Quality control for echosounders and LIDAR at the French Naval Hydrographic Service (SHOM)

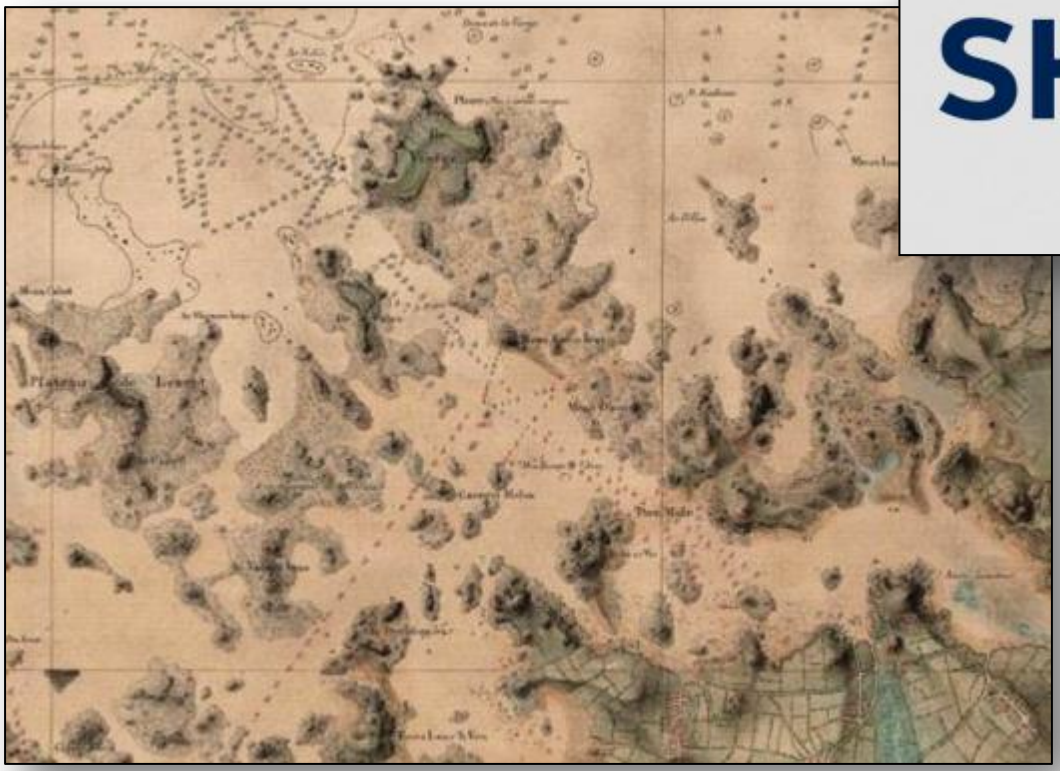
IDEF Christophe Vrignaud (Mars 2017)

I. **Background**

II. Quality Management

III. Conclusion

- Since 1886, Shom is the French Hydrographic Office
- Based on the previous « dépôt des cartes et plans de la marine » (1720).
- Certificated ISO 900



L'océan en référence

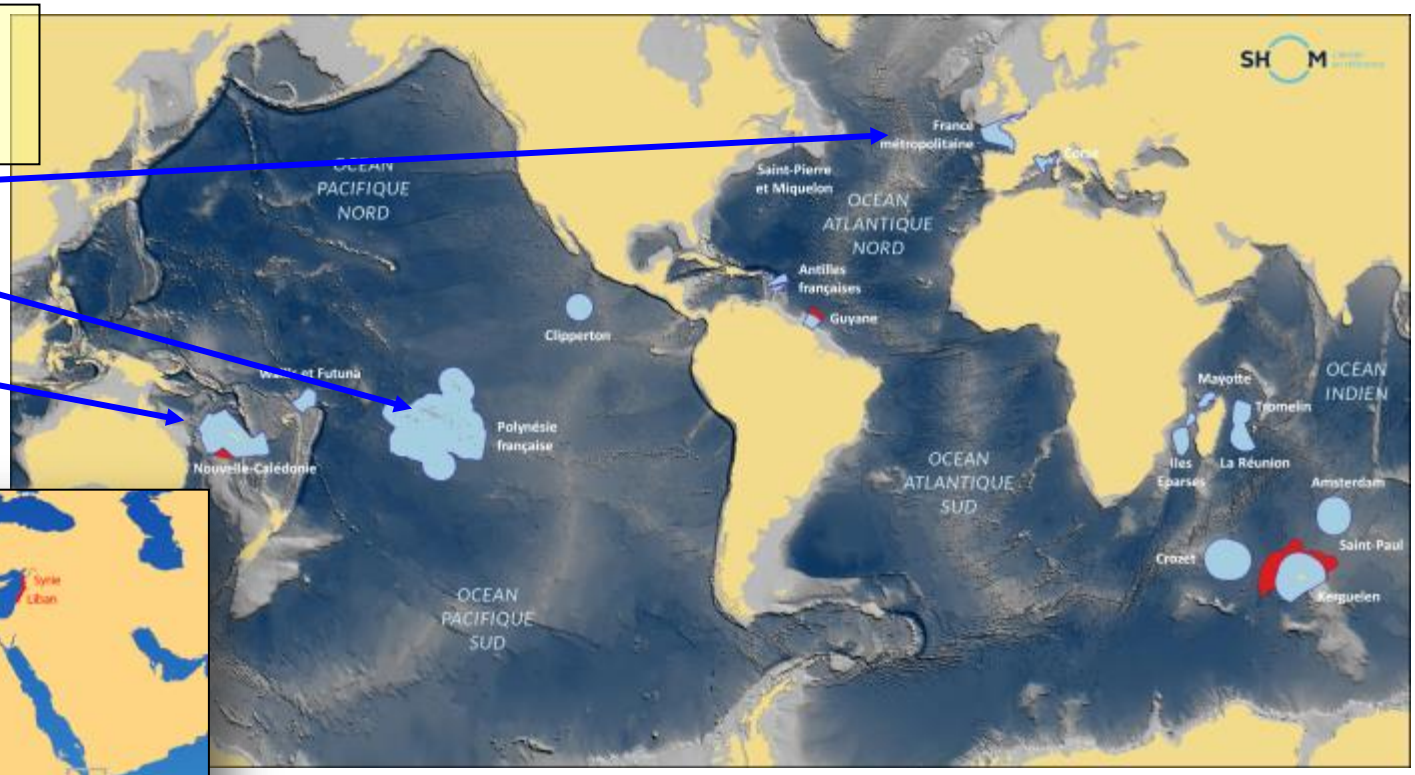
afaq ISO 9001 Qualité AFNOR CERTIFICATION

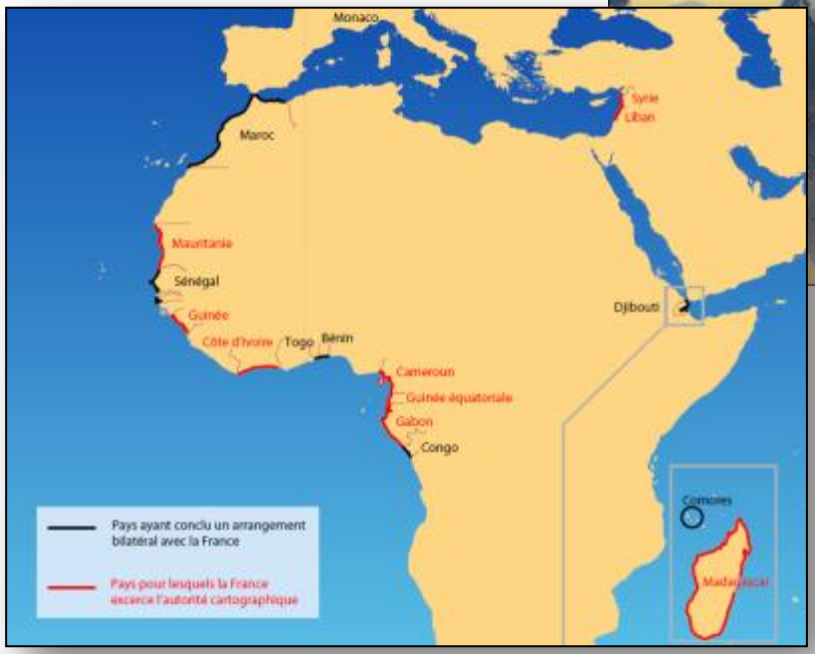
500 people in 5 offices
(80 in the “operational division”)

Brest (470)
Paris, Toulouse

Papeete

Nouméa

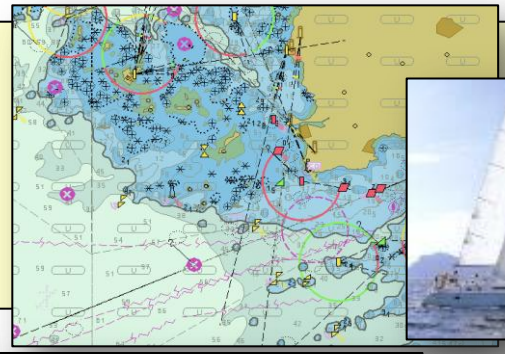




Areas of interest for Shom:

French EEZ (areas placed under French responsibility - 11 million sq. km) and other areas of historical responsibility.

❑ **National hydrographic service** (designated by the government to carry out general hydrography for the benefit of all sea users)



❑ **Defence service** (Within its areas of competence, SHOM supports the defence expertise and operational requirements in maritime environment)

❑ **Support to government maritime policies**

REMINDERS

HYDROGRAPHIC OFFICE – FRENCH BACKGROUND – SHOM'S FLEET

Hydro-oceanographic vessel "*Beautemps-Beaupré*" (3000t)
Navy/SHOM (95%) & Research/IFREMER (5%)
Kongsberg EM122 + EM1002 + SBP120

Oceanographic vessel "*Pourquoi pas ?*" (6600t)
Navy/SHOM (45%) & Research/IFREMER (55%)
RESON 7111 + 7150 (12kHz and 24kHz)

AUV *Daurade*
Covert REA (NATO concept)
RESON 7125

3 Hydrographic ships ("*La Pérouse*", "*Borda*", "*Laplace*") (1000t)
Kongsberg EM710

7 survey launches (3.6t)
Kongsberg EM2040c

HSL Chambyeron (Nouméa)
EA400 + SSS

REA
EA400 + SSS

Louis Hénin (Nouméa)
EA400 + SSS

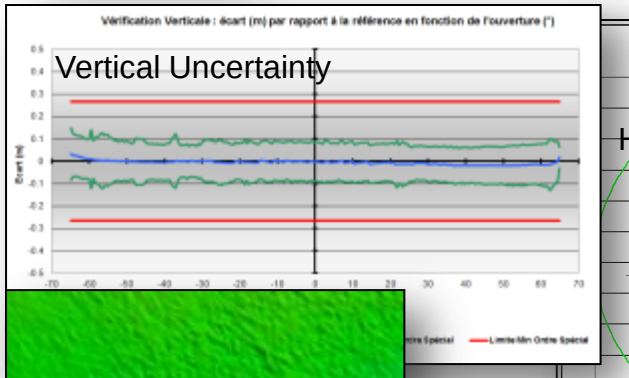
HSL BHPF1 (papeete)
EA400 + SSS

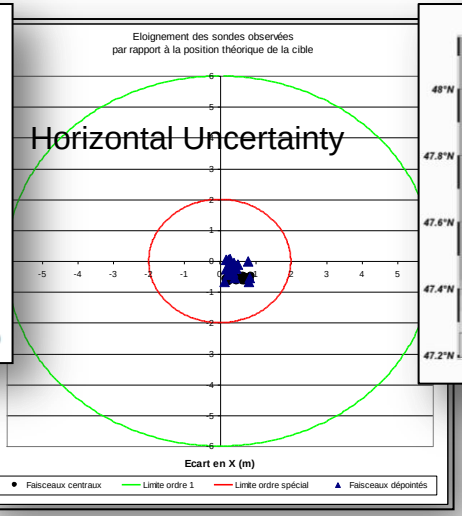
Definition of the International Organization for Standardization:

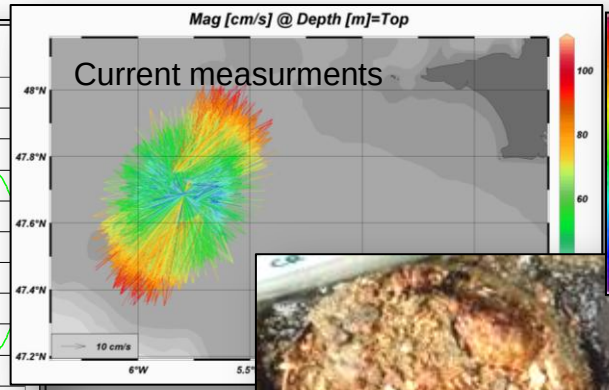
"An International Standard provides rules, guidelines or characteristics for activities or for their results, aimed at achieving the optimum degree of order in a given context."

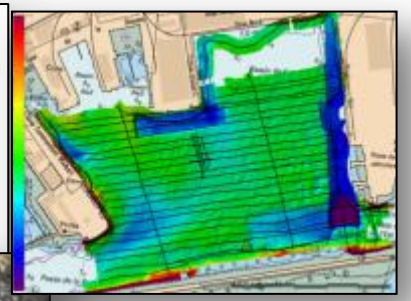
the International Hydrographic Organization Special Publication 44 gives the **minimum** standards that must be achieved for (Latest version: 5th edition – February 2008)

SP44 provides requirements for different measurements, exploring methods, and also guidelines for quality control and data processing.

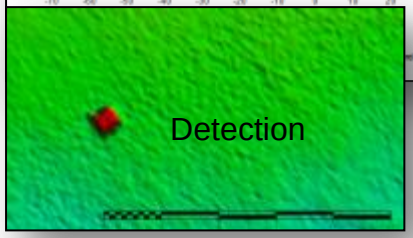








Coverage
Positioning
- of aids to navigation
- of Coastline

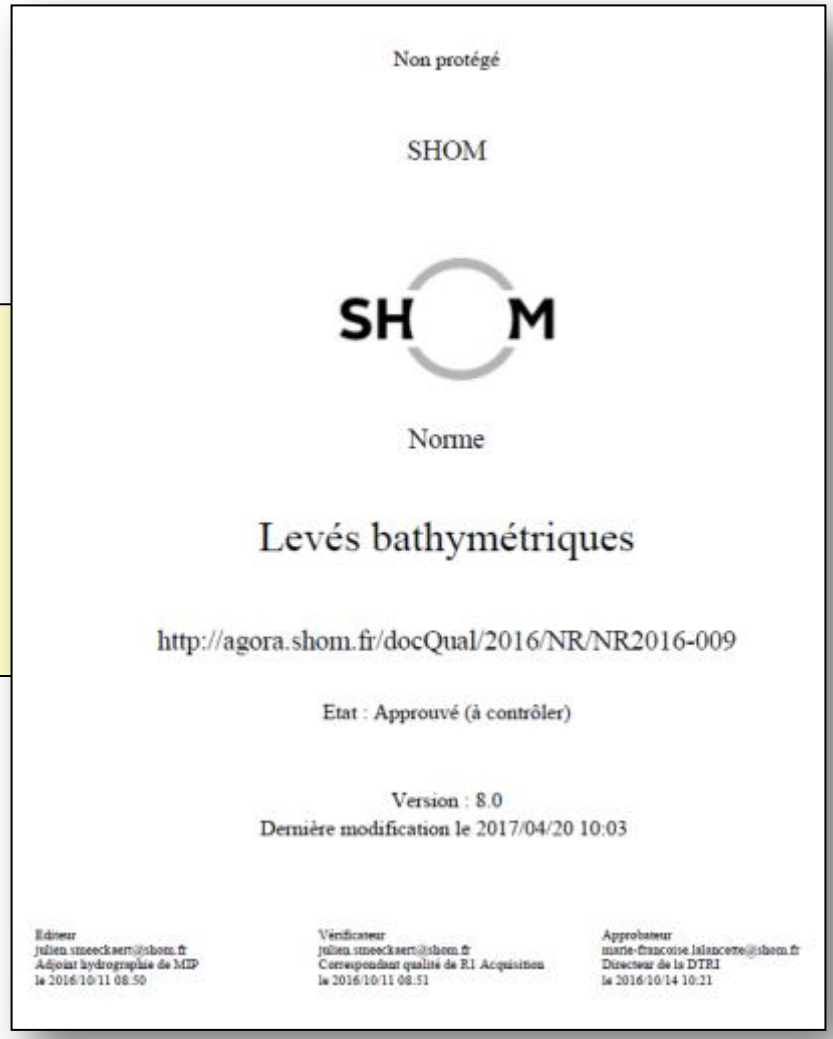


Nature of the seafloor

Shom uses its own standard – based on the S-44

Example for Special Order:

- double "full seafloor search" for Special Order (=200%)
- Search on every object 50cm above the seafloor (until 40m)



Non protégé

SHOM

Norme

Levés bathymétriques

http://agora.shom.fr/docQual/2016/NR/NR2016-009

Etat : Approuvé (à contrôler)

Version : 8.0
Dernière modification le 2017/04/20 10:03

Editeur
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Adjoint hydrographie de MIP
le 2016/10/11 08.50

Vérificateur
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le 2016/10/11 08.51

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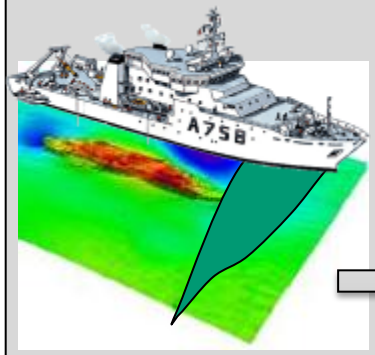
Directeur de la DTRI
le 2016/10/14 10:21

I. Background

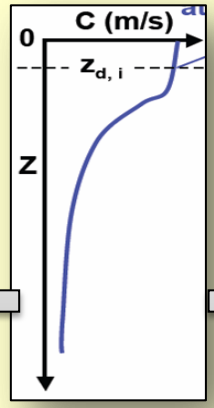
II. Quality Management

III. Conclusion



Echo Sounder

+



Sound Speed Profil and surface

+

Motion Unit

+

Positioning System + Time

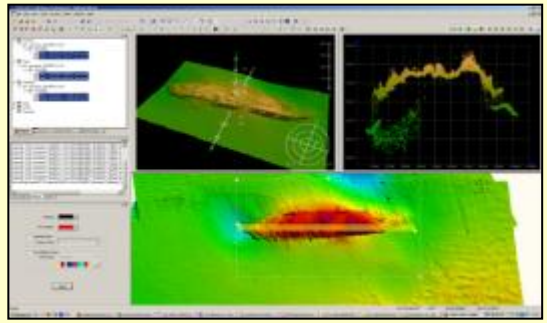
+

Lever Arms and angular offsets

+ Surveyor

+

Hydrographic Reference



Data Ready for post-preocessing

SHOM'S DATA QUALITY MANAGEMENT FOR MBES, SBES AND LIDAR

S44 standard states (extract from the 5th edition – February 2008):

survey being carried out. The surveyor is an essential component of the survey process and must possess sufficient knowledge and experience to be able to operate the system to the required standard. Measuring this can be difficult although surveying qualifications (e.g. having passed an IHO Cat A/B recognised hydrographic surveying course) may be of considerable benefit in making this assessment.

Surveyors competence and training are fundamental

SHOM trains its staff in its own training centre: « SHOM's school »

- Hydrographic training programme for surveyors: FIG/IHO/ACI S-5 cat. B accredited (14 months of maritime, academic and practical training in hydrography, oceanography and geophysics.
- Survey engineers are trained in ENSTA-Bretagne (S-5 cat. A programme)
- Vocational training throughout the career: hydrography, oceanography, nautical cartography, geophysics, quality management.

DATA QUALITY MANAGEMENT: SENSORS CALIBRATIONS

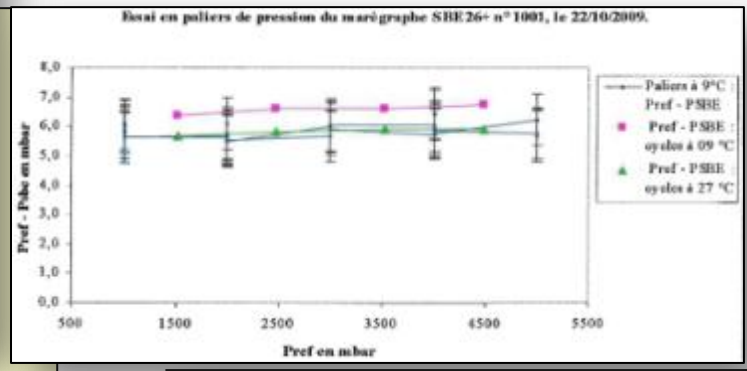
SHOM'S LAB

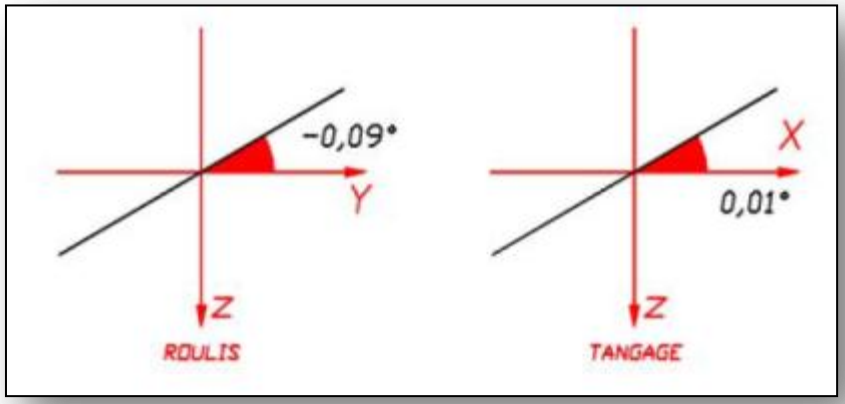
In Shom's lab:

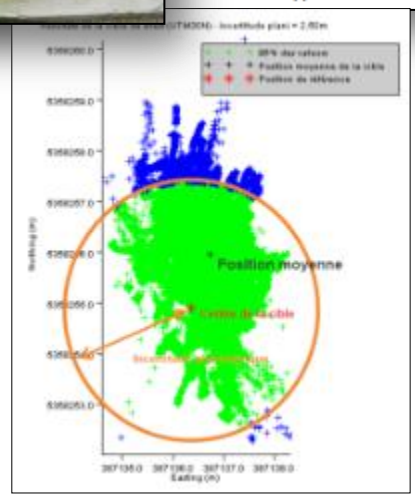
- Sound velocity sensor: every 18 month
- Tide gauge: every year
- Current Meter (Motion + Magnitude)

Others:

- GNSS receiver tests
- Lever arms and angular offsets: every 2-3 years in dry dock)



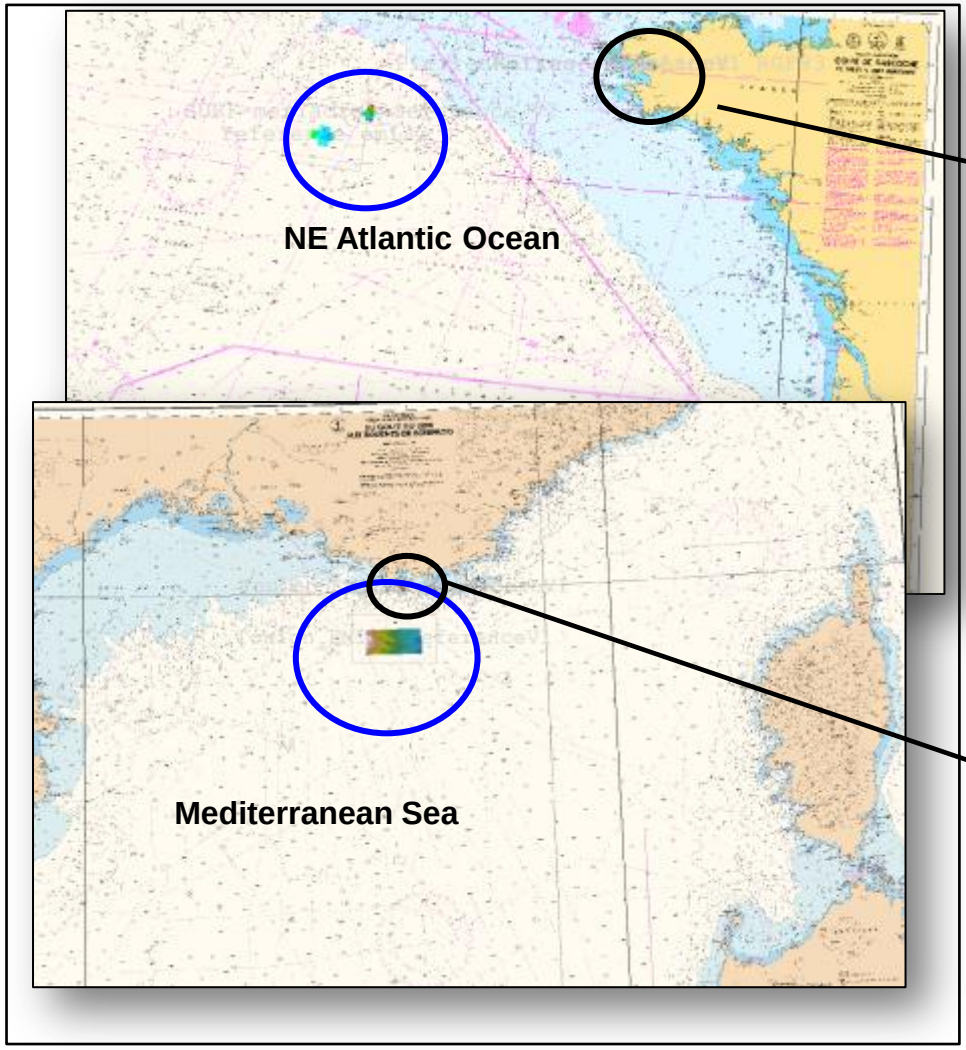




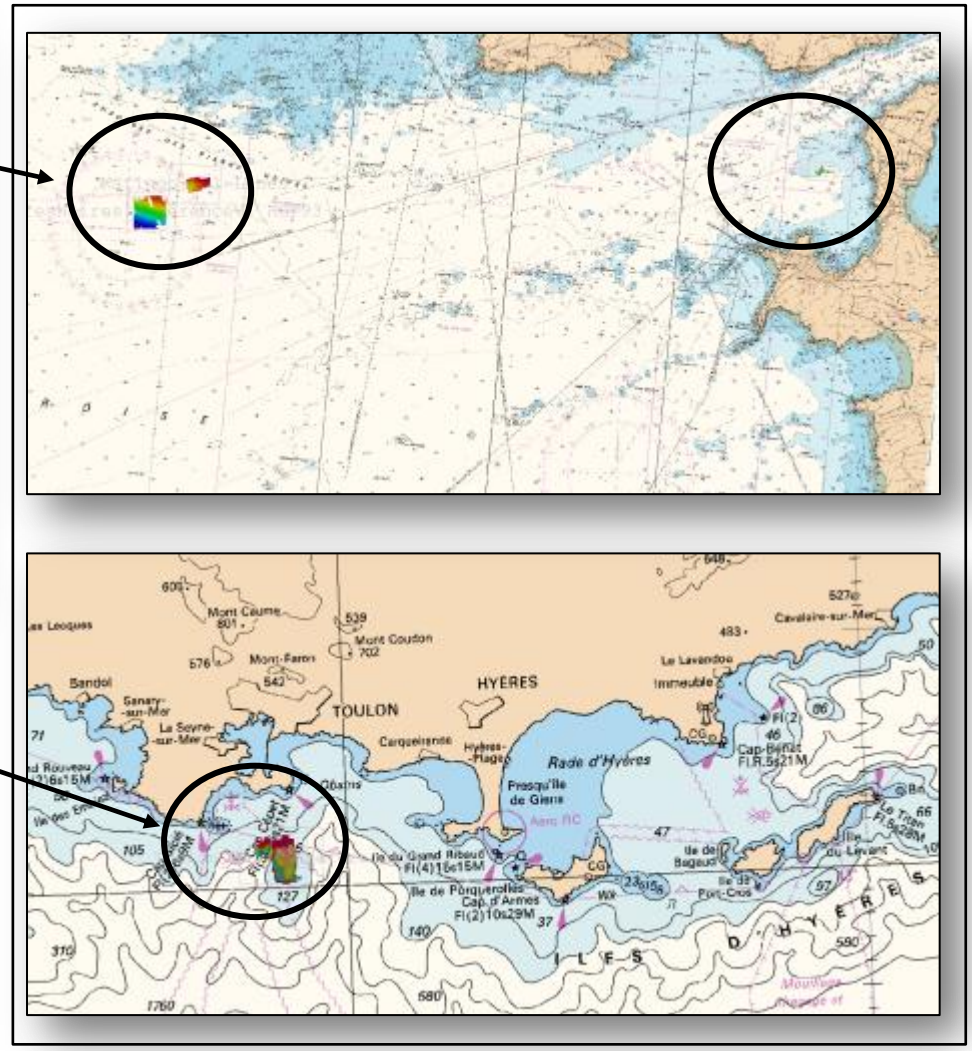
DATA QUALITY MANAGEMENT: PATCH TEST AND QUALIFICATIONS

DEDICATED AREAS

Deep Water (2200 & 4200m) Canyons and reference area



Medium Water (60m-100m) wreck, canyon and reference area



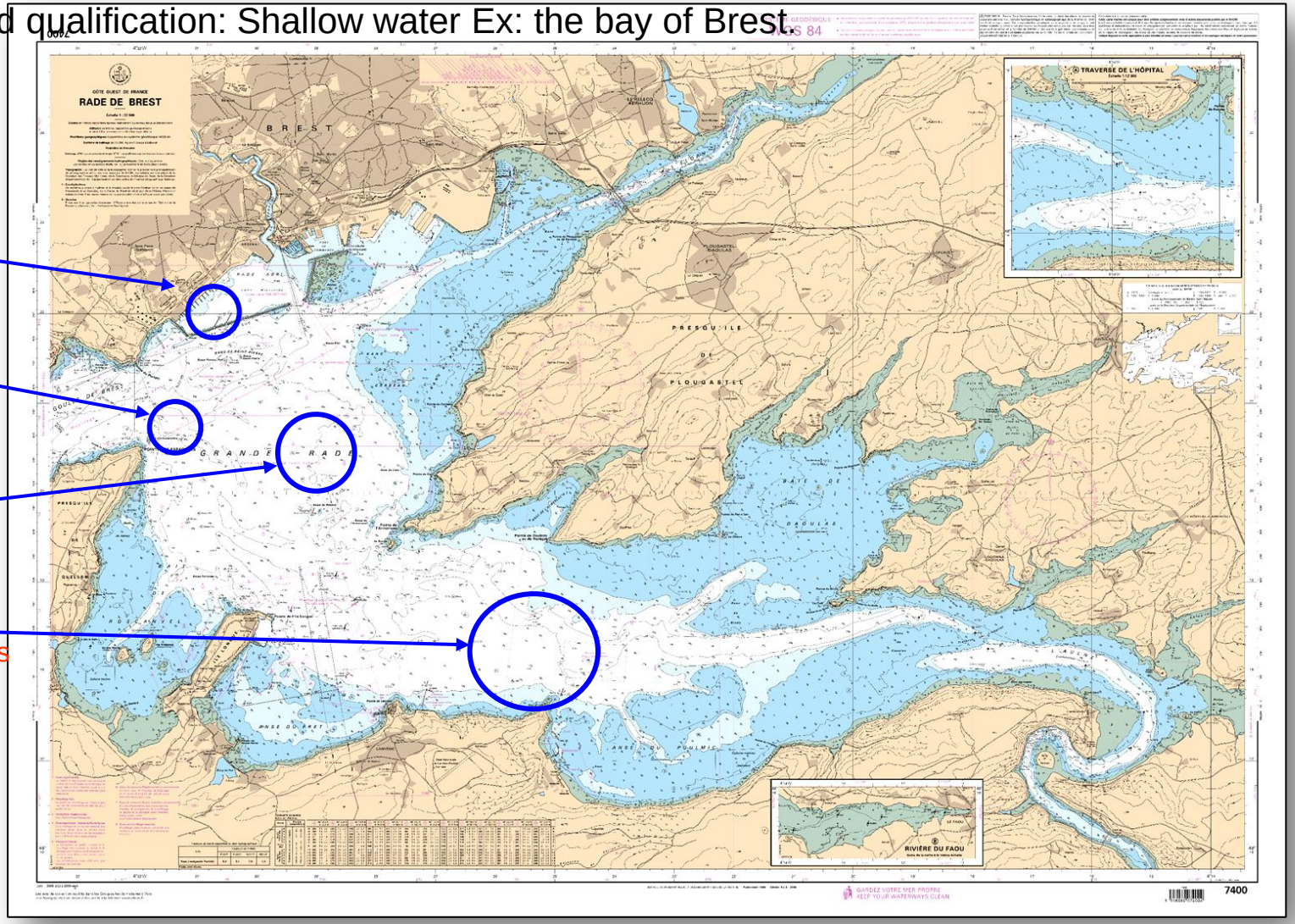
Areas for Patch test and qualification: Shallow water Ex: the bay of Brest

Cube 1mx1m (15m depth)
Horizontal verification

Wreck “Gobetas” (20m depth) – angular offset

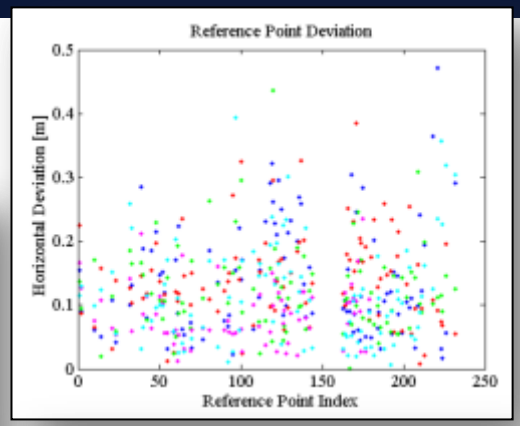
Reference area “Carré Renard” (20m depth)
Vertical verification

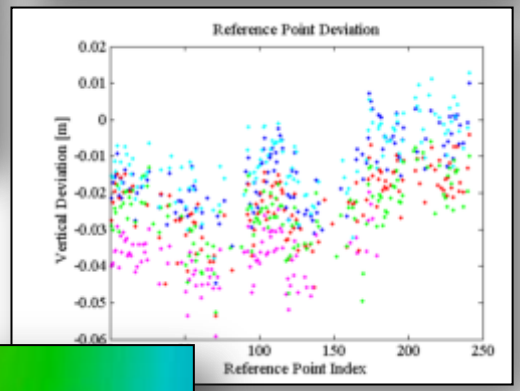
Cubes 1m + 75cm + 50cm (30m depth) – detection tests



DATA QUALITY MANAGEMENT: PATCH TEST AND QUALIFICATIONS

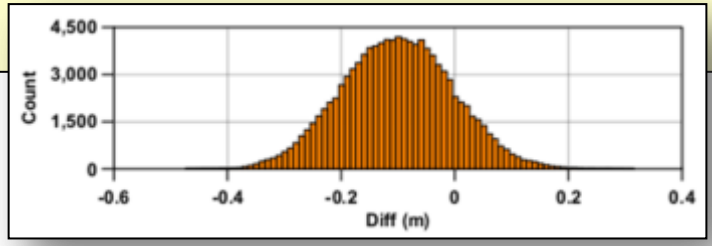
LIDAR

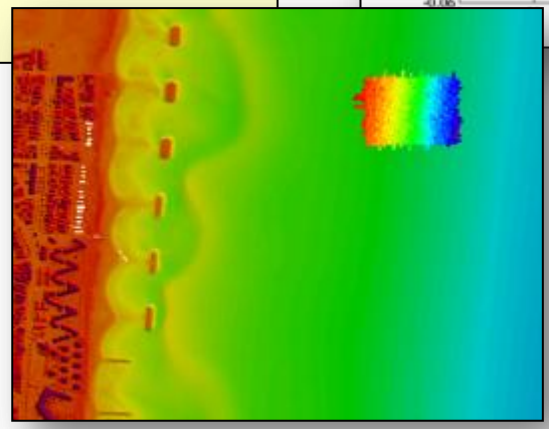




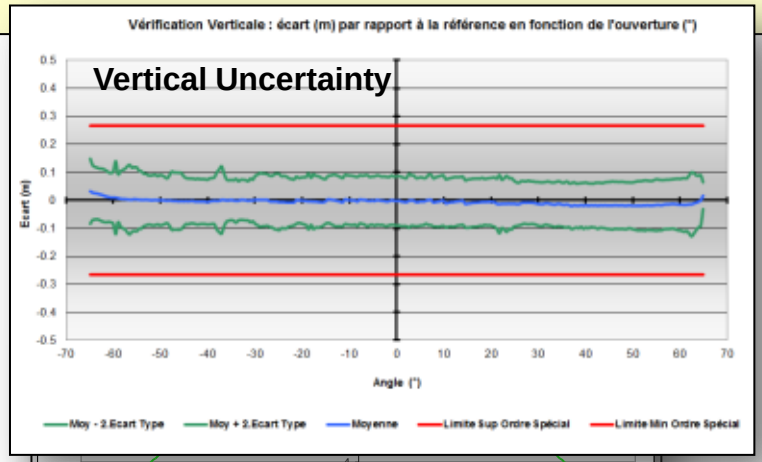
LIDAR:

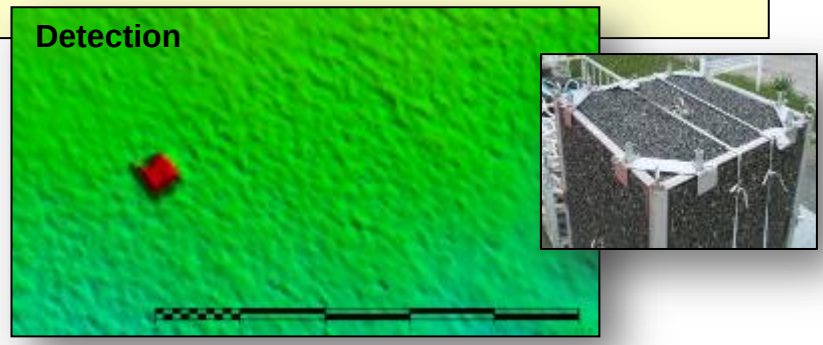
- Calibration: done by subcontractor
- Topography: qualification done by subcontractor (Horizontal and Vertical)
- Bathymetry: S-44 H&V qualification done by Shom using dedicated MBES (or SBES) surveys

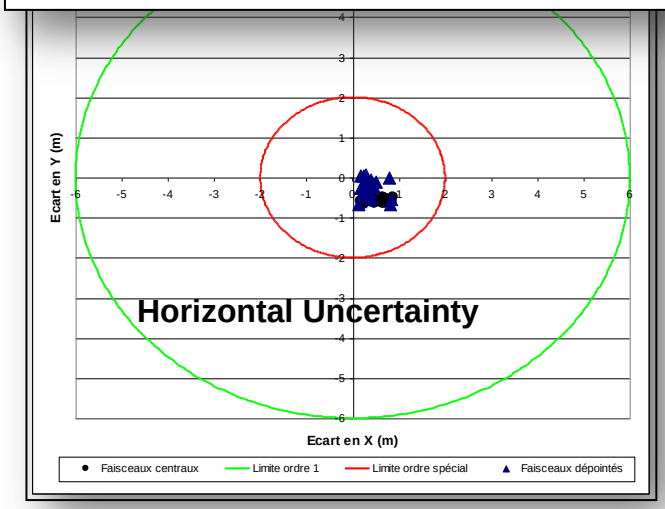


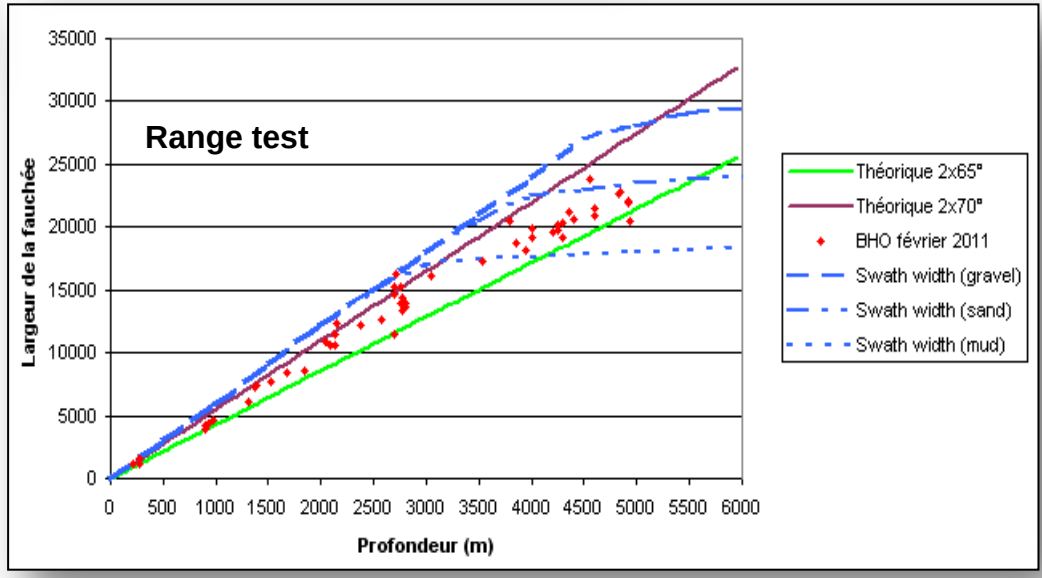


Every year, for every vessel: multibeam “check lines” are run and tested against the references (regarding S-44)



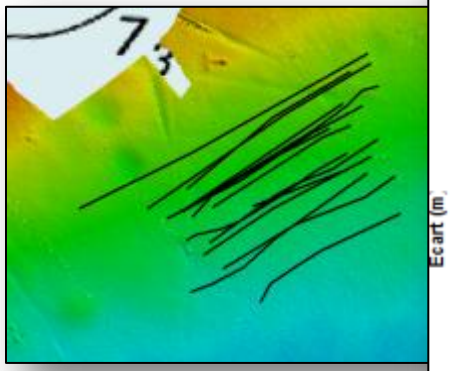


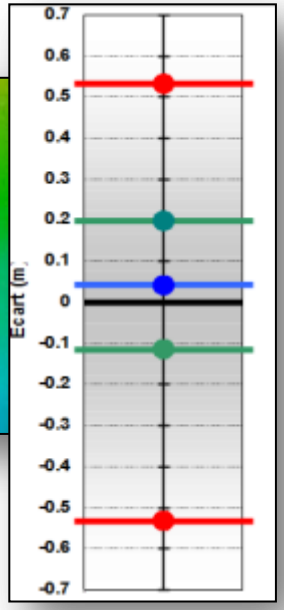




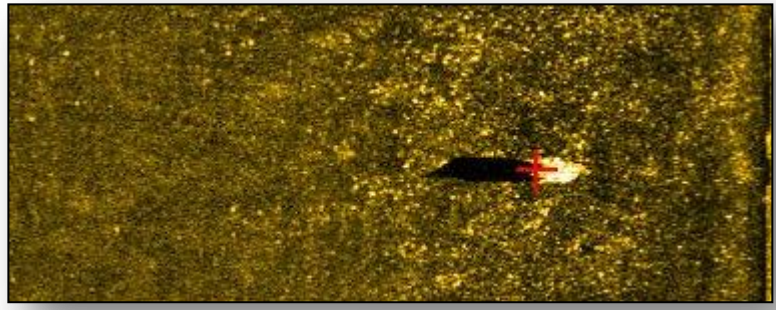
Every year: Single beam and Side Scan sonar “check lines” are run and tested against the references (even on portable systems)

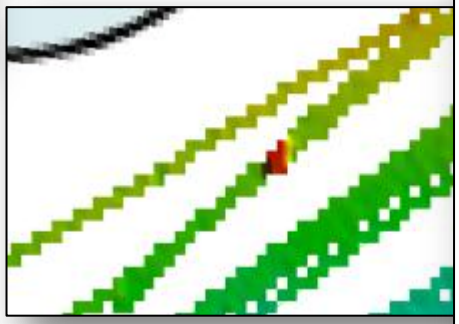
Vertical Uncertainty

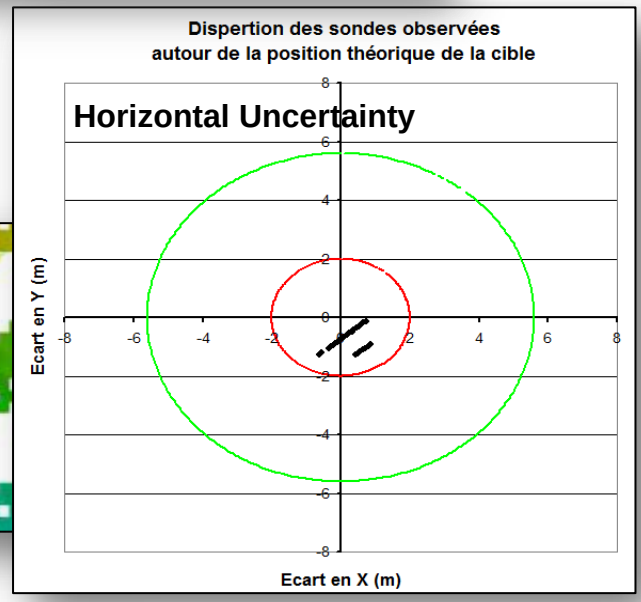




Detection (SSS)







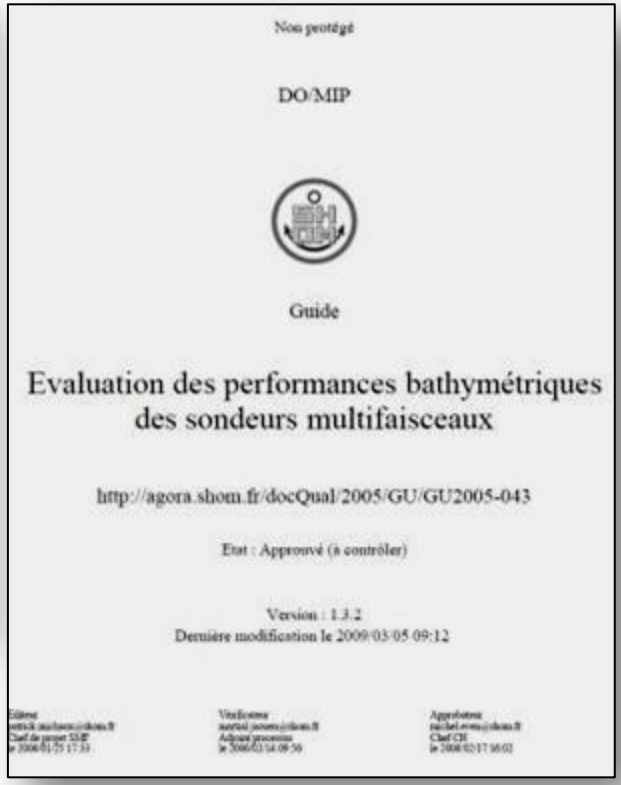
1 - Equipment database

Repairing registration during all the life of the devices

2 - Documentation database

Guides, manuals

(updated after each evolution of a system)


Non protégé

DO/MIP

Guide

Evaluation des performances bathymétriques des sondeurs multifaisceaux

http://agora.shom.fr/docQual/2005/GU/GU2005-043

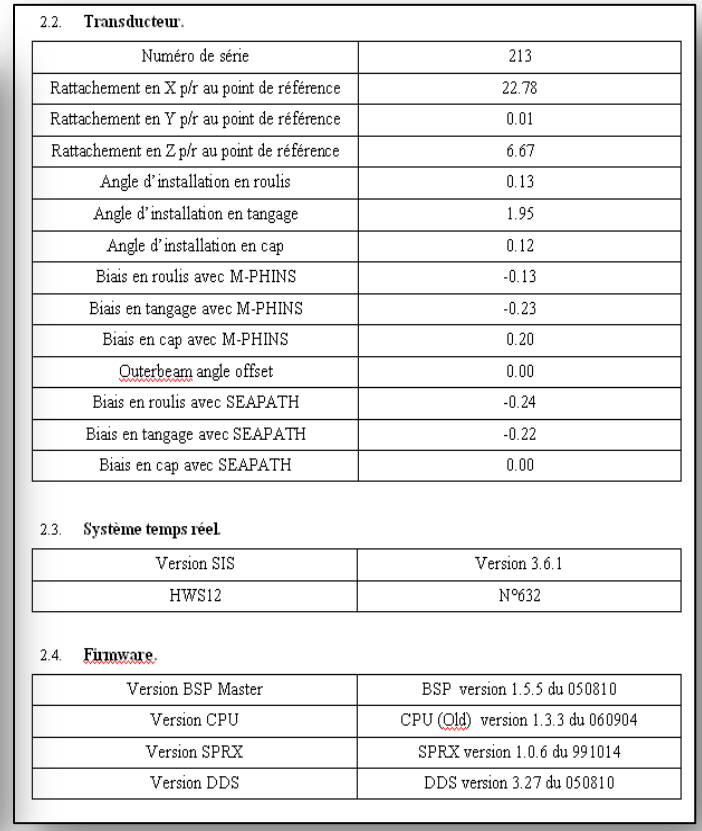
Etat : Approuvé (à contrôler)

Version : 1.3.2

Dernière modification le 2009/03/05 09:12

3 - Configuration database

Software, firmware and hardware configuration


2.2. **Transducteur.**

Numéro de série	213
Rattachement en X p/r au point de référence	22.78
Rattachement en Y p/r au point de référence	0.01
Rattachement en Z p/r au point de référence	6.67
Angle d'installation en roulis	0.13
Angle d'installation en tangage	1.95
Angle d'installation en cap	0.12
Biais en roulis avec M-PHINS	-0.13
Biais en tangage avec M-PHINS	-0.23
Biais en cap avec M-PHINS	0.20
Outerbeam angle offset	0.00
Biais en roulis avec SEAPATH	-0.24
Biais en tangage avec SEAPATH	-0.22
Biais en cap avec SEAPATH	0.00

2.3. **Système temps réel.**

Version SIS	Version 3.6.1
HWS12	N°632

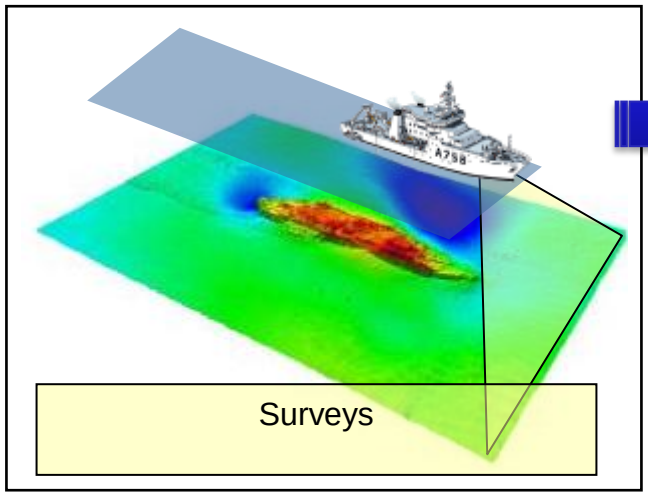
2.4. **Firmware.**

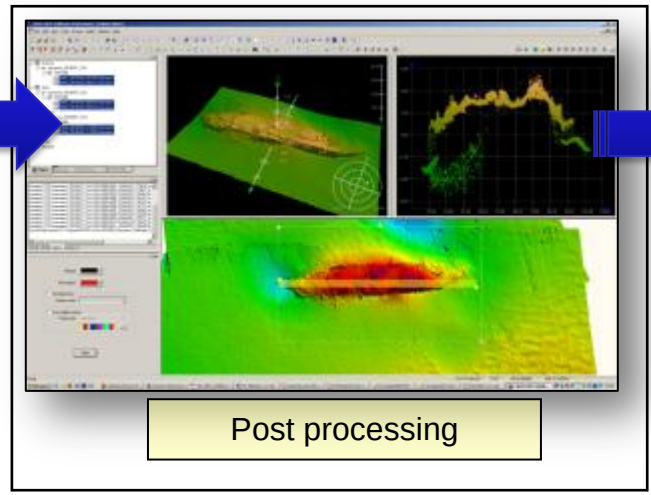
Version BSP Master	BSP version 1.5.5 du 050810
Version CPU	CPU (Old) version 1.3.3 du 060904
Version SPRX	SPRX version 1.0.6 du 991014
Version DDS	DDS version 3.27 du 050810

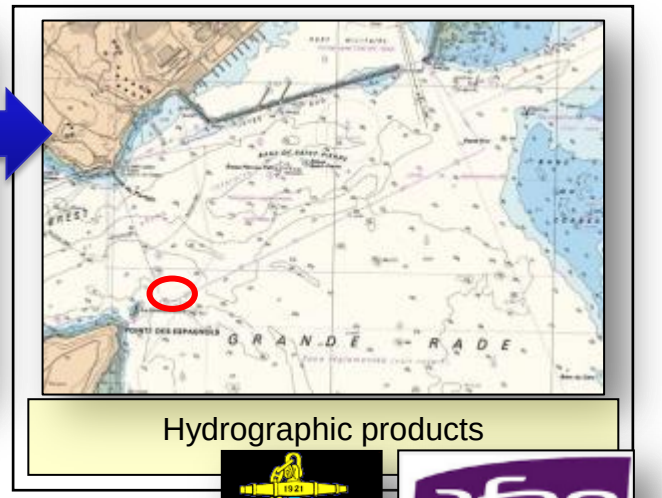
I. Background

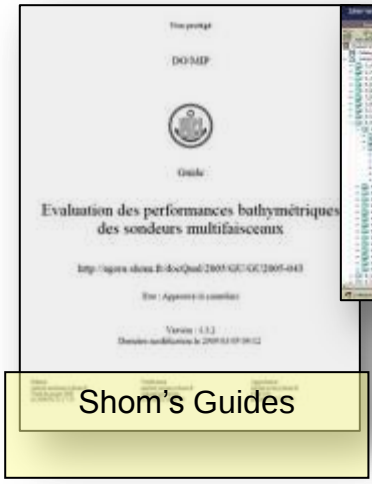
II. Quality Management

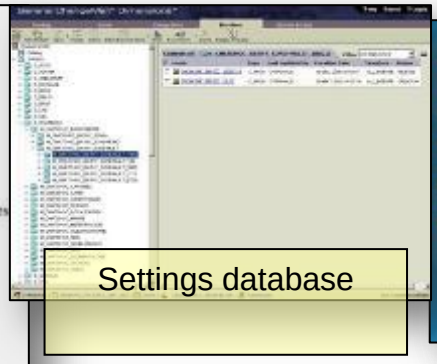
III. Conclusion

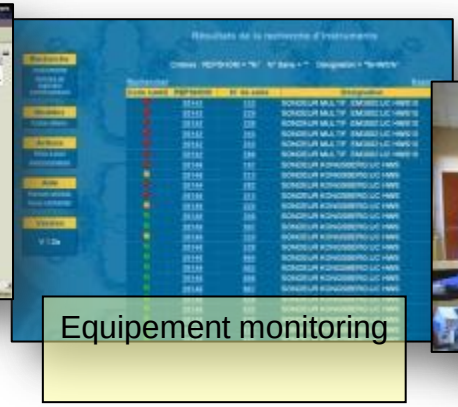

Surveys


Post processing

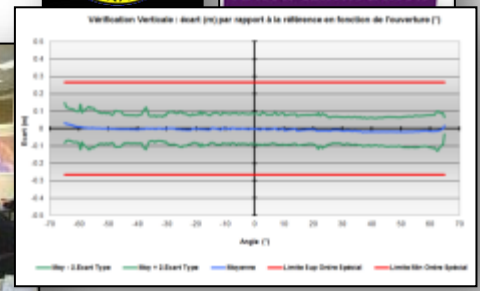

GRANDE RADE
Hydrographic products


Evaluation des performances bathymétriques des sondeurs multifaisceaux
Shom's Guides


Settings database

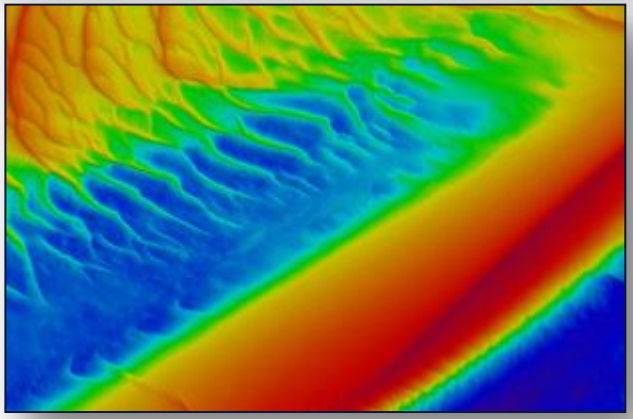

Equipement monitoring


Trainings


Qualification with calibrated sensors

Comments (for MBES):

- **Quality Management**: experimental estimation of uncertainties, with well trained surveyors / evaluations with the S44 standard / Final report for each vessel, each year. + verification during operational surveys
- **Compliancy for Horizontal Uncertainty** easy to achieved in real time, at sea (RTK, EGNOSS, Satellite corrections)
- **Compliancy for Vertical Uncertainty** not so easy to achieved: depending on the vessel shape, the speed, the sea state, the swath. Basically, with our devices: ±60° for Special Order, ±65° for Order 1a, ±70° for Order 2.
- According to Shom's experience, **yearly qualification sea tests dedicated for S-44 qualification are mandatory**
- Based on the last 2 years of surveys, **10.1% Special Order / 41.7% Order 1a** / **40.7% Order 1b** / **7.5% Order 2**



MERCI !