1 COMPANY

3 PLATFORMS

Remote Non-intrusive Corrosion Monitoring
- Installed Ultrasonic Sensors
  - Dual & Ultra-high Temp
  - Cellular & Wired Systems

Ultrasonic Solutions
- Applications Engineering
  - Customized Transducers
  - Standard Transducers

Remote Visual
- Inspection Cameras
  - Retrieval Tools
  - Sampling Tools
We **Offer**

The very best minds in the highly specialized fields of ultrasonic and remote visual technologies

We **Deliver**

Smarter solutions with a refreshingly personalized approach for the world’s critical asset management applications.

We **Specialize**

In the design and fabrication of industrial ultrasonic transducers and tooling for demanding in-situ test and inspection applications.
specialists in smarter solutions

ONE TEAM

300+ years of experience

Jim Shimp: Transducer Designer 38 years • Derrick Andreassi: PSU Intern ME • Tom Jenkins, BSEE: Transducer Designer 19 years • Lee Wagner: Lead Machinist 20 years • Jeremy Cirota, BSCE, MSME: Transducer Designer 4 years • Jesse McCaulley: CNC Operator 7 years • Suzanne Hackenberry: Transducer Assembler 17 years • Guy Roszel, BSME: Transducer Designer 4 years • Tina Hall: Transducer Assembler 24 years • Dane Hackenberger: Transducer Designer 38 years • Bruce Pellegrino: Marketing 37 years • Steve Strachan: BS Finance – Sales 9 years • Mark Feydo, BSEE: Instrument Designer 25 years • Jeff Anderson & Holly, BSEE: General Manager 29 years • Shelley Miller: Office Manager 31 years • Bob Shaffer, BSME: Transducer Designer 10 years • Dr. James Barshinger, BSME, MSME, PhD: President / CTO 15 years • Jeff Drost, BSME – RVI Product Manager 30 years • Not shown: Alfred Ng, BS, MS: ASIA Commercial Leader 30 years • Not shown: Alfred Ng, Zach Anderson, Brenda Harrop, Les Fultz and Jim Fultz

Smarter Solutions For Your Complex Asset Integrity Challenges
Smarter Solutions

For Your Complex Asset Integrity Challenges

asset integrity meets

THE INTERNET OF THINGS

 Seamlessly translate ultrasonic thickness measurements and metal-loss rates from an asset to your desktop or mobile device
remote, non-intrusive  CORROSION MONITORING

Refineries
- Flow Accelerated Corrosion (FAC)
- Microbiologically-induced Corrosion (MIC)
- High-pressure steam lines
- High point vent
- Baseline of new assets

Power Generation
- Chemical inhibitor process control
- Localized corrosion mgmt.
- Naphthenic Acid (HT) monitoring
- Pipeline Integrity (River/Road Crossings)

Others
- Pulp & Paper Mills
- Chemical Processing
- DOD/Military
- Aerospace
- Transportation (Rail)
- DOT/Bridges
- Mining
Smarter Solutions  For Your Complex Asset Integrity Challenges

remote, non-intrusive

CORROSION MONITORING
with installed sensors

Remarkably cost-effective, modular and robust solution for monitoring of ID corrosion and erosion using the latest solid-state electronics, wireless or wired technologies, cloud based software and innovative ultrasonic transducer designs.

- Calculating corrosion rates
- Monitoring known “low spots”
- Used in lieu of or in conjunction with invasive methods
  Coupons, ER probes, etc.
- Reducing recurring costs
- Continuously accessing more and better data on asset condition
Remote Asset Integrity Monitoring

Measure it. Manage it.

Smart PIMS Modbus Wired Solutions

✔ Modbus (static)
- Hard wired for areas w/out cellular or wireless infrastructure
- Passive system: No battery on board
- Data collected manually via tablet
- View real-time data from any connected tablet, PC or your control room
- ’Daisy-chain’ up to 32 DSIs on 1000’ RS-485 cable
- 16 single element or 8 dual element per DSI
- Temporary or permanently affixed sensors

✔ Modbus DL (DataLogger)
- Battery and on-board local storage
- Takes readings on defined intervals (ex. 1 x per month)
- Download all data to local device on 30th day
- UL/CSA: CI/D2, A-D, T4 rated
matPIMS
mat sensor

Array of piezo transducers
• Currently focused on linear array
• Extendable to 2D

Low profile
• < 0.010”
• Rugged, robust

Up to 32 channel & 60” length
• 1x15, 3x5, 1x32, 2x16, 4x8, etc.

DSI integrated with transducer

Multi-drop, digital addressable
using table, PC or integrated with other systems via RS485 / Modbus

Thickness range: 0.100” - 2.00”

Temp range: -30°F to 150°F

Smarter Solutions For Your Complex Asset Integrity Challenges
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- Wireless digital networks (Verizon or AT&T)...2G, 3G, 4G, LTE, etc.
- Battery life: 5-7 years
- Little to no IT support needed
- Cloud-based back end (webPIMS) for trending, analysis & reporting
- Login from anywhere, real-time to view readings / status of sensors or asset conditions
- 16 single element or 8 dual element per DSI
- Temporary or permanently affixed sensors
- UL/CSA: CI/D2, A-D, T4 rated

Remote Asset Integrity Monitoring
Measure it. Manage it.
**TRANSDUCER TYPES**

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
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<tbody>
<tr>
<td>Safe</td>
<td>Non-invasive to the asset’s pressure boundary</td>
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<tr>
<td>Absolute</td>
<td>Ability to directly measure remaining wall thickness. NOT a proxy for wall loss</td>
</tr>
<tr>
<td>Extremely Accurate</td>
<td>To 0.001” (0.025 mm), with ability to measure down to 0.040” (1 mm) in carbon steel, especially for fixed-location probes</td>
</tr>
<tr>
<td>Rugged, Reliable, Portable</td>
<td>Low recurring maintenance costs</td>
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<tr>
<td>Versatile &amp; Cost-effective</td>
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Continuous access to more & better data.

AWS-hosted cloud-based data management and remote monitoring for ultrasonic thickness measurements from installed UT sensors.

- View, report, analyze
- Remote collaboration
- Data can be hosted by SNI or by user
- Corrosion rates
- Set alarms for assets
- GPS sensor locations
- A-scan viewing
SAMPLE DATA: smartPIMS with DUALS
SAMPLE DATA: smartPIMS with HT

Temp compensation
Smarter Solutions For Your Complex Asset Integrity Challenges

INSTALLATION

Short Term (up to 12 months)
- Non-solidifying couplant (Viscotaq)
- Temperature range: -31°F (-35°C) up to 176°F (80°C)
- Needs secondary mechanical attachment (magnet / band / other)

Long Term (permanent)
- Adhesive (Cotronics EE132), others available
- Temperature range: -31°F (-35°C) up to 500°F (260°C)
- Dry couple (foil + band clamp, temperature ranges: -40°F (-40°C) up to 900°F (500°C)

DSI Mounting / Bracketing
- Up to 25’ from probes
Case Study

- Asset owner picked one CML over 1-yr. time period to compare manual UT vs. installed UT readings
- Manual readings taken bi-monthly and plotted on scale above

Results

- Precise: No
- Accurate: Maybe
- Repeatable: No
- Corrosion Rate: Undiscernible
- 6 readings x $75/CML = $450 for 1 yr

Represent manual UT readings
MANUAL VS. INSTALLED SENSOR COMPARISON

Case Study

- Asset owner picked one CML over 1-yr. time period to compare manual UT vs. installed UT readings
- Manual readings taken bi-monthly and plotted on scale above

Results

- Precise: Yes
- Accurate: 0.001” (1 mil)
- Repeatable: Yes
- Corrosion Rate: ~20mpy (~10mils loss in Sept-Oct)
- ~$1,500 / point... for life

Represent manual UT readings
Operator performed ILI using a smart pig to inspect a segment of their crude oil pipeline.

The ILI report showed a number of pits which were not present the last time the ILI was completed.

The operator wanted to know if the pits were episodic in nature or were growing (if so, at what rate).

Application

Asset integrity post inspection
- ILI run was performed, DA is executed, inspection company manually scanned and marked pits
- SNI installed probes on exact pits called out by inspection

Product Used

smartPIMS Modbus configuration w/ 8 dual element probes permanently attached to monitor pits
- smartPIMS systems are completely buried after DA is complete
- Operator will send personnel to defined locations quarterly to collect data w/ tablet

Outcome

Operator did NOT have to fix/repair, kept line running and continue normal ILI inspection intervals
Pit-track™

A unique ultrasonic hardware & software solution that allows asset owners to precisely monitor critical individual pits for growth

- Multiple dual-element transducers
- Measure down to 0.040” (1mm)
- Resolution to 0.0001” (2.5 micron)
- Temp range: -5⁰ to 300⁰F (-20⁰ to 150⁰ C)

When combined with SNI’s smartPIMS electronics and cloud software, multiple pits can be tracked with auto-alarm capability via e-mail.

Used post ILI and/or in conjunction with conventional UT scan data, Pit-track can monitor multiple individual pits with high precision.

Patent Pending
Flexible architecture
- Wired, cellular or wireless options

Single or multi-point options

Buried or above ground

Attached permanently or temporarily
- Up to 300°F: Magnets w/temp. couplant or epoxy
- Up to 900°F: Dry coupled / metal foil & clamped
- Systems can be moved / redeployed

Ease of deployment / installation
- Low cost: Fast, easy, no need for SNI to be on site
- No stud welding
- Little to no IT support required
- Data available in hours vs. days or weeks

Data backend
- Export to .XML / .CSV
- Integrated with other software programs
- All sensors connect to webPIMS
OVERVIEW

ULTRASONIC SOLUTIONS

Applications Engineering

Customized Transducers

Standard Transducers
Conventional TRANSDUCERS

- Utilizing state-of-the-art piezo-composite elements
- Offered with Quick Swap wedges for shear-wave weld inspection
- New MCX-style, low profile, swivel connectors
- Wide variety of sizes and frequencies
- Shipped with certification documents
  RF waveform, frequency spectrum, average center-frequency calculations
Smarter Solutions For Your Complex Asset Integrity Challenges

customized

TRANSDUCERS

Using industry-preferred design and simulation tools to create an optimized mechanical, electrical and ultrasonic model of the inspection task, including its scan plan

CAPABILITIES

SolidWorks
• Parametric 3D CAD
• Mechanical Properties Modeling

AutoCAD
• 2D CAD and Ray-tracing

CIVA
• Acoustic Beam Modeling and Delay Law Calculation for Conventional and Phased Arrays

PiezoCad & Field II
• Transducer Construction & Performance Modeling

UltraVision 3D
• NDT data imaging and analysis software for Conventional and Phased Arrays

ES Beam Tool
• Ultrasonic Inspection Plan Design and Validation Software
custom transducers

Solutions

AEROSPACE & NUCLEAR POWER APPLICATIONS

- In-Situ
- Phased Array
- O.D. Transducers
- Pulse-echo Arrays
- ASME Section XI
- Compound-radius Wedges
- 7 MHz Ultra-high-temp Delay Line
- SensorScan™ QS
- Small-diameter (< 0.25” / 6mm) ID Bore Probes
- 2 MHz PAUT Dual
In-Situ custom transducers

Self-aligning wand transducers for hard-to-access rotating equipment inspections

- 1-20MHz
- 0.1- 0.5" diameters
- Conventional shear-wave and PAUT types
- Available options: single-axis articulation, integral couplant delivery and CCTV
custom transducers

Phased Array

Linear & Matrix Models

- Annular, Daisy & Circular
- Contact & Immersion
- Single & Dual
- Flat & Curved
custom transducers

O.D. Transducers

For tubing weld or braze joints

- Clip-op fixture with integral transducer and couplant supply improves POD and consistency.
- Scalable to any size tube or pipe O.D.
- Normal-incidence longitudinal or angle-beam shear wave.
- Any frequency
custom transducers

ASME Section XI

Compound-radius Wedges

- Refracted longitudinal
- Phased-array duals
- Contact or immersion
- TOFD
- Complex wedges & delays
custom transducers

Delay Line

7 MHz Ultra-high-temp

- Transducer and mounting clamp
- Continuous duty at 500°C (932°F)
SensorScan™ QS

Conventional transducers for Quick Swapping onto delay lines or wedges
custom transducers

I.D. Bore Probes

Small-diameter (< 0.25” / 6mm)

- Shear-wave
- L-wave
- Duals
- Tandem
2 MHz PAUT Dual

With 2 x 16 elements per probe and detachable wedge
Our process:

1. Customer Issue
2. Special Probe Request
3. Application Request
4. Close Customer Interaction
   - Import Component Data files for Modeling
   - Build 3D mock-up or receive Customer samples
5. Concept Design
   - Fabricate Gen-1 Prototype for testing
   - Modify design as needed / Build Gen-2 for QC & Testing
6. Finalize design for production
7. Full documentation (mechanical, electrical and acoustic)
Remote Visual, Retrieval and Sampling Tools

Specializing in visual inspection technologies, Foreign Object Search and Retrieval (FOSAR) tools and custom design services
Inspection camera

PTZx

Portable, Industrial, Waterproof

A Pan-Tilt-Zoom-Lights, High-Resolution Color Video Inspection System

- State-of-the-art white LED lighting provides > 1700 lumens of cool white-light
- Add-on auxiliary lighting to brighten the darkest of environments

Loaded with features to efficiently inspect tanks, vessels, drums and other large confined spaces and piping systems
Complete Retrieval Tool Kits and Standard Tools for FOSAR: Foreign Object Search and Retrieval

- Including: alligators, magnets, snares, grippers and more
- Made of polished stainless steel construction
- Submersible and portable

Ideal for hazardous environments and confined spaces
THANK YOU!

CUSTOMERCARE@SENSORNETWORKSINC.COM OR (814) 466-7207