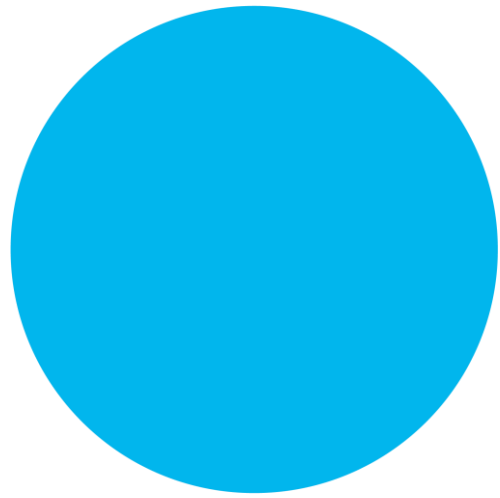


**iXblue**



# Referencing and use of S-44 for commercial surveys

Offshore windfarm, cable route

*Fabien Germond*

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# General Context

## Windfarm Project

- Windmills **type** and **best position assessment** (scientific approach):
  - Seafloor morphology and roughness
  - Shallow sediment layer (0 to 5m)
  - “deep” geological layer (up to ~50m)
  
- **Link** between windmills and shore:
  - Power and communication **Cable** – zone of interest 0 to 3-5m below seafloor
    - Cable burial assessment and risk associated
      - Trenching/Jetting **Obstacles**
      - UXO survey approach – **object detection** and **discrimination**

# General Context

## Windfarm Project - IHO S44 in tender document

- IHO guideline **recognized** in the industry (survey conduct **guidelines**, **QA/QC**, and staff certification ex Cat A)  
IHO is listened by the industry and has a direct impact on the commercial practice
- Usually **resumed** as one sentence → very vague
  - “**Must comply with IHO S44 Standards**”
  - Depth accuracy “IHO Order 1 Compliant”
  - Or “Depth resolution 0.1m” “with RTK position”
  - “Deliveries shall comply with IHO Order”
- Followed by **incoherent specs** such as “grid resolution of 0.1m down to 60m” -> Spec not depth dependent

# General Context

## Windfarm Project - IHO S44 in tender document

- Hydrography usually **not** the main focus
  - o multi-sensors approach **focus** on structural **geology** -> direct interest for the construction engineer
- Client **not expert** in the field of hydrography
  - o more often **helped by Consultant**, not especially expert in hydrography but more specialized in geophysics / geology (directly linked with engineering)
  - o Standards of surveys and specification **derived** from North Sea Oil and Gas field background
    - Could be significantly different spec if written by other field? ex construction background? Topo approach?*
  - o When no specs present -> Survey company advice the **best and optimal practice** according to the client needs versus budget allocated, mainly based on IHO standards (QA/QC, survey conduct)
  - o Client Rep onboard experienced enough to assess if the work is carried as standard

# Client expectation of the S44

## - Client Main Concerns:

- **Best Practice approach** in terms of methods and data QA/QC
- **Vertical Reference**
  - **Appropriate** for construction point of view (MSL, LAT, ... ?)
  - **Reliable**
  - **Easily repeatable** by all actors in any steps of the windfarm project (hydrographer not present). Must be understood by novice people (WORF / BATHYELLI... great help)
- **Detection**
  - Ensure finest detection as possible
  - Feature detection and classification oriented -> targeted object detection: 20cm with 50s/m<sup>2</sup>
    - **Not depth dependent**
      - 3D point clouds interpretation approach (gridding deteriorate the data visualization)

**Client and End Users require Pretty picture without any artefacts**

## - Still confusion between accuracy, precision, resolution

- Extra spec added not coherent with system capability and reachable TVU and THU

# Use of S44 by Survey Company

- Build a **Method Statement** which details how the project/survey will be carried with all the QA/QC carried and acceptance criteria linked with the SOW
- **Onboard** -> Survey in accordance to the common IHO practice, QA/QC by Client Rep – **Data validation** onboard
- **Delivery**
  - Deliver **all the QA/QC information** to the windfarm engineer to understand the data and the associated errors
  - **GeodataBase** (ArcGIS) – Oil and gas standards OGP SSDM or MEDIN data guidelines
    - Strong **metadata** standards but client specific. *Could be it homogenized? Quality should follow the dataset*
    - Visualization: oriented for **geological and object interpretation**
      - Must reveal all the details of the seafloor
  - no request for nautical charting specs
  - No ENC
  - No reference with CATZOC



# Survey in Practice

- **Timing very short – high commercial pressure**
  - Survey awarded by average 2 weeks in advance only
  - **Opportunity Vessel** -> mounting not as reliable as a pre-setup vessel -> **heavy checks to carry**
  - Mobilization time and **checks optimized**
  - Request for **Real time final datasets** onboard even in offshore area
- To fulfill this timing constraint
  - **Technology** evolved towards **efficient** and **reliable survey practice**:
    - Internal standards and methodology proposed to the client evolved rapidly in order to best match the client need with **competitive approach**
      - GNSS survey all referred to ellipsoid (PPK processing) – significant reduction of long period vertical variation errors and simplify the set up and checks
        - the most **appropriate** (cost efficient and simple vertical reference reduction)
        - **reliable** (reduce several errors dealing with long term vertical variation: squat, draft, tide, ...)
        - **repeatable** (technology accessible to all future actors)
      - Automatic processing with smart statistical algorithm
      - ...
    - Deliverables in **GIS geodatabase** format only – no more lonely ascii file

# Conclusion

- S44 match the client expectation as **S44** focus on Safety which is the **most rigorous approach**
- Briefly referred in tenders in order to remain on the protective side and avoid rewriting full spec
- Required accuracy, precision and resolution differ significantly from the S44
  - **IHO Order table not used**
  - **Leads to inconsistent specs between tenders** (wind farm operator)
- Construction approach -> **accuracy not depth related**
  - Accuracy table could be detailed with more parameters, Could it be adapted?
    - Acoustic resolution, Gridding resolution, Sounding density, Detection uncertainties, Relative uncertainties...
  - Would it be interesting to extend the question to the windfarm operators (people who write the tenders)?
- What about a standard for a-posteriori errors?