

Implementation of Video Motion Capture Technology for Manufacturing Ergonomics Assessment

What's the Risk?

Superior Tube Products, now part of Morton Industries, was a manufacturer of fabricated welded tubular assemblies and identified MSDs as a persistent driver of injuries, particularly in the wrist, elbow, shoulder and lower back. These injuries stemmed from awkward reaches, repetitive motions and manual handling across high-mix production cells such as tube bending, laser operations, punching and pressing, and wash processes. Historically, Superior Tube's approach to ergonomics was largely reactive. Issues were often addressed only after discomfort had escalated, and hazard identification depended heavily on informal observation rather than structured, objective data. Employees frequently worked through soreness, and supervisors relied on intuition to recognize ergonomic concerns.

In 2022, the company began taking important steps to shift away from this reactive model. The company created a dedicated safety function and launched a more proactive strategy focused on prevention. Early reporting expectations were introduced, enabling employees to share concerns at the first sign of discomfort. Job safety analyses were formalized, leadership walk throughs became routine, and overall participation in safety processes increased. These efforts revealed that while engagement was improving, the organization still lacked clear ergonomic insight based on measurable data. MSDs remained a leading contributor to injuries, and the existing tools made it difficult to distinguish between perceived and actual risk.

Challenges with new-hire acclimation and fluctuating production cycles added further complexity, making it difficult to consistently identify high-risk tasks. To progress from assumption-based prevention to evidence-based prevention, the organization needed a scalable way to understand where ergonomic risk was truly present, task by task and cell by cell, and to coach safer movements in real time without requiring in-house ergonomists for every assessment.

Project Aims

Superior Tube Products partnered with 3motionAI to integrate its Flashlight tool (video capture using a cellphone) and RiskAI dashboard (AI-driven motion analytics) with the following goals:

- Identify and mitigate key MSD risk factors affecting the upper quadrant (shoulder, elbow, hand) and the lower back for both new hires and existing employees
- Evaluate how 3motionAI technology can strengthen and quantify the impact of existing safety programs
- Create an enterprise-level view of ergonomic and musculoskeletal risk across all work cells
- Generate actionable data to guide improvements in movement patterns, task design and ergonomic solutions for the entire workforce



Description of Project Activities and Implementation

Superior Tube Products piloted 3motionAI's Flashlight and RiskAI tools for approximately eight months (May 2024-January 2025). The project included four main components, each contributing to a clearer and more data driven view of MSD prevention.

Onboarding and Training

The project began with hands-on onboarding provided by 3motionAI, which ensured that Superior Tube's leadership and supervisors were prepared to use the technology effectively. A 3motionAI representative visited the facility to coach the team on the fundamentals of capturing reliable assessment footage using the Flashlight tool. This included instruction on camera positioning, lighting, angles and the importance of following the operator's workflow in real time. The training equipped supervisors to confidently collect consistent, high-quality videos and laid the foundation for accurate and repeatable ergonomic assessments.

Video Capture of High-Risk Tasks Using the Flashlight Tool

Once trained, the safety team and supervisors conducted targeted video capture across work cells with known or suspected ergonomic risk. These sessions focused on representative tasks within tube bending, laser operations, wash-bay activities and associated material handling activities. Footage was taken during typical production cycles, even when operating windows were limited due to fluctuating schedules. Despite the intermittent nature of production, the team strategically captured tasks when product lines became active, ensuring that real conditions were reflected in the dataset.

Data Analysis Using the RiskAI Dashboard

Uploaded videos were analyzed through the RiskAI dashboard, which generated movement scores, joint-level risk metrics and visual heatmaps capturing factors such as shoulder elevation, trunk flexion, reach distance and task duration. Throughout the project, the team at Superior Tube Products worked closely with 3motionAI to interpret these results and deepen internal understanding of movement patterns. The team also collaborated with the provider to reorganize the system's dashboard structure so that work centers and tasks aligned with the organization's operational layout. This adjustment made the tool more intuitive, increased adoption across leadership, and strengthened the connection between analytic outputs and real-world workflows.

Figure 1. A task video is captured, analyzed through the 3motionAI engine and generated into ergonomic risk insights displayed in the RiskAI dashboard

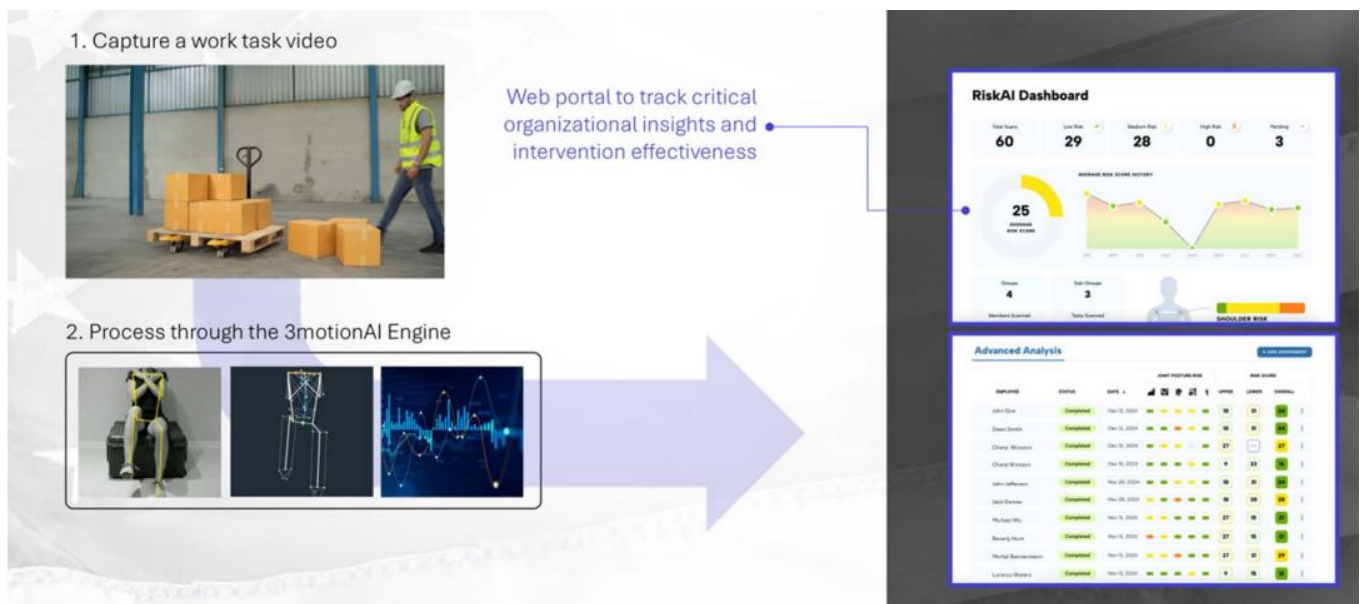


Figure 2. RiskAI dashboard showing completed risk assessments for various tasks

TASK	EMPLOYEE	STATUS	DATE					UPPER ↓	LOWER	OVERALL	
Wash Outer	Operator (RO) Bending	Completed	Jun 26, 2025					47	0	24	⋮
Wash Inner Tube	Operator (RO) Bending	Completed	Jun 26, 2025					37	0	18	⋮
Unload Bender	Operator (BB) Bender	Completed	Jul 9, 2025					31	0	16	⋮
Load Base and Legs	Operator (AP) Welder	Completed	Jun 18, 2025					31	15	23	⋮
Remove Part From Fixture	Operator (KH) Welder	Completed	Jun 18, 2025					31	14	22	⋮
Punch and Grind	Operator (BB) Bender	Completed	Jul 9, 2025					26	23	24	⋮
Weld Base Back	Operator (KH) Welder	Completed	Jun 18, 2025					25	0	12	⋮
Top Weld	Operator (AP) Welder	Completed	Jun 18, 2025					22	19	20	⋮
Lift to Fixture	Operator (KH) Welder	Completed	Jun 18, 2025					22	0	11	⋮
Wash Outer Solution (Shorter Wand)	Operator (RO) Bending	Completed	Jun 26, 2025					22	7	14	⋮

Development and Evaluation of Data-Driven Safety Improvements

The insights from RiskAI guided Superior Tube's continuous improvement efforts. Findings were reviewed during safety huddles and follow-up coaching sessions, where operators and supervisors discussed opportunities to modify techniques, reposition tools or adjust workflows. The team emphasized low-cost, high-impact fixes first, such as changes to tooling or minor adjustments to workstation layouts. As the project progressed, these targeted improvements helped validate assumptions, uncover hidden risks and reinforce a more proactive safety culture rooted in data rather than observation alone.

Project Challenges

The project was shaped by unforeseen circumstances that required the team to adapt its approach and rethink priorities. A gradual slowdown in production at the beginning of the project reduced the number of consistent work cycles available for ergonomic assessments, making it difficult to capture representative baseline and follow-up data for all work cells. This was compounded by updates to the Flashlight and RiskAI tools early in the project, as scoring methods, data structure and filtering capabilities evolved before complete baseline data could be established. These changes affected data consistency and the ease of establishing clear priorities of ergonomic risks. These constraints pushed the project to focus on high-risk areas identified by Superior Tube's Early Reporting System and then supported by tool-based data. The team shifted focus to the top-reported areas, and the pilot still produced meaningful insights, strengthened Superior Tube's understanding of ergonomic risks and demonstrated that meaningful ergonomic improvements do not always require major expenses.

Project Accomplishments and Lessons Learned

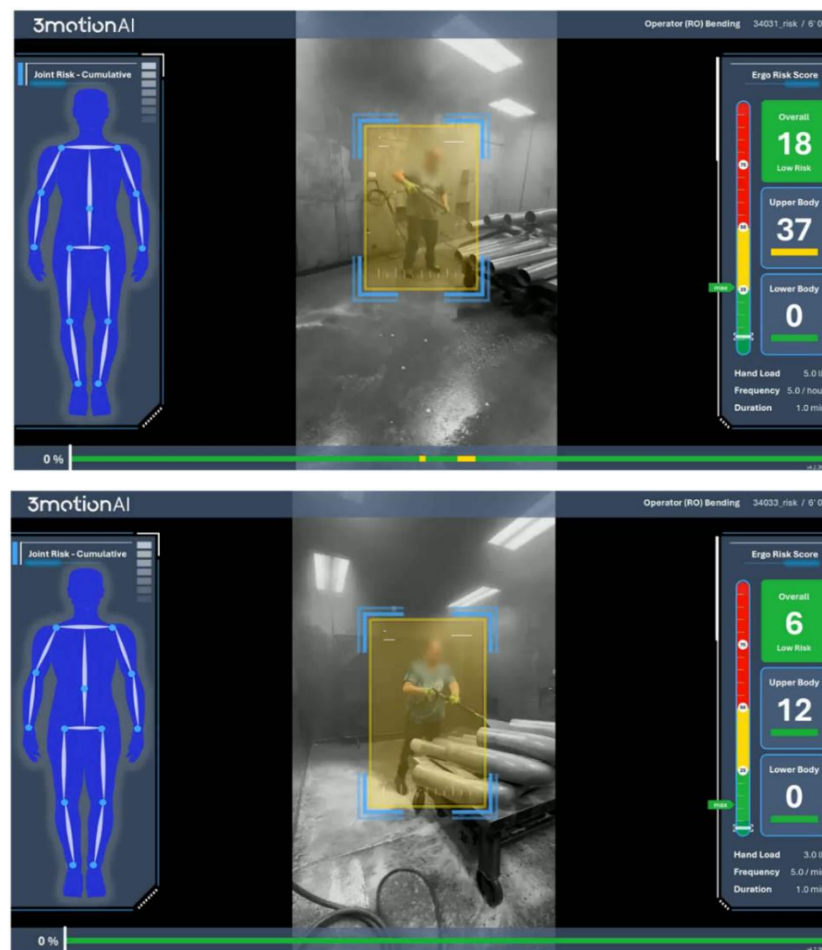
Project accomplishments centered on improved prioritization of risky tasks and included the following:

- Objective risk visibility and prioritization:** The Flashlight video capture tool and RiskAI dashboard provided objective measures of risk exposure for tasks and associated postures, revealing what truly drove risk exposure and allowing for more focus on high-value fixes instead of perceived problem areas. For example, the team initially assumed heavy-tubing operations carried the highest risk. Analysis showed those operators used effective techniques and aids, while the wash bay was the real driver of exposure due to an overly long wash wand that forced sustained shoulder elevation and extended reach.
- Engagement with workforce to develop effective solutions:** Employees reported enjoying receiving feedback through movement scores and learning how small adjustments could improve comfort.

Supervisors gained confidence using the data to coach teams, and leadership began using risk analytics to support planning discussions about workflow, workstation setup and equipment needs. Reviewing results with operators and supervisors led the team to implement a shorter wash wand that cost about \$45, required no sweeping process changes and immediately reduced shoulder strain. Operators reported feeling more comfortable, and the job became easier and more natural to perform.

- **Risk Priority Numbers (RPNs) established:** RPNs were created to rank tasks and sequence improvements
- **Injury reduction:** The total recordable incident rate decreased by 60% in one year.
- **Cost impact:** Workers' compensation costs dropped by over 98% across three years.
- **Insurance benefits:** The experience modification rate decreased by 36%, reflecting improved safety performance with reduced insurance risk and costs.

Figure 3. Images depict the upper body Ergo Risk Score before and after implementing a shorter wash wand



Beyond these accomplishments, the pilot also generated valuable learnings that strengthened Superior Tube's safety culture and informed future ergonomic improvements. The team saw firsthand that assumptions about tasks with the highest risk are not always accurate. For example, tasks involving heavy parts were not always

the highest-exposure tasks, and factors such as reach patterns, duration of tasks and repetition often mattered more than load alone. These findings reinforced the importance of measuring risk before investing, and the pilot showed that short videos, representative of real production demands paired with analytics, were enough to accurately identify true exposure drivers. The pilot also highlighted how small, low-cost design tweaks, such as adjusting tool length, fixture position or part-presentation height, can meaningfully, quickly and affordably reduce shoulder and back strain.

Lastly and importantly, the project reaffirmed that solutions come from the people who do the work. Frontline insights, combined with data, often surface the most effective fixes, as illustrated by the wash-bay wand change. Sharing the captured video and data analytics with affected employees allowed for collaboration and brainstorming to develop ideas for solutions.



Superior Tube Products, now part of Morton Industries, was a manufacturer of fabricated tubing products serving customers across a variety of industrial markets. Based in Davenport, Iowa, the company produced high-quality tubing solutions for applications requiring reliability, safety, and consistent performance. Superior Tube Products maintained a strong commitment to employee health and safety, continuously evaluating opportunities to improve workplace conditions through innovative technologies and data-driven ergonomic initiatives.

3motionAI

3motionAI, a SimpleTherapy solution, provides AI-powered video motion analysis technology that helps organizations identify and reduce workplace ergonomic risks. Using its proprietary 3DNeuroNET engine, the platform converts standard video into detailed movement data without requiring wearables, sensors, or specialized motion-capture equipment. Designed for large-scale workplace applications, 3motionAI enables safety professionals to assess risk, improve worker safety, and support data-driven ergonomic interventions across multiple facilities and operations.

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