Finding Efficiency in Standard Practices

IMCA/IOGP Geomatics Industry Day - April 2016

Mike Clark
Group Survey Manager
“More often, innovation is about ideas that ordinary people come up with to improve the way their organizations operate.”
Eliminate, Simplify, Standardize and Automate

- Implemented within our UK business in 2014
- Over 1,000 suggestions to date from across our UK business
- Challenging individuals to consider what we do, why we do it and how we do it
- Not unique to Subsea 7, not unique or new to our industry
- Continuous Improvement Programs have been successfully used and implemented across many other industries to reduce costs and increase efficiency

“In challenging environments, collaboration and innovations matters. The challenge may be complex but the solution doesn’t have to be”
Applying ESSA to Survey - Initial Focus Area

• The goal – to standardise our approach to routine sensor calibrations to deliver a fit for purpose vessel to our project & customer with reduced cost & effort whilst maintaining of quality & reliability of results

• Why?
  - Remove requirement for repeated “project” calibrations
  - Remove/reduce 3rd party costs
  - Remove contingency from tender/project schedules
  - Improved planning for better allocation of resources
  - Consistent performance & results
  - Standardised, central reporting
  - Improved quality & increased confidence
Agreeing the Standard

- Subsea 7 standard – ST-GL-OR-AM-009; Standard for Routine Calibration of Vessel Fit Survey Sensors

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Initial Requirement</th>
<th>Repeat Interval</th>
<th>Calibration/Verification</th>
<th>Cause for Additional Interim Requirement</th>
</tr>
</thead>
</table>
| Dimensional Control Survey         | At first vessel mobilisation | 5 years to coincide with vessel dry-dock | Calibration/Verification | • Change in placement of sensor or antenna  
                                           |                           |                        |                          | • Installation of new sensor/antenna       |
| GNSS                               | At system mobilisation    | Annually                             | Verification             | • Change in antenna location  
                                           |                           |                        |                          | • Change in system hardware  
                                           |                           |                        |                          | • Change in system software           |
| Gyro/Heading Reference             | At system mobilisation    | Annually                             | Calibration              | • Change out of sensor  
                                           |                           |                        |                          | • Change in sensor configuration  
                                           |                           |                        |                          | • Change in sensor placement/alignment |
| MRU/Attitude Reference             | At system mobilisation    | Annually                             | Calibration              | • Change out of sensor  
                                           |                           |                        |                          | • Change in sensor configuration  
                                           |                           |                        |                          | • Change in sensor placement/alignment |
| USBL                               | At vessel mobilisation    | Annually                             | Calibration              | • Change out of system hardware  
                                           |                           |                        |                          | • Change in system software  
                                           |                           |                        |                          | • Change in supporting sensor (MRU/gyro) |
Applying Technology
& Innovating Standard Practices
Alongside Calibrations

- Heading & Attitude / GNSS Verification
  - Additional personnel, equipment & software
  - Specific competence, skills
  - Lengthy observation periods, especially if establishing baseline
  - Exposure to quayside hazards
  - Requires vessel alongside, potentially puts calibration on critical path
Heading/MRU calibration

- RTK “moving base”
  - Calculates heading and attitude in real-time
  - Performance typically $\pm 0.05^\circ$ attitude over 20m baseline

- Direct measurement on coordinated VRF (helideck)
  - Consistency in measurement points
  - Repeatable results
  - Statistical output
  - Simple to use and cost effective!

<table>
<thead>
<tr>
<th>Calibrated MRU Reference</th>
<th>Start Time</th>
<th>End Time</th>
<th>Min</th>
<th>Max</th>
<th>SD</th>
<th>No of Observations</th>
<th>No of Rejections</th>
<th>% Rejected</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRUS</td>
<td>11:24</td>
<td>13:36</td>
<td>0.39$^\circ$</td>
<td>0.48$^\circ$</td>
<td>0.01</td>
<td>7986</td>
<td>26</td>
<td>0.33%</td>
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</table>
GNSS verification by post processing

- Alternative to traditional shore based observations
- Record GNSS RINEX data & post process
- Can be carried out at any time during operations and remove exercise from critical patch during vessel mobilisation
- Requires no additional equipment / personnel
- In line with IMCA S 015 / IOGP 373-19

“Where the survey CRS is the same as the GNSS CRS and verification of co-ordinate transformation is not required, GNSS antenna position can be verified by post-processing of raw GNSS data logged in RINEX format.”

- Question: Do we still need to verify PPP GNSS services?
Offset verifications

- Extending the use of RTK “moving base”
- Check baseline between antenna positions ±1-2cm
- Transfer independent GNSS solution from helideck to CRP for position comparison to verify complete surface position solution
USBL

• Taking advantage of today’s standard fit, high quality systems

• Sensors are now much more accurate, precise and reliable

  – GNSS PPP positioning
  – GNSS based heading sensors
  – Modern MRUs very stable
  – USBL systems perform much better
  – Redundant systems

Observed differences in USBL alignments over 4 years

• Heading: 0.14°
• Pitch/Roll: 0.05°

• Do we need to repeat the calibration or can we verify the performance another way?
Subsea 7’s management of calibrations & verifications

1. Standard Work Instruction

2. Standard Reporting Templates

3. Clear QC Metrics

4.1 SPIN VERIFICATION

4.1.1 Port Transducer - Transponder Positions

Vessel offset from transponder: 50m

<table>
<thead>
<tr>
<th>Eastings</th>
<th>Northings</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transponder position 250°</td>
<td>761441.04</td>
<td>9442155.80</td>
</tr>
<tr>
<td>Transponder position 340°</td>
<td>761440.67</td>
<td>9442155.54</td>
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<tr>
<td>Transponder position 070°</td>
<td>761440.77</td>
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<tr>
<td>Transponder position 160°</td>
<td>761440.95</td>
<td>9442156.07</td>
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</tbody>
</table>

Average

<table>
<thead>
<tr>
<th>Eastings</th>
<th>Northings</th>
<th>Depth</th>
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<tbody>
<tr>
<td>761440.85</td>
<td>9442155.79</td>
<td>497.05</td>
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</table>

Max. diff from average

| Average | 0.19 | 0.28 | 0.1 |

Max allowable difference ±0.5m or 0.2% slant

| 1.0 | 1.0 | 1.0 |

Pass/Fail

| Pass | Pass | Pass |
Subsea 7’s management of calibrations & verifications

- Intranet based repository of results
- QC & compare across sites
- Identify trends & anomalies
- Information available onshore/offshore 24/7
Efficiencies in techniques discussed

- The techniques are dynamic, no need to be alongside - reduces vessel time, removes activities from critical path

- The systems are relatively inexpensive, portable, rugged and simple to use

- The techniques can be carried out by the on board survey crew reducing cost from additional personnel and services

- Reduces HSE exposure from quayside activities

- By annual calibrations of this nature Subsea 7 has seen direct cost savings along with reduced tender costs

- Reliability, consistency and repeatability exceeds legacy methods
But.........

- Seven Borealis due to start project
- Client specifications required full set of calibrations
- Unable to get vessel alongside
- Unable to mobilise specialist equipment/personnel in time
- Potential delays to project
- But we have a solution, yes?

“That’s not standard....”
Standard Industry Practice

– During mobilization the gyrocompass shall be run up and an alignment check made against *known reference points onshore* to the satisfaction of the COMPANY representative.

– *…the position of GNSS antenna and representative offset points [should be checked] by conventional land survey methods from known control points in the local/survey CRS*

– The CONTRACTOR shall conduct a static comparison between the *known co-ordinates of an onshore point* and the computed position as derived using the DGNSS system.

– There are no calibrations applicable to GNSS systems however the correct installation and operation of these systems shall be verified by means of *land survey techniques* in the form of a system ‘health check’.

– GPS **Static Tests** - The GPS positioning system is to be **static tested**, not greater than 30 days prior to mobilisation. The static test shall consist of either:
  • a. comparison of the GPS solution against a *known shore station*, or
  • b. the computation of a point position by measuring at least 3 hours of phase data and computing a solution based on the fiducial network (AUSPOS etc)
Current “Standards” in Offshore Survey

“The wonderful thing about Standards is that there are so many of them to choose from”

(Rear Admiral Grace Hopper – US Navy)

• Operator Specifications
• IMCA / IOGP Guidelines
• “Industry Practice”
• Individual “project” specifications

• Lot’s of documents, but are they “standards”?  
• When is a standard not a standard – when it’s a guideline!  
• What/who defines industry standard practice and how can this be challenged and changed?  
• Do we have suitable & sufficient “standards” to cover our typical activities?  
• Do we apply continuous improvement to our “standards”?
What is a Standard?

“…a standard is an agreed way of doing something.”

“Standards are the distilled wisdom of people with expertise in their subject matter and who know the needs of the organizations they represent – people such as manufacturers, sellers, buyers, customers, trade associations, users or regulators.”

“Standards are knowledge. They are powerful tools that can help drive innovation and increase productivity. They can make organizations more successful and people’s everyday lives easier, safer and healthier.”

“The point of a standard is to provide a reliable basis for people to share the same expectations about a product or service. This helps to:
  • facilitate trade
  • provide a framework for achieving economies, efficiencies and interoperability
  • enhance consumer protection and confidence.”

“They are designed for voluntary use so it’s up to you – you’re not forced to follow a set of rules that make life harder for you, you’re offered ways to do your work better.
**Time for change?**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Content Description</th>
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<tbody>
<tr>
<td>Positioning Accuracies and Installation Tolerances</td>
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<tr>
<th>General Survey Operations</th>
<th>Vessel Dimensional Control &amp; Offsets</th>
<th>GNSS Operation &amp; Verification</th>
<th>Heading Reference Calibration and Verification</th>
<th>Attitude Reference Calibration and Verification</th>
<th>USBL Calibration and Verification</th>
<th>ROV MBE/Profiler Calibration</th>
<th>ROV DVL Alignment and Verification</th>
<th>ROV Bathymetry</th>
<th>Video Recording</th>
<th>Tidal Reduction</th>
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<td>Installation Operations</td>
<td>Pre-installation Survey</td>
<td>Installation Operations</td>
<td>Post-installation Survey</td>
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<td>Post-trench Survey</td>
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<td>Reporting &amp; Deliverables</td>
<td>Mobilisation Reports</td>
<td>Field Reports</td>
<td>Standard Listings &amp; Electronic Deliverables</td>
<td>Charting</td>
<td>GIS</td>
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- All contractors will have “standard operating procedures”
- Most operators will have survey specifications or standards
- Is it time to pool this knowledge, collaborate and develop some common industry standards?
- E.g. PAS (*Publicly Available Specification*)

**Why create a PAS?**

- Improve productivity
- Increase efficiency
- Reduce costs
- Maintain quality

- Accelerate innovation
- Agree good practice
- Build trust with consumers
- Can be developed into an international standard
Where Next?

- Subsea 7 will continue to look for efficiencies and challenge our current thinking and “standard practice”
- Considering “fit for purpose” & “good enough”
  - Project Procedures: Generic, off the shelf documents
  - USBL: can we further reduce the “calibration” requirements?
  - ROV Sensors: INS, pipetracker, MBE, gyro/MRU
  - Data Acquisition: what & why
    - MBE v Laser v DHSS
    - HD v SD v photo-mosaic
  - Reporting & Deliverables: reduced, simplified & standardised
    - Results orientated
    - Minimum

- But if there is no industry collaboration and buy-in are these or other areas worth pursuing?
Summary

• Subsea 7 have found that we can generate efficiencies within our survey operations through innovating on a subset of our standard regular practices

• However there remains reluctance to accept new practices that are not considered “industry standard”

• Current “industry standards” in places may be outdated, inconsistent and perhaps insufficient in scope

• Further efficiencies could continue to be made through innovating our ways of working through collaboration to simplify and standardise our routine operations
The most dangerous phrase in the language is “we’ve always done it this way.”

Rear Admiral Grace Hopper (1906-1992)