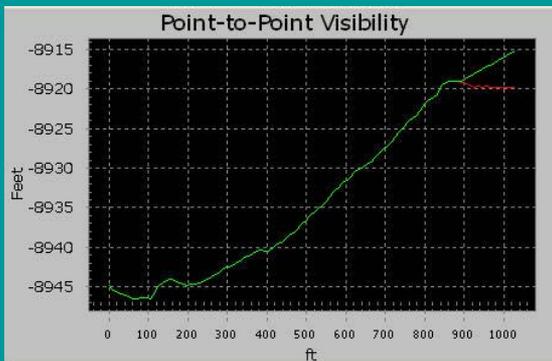




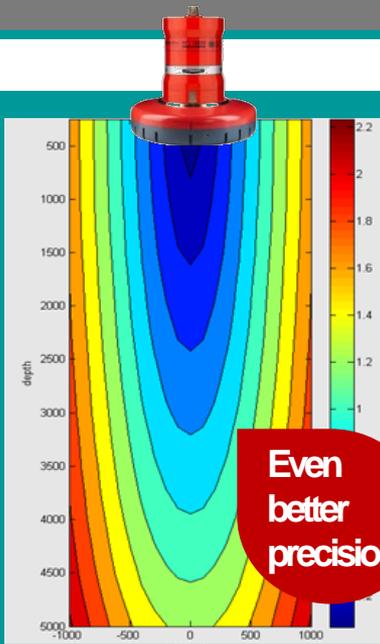
# Efficiency Improvements in Acoustic Metrology



**Darren Murphy**  
Senior Survey Engineer, Survey Support Group.



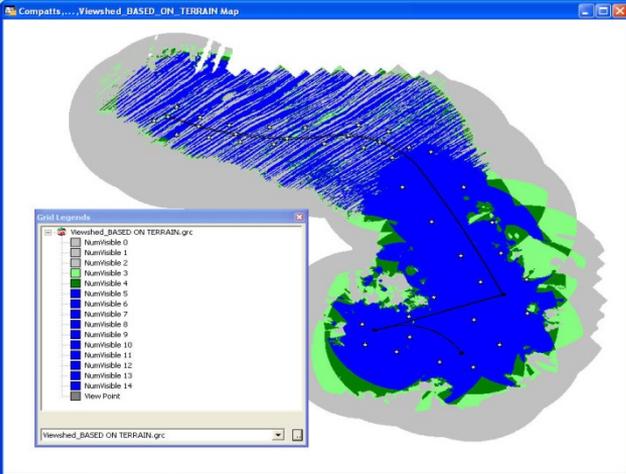
Product Advice



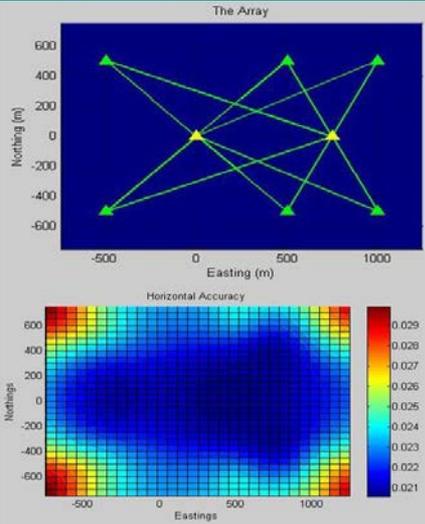
Project Support

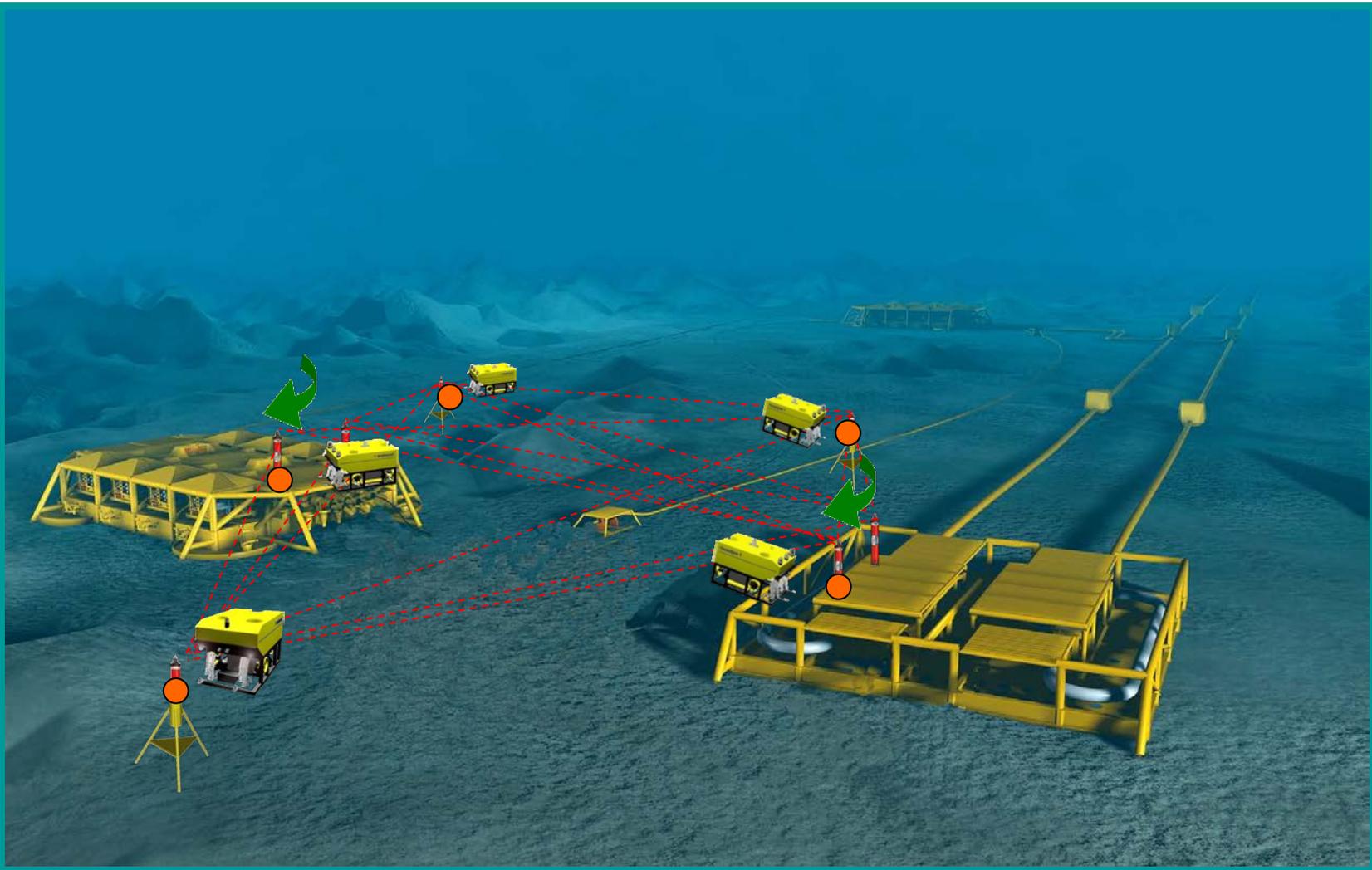
Even better precision

Technical Workshops

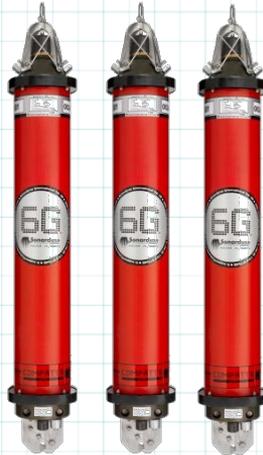


Internal Customer

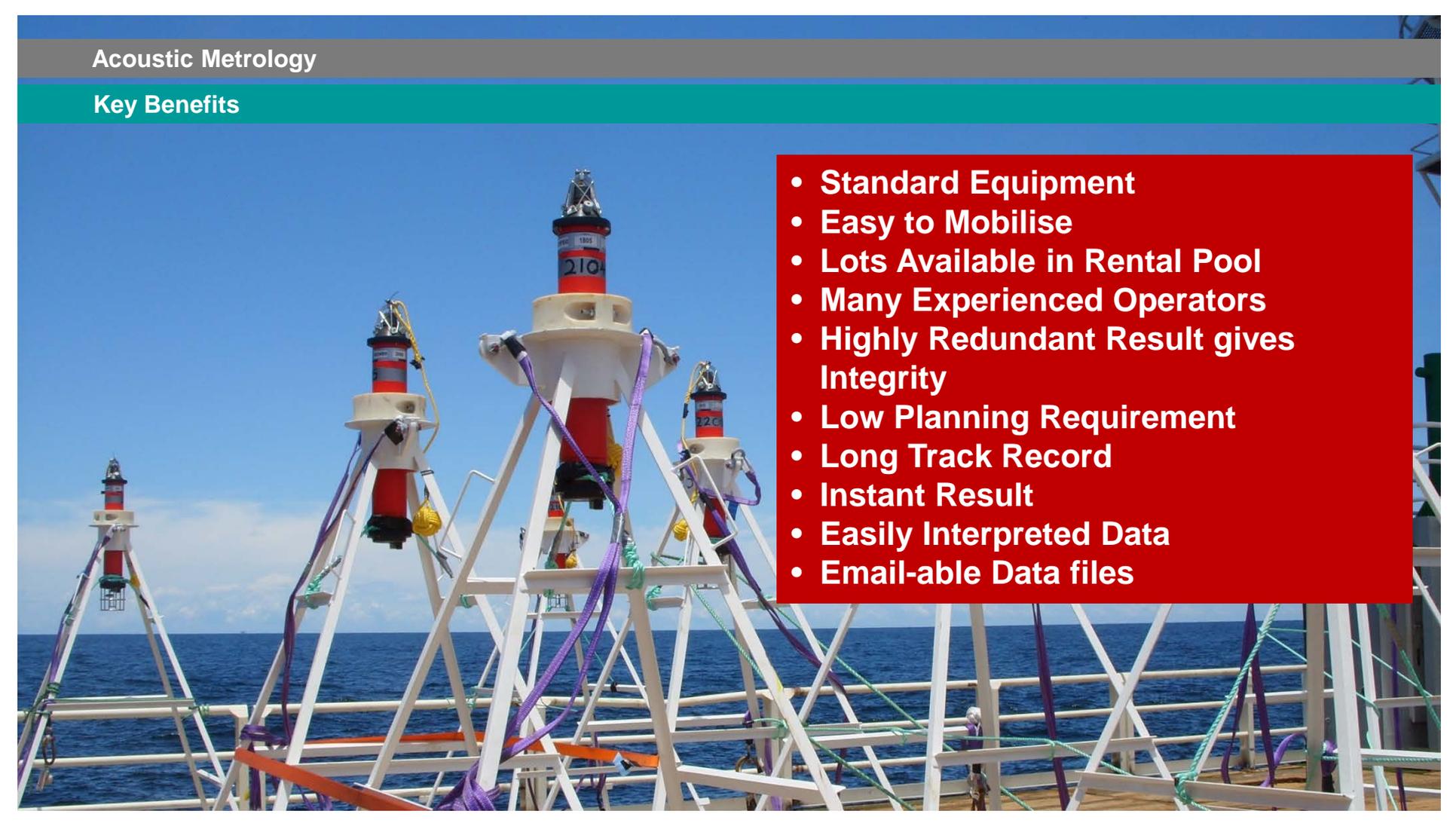




“Standard  
Off-the-Shelf  
Equipment”



“Large  
Existing  
User Base”

- 
- The background image shows several acoustic metrology stations on the deck of a ship. Each station consists of a white tripod-like frame supporting a red and white cylindrical sensor unit. The units are secured with purple and green straps. The ship's deck and railings are visible, and the ocean extends to the horizon under a clear blue sky. One of the sensor units has the number '210' printed on its side.
- **Standard Equipment**
  - **Easy to Mobilise**
  - **Lots Available in Rental Pool**
  - **Many Experienced Operators**
  - **Highly Redundant Result gives Integrity**
  - **Low Planning Requirement**
  - **Long Track Record**
  - **Instant Result**
  - **Easily Interpreted Data**
  - **Email-able Data files**

Typical Steps and Timings (800m WD - 5 Quadrants)

| Activity  | Time |
|---|------|
| Deploy Stand C6 to seabed and position          | 45   |
| Deploy Stand C6 to seabed and position          | 45   |
| Deploy Basket to Seabed with Hub C6s            | 15   |
| Install Hub 1 Beacon                            | 10   |
| Install Hub 2 Beacon                            | 10   |
| Depth Loop (4 beacons)                          | 20   |
| Depth Loop (4 beacons)                          | 20   |
| Depth Loop (2 beacons)                          | 10   |
| Inclinations and Ranges (2 Beacons, 1 Quadrant) | 30   |
| Inclinations and Ranges (2 Beacons, 1 Quadrant) | 30   |
| Inclinations and Ranges (2 Beacons, 1 Quadrant) | 30   |
| Inclinations and Ranges (2 Beacons, 1 Quadrant) | 30   |
| Inclinations and Ranges (2 Beacons, 1 Quadrant) | 30   |
| Array Calibration                               | 10   |
| Recover Stand C6                                | 15   |
| Recover Stand C6                                | 15   |
| Recover Hub C6s and Basket                      | 15   |

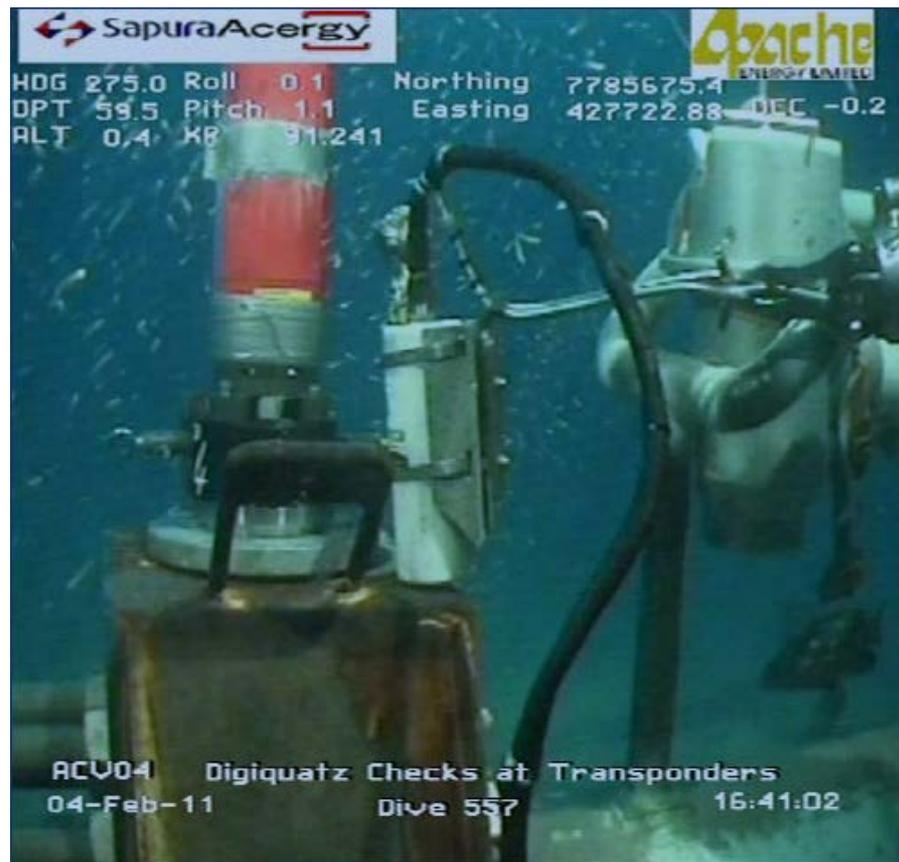
“Actual times from real campaign”

“Total time 6hrs 20mins”

## Acoustic Metrology

### Metrology at Devil Creek, Australia

- 60m water depth
- Metrology completed in 30mins
- Robust acoustics around jacket
- Position accuracy 0.02m RMS



## Acoustic Metrology

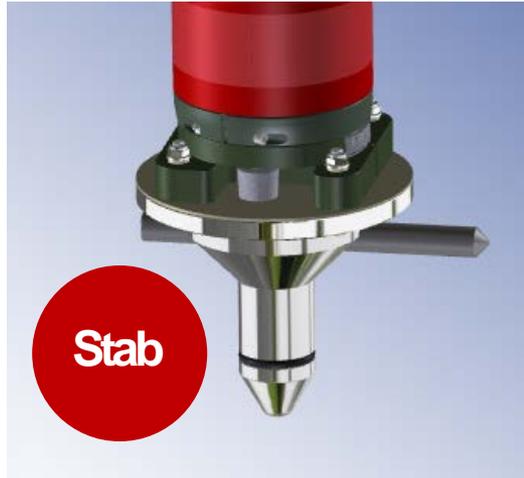
### Reducing the Steps – LGC6



**GyroCompatt6 replaces gyro frames  
reducing complexity and increasing  
robustness**



- Stabs and receptacles are never manufactured to the same standard causing error budgeting problems
- How can Sonardyne help?



Typical Steps and Timings (800m WD)

| Activity  | Time |
|---|------|
| Deploy Stand C6 to seabed and position          | 45   |
| Deploy Stand C6 to seabed and position          | 45   |
| Deploy Basket to Seabed with Hub C6s            | 15   |
| Install Hub 1 Beacon                            | 10   |
| Install Hub 2 Beacon                            | 10   |
| Depth Loop (4 beacons)                          | 20   |
| Depth Loop (4 beacons)                          | 20   |
| Depth Loop (2 beacons)                          | 10   |
| Inclinations and Ranges (2 Beacons, 1 Quadrant) | 30   |
| Inclinations and Ranges (2 Beacons, 1 Quadrant) | 30   |
| Inclinations and Ranges (2 Beacons, 1 Quadrant) | 30   |
| Inclinations and Ranges (2 Beacons, 1 Quadrant) | 30   |
| Inclinations and Ranges (2 Beacons, 1 Quadrant) | 30   |
| Array Calibration                               | 10   |
| Recover Stand C6                                | 15   |
| Recover Stand C6                                | 15   |
| Recover Hub C6s and Basket                      | 15   |

“Actual times from real campaign”

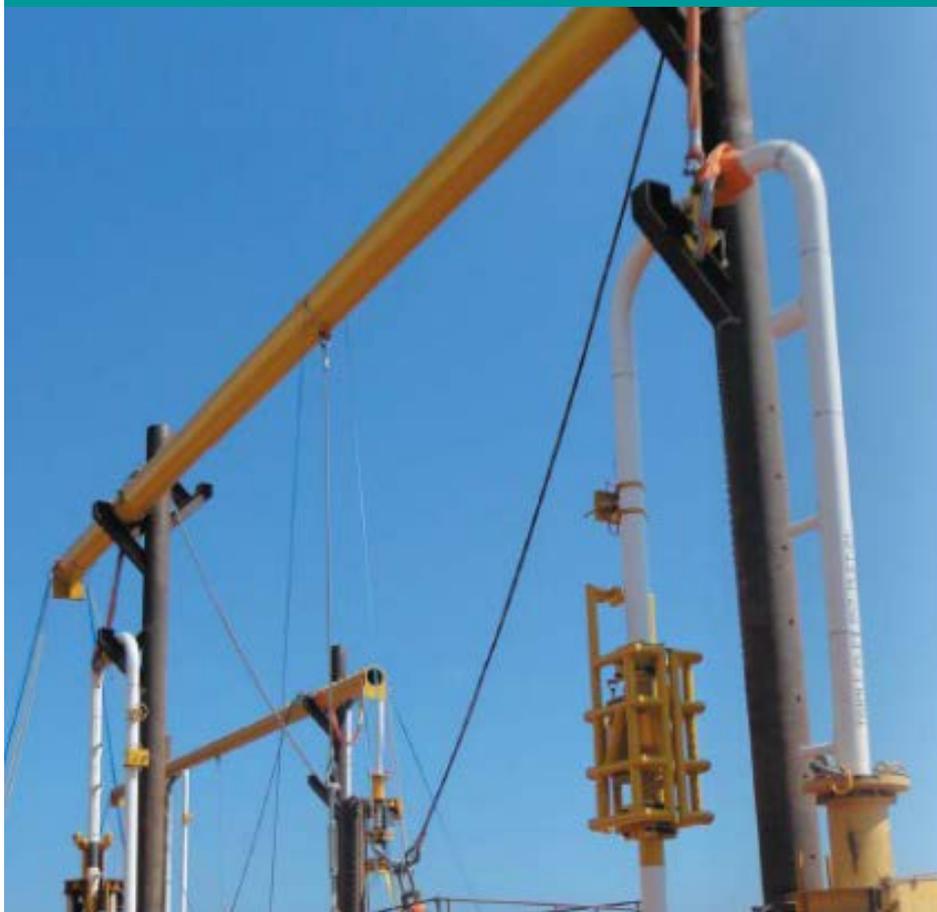
“Total time 6hrs 20mins”

Typical Steps and Timings (800m WD)

| Activity  | Time      |
|---|-----------|
| Deploy Stand C6 to seabed and position          | 45        |
| Deploy Stand C6 to seabed and position          | 45        |
| Deploy Basket to Seabed with Hub C6s            | 15        |
| Install Hub 1 Beacon                            | 10        |
| Install Hub 2 Beacon                            | 10        |
| Depth Loop (4 beacons)                          | 20        |
| Depth Loop (4 beacons)                          | 20        |
| Depth Loop (2 beacons)                          | 10        |
| Inclinations and Ranges (2 Beacons, 1 Quadrant) | <b>30</b> |
| Inclinations and Ranges (2 Beacons, 1 Quadrant) |           |
| Inclinations and Ranges (2 Beacons, 1 Quadrant) |           |
| Inclinations and Ranges (2 Beacons, 1 Quadrant) |           |
| Inclinations and Ranges (2 Beacons, 1 Quadrant) |           |
| Array Calibration                               | 10        |
| Recover Stand C6                                | 15        |
| Recover Stand C6                                | 15        |
| Recover Hub C6s and Basket                      | 15        |

“Actual times from real campaign”

“Total time 4hrs 20mins”



Fast, accurate subsea metrology

## Technip saves time in the West Delta Deep Marine

- GyroCompatts fitted with precise stab and receptacles
- This removed the requirement to rotate the GyroCompatts in the hubs
- Saved several hours per metrology
- Average error of 6mm



A GyroCompatt is measured into position on the hub by an ROV.

Engineer, fabricate and install approximately 80m of umbilicals, 12km of flexible flowlines and three flexible jumpers. Connect the flowlines and umbilicals to the wellheads and subsea manifolds.

Acoustic ranges could then be made whilst rotating the GyroCompatts and then using the attitude data recorded by the GyroCompatt, the projections of the hub position could be deduced. This meant we

By optimising its technique, Technip was able to complete each metrology operation in an average of 13 hours; one such operation was also conducted in under 9 hours. This resulted in the setup, measurements, drawings, jumper fabrication and installation for the entire



# Connect Metrology Workflow Tool/Calculator



**“Simplify Metrologies, allow better control and improve data collection efficiency”**

**“Office and Offshore versions  
allow multiple metrologies to  
be created and QC’d easily in a  
single job”**

**“Workflow and collection criteria can be defined in advance from the beach”**

**“Simple, intuitive GUI guides users through data collection, verification and processing”**

The screenshot displays the Connect Software interface for configuring a transceiver. The main window shows a table of transceivers:

| Type           | Name             | I/O Config        | Comms Status | I/O Status | Recording |
|----------------|------------------|-------------------|--------------|------------|-----------|
| 6G Transceiver | 6G Transceiver-1 | COM41 38400 8-N-1 | ✓            | ✓          | ✗         |

A 'Configure 6G Transceiver' dialog box is open, showing the following configuration details:

- Summary / Comms:** Name: 6G Transceiver-1, Type: 6G Transceiver
- Description:** (Empty field)
- Frequency:** MF OMNI, **Firmware:** 6.01.00.03
- UID:** 001239, **Wake Up Tone:** W1
- Address:** 1701, **HPR Channel:** 45

The 'Metrology Sensors' panel on the right shows a list of sensor data:

| Timestamp             | Data   |
|-----------------------|--|
| 21/10/2013 08:46:31.9 | >DIAG:1701,NONE  |
| 21/10/2013 08:46:31.9 | DIAG:  |
| 21/10/2013 08:46:30.9 | >CS:1701,TAT200,BLK100,RXW4800,TXW100,NPL187,TPL184,LG26,CIS0,AT8  |
| 21/10/2013 08:46:30.9 | CS:  |
| 21/10/2013 08:46:29.9 | >VS:1701,WKT1,HPR45,BT1,LI,VL15.1, DC-12.5,CAP100.0/67,79.0        |
| 21/10/2013 08:46:29.9 | VS:  |
| 21/10/2013 08:46:28.9 | >FS:1701,U001239,FV6.01.00.03,PV1.05,TDR;MF;OMNI;187;184;166,PR600 |
| 21/10/2013 08:46:28.9 | FS:  |

The 'Metrology Sensors' panel also includes a 'Port' section with 'Decode' checked and a 'Map' section showing a coordinate of -318,450.000 m.

The screenshot shows the main interface of the Connect Software. At the top, there is a toolbar with various icons and a dropdown menu set to 'PARO'. Below the toolbar is a table listing sensors:

| Type          | Name             | I/O Config        | Comms Status | I/O Status | Recording |
|---------------|------------------|-------------------|--------------|------------|-----------|
| G6Transceiver | 6G Transceiver-1 | COM41 38400 8-N-1 | ✓            | ✓          | ✗         |
| Paro          | PARO-1           | COM32 9600 8-N-1  | ✓            | ✓          | ✗         |

A 'Configure Digiquartz' dialog box is open in the foreground, showing the following settings:

- Paro
- Units:  PSI  Meters  KPa  hPa
- Surface Correction:
- Buttons: OK, Cancel

The screenshot shows the 'Metrology Sensors' window. It has tabs for '6G Transceiver', 'Depth', 'Sound Velocity', and 'Tides'. The 'Depth' tab is active, showing the following information:

- Source:
- Comms:  I/O Status:
- Depth: 195.013 m

Below this information is a line graph showing depth over time. The y-axis represents depth in meters, ranging from 194.97 to 195.05. The x-axis represents time, ranging from 22:19 to 09:23:49. The graph shows a sawtooth pattern, indicating depth fluctuations.

At the bottom of the window is a 'Map' section with a grid showing coordinates:

- X-axis: -318,500.000 m, -318,450.000 m, -318,400.000 m
- Y-axis: 507,500.000 m

## Adding Structures/Hubs/Receptacles with Offsets & C-Os

**Selected Structure**

**Attributes**

Name:

AutoCad File:  ...

Layer:

Notes:

**Structure Location**

Position: E 506,037.040 m  
N 504,355.730 m  
D 1,223.382 m

Heading:

Pitch:

Roll:

**Hubs**

Add

Name:

| Survey Receptacle |                                       | Hub Location |   |
|-------------------|---------------------------------------|--------------|---|
| Stbd:             | <input type="text" value="-0.260 m"/> | Position:    | E 506,034.463 m<br>N 504,353.822 m  |
| Fwd:              | <input type="text" value="3.196 m"/>  | Depth:       | <input type="text" value="1,223.138 m"/> Depth Not Installed <input type="button" value="Install"/> |
| Up:               | <input type="text" value="0.244 m"/>  | Pitch:       | <input type="text" value="0.00°"/>  |
| Pitch C-O:        | <input type="text" value="0.00°"/>    | Roll:        | <input type="text" value="0.00°"/> P/R Not Installed <input type="button" value="Install"/>         |
| Roll C-O:         | <input type="text" value="0.00°"/>    | Heading:     | <input type="text" value="238.14°"/> Heading Not Installed <input type="button" value="Install"/>   |
|                   |                                       | Heading C-O: | <input type="text" value="0.00°"/>  |

**Metrology Sensors**

6G Transceiver | Depth | Sound Velocity | Tides

Transceiver:  CIS:

Request:

>

| Timestamp             | Data                            |
|-----------------------|---------------------------------|
| 21/10/2013 09:31:33.7 | >AKEY:1701,KEY_DECLINED         |
| 21/10/2013 09:31:33.7 | AKEY:PK5CF650E35F5A965658741B95 |
| 21/10/2013 09:31:32.0 | >ARND:1701,RN6AEB91DEF91F77E0   |
| 21/10/2013 09:31:32.0 | ARND:IDK2                       |

Port  Decode

**Map**

## Add Tripods

Home View Setup Events Simulation Acoustics Metrology

ProjectExplorer

- Config
  - Geodesy
  - Project Center
  - Configuration
  - Devices
- Data
  - Metrology
    - Calculations
    - Beacons
    - Tripods**
    - Sound Velocity
    - Structures
    - Waypoints

Selected Tripod

Tripod W

Name: Tripod W

E 506,018.590 m  
N 504,349.060 m  
D 1,226.000 m

Cancel Apply

Setup Events Simulation Acoustics Metrology

Compatt 6 Add X Selected Beacon

| Name | Address | Type      |
|------|---------|-----------|
| 2509 | 2509    | Compatt 6 |
| 2510 | 2510    | Compatt 6 |
| 2512 | 2512    | Compatt 6 |
| 2513 | 2513    | Compatt 6 |

Summary / Comms Sensors Battery

Name:  Type: Compatt 6

Description:

Frequency: MF OMNI Firmware: 6.01.00.03

UID: 001249 Wake Up Tone: W1

Address:

Communications

Transceiver:

Metrology Sensors

6G Transceiver Depth Sound Velocity Tides

Transceiver:  CIS:

Request:

> Enter Request

| Timestamp             | Data  |
|-----------------------|---|
| 21/10/2013 10:05:15.1 | CS:2513;W1;TS1                                    |
| 21/10/2013 10:05:14.1 | >VS:2513,WKT1,HPR45,BT1,U;VLT15.1;IDC-12.5,CAP100 |
| 21/10/2013 10:05:13.3 | VS:2513;W1;W2;TS1                                 |
| 21/10/2013 10:05:12.3 | >FS:2513,U001249,FV6.01.00.03,PV1.05,TDR;MF,OMNI  |
| 21/10/2013 10:05:11.6 | FS:2513;W1;W2;TS1                                 |
| 21/10/2013 10:05:05.3 | >CS:2512,TAT200,BLK100,RXW4800,TXW100,NPL187,TF   |
| 21/10/2013 10:05:04.6 | CS:2512;W1;TS1                                    |
| 21/10/2013 10:05:03.6 | >VS:2512,WKT1,HPR45,BT1,U;VLT15.1;IDC-12.5,CAP100 |
| 21/10/2013 10:05:02.9 | VS:2512;W1;TS1                                    |
| 21/10/2013 10:05:01.8 | >FS:2512,U001248,FV6.01.00.03,PV1.05,TDR;MF,OMNI  |
| 21/10/2013 10:05:01.2 | FS:2512;W1;TS1                                    |
| 21/10/2013 10:04:50.7 | >CS:2512,TAT200,BLK100,RXW4800,TXW100,NPL187,TF   |
| 21/10/2013 10:04:50.0 | CS:2512;W1;TS1                                    |

Port  Decode

Map

506,000.000 m

506,05

504,350.000 m

Tripod W \

Manifold A Manifold

Attempt 1 of 3  
Request configuration status

## Define the Metrology

Home View Setup Events Simulation Acoustics Metrology

ProjectExplorer

- Config
  - Geodesy
  - Project Center
  - Configuration
  - Devices
- Data
  - Metrology
    - Calculations**
    - Beacons
    - Tripods
    - Sound Velocity
    - Structures
    - Waypoints

Add X

Calculation Details

Name:

Description:

Jumper Type:  Vertical  Horizontal

Jumper From:  ▼  
From Hub Ok

Jumper To:  ▼  
To Hub OK

Receptacles:  ▼

Tripods:   
 ▼

Calculation geometry setup is valid, Please select options below to save settings and plan data collection

Cancel Apply [Plan Selected Calculation](#)

## Configure the Data Collection Requirements

ProjectExplorer

- Config
  - Geodesy
  - Project Center
  - Configuration
  - Devices
- Data
  - Metrology
    - Calculations
    - Manifold - Hub
      - Plan Data Collection
        - Collection Settings**
        - Occupations
        - Acoustic Steps
        - Depth
        - Profile
      - Collect Data
      - View Data
      - Calculate Results
      - Report
  - Beacons
  - Tripods
  - Sound Velocity
  - Structures
  - Waypoints

## Quadrant Planning

Ranges and Attitudes are observed with the compatts rotated in the hubs in different quadrants. Quadrant 1 represents Structure North, Quadrant 2 is Structure East, etc.

Number of Quadrants:

5

Collect Baselines at Quadrants:

1

## Observation Planning

Number of Inclination measurements per set:

5

Number of Ranges per set:

10

## Sound Velocity Settings

Global Sound Velocity:

Source:

Use Sound Velocity from Compatts if Available



Yes



No

## Logging Times

Depth Sensor Logging Timeout:



Enable

30

Cancel

Apply

[Plan Metrology](#)

Home View Setup Events Simulation Acoustics Metrology

Project Explorer

- Config
  - Geodesy
  - Project Center
  - Configuration
  - Devices
- Data
  - Metrology
    - Calculations
      - Manifold - Hub
        - Plan Data Collection
          - Collection Settings
          - Occupations**
          - Acoustic Steps
          - Depth
          - Profile
        - Collect Data
        - View Data
        - Calculate Results
        - Report
      - Beacons
      - Tripods
      - Sound Velocity
      - Structures
      - Waypoints

Compatt Occupation Planning

Specify the which COMPATTs will occupy which hubs, receptacles or tripods. In order to plan for a move of a different compatt to an element, select that element and click new occupation.

| Element          | Compatt     | Status          | Has Incl   | Measure Incl | Has Gyro  | Measure HPR | Has Depth  | Has SV     | Stab Base to Xducer | Receptacle to Stab Base | Orientation  |
|------------------|-------------|-----------------|------------|--------------|-----------|-------------|------------|------------|---------------------|-------------------------|--------------|
| Manifold Hub1    | 2513        | Original        | Yes        | Yes          | No        | N/A         | Yes        | Yes        | 0.000 m             | 0.000 m                 | 0.00°        |
| <b>Tree Hub1</b> | <b>2512</b> | <b>Original</b> | <b>Yes</b> | <b>Yes</b>   | <b>No</b> | <b>N/A</b>  | <b>Yes</b> | <b>Yes</b> | <b>0.000 m</b>      | <b>0.000 m</b>          | <b>0.00°</b> |
| Tripod E         |             | Original        | No         | N/A          | No        | N/A         | No         | No         | 0.000 m             | N/A                     | N/A          |
| Tripod W         |             | Original        | No         | N/A          | No        | N/A         | No         | No         | 0.000 m             | N/A                     | N/A          |

New Occupation Delete Occupation

Cancel Apply

Element: Tree Hub1

Compatt: 2512

Status: Original

Has Inclinometer:

Measure Inclinations:

Has Gyro:

Has Sound Velocity:

Stab Base to Transducer: 0.000 m

Receptacle to Stab Base: 0.000 m

OK Cancel

Metrology Sensors

6G Transceiver Depth Sound Velocity Tides

Transceiver: 6G Transceiver-1 CIS: MF CIS1600

Request: Cancel

> Enter Request

| Timestamp             | Data                                    |
|-----------------------|---|
| 21/10/2013 10:05:15.8 | >CS:2513,TAT200,BLK100,RXW4800,TXW100   |
| 21/10/2013 10:05:15.1 | CS:2513;W1;TS1                          |
| 21/10/2013 10:05:14.1 | >VS:2513,WKT1,HPR45,BT1;U;VLT15.1;IDC-3 |
| 21/10/2013 10:05:13.3 | VS:2513;W1;W2;TS1                       |
| 21/10/2013 10:05:12.3 | >FS:2513,U001249,FV6.01.00.03,PV1.05,TD |
| 21/10/2013 10:05:11.6 | FS:2513;W1;W2;TS1                       |
| 21/10/2013 10:05:05.3 | >CS:2512,TAT200,BLK100,RXW4800,TXW100   |
| 21/10/2013 10:05:04.6 | CS:2512;W1;TS1                          |
| 21/10/2013 10:05:03.6 | >VS:2512,WKT1,HPR45,BT1;U;VLT15.1;IDC-3 |
| 21/10/2013 10:05:02.9 | VS:2512;W1;TS1                          |
| 21/10/2013 10:05:01.8 | >FS:2512,U001248,FV6.01.00.03,PV1.05,TD |
| 21/10/2013 10:05:01.2 | FS:2512;W1;TS1                          |
| 21/10/2013 10:04:50.7 | >CS:2512,TAT200,BLK100,RXW4800,TXW100   |

Port  Decode

Map

506,000,000 m

504,950,000 m

Manifold Hub1

Tripod W

The screenshot shows the 'Metrology Planning Steps' dialog box in the Connect Software interface. The 'ProjectExplorer' on the left shows the 'Acoustic Steps' option selected under 'Manifold - Hub'. The main area contains a list of steps to be generated, a 'Generate Steps' button, and 'Cancel' and 'Apply' buttons at the bottom. A blue box highlights the list of steps.

ProjectExplorer

- Config
  - Geodesy
  - Project Center
  - Configuration
  - Devices
- Data
  - Metrology
    - Calculations
      - Manifold - Hub
        - Plan Data Collection
          - Collection Settings
          - Occupations
          - Acoustic Steps**
          - Depth
          - Profile
        - Collect Data
        - View Data
        - Calculate Results
        - Report
  - Beacons
  - Tripods
  - Sound Velocity
  - Structures
  - Waypoints

Metrology Planning Steps

Click Generate Steps to create a measurement plan based on the options selected above.

- ▶ Set Up Compatts
- ▶ Measure Acoustic Links
- ▶ Inclination Compatt 2513 at Manifold Hub1
- ▶ Inclination Compatt 2512 at Tree Hub1
- ▶ SV Sound Velocity
- ▶ Baselines Measure Baselines at Quadrant 1

**Generate Steps**

Cancel Apply

[Plan Depth Loop](#) [Collect Acoustic Data](#)

The screenshot displays the 'Connect Software' interface for configuring depth loops. The top menu bar includes Home, View, Setup, Events, Simulation, Acoustics, and Metrology. The Project Explorer on the left shows a tree view with folders for Config, Geodesy, Project Center, Configuration, Devices, Data, Metrology, Calculations, Manifold - Hub, Plan Data Collection, Collection Settings, Occupations, Acoustic Steps, Depth (highlighted), Profile, Collect Data, View Data, Calculate Results, Report, Beacons, Tripods, Sound Velocity, Structures, and Waypoints.

The 'Depth Loop Details' dialog box is open, showing the configuration for 'Loop 1'. The dialog includes the following fields and controls:

- Name:** Loop 1
- Occupations:**
  - Starting Element:** Manifold Hub1 (dropdown menu)
  - Selected Elements:** Tripod E, Tree Hub1, Tripod W (list box)
  - Closing Element:** Manifold Hub1
- Available Elements:** An empty rectangular box for selecting elements.

Navigation buttons include '+', '-', '↑', and '↓' for element selection. At the bottom of the dialog are 'Cancel' and 'Apply' buttons. Below the dialog, there are links for 'Plan Seabed Profiles' and 'Collect Depth Loops'.

The screenshot displays the Connect Software interface. On the left is the Project Explorer tree, showing a hierarchy from 'Data' to 'Metrology' to 'Manifold - Hub' to 'Acoustic Steps'. The main window is titled 'Process Acoustic Steps' and contains a 'Step Queue' and an 'Occupations' table. A modal dialog box titled 'Confirm Rotate Compatt' is centered on the screen, displaying a question mark icon and the text 'Confirm Compatt 2513 has been rotated to 2' with 'Ok' and 'Cancel' buttons.

**Step Queue**

- Rotate Compatt 2513 to Quadrant 1
- Measure Inclination 2513 at Quadrant 1
- Rotate Compatt 2513 to Quadrant 2
- Measure Inclination 2513 at Quadrant 2
- Rotate Compatt 2513 to Quadrant 3
- Measure Inclination 2513 at Quadrant 3
- Rotate Compatt 2513 to Quadrant 4
- Measure Inclination 2513 at Quadrant 4
- Rotate Compatt 2513 to Quadrant 5
- Measure Inclination 2513 at Quadrant 5

**Occupations**

| Element       | Compatt | Quadrant | Orientation | Valid |
|---------------|---------|----------|-------------|-------|
| Manifold Hub1 | 2513    | 1        | 238.14°     | ✓     |
| Tree Hub1     | 2512    | 0        | 0.00°       | ✓     |
| Tripod E      | 2509    | 0        | N/A         | ✓     |
| Tripod W      | 2510    | 0        | N/A         | ✓     |

**Confirm Rotate Compatt**

Confirm Compatt 2513 has been rotated to 2

Ok Cancel

Auto Continue on step completed  
 Retry on Failed

Cancel Pause Close

Project Explorer
Metrology Sensors

Process Acoustic Steps

Step Queue

- Baselines from Compatt 2513
- Baselines from Compatt 2512
- Baselines from Compatt 2509
- Baselines from Compatt 2510

Sound Velocity: 1463.04 m/s

Baseline Summary

| From          | To        | Average  | Sigma   | Forward | Reverse |
|---------------|-----------|----------|---------|---------|---------|
| Manifold Hub1 | Tree Hub1 | 21.080 m | 0.011 m | 10      | 6       |
| Manifold Hub1 | Tripod E  | 30.163 m | 0.014 m | 10      | 0       |
| Manifold Hub1 | Tripod W  | 16.801 m | 0.010 m | 10      | 0       |
| Tree Hub1     | Tripod E  | 31.042 m | 0.011 m | 6       | 0       |
| Tree Hub1     | Tripod W  | 15.408 m | 0.008 m | 6       | 0       |
| Tripod E      | Tripod W  | N/A      | N/A     | 0       | 0       |

Raw Ranges

Avg: 21.080 m SD: 0.011 m Spread: 0.049 m O-C: Used 16 of 16

Bin: 0.020 m Show:  Used  All  Gate Values

Histogram List

Avg: 21.08  $\sigma$ : 0.06

Count

Range (m)

Forward 
  Reverse 
  Not Used

Depth Sound Velocity Tides

Transceiver-1 CIS: MF CIS1600

1 of 1 simultaneous interrogation

Cancel

---

Data

```

20.5 >SI:2512,INT4,IR2513,R228832,[XC85,DBVO],IR2509,R242430,[XC85,DBVO],
19.1 >SI:2512,W1,TS1,INT4,DIAG1,CIO,IR2513,IR2509,IR2510
18.1 >SI:2512,INT1,IR2513,R228820,[XC85,DBVO],IR2509,R242435,[XC85,DBVO],
16.2 >SI:2512,INT2,IR2513,R228823,[XC85,DBVO],IR2509,R242450,[XC85,DBVO],
14.3 >SI:2512,INT3,IR2513,R228777,[XC85,DBVO],IR2509,R242450,[XC85,DBVO],
12.3 >SI:2512,INT4,IR2513,R228824,[XC85,DBVO],IR2509,R242438,[XC85,DBVO],
10.4 >SI:2512,INT5,IR2513,R228796,[XC85,DBVO],IR2509,R242428,[XC85,DBVO],
08.5 >SI:2512,INT6,IR2513,R228811,[XC85,DBVO],IR2509,R242407,[XC85,DBVO],
07.1 >SI:2512,W1,TS1,INT6,DIAG1,CIO,IR2513,IR2509,IR2510
06.1 >SI:2513,INT1,IR2512,R228837,[XC85,DBVO],IR2509,R241248,[XC85,DBVO],
04.2 >SI:2513,INT2,IR2512,R228818,[XC85,DBVO],IR2509,R241217,[XC85,DBVO],
02.9 >SI:2513,INT3,IR2512,R228814,[XC85,DBVO],IR2509,R241192,[XC85,DBVO],
                
```

Waiting for Acoustic Command Response (3.0 s elapsed of 78.0)

Command Console

```

6 Ranges Requested from Compatt 2512 to: 2513, 2509, 2510,
From 2512 Range to: 2513 - 21.076; 2509 - 31.022; 2510 - 15.409; 00
From 2512 Range to: 2513 - 21.065; 2509 - 31.037; 2510 - 15.417; 00
From 2512 Range to: 2513 - 21.085; 2509 - 31.044; 2510 - 15.396; 00
From 2512 Range to: 2513 - 21.051; 2509 - 31.053; 2510 - 15.399; 00
From 2512 Range to: 2513 - 21.085; 2509 - 31.053; 2510 - 15.406; 00
From 2512 Range to: 2513 - 21.082; 2509 - 31.042; 2510 - 15.418; 00
6x baselines observed from Tree Hub1 to Manifold Hub1, 0 failed, time 11.4
6x baselines observed from Tree Hub1 to Tripod E, 0 failed, time 11.4
6x baselines observed from Tree Hub1 to Tripod W, 0 failed, time 11.4
4 Ranges Requested from Compatt 2512 to: 2513, 2509, 2510,
From 2512 Range to: 2513 - 21.091; 2509 - 31.038; 2510 - 15.427; 00
                
```

Auto Continue on step completed
Retry on Failed

Cancel
Pause
Close

506,000.000 m 506,050.000 m

Manifold Piece 1

Tree Hub1

Tripod W

Tripod E



## Sanity Check and Offline QC/Editing of all Data

Project Explorer

- Config
  - Geodesy
  - Project Center
  - Configuration
  - Devices
- Data
  - Metrology
    - Calculations
    - Manifold - Hub
      - Plan Data Collection
        - Collection Settings
        - Occupations
        - Acoustic Steps
        - Depth
        - Profile
      - Collect Data
        - Acoustic
        - Depth
        - Profile
      - View Data
        - Attitude
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        - Depth
        - Profile
        - Tide
    - Calculate Results
    - Report
  - Beacons
  - Tripods
  - Sound Velocity
  - Structures
  - Waypoints

**Observed Ranges**

| From          | Height  | To        | Height | Range    | Sigma   | Residual      | Used | Num |
|---------------|---------|-----------|--------|----------|---------|---------------|------|-----|
| Manifold Hub1 | 0.972 m | Tree Hub1 | None   | 21.081 m | 0.020 m | 714,433.361 m | Yes  | 20  |
| Manifold Hub1 | 0.972 m | Tripod E  | None   | 30.165 m | 0.020 m | 0.478 m       | Yes  | 20  |
| Manifold Hub1 | 0.972 m | Tripod W  | None   | 16.803 m | 0.020 m | 0.153 m       | Yes  | 20  |
| Tree Hub1     | None    | Tripod E  | None   | 31.043 m | 0.020 m | 714,423.423 m | Yes  | 20  |
| Tree Hub1     | None    | Tripod W  | None   | 15.409 m | 0.020 m | 714,424.435 m | Yes  | 20  |
| Tripod E      | None    | Tripod W  | None   | 40.322 m | 0.020 m | 0.747 m       | Yes  | 20  |

**Raw Ranges**

Avg 21.081 m SD 0.011 m Spread 0.049 m O-C Used 20 of 20

Bin  Show  Used  All  Gate Values

Histogram

Avg: 21.08  $\sigma$ : 0.06

Forward  Reverse  Not Used

Range (m)

**Selected Range Summary**

From:

To:

Range:

Std Dev:

Used:

**Metrology Sensors**

6G Transceiver | Depth | Sound Velocity | Tides

Transceiver:  CIS:

Request: Request simultaneous interrogation Complete

>

| Timestamp             | Data   |
|-----------------------|--|
| 21/10/2013 10:31:06.9 | >SI:2510,INT1,IR2513;R222974;[XC85,DBV0],IR2512    |
| 21/10/2013 10:31:05.0 | >SI:2510,INT2,IR2513;R222958;[XC85,DBV0],IR2512    |
| 21/10/2013 10:31:03.1 | >SI:2510,INT3,IR2513;R222961;[XC85,DBV0],IR2512    |
| 21/10/2013 10:31:01.1 | >SI:2510,INT4,IR2513;R222958;[XC85,DBV0],IR2512    |
| 21/10/2013 10:30:59.7 | SI:2510;W1;TS1,INT4,DIAG1,C10,IR2513,IR2512,IR2510 |
| 21/10/2013 10:30:58.7 | >SI:2510,INT1,IR2513;R222957;[XC85,DBV0],IR2512    |
| 21/10/2013 10:30:56.8 | >SI:2510,INT2,IR2513;R223002;[XC85,DBV0],IR2512    |
| 21/10/2013 10:30:54.8 | >SI:2510,INT3,IR2513;R222986;[XC85,DBV0],IR2512    |
| 21/10/2013 10:30:52.9 | >SI:2510,INT4,IR2513;R222970;[XC85,DBV0],IR2512    |
| 21/10/2013 10:30:51.0 | >SI:2510,INT5,IR2513;R222992;[XC85,DBV0],IR2512    |
| 21/10/2013 10:30:49.0 | >SI:2510,INT6,IR2513;R222958;[XC85,DBV0],IR2512    |

Port  Decode

**Map**

506,000,000 m

504,350,000 m

File Setup View Help

Explorer

- Setup
  - Geodesy
    - Configuration
    - Time Sync
    - Devices
  - Beacons
  - Metrology
    - Waypoints
    - Sound Velocity
    - Tripods
    - Structures
    - Calculations
      - Distance
        - Plan Data Collection
        - Collect Data
        - View Data
        - Calculate Results**
          - Attitude Calculation
          - Depth Calculation
          - Network Calculation

Summary and Control    Calculation Settings    Coordinates

Jumper Metrology Summary

Tree 12" Prod Tree to Manifold 12" Prod Man

|                 | At Tree 12" Prod                  | At Manifold 12" |
|-----------------|-----------------------------------|-----------------|
| Horizontal Rang | 73.004 m                          |                 |
| Vertical Range  | 0.942 m (Manifold 12" Prod Man is |                 |
| Hub Heading     | 40.000°                           | 290.000°        |
| Hub Pitch       | 0.000°                            | 0.000°          |
| Hub Roll        | 0.000°                            | 0.000°          |
| Jumper Bearing  | 90.872°                           | 270.872°        |
| Jumper Pitch    | 0.000°                            | 0.000°          |
| Jumper Roll     | 0.000°                            | 0.000°          |

Calculation Control

| Calc            | Status |         |                        |
|-----------------|--------|---------|------------------------|
| From Attitude   | ✓      | Compute | Reset Calcs    Reset   |
| To Attitude     | ✓      | Compute | Reset/Extract    Reset |
| Depth           | ✗      | Compute |                        |
| Horizontal      | ?      | Compute |                        |
| Overall         | ?      | Compute |                        |
| Install Results |        | Install |                        |

Config

- Geodesy
- Project Center
- Configuration
- Devices

Data

- Metrology
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Select Sections

- Site Details
- Metrology Summary
- Structure Details
- Attitude Determination
- Depth Determination
- Network Adjustment
- Show Raw Ranges

Reload

## Jumper Metrology Report

### Project Details

| Manifold Hub1 to Tree Hub1 details |                |
|------------------------------------|----------------|
| Client                             | Sonardyne      |
| Project                            | Connect Images |
| Created By                         | PWM            |
| Checked By                         | PWm            |
| Approved By                        | PWM            |

| Field Name      | Site Details  |
|-----------------|---------------|
| Block Reference |               |
| Geodetics       |               |
| Latitude        | N 4° 33.2415' |
| Working Depth   | 1,223.382     |
| Sound Velocity  | 1463.04 m/s   |
| Vessel          | Sonardyne     |

### Metrology Results

| Horizontal Range                 | 21.433 | m                       |      |
|----------------------------------|--------|-------------------------|------|
| Metrology Results                |        |                         |      |
| Vertical Distance                | 0.618  | m (Tree Hub1 is 1       |      |
| Hub to Hub Az                    | 207.49 | °                       |      |
| Pitch (°)                        | 0.00   | Pitch (°)               | 0.00 |
| Jumper Attitude At Manifold Hub1 |        | Jumper Attitude At Tree |      |
| Roll (°)                         | 0.00   | Roll (°)                | 0.00 |

PDF

XPS

Excel 2003

Excel 2007

6G Transceiver    Depth    Sound Velocity    Tides

Transceiver: 6G Transceiver-1    CIS: MF CIS1600

Request:

> Enter Request

| Timestamp             | Data                            |
|-----------------------|---------------------------------|
| 21/10/2013 10:43:59.8 | >AKEY:1701,KEY_DECLINED         |
| 21/10/2013 10:43:59.8 | AKEY.PKD9320738FC8B7723E6BA4DD3 |
| 21/10/2013 10:43:56.0 | >ARND:1701,RN312D018062B4AA35   |
| 21/10/2013 10:43:56.0 | ARND:IDK2                       |

Port  Decode

Map



**How can we help you?  
Any questions?**

**Darren murphy**  
Senior Survey Engineer, Survey Support Group.