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INTRODUCTION AND CORPORATE OVERVIEW.

- A. ACCOUSTO – ULTRASONIC INTEGRITY AND ENERGY SERVICES LIMITED is a wholly indigenous company that was
- B. Incorporated in the year 2013 to handle special investment portfolio in the different sub- sectors of the economy, like the inspection
- C. of pipelines and also carrying out the integrity of the pipes. Also, in the corrosion mappings for pipeline integrity, radiography
- D. inspection , liquid penetrant, material sorting and subsea inspection services.

AUIESL has the potential for ultra deep subsea ROV inspection in the area of maintenance and turnaround inspection Geological Drilling Energy and gas Ltd , also, has qualified and certified inspection energy capabilities.

The founders of AUIESL are seasoned Nigerian professionals who have made themselves in their areas of professional calling.

The company is made up of a strong and dynamic board of directors, an efficient management team and a result oriented workforce that is made up of both local and expatriate staff.

AUIESL has her corporate office in Abuja which is the federal capital territory .

OUR VISION

TO BE THE MOST CAPABLE AND FOREMOST INDIGENOUS INTEGRITY INSPECTION COMPANY IN NIGERIA.

OUR MISSION

As a local energy company with global presence, Acousto-Ultrasonic Integrity Energy Services Ltd was born out of innovation and concept. We are one company with dynamic research capabilities in the energy sector. Our real-time pipeline-monitoring device is accepted widely by the industries. We partner with renowned institutes/companies both in United Kingdom and beyond in carrying our technological development research.

The opportunities created in Nigerian by the local content law in the energy sector have given Acousto-Ultrasonic Integrity Energy Services technologies and edge among others with our patented technology "PipeAngel II", the only pipeline security of its kind in the world.

OUR CORPORATE PRINCIPLE

IN RESPONSIBILITY TO OUR SHAREHOLDERS, CUSTOMERS, EMPLOYEES, SUPPLIERS AND SUBCONTRACTORS, IT IS OUR PRIME OBJECTIVE TO ENSURE ECONOMIC SUCCESS ON A LONG- TERM BASIS, OWING TO SYSTEMATIC AND CONTINUAL IMPROVEMENT, WE WILL BE ABLE TO MEET THE CHALLENGES OF THE FUTURE.

QUALITY OBJECTIVE

TO ESTABLISH A DOCUMENTED QUALITY SYSTEM

TO DEMONSTRATE COMPLIANCE WITH ISO STANDARDS

TO EFFECTIVELY COMMUNICATE TO ALL EMPLOYEES, THE BENEFITS OF IMPLEMENTING A QUALITY SYSTEM TO COMPLY WITH ISO STANDARDS.

DR. ADO ABDU

MANAGING DIRECTOR/CEO.

SCOPE OF SERVICES

Our Inspection services Include:

- Ultrasonic Inspection
- Acousto-Ultrasonic Inspection
- Corrosion Mappings for pipeline integrity.
- Radiography Inspection
- Liquid Penetrant
- Current flaw detection
- Material sorting
- Subsea Inspection

Pipeline Inspection

PIPELINE MONITORING AND SUEILLANCE USING WIRELESS SENSORS NETWORK WITH SATTLITE





We have the potential for **ultra deep subsea ROV inspection** in the area of maintenance and turnaround Inspection Geological Drilling Energy and Gas Ltd has qualified and certified inspection Engineering capabilities.

Real-Time Pipeline Monitoring

Acousto-Ultrasonic Integrity Energy Services have a patented monitoring unit through our partner that is capable of identifying invasion on pipeline and communicate the location in loops between sensors to the base station via satellite and radio frequency. The system is submersible and surface; it has been tested on 870km distance pipeline network in Nigeria with an impressive result as confirmed by NNPC (Nigerian National Petroleum Corporation) subsidiaries.

○ **Product Perspective**

The product is a system that is capable of monitoring and detecting tampering on pipelines, specifically, oil pipelines. The product will provide a method of giving instant warning and a location when theft of oil from a pipeline is attempted using so called “hot-tapping” or “bunkering” techniques.

The system will involve attaching wireless sensor nodes at regular intervals (nominally 3km) along a pipeline. The nodal design will allow the system to be deployed along varying lengths of pipeline, potentially covering many hundreds of kilometres with a single system

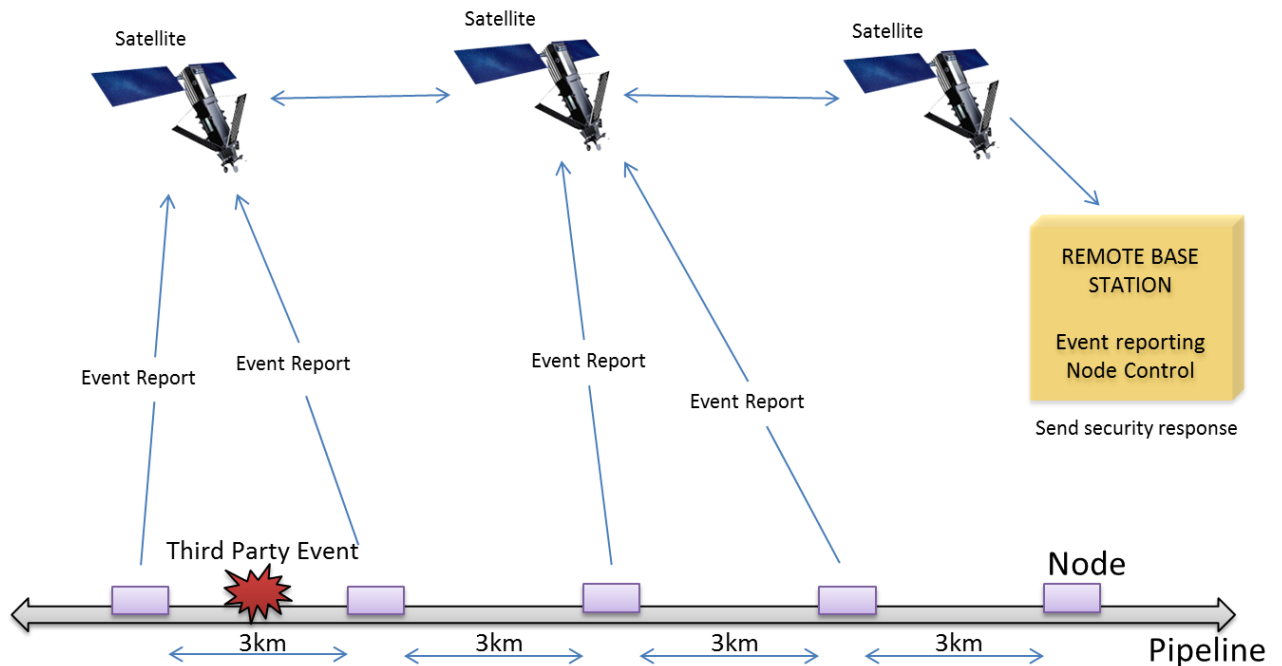


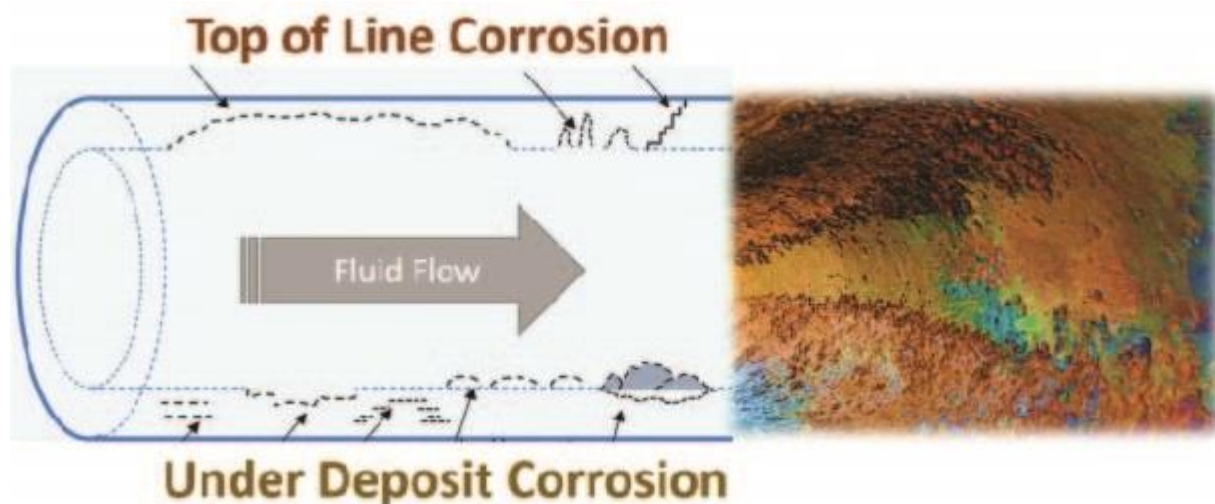
Figure 1 overview sketch of system. Nodes distributed at 3km intervals along a pipeline monitoring for vibrations from a “third-party event” and report the event back to a central base station that can be remote from the pipeline.

▪ Components

Each node of the system will be made up of number sub-systems. These will include an embedded computing system that will control the operation of each module, vibration detection sub-system to detect vibration along the pipeline, a satellite communication system to report attacks and node status back to the central computer, a power supply unit to keep power consumption to a minimum, a backup power supply to provide emergency power if the primary power source is lost, a close range wireless communication sub-system to allow data download and software updating of the module and a control system that will monitor communications from the nodes and report events to the user.

Corrosion Induced Leakage Contributes to Most Oil and Gas Transmission Loss

The inevitable corrosion of pipelines used in oil and gas transmission, particularly internal corrosion, is one of the leading causes of the failures that can result in contamination of the environment. Corrosive factors are especially significant on the top side of a pipeline. Known as **Top-of-line-Corrosion (TOLC)**, this process occurs as a result of different factors than **Under Deposit Corrosion (UDC)**, which happens on the bottom side of the pipe. This is illustrated in the image below.



Oil and gas transmission along the pipeline typically have the corrosive gaseous contaminants such as H_2S , CO_2 , and other gases along with moisture to cause corrosion on the top side of the pipeline, called top of line corrosion (TOLC). The bottom side of the pipeline tends to have the higher density components such as solids, water along water soluble acids to settle on the bottom and cause different types of corrosion, and thus called under deposit corrosion (UDC).

It is the slow thinning and the RATE OF THINNING caused by corrosion to provide the predictive capability for replacement of remedial actions in chemically modified the oil and gas characteristics before feeding into transmission.

Avante's pipeline monitoring system is used for corrosion thinning of the transmission pipeline even without knowing the original wall thickness. Typical accuracy or resolution depends on the overall thickness and are in most cases better than 0.01mm.

In addition to the top-bottom-side positions, additional sensor probes can also be placed along the pipelines for more capability in catching the coating degradation points whereby provide more predictability. Avante's pipeline thickness measurement module is designed to have capability of multiple channels for up to 8 or more probes with switching mechanism to provide that capability.

Flow of Oil and Gas Along and at Choke Points of the Pipelines are Non-Intrusively Monitored for Safety and Security.

Fluid flow measuring devices are available for accurate accounting for all contents being transmitted by the pipeline. However, they are installed mainly in critical choke points and are not always useful in determining exact locations of leaks along the miles or kilometers of the transmission pipelines. They are also not coupled with other suitable sensors to provide additional diagnostics for event confirmation.

- Acousto-Ultrasonic Integrity Energy Services Limited (**AUIESL**) Pipeline Integrity Monitoring System incorporates multiple modules of sensors that are installed externally and non-intrusively for quantitative and/or relative measurements of factors along the pipelines that affects functioning.
- Changes in relative differential flow rate; flow paths, present-absent of flow; coupling with vibration and temperature data are used in leakage and operational errors analysis to provide actionable alerts and remedial actions.
- Vibration analysis is used in Acousto-Ultrasonic Integrity Energy Services Limited(AUIESL) in distinguishing excavation and geohazards from drilling and cutting for tampering and theft.
- Coupling of all of the different sensor modules in detecting all of the factors that affects the oil and gas transmission, and data cumulative over time, Acousto-Ultrasonic Integrity Energy Services Limited(AUIESL) can provide a much more artificial intelligence-based analysis for preventative and timely maintenance and disaster prevention.

Non-Intrusive Monitoring of Changes in Relative Flow Rate; Flow Path, Present-Absent of Flow Along with Vibration and Temperature Data are Used in Leakage, Operational Errors Alerts.

Vibration Modes, Spectrum Analysis in Time and Frequency Domains of the Oil and Gas Pipeline Transmission Provides Actionable Intelligence for Excavation and Theft

Acousto-Ultrasonic Integrity Energy Services Limited (AUIESL) Vibration analysis is used in distinguishing excavation and geohazards from drilling and cutting for tampering and theft.

- Excavation, digging, earthquakes, and other geohazards induced pipeline vibration tends to be low in 10-100 Hz ranges. The duration of each vibration also tends to be slow and intermittent. Their intensity will be higher when they happened closer to the pipeline. Timely alerts and remedial actions taken for accident prevention.
- Drilling, cutting and direct mechanical actions (including gears induced wear vibration) on the metal pipeline tends to be higher in frequency domains and their actions tends to be continuous for a reasonable time domain.

This type of vibration wave tends to travel far and thus easily intercepted with AVANTE PIMS installed in kilometer or less distance between sensor modules and at choke points for timely actionable alerts. Theft and equipment failure induced loss can be minimized.

- The data from all sensor modules are gathered in suitable period and duration, they are collected in a separate controller and processor that are powered by battery and preferably backed with recharging from solar when other power sources are not available.
- The locations besides pre-assignment IP addresses of the monitoring unit and are logged with the data that are also tagged with GPS location and date-time incorporated in the monitoring system.
- The data are communicated in high speed with iridium satellite, and one of cellular, satcom, Wi-Fi, LoRAN, wireless mesh network, etc. to central monitoring center server for 24/7/365 monitoring and in case of exceptions, to provide real-time alerts.

Vibration Analysis is Used in Distinguishing Excavation and Geohazards from Drilling and Cutting.

Subsea/swamp Implementation

For implementation in a largely water based environment satellite communication is not viable unless antennas can be positioned above water. For a subsea system communication wires are laid between nodes and back to a node that is not subsea where communications can be relayed on via satellite communication methods.

User Interface Specification

- Provides an interface that allows the user to observe the status of nodes along the pipeline
 - Notify the user when an attack is detected.
 - Provide daily node status reports.
 - Notify the user when battery power is lost.
 - Notify the user if a node is tampered with.
- These reports will indicate to the user if any maintenance is required.
- A Satellite photo style map will show the pipeline, nodes and location of attack events.
- An attack event report will also indicate the location of the attack with approximate GPS coordinates.
- A report detailing the history of previous attacks, battery failures and node status can be generated.
- Password protected.
- The interface will not provide exact locations of nodes to prevent this information being disseminated.

The Control rack and monitor interface: The rack (**figure: 3**) below will house an industrial server (4U) running windows 7 professional. It will have an i7 cpu with 16 GB of Ram and 1 TB hard drive that is raid 1 configured. Two desk mounted 22" LCD monitors for the HMI (Assume you have now seen the HMI interface?) Power supply will be via a standard 220V or 110V (please tell us what you have in your facility). We will also have the Iridium modem and antenna jack (SMA interface) to hook the Antenna into. A UPS will be provided to give 15 minutes up time should power fail in the facility.

Also have an iridium satellite communications modem and act as the server for receiving satellite data from the nodes The antenna again would be the same size as the ones used for the nodes and we would suggest mounting it with a view of the sky

The industrial server will have Wi-Fi and Ethernet support as standard. If you require the server patching into your network please let us know. As standard you will have full admin access on the PC so your IT department can add any domain restrictions as they see fit.

We also have an optional Ipad / Iphone (and android) app that your remote engineers / security can use to interface back to the server to clear alarms / add notes to the alarm status (i.e. breach found, need repair, intruder in custody, etc).

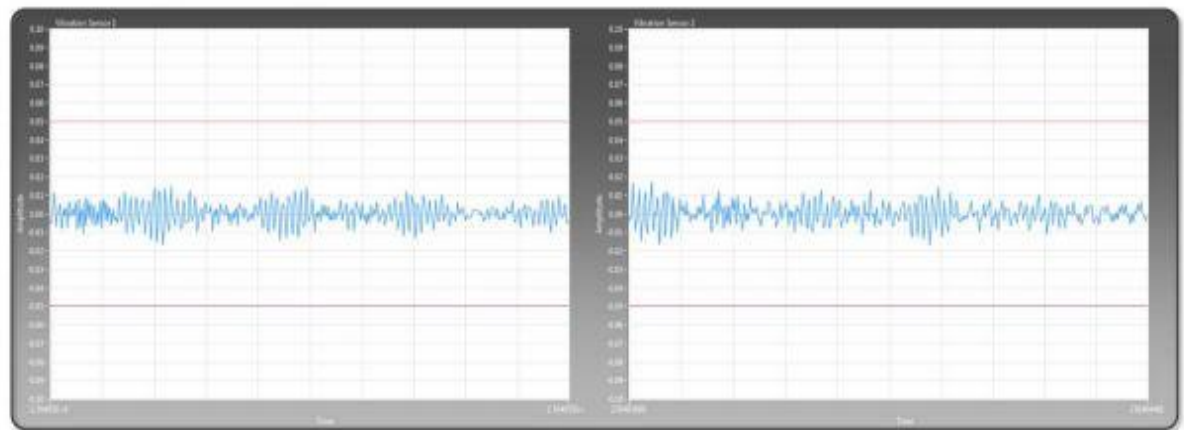
You do have cost options to increase the size of the UPS uptime on power failure, Change screen size / number of monitors, Smart apps for remote working staff, larger hard drive / RAM, different raid configuration.



The Rack and Monitor interface.

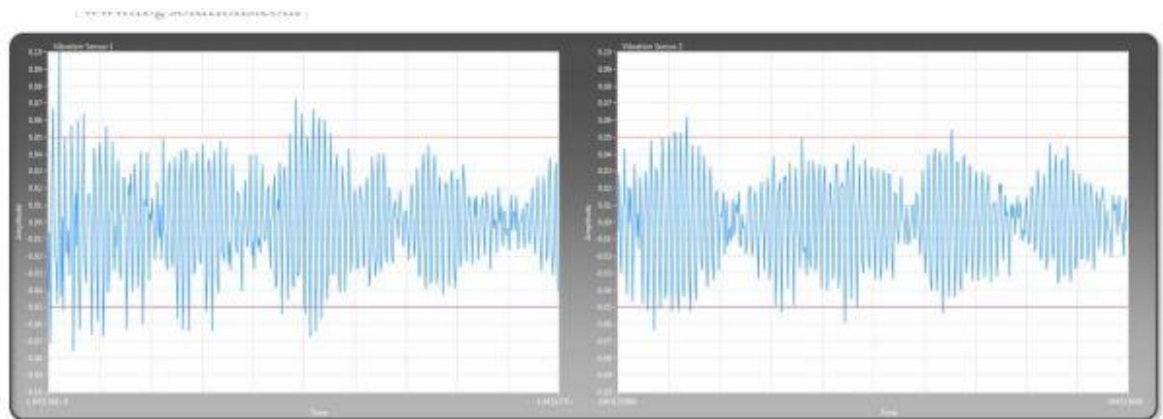
Figure 4 a & b below:

Vibration data at node showing vibrations from a third party event passing the pre-set threshold and triggering an event alarm. This is not typically viewable by the user and is presented to illustrate the collection of vibration data in the node.



Pipeline Monitoring System

Vibration data at a node showing background vibrations. This is not typically viewable by the user and is presented to illustrate the collection of vibration data in the node.

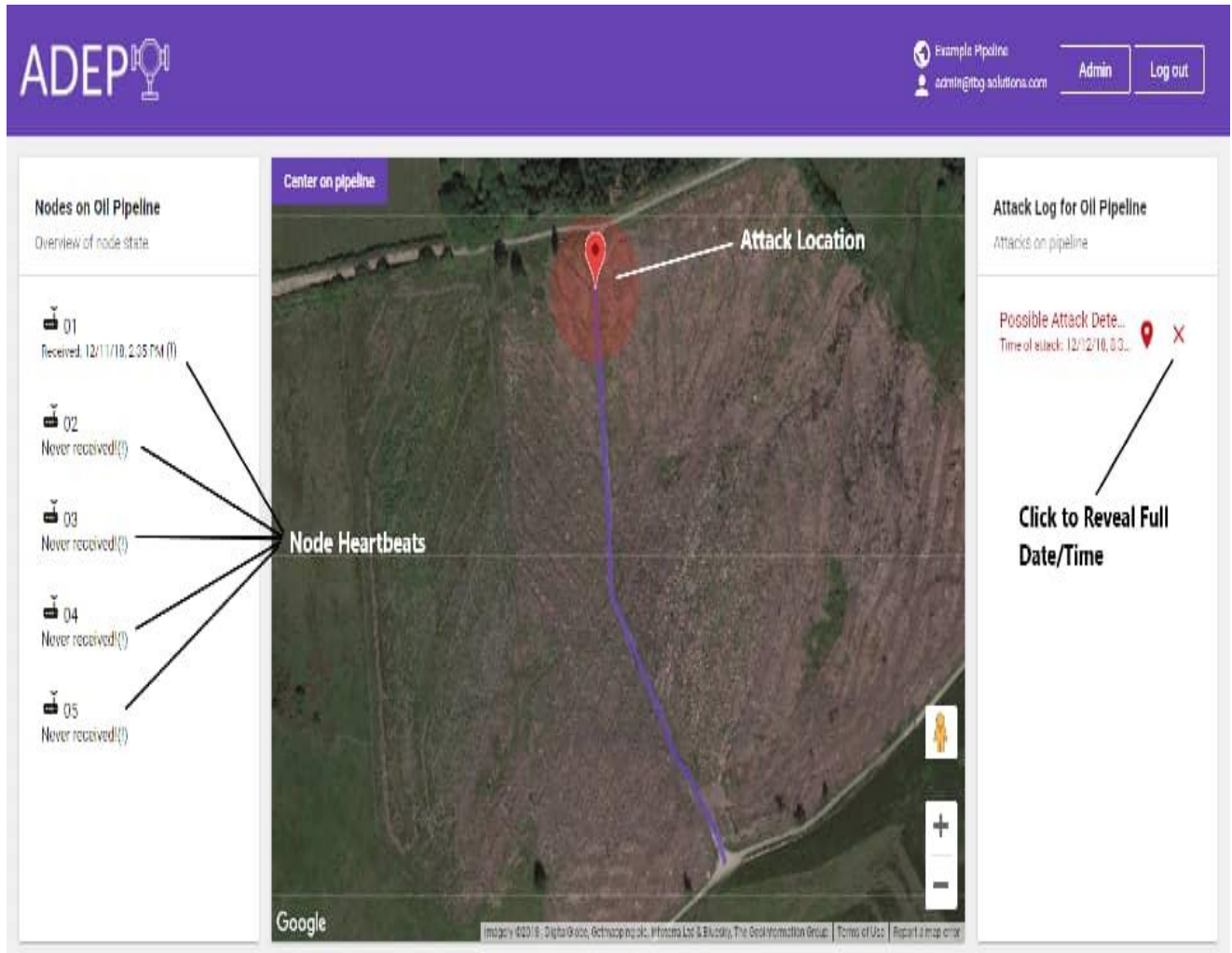


Pipeline Monitoring System

Vibration data at node showing vibrations from a third party event passing the pre-set threshold and triggering an event alarm. This is not typically viewable by the user and is presented to illustrate the collection of vibration data in the node.

PIPELINE ATTACK DISPLAY

Third party events on pipeline displayed on monitors for the HMI (Assume you have now seen the HMI interface below both mobile phones and computers in the control/Guard station rooms ALARTING the security operatives of the Pipeline monitors the HMI



Message will be displayed on both mobile phones and computers in the control/Guard station rooms ALARTING the security operatives of the Pipeline.

Pipeline Inspection

As a third party Inspection Company, Acousto-Ultrasonic Integrity Energy Services renders services like, Welding Inspection, NDT, SIT and Ultrasonic Inspection. We have covered a good numbers of high profile projects for our clients in the UK collaboratively and individually.

Subsea Inspection

We mobilize and conduct riser/umbilical inspection services for our client, with our team of qualified Inspection engineer, Acousto-Ultrasonic Integrity Energy Services is readily available to respond to our client's inspection request.

Integrity & Reliability Inspection

We carry out integrity & reliability inspection of equipment and machinery by monitoring its corrosion and vibration level to predict possible failure.

Our Capabilities

As established player in the oil and gas industry, we have the capabilities of supplying high standard equipment & chemical to our clients with technical capabilities in the areas such as Pipeline Integrity, corrosion monitoring and Inspection services. Acousto-Ultrasonic Integrity Energy Services provides mission critical inspection services to our clients, helping them optimize operations, mitigate challenges, and improve reliability, safety, production and asset management.

At Acousto-Ultrasonic Integrity Energy Services, we incorporate design, maintenance, Inspection, operations and management concept to achieving a successful asset Integrity Management 'AIM' program both upstream and downstream.

Our Believes

Best practice facilities must have comprehensive, fully integrated system and a culture directed at gaining greater lifetime effectiveness, value, safety, available, profitability and return from production and manufacturing asset

Integrity and Reliability

Acousto-Ultrasonic Integrity Energy Services Ltd, we carry out integrated Integrity & Reliability Inspection of equipment making sure the equipment meets its functional performance within a particular time frame as specified and guaranteed by the manufacture.

Oil Platform integrity inspection and vibration monitoring

We have proven track records working on sensitive platform and plants mitigating risk.

Acousto-Ultrasonic Integrity Energy Services Ltd provides mission-critical asset integrity management (AIM) expertise and services to our clients, helping them optimize operations, mitigate challenges, and improve reliability, safety, production and asset protection.

Asset Integrity Management

The primary objective of any Asset Integrity Management program is to maintain an asset in a fit-for-service condition while extending its remaining life in the safest, most reliable and cost-effective manner.

Storage Tanks Integrity inspection and corrosion monitoring

We look beyond our nose when it comes to equipment compliance and incorporate design, maintenance, inspection, operations and management concepts to achieving a successful AIM program both upstream and downstream. Best practice facilities must have comprehensive, fully integrated systems and a culture directed at gaining greater lifetime effectiveness, value, safety, availability, profitability and return from production and manufacturing assets.

We provides specialists and engineering support in all areas of Asset Integrity Management to Include

a) Pipeline Integrity Management

Pipeline Monitoring Real-Time using Lab VIEW, compactRIO & FPGA

b) Mechanical Integrity Management

c) Structural Integrity Monitoring

d) **Vibration Monitoring:** In a competitive marketplace, reliability, uptime, and operational cost of equipment can significantly impact the competitive posture of any facility. To optimize predictive maintenance of machinery and therefore the machine's reliability and utilization, monitoring health indicators such as mechanical, vibration, and power factor is a widely accepted practice. With the use of LabVIEW, CompactRIO & FPGA vibration and power monitoring devices, to overcome historic cost barriers. These provide an advantage for machines that have large surface areas or moving parts such as oil platforms and refinery structures.

e) Corrosion Services

i- Storage tanks corrosion mapping using Acoustic emission technique.

f) Design Review and Verification

g) Risk-Based Inspection (RBI)

h) Maintenance Strategies

i) Software Tools i.e. LabVIEW & FPGA with CompactRIO.

LabVIEW is a PC-Based that uses a combination of modular hardware, application software, and computer to take measurements and also data acquisition and instrument control applications to measure an electrical or physical phenomenon such as frequency, voltage, current, temperature, pressure or sound.

CompactRIO is a Programming tool for rapid development with automation controller hardware, reconfigurable control and acquisition system. It features embedded real-time processor for stand-alone or distributed operation.

FPGA is Field programmable gate arrays hardware-chip that provides the flexibility and performance with built-in-signal connection to variety of sensors and actuators.

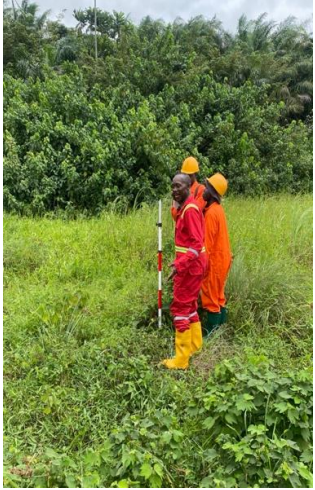



We also provide support in:

- **Management Strategies**
- **Health, Safety, Environmental Strategies (HSE)**
- **Training, Reviews and Auditing**

Acousto-Ultrasonic Integrity Energy Services Limited(AUIESL) went into understanding with **TBG Solutions** Engineering Company Limited and **National Instrument** in carrying out and providing engineering solutions.

We also supply and Installed Real-time Person-Borne Analysis to Detect Concealed Weapons & Explosives Objects Act System from our partner **THERMAL MATRIX**:

We also supply and Installed Real-time Person-Borne Analysis to Detect Concealed Weapons & Explosives Objects Act System from THERMAL MATRIX.

			
<p>Site Inspection for Nodes Installation at Forcados Receiving Manifold(FRM)</p>	<p>Sensor Installation on Field.</p>	<p>Complete installation of Sensors on site - FRM</p>	<p>Installation of the nodes on site.</p>