

MRA'S ENGINEERING SERVICES

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MRA is a 100% Australian owned and operated electrical and control systems engineering firm. Founded in the Hunter Valley in 1998, MRA specialises in large-scale, materials handling automation projects for the mining industry.

MRA's deep understanding of mine and port machine automation has helped establish a lasting reputation for quality, innovation and care. The Company's commitment to excellence and the project's success is why over 90% of our work comes from existing customers.

We are trusted to deliver projects to contracted time frames and have never claimed a variation that was not driven by our customers changing requirements. MRA is ISO9001 certified and our strong safety culture has resulted in zero-days LTI.

MRA specialises in:

- Automation
- Mobile machinery
- Conveyor optimisation
- Functional safety
- Machine-to-machine anti-collision
- Electrical engineering
- Research and development

Our work has included:

- Hundreds of conveyor systems
- 40 mine and port mobile machines
- 20 train load outs
- 10 dump stations
- 10 ship loaders

MRA's Engineering Services provides:

- Custom PLC and SCADA programming.
- Offsite simulation tools to minimise setup and reduce commissioning costs.
- Remote monitoring and software upgrading to reduce maintenance costs and operational downtimes.



The MRA Smart Automation Product Suite inclusions

Our Smart Automation Products have been proven in the field over several generations of technology and use laser data and analytics for smarter decision-making and automation control. These products include:

Smart Wagon Products form part of a full train load-out or dump station automation solution that can replace an onsite operator or an aged photo-electric (PE) cell solution. It includes speed detection, hang-up detection, profile monitoring for over and under loading, derailment protection, train speed indication integration and wagon door status detection.

Smart Stockyard Management is world class and represents a significant advancement in the management of a modern mined material stockyard, its stockpiles and its machines, including job and task management, rich visualisation and machine optimisation.

Mine-to-Port Quality Management is able to accurately track the properties and age of mined material down to 0.4 cubic metre from the mine site, stacked, reclaimed and into the vessels hatch.

Machine-to-Machine Anti-Collision works seamlessly with our Stockyard Management System to provide a SIL-rated functional safety anti-collision solution.

Ship Loader Anti-Collision System establishes a real-time protection zone surrounding the ship loader's boom and shuttle, its spout or spoon and operator cabin. During operations, any object entering or nearing this dynamically defined zone will trigger a collision warning.

Smart Stockyard Management System At Abbot Point, our machine-level laser optimisation increased throughput by 11.3%.



AUTOMATION

MRA has extensive experience in mine and port automation, including:

mobile machines // conveyor systems // dump stations & train load outs // materials handling plants // site wide control systems

We work with all major platforms delivering projects from design through to commissioning and life cycle support.

Our engineers specialise in problem solving and optimisation of existing infrastructures to ensure investments are achieving maximum efficiency and life expectancy.

OUR CAPABILITIES

- Control system design
- PLC / SCADA / Telemetry
- Commissioning
- Industrial software
- Plant optimisation
- Maintenance
- Life cycle support
- Asset management
- 24/7 remote support
- Mobile machine audits
- Project management
- Training and support services
- Decommissioning

SYSTEMS INTEGRATION PLATFORMS

Rockwell // Schneider // Siemens // Yokogawa // GE



MOBILE MACHINE SPECIALISTS

Over the past 15 years, MRA has developed control system software for more than 40 new mine and port mobile machines and numerous upgrades and performance improvement projects across Australia.

The software has ranged from basic manually operated machines through to complex and fully automated Stacker Reclaimers with SIL rated machine-to-

machine anti-collision systems. MRA develops all software in-house, including the complete functional safety lifecycle.

We engage a library of flexible tools to allow our software to be customised to client programming standards. In addition, we utilise existing and extensively tested functional blocks when applicable to reduce development and commissioning costs and durations.

sequencing logic and to optimise performance with a full suite of commands including stacking, reclaiming, and stockpile interactions. The simulation is astoundingly accurate and able to test machine position and important feedback parameters such as bucket wheel power with multiple simulations of stockpile stack, reclaim, restack, re-reclaim to be commissioned prior to on site testing. The simulation can also include manual operator interventions in any of the stack or reclaim processes to confirm correct automatic recovery and any impacts on future automatic operations on the stockpile.

Those familiar with yard machine commissioning will know that confirmation of correct behaviour under all possible stockpile and machine configurations is very time consuming and costly on a real plant. Real stockpiles can take weeks to be stacked and reclaimed and depending on plant operational requirements, a single stockpile may have a lifetime of months. MRA can short circuit this costly process.



SIMULATION ENVIRONMENT – SAVING TIME AND MONEY

Our specialist yard machine automation and integration team can undertake machine performance and behavioural testing in our offsite simulation environment. This speeds the commissioning process and saves significant onsite costs.

MRA can model the machine in a simulation environment to test

CONVEYOR OPTIMISATION

Complex conveyor systems face particular challenges associated with distance, difficult topology and load variability.

Our Conveyor Optimisation Model (COM) can help you meet the most challenging of conveyor environments. The COM is designed for the PLC control system and is independent of the variable speed drive solution. It is assembled offsite in our simulation environment and optimises the dynamic control during conveyor start-up, speed ramp and load sharing as well as minimising over tensioning and rope dislodgement.

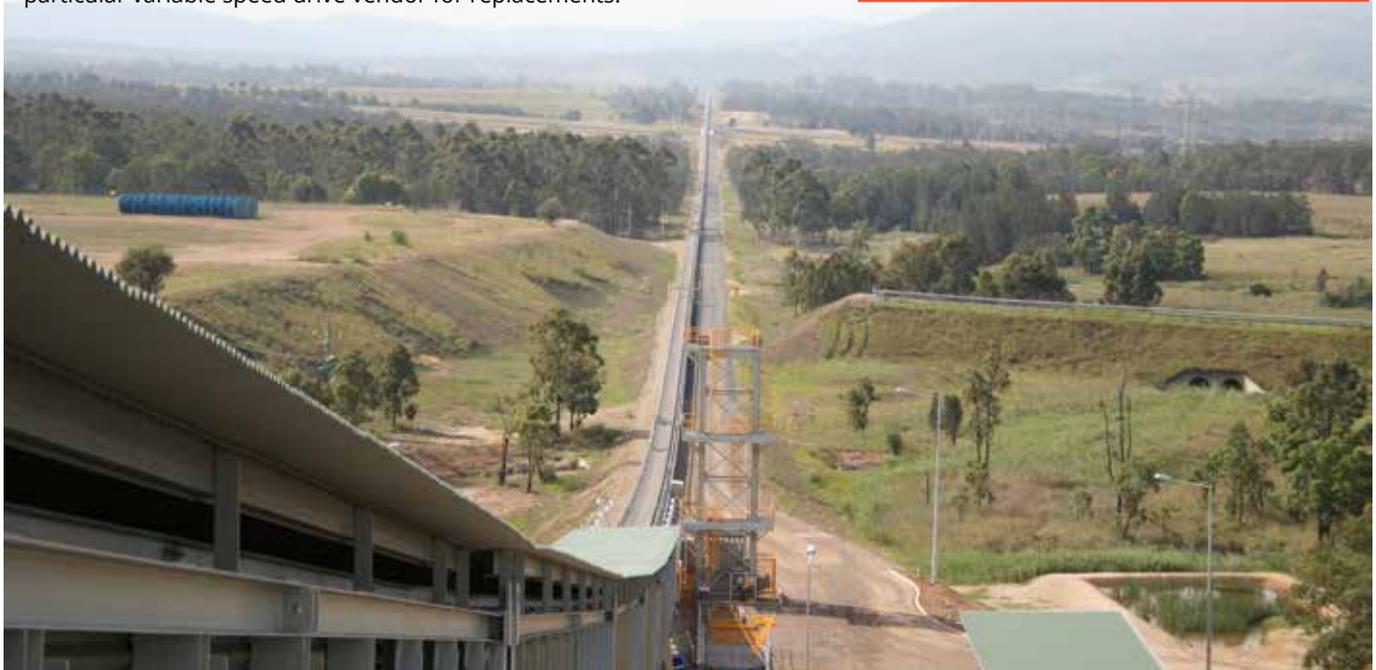
MRA has been proven the COM in some of Australia's most difficult conveyor environments, including: AngloAmerican at German Creek and Macquarie Generation at Antiene.

The MRA Conveyor Optimisation Model has a number of benefits:

- Cost effective to implement.
- Requires minimal onsite resources for commissioning.
- Requires minimal downtime to install.
- Requires little ongoing maintenance.
- Improves conveyor life expectancy.
- Provides vendor flexibility by not being reliant or locked into a particular variable speed drive vendor for replacements.

"We had a challenging 22km rope overland conveyor that was performing poorly, unable to correctly control the speed and tension. MRA analysed the problem and in their offsite simulation environment came up with a revised control strategy and coal tracking system that was installed and commissioned in two days and has been running perfectly for four years. MRA has since reviewed all our rope conveyor control strategies and train load out systems."

ANTHONY MANOUSSO Capcoal Control System Coordinator, AngloAmerican



FUNCTIONAL SAFETY

MRA's team of TUV certified engineers provide expertise across all functional safety applications, helping customers meet their desired outcomes and facilitating the process to achieve legislative requirements.

We understand the costs associated with SIL (Safety Integrity Level) systems and if necessary, can offer alternatives to achieve more cost-effective solutions.

MRA's functional safety team operates as an independent body within the organisation to ensure the integrity of our recommendations.

OUR CAPABILITIES

- SIL rated safety systems (AS61508)
- Anti-collision systems (ACS)
- Emergency shutdown systems
- Safety assessments and reviews
- Design / site audits to AS4024
- Isolation systems & failure mode / reliability assessments
- Functional safety compliance
- Functional safety facilitation workshops
- Functional safety documentation
- Third party reviews

MACHINE TO MACHINE ANTI COLLISION

MRA has extensive experience in anti-collision systems that are SIL-rated and compliant with the emerging use of AS61508 and its related standards. The SIL design is site specific and incorporates the functional specification of selected components, their diagnostic coverage, safety targets and failure rate calculations deemed necessary by the review process.

The process involves a HAZOP (Hazard and Operability Analysis) risk assessment that will require operators, superintendents, safety experts and machine experts to run through all possible collision scenarios and define the risks are and what controls can be put into place to reduce the risk.

The HAZOP can use the following methods to determine risks and consequences:

- Fault Tree Analysis (FTA)
- Failure mode and Effect Analysis (FMEA)
- Layers of Protection Analysis (LOPA)
- Markov modelling

Potential risks to be considered are:

- Machine to machine collision
- Machine to stockpile collision
- Machine to end buffer collision
- Machine to conveyor protection
- Machine to bund protection
- Machine to stockyard base layer protection
- Machine to work-area (exclusion zone)

The HAZOP will determine the Safety Integrated Function (SIF) for each task to be performed by the ACS PLC. Once these functions are formalised, a SIL rating will be incorporated into a Safety Requirements Specification (SRS) that will define all technical and management activities for the lifecycle of the Safety Instrumented Systems.

Protection methodologies are used to establish collision zones with minimum separation distances between machine pairs that can interact with each other. These are updated in real time as each machine operates along the berm and when stationary. The ACS will then restrict and inhibit machine motions should one machine enter within the

anti-collision zones of another. The collision zones will restrict machine operation using a low level inhibit and that are escalated for all major motions such as long travel and slew. These zones include:

- **Slow-down zones** are used to limit the speed of the major motion such as long travel or slew.
- **Inhibit zones** allow a machine can move at full speed in the opposite direction of the collision risk.
- **All motion stop zones** inhibit all major motions.

All anti-collision conditions are alarmed and reported to SCADA. Machine ACS bypasses are used to enable operators to recover the machine into a safe zone of operation.

Extensive machine integrity checks are performed on the machine for communications loss to on-board I/O modules, hardware errors, encoder discrepancy, over speed, moving without instruction and failure to detect motion. These form part of the System Requirement Specification.



ELECTRICAL ENGINEERING

MRA's electrical engineering capabilities range from initial concept design to commissioning and asset management. Our depth of experience and collaborative approach has been proven to deliver projects with a focus on innovation and cost efficiency.

MRA can provide project management from initial concept to detailed design and installation, offering post commissioning life-cycle support to assist with streamlining operations, reducing maintenance costs and increasing infrastructure life expectancy.

Our specialists provide training and support services, including ongoing reporting to monitor equipment and maintenance schedules. MRA also offers a design drafting services with a team trained in the latest versions of AutoCAD, AutoCAD Electrical and Micro Station.

OUR CAPABILITIES

- Electrical design
- Electrical drafting
- Commissioning
- Plant optimisation
- Drive systems
- Earthing design and analysis
- Power system and arc flash studies
- Lighting plan, design and studies
- Lightning protection
- Instrumentation
- Asset management
- Infrastructure audits
- Training and support services
- Decommissioning



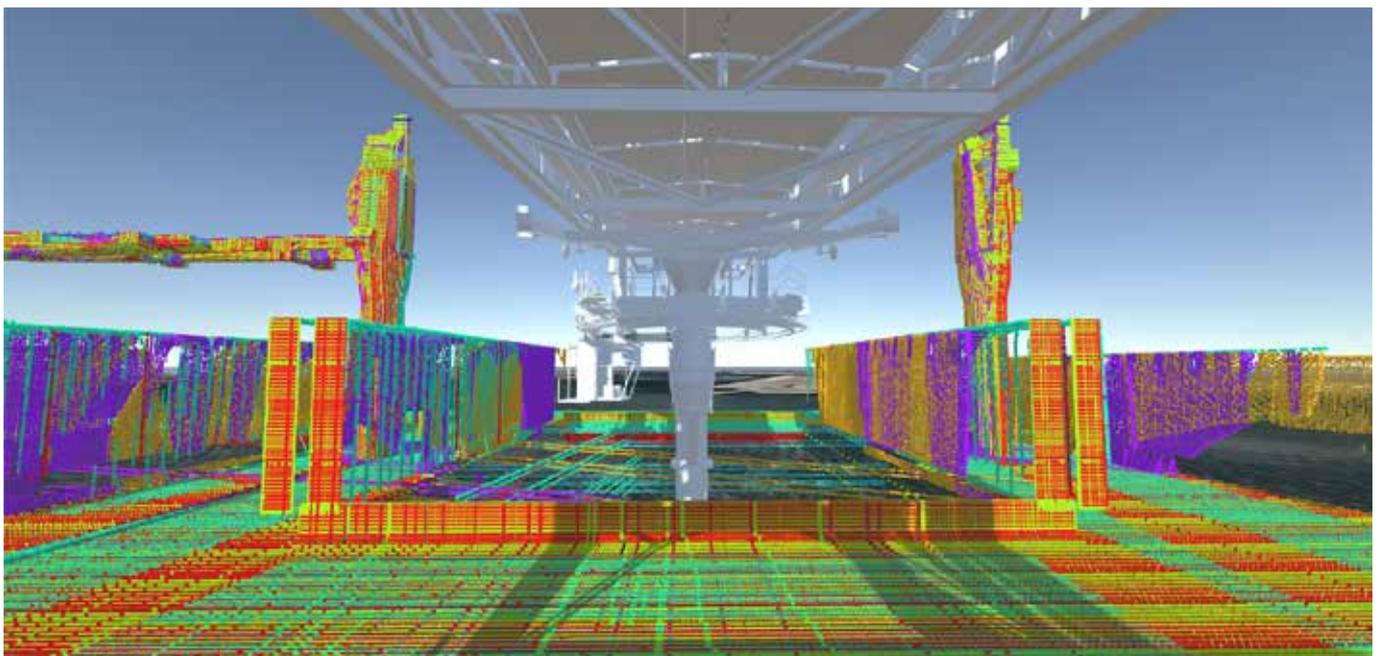
RESEARCH AND DEVELOPMENT

MRA's research and development team can collaborate with your product designers and engineers to help design, implement, test, benchmark and deploy your engineering innovations. We can prepare product and project plans for grants and business cases for funding approval.

A showcase for our R&D team and its ability to fuse academic research with practical field deployments can be seen with our Smart Automation Products Suite, which has helped transform the efficiency of mine-to-port materials

handling. Our commitment to engineering excellence and innovation is clearly on display.

Our understanding of the mining industry and mine and port automation technology is a key strength of our team as well as the use of lasers for data collection and system modelling. Our offsite simulation environment and tool-kits can be used to quickly and cost-effectively determine the feasibility and suitability of particular technologies and approaches to meet your project and business needs.



Keen to find out more?

You're welcome to contact our Engineering Manager Peter McPherson [m 0403 453 250](tel:0403453250) [e peter.mcpherson@mra.com.au](mailto:peter.mcpherson@mra.com.au) [w mra.com.au](http://mra.com.au)