



Jindalee

Fugro Report - Hydrographic Services in Australasia and the Pacific

Hugh Parker, IHO SWPHC Meeting, Niue, 13-15 February 2019

Hydrographic charting to IHO standards using conventional acoustic and airborne Lidar technology

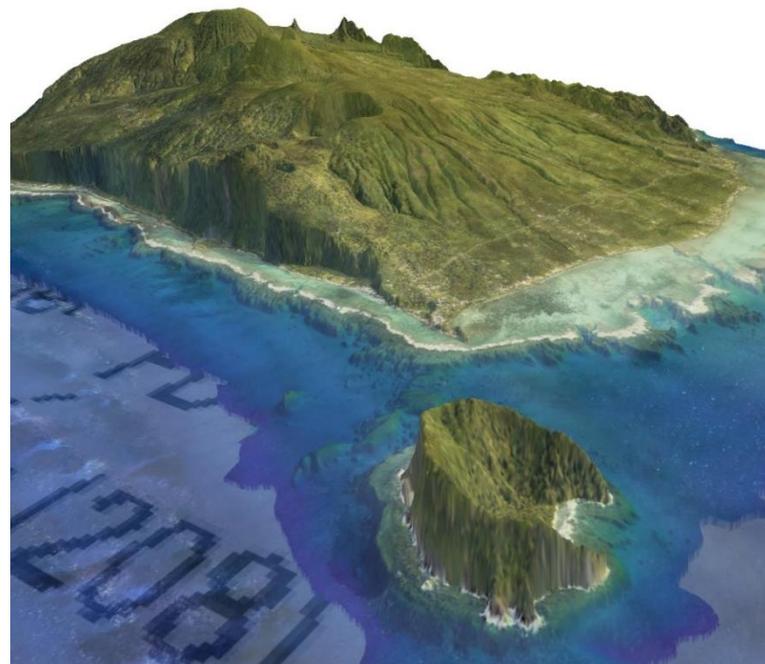
to provide maps and charts that characterise the ground surface from land, across the land-water boundary, and to full ocean depth.

Marine Site Characterisation



Main achievements during the year

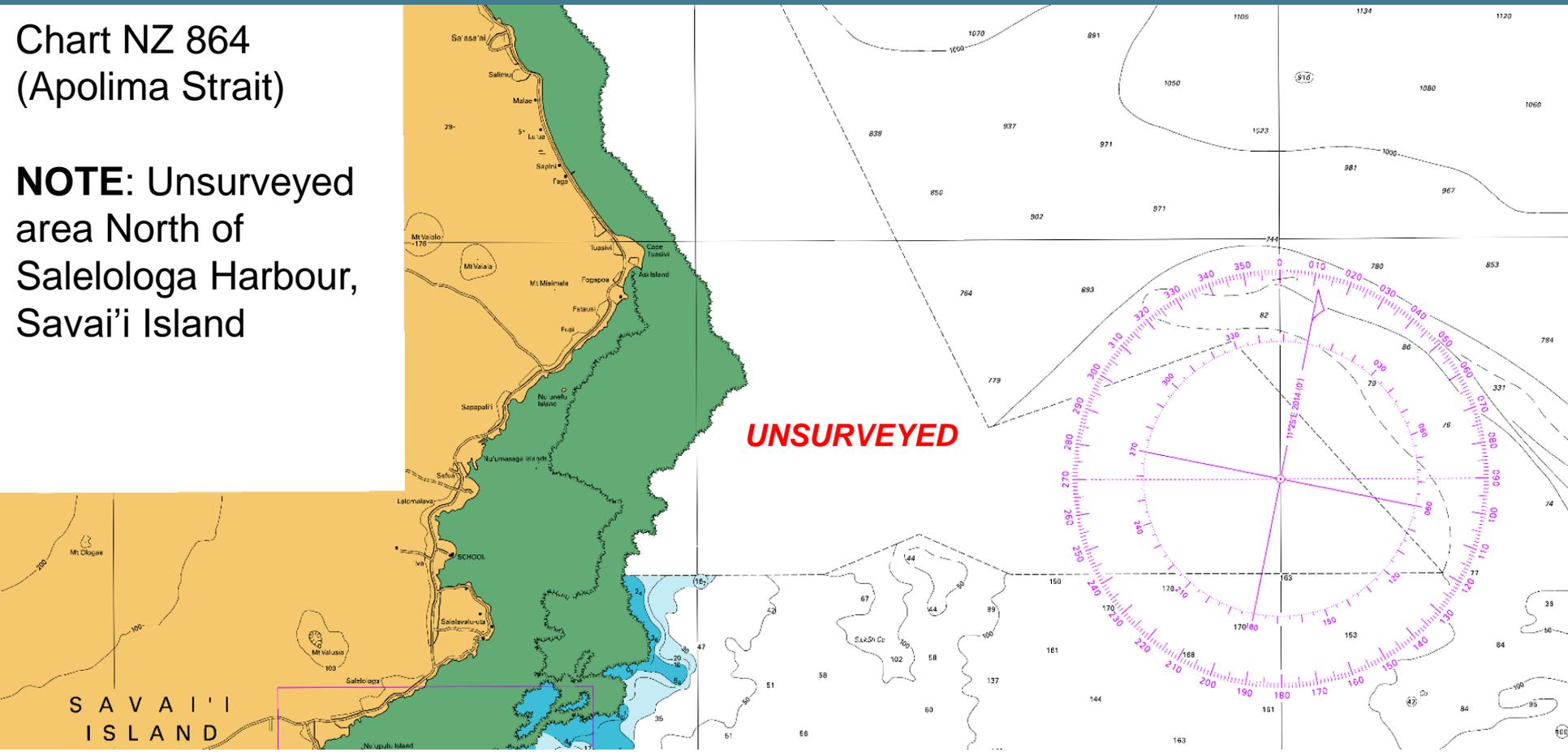
- Completion of the Field Work and 95% delivery for NMSA MWSP (ADB Funded)
- Completion of the Field Work and 95% delivery for NSW OEH coastal Lidar survey
- Geophysical survey in Kiribati
- Discovery of AE1 in PNG
- Accredited Category B hydrographic surveying training course (S-5B).
- Involvement in IHO HSPT S-44 6th Edition
- Active involvement in GEBCO 2030 and AusSeabed Initiatives
- Technology Developments into SDB, USV, ALB and Data Processing...



Good News Story...

Chart NZ 864 (Apolima Strait)

NOTE: Unsurveyed
area North of
Salelologa Harbour,
Savai'i Island

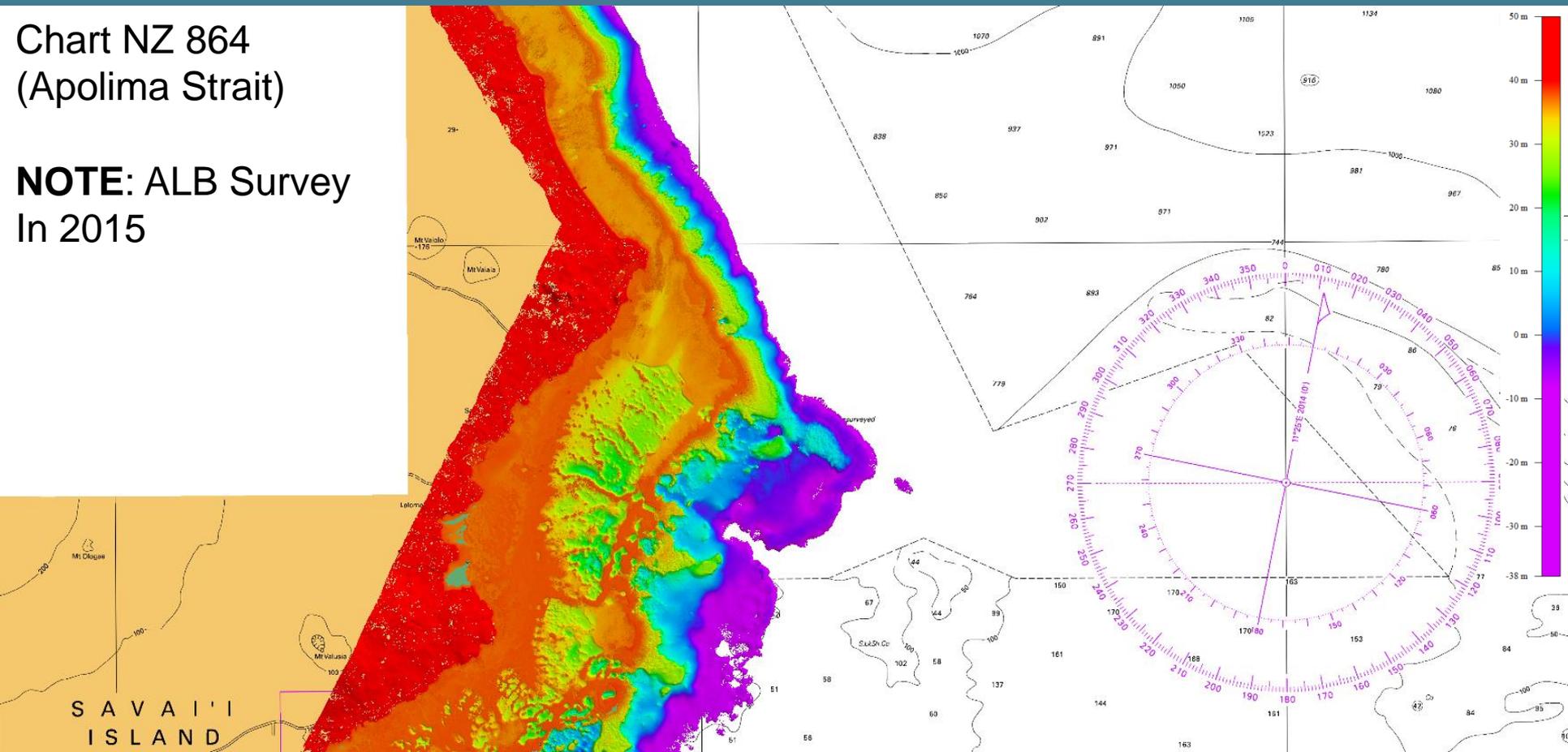


SAVAI'I
ISLAND

Good News Story...

Chart NZ 864 (Apolima Strait)

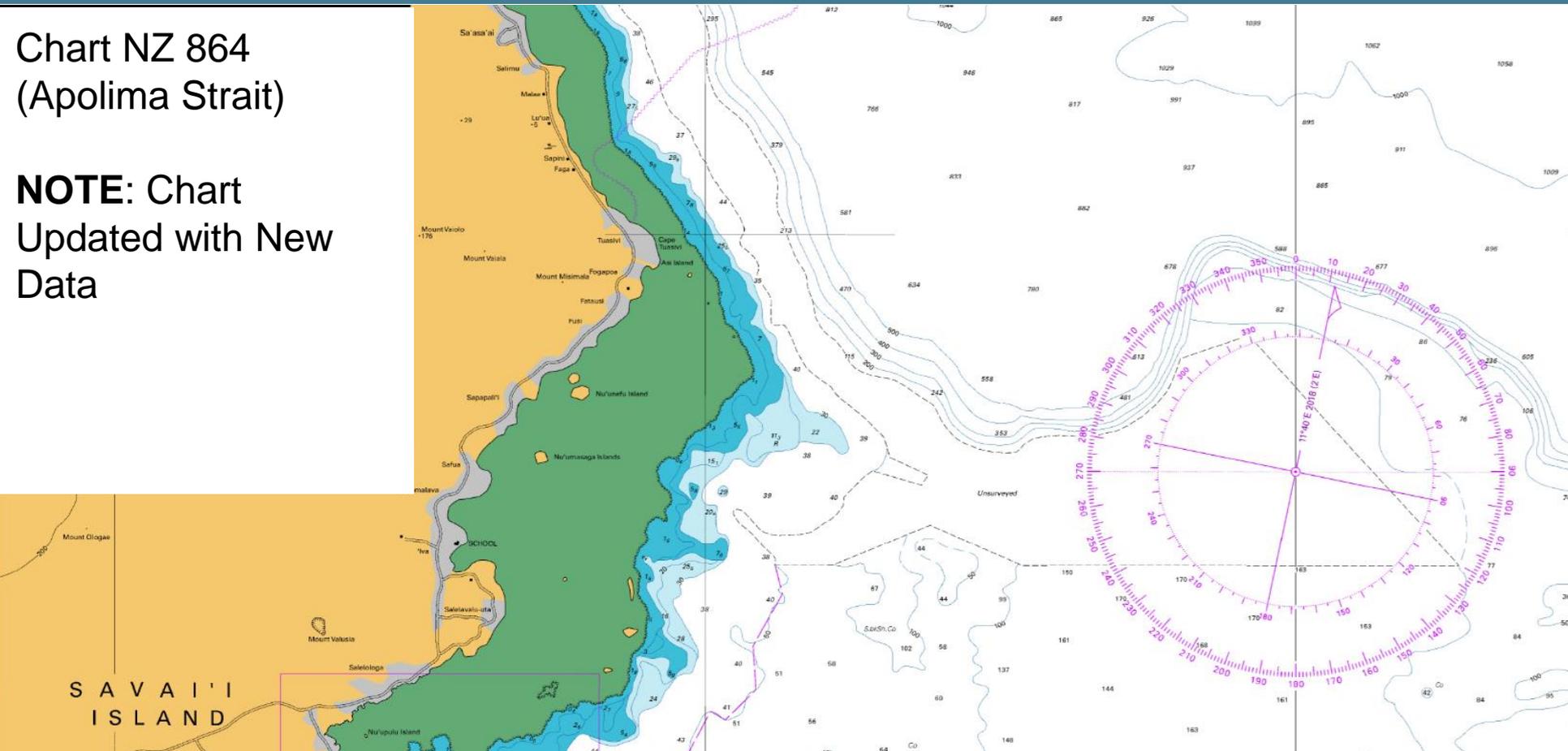
NOTE: ALB Survey
In 2015



Good News Story – Chart Updated!!!

Chart NZ 864
(Apolima Strait)

NOTE: Chart
Updated with New
Data



Good News Story – Finding AE1, December 2017

Fugro's role in the expedition to find HMAS AE1 has helped to solve Australia's oldest naval mystery, 103 years after the First World War Australian submarine vanished off Rabaul, Papua New Guinea.

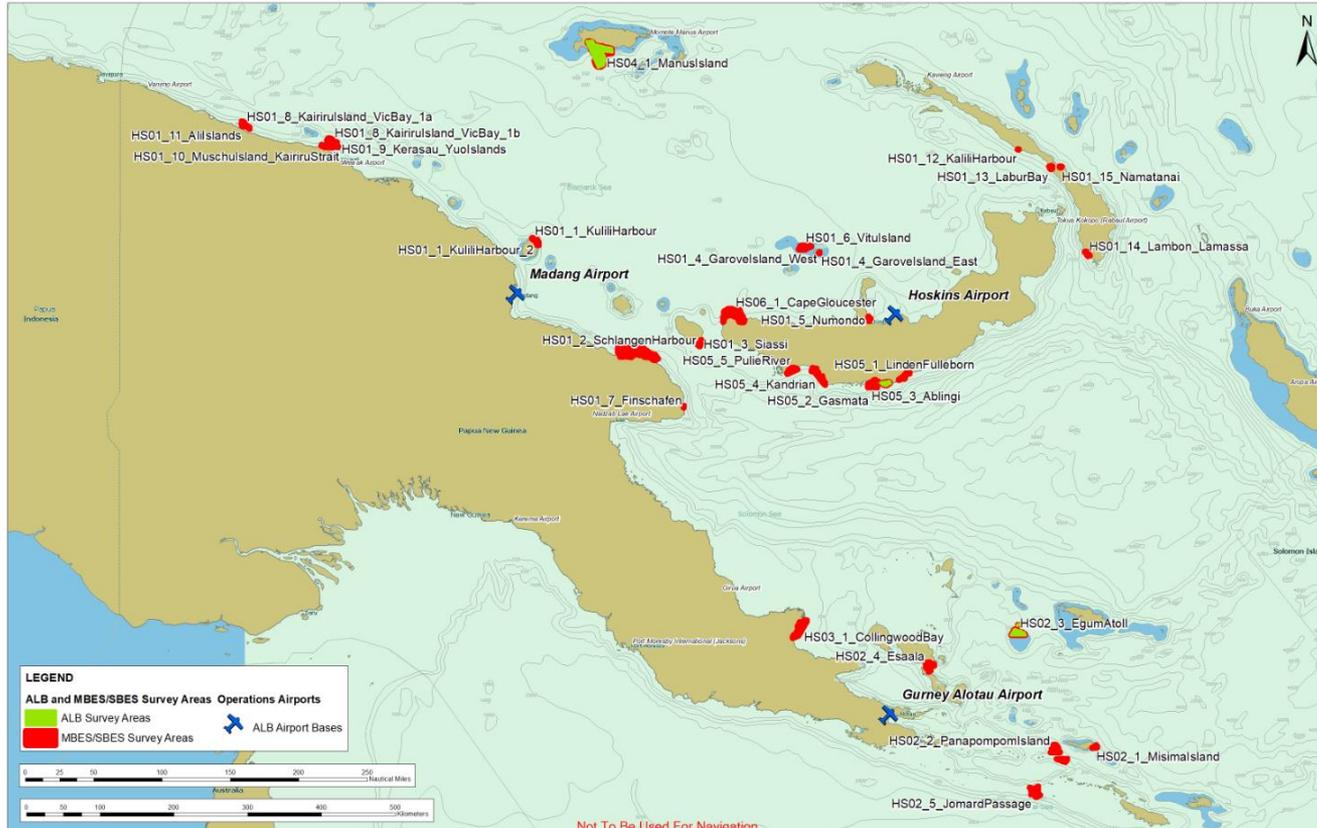


Progress on Surveys

- **PNG** – NMSA MWSP
 - 95% complete
 - All but one area delivered
- **AUST** – NSW OEH
 - Data Collection Complete
 - 40-60% Delivered
- **KIRIBATI** – Jacobs / NZDFAT
 - 100% Completed



NMSA MWSP – Survey Areas



Project objective: To improve safety and efficiency of international and national shipping in coastal areas and waterways in PNG

28+2 Areas (30 Total)

95% completed

All but 1 area delivered to AHO

NMSA MWSP - Vessel/MBES Component



MV Offshore Express



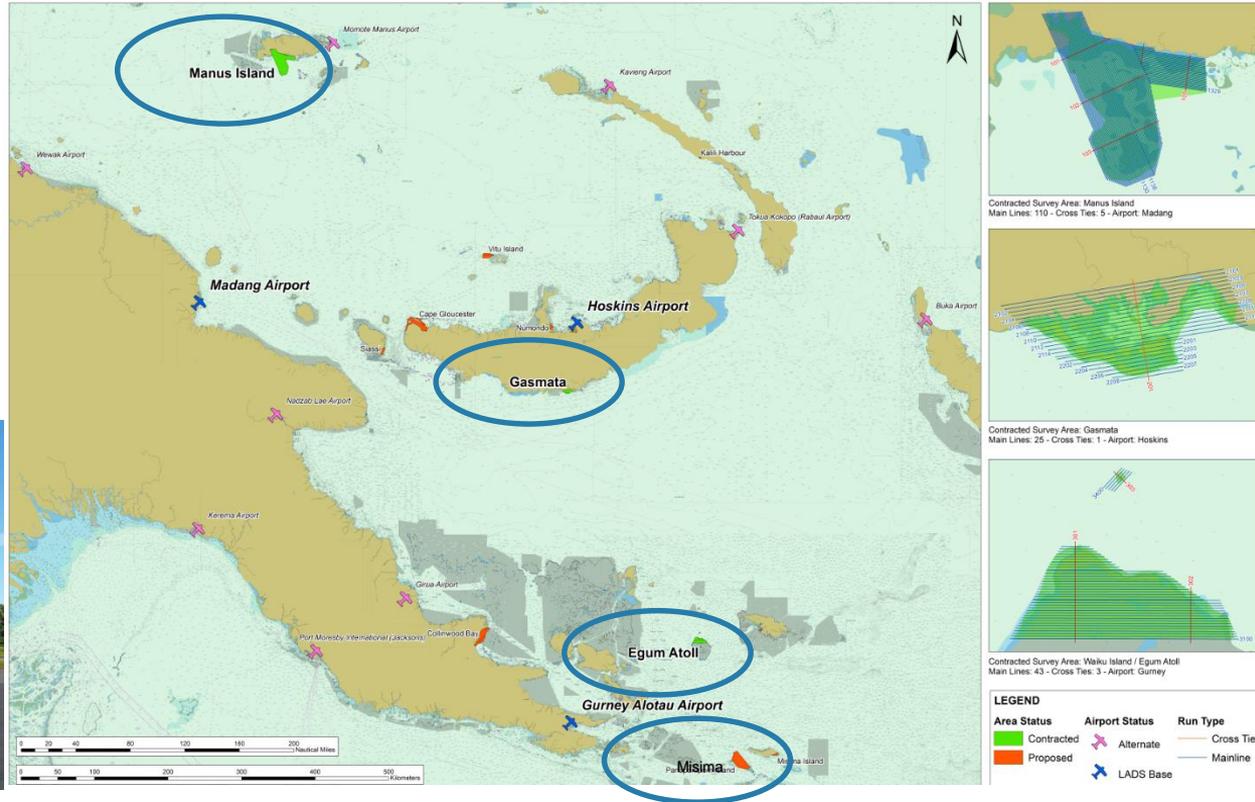
MAIN DIMENSIONS	
Length (Overall)	23.9 m
Beam	9.5 m
Maximum Draft	1.9 m
Deck Area	91 m ²
CLASSIFICATION	
AMSA 2B Ext 18 PAX Utility / Survey / Patrol Vessel	
CAPACITIES & SPEED	
Fuel	25,000 litres
Fresh Water	2,000 litres
Desalination Plant	6,480 litres / day
Cruising Speed	26 knots
Economical Speed	12 knots
ACCOMMODATION	
Berths	18 persons
DECK EQUIPMENT	
A-Frame	5 ton
Deck Crane	Palfinger PK 8500 7T
Moon Pool	1.2 m x 1.2 m

NMSA MWSP - ALB Component

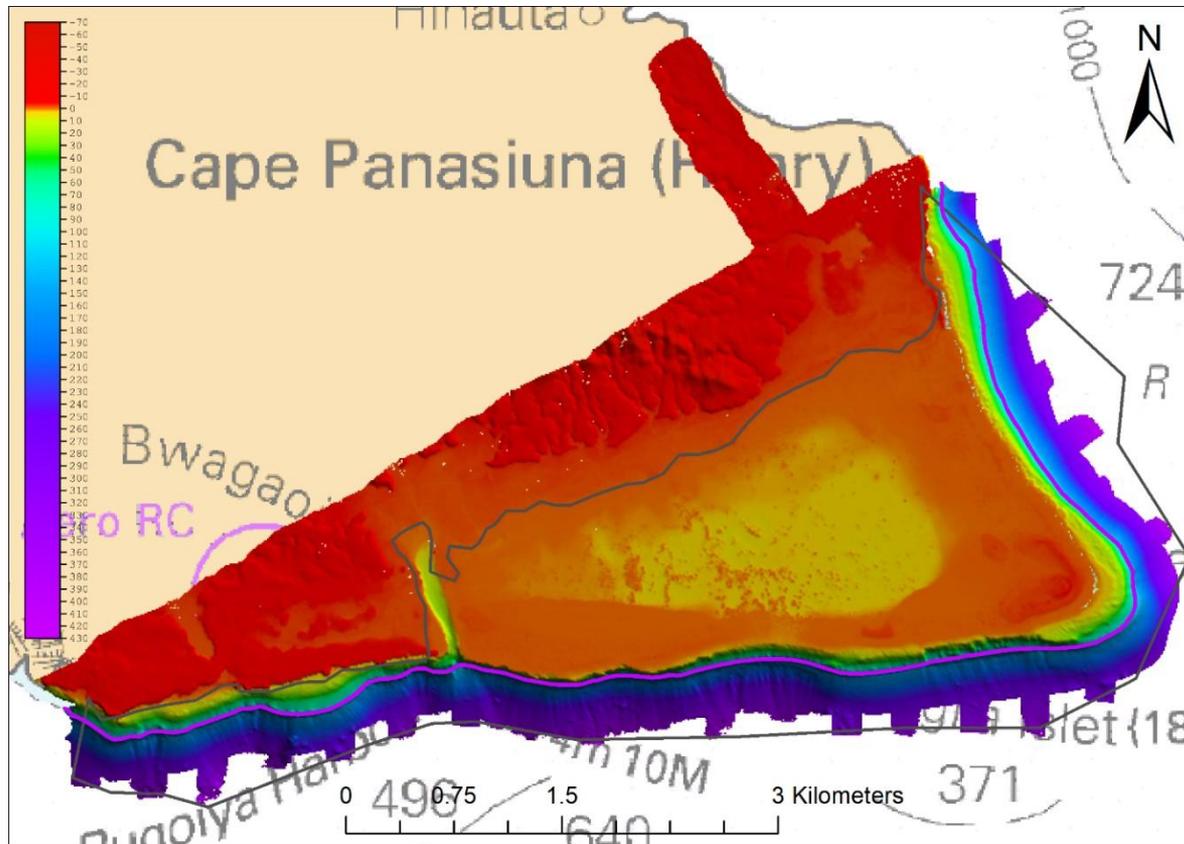


Areas surveyed with ALB:

- Manus Island
- Gasamta
- Egum Atoll
- Misima



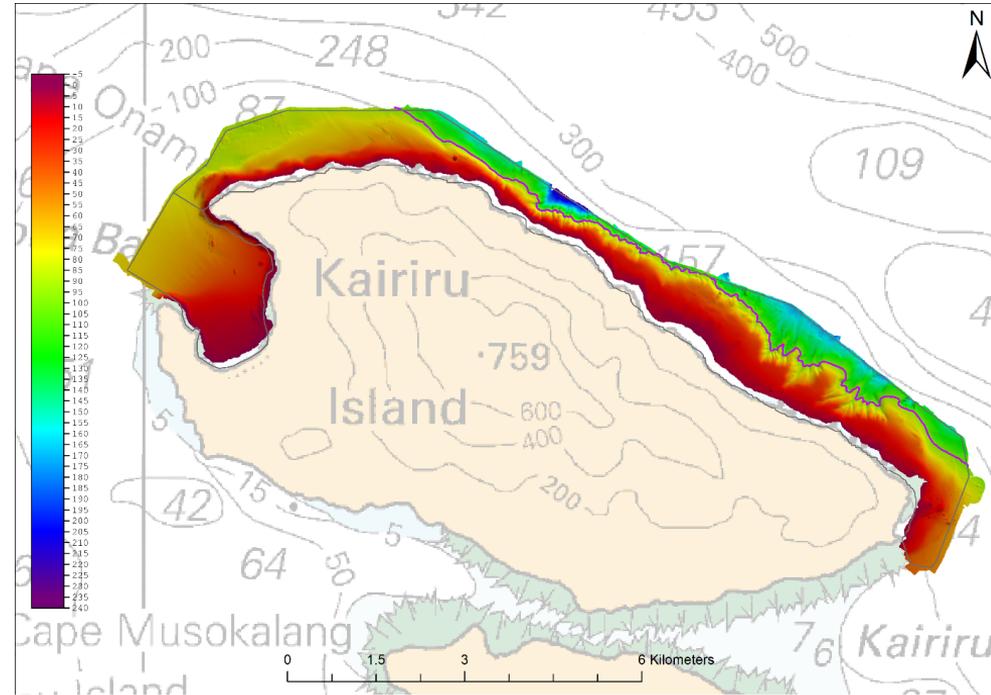
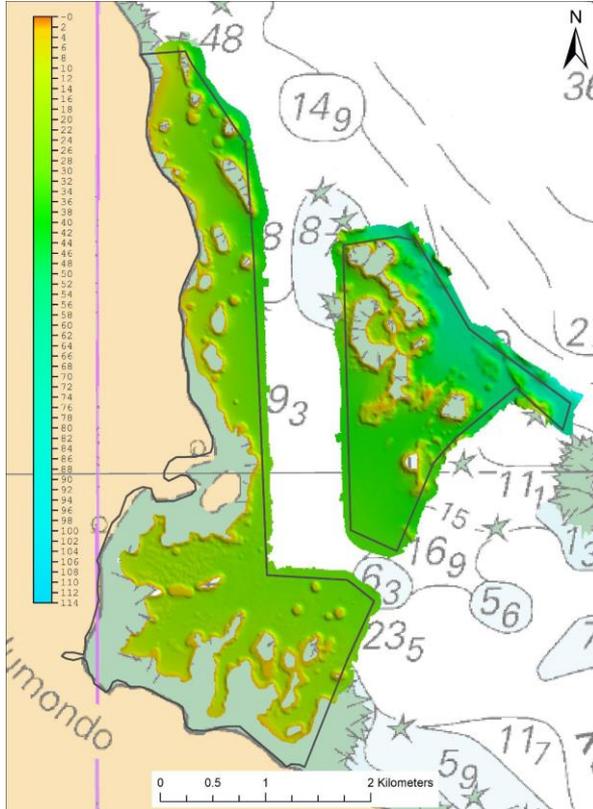
NMSA MWSP - Misima ALB and MBES – Coverage Achieved



NMSA MWSP - Example MBES Only Areas – Coverage Achieved

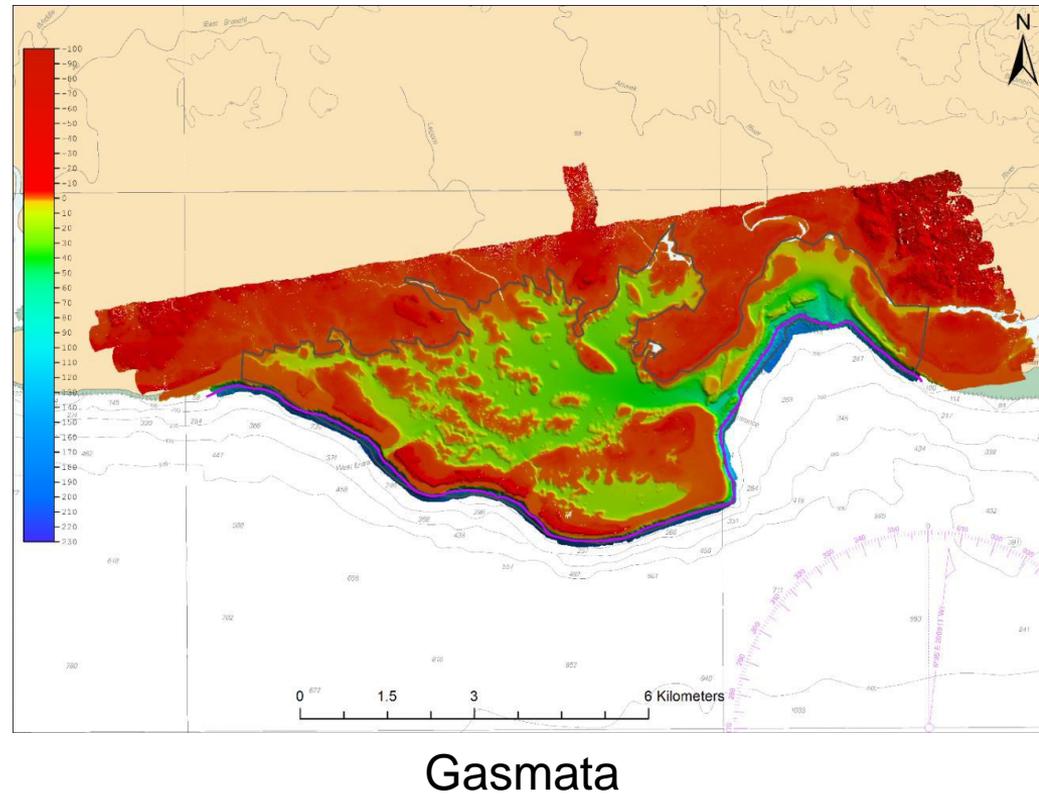
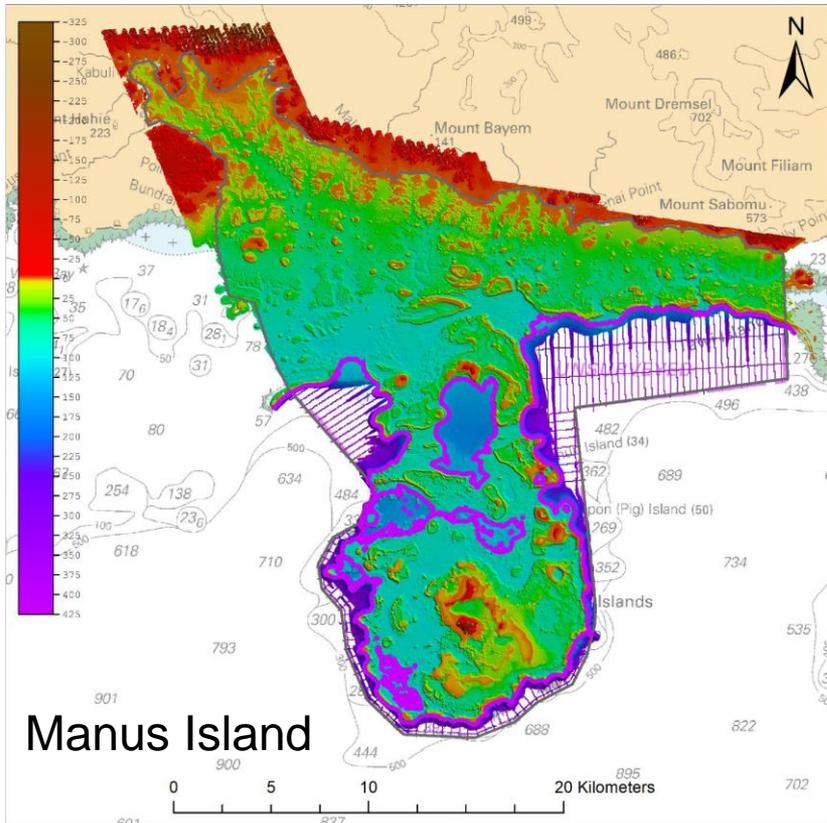


Numondo



Kairiru Island / Victoria Bay

NMSA MWSP - Example ALB and MBES – Coverage



Geophysical Survey in Kiribati - Overview

Elevated Development

- Feasibility study being conducted by NZDFAT
- Reclaim 299 hectares of low lying land
- Fill material being sourced from Tawara Lagoon
- Plan to build up to 1m above possible extreme water level projected for the year 2200.
- The total volume of fill material has been estimated to be approximately 8,500,000m³.
- NZDFAT contracted Jacobs NZ for the study.
- Jacobs contracted Fugro Australia to complete a marine geophysical survey to provide the necessary data to aid in the study.
- Five sites were identified as potential borrow areas based on historical data available, however only 3 of the 5 would be required for the plan.



Geophysical Survey in Kiribati – Vessel and Equipment

A local vessel, MV Kaotin Ribono was mobilised in Tarawa.

Survey equipment comprised;

- Multibeam Echosounder
- Singlebeam Echosounder
- Boomer Sub-bottom Profiler
- Refraction
- Grab Sampler
- Underwater Video
- Magnetometer / Gradiometer



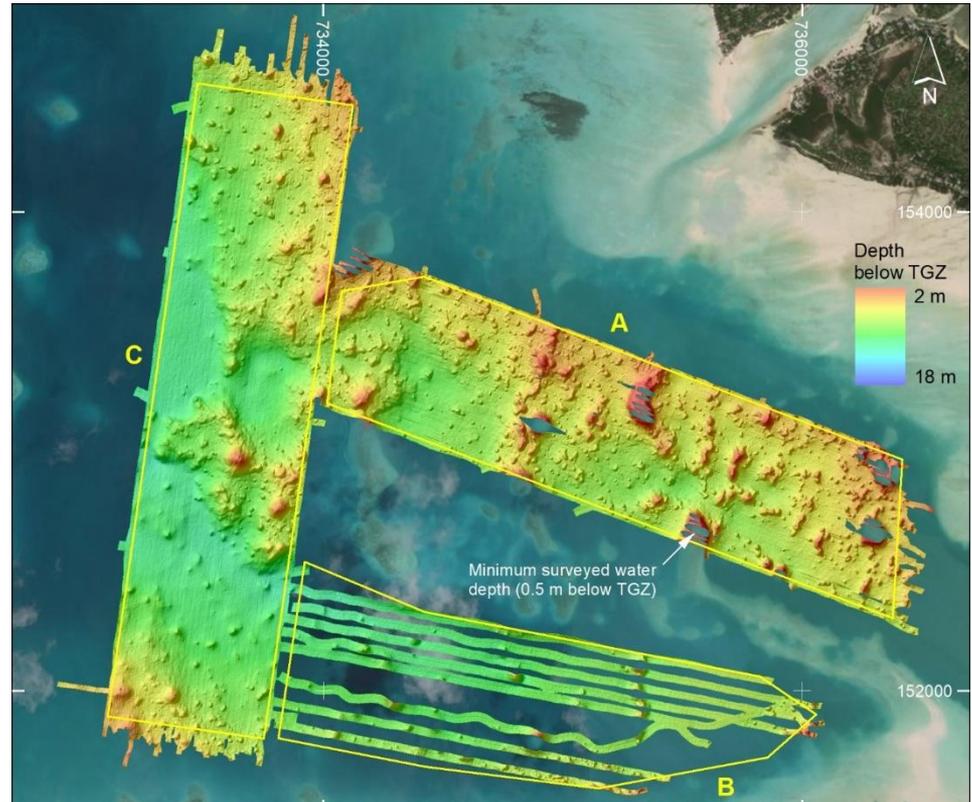
MV Kaotin Ribono

Geophysical Survey in Kiribati - Bathymetry

R2Sonic 2020 MBES

Acquired to within the safe working limits of the vessel at three of the proposed sites..

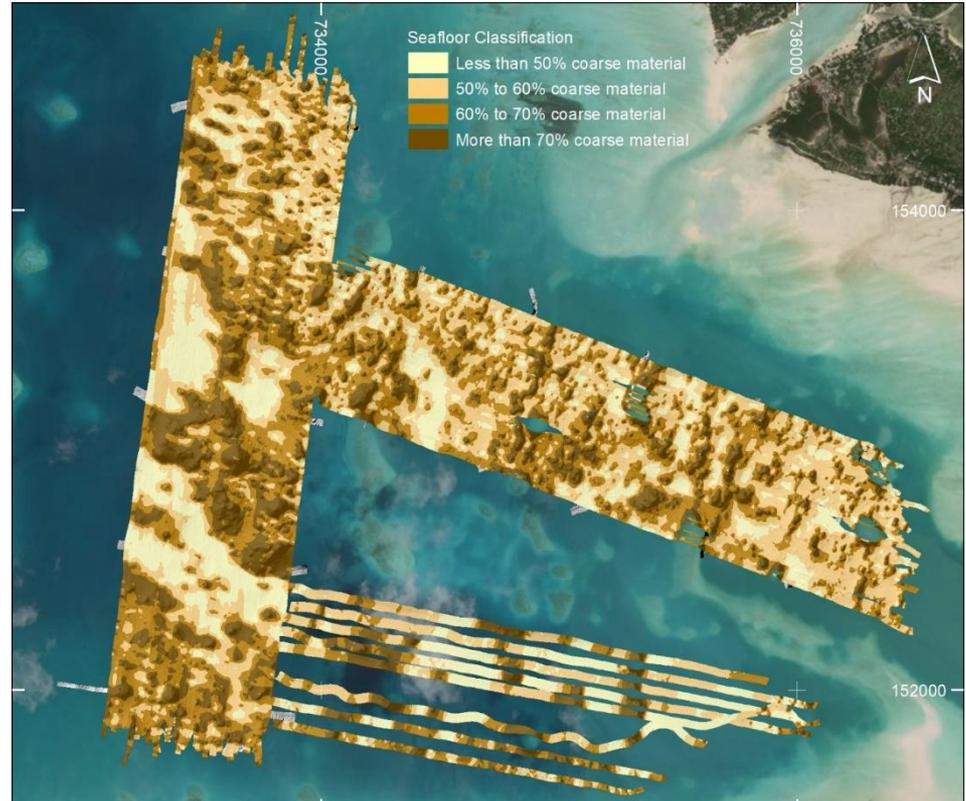
HF SBES utilised for QC of MBES data.



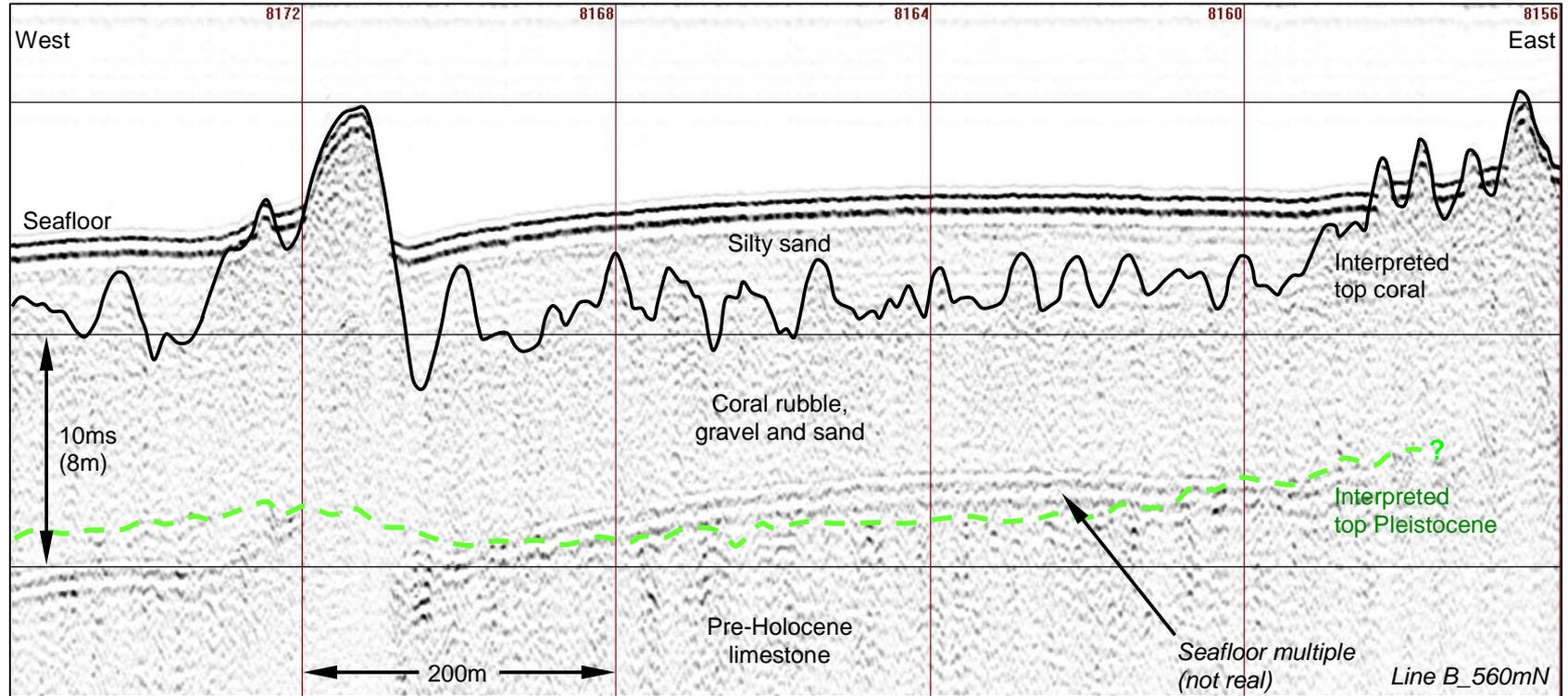
Geophysical Survey in Kiribati - Seabed Classification

R2Sonic 2020 MBES

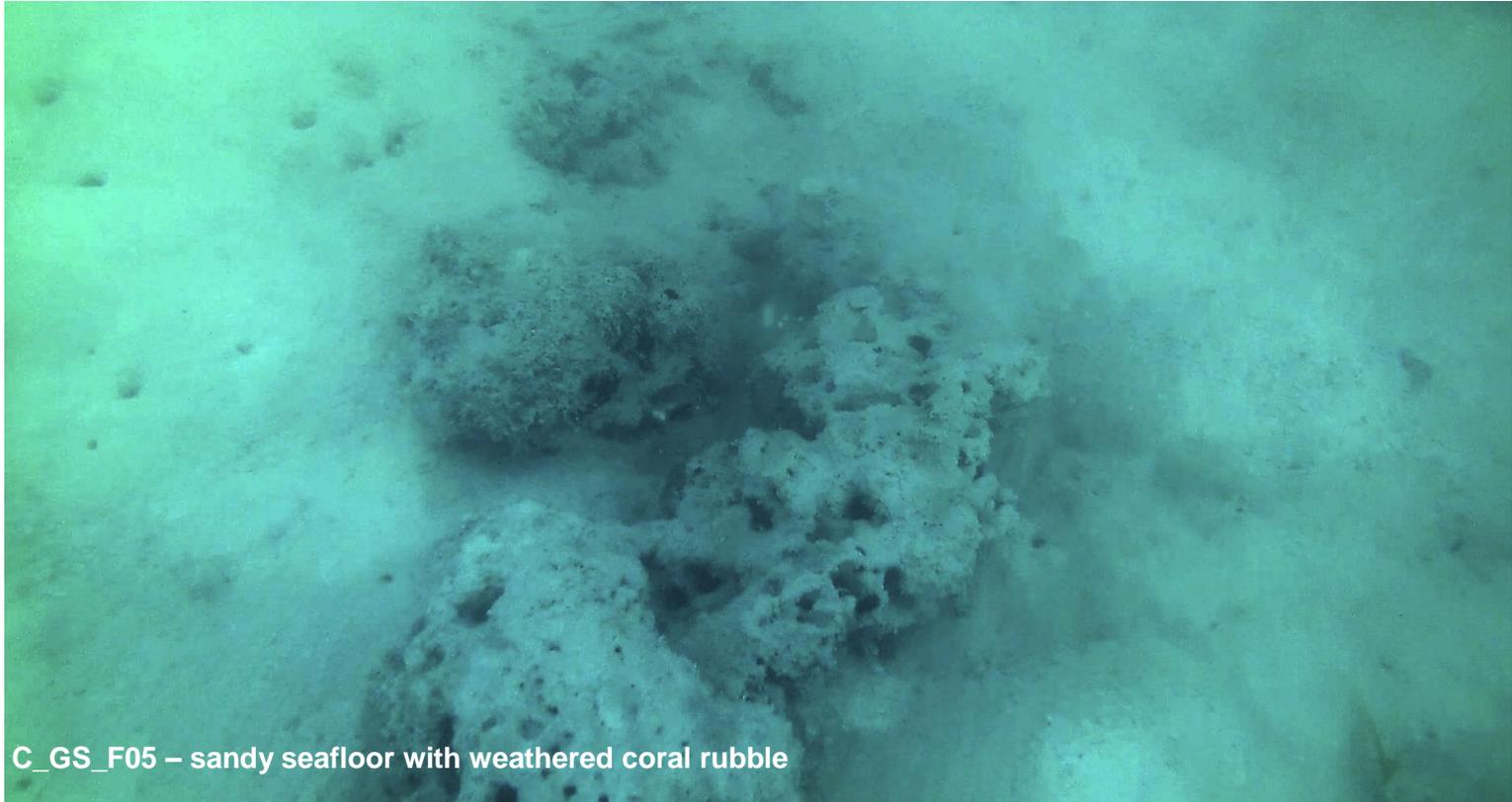
Backscatter used for seabed classification.



Geophysical Survey in Kiribati - Shallow Geology



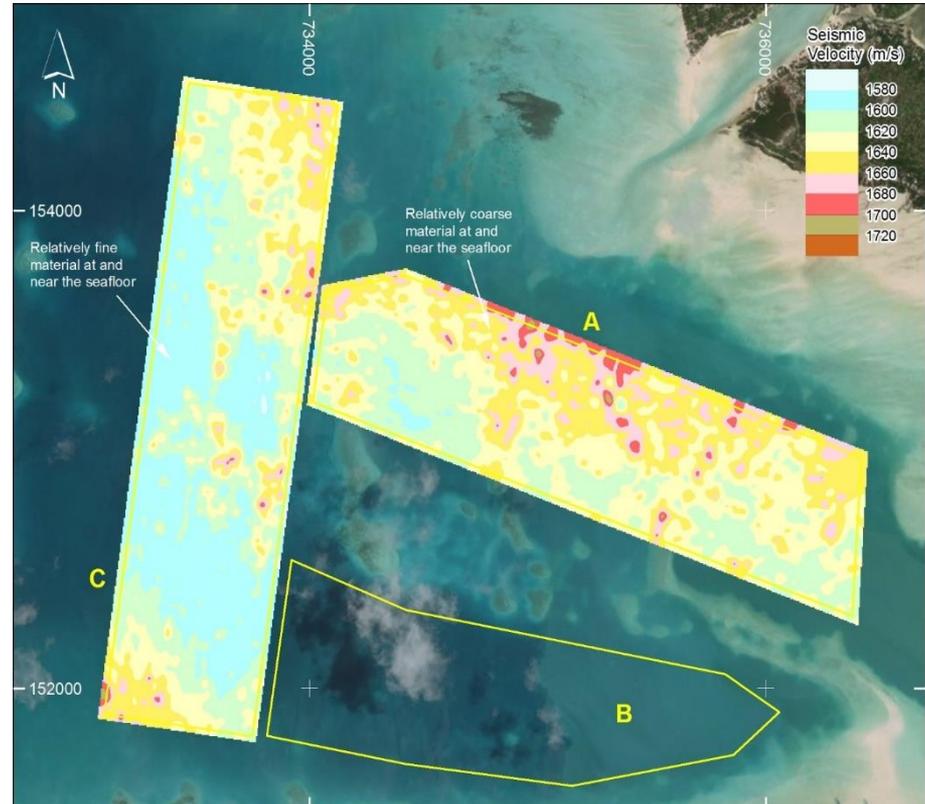
Geophysical Survey in Kiribati - Seabed Sampling / Ground Truthing



C_GS_F05 – sandy seafloor with weathered coral rubble

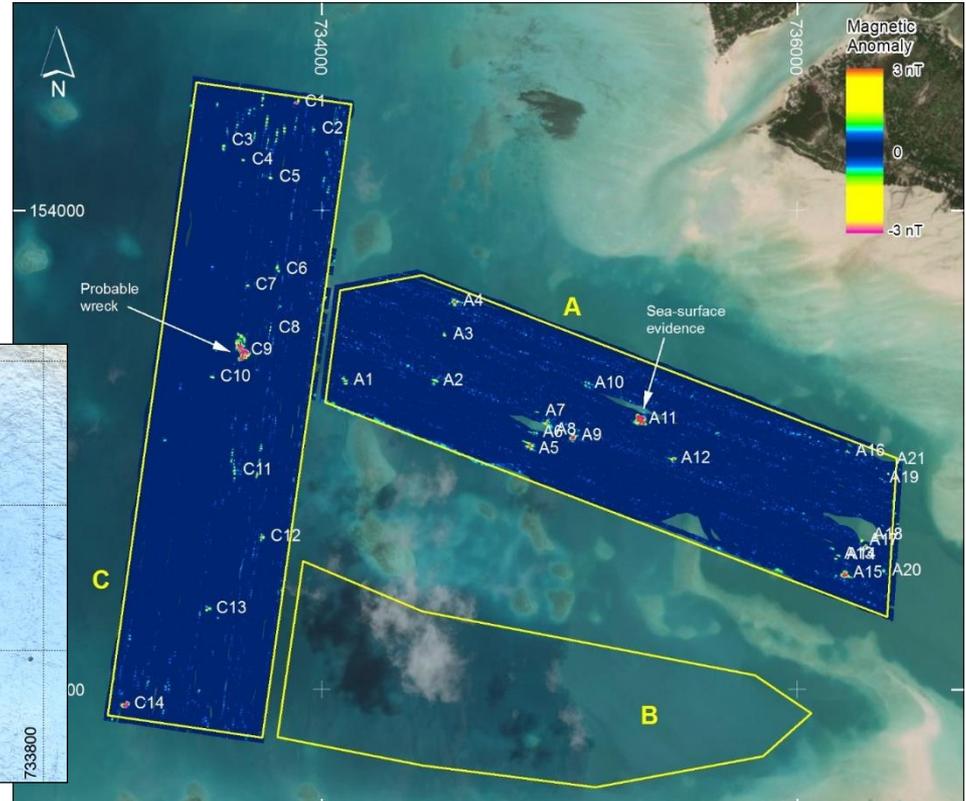
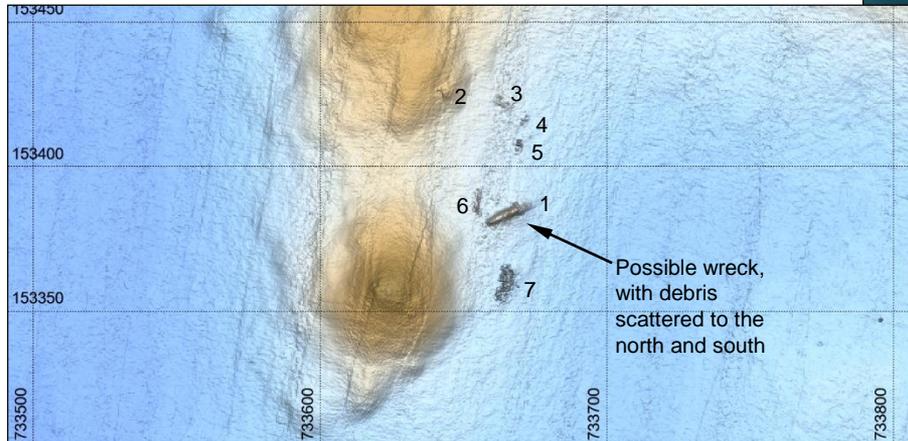
Geophysical Survey in Kiribati - Refraction

CRiSP Refraction Profiling completed to determine the stiffness and cementation of the material in the proposed dredge areas, allowing for better cost analysis to be conducted for dredging.



Geophysical Survey in Kiribati - Magnetic Anomalies

Geomagnetics Gradiometer and SeaSpy2 Magnetometers utilised to identify magnetic anomalies onsite.



Geophysical Survey in Kiribati - Concluding Remarks

Available data Kiribati indicated that they are at high risk of sea level rise.

Kiribati is on the frontline in the fight against climate change and sea level rise.

It is the litmus test for global society on how lives will need to change as a result of this environmental onslaught

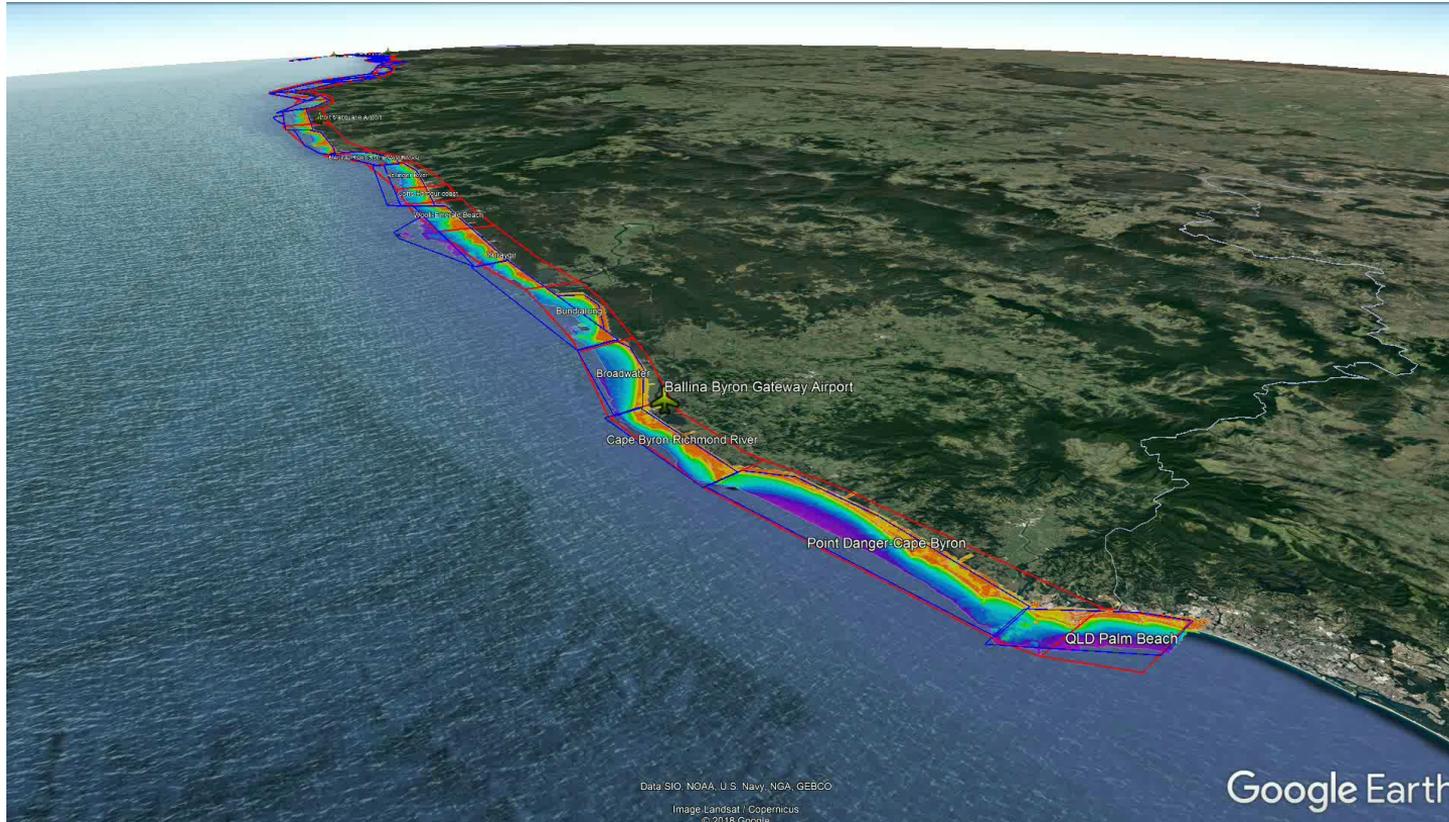
This country is very advanced in its response and has identified clear strategies which are now being implemented

This presentation has shown how marine geophysical surveys form a small yet, crucial part in this massive effort to mitigate against the inevitable rise of the worlds oceans

NSW Coastal Lidar Project – 2018



Office of
Environment
& Heritage



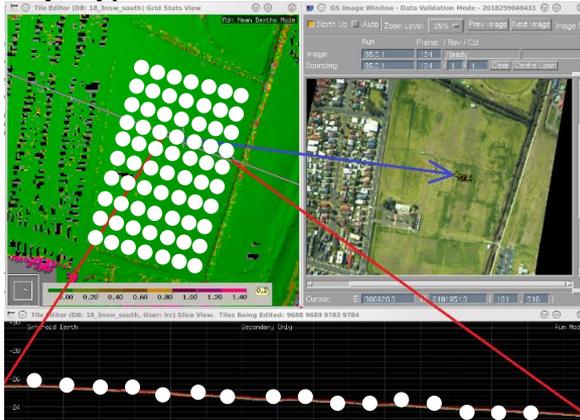
Depth relative
to MSL (m):



NSW Coastal Lidar Project - Data Accuracy Assessment

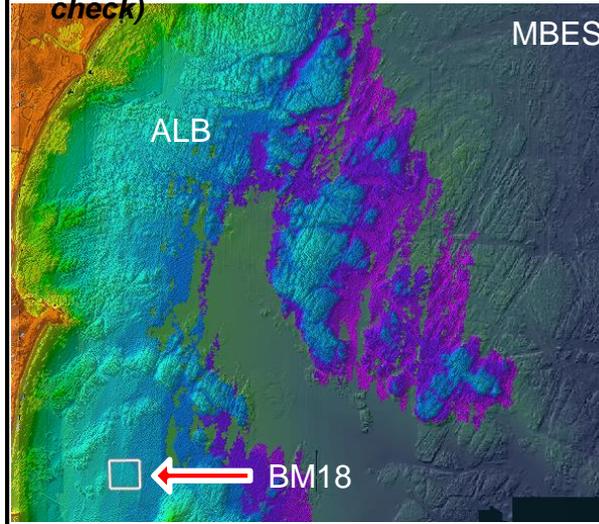
The collected ALB LiDAR & imagery data has been compared internally and externally against **land** and **bathymetric** benchmarks

Dry Benchmark (Absolute accuracy)



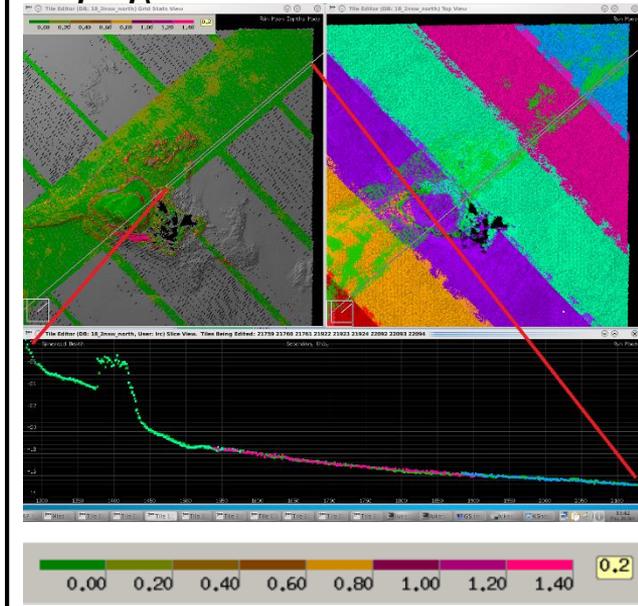
Run ID	No. of Comps	Mean Depth Diff	Std Dev
100.0.1.L.3	3246	-0.11m	0.05m
100.0.1.L.2	3267	-0.12m	0.05m
	Mean	-0.12m	0.05m
	St Dev.	+/-0.01m	+/-0.00m

Wet Benchmark (Absolute accuracy check)



BM ID	No. of Comparisons	Mean Depth Difference	Standard Deviation
18	14590	0.05m	0.13m

Internal Overlap (Relative accuracy)



NSW Coastal Lidar Project - Deliverables

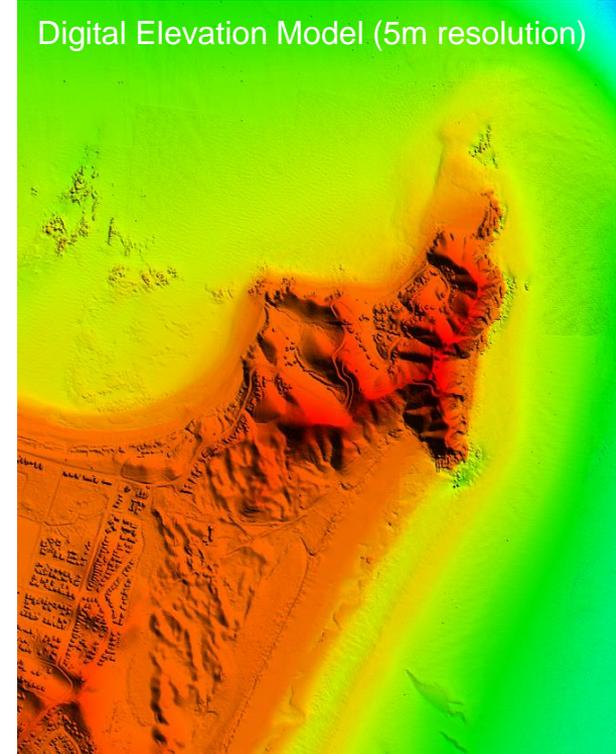
Orthorectified Mosaic (10cm GSD)



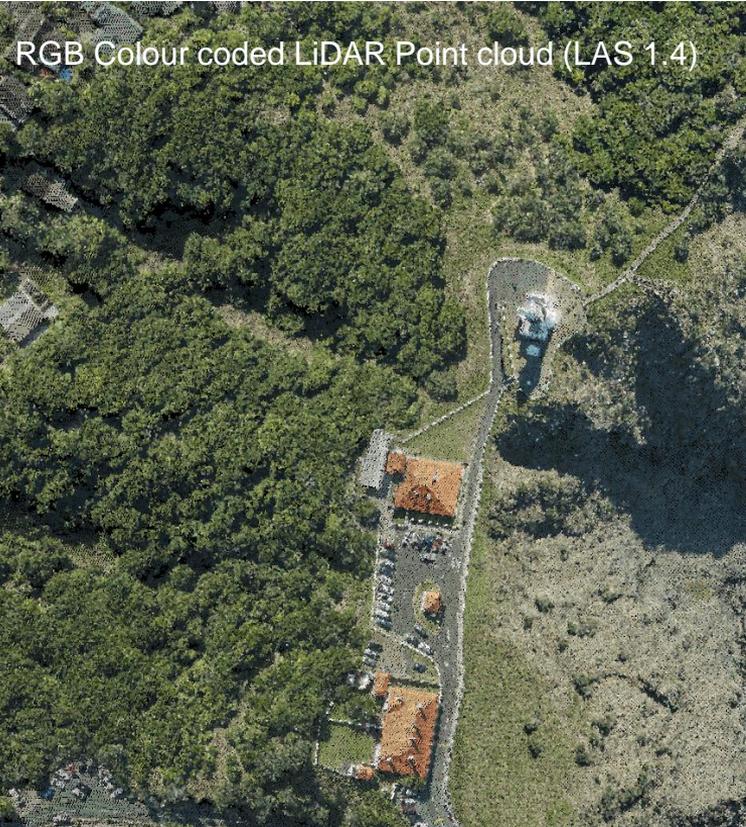
Relative Reflectivity Mosaic



Digital Elevation Model (5m resolution)



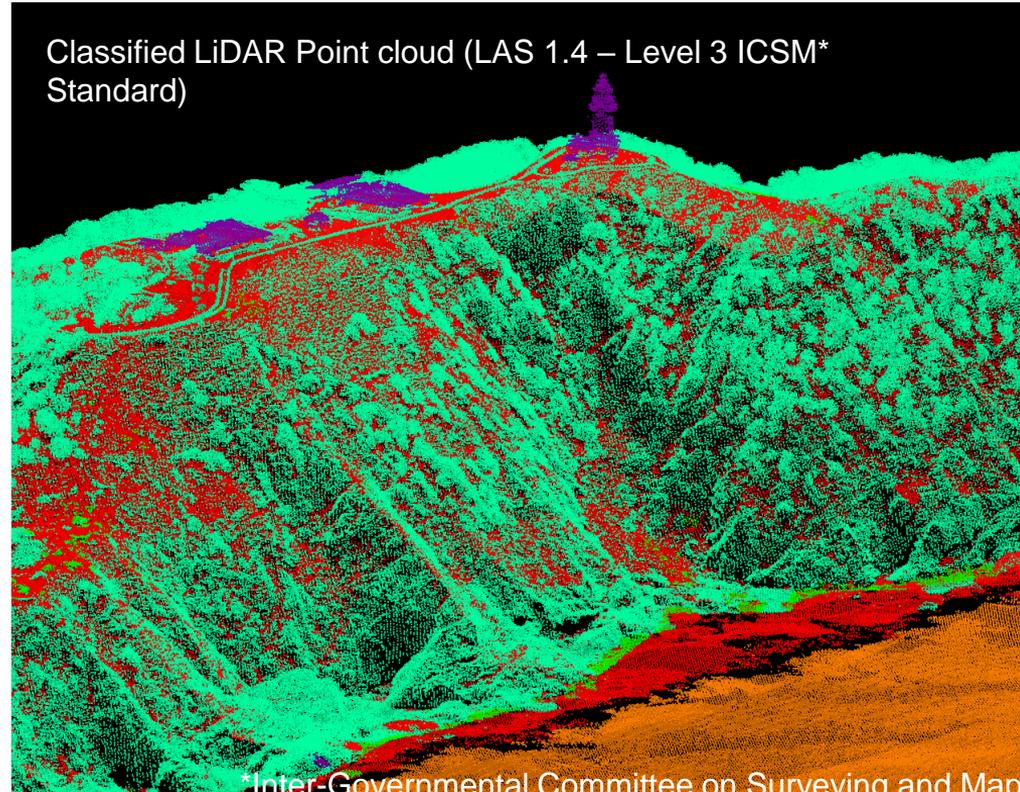
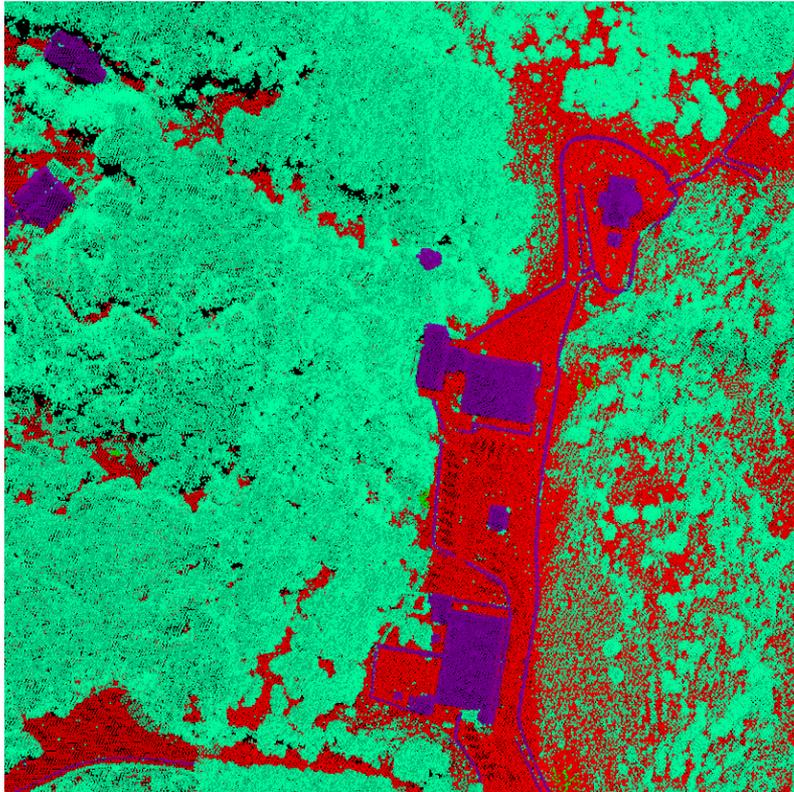
NSW Coastal Lidar Project - Deliverables



NSW Coastal Lidar Project - Deliverables



Office of
Environment
& Heritage



Plans that affect the Region

Airborne Lidar Acquisition Across Tuvalu's Nine Atolls

Data Acquisition: APRIL 2019

For:

- United Nations Development Programme (UNDP)
- Tuvalu Coastal Adaptation Project (TCAP)

Stakeholders:

- Tuvalu Government's Lands & Survey Division (LSD)
- Climate Change Policy and Disaster Coordination Unit (CCPDCU)
- Secretariat of the Pacific Community (SPC)
And...
- United Kingdom Hydrographic Office (UKHO)

Objectives:

- Acquire airborne lidar coverage of shallow water bathymetry (0 – 50m) depth
- Acquire airborne LIDAR coverage of all land forms across all nine atolls' islands, including intertidal
- reefs and sand flats
- Associated high resolution digital colour imagery



Success Stories to Share

Fugro Academy - Applied Hydrographic Survey Programme

- IBSC accredited Category B hydrographic surveying training course (S-5B).
- Located in Plymouth, UK at permanently based facility
- dedicated computer suites, lecture rooms, workshops, equipment, and vessels
- 24-Week duration
- First course starts in March 2019
- Open to all who meet course prerequisites
- plans to role out at other locations internationally



Lessons Learned to Share - Challenges

- Weather and Planning
 - Cyclone Season
 - Trade winds
- Data Processing and Delivery Time Frames



Mt Bagana in Autonomous Region of Bougainville

Lessons Learned to Share - Recent Developments

Internal **Satellite Derived Bathymetry** Capability for:

- Desktop study support
- Reconnaissance and background data for line planning and identifying where high resolution surveys should be focused
- Change detection tool

Autonomous Surface Vessel (with L3 ASV Global - UK)

- designed for medium to large-scale hydrographic survey applications, is scheduled for Q2 2019.

ALB Sensor Developments

- LADS HD upgrade to 7 KHz
 - Without any loss of power
 - Max Depth Measurement still 80m capable;
- New RAMMS Sensor (with Arete Associates - US)
 - Airborne multibeam lidar via a push-broom laser scanner with beam forming at the receiver
 - Low power consumption/high resolution
 - Adapted technology from an airborne mine detection system

Implementation of **Machine Learning and Cloud Processing** for MBES and ALB datasets





Thankyou

Any Questions?

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