

# Consolidated Olive Ridley Sea Turtle Mitigation Action Plan

**DRAFT**



Indice	details	page
<b>xx</b>	document issues	2
<b>xx</b>	table	3
<b>1.</b>	Introduction	4
<b>1.1.</b>	History	4
<b>1.2.</b>	Confirmed Olive Ridley Turtle Catches by Seismic Equipment on the TOTAL Operation in Gabon.	6
<b>1.3</b>	Hazard Assessment and Action Plan	7
<b>2.</b>	Localization of Operation and National Parks in Gabon	8
<b>3.</b>	Background Information Regarding Olive Ridley Turtles ( <i>Lepidochelys olivacea</i> )	9
<b>3.1</b>	Description	9
<b>3.1.1.</b>	Distribution	9
<b>3.1.2.</b>	Reproduction / Mating	9
<b>3.1.3.</b>	Nesting	9
<b>3.1.4.</b>	Threats	9
<b>3.1.5.</b>	Humans are still listed as the leading threat to Olive Ridley Turtles	9
<b>3.2.</b>	Ridley Turtle Migration	10
<b>3.2.1.</b>	Generalities on Sea Turtles	10
<b>3.2.2.</b>	Excellent Navigators	10
<b>3.2.3.</b>	Migration Methods	10
<b>4.</b>	Fairfield Nodal's Commitment to Mitigating the Entanglement Exposure to the Olive Ridley Turtles	10
<b>4.1.</b>	Entanglement in the Rope for Securing the Nodes to the Deployment/Recovery Line	10
<b>4.2.</b>	Attracted to the LED Light	10
<b>5.</b>	Mitigation Plan of Action (ongoing)	11
<b>5.1.</b>	Hose Used to Cover the Rope Lanyards	11
<b>5.2</b>	Acoustic Transponder Lanyard Removed	11
<b>5.3.</b>	Covering the LED Lights	12
<b>6.</b>	Combination of the three improvements	12
<b>7.</b>	Use of new material for cover the Lanyard	13
<b>7.1.</b>	The characteristics for the Hose ICTA 32 are	13
<b>7.2.</b>	Polyolefin	14
<b>7.3.</b>	Resistivity under sea water	14
<b>7.4.</b>	Preparation of the new lanyards	14
<b>8.</b>	Risk assessment for turtles	15
<b>8.1.</b>	Risk assessment for Node with Lanyard in the rack	16
<b>8.2.</b>	Node with lanyard on the conveyors	17
<b>8.3.</b>	Node in the back cabin during plug-in and unplugging of node on the line	18
<b>8.4.</b>	Node on the seabed	19
<b>9.</b>	Noise test for data acquisitions	20
<b>10.</b>	Conclusions	29

## 1.Introduction

A consolidated report is now used for our client Total considering all the progresses and result of investigations in the process to mitigate the strangled cases for turtles. We also integrate the analysis of the results of acquisitions with considerations of the use of 2 types of hoses.

### 1.1. History

To date; Eight (8) Olive Ridley Turtles have been entangled since 11 July 2014. These occurred during the acquisition of Seismic data along the coast of Gabon under contract with TOTAL Gabon. The turtles have been caught by their front flipper in every incident; the flippers are becoming entangled with the node lanyard that secures the node to the deployment/recovery line. The turtles have been confirmed deceased during each incident.



# Consolidated Olive Ridley Sea Turtle Mitigation Action Plan





1.2. **Confirmed Olive Ridley Turtle Catches by Seismic Equipment on the TOTAL Operation in Gabon.**

Date of Incident	Number of Turtles
2014-07-11	1
2014-07-19	1
2014-07-21	1
2014-07-29	1
2014-08-06	1
2014-08-07	1
2014-08-09	2
<b>Total Count of Entangled Turtles</b>	<b>8</b>

### 1.3. Hazard Assessment and Action Plan

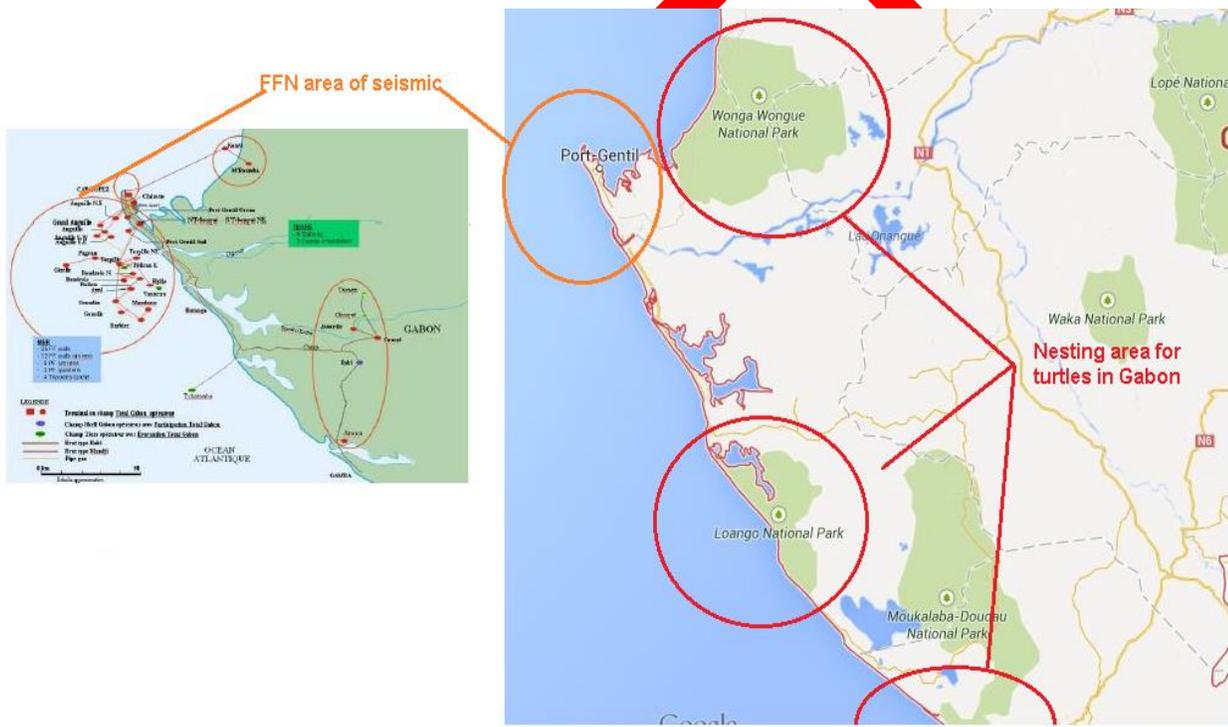
	Corrective/Preventative Actions	Action Party	Target Date	Comments	Status
1	Relocate the USBL Transponder to the pear clip of the hardware. Completely remove the transponder lanyard from all set up's before deployments and do not use.	Line Chief Chief Observer	2014-08-20	The transponder lanyard was the direct cause of one entanglement. Removing this from the set up will mitigate the possibility of another entanglement from this lanyard.	Completed 2014-08-13
2	Cover the LED light indicator on all nodes before deployment. This will be accomplished by taping over the window using tape.	Line Chief Chief Observer	2014-08-20	The LED indicator lighting is suspected of being an attraction to the turtles. Placing tape over the viewing window removes this as a causative factor.	Completed 2014-08-13
3	System command script generated by FFN Engineering to turn LED light off on node once deployed.	FFN Engineering Chief Observer	2014-08-13	The LED indicator lighting is suspected of being an attraction to the turtles. Turning this light off through the software before deployment removes this as a causative factor.	Completed 2014-08-13
4	Double wrap safety lanyard around deployment cable.	LineChief Chief Observer	2014-08-20	By double wrapping the safety lanyard this provides less line for potential entanglement.	Completed 2014-08-13
5	Installing 3/4" rubber hose around node lanyard to stiffen the hardware.	Line Chief Chief Observer Party Manager	2014-08-20	Install the hose on the node lanyard to stiffen the rope and prevent the rope from being pliable enough to wrap around the flipper of the turtle.	Completed 2014-08-13
6	Shorten node lanyards	Line Chief Chief Observer Party Manager	2014-08-20	By making the node lanyards as short as possible yet remaining functional will limit the possibility of entanglement.	Completed 2014-08-13
7	Use plastic spiral wrap on node lanyard to stiffen on test nodes.	Line Chief Chief Observer	2014-08-12	Install the spiral wrap on the node lanyard to stiffen the rope and prevent the rope from being pliable enough to wrap around the flipper of the turtle.	Completed 2014-08-13

**2. Localization of Operation and National Parks in Gabon**

In 2002 the Gabonese government designated 13 new National Parks, two with the specific purpose of protecting globally important nesting beaches. Overall, there are five parks protecting important sea turtle habitats:

- Pongara National Park
- Akanda National Park
- Loango National Park
- The Gamba Complex of Protected Areas (including Moukalaba-Doudou National Park)
- Mayumba National Marine Park (bordering on Congo's Conkouati-Douli National Park)

Since 2011 the government of Gabon has decreed that all sea turtle species must be protected.



**Fairfield Nodal/TOTAL geographic area of operations in reference to the Gabonese National Parks**

### **3. Background Information Regarding Olive Ridley Turtles (*Lepidochelys olivacea*)**

#### **3.1 Description**

The Olive Ridley is a small sea turtle, with an adult carapace length averaging 60 to 70 cm.

##### **3.1.1. Distribution**

The Olive Ridley turtle has a circum tropical distribution, living in tropical and warm waters of the Pacific and Indian Oceans from India, Arabia, Japan, and Micronesia south to southern Africa, Australia, and New Zealand. In the Atlantic Ocean, the Olive Ridleys are considered the most abundant, yet globally they have declined by more than 30% from historic levels. These turtles are considered endangered because of their few remaining nesting sites in the world.

##### **3.1.2. Reproduction / Mating**

Mating is often assumed to occur in the vicinity of nesting beaches, but copulating pairs have been reported over 1,000 km from the nearest beach. Research from Costa Rica revealed the number of copulating pairs observed near the beach could not be responsible for the fertilization of the tens of thousands of gravid females, so a significant amount of mating is believed to have occurred elsewhere at other times of the year.

##### **3.1.3. Nesting**

Olive Ridleys generally begin to aggregate near nesting beaches about two months before nesting season, although this may vary throughout its range. Nesting events are usually nocturnal, but diurnal nesting has been reported, especially during large arribadas.

**The nesting Period is from October to April in Gabon.**

##### **3.1.4. Threats**

Known predators of Olive Ridley eggs include raccoons, coyotes, feral dogs and pigs, opossums, caimans, ghost crabs, and the sunbeam snake. Hatchlings are preyed upon as they travel across the beach to the water by vultures, frigate birds, crabs, raccoons, coyotes, iguanas, and snakes. In the water, hatchling predators most likely include oceanic fishes, sharks, and crocodiles.

Adults have relatively few known predators, other than sharks, and killer whales are responsible for occasional attacks. Females are often plagued by mosquitos during nesting.

##### **3.1.5. Humans are still listed as the leading threat to Olive Ridley Turtles**

Humans are responsible for unsustainable egg collection, slaughtering nesting females on the beach, and direct harvesting adults at sea for commercial sale of both the meat and hides. Other major threats include mortality associated with boat collisions, and incidental takes in fisheries. Trawling, gill nets, ghost nests, long line fishing, and pot fishing, these activities have significantly affected Olive Ridley populations as well as other species of marine turtles.

### 3.2. Ridley Turtle Migration

#### 3.2.1. Generalities on Sea Turtles

Sea turtle migration refers to the long-distance movements of sea turtles (superfamily Cheloniodea) notably as adults but may also refer to the offshore migration of hatchlings. Sea turtle hatchlings emerge from underground nests and crawl across the beach towards the sea. They then maintain an offshore heading until they reach the open sea.

The feeding and nesting sites of adult sea turtles are often distantly separated meaning some must migrate hundreds or even thousands of kilometers.

Several main patterns of adult migration have been identified, such as the Leatherback sea turtles and Olive Ridley sea turtles. These do not show fidelity to any specific coastal foraging site. Instead, they forage in the open sea in complex movements apparently not towards any goal

#### 3.2.2. Excellent Navigators

They are ancient navigators and can recognize their own nesting beach even after many years. Female turtles return in maturity to the same beach for egg laying where it was hatched before. Scientist believe that turtles use earth's magnetic force to navigate perfectly. They transport massive nutrients and increase productivity of coastal underwater vegetation during their travel. They are extreme travelers and move as far as 12,000 kms to reach their nesting rookery. They can recognize color as is absence in many higher animal groups.

Sea turtle have color vision, but they probably do not see well while on the land. Loggerheads and Green turtles can see all colors from red to blue by example.

#### 3.2.3. Migration Methods

Turtle's navigational skills for migrations are still unknown. There are several hypotheses including astronomical cues and the earth's magnetic fields. Although unknown, there is scientific evidence that the sea turtles do have a navigational compass when making long migrations.

### 4. Fairfield Nodal's Commitment to Mitigating the Entanglement Exposure to the Olive Ridley Turtles

FFN is fully committed and aware of this unfortunate situation; the company fully supports the protection of these turtles during seismic operations. For this reason we take a proactive initiative to avoid catching any other turtles by implementing various innovative ideas for newly deployed node lines on the seabed.

**The Main cause of death to these eight turtles during the seismic operations has been from drowning due to entanglement. The following reasons are speculated to have contributed to the deaths.**

#### 4.1. Entanglement in the Rope for Securing the Nodes to the Deployment/Recovery Line

The turtles have been fowled in the node lanyard, the front flipper becomes entangled in the short ropes that secures the node to the seismic line.

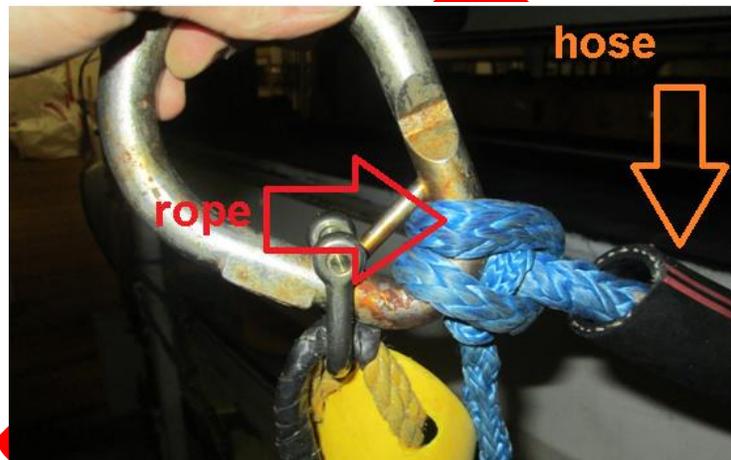
#### 4.2. Attracted to the LED Light

Another speculation is the turtles are attracted to the LED lights on the nodes. A study was done in India about the influence of the light on the turtles (Sea Turtle Article - Drawn to Blinking Lights - SR 48(11) 32-33). The Z700 nodes have blinking red, blue and green LED lights on them to indicate their status during normal operations.

## 5. Mitigation Plan of Action (ongoing)

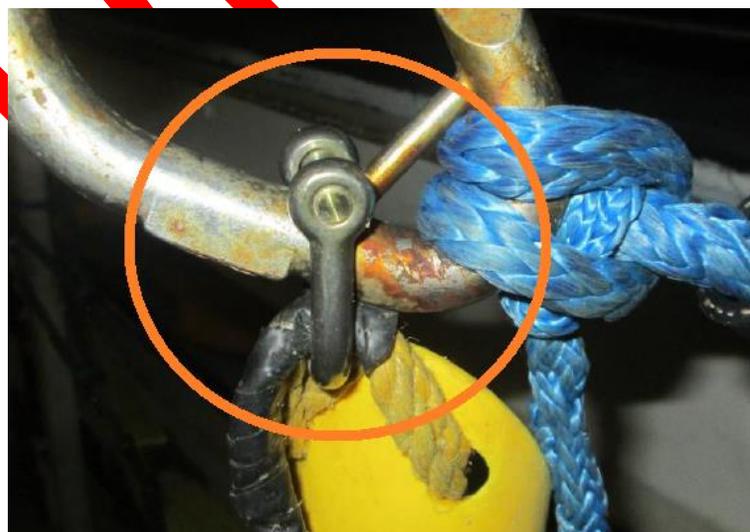
### 5.1. Hose Used to Cover the Rope Lanyards

The use of 0.75" rubber hose has been installed over the node lanyard on about 600 plus nodes of the most recently deployed receiver line (1488). This is the preferred method as it produces the best results to stiffen the rope and provide the lanyard with just enough flexibility to achieve its purpose. If this method proves successful and does not affect data quality, about 12-14" of 3.4" inside diameter hose will be added to each node lanyard.



### 5.2 Acoustic Transponder Lanyard Removed

The transponder's lanyards have been removed and are now being shackled directly to the pear links. This eliminates the possibility of the turtles to become entangled in the manner. The transponder is being connected directly to the pear link.



### 5.3. Covering the LED Lights

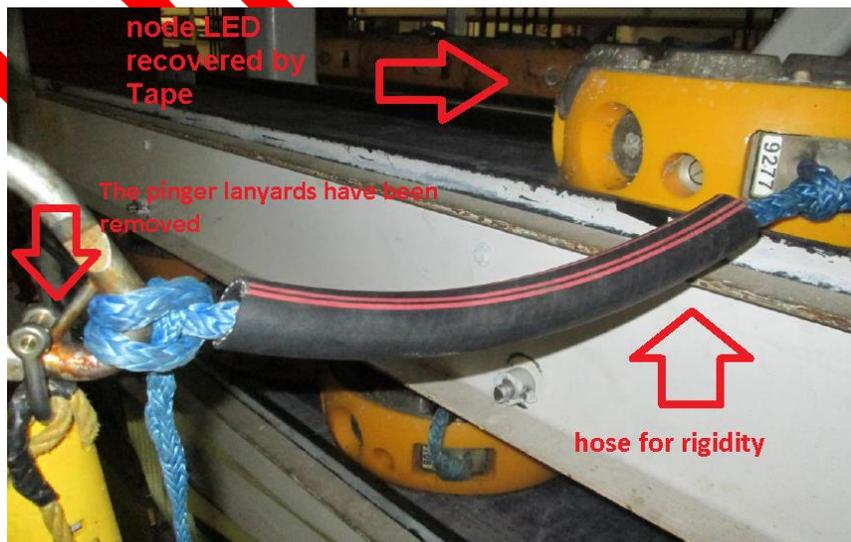
The LED indication light on the nodes has been covered in an attempt to mitigate the possibility this is attracting the turtles. This was accomplished during the deployment of receiver line 1488.

This was further mitigated by the Fairfield Nodal engineering team generating a new software command that allows the LED light to be extinguished before deployment and remaining off during the time on the seabed. This also removed the need for the taping over LED's done to the nodes previously.



### 6. Combination of the three improvements

FFN team is preparing the next line using the combination of these three correctives actions



## 7. Use of new material for cover the Lanyard

After consultation with specialists we decide to use another material lighter, smart and with good resistance to a lot of external factors. We found this material in Libreville. It's an electrical hose for isolation



### 7.1. The characteristics for the Hose ICTA 32 are

- Material polyolefin
- hose insulator, isolant, flexed ,no flames propagator are
- $\varnothing$  external Max 32mm
- $\varnothing$  internal Mini 23,1mm
- Maximum bend radius 96 Degrees
- Swat resistivity 750 Newton
- Impact strength 6j



**7.2. Polyolefin**

All surfaces like the Hose ICTA 32 are not effectively joined together by solvent welding because they have excellent chemical resistance and are unaffected by common solvents.

**7.3. Resistivity under sea water**

From flyer Polyolefin materials in Industrial Pipe Applications

50	10.4bar*	8.3 bar	9.2bar	95	NA	2.6bar*	2.6bar*
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Note - i) Design lifetime 50 years except where marked with an asterisk where it is a 10 year lifetime  
ii) For critical pipelines laid above ground we recommend the use of an additional 0.8 design factor

**Abrasion resistance of polyolefin pipes**  
Polyolefin materials have an exceptional abrasion resistance compared to other pipe materials. Compared to steel, the wear rate of PE is 4-6 times lower, which is why PE has replaced metal pipes for mine tailing slurry lines.  
A comparison with other non-metallic materials such as asbestos cement, GRP and clay pipes using the Darmstadt method (EN 295) is shown in the graph opposite. Clearly PE and PP pipes outperform all the alternative pipe materials.

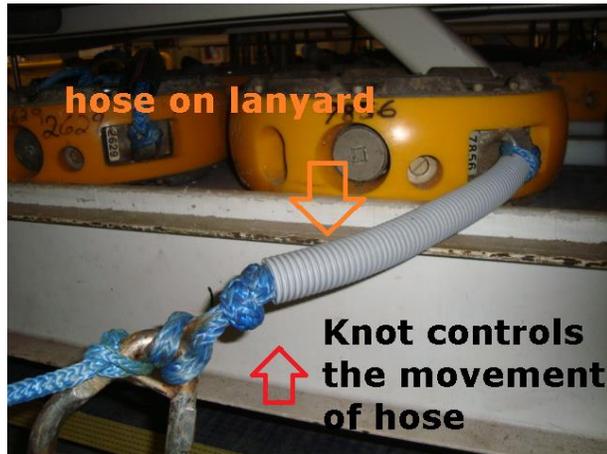
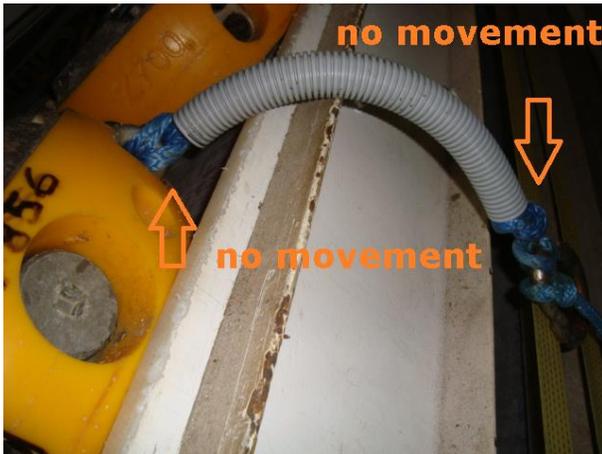
**Corrosion and chemical resistance of polyolefin pipes**  
Corrosion is the Achilles heel of metallic pipes. It is estimated that up to 3% of the GDP of Western European countries is lost annually in corrosion damage. In most situations corrosion is not an issue for polyolefin pipes and even sea water poses no problems which make them ideal for submarine outfall pipes or sea water intake pipelines.  
PE and PP are both highly resistant to chemicals and other aggressive media (refer ISO/TR 10358). Indeed acidic or alkaline based industrial solutions, hydrocarbon based fuels, detergents and other cleaning solutions are stored, transported and sold in pipes, vessels or packaging made of polyolefin materials. PP pipelines are particularly resistant to most acids and can operate up to temperatures of 80-90°C.

Number of load cycles (n in 1000)	Cement pipe	MC-DUR lined cement pipe	FRP pipe	Clay pipe	GRP pipe	PP or HDPE pipe
0	0.0	0.0	0.0	0.0	0.0	0.0
50	0.2	0.3	0.4	0.1	0.05	0.02
100	0.4	0.6	0.8	0.2	0.1	0.03
150	0.6	1.0	1.2	0.3	0.15	0.04
200	0.8	1.4	1.5	0.4	0.2	0.05
250	1.0	1.7	1.6	0.5	0.25	0.05
300	1.2	2.0	1.6	0.6	0.3	0.05
350	1.4	2.3	1.6	0.7	0.35	0.05
400	1.6	2.6	1.6	0.8	0.4	0.05
450	1.8	2.9	1.6	0.9	0.45	0.05
500	2.0	3.2	1.6	1.0	0.5	0.05

**7.4. Preparation of the new lanyards**

The lanyard with 12 inches length is covered by the grey hose. If necessary we do 1 knot for avoid any movement





### 8. Risk assessment for turtles

We are starting to test both solutions to see if we create noise that may be a discrepancy for the acquisition of data during the seismic acquisition phase. One full line will be prepared with this methodology. Some others technologies are in discussion and will be purposed soon. WE do a risk assessment for the node with lanyard covered with this grey hose from the rack position to the seabed position.

**DRAFT**

## Consolidated Olive Ridley Sea Turtle Mitigation Action Plan

Date 2014-08-14  
Author Michel Friedman  
Rev 00

### 8.1. Risk assessment for Node with Lanyard in the rack

Document Control Number <b>801-All-Form-187</b>	Hazard Identification & Risk Assessment-Form	
Revision 2011-08-10	Document Owner Position Corporate HSE Manager	

Operation Type	Lanyard with Flexy Icta 32 around the rope	Activity	Move and remove the lanyard from node assembling / disassembling the nodes
Environment	storage rack , conveyor	Hazard Index No.	
HAZARD:	escape from hands of operators	Hazard Location	from storage to conveyors
<b>Hazard Description:</b> escape of the hand of the operator <b>Outcome:</b> escape from hand of operator and falls on floor or can create an injury to the body of operator installing the lanyard to the node <b>Aggravating factors:</b> movement of vessel does that we the risks is increased for the operators			
Input risk analysis	Probability: <input type="checkbox"/> Gravity: 2	Level: High <input type="checkbox"/> Medium <input type="checkbox"/> Low <input checked="" type="checkbox"/>	
<b>LEVEL 3 HIGH: REQUIRES IMMEDIATE CORRECTIVE ACTION. ONSHORE MANAGEMENT REVIEW REQUIRED.</b> <b>Hazard Control measures:</b>  <b>ELIMINATE:</b> no elimination of the risk with Flexy Icta 32 but similar to the rope lanyard  <b>SUBSTITUTE:</b> : The flexible lanyard Flexy Icta 32 is similar to the actual system with but give rigidity to the lanyard , the turtles flipper will not be caught by the Flexy Icta 32 lanyard  <b>ISOLATE:</b> no  <b>ENGINEER:</b> no  <b>ADMINISTRATIVE:</b> no  <b>PPE:</b> Boiled suit, safety shoes, gloves, helmet and glasses			
Output risk analysis	Probability: <input type="checkbox"/> Gravity: 2	Level: High <input type="checkbox"/> Medium <input checked="" type="checkbox"/> Low <input type="checkbox"/>	
<b>Responsible person/s:</b> operator preparing the node before			
<b>Recovery measures:</b> none			
<b>Links:</b>			

## Consolidated Olive Ridley Sea Turtle Mitigation Action Plan

Date 2014-08-14  
Author Michel Friedman  
Rev 00

### 8.2. Node with lanyard on the conveyors

Document Control Number <b>801-All-Form-187</b>	Hazard Identification & Risk Assessment-Form	
Revision 2011-08-10	Document Owner Position Corporate HSE Manager	

Operation Type	Lanyard with Flexy Icta 32	Activity	Moving from/to storage to control room
Environment	Control Room and Conveyors	Hazard Index No.	
HAZARD:	During node movement on the conveyors node can fall or jam on the conveyor belts	Hazard Location	on all the conveyors from storage to control room
<p><b>Hazard Description:</b> The movement and change of direction of the nodes on the conveyor belt can attribute to the node falling or jamming.</p> <p><b>Outcome:</b> Due to the lanyard being sheathed with the Flexy Icta 32 the probability of the node lanyard becoming hooked on the conveyor belt is reduced due to the rope being protected and not exposed.</p> <p><b>Aggravating factors:</b> Movement of rack and conveyor, movement of vessel, lack of attention from operator</p>			
Input risk analysis	Probability: <input type="checkbox"/> Gravity: <input type="checkbox"/> Level: High <input type="checkbox"/> Medium <input type="checkbox"/> Low <input checked="" type="checkbox"/>		
<p><b>LEVEL 3 HIGH: REQUIRES IMMEDIATE CORRECTIVE ACTION. ONSHORE MANAGEMENT REVIEW REQUIRED.</b></p> <p><b>Hazard Control measures:</b></p> <p><b>ELIMINATE:</b> more attention of the operators on the various conveyors and in control room</p> <p><b>SUBSTITUTE:</b> we can not change the system rack /conveyor only we cover the node lanyard with Flexy Icta 32.</p> <p><b>ISOLATE:</b> no way to isolate it's a key task but similar to the actual with unprotected rope but preferred by use of the Flexy Icta 32.</p> <p><b>ENGINEER:</b> Additional clearance from level to level would prevent nodes from becoming hooked.</p> <p><b>ADMINISTRATIVE:</b> Installing the Flexy Icta 32 is preferable to other proposed methodology do to the ease of which it can be installed.</p> <p><b>PPE:</b> Coveralls, safety shoes, gloves, hard hat and safety glasses for operators.</p>			
Output risk analysis	Probability: <input checked="" type="checkbox"/> Gravity: <input type="checkbox"/> Level: High <input type="checkbox"/> Medium <input type="checkbox"/> Low <input checked="" type="checkbox"/>		
Responsible person/s: operator preparing the node, operators in various points of the conveyors			

## Consolidated Olive Ridley Sea Turtle Mitigation Action Plan

Date: 2014-08-14  
Author: Michel Friedman  
Rev: 00

### 8.3. Node in the back cabin during plug-in and unplugging of node on the line

Document Control Number <b>801-All-Form-187</b>	Hazard Identification & Risk Assessment-Form	
Revision 2011-08-10	Document Owner Position Corporate HSE Manager	

Operation Type	flexy lcta 32 lanyard used on the back cabin for assembling the seismic line	Activity	plugin of the lanyard to the orange line
Environment	cabin table and conveyors	Hazard Index No.	
HAZARD:	movement and position on the node considering flexibility of the lanyard	Hazard Location	onto the table of assembling to sea and from sea to table of assembling
<p><b>Hazard Description:</b> when movement of the node on the table , flexibility of the Landyard flexy lcta 32</p> <p><b>Outcome:</b> The lanyard Flexy lcta 32 must be plugged to the seismic line, the security line must be plugged also. the operator must have all his attention on this task. This new lanyard Flexy lcta 32 for plugging or unplugging have the similar properties of the simple rope lanyard and do not create a big change to the operator</p> <p><b>Aggravating factors:</b> movement of vessel rigidity of the lanyard Flexy lcta 32 when picking and moving the node from sea to table</p>			
Input risk analysis	Probability: <input type="checkbox"/> A	Gravity: 2	Level: High <input type="checkbox"/> Medium <input type="checkbox"/> Low <input checked="" type="checkbox"/>
<p><b>LEVEL 3 HIGH: REQUIRES IMMEDIATE CORRECTIVE ACTION. ONSHORE MANAGEMENT REVIEW REQUIRED.</b></p> <p><b>Hazard Control measures:</b></p> <p><b>ELIMINATE:</b> this part of the operation is similar to the rope operations and have same risk and problems</p> <p><b>SUBSTITUTE:</b> no substitution, this type of lanyard flexy lcta 32 must be used but for the moment with the rope</p> <p><b>ISOLATE:</b> no way to isolate even mitigate but the risk is smaller when the rope is with Flexy lcta 32 than the actual rope alone</p> <p><b>ENGINEER:</b> time of preparation of the lanyard flexy lcta 32 , its 30 secondes for rope more segment of hose .Also the datasheet of the product flexy lcta 32 indicates that the product have a maximum curvature of 96 degrees</p> <p><b>ADMINISTRATIVE:</b> This lanyard flexy lcta 32 must be used. for the moment the portion or segment of Flexy lcta 32 is the best quick safe solution. for cover the rope</p> <p><b>PPE:</b> Boiled suit, safety shoes, gloves, helmet and glasses for operators</p>			
Output risk analysis	Probability: <input type="checkbox"/> A	Gravity: 1	Level: High <input type="checkbox"/> Medium <input type="checkbox"/> Low <input checked="" type="checkbox"/>

## Consolidated Olive Ridley Sea Turtle Mitigation Action Plan

Date 2014-08-14  
Author Michel Friedman  
Rev 00

### 8.4. Node on the seabed

Document Control Number 801-All-Form-187	Hazard Identification & Risk Assessment-Form	
Revision 2011-08-10	Document Owner Position Corporate HSE Manager	

Operation Type	Lanyard with Flexy Icta 32 around the rope	Activity	seismic operation
Environment	node line , seabed	Hazard Index No.	
HAZARD:	flipper of turtles retained by the lanyard	Hazard Location	Seabed
<p><b>Hazard Description:</b> the turtle is floded because the flipper turtle is retained by the rope lanyard</p> <p><b>Outcome:</b> When the turtle is around the node the flipper is moving the lanyard and the rope do a circle where the flipper is caught by the lanyard. The turtle agonizes and is flooded because she can not escape</p> <p><b>Aggravating factors:</b> no aggravating factor</p>			
Input risk analysis	Probability: <input type="checkbox"/> E	Gravity: 5	Level: High <input checked="" type="checkbox"/> Medium <input type="checkbox"/> Low <input type="checkbox"/>
<p><b>LEVEL 3 HIGH: REQUIRES IMMEDIATE CORRECTIVE ACTION. ONSHORE MANAGEMENT REVIEW REQUIRED.</b></p> <p><b>Hazard Control measures:</b></p> <p><b>ELIMINATE:</b> it is a total elimination of the risk with Flexy Icta 32 because the radius of curvature is maximum 96 degrees</p> <p><b>SUBSTITUTE:</b> The flexible lanyard Flexy Icta 32 is changing the actual system because he give rigidity to the lanyard , the turtles flipper will never be caught by the Flexy Icta 32 lanyard</p> <p><b>ISOLATE:</b> no</p> <p><b>ENGINEER:</b> nits an easy methodology for avoid the risk of catch and flood a turtle</p> <p><b>ADMINISTRATIVE:</b> no</p> <p><b>PPE:</b> none at shis stage</p>			
Output risk analysis	Probability: <input type="checkbox"/> A	Gravity: 1	Level: High <input type="checkbox"/> Medium <input type="checkbox"/> Low <input checked="" type="checkbox"/>
Responsible person/s: crew on board			
Recovery measures:			
Links:			
References:			

**9. Noise test for data acquisitions**

 SYSTEMS ACQUISITION LICENSING PROCESSING IMAGING

# Turtle Mitigation – Noise Test

Control, Black Hydraulic Tube, Grey Electrical Conduit

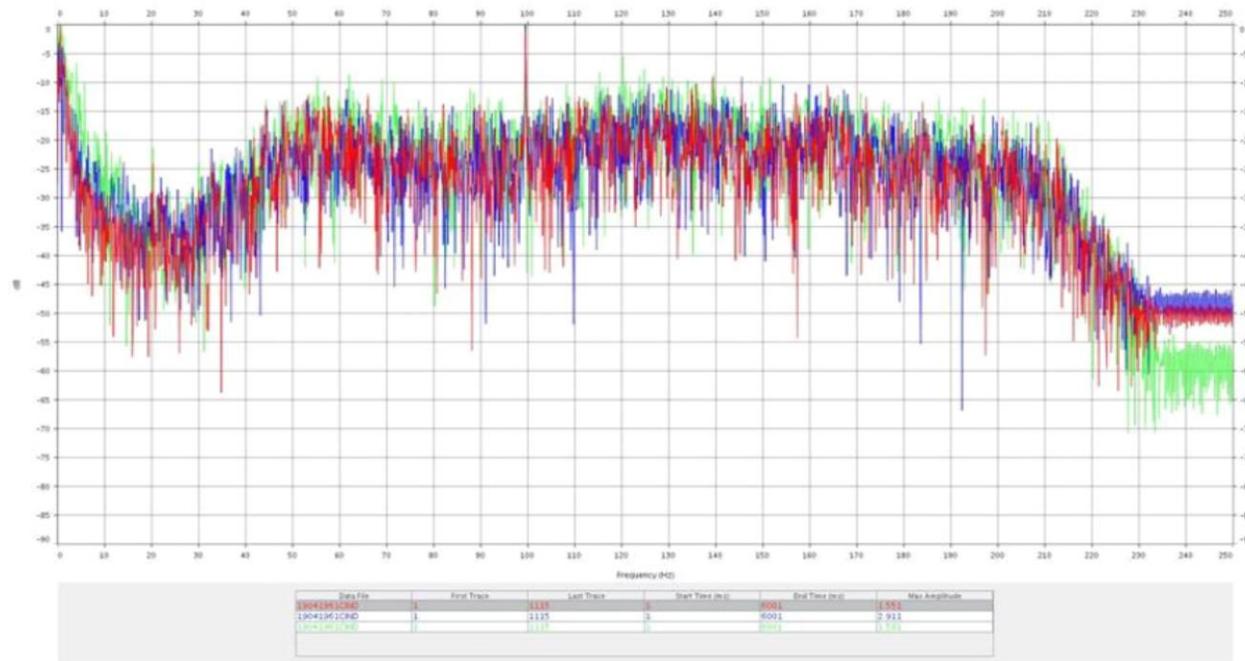


The image block contains a collage of four distinct visual elements. On the left is a photograph of a large blue and white offshore supply vessel on the open sea. To its right is a square area with a complex, multi-colored abstract pattern resembling a marbled or wood-grain texture. Further right is a horizontal strip showing a green and blue wave pattern. In the foreground, centered and slightly to the right, is a yellow cylindrical geophone component with the text 'Z700' embossed on it. The component has several circular ports and a red indicator light.

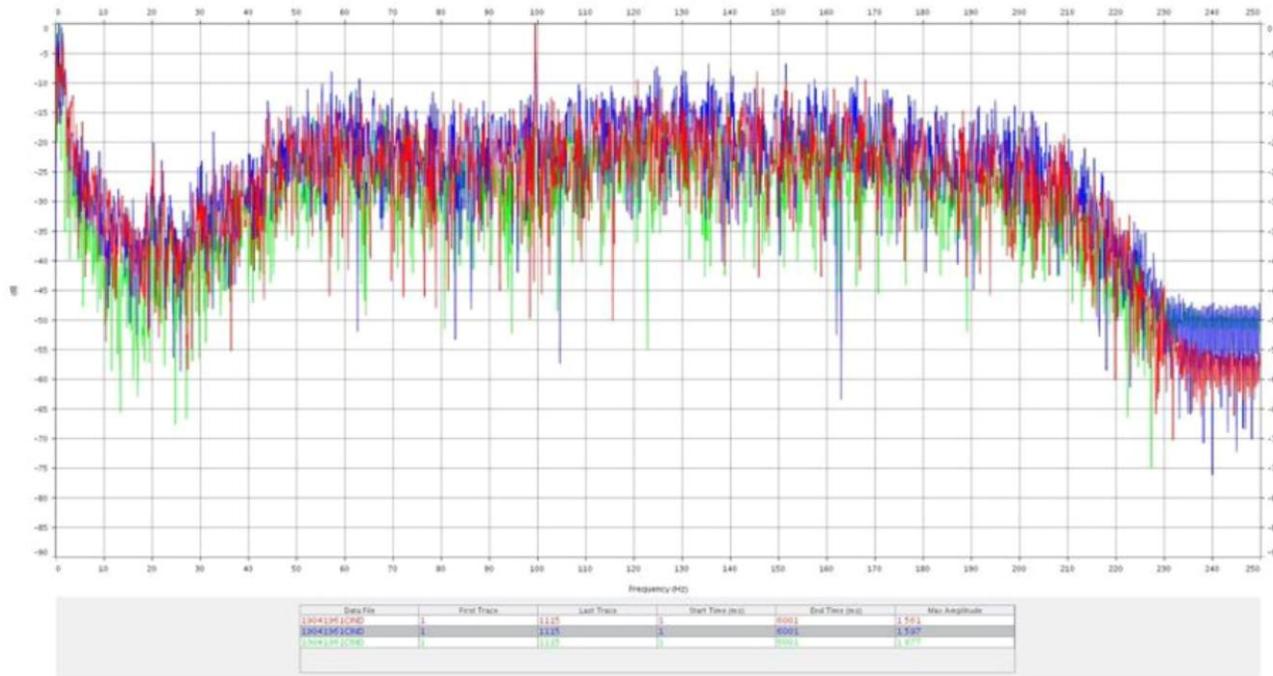
## Spectra Notes

- The following graphs are the spectra for the entire test deployment of the turtle mitigation lanyards.
- Each of the three colors depict one of the three nodes with that specific test.

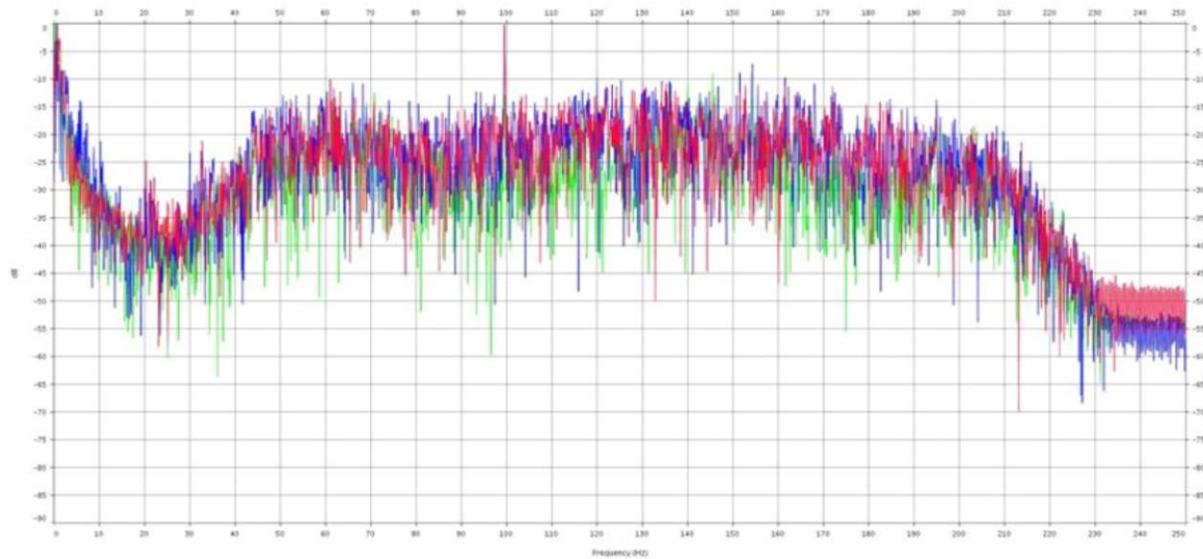
## Control (Dyneema) – C1



# Hydraulic Tube – C1



## Electrical Conduit – C1



Data File	First Trace	Last Trace	Start Time (sec)	End Time (sec)	Max Amplitude
13041341CND	1	1125	0	600	1.726
13041341CND	1	1135	0	600	1.726

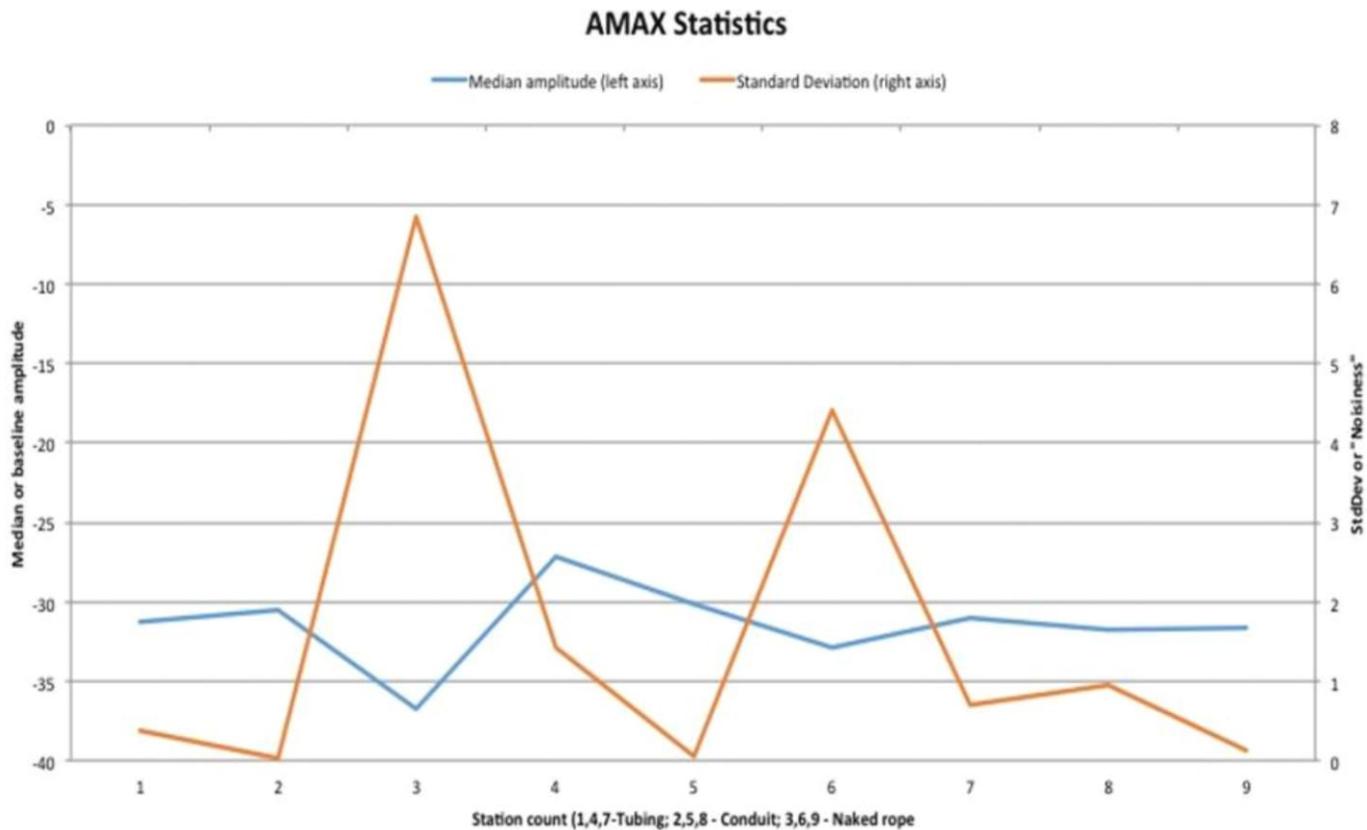
## From the Houston Area Geophysicist

- The geophone data is the best for analysis of mechanical noise as it does not require fluid coupling to be observed.
- Every channel has a floor amplitude and some anomalies. The anomalies are much higher amplitude with the original lanyard. I suspect that the noise is coming from motion of the connector link which is apparently free to move more with the soft lanyard by itself.

## From the Houston Area Geophysicist (pt2)

- Both of the shell material methods significantly reduce the magnitude of the amplitude anomalies.
- Both were significantly better than the current naked lanyard rope both in consistency and amplitude of noise floor and in reduction and less severity of the anomalous amplitudes.
- I would recommend either method from the point of view of noise characteristics

## Average Amp Vs StDev (Geophone)



## WKG Amplitude Measurements

- The follow graphs are from amplitude measurements from WKG.
- Each graph plots the Average and Max amplitude measurements for all samples for the whole trace length DBRMS, DBMAX, and DBAMAX.
- Hydraulic Tube Stations – 1181, 1187, 1193
- Electrical Conduit Stations – 1183, 1189, 1195
- Control Stations – 1185, 1191, 1197

## 10. Conclusions

Fairfield Nodal Team on project in Gabon has taken the decision to purpose this change on the material (covered Lanyard) because we are a group of persons responsible and very close to the environmental questions.

We intent to found the best solutions and best material doing modification of the lanyards.

We also have done tests and interpretations for the noises during the data acquisition.

Any other suggestion, knowledge or support from part of anybody on this project is welcomed because FAIRFIELD NODAL have a strong commitment to the environmental safe management.

**DRAFT**