Adra Group’s respected engineering experience continues to deliver clever practical solutions to its clients.

**Balanced Machine Engineering**

Adra is trusted to manage 60 large bulk materials handling machines for clients in iron ore, coal, grain, woodchips and more. Since 2007, Adra has developed or audited balanced machine management frameworks for four of the five largest Australian mining companies.

Our group of experts have come from machine design and maintenance backgrounds, and are able to provide a full suite of services up to complete turnkey management.

Being fully independent to manufacturers and suppliers, Adra is often engaged to provide client representation associated with construction, failure, and warranty issues.

Adra operates independently to machine suppliers, and fosters long-term relationships of trust and accountability with our clients.

We understand the cost, risk and production pressures facing clients and are well-placed to provide value solutions.

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<td>Yallourn Brown Coal Mine Annual maintenance shutdown (2 weeks)</td>
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<td>ENGIE</td>
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Case Study: Solve Reclaimer Pantograph Cracking

The issue
Adra identified cracks at the connection of the pantograph structure to the luffing cylinders during a routine inspection.

The solution
The machine OEM proposed a modified gusset profile and Adra analysed the repair original design and repair to verify the changes. The analysis predicted the cracking, confirming it was the result of a design flaw. Adra delivered a modified gusset designed to lower the stress concentration, provide a uniform stress distribution and improve the load transfer from the gusset to the pantograph mounting beam.

The results
Through Adra’s advocacy the OEM implemented the repair under warranty using the improved gusset design.

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Case Study Remediate Corroded Stacker-Reclaimer

The issue
Adra was engaged to remediate a heavily corroded Stacker – Reclaimer, which was displaying considerable corrosion throughout the structure.

The solution
Adra audited the machine and conducted desktop engineering analysis to assess the damage and residual strength of the machine, to determine the required remediation. This led to the development of a detailed procedure to replace the critical corroded sections.

The results
In addition to resolving the issue, the approach avoided the need for an expensive trestle to support the structure during remediation.
Case Study: Replace Damaged Stacker Frame

The issue
Overloading of a Crawler Mounted Stacker led to cracking and buckling defects in the stacker underframe.

The solution
Adra inspected the damage and determined a method to re-start production immediately with controls in place to operate safely. We then designed a replacement underframe Kragarm, managed the procurement and fabrication QA, developed a detailed methodology for the replacement and provided technical support during the shutdown.

The results
The shutdown finished on time with the new crag arm installed. The stacker was re-commissioned at full capacity as planned.

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The issue

Adra was engaged to inspect a Reclaimer Tripper structure that did not meet Australian Standards and was not fit for purpose, as demonstrated by faults such as deformed structural members.

The solution

Adra conducted a series of investigations from on site inspections, analysis of the structure and implementation of a Machine Risk Management Program (MRMP).

The results

The analysis informed the owner on the steps required to upgrade the tripper. The upgraded design met Australian Standards including the additional loads of a dust suppression system and additional electrical equipment which were added at the same time.
Case Study SHIPLOADER UPGRADE

Replace Damaged Stacker Frame

The issue
In 2017, Adra managed a major upgrade of a 40-year-old slewing shiploader to extend its life. Adra's involvement began with a routine inspection of the shiploader and we remained the owner’s engineer throughout the project.

The solution
Adra took a three-phase approach to the shiploader upgrade:

- **Assessment and planning**
  - Analyse the loads and run the applicable load cases to audit compliance to AS 4324
  - Create a stability model that was used to help specify the replacement slew bearing and confirm expected jacking loads during the shutdown
  - Laser scan survey of the boom and leg structures. CAD and FEA models were created from the survey point cloud data
  - FEA analysis of the leg structure and root cause analysis of existing deformation
  - FEA analysis of the boom structure to identify over-utilised members. Member reinforcement was prioritised as approximately 1,500 kg of new steel was added to the boom structure

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Specifications and procurement

• Develop repair methods for defects such as corroded and deformed members, and confirm the quality of the repairs during construction
• Develop a load spectrum for the new slew bearing. The load spectrum includes the range of loads on the bearing along with percentage of time that the bearing will be subject to each load case. This was used in the specification for the new bearing
• Test the loads on the winch rope using a load cell to verify the load cases and develop the specification for the new winch
• Analyse the slew drive torque for each applicable operating load case and develop the specification for the new slew drive
• Detailed shutdown planning including prioritisation of works to suit the shut window between ship arrivals
• Project engineering, procurement and project management services

Construction and commissioning

• Develop a Machine Control Requirements block diagram which defines the interlocks required for safe operation, and test / verify each scenario during commissioning
• Design a crane mounted lifting frame to manoeuvre the jacking system into place
• Check improvised tools that were found on the worksite. When the tools failed the engineering checks, substitute tools were designed
• Check the existing gangway to lay down the ship loader “jet slinger” during construction, helping to balance the shiploader
• Superintendent and construction manager role with full time staff on site

The results

The shiploader was upgraded as planned. Adra delivered:

Quick facts

- In time for the first ship arrival after the shutdown.
- Nil significant safety incidents.
- 20-year extension of life, providing the client a highly reliable asset for 60+ years, delivering certainty of operation and significant efficiencies in cost.