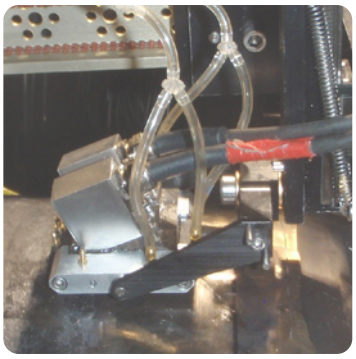
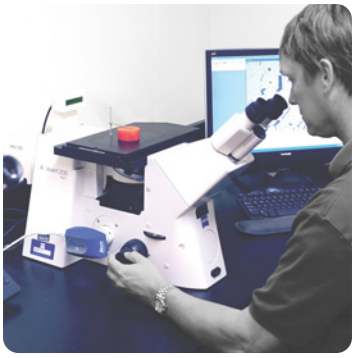
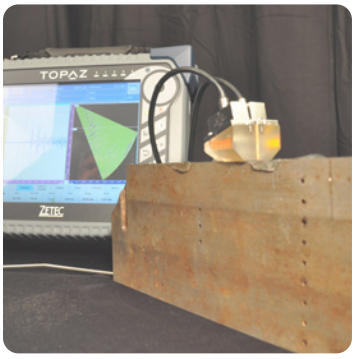
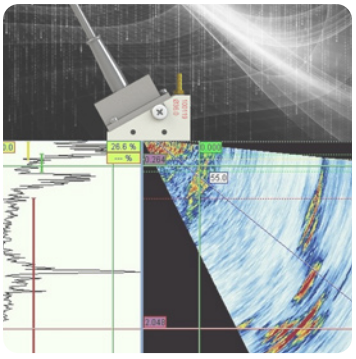
Structural Integrity Associates, Inc.®

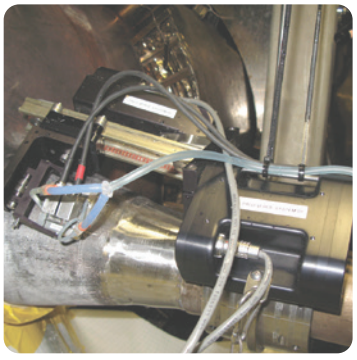
NUCLEAR POWER
NON-DESTRUCTIVE EXAMINATION (NDE) SOLUTIONS



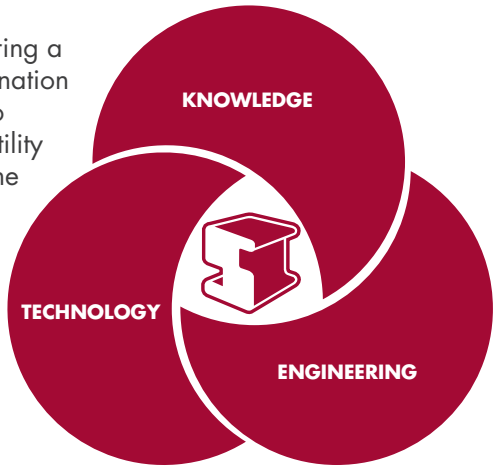




OUR MISSION

To provide the highest value nondestructive examination and monitoring services available through the integration of knowledge, technology, and engineering support

STRUCTURAL INTEGRITY has a team of world-class NDE professionals, pairing a wealth of industry-leading experience with cutting-edge technology. This combination empowers us to provide fully integrated inspection and engineering solutions to address the unique challenges faced by nuclear plants. SI has been a trusted utility partner for more than 40 years, providing comprehensive solutions to extend the life of critical assets and ensure plant sustainability.



We are committed to excellence, driven to innovate, and dedicated to supporting the nuclear industry well into the future. We are constantly developing new NDE technologies and coupling them with innovative engineering practices to minimize the burden and maximize the value of critical inspections.

KEY NDE STATISTICS

50+
Plants Serviced

200+
Outages Supported

250+
Combined Years of Experience

Worldwide Services

WORLD-CLASS PROFESSIONALS

Dedicated to ensuring that NDE results are accurate, reliable, and deliver an informed material condition to asset owners

NDE is only as good as the person applying it and for this reason, SI invests significantly in the development and qualification of our NDE professionals. Our NDE team includes Level I, II, and III certified technicians that hold multiple qualifications within the EPRI Performance Demonstration Initiative (PDI) program and have decades of experience in the successful application of NDE in the nuclear industry.

Our teams is actively engaged in the American Society for Nondestructive Testing (ASNT), the American Society of Mechanical Engineers (ASME), the Electrical Power Research Institute (EPRI), and other organizations, helping to develop the codes, standards, and best practices that guide the application of NDE around the world.

INDUSTRY-PROVEN PROGRAMS

NUCLEAR NDE PROGRAM

SI has supported advanced NDE applications for more than 20 years. Our nuclear NDE program recognizes and fully complies with ASME Code, as well as Regulatory and Industry requirements and guidance from the following sources:

- ASME Section XI: Rules for Inservice Inspection of Nuclear Power Plant Components
- ASME Section V: Nondestructive Examination
- 10CFR50.55a Codes and Standards: Invokes, incorporates by reference and modifies ASME Code and Code Cases and industry documents
- Primary ASME Section XI NDE-related Code Cases:
  - N-770-5: Alternative Examination Requirements and Acceptance Standards for Class 1 PWR Piping and Vessel Nozzle Butt Welds Fabricated with UNS N06082 or UNS W86182 Weld Filler Material
  - N-824: Ultrasonic Examination of Cast Austenitic Piping Welds From the Outside Surface
  - N-831-1: Ultrasonic Examination in Lieu of Radiography for Welds in Ferritic or Austenitic Pipe
- NUREG-1801 and -2191: Generic Aging Lessons Learned – technical basis reports for plant license renewal, address the initial (40 to 60 years) and subsequent (60+ years) periods, including augmented NDE requirements.
- EPRI Performance Demonstration Program - Industry Implementation of Section XI, Appendix VIII

COMMERCIAL NDE PROGRAM

SI supports a wide range of NDE applications in non-nuclear power generation and other critical infrastructure facilities. This breadth of experience enables us to accurately characterize unique conditions and utilize the most advanced technology. Our commercial NDE program complies with Recommended Practice SNT-TC-1A for Personnel Qualification and certification in Nondestructive Testing and applies to all non-Section XI examinations within nuclear as well as other industries.

OUR QUALIFICATIONS

- **PDI 1** – Conventional UT of Ferritic Steel Welds
- **PDI 2 w/IGSCC** – Conv. UT of Austenitic Steel Welds
- **PDI 3 w/IGSCC** – Thru-wall Sizing in Ferritic/ Austenitic Steel Welds
- **PDI 12** – Manual PAUT of RPV Welds
- **PDI 13** – Manual PAUT of Nozzle-to-Shell and Nozzle Inner Radius
- **EPRI-PIPE-MPA-1** – Manual PAUT Piping
- **EPRI –PIPE-TWS-MPA** – Manual PAUT Piping Thru-wall Sizing
- **SI-UT-130** – Manul DMW PAUT
- **SI-UT-217** – Automated/Manual Encoded DMW PAUT
- **SI-UT-218/EPRI-ENC-DMW-PA1** – Encoded DMW PAUT
- **SI-UT-126/EPRI-WOL-PA-1** – Manul WOL PAUT
- **SI-UT-149** – Encoded WOL PAUT
- And more…

NDE METHODS & TECHNOLOGIES

We strive to use technology, knowledge, and experience in new ways to provide valued solutions for our clients. Armed with the facts about equipment condition, owners can make informed decisions about asset management and equipment's fitness for service.

ACOUSTIC EMISSIONS TESTING - (AE)

- Heavy Lift Equipment, Leak Detection, Transformer Monitoring
- Safety and Non-safety related applications
- Significantly reduces inspection time and associated dose

ELECTROMAGNETIC TESTING - (ET)

- SIPEC™ Dynamic Pulsed Eddy Current
- Eddy Current Testing (ECT)
- Eddy Current Array (ECA)
- Tangential Eddy Current Array (TECA)

GUIDED WAVE TESTING - (GWT)

- Rapid, cost-effective inspection of buried, insulated, or otherwise inaccessible piping
- Long-Range, Short-Range and Monitoring technologies
- Detection of corrosion in remote inaccessible locations

ULTRASONIC TESTING - (UT) NDE

SI Provides numerous manual, semi-automated, and fully automated scanning systems to perform UT

- **Conventional UT** (low frequency and high frequency)
- **Advanced UT**
  - Phased array UT (linear array, annular array, matrix array, and FMC/TFM)
  - Immersion UT testing, Time of Flight Diffraction (ToFD)

LIQUID PENETRANT TESTING - (PT)

Liquid penetrant examination is an economical and versatile way to check for material flaws open to the surface of non-porous materials. PT is often used for on-site inspection of welds, boiler tube sheets, pressure vessel castings, and non-magnetic materials for cracks, pitting, and breaks.

3D SCANNING PROFILOMETRY

Conventional pit gauge measurement of external corrosion on pipe surfaces can be a time-consuming and inaccurate process. 3D laser scanning improves accuracy, dramatically reduces the amount of time spent gathering data for external corrosion on piping, and creates accurate 3D models of difficult-to-measure parts.

MAGNETIC PARTICLE TESTING - (MT)

Magnetic particle examination is used to identify surface and near-surface defects in ferromagnetic materials. This technique uses ferrous particles with an applied current to allow the inspector to determine the location of the indication for further review. MT does not require as extensive cleaning or surface preparation as other techniques, and is often used with inspection of welds, seams, boiler tube sheets, pressure vessel castings, and water tubes.

MATERIAL CHARACTERIZATION

- Positive Material Identification (PMI)
- Laser Induced Breakdown Spectroscopy (LIBS)
- Hardness Testing
- Field Metallographic Replication

NDE TRAINING SERVICES

SI offers industry-specific training courses to help our clients understand the different NDE methods and technologies and put the best to use. We provide a general introduction and review of the most common NDE methods, hands-on technology demonstrations, structural Health Monitoring (SHM) concepts, and technologies and a general process for matching inspection needs with NDE methods, technologies, techniques, code compliance, quality control measures.

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INNOVATIVE SOLUTIONS

Structural Integrity has a long history of industry-leading experience in the implementation and the introduction of new non-destructive evaluation technologies that provide value to our clients through improved information gathering and more efficient inspections.

2006 — First to apply PAUT in lieu of Radiography Testing on an ASME Class 1 Component

2006 — First to develop and qualify a manual phase array ultrasonic testing (PAUT) procedure for weld overlays

2008 — First to create and qualify a manual PAUT procedure for the examination of dissimilar metal (DM) welds

2010 — First to develop and qualify an automated PAUT procedure for heavy-wall, full-structural weld overlays installed on main loop RCS piping

2013 — First to develop, patent, and deploy a PAUT solution for high-density polyethylene piping in the nuclear industry

2017 — First develop, qualify, and deploy a manual-encoded PAUT procedure to examine dissimilar metal welds with our LATITUDE™ non-mechanized encoding technology

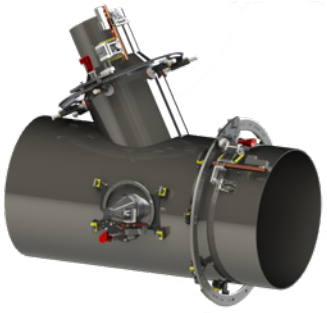
2024 — SI Introduces first commercial CASS examination solution.

SI has extensive experience designing and manufacturing custom tools to facilitate unique and/or challenging inspections. We are also proficient at developing, testing, and validating novel sensors and implementation technology to improve detection and enable characterization of previously un-inspectable configurations.

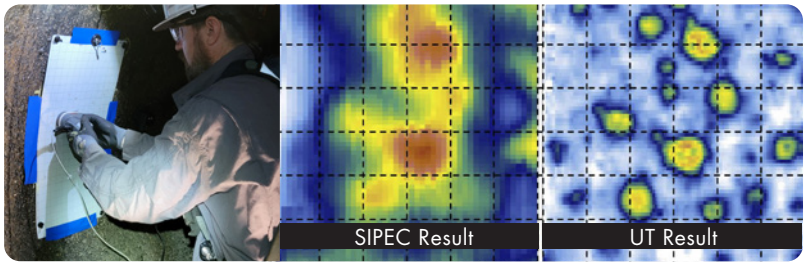
High Density Polyethylene, HDPE Scanner

LATITUDE™ Manual Encoding Scanner

Robototic Tank Inspection Vehicle



Reactor Coolant Piping Scanners



SIPEC™ Dynamic Pulsed Eddy Current Inspections through Coating/Buildup

SIIQ™ Remote Monitoring Technology

Thick-Film UT for Online Monitoring

NDE APPLICATIONS

UT ILO RT

For new construction and replacement weld examination services, SI is well-versed in code-compliant ultrasonic examinations performed in lieu of radiography. Code compliant UT examinations can be performed per the requirements of B31.1 and B31.3, including applications of ASME Case 189. Since these exams can be conducted concurrent with fabrication activities (i.e., no radiation source), results are higher welding production rates and more timely delivery of results for any repair needs.

CORROSION MAPPING

SI uses a high-resolution ultrasonic dual-matrix phased array probe for thickness mapping. This probe can be used with an encoding device or scanner to generate a detailed map of component thickness over large areas. For components with thick coatings, wraps, or liners, SI can use our SIPEC technology to map thickness through the coating layer. Advantages include:

- Digital data record allows third party verification and routine monitoring.
- Non-Invasive Inspections (NII).
- Encoded semi- and fully automated scanning available.
- Manual encoded examinations with LATITUDE™.
- On-line inspections, even at elevated temperatures.

SYSTEM INTERNALS

Structural Integrity provides NDE services for inspecting the walls and floors of tanks and other non-pressurized vessels using a variety of GWPA, SIPEC™ ECT, EMAT UT methods and technologies.

- Tank walls and the floor-to-wall region are inspected to EPRI license renewal guidelines using GWPA techniques.
- Tank floors receive 100% inspection coverage per EPRI guidelines via manual techniques or precision robotics.
  - Robotic examinations allow submersible inspections within full tanks to simplify implementation and limit risk.
  - Absolute Acoustic Positioning precisely positions and repositions the robot and probing device for subsequent inspections.

PRESSURE VESSELS

Structural Integrity provides truly integrated engineering solutions for High-Pressure Equipment by applying advanced engineering tools and inspection techniques. Our vast experience comes together to provide solutions that can reduce life cycle cost, reduce downtime and extend equipment life, such as our novel SI In-Vessel Automated Scanner (SIIVAS) system.

CASS COMPONENTS

In addition to current ISI requirements, License Renewal requires specific attention to CASS Cast Austenitic Stainless Steel components commonly found in RCS Main Coolant Loops and Pressurizer Surge Lines. Industry research, combined with our ultrasonic testing expertise and culture of innovation, has resulted in SI developing the first effective commercial solution to inspect CASS: Ultrasonic Procedure SI-UT-228 i.a.w. Code Case N-824 / ASME Section XI, App III, Supp. 2.

HEAVY LIFT RIGS

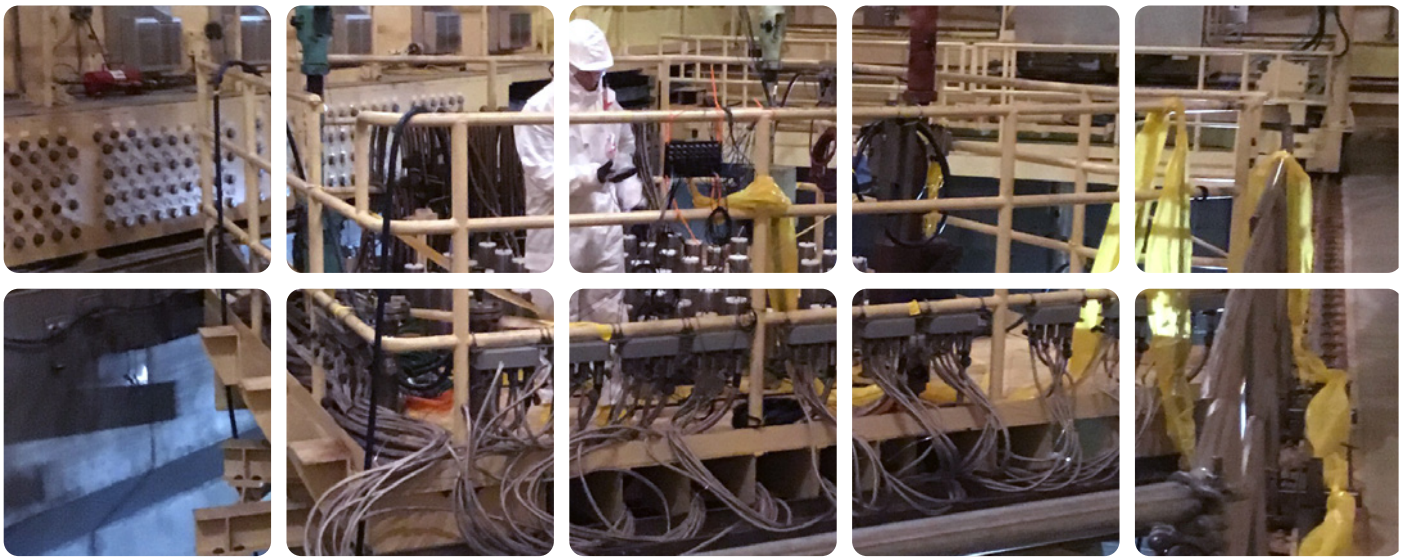
SI provides certified, experienced personnel, equipment and procedures for safety and non-safety related applications for heavy lift equipment testing, such as reactor head and internals lift rigs, ISFSI yokes, etc.

- State of the art flaw detection using acoustic emission technology
- Significantly reduces inspection time and associated dose.
- Global inspection results in targeted recommendations.

RAW WATER PIPING

Innovative, multi-technology approach to rapidly scanning and characterizing extensive portions of service water / emergency cooling systems. Can be applied to buried or above-ground piping.

- GWT to scan long sections of piping and identify areas with general corrosion.
- Corrosion mapping to develop thickness distributions/ profiles in local regions with significant degradation.
- Detailed PAUT to characterize worst-case wall loss.



WELD OVERLAYS (WOLs)

SI performs examination of WOLs installed either preemptively or in response to inspection findings. Full integration of NDE with engineering and welding activities enables optimized overlay design conditions and minimizes implementation time. Accurate characterization of WOL geometry and subsurface conditions enables detailed life assessment of the as-installed repair.

TURBINE & GENERATOR ROTORS

Solutions to ensure a safe, reliable, and efficient operation.

- Decades of expertise with technology development and application.
- Faster, less invasive, and lower cost alternative to OEM inspections.
- Complete open/clean/close services in combination with trusted partners.

DISSIMILAR METAL WELDS (DMWs)

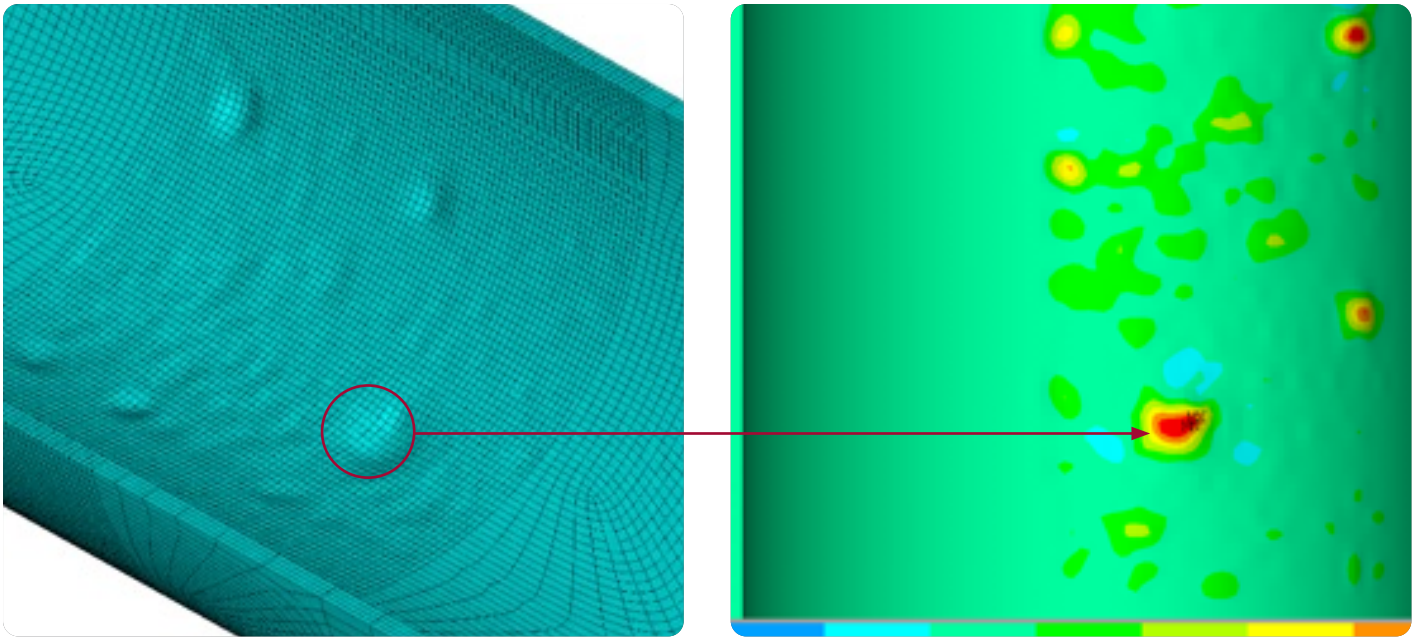
SI performs examinations of DMWs in accordance with Section XI, Appendix VIII requirements via PAUT methods. The scope and execution of these exams can be customized to address specific needs, with deployment options ranging from fully manual to manually encoded to fully automated. Results are rapidly processed and validated by experienced field technicians to support prompt decision making in the event of findings.

BURIED PIPING

- Coating Assessment
- GWT to identify remote/inaccessible areas with wall loss.
- Local UT to characterize defects (manual or automated).
- Soil sampling and corrosivity analysis.

OTHER APPLICATIONS

- HDPE Fusion Joint Examinations
- Socket-weld Examinations
- Austenitic/ferritic piping inspections (Appendix VIII, Supplements 2, 3),PDI 1 Examinations
- Vessel shell inspections (Supplements 4, 6)
- Third-party inspection oversight
- Coating Assessment
- GWT to identify remote/inaccessible areas with wall loss.
- Local UT to characterize defects (manual or automated).
- Soil sampling and corrosivity analysis.



COMPLEMENTARY ENGINEERING SERVICES

Turnkey, muti-disciplinary expertise to develop contingencies, evaluate findings, and maximize generation

SI was founded as an engineering company dedicated to addressing complex degradation problems in structural and mechanical components. This expertise is fully integrated with our NDE capabilities, enabling us to quickly assess and resolve problems identified during inspections.

ENGINEERING MECHANICS

Stress analysis and fracture mechanics to demonstrate fitness for service in accordance with ASME Codes, including Section III and Section XI. Can be performed in advance of inspections to improve margin, or emergently in response to unanticipated findings.

DAMAGE MECHANISMS

Expertise with modeling and evaluation of complex damage phenomena, including: fatigue cracking, vibration failures, stress corrosion cracking (SCC), general corrosion, flow accelerated corrosion (FAC), microbiologically induced corrosion (MIC), and many others.

CYCLE CHEMISTRY

Review and modification of operational procedures, chemical treatments, and process equipment to minimize degradation, improve performance, maintain reliable operation, and reduce cost.

RISK ASSESSMENT

Segment- or system-wide evaluations providing a quantitative ranking of locations mostly likely to exhibit degradation. Can be developed in advance to fine-tune inspection scope and prepare contingencies, or upon findings to evaluate extent of condition for appropriate scope expansion.

INSPECTION PLANNING, NDE MODELING

Development and optimization of exam scopes to ensure comprehensive characterization while minimizing risk. NDE modeling through CIVA and FEM to visualize inspection results, optimize sensor design, validate planned techniques, and eliminate the need for expensive mock-ups.

REPAIR DESIGN, ANALYSIS, AND IMPLEMENTATION

Contingency or emergent evaluation of repair methods to address as-found degradation in accordance with Code requirements; updates to design basis analyses; repair implementation (e.g., weld overlays, patch plates, etc.) and post-installation NDE.

REGULATORY SUPPORT

Extensive familiarity with ASME Code, code cases, and NRC guidelines to perform prompt operability determinations, prepare relief requests, and support productive regulatory interactions.

LABORATORY ANALYSIS

State-of-the-art metallurgical laboratory capable of characterizing material conditions, identifying damage mechanisms, evaluating root causes, and developing recommendations to avoid repeat failures.