



National Coordination of Seabed Mapping Workshop – Summary Notes

November 8-9 2017

Background and objectives

In the spirit of “collect once, use many times”, representatives from Commonwealth and State Governments, universities and industry came together to progress the coordination of seabed mapping efforts in Australia. This 3rd workshop follows two previous workshops (October 2016 and May 2017). The objectives of this workshop were to:

1. Present an update on the progress made since the last workshops.
2. Present and discuss various utilities, tools and methods that may be of national benefit.
3. Finalise the national multibeam guidelines.
4. Discuss future activities and direction for the group.

Workshop summary

Since the previous workshops, the following progress has been made:

1. A Government priority map was collated and provided to the AHO for consideration as supplementary material for their “Hydroscheme” acquisition plan. To help prioritisation of areas, GA and AHO visited LINZ to discuss their prioritisation methodology.
2. A website domain was approved (AusSeabed.ga.gov.au) and a draft structure and content created. This material was reviewed (Activity 1) and the website is planned to be live by March 2018.
3. A National MBES guideline is being drafted bringing together contributions from many working group partners.
4. AHO and GA have started discussions regarding data submission and accessibility.
5. A point cloud-based workflow is being developed by GA.

During this workshop, presentations and activities took place to progress and validate the work so far, and also progress the remaining actions (see [workshop agenda](#) for more details).

In the introductory presentations from GA and the AHO, the AHO highlighted that they fully supported this seabed mapping coordination working group (WG) and wanted to keep using this WG to support their Hydroscheme Industry Partnership Program (HIPP). It was also highlighted that the HIPP will in-part be governed through a national board, and that this WG may become part of the board.

The following workshop summary focusses on the actions raised to progress each activity. Complementary notes can be found in Appendix 2 and Q&A + notes for each presentation in Appendix 3.

Workshop Actions

Activity 1 AusSeabed.gov.au website discussion

A new website has been created – AusSeabed.gov.au – designed to be a one-stop-shop for information on the National Seabed Mapping coordination activities and resources. During this activity, the draft website structure and content outline was discussed.

Outcomes:

1. The group produced an agreed structure and outline for AusSeabed.gov.au.
2. The group also prioritised the content.

Actions:

1. GA will update the website structure diagram and content outline to reflect the group decisions [Complete – see page 8]
2. Content will be created by GA where possible. Where additional contributions are required, GA will seek input from the wider WG. To progress input from other contributors, GA will create a list of content where contributions from other WG members is required, and this will be accompanied by a sign-up sheet where volunteers can self-nominate.
3. The content that will be prioritised is the **Survey Register** and **News and Events**. A communication space will replace the present google drive or dropbox as these are not accessible by all.
4. Prior to the release of the website, all content will need to be approved by each WG member. GA will be distributing final content and seeking approval for use of member logos prior to public release. In order to progress this content in a reasonable timeframe, GA requests that WG members keep in mind the 80/20 rule when reviewing content – are you mostly happy with the content? What are the burning issues we need to address before release? Can you and your agency live with it as it stands, or what can't you live with?

Activity 2 – National tools

Knowledge sharing, utilising available material and developing common approaches can contribute to increasing our overall efficiency. This activity included presentations from a number of people outlining tools that could help coordination efforts, and a subsequent small-group discussion about these and other tools, and their potential benefits. This activity identified many tools, utilities, methods (Appendix 2) that could benefit our Seabed Mapping Coordination efforts and which could be accessed or referred to, on the website.

Actions:

1. The person or committee who will provide the content for the “tools” (Activity 1 – action 2) will also be responsible for executing the following actions:
 - a. Compile additional information on each tool that was raised during the workshop (see table in Appendix 1-Summary notes) in order to better understand the tools proposed. Then organise and prioritise the tools that will go on the website. This could be done using an online survey.

- b. Produce website content (Descriptions and information) for each tool that will appear on the website.

Activity 3 – Data submission and accessibility

A “National Data Centre” where data can be submitted and access by all is needed. In this activity, participants discussed seabed data management and produced a list of requirements for submission and accessibility that should be considered when designing the “National Data Centre”:

Actions:

1. GA and AHO will meet to discuss a solution to support data management and accessibility.
2. GA will explore website functionalities of existing Websites and Portals that were deemed exemplary. Note that spatial capability was deemed fundamental and the only form of data delivery that people would like to see on the website.
3. When designing the data submission functionality, the “National data centre” should insure that the system will include a workflow starting with Survey Register and terminating with Data submission. The system should also include a “point system” to incentivised submission of fuller, comprehensive datasets (raw, ancillaries, reports, etc).

Activity 4 – Survey register and data coverage

Two action items identified in the previous workshops were to create a survey register and a coverage map of available data to assist in the planning of future seabed mapping surveys. In this activity participants agreed upon a set of metadata (attributes and other information) that should be submitted as part of a survey register.

Actions:

1. Develop a survey register functionality that will be available on the website and will be recommended in the National Guideline. The process should be simple and connect to the data submission process. Until a fully functional register is up and running, an interim solution, which may consist of a table or a form to fill, will be managed by GA and made available on the shared drive or website.
2. For data coverage, the group decided that it would be better to work on a solution for displaying data points rather than compile data coverage from each agency as this would take time that could be otherwise better used towards creating a data submission portal.

Activity 5 – National Multibeam Guideline Draft

Following the previous workshop (May 2017) on the National MBES guideline, a first draft has been prepared. The activity undertaken here focussed on reviewing this first draft.

Actions:

1. Complete the sections of the [guideline](#) following the [review outcomes for each section](#) identified during the activity. A signup sheet is provided [here](#). Keeping in mind that there is a dual aim to both encouraging non-experts to use the guidelines (e.g. managers, researchers) and providing enough detail and structure so that experienced users (e.g. surveyors, or field experienced people) are comfortable using this guideline too.
2. Each section of the guideline will be reviewed separately by experts.

3. The guideline will be formatted using the GA record template and logos from all contributors will be placed on the cover page. A list of contributors will also be included in the content. Also consider wiki-style document on the website.
4. Final reviews will be undertaken by (at a minimum) a non-expert, a seabed mapping expert, and an international seabed mapping expert.
5. Release of version 1 aimed for April 2018.

Wrap up – where to next with the National Seabed Mapping Coordination Initiatives

1. Guideline timeline



2. Prepare a communication plan for the National Seabed Mapping Initiatives (e.g. working group, website, guideline, etc.)
 - a. Upcoming conferences where workshops/meetings can be held to raise the profile of the WG:
 - i. AGU 2017 (Louisiana, Dec: International seafloor mapping symposium and side meeting)
 - ii. NAV18 (Gold Coast, May: The future of navigation with incoming modern technologies)
 - iii. Geohab 2018 (California, May: Seafloor and habitat mapping conference)
 - iv. Resource for Future Generations 2018 (Vancouver, June: Marine Geoscience and Seabed mapping Initiatives and Collaborations)
 - v. AMSA 2018 (Adelaide, July: Seafloor mapping symposium convened by K. Picard and D. Ierodiaconou)
 - vi. Shallow Survey 2018 (Oct., St-John, Canada)
 - vii. HYDRO 2018 (Nov., Sydney)

Activity 6 – NESP MBES Field Manual

The National Environmental Science Program (NESP) is committed, as part of D2 project, to deliver a suite of field manuals that will be used on any survey where data is being acquired for baseline or monitoring of marine parks, more specifically the Commonwealth Marine Parks. These manuals cover the entire workflow, i.e. from planning to data and product delivery. One of the manuals is for multibeam data and its preparation is being led by Vanessa Lucieer from UTAS.

This activity aimed to discuss the content and specifications to be included in the MBES manual, considering the National MBES guideline in development and how to make it a relevant document for Parks Australia. Note that all representatives of the National working group were present even though only a few were directly associated with the NESP.

Actions:

1. Accentuate the rationale for multibeam in the 'MBES for marine monitoring' section of the NESP manuals.
2. Add a section on survey design and decision-tree to help management decide on best survey type and specifications to use depending on the Marine Parks specifics.
3. Integrate the National MBES guideline within the NESP field manual, as the National Guideline is meant as an overarching guideline to any seabed mapping surveys done in Australia.
4. Provide succinct steps and workflow that can be supported by the National MBES Guideline or other documents and a specification table.

Appendix 1 – List of Attendees

Name	Affiliation
Nathan Quadros	CRCSI
Kevin Mackay	National Institute of Water & Atmospheric Research
Nicole Bergersen	Acoustic Imaging
Kam Austine	EGS
Paul Kennedy	Fugro
David Donohue	IXSurvey
Iain Parnum	Curtin University
Marie Young	Deakin University
Daniel Ierodiaconou	Deakin University
Alan Jordan	NSW Department of Primary Industries
Owen Cantrill	Maritime Safety Queensland
Ralph Talbot-Smith	WA Department of Transport
Ursula Harris	Australian Antarctic Division
Mark Case	Australian Institute of Marine science
Luke Pugsley	Australian Maritime Safety Authority
Stuart Edwards	CSIRO – Marine National Facility
Ian Halls	Royal Australian Navy – Australian Hydrographic Office
LCDR Wendy Stewart	Royal Australian Navy – Australian Hydrographic Office
LCDR Chris Waterson	Royal Australian Navy – Australian Hydrographic Office
Justy Siwabessy	Geoscience Australia
Michele Spinoccia	Geoscience Australia
Kim Picard	Geoscience Australia
Jodie Smith	Geoscience Australia
Ian Atkinson	Geoscience Australia
Brendan Brooke	Geoscience Australia
Maggie Tran	Geoscience Australia
Steph McLennan	Geoscience Australia
David Hudson	Geoscience Australia
Rachel Przeslawski	Geoscience Australia – National Environmental Science Programme
Scott Nichol	Geoscience Australia – National Environmental Science Programme

Appendix 2 - Summary notes from each activity

Activity 1 – AusSeabed.gov.au website discussion

Changes to website layout and content

- About us
 - Overview
 - How to get involved
 - Where to submit data
 - Seabed mapping
 - Examples and links (use cases of bathymetry and seabed data)
 - Benefits and values
 - Partners
 - Logos
 - Private sector in alphabetical order
 - *In addition to the list we already have, add SSSI, SIBA, GEBCO, IHO, Seabed 2030*
 - Education resources
 - Information
 - Activities
 - NOAA website has good resources, [Investigator animation](#)
- Products (rename to Data, products and planning)
 - Include data submission tool (with QA function)
 - Coverage – link with AODN data
 - Survey register
 - Minimum metadata requirements
 - Workflows into data submission
 - Data coverage
 - For legacy data, metadata will be sufficient and interested parties can follow up with the custodian – link to data repository holding metadata.
- Resources & tools
 - Guidelines –
 - Two categories – Working Group Endorsed + Other known guidelines
 - Bathymetry survey planning resources – a flow chart to visualise the logical survey planning process – this could be interactive (click and navigate to relevant sections of the National Multibeam Guideline) and with a reporting function to export information as a pdf
 - Seabed mapping capability catalogue
 - Vessel specifications and system quality assessment
 - Organisations and equipment (not just vessels)
 - Technical resources – links to documents and papers referred to in the national guideline
 - List of permitting authorities with links
 - Legal information
 - Licensing, data sharing, copyright statement, navigation disclaimer, references

- Professional development and certification resources – requires compilation and maintenance
- A place for the latest research to be listed was suggested – will require compilation and regular maintenance
- Suggestion: forum to troubleshoot and collaborate (on a .gov.au website this requires vetting all comments, even in a closed forum – please suggest alternatives)
- News & events
 - Accessing Google Drive is an issue for some organisations – will require an alternative communication method.
 - Forum/discussion board/blog for various sub-groups (all, between govt. departments or organisations) to discuss equipment, meetings. Likely password-protected for users to control access. Again, will need an alternative to .gov.au website
- Contact
 - Generic point of contact for AusSeabed.gov.au
 - Other relevant contacts for state and territory and Commonwealth jurisdictions
 - Website user guide – Geoscience Australia’s [AUSPOS](#) website has a good model user guide for submitting data and troubleshooting

Website planning and execution

- Consider use cases of intended audience in planning website functionality and layout
 - Access and download data
 - Submitting and uploading data
 - General information
- Consider compatibility to AODN

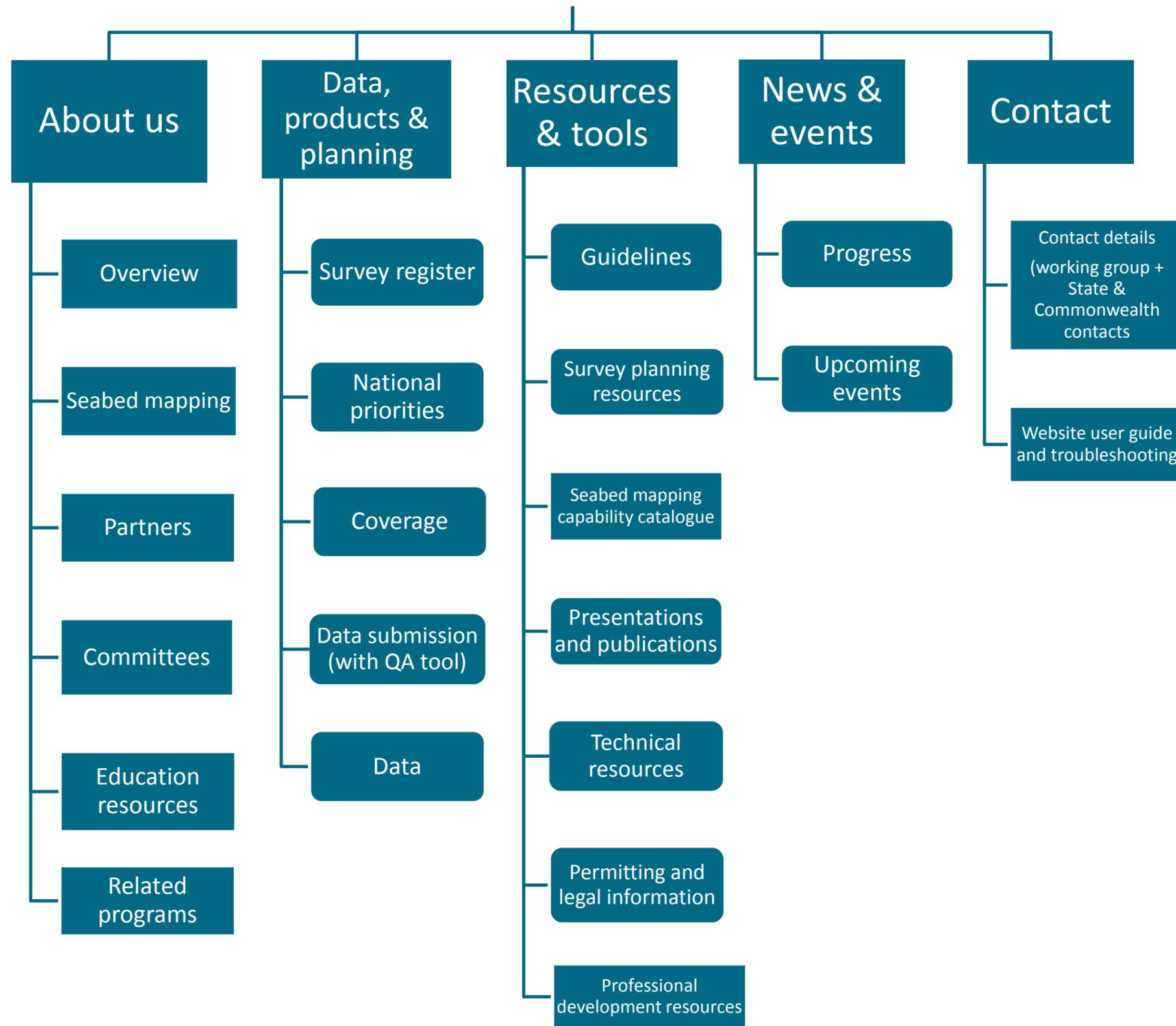
Existing websites and portals

- [INFOMAR](#) – Integrated Mapping for the Sustainable Development of Ireland’s Marine Resource (Geological Survey of Ireland and the Marine Institute)
- NOAA
- WA Department of Transport
- [ELVIS](#)
- UK Hydrographic Office

Outcomes & actions

- Extra content will need volunteers to write & compile it
- Data submission, coverage, access and download – spatial capability is fundamental and the only form that people were seeing on the website
- We need use cases for website development
 - This will ensure the site is optimally designed for those who will be using it
 - Please suggest a use case and the requirements

AusSeabed.gov.au



Activity 2 –Tools, utilities, and methods discussion

Tools can be grouped into survey planning, processing and post-processing & data management

Ease of use and automatic metadata stripping are highly desired functions in many of the tools that were discussed – make it simple for the user and minimise the steps that are needed

Planning tools

Utility/Tool/Method	Priority for working group	Similar existing tools	Owner/ developer	What stage is it at? (e.g. complete, in development, trial, concept)	Open source?	Costs	Ease of use Running requirements (platform)	Other Comments
LINZ prioritisation tool	Needed but requires adaptation and work for Australia		LINZ	Complete but does not meet all our requirements			ESRI	Environmental factors not included Economic and national benefit factors – hard to quantify, can prioritise without it but useful Input data (tidal, SST, IMOS etc.)
Bathymetry master dataset (to benchmark future surveys)			TBD	Concept	Yes			Defining the “highest quality” data will need a process
Line planning tools (eg IX Blue tool)		Many available						Considered very useful Must be open source

Processing and post-processing tools

Utility/Tool/Method	Priority for working group	Similar existing tools	Owner/ developer	What stage is it at? (e.g. complete, in development, trial, concept)	Open source?	Costs	Ease of use Running requirements (platform)	Other Comments
A priori Total Propagated Uncertainty tool (IHO specification)		Many available						Need to settle on a single tool to recommend on the website
HydroCharting – for coverage calculation	High			Complete	Hydrochart.dk	Free	GUI	New RZ sonic Old – all Coverage tool Need tool for mass usage
AusCoast vertical datum transformation (VDT)	High		ICSM CRCSI			Free		Cost effective Caveats on accuracy dependent on datum Need proper vertical datum Good around tide current gauges
las tool			Fugro					Converts all .las files on the fly

Fugro tool	High (but need all digital files)		Konsberg Github	Complete	Yes	Free		
CARIS script		CARIS script	CSIRO – Matt Boyd	Infancy	Can be released/shared but may have possible issues with CARIS	Free	Python backend Can build raw surface to compare to determined processes	Construct CARIS scripts on directory All files Standard names (Julian day) etc Reduces button-clicking Mimics CARIS on board Uses CARIS uncertainties
Rob Hare uncertainty propagation tool	Moderate-high		Rob Hare, Dave Wells	Basic but concept is good	Excel (>10 years)	Free	Excel spreadsheet	Reson (shows problem with beams) Graphical Need tool to standardise uncertainty creation Strip out THVs
SVP builder – interface between database and user	High			Complete but unsure of usage or update	Built in house			Climatology database Not sure if updated Consult with Rob Beaman

Data management tools

Utility/Tool/Method	Priority for working group	Similar existing tools	Owner/ developer	What stage is it at? (e.g. complete, in development, trial, concept)	Open source?	Costs	Ease of use Running requirements (platform)	Other Comments
Point cloud solution – to display and access data	High		Johnathan Kool (GA)	In development	Yes			Efficient transfer of data Transfer tool – UDP based (web)
QA tool			QA4Bathy – CRCSI – Presented by Nathan Quadros e.g. CARIS, Bathy database UNH SVP tool	Bathymetry – idea AUV – started LiDAR – complete	Open form webpage, National standards	Build (\$30-40K) Time of user input and testing	Seems quite user friendly and flexible	Semi-automated metadata tool. Raises quality of data Ensures consistency across submitted data Data needs to be put through this before going into National Data Centre Compare overlapping survey data Could also be a procedure (eg data validation) Check: Have minimum requirements set out in the guideline been met?

Transformation tool (file formats)	for national data centre, not all	FME			FME - no			GDAL is open source
Robogeo http://robogeo.com/home/				Complete	No	\$70-80		Geocoding digital photos USBL & stills Develops metadata to tag photo information Content Tag metadata on photo Fully automated Strips information

Other tools

Utility/Tool/Method	Priority for working group	Similar existing tools	Owner/ developer	What stage is it at? (e.g. complete, in development, trial, concept)	Open source?	Costs	Ease of use Running requirements (platform)	Other Comments
Communications tool	Immediate	Many available						Not everyone can access Google Drive

Activity 3 – Data Submission and Accessibility

- GA is the preferred access point, however consider custodian-orientated datasets (up to departments to store and curate data, rather than someone else), e.g. AWS, separate buckets, points to those datasets. It also allows for users to embargo their datasets.
- If organisation wants to maintain control of data, adequate data management resources will be needed
- Data needs to link to AODN-IMOS
- **QSIC data submission (can somebody provide more information about this point? We couldn't find submission functionality)**
- Functionality
 - Drag & Drop (simple to navigate)
 - Automated QA/QC, re-upload and submit
 - Upload raw data & processed data by line (other data types)
 - Download: option of raw, processed, grids, variety of formats (cater for audience)
 - All navigation & motion data
 - Click, zip & ship
 - Use open source utility that will enable downloading points in the preferred format (eg. GDAL)
 - View coverage daily, download data monthly
 - Incentive scheme for submitting data - what is in it for the data submitters? (Rewards scheme, publications, where does the data go, recognition)
- Embargoed data is a case-by-case basis (up to 24 months, must have an end date defined)
 - Metadata is always public
- Licensing needs to be addressed
 - Requires licensing agreement
- Disclaimers on data
- Formats
 - Metadata
 - xml
 - WMO compliant (Marine Community Profile/WMO Core profile)
 - Readme .txt with downloads
 - .png for quick view of data before download
 - Las
 - Geotiff
 - ASCII XYZ

Activity 4 – Survey register and data coverage

Minimum metadata requirements

- Simplicity in the submission process was strongly favoured over comprehensive metadata, leaving it up to interested individuals to follow up with survey owners.
- The survey register needs to link into the existing survey metadata of organisation (they don't want to redo the work they need to complete with their organisational requirements - Hydro, EGS)
- Metadata entered in the survey register should link to the data submission metadata to reduce duplication.
- This tool should help in guiding data acquisition by building on missing coverage, guiding quality assessments based on visual assessment, ZOCs and system review. (E.g. Investigator example).
- The minimum metadata fields included (for indexing):
 - Generic contact email for organisation (individuals can move on, keep email generic)
 - Principal organisation
 - Scheduled start date
 - Survey name
 - Survey purpose (drop-down menu, also allowing for multi-purpose surveys)
 - Standard/quality expected
 - Status (planned, scheduled, complete, abandoned)
- Other suggested fields include:
 - Approximate cost of survey
 - Transit or survey
 - Potential collaborators
 - License agreement
 - Planned horizontal and vertical control

To consider:

For survey register, how to deal with last minute change of plans

For data coverage, other data types such as LiDAR, satellite bathymetry, etc.

Parking lot discussion topics

- SVP open data access
- Which datum are users acquiring data in?
 - Still varied – LAT, MSL, AHD, ellipsoid
- Research visibility as a website page
- Bathymetry master dataset – who will host, how to produce (quality thresholds) and update
- Copyright – research GA cases to understand what needs to be implemented

Activity 5 – Iron out the National MBES Guideline – Part 1

The table below provides the summary points of the guideline that were agreed upon during the activity. These would have been considered in the final writing/review activity – Part 2

Purpose	Overall minimum requirements to insure minimum standards and facilitate data submission and accessibility
Survey planning	Survey register and available data Authorities
Data type	Bathy: Mandated Seabed Backscatter: Mandated Water column backscatter: Desirable
Mapping coverage	2 basic types of surveys: 1) 100% coverage (10% overlap of the “good” swath -no gaps between lines) 2) Partial
Resolution	Survey purpose dependent Desirable – 1 m where possible Could make a matrix of water depth and vessel speed (transit data, multi-purpose surveys) or application/purpose based recommendations
Depth uncertainty	<i>Survey purpose-specific – leave it out</i>
Vertical Reference	Difference between reporting and processing datum. The datum will vary based on the purpose of the survey but it’s important to retain all this information to allow calculation back to the ellipsoid (Nick Dando) – if it’s not retained, the usefulness of the data for other applications is limited
Tides	Record from raw data. Recommend – deploy tide gauge (min 1 to enable terrestrial datum conversion) Record GPS tide While acquiring, if requires to refer to MSL, get predicted tides from the Bureau of Meteorology (BOM) - coordinate in advance of surveys
Sound speed profiles (SVP)	Min of 1 SVP/day, but should be monitored and adjusted as needed. Measurements of SV should also be made continuously at the sonar transducer. If sound speed at the transducer varies by > 2m/s another SVP should be collected
Horizontal Reference	Same as Vertical Reference note
Seabed Backscatter	Always collect during survey collect minimum calibration line during Patch test (Appendix)
Water Column Backscatter	Desirable Provide options if data is not collected, eg. Data download to Repository
Classification ground truth	Follow NESP seabed sampling guideline. To optimise information from seabed backscatter and calibration, recommended to ground-truth Should be done for the shelf, not required in depth > 200m
Metadata	These fields will match with register and data submission minimum metadata
Point data attribution	There is a shift from parent-level uncertainty (survey-specific) to uncertainty for individual points. All data should be attributed with its uncertainty estimate Fundamental parameters for points – line ID, time, backscatter
Archiving	National Data Centre (TBA) Depends on data collector, up to client to submit data to appropriate repository

***The guideline should also contain a Scenario-based part, which is based on end-user needs. For example, if you are mapping for charting, this is what you need to consider; if you are mapping for science and collecting data types x y z, consider line spacing, frequency etc (with contact details for experts or organisations that provide expertise**

Activity 6 – NESP/Marine Park MBES field manual

- We need to accentuate the rationale for multibeam in the ‘MBES for marine monitoring’ section, particularly highlighting how it informs sampling design and biological gear deployment (e.g. BRUVs).
- At the moment, much of the field manual covers off on the same things as the national guidelines. There was general agreement that field manual can differentiate itself by focussing more on survey design, including a decision tree for MBS – this is not covered in the national guidelines, nor is MBS included well in Scott Foster’s Chapter 2 (attached). The AIMS has a nice system for deciding how and when to do MBS surveys – Mark can provide this.
- The MBS field manual is arguably a bit trickier than the other field manuals, in that both the National Guidelines and NESP projects were developed independently with similar goals. However, the National guideline is meant to meet a wider end-user base, then the NESP guideline nests within it. We now have to bring them together without too much overlap. The contributors present have some ideas on how to do this.
- There was a lot of support to include information related to monitoring specific marine parks, including both small and large ones, as well as shallow, deep, and mixed. This should include alternative options for costing (e.g. continuous vs staggered line spacing). The idea is that Parks Australia and researchers could then use these to estimate cost of mapping the AMPs.
- It would be good if the field manual included succinct steps – this will match the other field manuals, as well as providing a clear workflow that can then be supported by more detail in the national guidelines.
- We should provide some tangible recommendations/requirements on specifications (e.g. resolution, line spacing), supported by a decision tree if necessary.

Appendix 3 – Q&A during presentations

Point-Cloud presentation – Johnathan Kool

- Coursera for training courses, AWS costs low compared to old methods, use dev/test environment. (Ian Hall)
- Getting around legislative issues with using AWS, CIOG - infrastructure. However, other federal agencies cleared federal govt. (at higher classification). May still be challenging when sharing with international partners and data are involved. (Mark Case)
- U.S fully cleared AWS solution for govt. data
- with AWS, users of the data (management do not have skills to use), interested in development of standard colour coded-depth for upper management use. (Ralph Talbot)
- q - Spark is open source, plugins to hadoop, databases, s3. (Ralph Talbot)
- Data collection further than HIPP, open to future survey planning and product development, inviting private companies (Ian Hall)
- treasury, does not pay for storage, firewall issues, but can use interoperability (Ralph Talbot)
- questions: interoperability, accessibility, how to set up environment

Seamap Australia presentation - Dan Ierodiaconou

- collate habitat mapping data from state and other agency resources
- Victorian Marine Data Portal
- based on CMECS, species dominance classification approach.
- seamap australia report (in review, but to be released end of year 2017)
- provide one-stop-shop for habitat data, levers of existing AODN data availability

Comments:

- each state develops their own depending on management questions. This is an opportunity to be pushed into national scheme and take best of national schema.
- can use the data directly instead of using the generalised classification if it doesn't suit the purpose of the study (Rachel Przelawski)

International Multibeam backscatter working group presentation - Ian Parnum

- Group of papers out in special publication (JGR) as a result of the working group.
- There are multiple levels of calibration depending on what is needed (absolute, relative)
- Welton 2014 thesis (source lvl vs. power setting)
- insonification angle best between 20 - 60 deg. (Best quality of data)
- for monitoring, keep same settings as previous survey completed in area.
- future activities: Alex Schimel will do a comparison of software, calibration protocols, water column group.

IX blue Line planning tool presentation - Dave Donahue

- survey linear distance estimation (hydroscheme IHI)
- SAGA (open source), QGIS, s-57 soundings to raster format
- current internal workflow (convert all vector to raster, load gridded raster bathy, calculation on each cell with mean depth value, dependant on system, store calculated area as grid, polygon for survey, generate sum of of linear nm.
- this process takes hours instead of months.
- no allowances for turns, cross lines, etc. this estimator is just for lines.

Line conversion tool presentation - Paul Kennedy

- manage datasets and metadata
- multibeam tool for ArcGIS (MBES toolbox)
- available on GITHUB
- line estimator, provides quick method of visualising datasets in arcgis
- can use .all, jsf, seg etc

QA4bathy presentation - Nathan Quadros

- qa4lab.com
- draft forms for gathering specifications from the user. Supplier sent matching user requirements
- test site available for proof of concept

- luke Foster (AGO), purchase worldwind data - possible sharing of data collaboration between GA and AGO
- purchase time off satellites for specific area