

# Early Stage Rollout and Advanced Functionality of Digital Mining Analytics & Insights Platform

AMERICAN  
INDUSTRIAL  
PARTNERS

## BUSINESS PROBLEM

CR Digital (CRD) develops its products to be widely connected in the mining data ecosystem, using open API concepts to drive potential for data interoperability. The mining industry has not yet optimized its processes, leading to inefficient operations and reduced productivity. CRD's high level goal is to increase revenue for its digital products in the Americas by increasing productivity measured by weight per unit time. This project will focus on developing a suite of advanced analytics solutions for CRD's Analysis and Improvement (A&I) Service by tailoring advanced analytics reports in Orion, a tableau like platform.

## DATA SOURCES

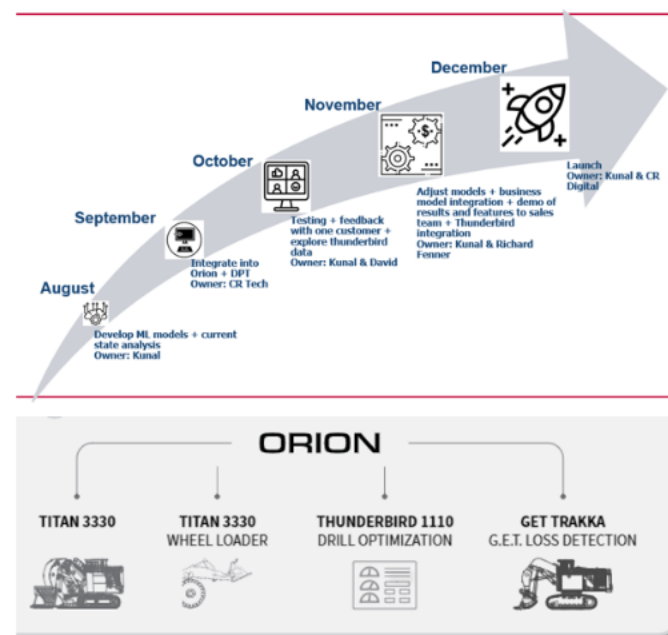
Currently, CRD has data available for the Titan product used by the mines in Australia. Spanning the past 5 years, the data is available in the database called the Orion Data Warehouse, a master data warehouse that feeds the Orion analytics platform.

## Data Types and Format

The data can be accessed using Microsoft SQL Server Management Studio and is in multiple formats including dates, real numbers, floats, characters, etc. SQL will be the main method for data extraction

## APPROACH

Approach involves 5 steps: 1) Analyze the Orion production data warehouse to scope data availability, 2) Understand customer needs and where we can generate value from the data, 3) Perform predictive analytics using machine learning to develop advanced analytics reporting, 4) Integrate upgraded reporting with the A&I business model + Orion, 5) Generate feedback from beta testing + retune ML models



## IMPACT

CR Digital has three main products that customers pay for: a) Titan 3330, a load haul optimization solution, b) Thunderbird, a drill efficiency indicator, and c) GET Trakka, a ground engaging tool (GET) loss detection system. The digital mining industry is very retroactive and decisions are made based on reactive reporting. Typically, a supervisor at a mine would look at current performance and devise a strategy based on what has already happened. With machine learning, our solution will not only enable constant learning of operator behavior but also recommend optimal procedures for performing certain load and haul, and drilling operations. Ultimately, our goal is to increase productivity measured in tons per unit time. Our solution will be an addition to the business model related to Analysis and Improvement, CRD's data analytics service and support program. A slight increase in productivity could result in millions of dollars of increase in revenue as well as an increase in net income (EBITDA). AIP's goal is to have a highly profitable exit with a high sale multiple and a higher EBITDA is North America and this project will feed directly into CRD's performance.

### DRIVERS

Despite the advances of technology in the mining industry, very little is understood on how advanced analytics can be used to improve productivity in load and haul operations. In fact, productivity often relies on making quick decisions and can be impacted by how operators engage with variables. The goals of this project are to understand how these variables interact with each other and how can they be tuned to increase a mine's productivity.

### BARRIERS

Two key barriers impacted our project, a) Due to the covid-19 pandemic, we were constrained from visiting not only the CRD workplace but also the mining sites in Australia, impacting our ability to move fast and interact real time with operators for beta testing, b) Due to the lack of data with the Thunderbird, we had to rely on certain assumptions, as opposed to facts, to form the next steps to scale the project.

### ENABLERS

CRD as an organization has a strong penchant for new technologies, including ML/AI, and CRD's data infrastructure was a big enabler for meaningful results. Furthermore, the project involved several teams including external stakeholders (machine operators and supervisors) and the team at CRD was instrumental in relaying the message and influencing the mining companies to be aligned with the project goals.

### ACTIONS



The actions can be summarized in 5 steps: 1) Analyzed the Titan production data warehouse to scope data availability, 2) Understood customer needs that drove revenue, 3) Performed predictive analytics to develop algorithms that allowed CR to deliver potential productivity increases, 4) Integrated the ML offerings with CRD's business models to drive future revenue, and 5) Performed beta testing to create a feedback loop with CRD's customers.

### INNOVATION

While retroactive analytics exists in load and haul operations, we saw an opportunity to perform predictive analytics to carve out clandestine value from the Titan data. Using XG Boost and making results interpretable with Shapley Values, we applied machine learning to optimize operational performance of hydraulic excavators or wheel loaders, making this a novel technique in fairly robust operations environment with load and haul.

### IMPROVEMENT

From a customer's perspective, the solution, in combination with new sensing and measurement, has the potential to provide annual revenue increases of up to 15% for top loading and up to 20% for single and double benching.

### BEST PRACTICES

Engage all stakeholders throughout the project to fully understand the complexities of the problem, brainstorm potential solutions, and acquire buy-in from owners, especially technical teams, at the head of the project timeline. Solution design should be coupled with continuous 'on-the-ground' and real time testing in order to identify errors and improvements, and set sufficient time to address them.

### OTHER APPLICATIONS

Our solution is highly adaptable to various industries that use data to make decisions. It can be leveraged to increase throughput, optimize capacity, provide guidelines for inefficient operators, understand machine limitations, identify decreases in performance, etc. Additionally, it has the potential to optimize the performance of autonomous excavators and wheel loaders that offer high potential to increase productivity and improve safety.