill ships ($$$$)

- Easily moveable between sites
- No need for extra survey(s) to land legs and elevate
- Good market availability
- Can transit globally when budget allows
- Effective heave compensation required
- Seabed templates becoming more sophisticated



- Core diameter: 61 - 64 mm
- Typical coring rate: 50 m /day
- Typical open hole rate: 80 m/day
- Supports full downhole logging
- Supports borehole instrumentation

Photo credits: 1 David McInroy / 2 Thomas Andrén / 3 IODP JRSO - Coring Tools and Technology https://iodp.tamu.edu/tools/ / 4 Fugro. 1 & 2 also ECORD-IODP.

Scaling-up: larger geotechnical, well-intervention and deep water drilling vessels with marine heave-compensated wireline coring

MSPs capable of deploying up to 3000 m of drill pipe

Capable of implementing many ‘JR-type’ expeditions

Example of a deep water drill ship capable of deploying 11-12 km of pipe – but expensive

Alternative: work with JAMSTEC and deploy *Chikyu* as an MSP

Photo credits: 1 Michael Rubis, Fugro Marine Services / 2 Geoquip Marine / 3 Noble Corp. / 4 JAMSTEC

Lift boat or fixed platform deploying onshore mining-style wireline coring

‘Lighter’ coring system, higher rotational speed, smaller gap between borehole wall and drill pipe, can lead to better hole condition and better core quality

- Water depth range: 4 – 110 m (platform-determined)
- Smaller lift boats up to 55 m water depth ($)
- Larger up to 84 m ($$) and 110 m water depth ($$$)
- Typical pipe deployment (water + penetration):
  2400 m typical (coring apparatus-determined)

- Can access very shallow water
- Essentially a land-based set up with no swell
- Can use land-based mining-style equipment
- Smaller, less accommodation (shared cabins)
- Need seabed survey(s) for safe landing of legs
- Cannot easily cross oceans, used near market areas

- Core diameter: 61 - 83 mm
- Typical coring rate: 30 m /day
- Typical open hole rate: 50 m/day
- Supports full downhole logging
- Supports borehole instrumentation

Photo credits: 1 Chris Lowery / 2 Auriol Rae / 3 Dave Smith. All also ECORD-IODP.

Lift boats: other considerations

Photo credits: 1 Patricia Maruejol, ECORD-IODP / 2 Google Maps, imagery: TerraMetrics / 3 Pierre Jaquet, flickr / 4 Combifloat / 5 Niklas Leicher, Universität Köln

Research or multipurpose vessels deploying alternative coring apparatus: seafloor drills (SFD) & giant piston corers (GPC)


1

RRS James Cook
X357, 2015, Central North Atlantic


2

R/V Kaimei, X386, 2020 - 2022
Japan Trench


3

MARUM MeBo70
X357, 2015, Central North Atlantic


4

Benthic Geotech PROD Systems

SFD

- Core diameter: typically 61-73 mm
- Max pipe: 50 - 200 m
- Water depths: Up to 2-4 km
- Typical coring rate: 15 m /day
- Heave-free, mining-style coring
- No or limited downhole logging
- No or limited borehole instrumentation


5

OSIL Giant Piston Corer
Operated by JAMSTEC
X386: Japan Trench

- Water depth range: 10m up to limit of coring apparatus

- Cost-effective platforms to deploy smaller-scale coring methods
- Sizeable, well-equipped labs for 3rd party equipment
- Nationally-owned assets offer in-kind contribution opportunities
- In-kind contributions = less cost to ECORD

- Compromise needed to take advantage of alternative coring methods: lower penetration, no downhole logging.

GPC

- Core diameter: 100 mm
- Max pipe: Typically 40m, but up to 70 m
- Water depths: up to full oceanic depth
- Typical coring rate: 1 core per day
- No downhole logging
- No borehole instrumentation

Photo credits: 1 NOC / 2 JAMSTEC / 3 David Smith, ECORD-IODP / 4 Benthic.com / 5 Ken Ikehara, ECORD-JAMSTEC-IODP.

Ice-breaking research vessels deploying alternative coring apparatus

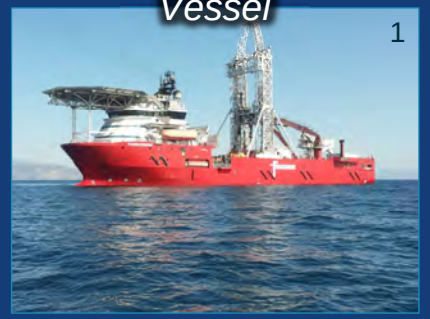
RSV Nuyina

RRS Sir David Attenborough

MSP Phases: Opportunities

Offshore Phase

Vessel



Coring

Container labs and science facilities

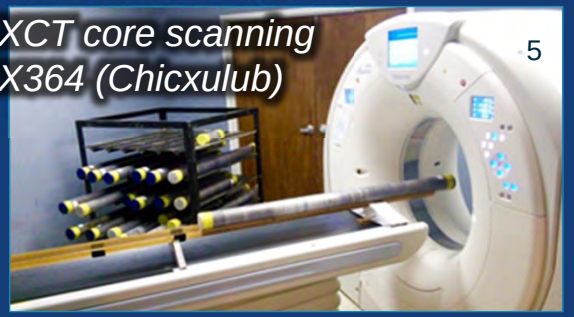
\+ *3rd party equipment*

- Measurement of ephemeral properties
- Observations to guide drilling

Between offshore and Onshore Science Party, 2-3 months

Time

XCT core scanning X364 (Chicxulub)



- Time for core measurements (e.g. X-ray CT scanning, dating)
- Science Party can digest offshore data
- Produce a targeted sampling plan

Onshore Science Party at MARUM (University of Bremen) and IODP Bremen Core Repository

Established labs and facilities

- Full suite of IODP measurements
- Development of shore-based collaborations (SP and beyond SP)

Photo credits: 1 Michael Rubis, Fugro Marine Services / 2 Robert Gawthorpe / 3 MARUM / / 4 ECORD-IODP / 5 Exp. 364 Preliminary Report (Morgan et al. 2016)

THANK YOU

Any questions?

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MSP Facts
9 expeditions completed
195 boreholes
3605 cores
7505 m recovered
480 days offshore
209 days onshore @ OSP
1335 mbsf deepest hole
19.8 m shallowest water
8023 m deepest water

Credit: ECORD-IODP