

# RV Investigator Voyage Plan

VOYAGE #:	IN2022_V05				
Voyage title:	The tsunamigenic s of Australia's Tasm	The tsunamigenic submarine landslides and deep-marine canyons of Australia's Tasman Sea margin: Causes and Consequences			
Mobilisation:	Hobart, Saturday N	1ay 21 - Wec	Inesday May 25, 2022		
Pre-voyage quarantine onshore (7 days) INCLUDES MOBILISATION ACTIVITIES (non-seagoing personnel only)	Thursday May 19 - Thursday May 26, 2022				
Pre-voyage quarantine onboard (departing day 3)	Thursday May 26 - Friday May 27, 2022				
Depart:	Hobart, CSIRO Wharf, Saturday May 28, 2022				
Return:	Brisbane, Wagners Wharf, Sunday July 03, 2022				
Demobilisation:	Brisbane, Wagners Wharf, Monday July 04 - Tuesday July 05, 2022				
Voyage Delivery Coordinator / Voyage Manager:	Max McGuire     Contact details:     Max.mcguire@csiro.au		Max.mcguire@csiro.au		
Chief Scientist:	Tom Hubble				
Affiliation:	School of Geosciences The University of Sydney	Contact details:	Madsen Building The University of Sydney Sydney 2006 NSW Australia <u>Tom.Hubble@sydney.edu.au</u>		
Principal Investigators:	Hannah Power, David Airey, Michael Kinsela, Scott Nichol, Maria Seton				
Project name:	The tsunamigenic submarine landslides and deep-marine canyons of Australia's Tasman Sea margin: Causes and Consequences				
Affiliation:	The University of Sydney and The University of Newcastle	Contact details:	tom.hubble@sydney.edu.au Hannah.Power@newcastle.edu.au		

## Scientific objectives

South-Eastern Australia's continental margin (SEACM) is internationally recognized for its geological significance due to an intriguing geological structure, enigmatic submarine landslides, and well-preserved, glacial low-stand, shelf-edge sediments. This is despite a relatively sparse and incomplete data set. This project will utilise the seismic reflection profiling, swath mapping, coring, and dredging capabilities of the RV Investigator to gather the data required to test competing models for the SEACM's geologic evolution and how its submarine landslides generate dangerous and potentially lethal tsunami.

The major scientific objectives are to:

- determine the characteristics and distribution of the SEACM's submarine landslide debris deposits to establish whether these materials are shed as large, fast-moving translational-blocks or viscous, slower-moving turbidity-currents and grain-flows, i.e., slabs or slurries;
- explore the architecture of sedimentary materials that have been deposited on the SEACM and adjacent abyssal plain during the last 60 million years;
- date key geologic events in the margin's evolution;
- investigate the delivery of shelf-edge sediment to the upper slope and the heads of the margin's deepmarine canyons; and
- investigate the role of the canyons in determining the distribution and occurrence of landsliding.

## Voyage objectives

We intend to deploy the seismic reflection profiling system together with the multibeam sonar and subbottom profiling systems to map specific features of interest present on the continental slope and abyssal plain offshore the SEACM between Green Cape (Victoria – New South Wales Border) and the northern tip of Fraser Island (South-East Queensland). These mapping and profiling results will be used in conjunction with earlier survey results to inform the selection of appropriate core and dredge sites which will be sampled using the Jumbo Coring System, Box Dredges, and/or the Smith-MacIntrye Grab as is appropriate.

The primary objective of this voyage is to locate and sample deeper-water features that were beyond the operational 'reach' of the RV Southern Surveyor's facilities and equipment. The earlier voyages investigating the marine geology of the region were not able to efficiently map or sample the lower slope, deep canyons, and abyssal plain features that represent the sites where upper-slope and mid-slope landslide materials are thought to be deposited. Included in this objective is the 'maximised acquisition' of abyssal plain bathymetry between the toe of the continental slope and the line of Tasman Seamounts located to the north of Port Macquarie.

The secondary objective is to identify, map, and sample continental-shelf-edge coastal features suspected to have delivered sediment to the upper-continental slope and canyon heads when sea-levels were lowered during the many Pliocene and Pleistocene glacial maxima. These features are thought to be a critical component of the "source-to-sink" sediment pathway that influences continental slope depositional and erosional processes.

From South to North the specific features of high interest are the:

- Ulladulla Canyon and Slope (Possible test run of Seismic System Rank 1) Short Kasten/Gravity Cores
- Bulli Slide (Rank 1) Seismic Profiling and Sampling (Coring and/or Dredging)
- Coffs Harbour Slope (Rank 2)

- Yamba Slides and Slope (Rank 1) Seismic Profiling and Sampling
- Byron Slide and Canyon (Rank 1) Seismic Profiling and Sampling
- Clarence and Tweed Canyons (Rank 2) Seismic Profiling and Sampling
- Nerang Plateau (Rank 2)
- "The Block" offshore Brisbane (Rank 3) One Day Seismic to image its "Tension Crack"
- Barwon Bank and Noosa Canyon (Rank 1) Seismic Profiling and Sampling (Coring and Dredging)
- Wide Bay Slopes and Olistostromic Slide Block (Rank 1) Seismic Profiling and Sampling (Coring and Dredging)
- Barwon Bank (Prior to Return to Brisbane)

Given the variety of potential features of interest located on the outer shelf, continental slope, and abyssal plain within the general area of interest between Ulladulla and Fraser Island it should be possible to employ an appropriately flexible response to challenging weather conditions in that the geographic focus of our operations can be modified to sensibly accommodate weather and sea state forecasts.

## Voyage Risk Assessment (VRA)

The MNF, in consultation with the science party and other relevant stakeholders, will develop a comprehensive Voyage Risk Assessment (VRA) to ensure voyage risks are identified and appropriately controlled.

The MNF will arrange a meeting to undertake this risk assessment process.

This voyage has undergone a comprehensive risk assessment process. The full VRA is at Appendix C.

Note: Seismic-profiling and seafloor sample operations will occur mainly during daylight hours, ie., during the day shift; with the nightshift focussed on swath-mapping and the collection of multibeam bathymetry sub-bottom profile data. To facilitate the needs of processing seismic data and the management of sediment cores and/or dredge samples the science crew will operate on three shifts, with the majority of science personal working during an early or late day shift. The shifts will consist of an early day shift (6 am to 6 pm approximately 8 people); a late day shift (12 am to 12 pm, approximately 8 people) and a night shift (10 pm and 10 pm; 3 people). While some sample analysis and preparation will be undertaken on the voyage most of the detailed analysis and interpretation of the collected data and samples onshore after completion of the voyage. This means that seismic profiling or sediment sampling work will be completed during the day while the large amount of multibeam swath-mapping and subbottom profiling will be completed during the 12-hour night shift. The reductions to total scientific staff arising from the ongoing COVID-19 situation means that the significant piggyback operations will probably not be attempted.

## Media Activities

The MNF will seek to pursue opportunities that arise during the voyage to promote the science, scientists and ship, via conventional and social media channels, in consultation and/or collaboration with the relevant ship user.

ORGANISATION	ACTIVITIES	TIMING	RESPONSIBLE PERSON
CSIRO	Chief Scientist and Co-Chief Scientist	Pre-departure	Tom Hubble
USYD	undertaking interviews with networks to		and Hannah
UniNewcastle	discuss science being undertaken		Power
CSIRO USYD UniNewcastle	Live cross to network and a range of stories and blogs to be released.	Throughout voyage	Tom Hubble and Hannah Power
CSIRO	Post voyage media engagement on wharf	Post Voyage	Tom Hubble
USYD	apron with technical support personnel and		and Hannah
UniNewcastle	Voyage Manager		Power

## Overall activity plan including details for first 24 hours of voyage

- Transit south-to-north from Hobart towards Bass Straight and Dalmeny with daylight bird and marine mammal population surveys and Bathymetric/Sub-Bottom Profile Surveying (Note that Marine Mammal and Bird Surveys will be undertaken at all appropriate times during the voyage). (First 48 hours).
- Transit to Bateman's Bay and Ulladulla (complete slope and abyssal plain surveys offshore Merimbula and Bateman's Bay) with Bathymetric/Sub-Bottom Profile Surveying. Gravity Coring and/or Kasten Coring and/or Dredging of several sites offshore Ulladula. This is intended as a short familiarization operation to ascertain the performance of the coring systems in the context of the specific characteristics of the steep slopes presented by the SEACM. (Approximately 2 days).
- Transit south-to north to Wollongong/Bulli and then undertake seismic reflection surveying of the slope and abyssal plain associated with the Shovel and Bulli Slides with Bathymetric/Sub-Bottom Profile Surveying for selection of coring sites within &/or adjacent to the Shovel and Bulli Slides as well as the adjacent downslope continental slope and abyssal plain. Undertake coring and/or dredging operations at selected appropriate sites. (Approximately 5 days).

Transit south-to north to Coffs Harbour (complete slope and abyssal plain surveys offshore Sydney and Port Macquarie). (Approximately 4 days).

- Transit south-to north to Broom's Head and Yamba and then undertake seismic reflection surveying of the slope and abyssal plain associated with the Brooms Head and Yamba Slides with Bathymetric/Sub-Bottom Profile Surveying for selection of short coring sites within &/or adjacent to the Brooms Head and Yamba Slide Complexes as well as the adjacent downslope continental slope and abyssal plain. Undertake coring and/or dredging operations at selected appropriate sites. (Approximately 5 days).
- Transit south-to north to Byron Slide, Clarence and Tweed Canyons then undertake seismic reflection surveying of the slope and abyssal plain associated with the Byron Slides with Bathymetric/Sub-Bottom Profile Surveying for selection of coring sites within &/or adjacent to the Byron Slide, Clarence Canyon

and Tweed Canyon as well as the adjacent downslope continental slope and abyssal plain. Undertake coring and/or dredging operations at selected appropriate sites. (Approximately 5 days).

- Transit south-to-north across the Nerang Plateau (Gold Coast). Remap Bathymetry of upper continental slope and shelf edge to identify if there has been retreat of the upper slope failure scarps Swath Map and take piston cores if appropriate targets are identified. (Approximately 3 days)
- Transit south-to north to Barwon Bank and Noosa Canyon Area and then undertake seismic reflection surveying of the slope and abyssal plain associated with the Noosa Canyon Area with Bathymetric/Sub-Bottom Profile Surveying for selection of coring sites within &/or adjacent to the Noosa Canyon as well as the adjacent downslope continental slope and abyssal plain. With opportunistic Undertake coring and/or dredging operations at selected appropriate sites. (Approximately 6 days).
- Transit south-to north to Wide Bay Slides and Slide Block and then undertake seismic reflection surveying of the slope and abyssal plain associated with the Wide Bay Slides and Slide Block Area with Bathymetric/Sub-Bottom Profile Surveying for selection of coring sites within &/or adjacent to the Wide Bay Slides and Slide Block as well as the adjacent downslope continental slope and abyssal plain (possibly as far north as Waddy Point). Undertake coring and/or dredging operations at selected appropriate sites. (Approximately 5 days).
- Transit north-to-south to Barwon Bank for further Swath Mapping and Sub-bottom profiling Or if time
  permits transit to "The Block" (offshore Brisbane) and then undertake seismic reflection surveying of
  the slope and abyssal plain associated with the "The Block" (Brisbane) Area with Bathymetric/SubBottom Profile Surveying for selection of coring sites within &/or adjacent to the "The Block" (Brisbane)
  as well as the adjacent downslope continental slope and abyssal plain. Undertake coring and/or
  dredging operations at selected appropriate sites. (Approximately 2 days).
- Transit to Brisbane, demobilise and disembark.

## Total of 34 Days of Planned Activities (including transit) within a 37-day voyage.

## Sediment Sampling Sites

Long Cores (Expected to be between 10 and 20 – mostly gravity cores) Maximum recovery approximately 280 m (more likely 180 m)

## South to North

- Shovel Slide Scar (Upper Slope its known to be soft)
- Bulli Slide Scar (Upper Slope its known to be soft)
- Bulli Canyon Mouth (Unknown Probably Mud)
- Byron Slide Scar (Upper Slope its known to be soft)
- Byron & Richmond Canyon Mouth (Unknown Probably Mud)
- Clarence Canyon Mouth (possibly x 2). (Unknown Probably Mud)
- Noosa Canyon Mouth (possibly x 2) (unknown)
- Wide Bay Canyon Mouth (x 2) (unknown)
- North Tasman Abyssal Plain (x 2) (Olistostrome Drape Sample Pelagic Muds)

Kasten or Short Gravity Cores (4 or 6 metres) Approximately 20 (possibly more) Maximum Recovery 120 to 150 m

South to North Desired Sites (Stiff Mud underlying soft, thin sediment drape)

- Offshore Batemans Bay / Ulladulla 3 or 4 Short Cores on line BMR Seismic Line 68/3 (Downslope from Fig 6a Seismic Line in Colwell et al 1993)
- Bulli and Shovel Slides 3 or 4 short cores (or dredges)

- Brooms Head and Yamba Slide Block Fields 6 to 8 short cores
- Byron/Richmond Canyon (2 Cores)
- Clarence and/or Byron Canyon (2 Cores)
- Wide Bay Slopes (4 to 8 Short Cores)

## Dredge Sites – Approximately 12

Sites to determined – opportunistic

### Camera Deployment Sites – Approximately 4 to 6

Sites to be Determined – opportunistic

Most likely locations are deep-water sites (3000 m to 4500 m water depth) located on the abyssal plain near and within canyon mouth features to the north of Port Macquarie.

Sites to be selected on the basis of deep-water bathymetry collected in these areas.

The most likely targets are 1) Byron Canyon, 2) Clarence Canyon, 3) Noosa Canyon, 4) Wide Bay Canyon and possibly 5) Bulli Canyon.

### **Basic Plan for Core Management**

<u>On Board</u>

- Long Cores after coring procedure, cut core recovered into 1 m segments, label appropriately and store (Long Cores) in cold facility. (Note Some of the Long Cores will be split and logged onboard similarly to Kasten Cores).
- A) Kasten Cores to be inspected, a working slab to be extracted for field logging and sub-sampling (Geotech, Sedimentology and Post-cruise paleaontological dating);
- B) Kasten cores an archive section to be cut out 'from the box' and transferred to a square 50mm \* 50 mm PVC tube for photographing and then storage.
- Full Inventory of Collected Cores (to be generated as cores are collected). Photographs, Field Logs, Samples

### At Demobilisation

 Decanting Operation – Cores transferred from CT Lab to aft main deck and repacked into pallets for transport to cold storage. An all-scientific hands to the task situation (12-20 people carrying 1 or 2 cores at a time from the cold store to the Sheltered Science Area or the Aft Main Deck), probably during the last two days of the cruise during the transit from the last site to Brisbane with possible completion of task alongside if weather is foul). Estimated time 6 hours if we've got lots of core.

### Transport to Storage

• Sensitive/refrigerated cold transport to Sydney/Canberra/Newcastle for long-term storage and examination – In the first instance the Geoscience Australia cold store in Canberra for Long Cores with the Kasten Cores Archive sections going to Sydney Uni.

### Decanting

• Small team of principle scientists and students to organise transfer of transported core to cold stores on arrival at storage facilities. (Hubble, Kinsela, Power, Mollison, plus students)

### Long-Term Storage

• Initially at Sydney or Newcastle in a Refrigerated Container if required.

## Approximate Voyage Track (Hobart to Brisbane) And Locations of Named Onshore Sites Near Detailed Surveying Sites



Figure 1: Voyage Track and Areas of Interest (more detail for Boxes A, B, and C is in Figures 2 to 4)

# Areas of Surveying Interest – Box A



Figure 2: Box A specific areas of interest; we aim to maximise the bathymetric coverage in the yellow box / seismic lines and or sediment sampling to be undertaken in the red boxes

# Areas of Surveying Interest – Box B



Figure 3: Box B specific areas of interest; we aim to maximise the bathymetric coverage in the yellow box / seismic lines to be undertaken in the red boxes

# Areas of Surveying Interest – Box C



Figure 4: Box C specific areas of interest; we aim to maximise the bathymetric coverage in the dashed yellow boxes / seismic lines and sediment sampling to be undertaken in the red boxes

# Waypoints and stations (Steaming at 9 knots)

SITE	DEGREES DECIMAL MINUTES LATITUDE	DEGREES DECIMAL MINUTES LONGITUDE	DISTANCE (NM)	TOTAL DISTANCE (NM)	STEAMING TIME (HRS)	TOTAL STEAM (HRS)
Hobart	42° 52.2S	147° 21.0E				
Storm Bay	43° 20.0S	147° 25.5 E	30	30	3.1	3.1
Cape Pillar	43° 20.0S	148° 7.9'E	24	54	2.7	5.8
Bicheno	42° 53.1S	148° 34.0'E	90	144	10.0	15.8
Flinders Island	40° 00.0'S	149° 37.5'E	126	270	14	29.8
The Skerries	38° 04.6′S	150° 50.2'E	129	399	14.2	44
Narooma	35° 59.0'S	151° 03.0	126	525	14	58
Ulladulla	35° 27.0'S	151° 32.5'E	36	561	4	62
Wollongong	34° 28.0'S	152° 07.5'E	68	629	7	69
Port Macquarie	31° 30.0'S	154° 00.0'E	208 + LB's	1269	72	141
Coffs Harbour	30° 15.0'S	154° 00.0'E	72 + LB's	1560	24	165
Yamba	29° 25.0'S	154° 26.0'E	54	1614	6	171
Byron Bay	28° 35.0′S	154° 42.0'E	54	1668	6	177
Gold Coast	28° 00.0'S	154° 42.0'E	36	1704	4	181
Moreton Island	27° 09.0'S	154° 15.0'E	63	1707	7	188
Noosa Heads	26° 25.0′S	154° 15.0'E	45	1752	5	193
Wide Bay	25° 58.0′S	154° 15.0'E	27	1779	3	196
Waddy Point	24° 33.0′S	154° 15.0'E	90	1869	10	206
Noosa Heads	26° 25.0'S	153° 50.0'E	117	1986	13	219
Caloundra	26° 49.0'S	153° 09.0'E	45	2031	5	224
Brisbane	26° 06.6'S	153° 05'E	ТВА		12	236

\*LB's refers to "mowing the lawn" Loop-Backs" ie. bathymetric swath-mapping

## Time estimates

The above time estimates are based on a steaming speed of 9 knots.

**Note**: As your voyage departs from Hobart and will finish in Brisbane, there is a requirement for MNF GSM to conduct calibration lines in Storm Bay (outgoing). These lines are surveyed to calibrate and build a time series dataset to monitor backscatter data from the multibeam echosounders. The ship is requested to remain steady on a survey speed of 8 knots for a period of approximately 15 minutes. Please allow for these calibrations in your Time Estimates.

DATE (FINISH)	TIME HOURS	ΑCTIVITY
25/5/2022	48	Narooma - Bathymetry and Sub-Bottom Surveying
28/5/2022	48	Ulladulla - Sampling, Bathymetry and Sub-Bottom Surveying
31/5/2022	72	Wollongong – Seismic, Sampling, Bathymetry and Sub-Bottom Surveying
3/6/2022	48	Port Macquarie – Bathymetry and Sub-Bottom Surveying
4/6/2022	24	Coffs Harbour Bathymetry and Sub-Bottom Surveying
7/6/2022	72	Yamba – Seismic, Sampling, Bathymetry and Sub-Bottom Surveying
11/6/2022	72	Byron Bay – Seismic, Sampling, Bathymetry and Sub-Bottom Surveying
14/6/2022	72	Gold Coast – Seismic, Sampling, Bathymetry and Sub-Bottom Surveying
16/6/2022	48	Moreton Island – Seismic, Sampling, Bathymetry and Sub-Bottom Surveying
19/6/2022	72	Noosa Heads – Seismic, Sampling, Bathymetry and Sub-Bottom Surveying
23/6/2022	72	Wide Bay – Seismic, Sampling, Bathymetry and Sub-Bottom Surveying
26/6/2022	72	Waddy Point – Seismic, Sampling, Bathymetry and Sub-Bottom Surveying
28/6/2022	24	Noosa Heads – Sampling Bathymetry and Sub-Bottom Surveying

## Seismic Strategy & Parameters

The RVI seismic system will use all parameters previously tested in IN2021\_E04. 6m streamer and source depth have been selected to reduce the impact of swell, while maintaining an appropriate bandwidth in the recorded data.

Source Depth:	6m, Dual Source Rail
Source Volume:	2 x 45/105cuin GI (True GI Mode)
Pressure:	140 bar (operational)
Shot point interval:	12.5m (6s, TBC with expected water depth on each transect)
Recording Length:	6s (TBC with expected water depth on each transect)
Streamer Length:	500m (40 channels)
Streamer Depth:	6m
Deployment Speed:	2kts – 4kts
Acquisition Speed:	4kts

# Piggyback projects

**Craig Hanstein**: Standard ARGO Float deployments x 3 & 3 buddy floats.

ARGO FLOAT No.	Latitude	Longitude
Hull 1330	31° 30.0'S	154° 00.0'E
Hull 1340	29° 25.0'S	154° 26.0'E

## Permits

EPBC Cetacean Permit

The Australian Government's Department of Agriculture, Water & Environment EPBC permit shall apply: *Cetacean Permit CP2019.0003* 

Australian Marine Park Permit PA2020-00051-5 ARGO float deployments

# Appendix A

## Scientific equipment and facilities provided by the Marine National Facility

Some equipment items on the list may not be available at the time of sailing. Applicants will be notified directly of any changes. Indicate what equipment and facilities you require from the Marine National Facility by placing an **X** in the relevant box.

STANDARD LABORATORIES AND FACILITIES					
NAME	REQUIRED	NOTES/COMMENTS			
Aerosol Sampling Lab		Please indicate the intended activity in this lab			
Air Chemistry Lab		Please indicate the intended activity in this lab			
Preservation Lab		Please indicate the intended activity in this lab			
Constant Temperature Lab (Min temp: 2°C / Max temp 35°C)	x	• Temporary Sample Storage 2° to 4°			
Underway Seawater Analysis Laboratory		Please indicate the intended activity in this lab			
GP Wet Lab (Dirty)	х	Sample examination and Sample Testing			
GP Wet Lab (Clean)		Please indicate the intended activity in this lab			
GP Dry Lab (Clean)		Please indicate the intended activity in this lab			
Sheltered Science Area		Please indicate the intended activity in this area			
Observation Deck 07 Level		Please indicate the intended activity in this area			
Internal Freezer (Dirty Wet lab) (Min temp -25°C / Max temp 0°C) <u>Volume: &gt;20m<sup>3</sup></u>		<ul> <li>Please indicate the intended activity in this area</li> <li>Please indicate the required setpoint temperature</li> </ul>			
Clean Freezer (Dirty Wet lab) (Min temp -25°C / Max temp 0°C)		<ul> <li>Please indicate the intended activity in this area</li> <li>Please indicate the required setpoint temperature</li> </ul>			

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STANDARD LABORATORIES AND FACILITIES					
NAME	REQUIRED	NOTES/COMMENTS			
Volume: >2.5m <sup>3</sup>					
Co-located within the Internal freezer and separated					
<u>by a door</u>					
Blast Freezer (Dirty Wet lab) (Min temp -30°C / Max temp 0°C) <u>Internal volume &gt;1.5m<sup>3</sup></u> <u>Capable of reducing the temperature of 150kg of</u> <u>water from +20C to -30C in one hour.</u>		<ul> <li>Please indicate the intended activity in this area</li> <li>Please indicate the required setpoint temperature</li> </ul>			
Cool Room (Dirty Wet lab) (Min temp 0°C / Max temp 10°C)	x	<ul> <li>Please indicate the intended activity in this area</li> <li>Please indicate the required setpoint temperature</li> </ul>			
Ultra-Low Temperature Freezers x2 (Main Deck) Min temp -80°C / Max temp -80°C)		Please indicate the intended activity in this area			
YODA Freezers (x2) (Clean Dry lab) (Min temp -20°C / Max temp 10°C)		<ul> <li>Please specify if both or only one are needed</li> <li>Please indicate the intended activity in this area</li> <li>Please indicate the required setpoint temperature</li> </ul>			



MOBILE LABORATORY AND FACILITIES (MAY REQUIRE ADDITIONAL SUPPORT)			
NAME	ESSENTIAL	DESIRABLE	NOTES/COMMENTS
Modular Isotope Laboratory			If nominated, additional processes to be completed.
Trace Metal Niskin Sampling Container (TM1-blue - 20ft)			• Used for the determination of trace metal concentrations. It is a clean laboratory containing laminar flow cabinets and is stored on the main deck (if possible).

MOBILE LABORATORY AND FACILITIES (MAY REQUIRE ADDITIONAL SUPPORT)			
NAME	ESSENTIAL	DESIRABLE	NOTES/COMMENTS
Trace Metal Seawater Analysis Laboratory (TM2-white - 20ft)			<ul> <li>Used for wet sampling of trace metal clean Niskins and is stored on the main deck (if possible).</li> <li>Cannot be overstacked</li> </ul>
Trace Metal Rosette and Niskin Storage Container			10-foot container
Modular Hazchem Locker			
Stabilised Platform Container			Please indicate what instruments are to be installed in the container Cannot be overstacked
Clothing Container			The use of this container will be identified by MNF

STANDARD SAMPLING EQUIPMENT				
NAME	ESSENTIAL	DESIRABLE	NOTES/COMMENTS	
CTD - Seabird 911 with 36 Bottle Rosette				
CTD - Seabird 911 with 24 Bottle Rosette				
Lowered ADCP				
Continuous Plankton Recorder (CPR)			*note: Use of this item must be flagged with the relevant CSIRO Oceans & Atmosphere team responsible for CPR cassette preparation and sample processing. Please discuss your planned CPR use with your VOM, who will assist in liaising with the CPR team.	

SPECIALISED SAMPLING EQUIPMENT				
NAME	ESSENITIAI		NOTES/COMMENTS	
	LJJLINIAL		(THESE ITEMS MAY REQUIRE ADDITIONAL MNF SUPPORT STAFF)	
TRIAXUS – Underway Profiling CTD			Triaxus is a pilotable towed vehicle capable of carrying a variety of instrumentation. Constant depth towing or undulating profiles (e.g. cyclic depth pattern from the surface to 200m) are possible. Towing speed depends on the tow profile, instrumentation payload and prevailing conditions. Typically, undulations from the surface to 200m are possible at 8knt, with slower speeds for deeper profiles and faster for constant-depth towing. Maximum achievable depth typically 300m Usual instrumentation: SBE9plus (pressure sensor and communication hub) and dual pumped temperature/conductivity/dissolved oxygen circuits. Usual auxiliary instrumentation includes an ECO-Triplet (ChI, CDOM, backscatter), transmissometer, PAR sensor, and Laser Optical Plankton Counter. Contact MNF for further details on other instrumentation and capability.	
Desired towing profile:				
Additional instrumentation:				
(please supply, make and model and				
datasheets and a contact person for discussion				
on integration)				
Piston Coring System	х			
Gravity Coring System	Х			
Multi Corer				
Kasten Corer		Х		
Smith Mac Grab	X			
Rock Dredges	х			

SPECIALISED SAMPLING EQUIPMENT			
NAME	ESSENITIAL		NOTES/COMMENTS
	ESSENTIAL	DESIRADLE	(THESE ITEMS MAY REQUIRE ADDITIONAL MNF SUPPORT STAFF)
Rock Saw			Requires trained science personnel
Seaspy Magnetometer			
Portable Pot Hauler			
Equipment to measure seawater sound velocity/CTD:	x		
XBT System			2 per day provided
Valeport Rapid SV			
Valeport Rapid CTD			
Valeport SVX2			
Trace Metal Rosette and Bottles			
Trace Metal In-situ Pumps (x6)			<ul> <li>See non-MNF owned section below for additional 2 units.</li> <li>Science team to organise and pay for battery packs for this system (+ spare).</li> <li>They can be sourced through a supplier such as 'Batteryworld Hobart' (Graham Cowie, 03 6272 3900) who has made these previously.</li> <li>The science teams need to calculate how long they will be deployed and bring enough batteries to cover their deployment times. They are rated to 30 Amp hours, which equals to 36,000 litres of sea water being filtered.</li> </ul>
Deep Towed Camera	Х		
Drop Camera		X	
Sherman Epibenthic Sled			Stern ramp must be removed to operate this system.

SPECIALISED SAMPLING EQUIPMENT					
NAME	ESSENTIAL		NOTES/COMMENTS		
		DESINADEL	(THESE ITEMS MAY REQUIRE ADDITIONAL MNF SUPPORT STAFF)		
Brenke Sled	ļ				
EZ Net (Multiple net system, 1m x 1m)			Please specify 335-micron, 500-micron, or 1,000-micron mesh		
Hydro-Bios MultiNet (1m x 1m)			Please specify 335-micron, 500-micron, or 1,000-micron mesh		
Surface Net (1m x 1m)			Please specify 335-micron, 500-micron, or 1,000-micron mesh		
Bongo Net 485mm diameter			500 micron mesh only		
Beam Trawl					
MIDOC			Multiple opening/closing net system with cod ends- suitable for pelagic trawls		
Pelagic Trawl System (net, doors)			Contact MNF to discuss net and mesh dimensions		
Demersal Trawl System (net, doors)			Contact MNF to discuss net and mesh dimensions		
RMT-8 (Rectangular Midwater Trawl) Utilises a single warp so can be deployed on the general-purpose towing wire in self- contained mode. Must be deployed with stern ramp covered.			8m2 mouth area Tow speed ≤2 knots		
RMT-16 (Rectangular Midwater Trawl) Utilises a single warp so can be deployed on the general-purpose towing wire in self- contained mode. Must be deployed with stern ramp covered.			16m2 mouth area Tow speed ≤2 knots		
Trawl Monitoring Instrumentation (ITI) (2,000m depth limit)			MNF to identify this need, dependent on pelagic or demersal trawling requirement		
Stern ramp	EXPOSED	INSTALLED	MNF to identify this requirement		

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RESEARCH SUPPORT INFRASTRUCTURE				
NAME	ESSENTIAL	DESIRABLE	NOTES/COMMENTS	
Salt Water Ice Machine (Dirty Wet lab)				
Radiosonde Receiver System				
Laboratory Incubators (Clean Dry lab)				
Deck Incubators			Temperature controlled deck incubators	
Milli-Q System				
Sonardyne USBL System				

SCIENTIFIC / SAMPLE ANALYSIS SYSTEMS						
MICROSCOPES:				NOTES/COMMENTS		
BRAND / MODEL	ТҮРЕ	ESSENTIAL	DESIRABLE	Refer to the "MNF microscopes procedure" for more information		
Leica / M80	Dissecting	х				
Leica / M80	Dissecting	х				
Leica /MZ6	Dissecting	х				
Olympus / CH	Compound		х			
Olympus /CH	Compound		х			
Leica / MTU282	Camera tube		х			
Adapters for tube / Nikon	Pentax					
Ring Light *2 / MEB121	LED					
Heavy Duty Electronic Balance (8	80kg)		х			
Medium Duty Electronic Balance resolution)	(15kg/5g	x				

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SCIENTIFIC / SAMPLE ANALYSIS SYSTEMS						
MICROSCOPES:			NOTES/COMMENTS			
Light Duty Electronic Balance (3kg/1g resolution)	Х					

## Underway systems

ACOUSTIC UNDERWAY SYSTEMS			
NAME	ESSENTIAL	DESIRABLE	NOTES/COMMENTS
75kHz ADCP	Х		
150kHz ADCP	х		
Multi Beam Echo Sounder EM122 12kHz (100m to full ocean depth)	x		
Multi Beam Echo Sounder EM710 70-100kHz (0-1000m approx.)	x		
Sub-Bottom Profiler SBP120	х		
Scientific Narrowband Echo Sounders EK60 (6 bands, 18kHz-333kHz)		х	EK60s will be onboard for use as a backup for EK80s and set in narrowband mode Quantitative measurements from scientific echosounders requires sphere calibration in the watermass of sampling
Scientific Narrowband/Broadband Echo Sounders EK80 (6 bands, 18kHz-333kHz)		х	EK80s will be used in narrowband mode unless otherwise requested Quantitative measurements from scientific echosounders requires sphere calibration in the watermass of sampling
Multibeam Scientific Echo Sounder ME70 (70-100 kHz)			
Omnidirectional Echo Sounder SH90			
Gravity Meter		Х	

ATMOSPHERIC UNDERWAY SENSORS					
NAME	ESSENTIAL	DESIRABLE	NOTES/COMMENTS		
Nephelometer					
Multi Angle Absorption Photometer (MAAP)					
Scanning Mobility Particle Sizer (SMPS)					
Radon Detector					
Ozone Detector					
Condensation Particle Counter (CPC)					
Picarro Spectrometer (analysis of CO <sub>2</sub> /CH <sub>4</sub> /H <sub>2</sub> O)					
Aerodyne Spectrometer (analysis of $N_2O/CO/H_2O$ )					
Cloud Condensation Nuclei (CCN)					
Polarimetric Weather Radar					

UNDERWAY SEAWATER SYSTEMS AND INSTRUMENTATION					
NAME	ESSENTIAL	DESIRABLE	NOTES/COMMENTS		
Thermosalinograph					
Fluorometer					
Optode					
pCO2					

SEAWATER SYSTEMS					
NAME	ESSENTIAL	DESIRABLE	NOTES/COMMENTS		
Trace metal clean seawater supply					

SEAWATER SYSTEMS					
NAME	ESSENTIAL	DESIRABLE	NOTES/COMMENTS		
Scientific clean seawater supplied to laboratories					
Raw seawater available on deck and in laboratories					

EQUIPMENT AND SAMPLING GEAR REQUIRING EXTERNAL SUPPORT (MAY REQUIRE ADDITIONAL SUPPORT FROM APPLICANTS)						
NAME	ESSENTIAL	DESIRABLE	PLEASE GIVE THIS CAREFUL CONSIDERATION, AS THERE IS NO GUARANTEE THAT THESE RESOURCES WILL BE AVAILABLE UNLESS SPECIFICALLY REQUESTED. LIAISE WITH YOUR VOYAGE OPERATIONS MANAGER AS REQUIRED. ADDITIONAL STAFF MAY BE REQUIRED FOR THESE ACTIVITIES.			
Seismic Compressors	Х					
Seismic Acquisition System	Х					

NON-MNF OWNED EQUIPMENT WHICH MAY BE ACCESSED					
ΝΑΜΕ	ESSENTIAL	DESIRABLE	PLEASE GIVE THIS CAREFUL CONSIDERATION, AS THERE IS NO GUARANTEE THAT THESE RESOURCES WILL BE AVAILABLE UNLESS SPECIFICALLY REQUESTED. LIAISE WITH YOUR VOYAGE OPERATIONS MANAGER AS REQUIRED. ADDITIONAL STAFF MAY BE REQUIRED FOR THESE ACTIVITIES.		
D & N Francis winch			15mm electro-optical cable		
Box Corer					
UTAS In-Situ Pumps (x2)					
EM2040		х	Shallow water multibeam echosounder system. ?		

# Appendix B

# User Supplied Equipment

Owner	Item Name	Weight	Dimensions	Location on Vessel
Hubble Power	4 to 6 Collapsible Plastic Pallets for Core	1200 kgs		Constant Temperature Lab and then in the
Airey	Transport and Storage			refrigerated container
Hubble Power	Timber Blocking for Core Stacking within Plastic	Max 200 kg	40 tubes 4 m long 50 mm	Dirty Wet Lab and/or constant temperature
Airey	Pallets		by 50 mm	lab
Hubble Power	PVC Duct Tubing for Archive Samples of Kasten	Max 200 kg	40 tubes 4 m long 50 mm	Dirty Wet Lab and/or constant temperature
Airey	Core		by 50 mm	lab
Hubble Power	Sample Packaging Materials (Plastic Tubs, Plastic	Max 250 kgs	TBD (Small)	Dirty Wet Lab and/or constant temperature
Airey	Bags, Smaple Tubes etc			lab
Geoscience	Core Splitting Device	Approximately 200	Approximately 2m by 1m	Dirty Wet Lab
Australia		kg	by 0.5 m	
Martin Jutzler	Core Photography Rig	Approximately 50	Approximately 2m by 1m	Dirty Wet Lab
		kg	by 0.5 m	
Hubble Power	Geotechnical Testing Equipment	200 kgs	TBD (Small)	Dirty Wet Lab
Airey				