United States Coast Guard

COUVILLION

MC-20 Sub-Bottom Imaging

Technical Evaluation and Proposal

Couv-MC20-ENG-PROP-00019-Rev0

2019

Revision	Date	By	Check	Approve	Remarks
0	2019	CG		Couvillion	Initial Document

MC 20 Sub-bottom Conductor Imaging Survey

Technical Evaluation & Proposal

Couvillion Group issued a Statement of Work to locate the buried conductors on MC 20 site by imaging technology as part of Task 8, Data Gaps and Closure. Couvillion Group also conducted market research for applicable technologies, contacted and met with several different vendors. Vendors were then short listed based on initial interviews and were then asked to respond to the Statement of Work.

Potential Vendors Contacted (* indicates selected to respond to statement of work):

- Fuegro
- Pangeo*
- Terrasond*
- Konsberg
- Polarized Induction Associates*
- Oceaneering

  It should be noted that the team found the most applicable technology had been develop for and employed in the Wind Farm Industry.

After several follow up sessions and reviews, Couvillion recommends Pangeo and its technology to perform the sub-bottom survey & analysis to fill the conductor imaging data gap identified in Task 8. This recommendation is built on the following criteria:

- Most suitable technology to satisfy the objective as outlined in the SoW.
- Most similar experience and ability to show like examples.
- Availability to perform job.
- Cost.
- Technical capability, operational knowledge and experience in offshore environments.

In order to perform the scope of work, Couvillion also evaluated suitable vessels to enable the operation and provide the needed support for Pangeo. Previous sessions with Pangeo revealed that an existing relationship and history of operational experience already existed with Oceaneering. The relationship and experience are viewed favorably in that each vendor understands the needs and interfaces of the other required to make a successful operation. In addition, Oceaneering's understanding of and experience on the MC 20 project make this vendor a natural choice.

Oceaneering proposed a "bare bones" vessel of opportunity for the project, however upon review and evaluation Couvillion directed Oceaneering to consider an alternative option using the Chloe Candies to support Pangeo to run their Acoustic Corer equipment. The Chole Candies is a larger vessel that can easily accommodate Pangeo needs while also providing additional space for personnel, ability to conduct other operations simultaneously such as offloading Oil collected at site. In addition, the 2nd ROV on the Chole Candies mitigates the risk of a single ROV supported vessel going down. Couvillion estimates the difference in daily vessel costs to be more than made up in mobilization and crane costs on the Vessel of Opportunity as well

as from realizing efficiencies with a known vessel (The Chole Candies) and her associated equipment. Safety and familiarity / competency of the crew were other factors that Couvillion took into consideration.

Couvillion Group will provide project management, Oceaneering will provide a suitable vessel, ROV and positioning and Pangeo will supply the AC Spread and respective personnel.

ACOUSTIC CORER SURVEY

Table of Contents

TECHNICAL REPORT

1.1 Technical Proposal

The section of the proposal provides an explanation of how PanGeo Subsea proposes to carry out an acoustic survey to identify and accurately map 28, 30-inch well conductors and/or their internal casing strings that were buried under a mudslide, which toppled the producing platform and moved it over 500 ft downslope in 2004". The proposed Acoustic Corer survey area can be seen in Figure 1.

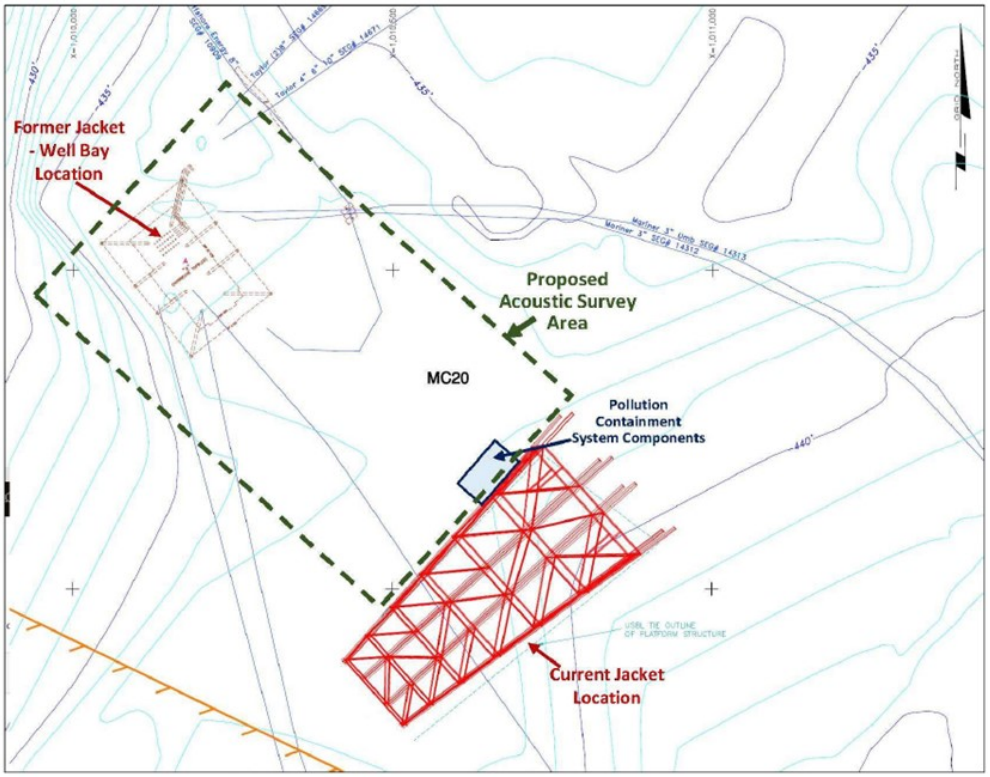

Figure 1: Proposed Acoustic Corer survey area

THE CHALLENGE

The challenge associated with the survey is to image and track buried, dipping, twisted and tangled conductors (Figure 2). This can only be achieved using 3D imaging and using state-of-the-art ZoomSpace volumetric data processing.

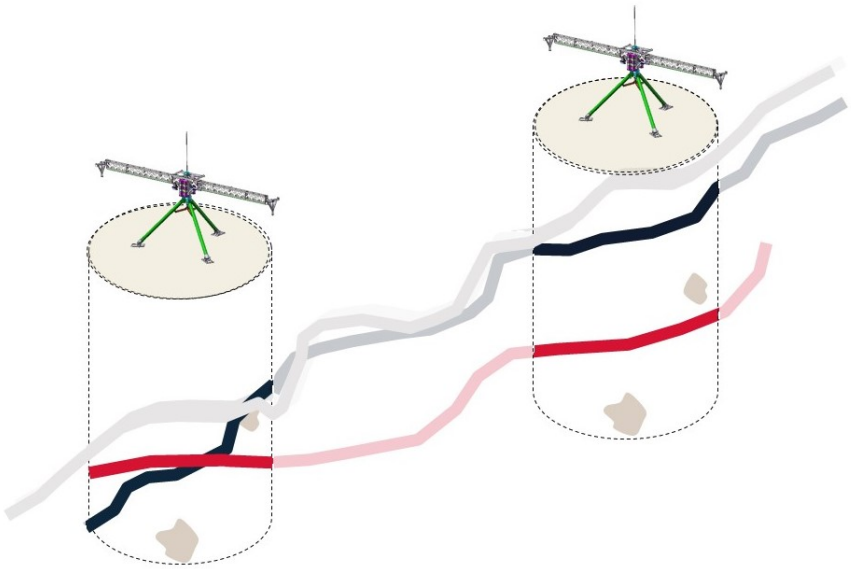

Figure 2: Buried and twisted conductors

2.1 Assumptions

The following assumptions have been made in order to provide this technical proposal.
If the unconsolidated sands/clays are water saturated, the acoustics will be able to penetrate to a required depth of 175ft. In addition, the seabed is to have sufficient bearing capacity to provide stable placement of the Acoustic Corer on the seabed.
The thinnest soil cover, which is estimated to be located at 60ft over the buried well conductors, is in the vicinity of the pollution containment system. The location of the pollution containment system indicates the presence of at least one conductor in this area. The pollution containment system is estimated to be 60ft x 40ft (scaled from Figure 1).
The 28 well conductors and internal casing strings are expected to have an outside diameter of 30in. The survey slope area of approximately 0.25 degrees is well within the AC tolerance.
AC data acquisition and data QA/QC will occur onboard, but data post-processing and analysis will occur onshore at the PanGeo Subsea office (Canada). Reporting will be delivered from this same office. Satellite based internet communications will be provided onboard for efficient transfer of data from/to the vessel.

PROPOSED APPROACH

The Acoustic Corer delivers a 40’ diameter data volume down to depth. The first acoustic core (AC1) will be acquired as close to the pollution containment system as permissible. Positioned offset from the

containment system is shown in Figure 3. AC1 data will be processed and analyzed to identify the buried 30" well conductor(s) and/or their internal casing string(s). The orientation of these buried infrastructure will be determined from AC1 data. The interpreted data from AC1 will be used to recommend placement of AC2. The distance of AC2 from AC1 (and all subsequent AC's) will be based on the interpreted results. Results will be discussed with the Client and decisions for AC placement will be made jointly.

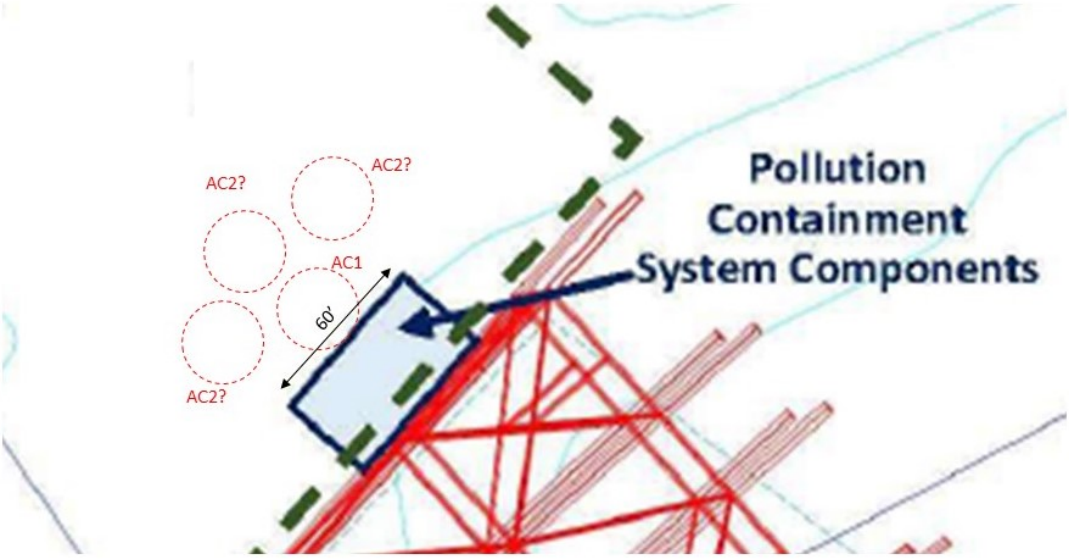

Figure 3: Containment System positioned offset

3.1 Conductor Trend Report

PanGeo will provide a **Conductor Trend Report** after each AC survey. This report will provide the orientation of all conductors identified which will be used to decide upon the placement of subsequent Acoustic Core positions (Figure 4).

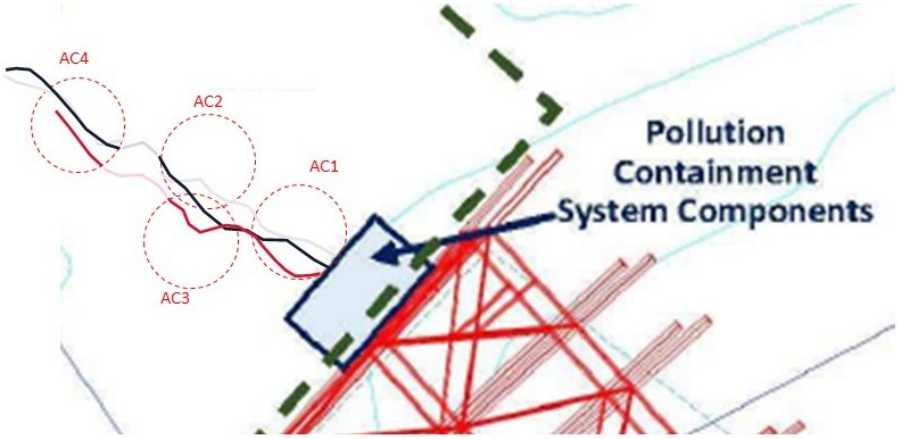

Figure 4: Conductor Trend Report will decide placement of AC positions

3.2 Enhancement of Non-Specular Data

AC data comprises specular (stratigraphy) & non-specular (diffractors e.g. pipes) returns. AC SAS acquisition is biased towards non-specular imaging. Further enhancement of results can be achieved using *ZoomSpace* specular/non-specular filters which will be used to enhance and isolate the acoustic responses associated with the conductors. As seen in Figure 5, the filters isolate the diffractor (pipe) in the bottom image. This process will aid in the imaging of AC data.

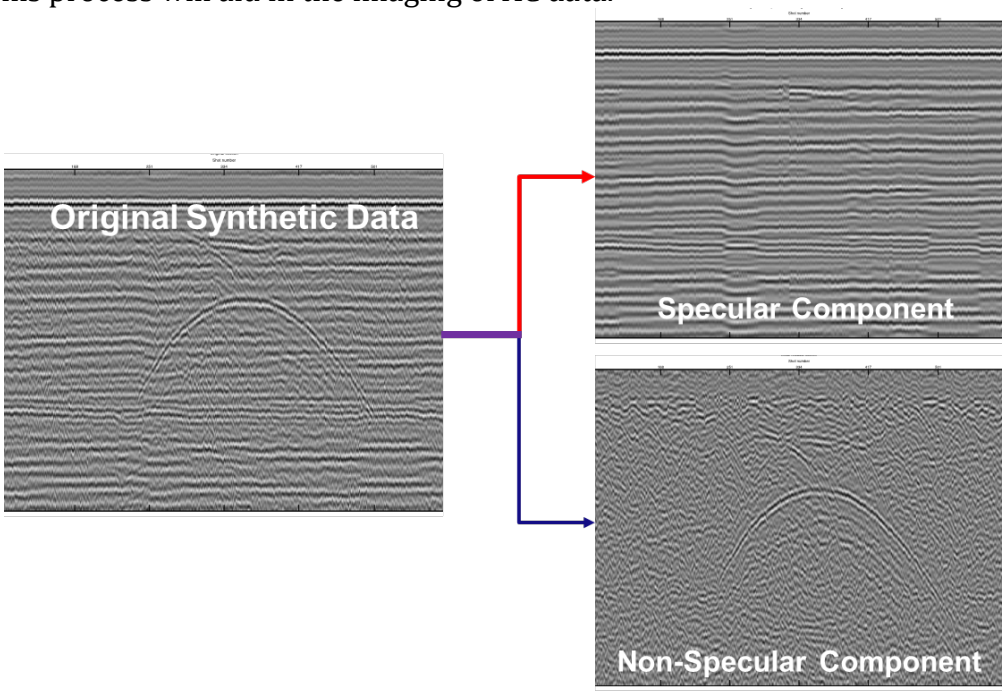

Figure 5: Applying ZoomSpace filters to enhance AC data

3.3 AC Results

AC volumetric data can be sectioned and sliced to produce images of conductors/strings within the acoustic core volume (Figure 6).

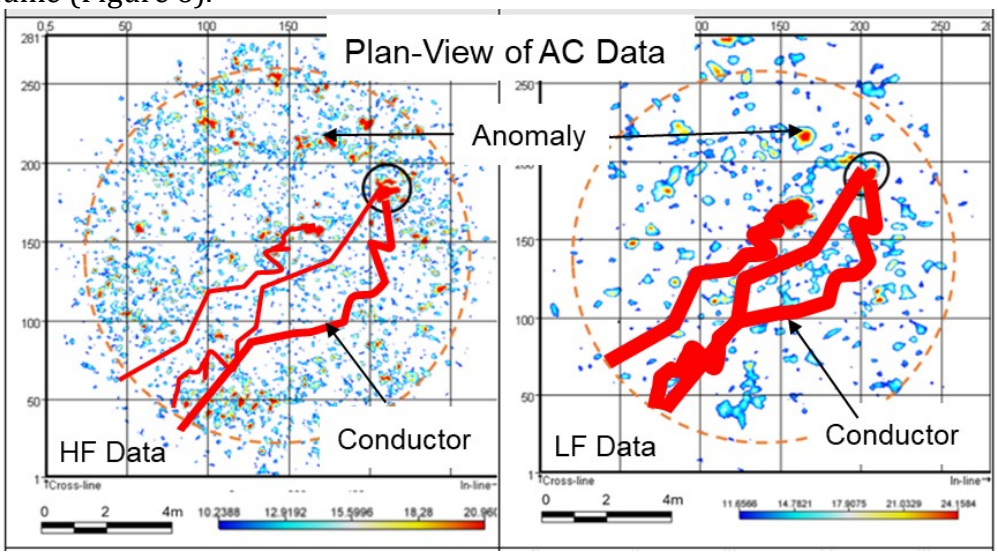

Figure 6: Plan view of AC data

The HF data provides higher resolution images but cannot penetrate as deep as the LF data. Both HF and LF will be used to image the conductors/strings. The highest confidence in results occurs when the conductor/string is visualized in both HF and LF acoustic cores. The depth of penetration is dependent upon the soil (Figure 7).

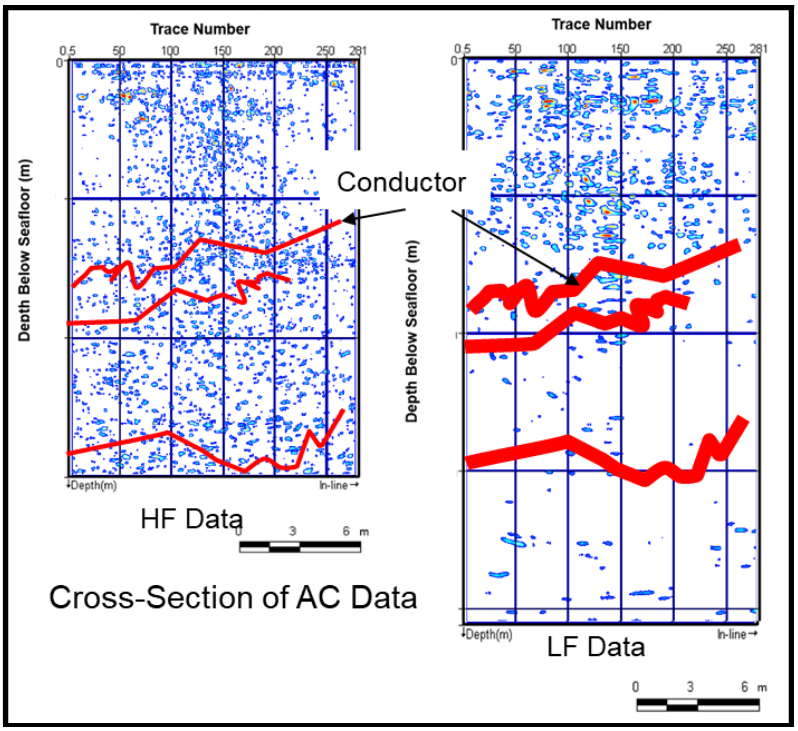

Figure 7: Conductors buried below seafloor (m)

3.4 Final Report Deliverables

For each Acoustic Core, it is PanGeo's intent to deliver the following:

- Report the data quality and AC system performance;
- Number of conductors/strings identified within the Acoustic Core;
- Sample images of identified conductor/strings;
- The track of each identified conductor/string by provision of conductor/string positional co-ordinates and burial depth within the acoustic core. 3D plots of the tracks as appropriate;
- Where possible:
    - Provide details of twisting or entanglement of conductors/strings;
    - Provide continuity of conductors/strings in adjacent AC data sets;
- Report position, size and shape of any additional acoustic anomalies, other than conductors/strings, identified in the Acoustic Cores and suggestive of debris or infrastructure;
- A recommendation of where to acquire the next Acoustic Core and the information supporting this recommendation.

The final report will contain:

- Survey methodology;
- A chart showing the locations of the Acoustic Cores;
- Sections describing results and interpretation of each Acoustic Cores including sample images of the buried infrastructure;
- Integrated Acoustic Core data analysis to provide the track of each identified conductor/ string in 2D/3D plots;
- Details of conductors/strings continuity and entanglement if successfully visualized;
- Confidence in results
- Conclusions and recommendations

4 OPERATIONS

4.1 General

PanGeo will be responsible in providing to Couvillion the complete spread to undertake the campaign. This would include but is not limited to providing the Vessel, ROV, Survey, and Acoustic Corer System as well as all marine and operating crew necessary for a safe 24/7 offshore operation. PanGeo will provide dedicated project management, engineering and geoscience to ensure the scope of work is delivered in accordance to the terms and conditions of the contract.

4.2 Vessel Requirements.

The following are general specs of the vessel required:

- DP 1/2 class Vessel;
- A 20 ton crane or A-Frame with sufficient lifting cable to reach the worksite;
- A suitable ROV with manipulator functions capable of connecting and disconnecting crane hook Acoustic Corer™;
- High accuracy DGPS and USBL positioning systems;
- 380 - 440v 30 amps, 3 phase power to AC control van;
- Accommodation for up to 6 PanGeo personnel;
- Satellite based internet communications will be provided onboard for efficient transfer of data from/to the vessel.
-

4.3 Proposed Personnel and Equipment

4.3.1 PanGeo Subsea Personnel

An operational team of six will be required to support system operation, maintenance, data processing and onboard reporting on a 24 hr basis.
In addition a dedicated onshore project manager will be provided throughout the project.

4.3.2 PanGeo Subsea Acoustic Corer System

The system will consist of:

- 1 x 20' DNV certified ISO Control Van / Workshop;
- 1 x 40' DNV certified ISO Deployment basket used to transport the Acoustic Corer™;
- 1 x DNV certified Acoustic Corer™;
- 1 x non-lifting umbilical winch containing 1250m umbilical, foot print 1.6 m x 1.4 m;
- 1 X 8' DNV certified spares container;
- Certified lifting slings;
- 1 x Over-boarding sheave.

A detailed equipment list will be included in the Project Execution Plan (PEP).

4.3.3 System Weights and Dimensions

Item	Weight in air (kg)	Length (m)	Width (m)	Height (m)
Acoustic Corer™ DNV 2.7.1 (folded)	5,000	8.0	2.3	2.1
Transport Basket DNV 2.7.2 (empty)	10,000	12.2	2.4	2.4
ISO Control Van DNV 2.7.1	10,000	6.1	2.4	2.0
1250m Winch & Umbilical	2,000	1.5	1.8	1.5
Spares container	4,000	1.5	1.8	2.7

4.3.4 Operational Specifications

The following operating specifications currently apply:

- Water depth: 15 m to 850 m;
- Seabed slope: Up to 15 deg;
- Soil bearing capacity: At least 25 kPa;
- Bottom current:
    - Equipment stability: max 2 knots
    - Data acquisition: max 0.8 knots
- Wave: max 1.5m Hs;
- Winds: max 25 knots.

4.4 Method of Deployment

The Acoustic Corer™ can be deployed using either the vessel crane or A-Frame and lifted from the vessel deck from a horizontal position to the vertical and then overboarded to the target location. The vessel should be provided with high accuracy DGPS positioning system, Veripos Ultra together with vessel mounted Kongsberg Hi-PAP 500 USBL positioning system or similar. The combination of High accuracy DGPS and calibrated USBL will provide positioning accuracy of <1.0m to the target location and +/-0.4m in absolute position of the Acoustic Corer™ centre.
A ROV shall be deployed to the seabed prior to deploying Acoustic Corer™ to confirm there are no hazards on the seabed at the target location. The ROV shall also be used to disconnect/re-connect the crane wire and confirm Acoustic Corer™ umbilical is free from any obstructions and that the Acoustic Corer™ packages are free from any obstructions. The ROV shall be recovered to deck prior to any data acquisition.

4.5 Length of Time per Acoustic Corer™

The first Acoustic Core acquisition time once the tool is positioned on the seabed, is typically 18 hours. Subsequent acquisition time is 12 hours.

4.6 Permitting

The Acoustic Corer™ is a seabed deployed unit that rests on a set of tripod legs. The leg assemblies can be fitted with acoustically transparent “mud mats” for use in softer sediments. The unit has insignificant seabed impact, but permitting for activities on the seabed might be a requirement and remain the responsibility of the Employer.

APPENDEX 1: ACOUSTIC CORER

5.1 Acoustic Corer Subsea Equipment

The Acoustic Corer (Figure 8) 3D sub-bottom imaging technology uses multi-aspect acoustic imaging to delineate sub-seabed stratigraphy and buried geohazards such as boulders, hard layers, shallow gas, and abandoned seabed infrastructure. These present a considerable potential cost and schedule risk during the installation of offshore infrastructure.

The Acoustic Corer™ unit consists of two sonar heads attached to each arm of a 12m boom. A tight grid of acoustic data is acquired as the boom rotates 180° thereby creating a 360° acoustic core.

Figure 8: Acoustic Corer

The AC is a highly integrated semi-autonomous electromechanical machine comprised of the following main components and assemblies:

- 1 x Upper weldment and central hub assembly with integrated electric servomotor
- 1 x Folding tripod leg assembly (attached below central hub assembly)
- 2 x 6m long folding boom (attached above central hub assembly)
- 2 x Acoustics Carriage (installed on each boom)
- 2 x Electric servomotor (installed on each boom to move acoustics carriages)
- 5 x AC subsea electronics bottle (chirp TX / RX, power, sensors, motor control)
- 2 x High Frequency Chirp Projector (installed on each acoustics carriage)
- 2 x Low Frequency Chirp Projector (installed on each acoustics carriage)
- 5 x Hydraulic cylinders, HPU, and associated distribution equipment and hoses
- 1 x Optical gyro (installed on upper weldment)
- 1 x Depth Sensor (installed on upper weldment)
- 1 x Velocimeter (installed on upper weldment)

- 3 x Altimeter (installed on upper weldment and each acoustics carriage)
- 2 x Tilt Sensor (installed on each acoustics carriage)
- 2 x Pan/Tilt Color Camera
- 2 x Underwater lights
- Associated subsea interconnect cabling

The AC, with a mass of *circa* 5500kg in air and *circa* 3900kg in water, is deployed in the folded configuration as shown in Figure 9 and then unfolded at a specified depth prior to landing on the seabed as shown in Figure 10.

5.1.1 AC Control Van and Spares Van

The AC topside survey equipment is self-contained in the 20ft ISO container known as the AC Control Van. High-powered processing computers in 19" rack form factor is used for data acquisition, viewing, and processing. Additional PCs are used for post-processing, visualization tools, and report generation. Spare parts, consumables, and tools are stored in the 10ft ISO container known as the Spares Van.

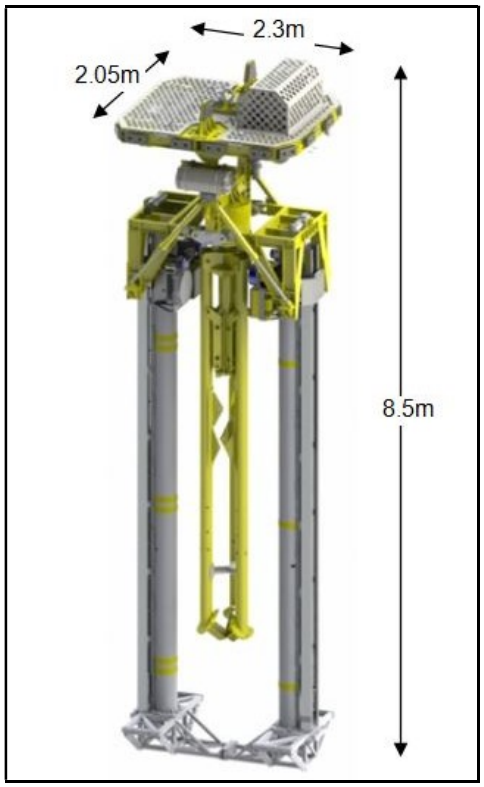

Figure 9: AC Folded – Launch and Recovery Configuration

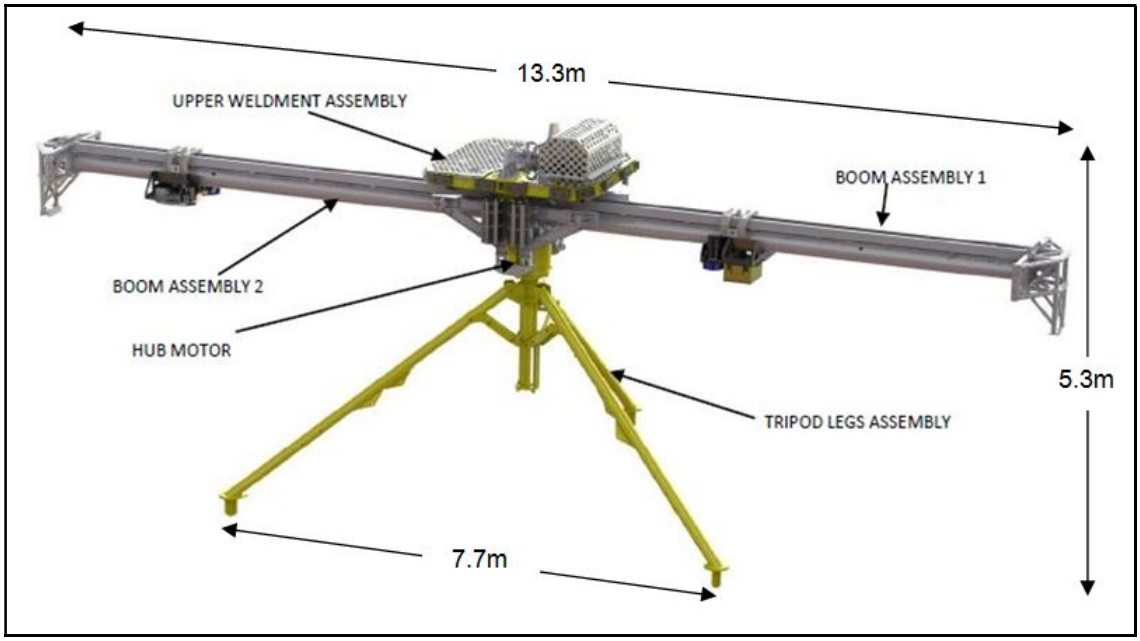

Figure 10: AC Unfolded – Survey Configuration

5.1.2 AC Umbilical Winch

The AC umbilical winch, shown in Figure 11, has 600m of non-load bearing fiber and copper umbilical on its drum. The umbilical winch has a 1.6m x 1.4m footprint, weighs 2500kg, and is normally operated from a wired remote control. The winch has speed control and an automatic level-wind system.

Figure 11: AC Umbilical Winch

An over-boarding sheave and mount is used to manage the AC umbilical as it leaves the vessel.

5.1.3 Acoustic Corer system power requirements

The Acoustic Corer system runs off a single 440V 3-phase 63A power supply. The AC winch and control van are all powered from the single supply power distribution and protection equipment – circuit breakers and GFI units – are housed in the control van.

5.1.4 Acoustic Corer lifting equipment

All lifting equipment will be certified. The control and spares vans have dedicated 4-point bridles as does the umbilical winch. The AC itself has a dedicated 3-point bridle for lifting the unit horizontally.

Support Vessel

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1.1 General Introduction

Oceaneering International, Inc., is a turnkey marine contracting organization that can manage, engineer, plan, and execute offshore projects utilizing Oceaneering resources. Oceaneering focuses on managing, scheduling, and operating Oceaneering's vessel fleet.

Oceaneering's Subsea Projects Group consists of experienced Project Managers and Engineers, operating out of Oceaneering in Houston, Texas. The Subsea Projects Group integrates project teams utilizing personnel from the various Oceaneering service lines as appropriate to the scope of work. The integrated ROV/Survey service offers significant operational and deliverable product benefits, thereby saving time and money.

Oceaneering is constantly engaging in subsea installation work and inspection, maintenance and repair services on subsea facilities, offshore platforms rigs, subsea pipelines, production facilities, and subsea developments primarily in the Gulf of Mexico.

1.2 General Project Description

Couvillion Group, L.L.C. requested for Oceaneering to provide a Vessel, ROV, and Survey services.

Oceaneering is proposing the Chloe Candies to support Pangeo to run their Acoustic Corer equipment.

The project will mobilize and demobilize at Oceaneering's dock in Fourchon, Louisiana.

Duration of the project is estimated to take 7-10 days, with an estimated mobilization date of late July, 2019.

Company "free issue" items:

- Pangeo Acoustic Corer Equipment

SECTION 2 - SCOPE OF SUPPLY

Chloe Candies

The Chloe Candies is a 280' X 59' Dynamically Positioned (DP-2) Intervention Vessel (60 person accommodations). Included onboard are two Millennium Plus 220hp ROV systems. The MSV has a 100 ton marine crane, a 100 ton winch, 9,064 square foot working deck, and a 28' x 20' working moon-pool. The helideck is designed according to CAA regulations and is suitable for a Sikorsky S76 and smaller helicopter. Oceaneering Survey real time survey will be used for surface and subsea positioning.

Included:

- Oceaneering vessel crew, lube, & subsistence
- Oceaneering vessel superintendent & project crew (offshore)
- Oceaneering ROV personnel & standard vessel ROV equipment – (24 hour op's)
- Oceaneering Survey personnel and equipment (24 hour op's)
- 1 x standard video of the above-mentioned works

Millennium Plus ROV

The Millennium® Plus ROV (Remotely Operated Vehicle) is a side entry cage deployed, dual manipulator 220hp heavy work class ROV. The cage or Tether Management System (TMS) supplies an additional 110hp and is capable of powering skids and also has thruster control and auto heading.

The Millennium® Plus model maintains the integrity of the standard Millennium® ROV while offering more serviceability, tooling flexibility and simple survey integration capabilities. These characteristics compliment the more demanding needs of heavier construction and completion work scopes. As with the original Millennium® design, the Millennium® Plus system employs microprocessor based telemetry to minimize maintenance, decrease set up time, simplify troubleshooting and to provide more automatic control functions.

Capabilities:

- Fly-by-wire station keeping system
- 220hp ROV & 110hp TMS
- Depth rating: 10,000 fsw
- HD & 3D HD Cameras

- **Included in Vessel Spread:**

Table 2.1- CHLOE CANDIES

Item	Description	Notes
2.1	Oceaneering Vessel Project Crew (offshore)	Vessel OM (1) Riggers (3)
2.2	Oceaneering Millennium Plus WROV, Personnel, and Standard WROV Equipment	Supervisor (2) Pilot/Technician (4)
2.3	Oceaneering Survey Personnel and Equipment	• Surveyors (2) • 24 Hour ops • Positioning only
2.4	1 x HD Video of the Above Mentioned Works	• Daily Progress Reports (DPR's) only

Proposal to: Couvillion Group/ for: Pangeo Vessel Support

ATTACHMENT C - Vessel Specifications

OCEANEERING®

oceaneering.com

MSV Chloé Candies

FEATURES

- U.S. Flag - Jones Act Compliant
- Two *Millennium*® Plus 220 hp work class ROVs
- Open deck area 8,000 ft^2 with overboarding capabilities to 70 T

Connecting What's Needed with What's Next™

Typical Projects

- Inspection, Maintenance & Repair (IMR)
- Well intervention services
- Well stimulation
- Plug & abandonment operations
- Subsea hardware installations
- Umbilical installation / connection
- Jumpers & flying leads
- Pre-lay & post-lay mats
- Flowline remediation
- Subsea pumping

Features

- Two Millennium® Plus 220 hp work class ROVs
- Onboard tooling suite
- 100t hydramarine knuckle boom crane
- 75T auxiliary winch and overbaording davit
- Large working moonpool
- Accommodations for 60
- Kongsberg DP class II rated
- Satellite communications equipment system for transmitting streaming video of real-time work to shore personnel

Specifications

Dimensions:

Length:	280 ft / 85.25 m
Beam:	59 ft / 18 m
Molded Depth:	24 ft / 7.4 m
Draft:	16.4 ft / 5 m
Open Deck Area:	8,000 ft² / 745 m²
Deck Load Rating:	1,000 lbf/ft² / 5 mT/m²

Power & Propulsion:

Total Power Generation:	6,662 hp / 4490 kW
Bow Thrusters:	2 x 1,020 hp / 750 kW
Stern Thrusters:	2 x 2,311 hp / 1,700 kW

Capacities:

Fuel Oil:	164,141 gal / 621 m³
Lube Oil:	1,638 gal / 6.2 m³
Potable Water / Ballast:	235,000 gal / 452,212 gal

Accommodations:

Persons:	60

Main Crane:

Hydramarine knuckle boom crane:	100 T harbor lift
Whipline:	5 T

Auxiliary Winch & Overboarding Davit

Auxiliary Winch:	100 T

Performance:

Speed / Economical:	10 knots

Dynamic Positioning:

Kongsberg SDP22

Kongsberg DP Class II

References:	2 x Fugro XP DGPS HIPAP 501 2 x Kongsberg MRU1 & 1 x MRU3
Platform References:	Cyscan

Moonpools:

Working Moonpool:	25 ft x 20 ft / 7.62 m x 6.1 m

Remotely Operated Vehicles (ROV):

(2) Millennium® Plus 220 hp work class ROV Systems

Built-in Survey System:

Oceaneering® Survey Services

Helicopter Deck:

Deck Space:	Octagon 57.28 ft / 17.46 m
Weight capacity:	11,700 lb / 5307 kg

The helideck is adequate for all types of single rotor helicopters with a "D" value of up to 16 m and landing weight up to 11,700 lb / 5,307 kg.

Certifications/Flag:

USCG

Lloyds (DP)AA

SOLAS

Flag: USA

Call Sign:	WXXP Chloe' Candies

Communications System:

RigNet

Power on deck

OCEANEERING®

01.28.2016

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oceaneering.com

ATTACHMENT D - ROV Specification

OCEANEERING®

oceaneering.com

Millennium® Plus

Heavy work class ROV

The Millennium® Plus ROV is a side entry cage deployed, dual manipulator 220 hp heavy work class ROV. The cage or Tether Management System (TMS) supplies an additional 110 hp and is capable of powering skids, and has thruster control and auto heading.

FEATURES

- Fly-by-wire station keeping system
- 10,000 fsw / 3,000 msw depth rating (13,000 fsw / 4,000 msw optional)
- 220 hp

Connecting What's Needed with What's Next™

08.16.2017

Specifications

Vehicle Specifications	
Weight in air	8,800 lb / 4,000 kg
Dimensions (LxWxH)	10.8 x 5.5 x 6.3 ft / 3.3 x 1.7 x 1.9 m
Depth rating	10,000 ft / 3,000 m (standard) 13,000 ft / 4,000 m (optional)

Vehicle Power and Performance	
Hydraulic power units	2 x 110 hp(E)
Propulsion	4 x vectored horizontal 4 X vertical
Thrust	
Forward/reverse:	2,000 lb / 900 kg
Lateral:	2,000 lb / 900 kg
Vertical:	2,080 lb / 950 kg

Vehicle Manipulators and Tooling	
Manipulators (2)	5 or 7 function: rate, SC, or hybrid control
Hydraulic Tool Control	Multiple directional control valves with proportional pressure and flow control Maximum 40 gal/min

Vehicle Cameras and Lighting	
Cameras	Standard definition (SD) High definition (HD) 3D HD (optional)
Lighting	Up to 8 x 250 W (quartz halogen or high-intensity LED)

Vehicle Control and Navigation	
Automatic control	Fly-by-wire station keeping system Auto heading/depth/altitude/pitch Cruise control
Heading and altitude sensors	Survey-grade gyro Backup flux gate compass
Depth sensor	High-resolution digiquartz Backup analog depth sensor
Navigation sensor	Doppler velocity log
Obstacleavoidance sonar	Kongsberg 1071 or 1171 Tritech SeaKing

Vehicle Optional Power and Data Interfaces	
Data links	Multiple RS232 and RS485 Ethernet Optical fiber
Power	24 V DC and 110 V AC

Tether Management System (TMS)	
Type	Side entry cage or top-hat
Propulsion	2 x horizontal (cage only)
Hydraulic power unit	1 x 110 hp(E)
Electro-optical tether	2,000 ft / 600 m (cage) 4,000 ft / 1,200 m (cage) optional 1,300 ft / 400 m (top-hat)
Cameras	2 x charge-coupled device (CCD)
Lighting	2 x 250 W (quartz halogen or high-intensity LED)

Launch and Recovery Systems (LARS) (choice of)
Overboarding
A-frame w/ or w/o docking head
Heavy-weather overboarding system
Cursor
Winch
Heavy lift winch with conventional or OHRA level wind

COUVILLION

371 WALKER ROAD
PO BOX 344
BELLE CHASSE LA 70037

T 504 / 656 / 8234
F 504 / 656 / 8235

COUVILLION

371 WALKER ROAD
PO BOX 344
BELLE CHASSE LA 70037

T 504 / 656 / 8234
F 504 / 656 / 8235

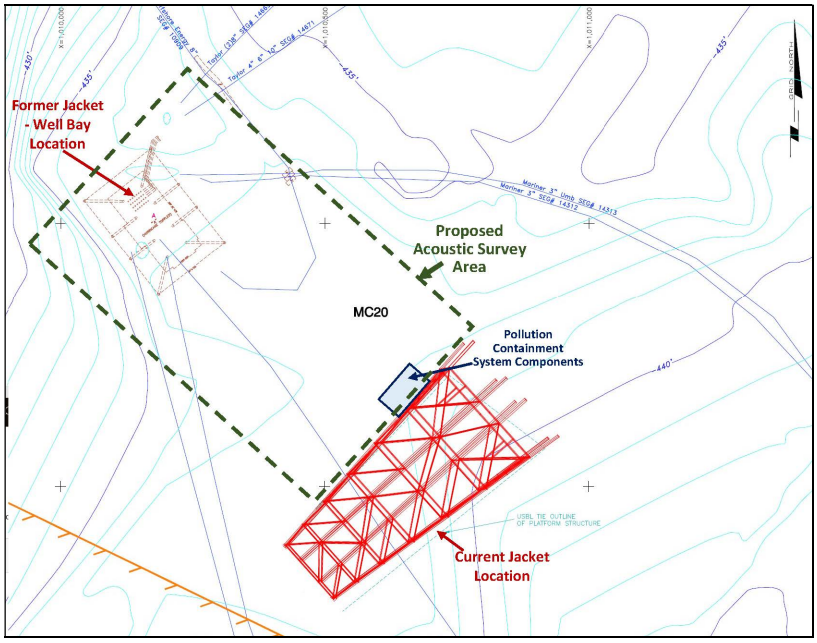
Mississippi Canyon 20 Sub-bottom Acoustic Survey

Statement of Work

Objective: Sub-bottom/Below mudline (BML) acoustic survey to identify and accurately map twenty-eight (28), 30-inch well conductors and/or their internal casing strings that were buried under a mudslide, which toppled the producing platform and moved it over 500 ft downslope in 2004.

Survey Parameters:

- **Location:** Gulf of Mexico, Mississippi Canyon Area, Block 20 (MC20); approximately 11 miles south of Plaquemine Parish, Louisiana.
- **Water Depth:** Approximately 435–450 ft.
- **Sediment/BML Conditions:** Unconsolidated sands/clays with an estimated 60-175 ft of coverage overlain on top of the buried well conductors.
- **Survey Area:** An 800 ft by 300 ft (or larger) grid that fully encompasses the previous platform/conductor bay location down to the site of the current jacket location – in close proximity to pollution containment system components (*see below*).



Survey Expectations:

COUVILLION

371 WALKER ROAD
PO BOX 344
BELLE CHASSE LA 70037

T 504 / 656 / 8234
F 504 / 656 / 8235

- **Acoustic/Remote-Sensing Equipment:** Equipment package(s) will need to allow for up to 600 ft sediment penetration with fine enough detail to properly identify and accurately map the buried well conductors. Package(s) could be a combination of sensing tools and methodologies; i.e., magnetometers, sub-bottom profilers, 2D/3D seismic arrays, controlled source electro-magnetics (CSEM), etc.
    - **Notes:**
        - Contract proposal should define depth limitations and achievable resolution with the proposed sensors; as one aspect of the survey efforts is to understand the BML depth from the end of conductors to where the tubulars go vertical.
        - Contract proposal should discuss whether or not the downed platform jacket, the pollution containment components (*attached to the jacket*), the conductors, and/or other debris may affect the technology, resolution, and post-processing results.
- **Survey/Sensor Requirements:** Proposal to provide an outline of the sensor/equipment requirements; such as, requisite vessel(s), mandatory personnel, and sensor platform(s) (i.e., Autonomous Underwater Vehicle (AUV), Remotely-Operated Vehicle (ROV), etc.).
    - **Notes:**
        - Contract proposal should address whether sensor package(s) could be effectively tooled to an existing, government-owned/-contracted AUV/ROV.
        - Contract proposal should outline any limiting conditions associated with the survey/sensor requirements that should be considered.
- **Timing:** Proposal to provide and estimate of how many days needed to perform:
    - Mobilization/Demobilization of equipment/vessels/etc.;
    - In-field survey times;
    - Post-Processing/Analyses; and
    - Survey Report/Map Development and Issuance.
- **Costs**: Proposal to provide an estimate of the Daily and Total Project Costs.
- **Survey Examples/Past Performance:** Proposal to provide examples of prior surveys and analysis to support the recommended sensors and methodologies.
- **Other:** Proposal to provide any additional information needed to meet the objective outlined above (i.e., sediment cores, bathymetry survey of location, etc.).