

EDGE COMPUTING MAKES NDE SMARTER

Traditional nondestructive evaluation (NDE) has no use for edge computing, but that is about to change.

The use of artificial intelligence (AI) and machine learning (ML) requires significant computational power. As AI/ML adoption grows, the computational demands on inspection equipment increase rapidly. This is especially true for ultrasonics, but the same trend is seen in other NDE methods as well.

While cloud computing offers power, it's cumbersome for handling large, sensitive datasets. Standard laptops and off-the-shelf NDE equipment lack the necessary computational resources. The emerging solution is to add a separate computing unit to the system: an edge computer. This has surprising implications.

Background

Traditional inspections are done by keying in the settings on the screen of the NDT machine. The equipment may employ sophisticated electronics (like field-programmable gated arrays, FPGAs), but they must remain versatile—configurable and adjustable for any potential task the inspectors might face. As inspections grow more complex, it's becoming increasingly problematic to configure or program these machines. This leads to overly complex procedures,

where human inspectors need to manage the minute details of the inspection settings and oversee the process.

Then there are highly automated inspection cells, which complete predefined inspection routines with the help of complicated mechanics or robotics, acquiring data in a fully automated way. However, even in these cases, the underlying NDE electronics are often built on a general-purpose NDE device, with the smart features focused more on the mechanics than the NDE itself.

Inspections are getting more complex, with more channels, more elements, and more data. While more data improves inspections, it also places a significant burden on the evaluation process. Increasingly, advanced signal processing techniques like total focusing method (TFM) beamforming are used, further raising computational requirements.

All of this leads to overcomplicated inspection software and procedures for inspectors. The complexity then translates to reduced focus on inspection targets and increased risk of human error.

Progress Up Until Now

The way to deploy AI locally and easily on top of existing inspections turns out to be edge computing. These small

boxes contain impressive computational power and can be connected to the inspector's PC or local network, processing the huge data files produced by modern techniques in seconds. Additionally, software installations, updates, and version control can be handled directly on the box, avoiding the typical hassle of installing additional software on corporate computers. (This was the immediate issue that brought edge computers to the industry.) But there's more.

As soon as the computational power is available, it can also be used to improve signal processing. This enables the use of many techniques that have been known for a long time but were too complex to be used in practice, such as the synthetic aperture focusing technique (SAFT) in ultrasonic testing. Sophisticated signal processing can be provided in software tailored to the needs of the procedure.

Edge computers can also be directly connected to traditional NDE equipment, such as ultrasonic or eddy current machines, or cameras for visual inspection. This allows the edge computer to take over tasks traditionally assigned to the machine's electronics, enabling the freedom to use even the most sophisticated signal processing, filtering, and reconstruction algorithms.

Taken together, this enables us to build systems that process and automatically evaluate data as it's acquired and generate reports on findings as soon as the acquisition is complete. It allows us to upgrade traditional rule-based automated inspection systems used in manufacturing to more robust smart systems that reduce false calls, improve sensitivity, and, most importantly, enable better discrimination between benign indications and unacceptable defects.



CREDIT: TRUEFLAW LTD.

Edge computing devices are commonly used to implement local AI/ML evaluation on top of existing inspections.

Edge computers introduce two important uncouplings in the traditional system. First, they uncouple the inspection software from the acquisition electronics, allowing flexible signal analysis, fusion of multiple NDE modalities, and the integration of real-time AI/ML evaluation. Second, automated processing uncouples the evaluation from the inspector. In automated inspections, the “middleman” evolves into a hub that automatically oversees the acquisition and quality of NDE data, evaluates the data, and forwards reports to inspectors for review and final judgment. This appears to be a pivotal role that enables full NDE 4.0. Perhaps this should not come as a surprise, as edge computers are assuming a similar role in other areas of Industry 4.0 as well.

In the traditional NDE world, edge computers had no role. They appeared

in the margins of our industry as a way to connect AI/ML to existing procedures locally. It seems this is only the beginning, and these small boxes have a far greater role to play in NDE's future. In the next year, we'll see more and more specialized inspections made possible by edge computing. We'll see these boxes provide support for oversight in the hands of end users. We'll see them improve automated inspections in manufacturing and various other industry sectors. In the process, NDE will also become more software-driven. 

Jukka Virkkunen: Managing Director, Trueflaw Oy, Espoo, Finland; jukka.virkkunen@trueflaw.com

NDE Outlook focuses on possibility thinking for NDT and NDE. Topics may include technology trends, research in progress, or calls to action. To contribute, please contact Associate Technical Editor Ripi Singh at ripsi@inspiringnext.com.

ASNT received two 2025 TRENDY Awards last month in an annual awards ceremony recognizing associations' best and most unique communications and marketing pieces, organized by Association TRENDS. The July 2024 issue of *Materials Evaluation*, a technical focus issue on direct and remote visual testing, was recognized with a gold TRENDY Award in the monthly professional society magazine category. ASNT's social media team also earned a bronze TRENDY Award in the best social media category for their promotion of the ASNT Foundation's 2024 golf tournament.



- ★ Connect with employers with open positions
- ★ Access resume writing and interviewing tips
- ★ Receive job alerts directly to your email inbox

View the latest job postings, visit
asnt.org/ndtcareers



SHOWCASE

INSPECTION POINT LABELS

Consistency in inspection point locations or ultrasonic thickness testing (UTT) measurement locations is vital for reliable UTT results. Here's why:

- **Data repeatability.** Consistency ensures measurements taken over time are comparable, making it easier to track material degradation or changes in thickness.
- **Accurate analysis.** Accurate location data is essential for fitness-for-service (FFS) assessments. Deviations can lead to inaccurate conclusions about equipment integrity.
- **Inspection planning.** Consistency simplifies planning and execution of inspection programs, ensuring all critical areas are examined routinely.

NDT Seals' low-leachable, high-strength labels increase the accuracy of risk-based inspection (RBI) and FFS programs.

NDT SEALS
NDTSEALS.COM



ULTRASONIC TESTING SCANNER

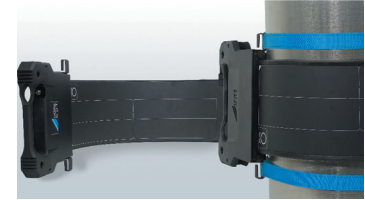
The Axis Scanner and Batt Pack Pro combine to create the ultimate portable B-scan testing solution, offering unmatched versatility and mobility for ultrasonic thickness inspections. The compact Axis Scanner is designed for tight spaces and challenging environments, delivering precise B-scan data with smooth, high-resolution scanning. Paired with the Batt Pack Pro, a battery-powered control unit with an integrated touchscreen interface, this system eliminates the need for external power, enabling truly field-ready inspections. With quick setup, lightweight design, and reliable performance, this pairing provides an efficient, all-in-one solution for accurate thickness evaluations in real-world inspection.

SCANTECH INSTRUMENTS
SCANNDT.COM



PARTNERED CONTENT
TO SEE YOUR PRODUCT FEATURED IN PRODUCT SHOWCASE,
PLEASE CONTACT PETER ROY AT PROY@ASNT.ORG.

BENDABLE DIGITAL X-RAY DETECTORS



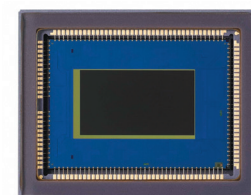
DÜRR NDT has introduced the D-DR 1043B NDT, the latest addition to its bendable digital X-ray detector series, designed for industrial radiography applications. Following the successful launch of the D-DR 1025B NDT, this new model is tailored for weld inspections on large-diameter objects, minimizing exposures and enhancing efficiency. With an active area of 97 × 427 mm, it can inspect a 300 mm pipe weld with just three exposures.

Both models offer continuous bending from flat to 150 mm or 300 mm diameters in one direction, with exposures possible on both sides, enabling versatile use. A simple mounting system allows the detectors to be easily attached to a pipe using two straps and then rotated along the weld seam.

Featuring a pixel pitch of 99 µm and achieving 100 µm spatial resolution, the detectors meet DIN EN ISO 17636-2 (Class B) standards. Ideal for pipelines, tanks, and vessels, they also function in a flat position for straight object inspections.

DÜRR NDT
DUERR-NDT.COM

CMOS SENSORS



The LI7070SAC (color) and LI7070SAM (monochrome) sensors, featuring approximately 2.12 effective megapixels