



APPLIED ULTRASONICS

ULTRASONIC IMPACT TECHNOLOGY (UIT)

Bringing innovation | Building reliability | Extending asset life

Case Study Examples

UIT APPLICATIONS

DIPPER & DRAGLINE BUCKETS

- Crack repairs
- Linkage repair/replacement
- Teeth
- Adapters
- Distortion control

In the majority of these examples the cracks were being treated every refurb cycle and were the key reason for the bucket needing to be changed out. By using UIT during the repair process, fatigue life improvements enabled the site to extend the bucket changeout cycle by 9 weeks and deliver an additional 3.6M BCM before changeout.

PROJECT EXAMPLES



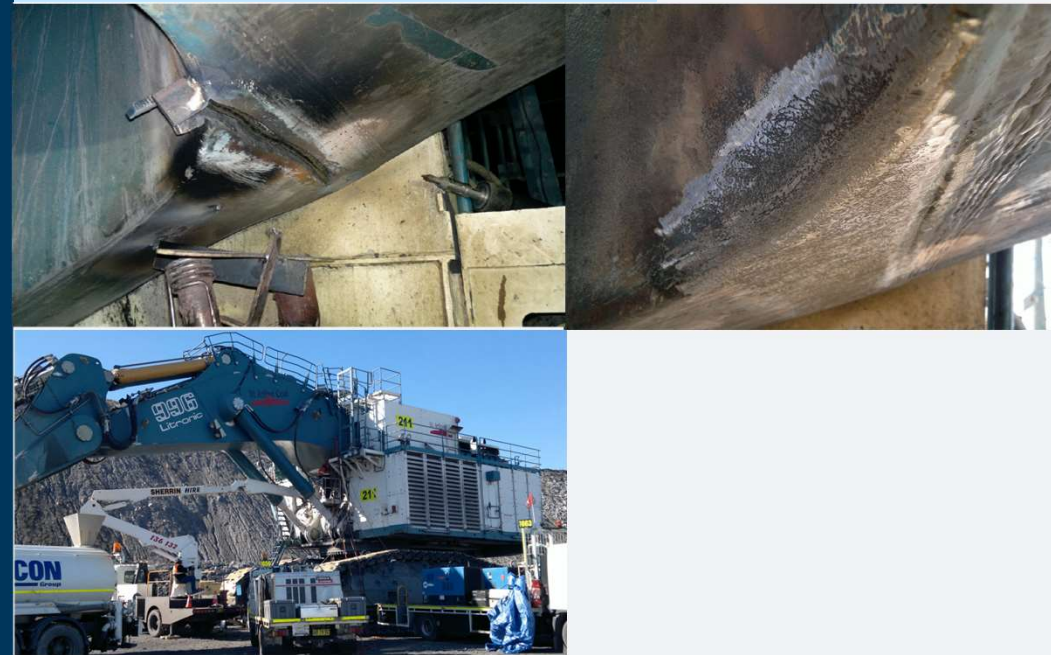
UIT APPLICATIONS

EXCAVATOR BOOM FIELD REPAIR

- Boom crack repaired in the field minimizing downtime
- UIT was used to treat critical structural welds

The use of UIT being a mobile machine allowed for a field repair to be undertaken driving significant cost and time savings due to not needing to remove the boom. 20,000hrs post repair and still no signs fatigue or cracking.

PROJECT EXAMPLES



UIT APPLICATIONS

Dipper Handle Pyramid

- Large (6ft) crack located in Pyramid area of Dipper Handle casting, requiring repair leading to downtime every 3 weeks to repair crack
- UIT used to treat each weld layer
- UIT repair lasted 26 weeks until the replacement part was available
- 8 x life extension
- Was treated on the machine

PROJECT EXAMPLES



UNPLANNED OUTAGE DIPPER HANDLE REPAIR COST BENEFIT

DESCRIPTION	KEY FIGURES
Repair frequency	21 days
Repair duration	2 days
Hours of operation per day	20 hours
Hours of lost operation per repair	40 hours
Projected shovel gross revenue per hour	\$40K
Shovel production gross revenue lost per repair	\$1.6M
Repair cycles eliminated per annum using UIT	8
Cost benefit per annum of using UIT	\$12.8M

UIT APPLICATIONS

DUMP TRUCK BEDS

- Truck body frame rail welds consistently cracking
- Welds excavated, replaced and UIT used to treat new welds
- Cracks never reappeared

UIT was used to treat truck trays that had significant cracking evident in the front chassis section. Post repair 35,000hrs later still no cracking or structural issues noted.

PROJECT EXAMPLES



UIT APPLICATIONS

US Navy

- Stress Corrosion Cracking (SCC) present in ship support structures,
- Standard weld repairs were failing prematurely and weld repairs ultimately resulting in additional cracking
- UIT was implemented pre/during/post welding on USS Cape St. George as the trial
- Result was zero cracks present on USS Cape St. George, (5 years later).
- Post trial UIT was performed on 20+ CG class ships and zero cracking present in UIT treated areas (5 years + since treatment)
- US Navy expanded UIT use to LCS and EPF class ships
- Cost avoidance in \$100M+

PROJECT EXAMPLES



UIT APPLICATIONS

KDOT Bridge

- Engineer's estimate: \$32.7m to replace superstructure
- UIT incorporated into the welding procedure
- Reduced retrofit cost from \$32.7M to \$11.6M (saving over \$20M)
- UIT is endorsed by the American Association of State Highway and Transportation Officials (AASHTO)

PROJECT EXAMPLES



UIT APPLICATIONS

Aerospace Orion Program

- Critical Friction Stir Welds (FSW) joining sections of aluminium
- Use of UIT mitigated distortion and enabled FSW to meet design tolerance

UIT has the ability to work with a range of different steel and alloy types. Applications also vary in why it is used, ie, fatigue life extension, distortion control, stress relief etc

PROJECT EXAMPLES



UIT APPLICATIONS

Ring Gear

- 12 foot diameter Ring Gear developed a through crack at bolted connection
- Standard weld repairs not viable, distortion would render gear inoperable
- UIT employed, treating each weld layer to mitigate distortion
- 100% success – final measurements within tolerance, gear true and round

PROJECT EXAMPLES



UIT APPLICATIONS

Crusher Roll

- Fatigue hard-facing/base metal interface cracking resulting in separation of large sections
- UIT performed after build-up of base metal and machining
- Compressive residual stress reduced tensile stresses at interface
- 3-5 x life extension

PROJECT EXAMPLES



UIT APPLICATIONS

Rotary Kiln

- Kiln consistently cracking at circumferential welds near bearing pads
- UIT process applied to weld layers, cap and toes
- Cracking yet to reoccur in UIT treated regions 10 years on

PROJECT EXAMPLES

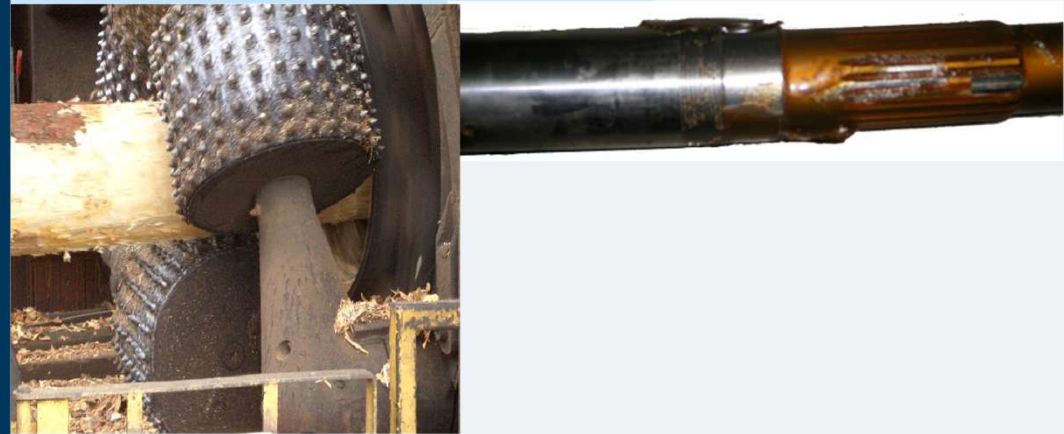


UIT APPLICATIONS

Debarker Shaft

- Poor service life – component fails within 2 months at shaft transition resulting in unscheduled outages and lost production
- UIT used to treat shaft at transition
- Shaft survival rate increased by x 3

PROJECT EXAMPLES



UIT APPLICATIONS

Crankshafts

- Substandard service life of crankshafts
- UIT used in place of existing process (shot peening) which resulted in residual compressive stresses 4 x deeper than shot peening and 5 x crankshaft life improvement
- Manufacturing lines were converted to integrate UIT to ensure all high stress areas were treated

PROJECT EXAMPLES



UIT APPLICATIONS

Semi-submersibles (Noble Drilling)

- UIT incorporated into the welding procedure for all welding work on platforms
- Fatigue life of repairs extended x 8 in all applications
- 15 year life extension of asset granted by independent certifying body - American Bureau of Shipping (ABS)

PROJECT EXAMPLES



UIT APPLICATIONS

Transocean Derrick Gussets

- Deepwater Pathfinder – cracking in derrick base
- UIT incorporated into welding procedure for this repair
- Fatigue life extension through introduction of residual compressive stress

PROJECT EXAMPLES



UIT APPLICATIONS

CAT MWL Bucket Distortion

- Bottom bucket edge bows during fabrication processes, creating either a concave or convex bucket edge
- Bucket placed in press to bend edge to an intolerance position
- Targeted UIT application controls distortion bucket and when used in conjunction with welding results in producing an in tolerance bucket lip area

PROJECT EXAMPLES

