Finding Efficiency in Standard Practices

IMCA/IOGP Geomatics Industry Day - April 2016

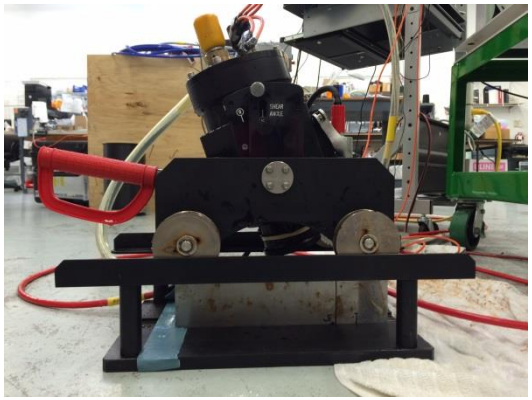
Mike Clark

Group Survey Manager

Efficiency & Innovation

AIV

Imperium NDT



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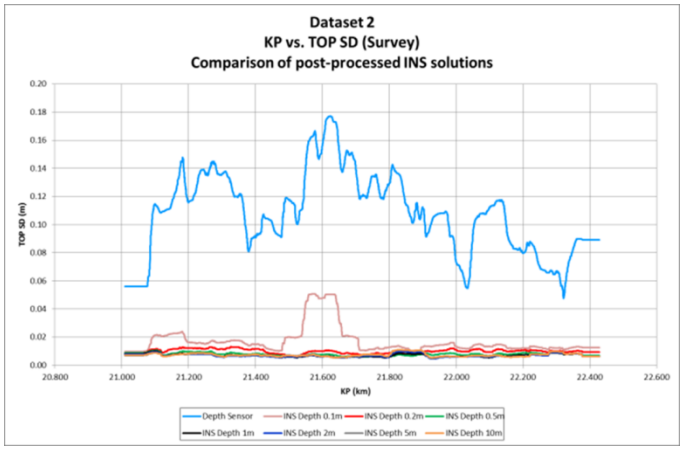
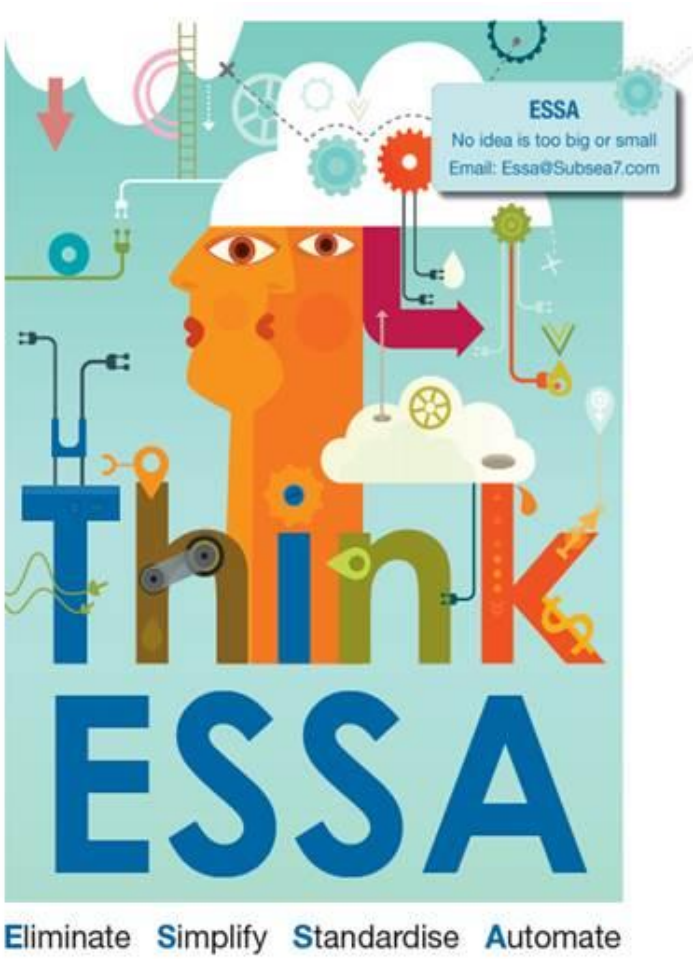


"More often, innovation is about ideas that ordinary people come up with to improve the way their organizations operate."

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

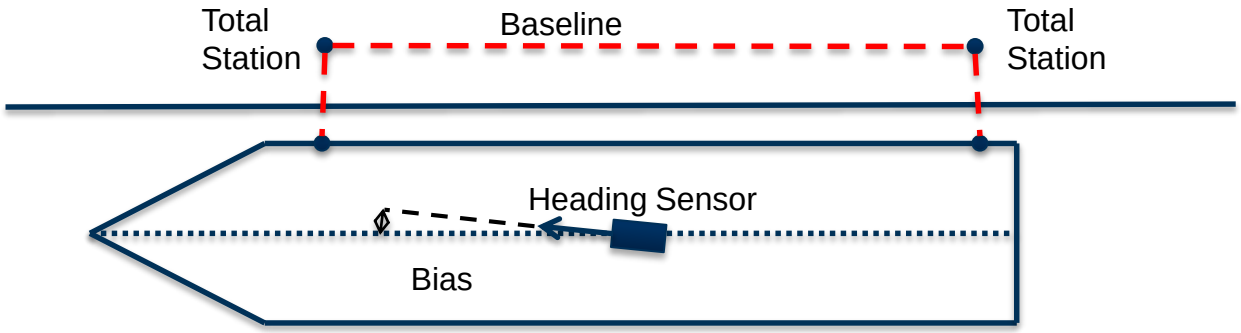
Agreeing the Standard

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

Requirement	Initial Requirement	Repeat Interval	Calibration/ Verification	Cause for Additional Interim Requirement
Dimensional Control Survey	At first vessel mobilisation	5 years to coincide with vessel dry-dock		• 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

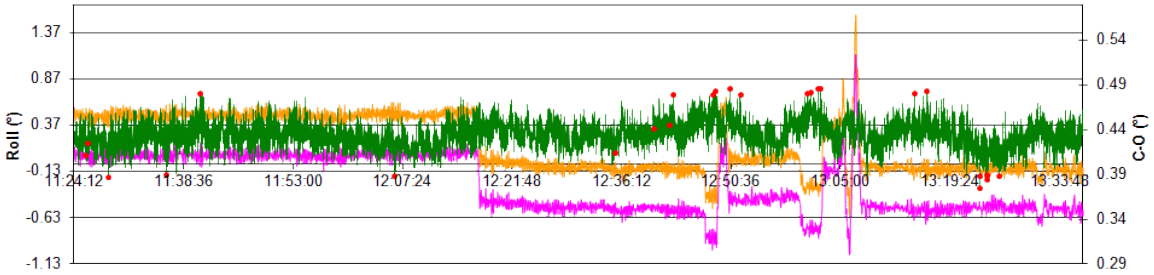
Alongside Calibrations



- 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

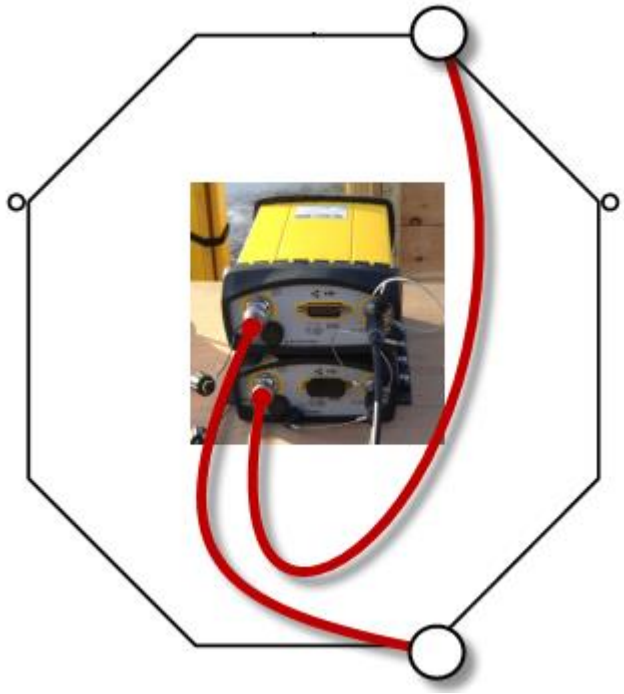
Heading/MRU calibration

- RTK “moving base”
  - Calculates heading and attitude in real-time
  - Performance typically ±0.05 ° attitude over 20m baseline
- Direct measurement on coordinated VRF (helideck)
  - Consistency in measurement points
  - Repeatable results
  - Statistical output
  - Simple to use and cost effective!

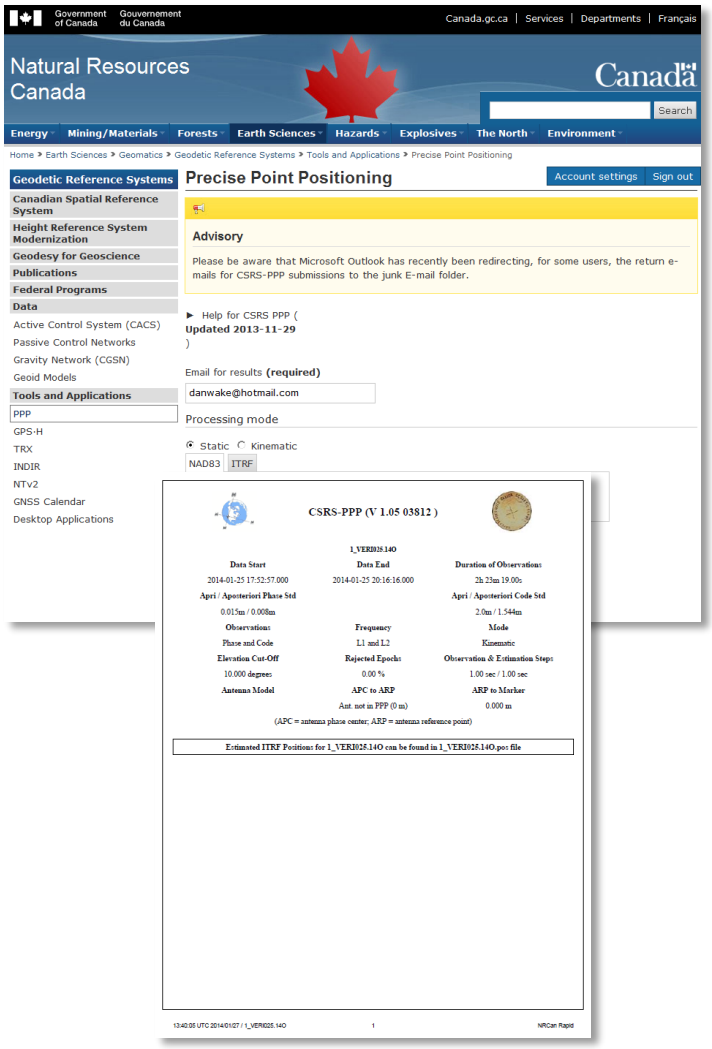


Calibrated MRU Reference	Start Time	End Time	Min	Max	C-O	SD	No of Observations	No of Rejections	% Rejected
MRU5	11:24	13:36	0.39°	0.48°	0.43°	0.01	7966	26	0.33%

SD 0.01°



GNSS verification by post processing

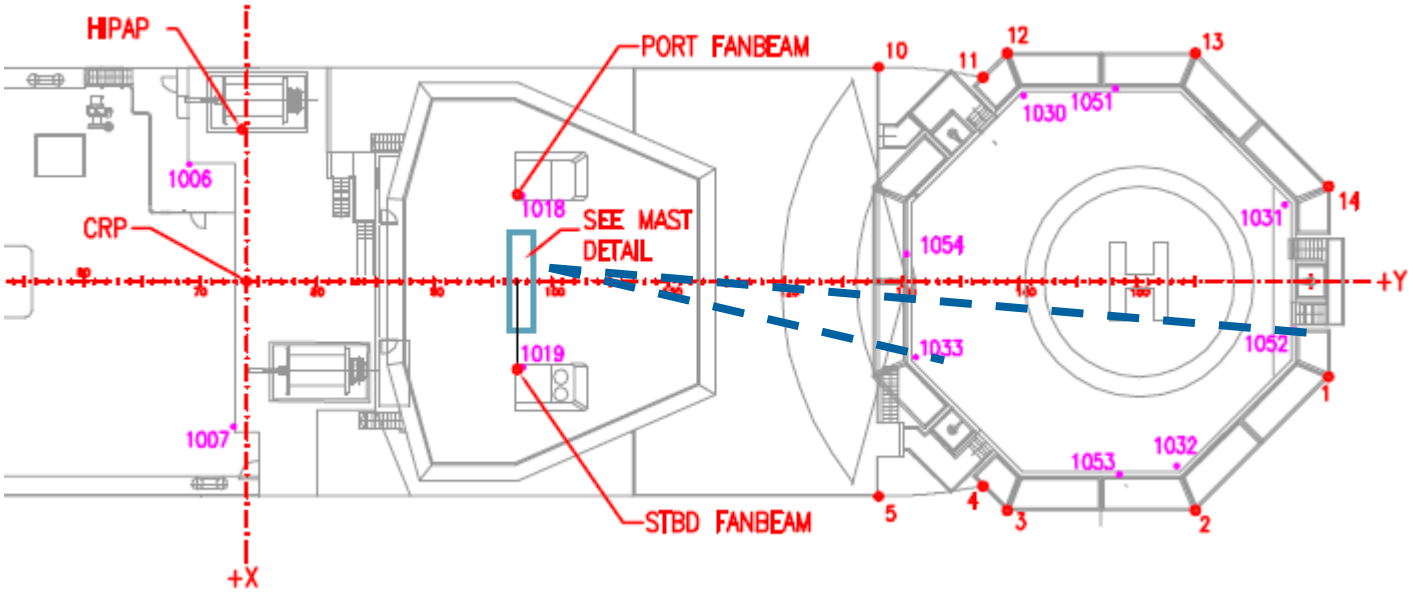


- Alternative to traditional shore based observations
- Record GNSS RINEX data & post process
- Can be carried out at any time during operations and remove exercise from critical patch during vessel mobilisation
- Requires no additional equipment / personnel
- In line with IMCA S 015 / IOGP 373-19

"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 todays 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

Latest USBL Calibrations - HiPAP Port Pole

Date	Equipment	Location / Water Depth	Method	Results C-Os / SDs		
				Hdg	Pitch	Roll
08/01/16	HiPAP 500 Port Pole	Pointe Noire, CON / 394m	Cardinal Points (recip hdgs), Spin, Transit Lines	180.44°	0.11°	-0.10°
				0.02°	0.01°	0.01°
07/02/15	HiPAP Port Pole	Skudefjord, NO / 394m	Cardinal Points (sing hdg), Spin, Transit Lines	180.58°	0.13°	-0.12°
				0.03°	0.01°	0.01°
04/01/14	HiPAP Port Pole	offshore Angola / 724	Cardinal Points, Spin, Transit Lines	180.49°	0.08°	-0.08°
				0.01°	0.00	0.00
09/12/12	HiPAP Port Pole	offshore Stavanger / 708	Cardinal Points	180.47°	0.100°	-0.130°
				0.010°	-	-

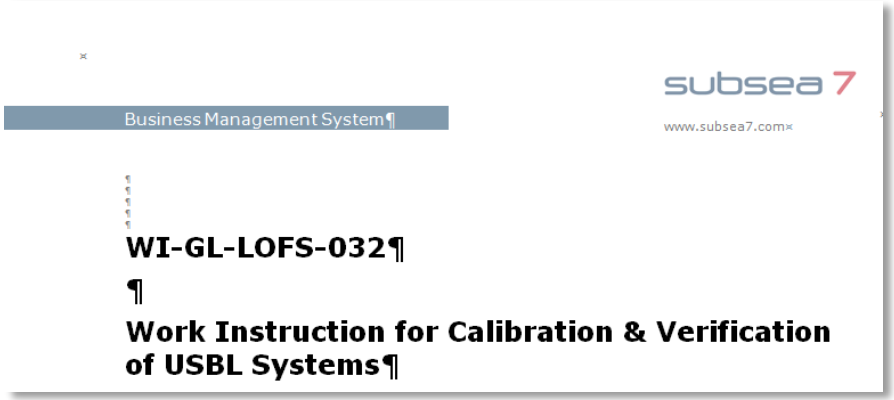
Observed differences in USBL alignments over 4 years

- 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



Business Management System¶

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WI-GL-LOFS-032¶

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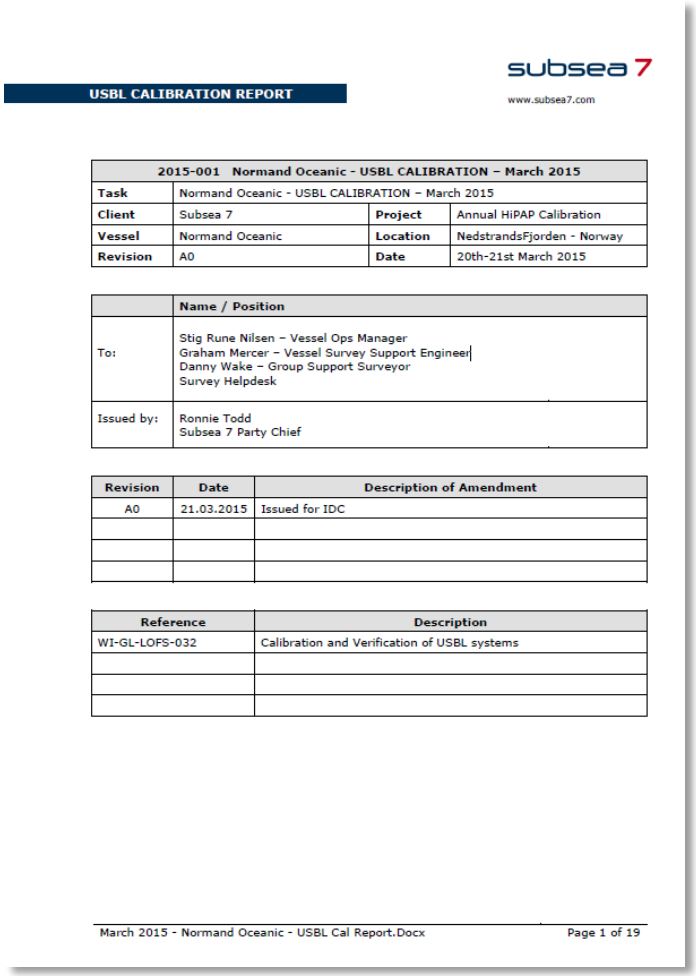
Work Instruction for Calibration & Verification of USBL Systems¶

2. Standard Reporting Templates



USBL CALIBRATION REPORT

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2015-001 Normand Oceanic - USBL CALIBRATION – March 2015			
Task	Normand Oceanic - USBL CALIBRATION – March 2015		
Client	Subsea 7	**Project**	Annual HiPAP Calibration
Vessel	Normand Oceanic	**Location**	NedstrandsFjorden - Norway
Revision	A0	**Date**	20th-21st March 2015

	Name / Position
To:	Stig Rune Nilsen – Vessel Ops Manager Graham Mercer – Vessel Survey Support Engineer Danny Wake – Group Support Surveyor Survey Helpdesk
Issued by:	Ronnie Todd Subsea 7 Party Chief

Revision	Date	Description of Amendment
A0	21.03.2015	Issued for IDC

Reference	Description
WI-GL-LOFS-032	Calibration and Verification of USBL systems

March 2015 - Normand Oceanic - USBL Cal Report.Docx Page 1 of 19

3. Clear QC Metrics

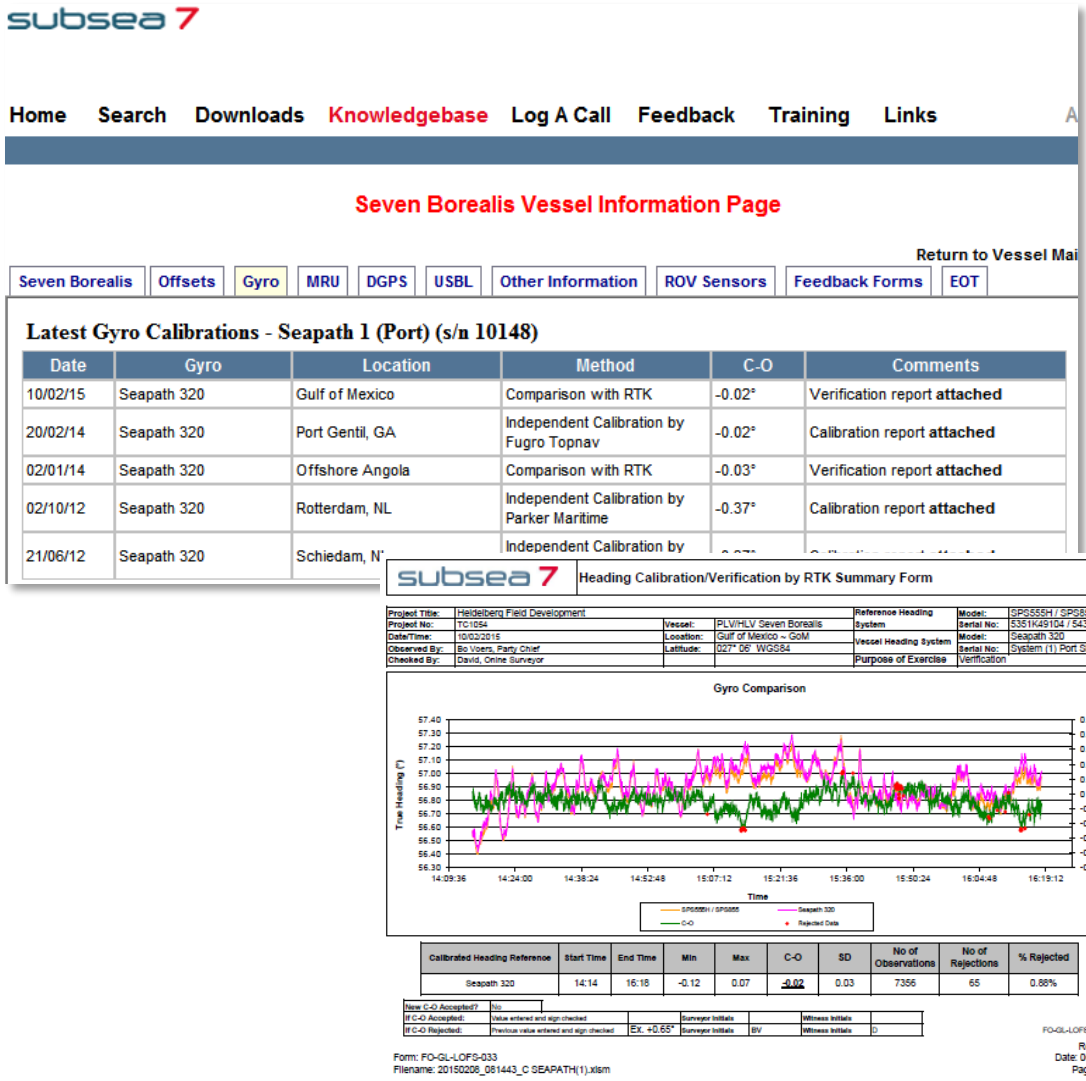
4.1 SPIN VERIFICATION

4.1.1 Port Transducer - Transponder Positions

Vessel offset from transponder: 50m

	Eastings	Northings	Depth
Transponder position 250°	761441.04	9442155.80	496.94
Transponder position 340°	761440.67	9442155.54	497.09
Transponder position 070°	761440.77	9442155.77	497.07
Transponder position 160°	761440.95	9442156.07	497.12
Average	761440.85	9442155.79	497.05
Max. diff from 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



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Seven Borealis Vessel Information Page

Return to Vessel Mai

Seven Borealis | Offsets | Gyro | MRU | DGPS | USBL | Other Information | ROV Sensors | Feedback Forms | EOT

Latest Gyro Calibrations - Seapath 1 (Port) (s/n 10148)

Date	Gyro	Location	Method	C-O	Comments
10/02/15	Seapath 320	Gulf of Mexico	Comparison with RTK	-0.02°	Verification report **attached**
20/02/14	Seapath 320	Port Gentil, GA	Independent Calibration by Fugro Topnav	-0.02°	Calibration report **attached**
02/01/14	Seapath 320	Offshore Angola	Comparison with RTK	-0.03°	Verification report **attached**
02/10/12	Seapath 320	Rotterdam, NL	Independent Calibration by Parker Maritime	-0.37°	Calibration report **attached**
21/06/12	Seapath 320	Schiedam, N	Independent Calibration by		

subsea 7 Heading Calibration/Verification by RTK Summary Form

Project Title:	Heidelberg Field Development			Reference Heading System	Model: SPS555H / SPS855
Project No:	TC1054	Vessel:	PLV/HLV Seven Borealis		Serial No: 5351K49104 / 5433R03483
Date/Time:	10/02/2015	Location:	Gulf of Mexico ~ GoM	Vessel Heading System	Model: Seapath 320
Observed By:	Bo Voers, Party Chief	Latitude:	027° 06' WGS84		Serial No: System (1) Port Side
Checked By:	David, Online Surveyor			Purpose of Exercise	Verification

Gyro Comparison

Calibrated Heading Reference	Start Time	End Time	Min	Max	C-O	SD	No of Observations	No of Rejections	% Rejected
Seapath 320	14:14	16:18	-0.12	0.07	-0.02	0.03	7356	65	0.88%

New C-O Accepted?	No						
If C-O Accepted:	Value entered and sign checked		Surveyor Initials		Witness Initials		
If C-O Rejected:	Previous value entered and sign checked	Ex. +0.65°	Surveyor Initials	BV	Witness Initials	D	

FO-GL-LOFS-033 Rev. 5

Form: FO-GL-LOFS-033
Filename: 20150206_081443_C SEAPATH(1).xlsm

Revision:5
Date: 06.Feb.15
Page: 1 of 1

- 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.

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Time for change?

Standard	Content Description
Positioning Accuracies and Installation Tolerances	
General Survey Operations	Vessel Dimensional Control & Offsets
	GNSS Operation & Verification
	Heading Reference Calibration and Verification
	Attitude Reference Calibration and Verification
	USBL Calibration and Verification
	ROV MBE/Profiler Calibration
	ROV DVL Alignment and Verification
	ROV Bathymetry
	Video Recording
	Tidal Reduction
Installation Operations	Pre-installation Survey
	Installation Operations
	Post-installation Survey
Trenching & Plough Operations	Pre-trench Survey
	Trenching & Plough Monitoring
	Post-trench Survey
Rock Placement	
Out of Straightness Surveys	
Spoolpiece Metrology	
Reporting & Deliverables	Mobilisation Reports
	Field Reports
	Standard Listings & Electronic Deliverables
	Charting
	GIS

- 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)*

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)

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seabed-to-surface

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