



THUNDERBOLT SKYWAY™

**REMOVE CREW FROM THE LINE OF FIRE.
ACHIEVE FASTEST-EVER RELINE TIME.**

Trusted OEM RUSSELL MINERAL EQUIPMENT delivers step-change technology for mill operators with THUNDERBOLT SKYWAY – the world’s first semi-automated suspension, guidance and firing system for THUNDERBOLT Recoilless Hammers.

380

Mine sites served by RME equipment and services.



480+

RUSSELL MRMs engineered, manufactured and delivered.



860+

THUNDERBOLT Recoilless Hammers sold.





OUR CUSTOMERS' CHALLENGE

Mineral processing operations face immense challenges – complex ore bodies, rising costs, environmental risks, geopolitical instability. Volatility is not going away. Consequently, mine sites face endless pressure to increase operational efficiency to survive and thrive.

Productivity at these mine sites hinges on efficient comminution. This is particularly true with large SAG mills, where even small changes to throughput can have a sizeable impact on profitability over time. One of the most important drivers is to minimise concentrator shutdown duration. Mill relining productivity is key to achieving this.

On the other side of this same coin is the paramount issue of safety. With grinding mill liner exchange being one of the most dangerous maintenance tasks associated with mineral concentrators – akin to the hazards faced in underground mining – operators' efforts to hit production targets at lower operating cost must be balanced with the cost of risk and safety.

It is this relentless pursuit to synchronously improve mill relining *productivity* and *safety* that RUSSELL MINERAL EQUIPMENT (RME) has dedicated itself to since its inception – an important journey that has led to the development of **THUNDERBOLT SKYWAY**.



SOLUTION

THUNDERBOLT SKYWAY is revolutionary. It complements the advanced suite of **RME INSIDEOUT Technology** solutions that deliver a step change in mill reline safety and concentrator profitability. These technologies combine to not only facilitate faster relining, but they remove people from risk inside and outside the mill – representing a safety world-first.

SKYWAY is a sophisticated multi-axis mechanised gantry system, custom-built to closely-couple the contour of the mill's exterior. Its purpose is to support the suspension, automated positioning and travel of **THUNDERBOLT Recoilless Hammers** and **RUSSELL Elevating Platform** modules for operators and crew.

Ground-breaking in both form and function, SKYWAY delivers an accelerated and inherently safer way to remove worn liner bolts during the knock-in stage of mill relining. It does this by eliminating the need for reline crew to manually guide recoilless hammers into position. Instead it offers semi-automated, consistently fast and smooth, hammer suspension, guidance and firing control via remote control.

SKYWAY also offers ergonomic access to a larger number of liner bolts and extends far higher than human reach. This dramatically reduces the frequency of time-consuming inching cycles, contributing to the fastest method ever devised for worn liner bolt removal.

Most importantly, safety is improved. SKYWAY technology significantly reduces relative hours of risk exposure outside of the mill during relining. It eliminates numerous dangerous manual tasks including the need for crew members to work near suspended loads and at-height hazards.

SKYWAY offers a flexible implementation model to suit a wide-range of operational requirements for minerals processing.

This high-tech world-first technology is the result of a multi-year RME-Customer engineering partnership. The technology is proven commercially with a number of active installations that are successfully demonstrating a clear reduction in the residual risks inherent in relining practices and reduced concentrator shutdown duration.



BENEFITS

- **Safety** – Removes crew from danger zones such as working near suspended loads during knock-in. Significantly reduces risk exposure.
- **Speed** – Automated movement of liner removal tools accelerates worn liner removal activities, reduces knock-in duration, thereby delivering greater reline productivity. No other bolt knock-in solution is faster.
- **Consistency** – Automation provides greater consistency and accurate repeatability in hammer-to-bolt alignment, pre-loading and movement between bolts, every time.
- **Variability** – Eliminates human error and disparity as a result of skill, performance, fatigue, or crew size performing bolt knock-in activities
- **Predictability** – By overcoming performance variance, mine sites can improve predictability and reliably complete relines on time within the planned window
- **Optimisation** – Increase operational efficiency and unlock new opportunities for safety and productivity optimisation.
- **Availability** – Faster, safer relines improve mill availability and the opportunity to improve production.
- **State-of-the-art technology** – Implement industry-best practice for reline safety and productivity with the world's preeminent OEM of mill relining technologies. Future-proof your mine site and improve return on asset usage.
- **Engineered-to-order** – Custom-designed and purpose-built for your grinding mill circuit.
- **Straightforward** – Easy-to-operate for appropriately trained reline crew. Upskill local operators by leveraging automation and mechanisation.
- **Flexible** – Fixed and portable offerings to meet mine sites' requirements. Suitable for greenfield and brownfield applications. Implement SKYWAY, SKYPORT or a combination of both. Modules can serve multiple mills on a single site.
- **Compliant** – Engineered and rated to comply with stringent Australian and International standards.
- **Quality** – Designed and built to same exacting standards as all RME Mill Relining System equipment.
- **Proven** – Two installations already commissioned on SAG mills in Central America and South East Asia.



RME INSIDEOUT Technology

A phased approach to mill relining optimisation

RUSSELL MINERAL EQUIPMENT has developed a robust staged implementation program for RME INSIDEOUT Technology which allows mine sites to access reline-by-reline safety and productivity uplift. Our carefully-designed and agile methodology is commercially-proven to deliver maximum benefit at every stage. Customers will have a strong sense of confidence as they proceed with their mill relining optimisation journey.

FEATURES

Structure (SKYWAY)

THUNDERBOLT SKYWAY is a state-of-the-art, engineered-to-order multi-axis gantry system that is constructed around the exterior of a grinding mill. This structure is configured to the shape of the mill and serves to support THUNDERBOLT Recoilless Hammers and RUSSELL Elevating Platform modules for the safest positioning of crew during a reline operation.

SKYWAY consists of both fixed (structural towers and rails) and mobile plant (elevating work platform and THUNDERBOLT Recoilless Hammer modules). SKYWAY's mobile modules can be shared between a site's multiple large grinding mills for optimal asset utilisation and securely stored adjacent to the mill between relines. All modules have been engineered for ease of maintenance accessibility and transportation by overhead crane on and around site.

Safety

THUNDERBOLT SKYWAY heralds a new era for mill reline safety. RME manufacturing guarantees a commitment to core principles of safety, integrity and quality in every respect. The system is precision-engineered in-house and complies with the most stringent Australian and International Standards.

Furthermore, SKYWAY features an extensive machine safety technology package as-standard to improve operator security whilst ensuring productivity. This includes emergency stops, warnings and alarms, safe access ladders, mobile platform gates, safety gates, guard rails and integrated counter balance valves to keep your reline crew safe from harm.

Operation

THUNDERBOLT SKYWAY's 'Operator Experience' is second to none, and its operation is intuitive for appropriately trained reline crew.

SKYWAY features precise hydraulic control of THUNDERBOLT Recoilless Hammers, providing for fast, accurate, smooth and consistent movements bolt-to-bolt and increased hammer preloading compared to conventional manual handling methods.

Ergonomically-designed remote joystick control pendants deliver machine and crew security and flexibility, ensuring the operator is well-positioned to observe relining operations. These sophisticated pendants control SKYWAY's mast, carriage, hammer and mobile platform, as well as combination hammer/elevating platform modules. Remote control pendants feature an attached waist belt for operator comfort and safety.

SKYWAY's power and control cabinets feature smart touchscreen technology to keep operators always-informed about machine safe operation, health, temperature, and fault conditions, should they occur.

Productivity

THUNDERBOLT SKYWAY carries a higher reach for suspension of hammers and operator work platforms compared to mobile jibs and monorail systems. This higher reach means access to more rows of liner bolts and reduces the number of inching movements and inching time per reline.

SKYWAY also boasts five-axis of movement for responsive and precise alignment of THUNDERBOLT Recoilless Hammers. Rated load capacities range from 400 – 800 kg to ensure equal performance across all duties through to the heaviest relining process use. SKYWAY will also expertly 'pull' and 'push' the hammer with a force of 500 kg. These capabilities, and more, work together to accelerate bolt and liner knock-in time, reduce the number of mill inches required, and drive down knock-in duration.





APPLICATIONS

THUNDERBOLT SKYWAY is intended for use as a purpose-built semi-automated suspension and guidance system for THUNDERBOLT Recoilless Hammers and RUSSELL Elevating Platform modules – solutions which accelerate worn liner removal activities and improve crew safety.

SKYWAY will be favoured by progressive mine sites with larger capacity mills and potential mine life longevity. It demonstrates compelling safety benefits for high-altitude mine sites due to the personnel fatigue management advantages they afford.

SKYWAY is particularly well-suited to greenfield projects where plant design for effective whole-of-life maintenance and cost efficiencies can be achieved. RME offers MILL RELINE DIRECTOR (MRD) Plant Design studies to support these applications, ensuring that any constraints to efficient mill maintenance are eliminated from the outset.

THUNDERBOLT SKYWAY’s automation capabilities facilitate significant reductions in the time required to knock-in bolts and liners compared to conventional methods. Detailed MILL RELINE DIRECTOR (MRD) studies on SAG mill relines using THUNDERBOLT SKYWAY have demonstrated that bolt knock-in can be performed significantly faster, and save many reline hours compared to conventional methods.

In addition to increasing bolt knock-in speed, THUNDERBOLT SKYWAY improves liner bolt removal consistency. Even skilled human operators have a high degree of variability across individual reline activities. This variability contributes to unpredictability. SKYWAY overcomes these problems by leveraging cutting-edge automated technology to create efficient and optimal travel paths for the hammer as it moves from bolt-to-bolt. MRD modelling indicates that the standard deviation for the automated knock-in is nearly half the equivalent value compared to conventional methods.

MILL RELINE DIRECTOR Safety (MRDS) studies have also proven beyond doubt that THUNDERBOLT SKYWAY will dramatically reduce relative person-hour exposure to risk by over 40%. How? SKYWAY eliminates the need to manually handle and manoeuvre liner removal tools around the mill deck where personnel are exposed to hazards such as suspended loads, slips, trips and falls. Instead, an operator pilots the liner removal tool using a sophisticated remote control from the safety of an operator pod.



There’s an industry adage that says ‘if the mill isn’t turning, the plant isn’t earning’ – a fact that keeps the attention squarely on mill availability. Not only does THUNDERBOLT SKYWAY reduce mill relining duration so mineral processors can optimise throughput and capacity, it is simply unparalleled in terms of reducing risk and improving safety.

John Russell

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RUSSELL Mineral Equipment

LEARN MORE



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RME Regional Service Centre



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RME delivers innovation to the world

RME's passion and mission has always been to minimise Mill Relining time and to increase relining crews' safety. RME Mill Relining System technologies, used effectively, have quartered the time previously taken to line large mills. Looking forward, RME's focus is to secure the potential of RME's Mill Relining System performance for each and every one of our Customers, past, present and future.

Our commitment to industry is to visibly, defensibly and sustainably improve our Customers' concentrator performance.



RME's global reach extends to over 380 mine site locations.

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