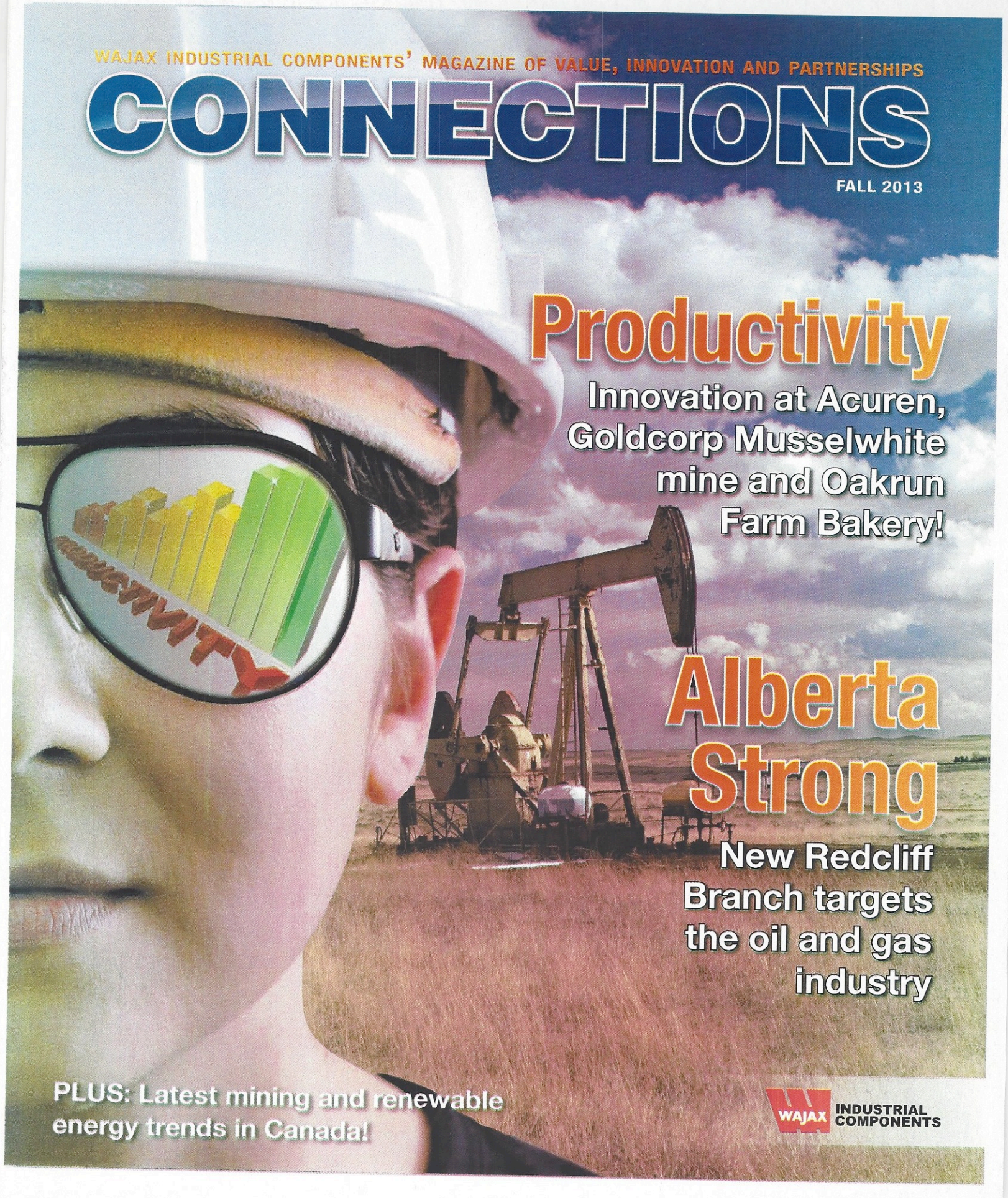
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PRODUCTIVITY THROUGH RE-ENGINEERING

Without Limits

New way to X-ray power-generating station boilers

By Carroll McCormick

Given just 7 months last year to design and build a system that could rapidly X-ray a power-generating station boiler, Gary Haynes began scheming. With the close cooperation of key companies, Haynes was able to rapidly source subsystems, assemble, test and deliver a computer-controlled machine that did the job.

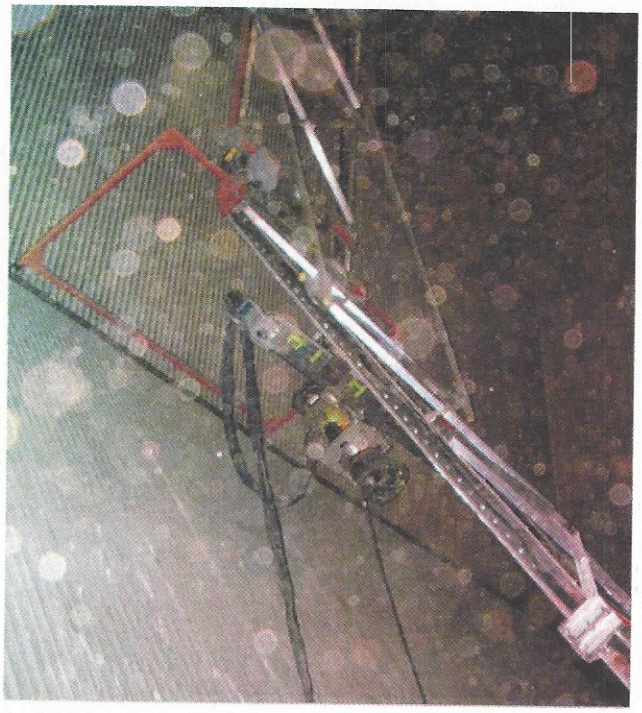
Haynes is a licenced radiographer and works in the Edmonton, Alberta office of Acuren, which specializes in Non-Destructive Testing (NDT), inspection and engineering. He also is the Team Lead-Advance RT Applications, Prairie Region.

Haynes' client threw down a weighty gauntlet for what the system had to do: X-ray 1,524 square feet of boiler wall and integrate tubes in 52 hours flat. A radical solution was called for, since the traditional approach to the task would have taken much longer.

Acuren workers would normally muscle a 60-pound GE ERESCO MF4 digital X-ray machine up and down scaffolding, and precisely position it over 1,016 adjacent sections of the boiler, shooting 3 images per section. At the same time, other workers would have to position a GE Digital Detector Array (DDA) precisely opposite the MF4 on the other side of the boiler wall. In much the same way that a digital camera works, the DDA records each of the 3,048 images taken by the MF4 for downloading to computers.

While pondering the shortcomings of an idea to have workers roll the MF4 and DDA along a track system, Haynes happened across a video of a computer-controlled Stepper

Three degrees of motion: the orange X-ray tube rotates, and also slides side to side and up and down. Photo: Acuren

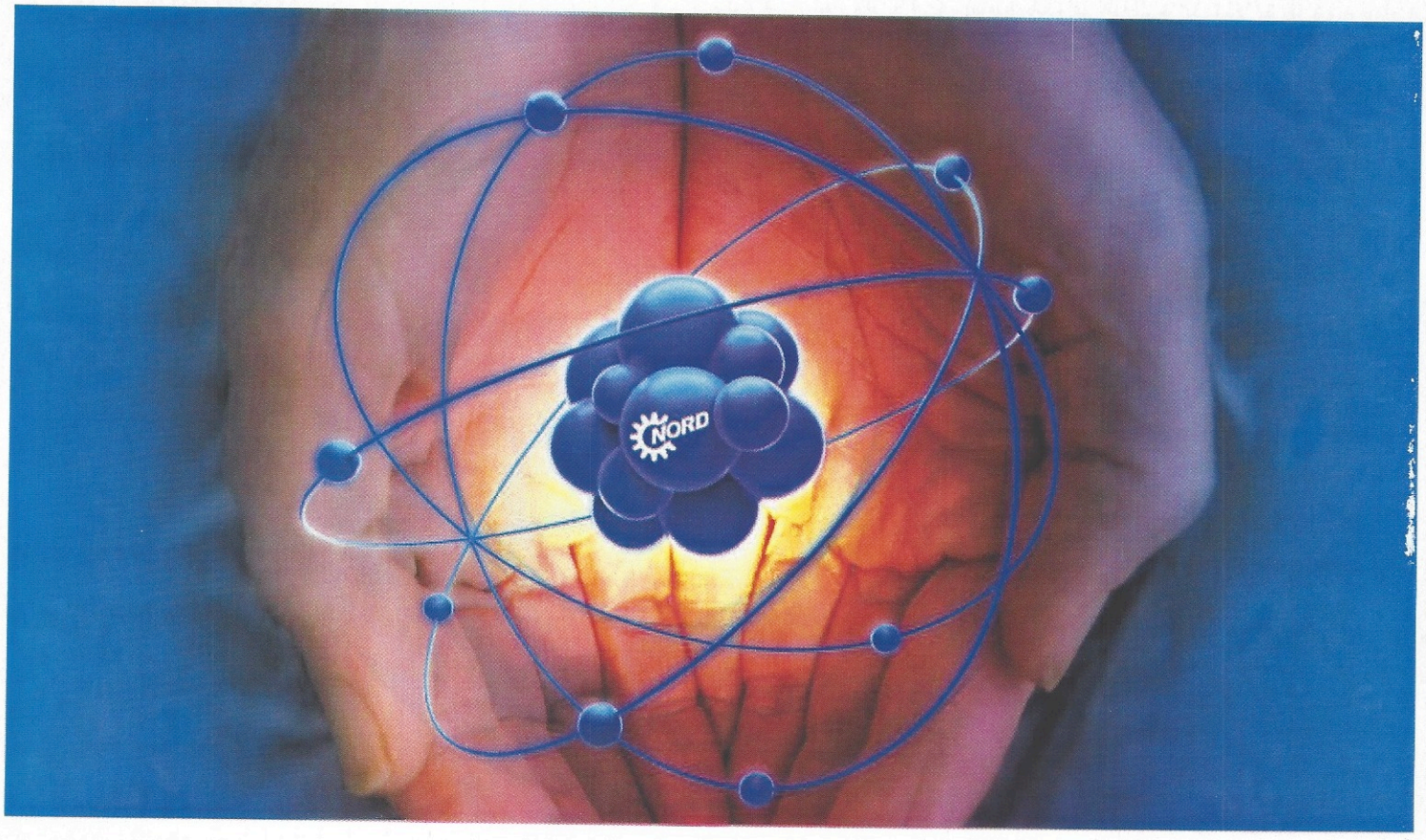


The red steel frame keeps the X-ray exactly 32 inches from the boiler wall as it approaches the 55° bend to the vertical. The steady rain of fly ash causes the circles.
Photo: Acuren

motor shot by Stepper 3 LLC, a motion-control company based in Willingboro, New Jersey. Haynes contacted Stepper 3 and learned that its gear could help solve his problem.

Computer-controlled Stepper motors would minimize worker time in the boiler, thus greatly speeding up the X-ray work. They also would keep the MF4 and DDA aligned. "The Stepper motors put out a specific number of pulses per inch of travel. Computers would track the motor movement, and by extension, the movement and location of the MF4 and DDA," says Haynes. "This would give me the control and precision to line up each shot and also keep the DDA and MF4 in synch."

During the 7-month design and construction process, Haynes worked with bearings, linear motion and power transmission wholesaler Ringball Corporation and the



Edmonton, Alberta branch of Wajax Industrial Components. Ringball tracked down hardware for the various system tasks, and Wajax supplied quotes and kept parts moving along the critical supply chain to Acuren.

"Think of the partnership this way," says Mark Bromley, Outside Sales at Ringball. "Gary Haynes [Acuren] designed and built the car. Stepper 3 made the car go. We sourced the parts for the car, sold them to Wajax, and Wajax sold the parts to Gary. Wajax and Ringball operated jointly from the start. Because we had an existing relationship with Wajax, we worked together seamlessly — and Wajax was awesome."

As Acuren gradually built and tested the system, the sourcing of components kept Ringball and Wajax on their toes. "As we worked along, the parts we needed did evolve and change, sometimes daily," says Bromley.

According to Paul Croxford, Edmonton Branch Manager for Wajax Industrial Components, Senior Technical Sales Representative Chaz Wescott was the Wajax point of contact and serviced the Acuren account. "Chaz made sure the parts ordered were delivered to Acuren on time," says Croxford. "He also ensured the correct quantities were ordered [for the project]."

This is the solution that was developed by Acuren:

First, the tube-shaped MF4 was hung inside 2 rings attached to either end of a box. A Stepper motor bolted to the box spins a cog that turns a sprocket on 1 of the rings. As the ring turns, the MF4 rotates, so its aperture faces the boiler wall from 3 angles: 0°, 45° left and 45° right.

- This takes care of the shooting angles.

The box is attached to a 6-foot long carriage to which another Stepper motor is attached. It moves the MF4 and its box left and right along the carriage — the x-axis — just like the movement of a print cartridge in a printer.

To build the carriage, Ringball went to Pittsburg, California-based Bishop-Wisecarver (BWC), which manufactures linear and rotary motion products. BWC supplied its LoPro linear-motion system, in which a block moves along a track. The box holding the MF4 is bolted to the block. Four small metal wheels on the block grip the 2, V-shaped edges of a track. A belt attached to the Stepper motor moves the block and its cargo back and forth along

The Digital Detector Array, which captures the X-ray image, must stay precisely opposite the X-ray machine on the other side of the boiler wall.
Photo: Acuren

the track.

The LoPro system performs well in dirty environments — and the inside of the boiler was filthy with fly ash. "As the wheels travel along the track, their sharp V-shaped edges clean the dirt off," says Ringball's Bromley.

- This takes care of the 2nd plane of motion.

For the 3rd plane of motion (the vertical y-axis), Acuren's Haynes built a ladder-like structure. Two more LoPro systems were bolted to the inboard faces of the ladder. He bolted the carriage to the 2 LoPro blocks, at 90° to the long axis of the ladder, rather like a movable rung. A nylon strap and cable winches the carriage and MF4 up and down the track/ladder.

- The system now has 3 planes of motion.

The base of the entire system is bolted to a track, which is tack-welded to the bottom of the boiler. Much like a real ladder, the system leans up against the boiler wall, but is held away from the wall by a frame to keep the MF4 aperture exactly 32 inches from the wall.

The boiler wall begins with a 21-foot long slope, then it jogs 55° to the vertical. The blocks on the ladder tracks are trapezoid shaped. This enables the wheels to stay on the track, as the carriage holding the MF4 rounds that 55° bend and up the remaining 5 feet or so of the ladder.

The automated system drives the MF4 over a swath about 6 feet wide and 24 feet long. Workers then shift the whole system 6 feet over along that tack-welded track. Swath by swath, the inside of the boiler is X-rayed. A simpler system on the other side of the boiler wall uses 2 more LoPro linear-motion systems to permit the DDA movement along the x-axis and y-axis.

Stepper 3 wrote software and designed circuit boards to automate the system, which is operated by 2 laptops: 1 for the Stepper motors and the other for the DDA. Acuren built 4 complete systems: 1 for each side of the 2 cells in the boiler. A team of 12 people operated them and radiographers in a command trailer immediately reviewed the 3,048 digital images as they came in.

"It can't be understated just how successful this project was," says Acuren's Haynes. "Our customer was amazed how well it worked, and how we were able to accommodate their very tight time frame." ■

Non-Destructive Testing at Acuren

Specializing in Non-Destructive Testing (NDT), Acuren employs over 3,500 dedicated professionals, supporting the mechanical integrity and inspection programs of the world's largest industrial firms. This includes petroleum refinery, pipeline, power generation, pulp and paper, pharmaceutical, aerospace and automotive.

Acuren is a part of Rockwood Service Corporation, an organization committed to continuous quality improvement, and to the ongoing development of state-of-the-art inspection, testing and related engineering services. Acuren provides the full spectrum of NDT/NDE methods in accordance with industry, government, military, code authority and client requirements.

Together with Hellier, Sperry and RAT, Acuren provides a spectrum of capabilities; each business unit dedicated to repeatable, reliable service. Comprehensive programs for safety, technical training, quality, subject experts and information management systems support Acuren's NDT/NDE services. Acuren also operates 7 fully equipped advanced materials testing laboratories.

For more information about Acuren and its range of services, visit www.acuren.com.