



RV Investigator Voyage Plan

Voyage #:	IN2021_E02
Voyage title:	Equipment Calibrations 2021
Mobilisation:	Monday, 15 November – Wednesday, 17 November 2021, Hobart
Medical testing:	Thursday, 18 November – Friday, 19 November 2021 (<i>bunkering Selfs Point, 19 November @~1015 hrs</i>)
Depart:	Saturday, 20 November 2021, Selfs Point, ~0930hrs
Return:	Saturday, 27 November 2021, Hobart PW04
Demobilisation:	Sunday, 28 November – Monday, 29 November 2021, Hobart PW04
Voyage Delivery Coordinator	David Flynn
Voyage Manager:	Tegan Sime
Deputy Voyage Manager:	David Flynn
Technical Lead:	Jason Fazey
Affiliation:	CSIRO – MNF Facilities

Voyage Scope Of Works:

Team	Activities Targeted	Time Requested / Required	Limitations / Constraints / Requirements	Day / Night Operations	Ideal Water Depth Operations	Comments:
MNF Facilities / Operations / RAPP MacGregor	GP Winch Annual Calibration (Heavy Ocean Towing System new wire)	12hrs (6hr full spool + respool as backup)	Requires RAPP MacGregor Software Tech. 500kg Dummy weight chosen by SIT+FO.	Daylight	5000m	Essential system for IN2021_V05 (Keesing), IN2022_V01 (Post), IN2022_V02 (Jutzeler)
	CTD Winch #1 Annual Calibration	6hrs	Requires RAPP MacGregor Software Tech. 500kg Dummy weight chosen by SIT+FO.	Daylight	5000m	
	CTD Winch #2 Annual Calibration	6hrs	Requires RAPP MacGregor Software Tech. 500kg Dummy weight chosen by SIT+FO.	Daylight	5000m	
	Deep Core Winch Annual Calibration	12hrs (6hr spool testing each x2)	Requires RAPP MacGregor Software Tech. 2.7T Piston Core Head Dummy weight chosen by FO.	Daylight	3500m or deeper	Essential system for IN2022_V01 (Post), IN2022_V02 (Jutzeler)
	Towed Body Winch Annual Calibration	6hrs	Requires RAPP MacGregor Software Tech. 500kg Dummy weight chosen by SIT+FO.	Daylight	3500m	
	PORT & STBD Trawl Winch Calibrations, also "Fishing Mode Software" comissioning. ***Trawl Winch Fishing Calibrations using Marport Trawl Monitoring Equipment.	12hrs	Requires RAPP MacGregor Software Tech. Midwater trawl gear (open cod-end) providing resistance for calibrations.	Daylight	1600m Max on Marport Sensors	Essential system for IN2022_V05.

Team	Activities Targeted	Time Requested / Required	Limitations / Constraints / Requirements	Day / Night Operations	Ideal Water Depth Operations	Comments:
Seagoing Instrumentation Team (SIT)	Deep Tow Camera (DTC) with eDNA sensor (if ready)	24hrs (3x 6hr slots + 1x 6hr slot as backup)	Weather permitting for deployment, recovery	Daylight preferred, night operations OK	3x deployments ~300m / 2000m / 5000m in order + 1x deployment contingency	Requires (DTC) serviceable with new deep view ports to permit deployment to 3,900m. HOTS cable buoyancy / behaviour in water is unknown.
	Sea Surface Temperature Radiometer (ISAR)	0hrs	Support Equip. in bridge	N/A	N/A	Access to port bridge wing while underway (conditions permitting).
Geophysical Survey and Mapping (GSM)	Opportunistic Mapping	Ad Hoc	Ad Hoc	N/A	N/A	N/A
Data Acquisition and Processing (DAP)	New & Existing Staff cross-training + PABX Phone Upgrade Testing Misc. upgrades/tests	0hrs	N/A	N/A	N/A	No dedicated ship time required or system outages/interruptions expected.

Voyage objectives

The primary voyage objective for this voyage, is for the Marine National Facility (MNF) to calibrate and commission new, upgraded and existing critical equipment (with sea trials and personnel training) onboard *RV Investigator* for upcoming voyages in the 2021 schedule and beyond.

Specifically, work will focus on the finalization of hardware and software calibrations of onboard winches, using OEM technician support, together with experienced crew operators and engineering & technology support staff. This includes calibrations and trials of the Deep Towed Camera using the new Heavy Ocean Towing System cable, as well as software commissioning of ‘fishing mode’ on trawl warp controllers to improve automation for safer and more effective fishing operations.



Yellow Frame Headweight 500kg – HOTS & TBW Calibrations

Figure 1. Selected test ‘dummy’ weights for calibrations of winches and wire spooling.

Piggyback projects

Whilst not prioritised in the scope of works, some other ancillary voyage objectives will be targeted for achievement where they don’t limit or impact above priorities.

- 1) A 2nd Sea Surface Temperature Radiometer (ISAR) installed on port bridge wing for comparison to existing 1st ISAR unit. Requires running cable & conduit into bridge in port period (IN2021_P05_01) lead by Nicole Morgan from SIT.
- 2) Underway aerosol particulate CO² sensor upgrade & replacement, testing & monitoring underway by Craig Neill from O&A.

Voyage Risk Assessment (VRA)

A Voyage Specific Risk Assessment (VSRA) has been created and ASP has a number Job Safety Environment Analyses (JSEAs) that ensure this voyage's risks have been identified and appropriately controlled. ASP also maintains a service contract with the Original Equipment Manufacturer (OEM) RAPP MacGregor, who is contracted to provide ongoing OEM support with regard to maintenance, calibration, and equipment repairs. This is undertaken with a RAPP Technician onboard during this trials and calibration voyage.

Overall Activity Plan First 96hrs of Voyage

Day	Date	Time	Activity
Thursday	18 Nov	0800 - 0930	Complete 3 rd Covid-19 test, board vessel
Friday	19 Nov	0800	Depart from PW04 Hobart @~0800hrs to Selfs Point for bunkering.
Saturday	20 Nov	0800	Depart Selfs Point/River location and commence piloted transit through Derwent Estuary.
Saturday	20 Nov	1100	Commence long steam to Deep Water Site for Winch Calibrations
Sunday	21 Nov	0730	Arrive on station "Deepwater Site 5000m" team toolbox meeting
Sunday	21 Nov	0830	General Purpose Winch & HOTS wire calibration
Sunday	21 Nov	1700	Afternoon Debrief, nighttime mapping operations, prepare for next day ops

Voyage track example

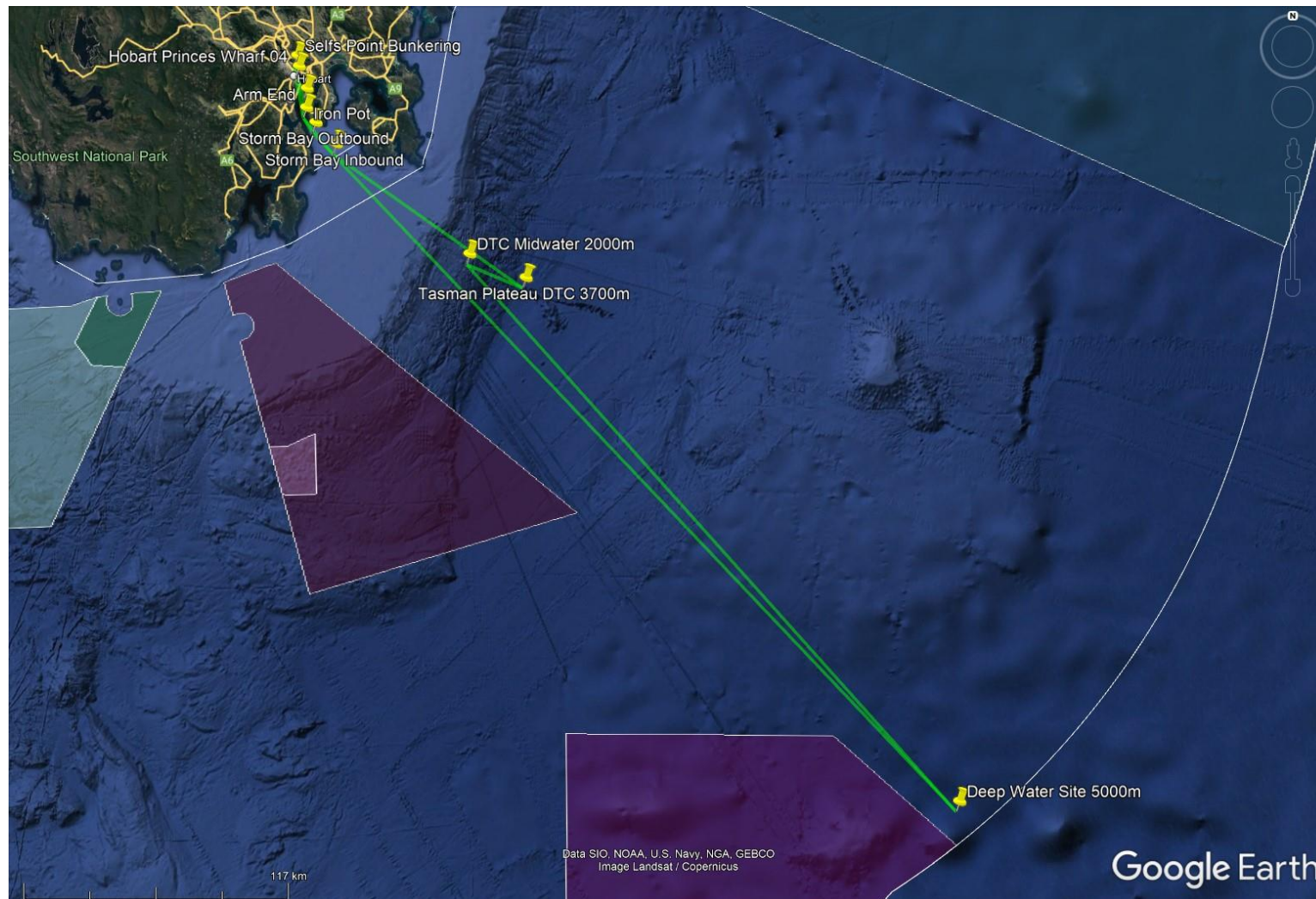


Figure 2. Proposed voyage track as a green line, with track waypoints yellow pins, commonwealth marine parks shaded colours and Australia's EEZ (200NM limit) in white.

Waypoints, stations & time estimates

The following time estimates are based on a steaming speed of 10.5 knots.

SITE / WAYPOINT ACTIVITY	LATITUDE DD	LONGITUDE DD	DISTANCE (NM)	TOTAL DISTANCE (NM)	STEAMING TIME (HRS)	TOTAL STEAM (HRS)
Hobart Princes Wharf #04	-42.88644	147.33872	0.0	0.0	0	0.0
Selfs Point Bunkering	-42.84480	147.33042	2.5	2.5	0.5	0.5
Arm End Pilot Transit	-42.97317	147.37933	8.0	10.5	1.6	2.1
Iron Pot Transit	-43.04765	147.37573	4.5	15.0	0.9	3.0
Storm Bay OUTBOUND Transit	-43.10639	147.42485	4.1	19.1	0.5	3.5
Deep Water Site GP / HOTS Winch Calibrations DTC Test + Shallow Cast CTD #1 & #2 Winch Calibrations Deep Core Winch Calibrations Towed Body Winch Calibrations	-45.71373	150.92042	216.7	235.9	20.6	24.2
DTC / Midwater Site PORT & STBD Trawl Winch Cal. Deep Tow Camera – Shallow Cast Deep Tow Camera – Midwater Cast	-43.62431	148.23867	169.8	405.7	16.2	40.3
Tasman Plateau DTC 3700m Deep Tow Camera - Deep	-43.71727	148.53772	14.1	419.8	1.3	42.4
Storm Bay INBOUND Transit	-43.19183	147.53338	54.0	473.8	6.7	49.1
Iron Pot Transit	-43.04765	147.37573	11.1	484.9	1.4	50.5
Hobart Princes Wharf #04	-42.88644	147.33872	9.8	494.7	2.5	52.9

CTD Configuration

Note: No CTD casts are planned on this voyage.

Permits & Notifications

- Australian Marine Parks blanket permit (Permit Number: **PA2020-00041-2**; 24 June 2020 to 20 August 2023) covers the MNF for all planned underway science activities within commonwealth marine parks, as listed in this voyage plan. No other activities requiring further permits are planned within commonwealth marine parks for this voyage (e.g. rock dredging, hydrabios net sampling, CTD water retention).

Signature

Your name	Jason Fazey
Title	Technical Lead
Signature	Jason Fazey
Date:	20 November 2021

List of additional figures and documents

Appendix A:	Selected MNF Equipment List
Appendix B:	User Supplied Equipment Manifest
Appendix C:	Hazardous Materials Manifest

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		<ul style="list-style-type: none"> Please indicate the intended activity in this lab
Air Chemistry Lab		<ul style="list-style-type: none"> Please indicate the intended activity in this lab
Preservation Lab		<ul style="list-style-type: none"> Please indicate the intended activity in this lab
Constant Temperature Lab (Min temp: 2°C / Max temp 35°C)		<ul style="list-style-type: none"> 4°C as desired setpoint for temperature
Underway Seawater Analysis Laboratory	X	<ul style="list-style-type: none"> PCO² (Carbon Dioxide Sensor) Calibration and Testing of new sensor underway
GP Wet Lab (Dirty)	X	<ul style="list-style-type: none"> General Activities
GP Wet Lab (Clean)		<ul style="list-style-type: none"> Please indicate the intended activity in this lab
GP Dry Lab (Clean)		<ul style="list-style-type: none"> Please indicate the intended activity in this lab
Sheltered Science Area	X	<ul style="list-style-type: none"> Deep Tow Camera storage and preparation area
Observation Deck 07 Level		<ul style="list-style-type: none"> Please indicate the intended activity in this area
Internal Freezer (Dirty Wet lab) (Min temp -25°C / Max temp 0°C) Volume: >20m ³		<ul style="list-style-type: none"> Please indicate the intended activity in this area Please indicate the required setpoint temperature
Clean Freezer (Dirty Wet lab) (Min temp -25°C / Max temp 0°C) Volume: >2.5m ³ Co-located within the Internal freezer and separated by a door		<ul style="list-style-type: none"> Please indicate the intended activity in this area Please indicate the required setpoint temperature

STANDARD LABORATORIES AND FACILITIES		
NAME	REQUIRED	NOTES/COMMENTS
Blast Freezer (Dirty Wet lab) (Min temp -30°C / Max temp 0°C) Internal volume >1.5m ³ Capable of reducing the temperature of 150kg of water from +20C to -30C in one hour.		<ul style="list-style-type: none"> Please indicate the intended activity in this area Please indicate the required setpoint temperature
Cool Room (Dirty Wet lab) (Min temp 0°C / Max temp 10°C)		<ul style="list-style-type: none"> Please indicate the intended activity in this area Please indicate the required setpoint temperature
Ultra-Low Temperature Freezers x2 (Main Deck) Min temp -80°C / Max temp -80°C)		<ul style="list-style-type: none"> Please indicate the intended activity in this area
YODA Freezers (x2) (Clean Dry lab) (Min temp -20°C / Max temp 10°C)		<ul style="list-style-type: none"> Please specify if both or only one are needed Please indicate the intended activity in this area Please indicate the required setpoint temperature

MOBILE LABORATORY AND FACILITIES (MAY REQUIRE ADDITIONAL SUPPORT)			
NAME	ESSENTIAL	DESIRABLE	NOTES/COMMENTS
Modular Isotope Laboratory			<ul style="list-style-type: none"> If nominated, additional processes to be completed.
Trace Metal Niskin Sampling Container (TM1-blue)			<ul style="list-style-type: none">
Trace Metal Seawater Analysis Laboratory (TM2-white)			<ul style="list-style-type: none"> Cannot be overstacked
Trace Metal Rosette and Niskin Storage Container			<ul style="list-style-type: none"> 10-foot container
Modular Hazchem Locker			<ul style="list-style-type: none">
Stabilised Platform Container			<ul style="list-style-type: none"> Please indicate what instruments are to be installed in the container Cannot be overstacked
Clothing Container			<ul style="list-style-type: none"> 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			N/A
CTD - Seabird 911 with 24 Bottle Rosette	X		Rosette used in CTD lab with additional weights to load and calibrate CTD winches
Lowered ADCP			
Continuous Plankton Recorder (CPR)			

SPECIALISED SAMPLING EQUIPMENT			
NAME	ESSENTIAL	DESIRABLE	NOTES/COMMENTS (THESE ITEMS MAY REQUIRE ADDITIONAL MNF SUPPORT STAFF)
TRIAXUS – Underway Profiling CTD			<p>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</p> <p>Usual instrumentation: SBE9plus (pressure sensor and communication hub) and dual pumped temperature/conductivity/dissolved oxygen circuits. Usual auxiliary instrumentation includes an ECO-Triplet (Chl, CDOM, backscatter), transmissometer, PAR sensor, and Laser Optical Plankton Counter.</p> <p>Contact MNF for further details on other instrumentation and capability.</p>
Desired towing profile:			
Additional instrumentation:			

SPECIALISED SAMPLING EQUIPMENT			
NAME	ESSENTIAL	DESIRABLE	NOTES/COMMENTS (THESE ITEMS MAY REQUIRE ADDITIONAL MNF SUPPORT STAFF)
(please supply, make and model and datasheets and a contact person for discussion on integration)			
Piston Coring System	X		<ul style="list-style-type: none"> To be left onboard from previous voyage (IN2021_E01)
Gravity Coring System			
Multi Corer			
Kasten Corer			
Smith Mac Grab			
Rock Dredges			
Rock Saw			<ul style="list-style-type: none"> Requires trained science personnel
Seaspy Magnetometer			
Portable Pot Hauler			
Equipment to measure seawater sound velocity/CTD	X		To be left onboard from previous voyage (IN2021_E01)
XBT System	X		To be left onboard from previous voyage (IN2021_E01)
Valeport Rapid SV	X		To be left onboard from previous voyage (IN2021_E01)
Valeport Rapid CTD	X		To be left onboard from previous voyage (IN2021_E01)
Valeport SVX2	X		To be left onboard from previous voyage (IN2021_E01)
Trace Metal Rosette and Bottles			
Trace Metal In-situ Pumps (x6)			<ul style="list-style-type: none"> See non-MNF owned section below for additional 2 units
Deep Towed Camera	X		

SPECIALISED SAMPLING EQUIPMENT			
NAME	ESSENTIAL	DESIRABLE	NOTES/COMMENTS (THESE ITEMS MAY REQUIRE ADDITIONAL MNF SUPPORT STAFF)
Drop Camera			
Sherman Epibenthic Sled			
Brenke Sled			
EZ Net (Multiple net system, 1m x 1m)			<ul style="list-style-type: none"> Please specify 335-micron, 500-micron, or 1,000-micron mesh
Hydro-Bios MultiNet (1m x 1m)			<ul style="list-style-type: none"> Please specify 335-micron, 500-micron, or 1,000-micron mesh
Surface Net (1m x 1m)			<ul style="list-style-type: none"> Please specify 335-micron, 500-micron, or 1,000-micron mesh
Bongo Net 485mm diameter			<ul style="list-style-type: none"> 500 micron mesh only
Beam Trawl			
MIDOC			<ul style="list-style-type: none"> Multiple opening/closing net system with cod ends- suitable for pelagic trawls
Pelagic Trawl System (net, doors)	X		<ul style="list-style-type: none"> Required as load for trawl winches during calibration and software comissioning
Demersal Trawl System (net, doors)			<ul style="list-style-type: none"> 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.			<ul style="list-style-type: none"> 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.			<ul style="list-style-type: none"> 16m² mouth area Tow speed ≤2 knots

SPECIALISED SAMPLING EQUIPMENT			
NAME	ESSENTIAL	DESIRABLE	NOTES/COMMENTS (THESE ITEMS MAY REQUIRE ADDITIONAL MNF SUPPORT STAFF)
Trawl Monitoring Instrumentation (ITI) (2,000m depth limit)	X		<ul style="list-style-type: none"> Used in support of (and as backup to) the rented Marport Trawl Monitoring System
Stern ramp		EXPOSED	

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			<ul style="list-style-type: none"> Temperature controlled deck incubators
Milli-Q System			
Sonardyne USBL System			

SCIENTIFIC / SAMPLE ANALYSIS SYSTEMS				
MICROSCOPES:				NOTES/COMMENTS
BRAND / MODEL	TYPE	ESSENTIAL	DESIRABLE	Refer to the "MNF microscopes procedure" for more information
Leica / M80	Dissecting			
Leica / M80	Dissecting			
Leica /MZ6	Dissecting			
Olympus / CH	Compound			
Olympus /CH	Compound			
Leica / MTU282	Camera tube			

SCIENTIFIC / SAMPLE ANALYSIS SYSTEMS				
MICROSCOPES:				NOTES/COMMENTS
Adapters for tube / Nikon	Pentax			
Ring Light *2 / MEB121	LED			
Heavy Duty Electronic Balance (80kg)				
Medium Duty Electronic Balance (15kg/5g resolution)				
Light Duty Electronic Balance (3kg/1g resolution)				

Underway systems

ACOUSTIC UNDERWAY SYSTEMS			
NAME	ESSENTIAL	DESIRABLE	NOTES/COMMENTS
75kHz ADCP			
150kHz ADCP			
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	X		
Scientific Narrowband Echo Sounders EK60 (6 bands, 18kHz-333kHz)	X		<ul style="list-style-type: none"> EK60s will be onboard for use as a backup for EK80s and set in narrowband mode
Scientific Narrowband/Broadband Echo Sounders EK80 (6 bands, 18kHz-333kHz)	X		<ul style="list-style-type: none"> EK80s will be used in narrowband mode unless otherwise requested
Multibeam Scientific Echo Sounder ME70 (70-100 kHz)			
Omnidirectional Echo Sounder SH90			

ACOUSTIC UNDERWAY SYSTEMS			
NAME	ESSENTIAL	DESIRABLE	NOTES/COMMENTS
Gravity Meter	X		

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 ₂ /CH ₄ /H ₂ O)			
Aerodyne Spectrometer (analysis of N ₂ O/CO/H ₂ O)			
Cloud Condensation Nuclei (CCN)			
Polarimetric Weather Radar			

UNDERWAY SEAWATER SYSTEMS AND INSTRUMENTATION			
NAME	ESSENTIAL	DESIRABLE	NOTES/COMMENTS
Thermosalinograph			
Fluorometer			
Optode			
pCO ₂	X		<ul style="list-style-type: none"> PCO₂ (Carbon Dioxide Sensor) Calibration and Testing of new sensor underway – new sensor being monitored remotely by Craig Neill

SEAWATER SYSTEMS			
NAME	ESSENTIAL	DESIRABLE	NOTES/COMMENTS
Trace metal clean seawater supply	X		
Scientific clean seawater supplied to laboratories	X		<ul style="list-style-type: none"> Required for Hydrochemistry comparison of nutrient analysers
Raw seawater available on deck and in laboratories	X		

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			
Seismic Acquisition System			

NON-MNF OWNED EQUIPMENT WHICH MAY BE ACCESSED			
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.
D & N Francis winch			<ul style="list-style-type: none"> 15mm electro-optical cable
Box Corer			<ul style="list-style-type: none">
UTAS In-Situ Pumps (x2)			
EM2040			<ul style="list-style-type: none"> Shallow water multibeam echosounder system

Appendix B

User Supplied Equipment

Item Name	Weight	Dimensions	Location on Vessel
ISAR #2	23kg	230mm x 700mm tube	Port bridge Wing
CTD 24 bottle spare rosette	154kg no weights	1800mm x 1500mm	Sheltered Sceince
Heavy Ocean Towing System (HOTS) - First Use	815kg per Km (7.8km total)	19mm Diamater x 8km Length. Spooled to General Purpose Winch	1st Platform (Below Deck) General Purpose Winch Room
Marport Trawl Monitoring System (MTMS)	30kg each pelecane case	2x 100cm x 30cm x 40cm	Bridge and Trawl Equipment Storage
CO2 spectrometer	15 kg	case 80x53x34 cm instrument 44x44x20 cm	underway seawater lab
CO2 spectrometer	10 kg	50 x 32 x 17 cm	underway seawater lab
CO2 spectrometer	10 kg	50 x 32 x 17 cm	underway seawater lab
panel PC	5 kg	case 59 x 35 x 24 cm PC 40x40x10 cm	underway seawater lab

Appendix C

Hazardous Materials Manifest

No hazardous materials are to be taken or used onboard.