S-102 v2.0 Status Brief

S-100 TSM6
(SEP 2018)

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S-102 v2.0 - IHO Publication Timeline

- (APR 2018) S-102PT/S-100 WG3 Sessions in Singapore
- (APR – JUN 2018) Roll in changes from Singapore meeting
- (JUN 2018) Final Project Team prep for HSSC Submission
- (JUN – SEP 2018) Submitted for HSSC approval
- (SEP 2018) Reconcile HSSC comments
- (NOV 2018) Submitted for Member State Approval
- (DEC 2018) Publication of S-102 with S-100 v4.0.0

Version 2.0 Goal: ***Finalize spec. to support SPAWAR/KHOA S100 test bed ingest and interoperability testing.***

S-102 v2.0 – Coordinate Reference

S-102 V2.0 Product Specification supports the following projections:

- WGS84 Geographic (EPSG 4326)
- WGS84 UTM North (EPSG 32601 – 32660)
- WGS84 UTM South (EPSG 32701 – 32760)
- WGS84 UPS North (EPSG 5041)
- WGS84 UPS South (EPSG 5042)
- www.epsg-registry.org

Note: All data will be converted to un-projected WGS84 at time of ingest.

S-102 v2.0 - Portrayal

- **Do not display uncertainty at cursor location**
- **Depth Zones and Colour Tokens will be set to match those of S-101**

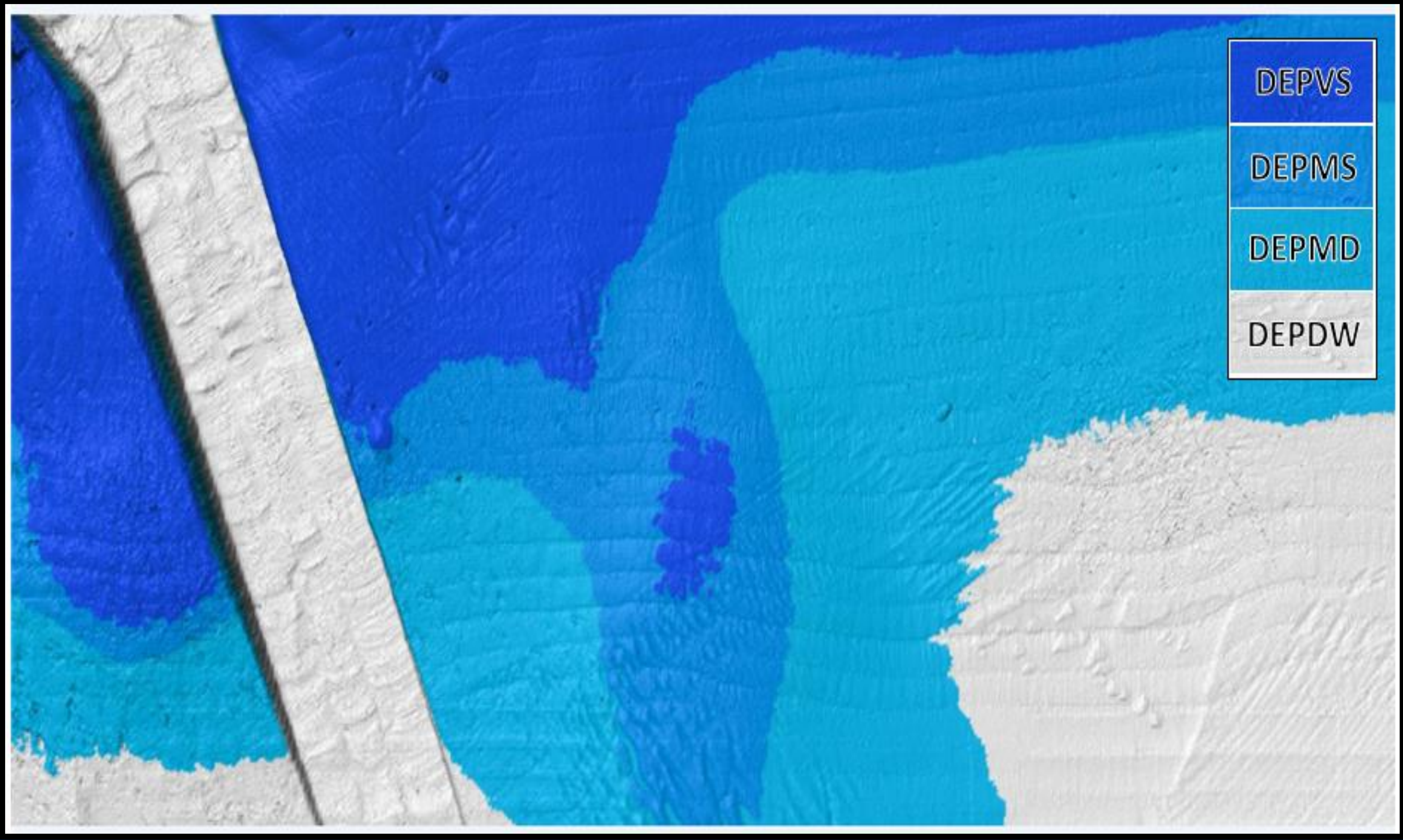
Depth Zone Name	Description	Colour
Deep Water (DEPDW):	Deeper than the deep contour.	White
Medium-deep water (DEPMD):	Depths between the deep contour and the safety contour.	Blue (L)
Medium-shallow (DEPMS):	Depths between the safety contour and the shallow contour.	Blue (M)
Very Shallow Water (DEPVS):	Depths between the shallow contour and the zero metre contour.	Blue (D)
Drying Foreshore (DEPIT):	Intertidal area.	Yellow-Green

- **Transparency values will be set to match those of S-101. Values are defined by an alpha value ranging from 1.0 (opaque) to 0.0 (fully transparent)**

Name	Alpha	Depth Zones Used
ENC DAY	1.0	DEPIT, DEPVS, DEPMS, DEPMD, DEPDW
ENC DUSK	0.4	DEPIT, DEPVS, DEPDW
ENC NIGHT	0.2	DEPIT, DEPVS, DEPDW

S-102 v2.0 - Portrayal

ENC DAY



S-102 v2.0 – Gridding Methods

- Shoalest Depth
- Basic Weighted Mean
- Total Propagated Uncertainty (TPU) Weighted Mean
- Combined Uncertainty and Bathymetric Estimator (CUBE)
- Nearest Neighbour
- Natural Neighbour
- Polynomial Tendency
- Spline
- Kriging

* Gridding method is a way to determine best portrayal options

S-102 v2.0 – HDF5 Structure

- NOAA verified compliance with proposed S-100 v4.0 Part 10c.
- Currently being assessed by SPAWAR and KHOA (i.e. S-100 Test Beds)
- S102 Grid (S-100_Grid_Coverage)

Attribute	Allowable Encoding Value	Type	Multi
S102 Elevation	Decimal metres with precision not to exceed 0.01 metres	Real	1
S102 Uncertainty	Decimal metres with precision not to exceed 0.01 metres	Real	1

- S102 Tracking List (S-100_PointSet)

Attribute	Allowable Encoding Value	Type	Multi
X	Integer expressing a column of the associated 2D S102_Grid dataset	Integer	1
Y	Integer expressing a row of the associated 2D S102_Grid dataset	Integer	1
Original Value	Decimal metres with precision not to exceed 0.01 metres	Real	1
Track Code	Integer expressing a valid enumeration value defining the reason a modification was made at this grid location	Integer	1
List Series	Integer expressing a value defining the index location in the metadata defining the modification	Integer	1

S-102 v2.0 - Converter

- **US Navy completed converter June 2018**
- **NOAA verified compliance with proposed S-100 v4.0 Part 10c**
- **Currently being assessed by SPAWAR and KHOA (i.e. S-100 Test Beds)**
- **Transforms a BAG to an S-102 file**
  - Currently does not support VR
- **Design**
  - C/C++ for Linux (RHEL/CentOS) and Windows (NOAA)
  - Dependencies:
    - OpenNavSurf (BAG) v1.5 or Higher
    - US Navy developed GFF library (HDF5 wrapper), distributed with the converter

S-102 v2.0 – Future Changes

- **Maintain compliance with future S-100 versions**
- **Variable resolution**
  - GDAL Compliance
- **Add temporal aspects needed?**
- **Evolve Tracking List to record “true” location of grid overrides**
- **There is a need to accommodate the production of enhanced charting products (ex. bENC).**
  - Contouring ???

Questions?

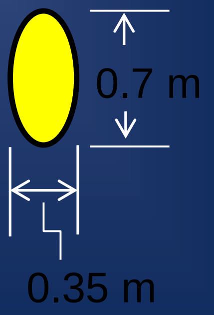
S-102: Why is Grid Resolution Important?

What is the source of modern bathymetry?

- Modern sonars are high resolution collection systems.

Example: SIMRAD EM2040

- Beam Width (1° x 0.5 °)
  - **400 Soundings per ping (single swath / single receiver)**
- Max ping rate (20 Hz)
- Coverage (5.5 times water depth)
- At 40 meters the nadir footprint is 0.7m x 0.35m:



- Rate of collection:

400 soundings X 20 pings/sec = ***8000 soundings/sec.***

S-102: Why is Grid Resolution Important?

1. **A single thirty (30) day survey (12 hour days):**
   - 345.6 million soundings collected each day
   - **10.4 billion** soundings collected each month
2. **Survey coverage at 8kts:**
   - 39 km2 / day
   - 1172 km2 / month
3. **Hydrographic Offices utilize gridded surfaces to process bathymetry:**
   - Typical grid size in 40 meters of water: **1-meter**
   - To grid up entire survey area at 1-meter resolution: **554.4 million nodes**
4. **The final 1-meter grid is the "Navigation Surface"**

S-102 Why is Grid Resolution Important?

To produce a 1:22K ENC:

1. **Defocus the 1-meter "Navigation Surface" to 6-meters.**
   - 554.4 million nodes (1-meter navigation surface)
   - 92.4 millions nodes (6-meter production grid)
2. **Select soundings from the 6-meter grid.**
   - ~500 to 1000 soundings make it to a digital chart, or < 1% of the original data.

*IEC 60945 specifies that character size in mm be not less than 3.5 x the viewing distance in metres. Hence "readable from 1 metre" requires that characters be not less than 3.5 mm in size."

169 nodal depths underneath a single charted sounding

3.5 mm
or
77 m
real world