Using intelligent solutions to solve your complex challenges

May 14, 2017

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<th>Time</th>
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<tbody>
<tr>
<td>17h30–20h30</td>
<td>Registration and Cocktail Reception</td>
<td>Indaba Hotel Pool Deck</td>
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May 15, 2017

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<tr>
<th>Time</th>
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<tbody>
<tr>
<td>07h00–08h00</td>
<td>Registration</td>
<td>Indaba Hotel, Conference Auditorium</td>
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<tr>
<td>08h00–08h30</td>
<td>Welcome, Safety and Overview</td>
<td>Arne Weissenberger Regional Director Mining and Metals HATCH</td>
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<td>08h30–09h00</td>
<td>Driving the New Mining Paradigm</td>
<td>By: Ivan Mullany Global Director Mining and Metals HATCH</td>
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<td>09h00–10h00</td>
<td>Digital Mining Overview</td>
<td>Jeanne Els Regional Director Digital Mining Australasia HATCH</td>
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<td>10h00–10h30</td>
<td>Effects of an Electric Fleet on Mine Ventilation</td>
<td>By: Brian Rogers Director, Gas Handling &amp; Ventilation HATCH</td>
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### Digital Twin
Synopsis: The digital twin is an emerging concept used in manufacturing, process, and other capital-intensive industries. In this session, we will explore the application of the digital twin as it relates to design/build/operated in mining.

By: A. Mullan, HATCH

### Rail Optimisation
Synopsis: Rail scheduling is a challenging problem given both its spatial and temporal characteristics. Rail lines can be hundreds of kilometres long, while single-line train crossing strategies are based on a station or passing loop level and require the analysis of the problem on a minute time scale. In mixed-use rail systems with limited passing loop infrastructure, trains have different passing priorities and lengths, thus differing in their ability to use passing loops. Most commercial software tools for simulating rail systems often resort to problem-specific rules and heuristics. They can typically only be used by highly specialized personnel, but are still unable to solve complex rail configurations since the simulation approach is not well suited to optimize the train crossing problem. This paper presents an integer formulation for the detailed scheduling of trains on a single main line using the modelling elements/ equations presented as part of the process systems-based unit-operation-port-state superstructure (UOPSS) framework. This model is the basis of the patent-pending Hatch Rail Optimizer (HRO) software. Other approaches in the literature fail to address many of the intricacies solved by our work. This approach is demonstrated through a practical case study involving a 37-kilometre rail corridor with five different train sizes over a week-long scheduling horizon. Interesting computational experiences comparing mixed integer linear programming (MILP) and integer programming (IP) formulations are also discussed.

By: L. Furstenberg; HATCH

### Gamification of Dynamic Simulation:
Synopsis: An interactive session to demonstrate a complementary approach for communicating dynamic simulation results. Lessons are best learned by experience. This approach allows interaction within a controlled environment to help players learn from the simulation. Players should identify system bottlenecks and test their own theories on correcting them. In each session players compete against their peers in friendly competition towards an objective.

By: L. Furstenberg, HATCH

### Performance Centres
Synopsis: With the advances in digital technology, the need to always have expert resources located at remote mining operations to solve complex operational problems is diminishing. A performance centre is a team of experts that is located remotely from mining operations. They analyse live and historic data and work closely with operations teams to identify and implement solutions that significantly improve and permanently sustain productivity outcomes. Through a performance centre, operational teams have ongoing direct access to experts with deep domain expertise who can solve their most difficult challenges and ensure that they remain in place. Hatch is working with a number of organisations to develop and implement performance centres.

By: P. Lottering, Global IO

### A Roadmap to the Mine of the Future
Synopsis: The digital era is upon us, with information available at the click of a button. Mining should be easier, quicker and more productive, but the opposite trend is evident. Instead, mining is faced with complexity introduced through data rigidity, brought about by capital and human intensive processes, and a focus on survival brought about by the downswinging in commodity prices. The challenge facing mining is to transform at a steep pace, whilst still achieving the ultimate objective. The big question is still: “How do we practically address this challenge in time?”

By: C. Holtzhausen, Regional Director, Advisory, HATCH

### Hatch Smart Hybrid System
Synopsis: Many mining operations rely on costly locally generated diesel power for energy needs. In certain cases, alternative/renewable energy sources, together with diesel generation, form a hybrid power system that can reduce overall energy costs. The Hatch Smart Hybrid System is a solution that combines solar or wind energy or other clean energy sources with energy storage and intelligent energy management to minimise the cost of electricity with improved power system reliability.

By: Dr. M. Sedighy, HATCH

### Dynamic Simulation
Synopsis: Hatch’s mining group has developed a methodology to evaluate a proposed or existing mine design in terms of ore body productive capacity and ore and waste handling. The objective is to ensure that the systems are not over- or under-designed but able to maintain flexibility. Using a combination of simulation-based technologies, Hatch first determines the productive capacity of the ore body under the mining methods used. This lets us understand the real crew and equipment requirements, and identifies the constraining resource(s). Using the scheduled output of a mining simulation model in combination with standard ore/waste/backfill-handling simulations, the process ensures that the resultant system is designed based on what is dynamically required from the mining method/ore body. This session presents case studies of this methodology as used in generic mines in Ontario and Northern Canada.

By: P. Rutherford; HATCH

### Round Table Discussion 1: Mine Of the Future
By: C. Holtzhausen, Regional Director, Advisory, HATCH

### Round Table Discussion 2: Energy Strategy for African Mines
By: R. Van Beers, Regional Director Energy, HATCH & Dr. M. Sedighy, HATCH
## May 16, 2017

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<th>Time</th>
<th>General Topics (Auditorium)</th>
<th>Digital Mining (Room 10)</th>
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<td>08h00–</td>
<td><strong>Integrated Mine-to-Mill Optimisation to Maximise Operational Profitability</strong>&lt;br&gt;Synopsis: The operational profitability of the mining and mineral processing industry is currently facing several issues due to metals market conditions and the nature of ore bodies. However, thorough a holistic assessment and optimisation from mine-to-mill operations, significant improvements can be achieved in the overall performance. Thus a healthy profitability can be maintained in a sustainable manner. Through this methodology, integrated mining and processing strategies are tailored to the operation and ore types in order to maximise the throughput while minimising the overall cost per ton treated.&lt;br&gt;&lt;br&gt;By: W. Valery, PhD, Global Director, Consulting and Technology, HATCH &amp; R. Valle, MBA, P.Eng., Director, Process Improvement, HATCH</td>
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<td>08h30–</td>
<td><strong>Predictive Maintenance</strong>&lt;br&gt;Synopsis: Traditional approaches to maintenance can often lead to unplanned downtime, early replacement of components, or in many cases, simply waiting until a component fails before it is replaced. Predictive maintenance is simply what the name implies—maintenance resources and equipment are maintained based on fact-based expectations of when they will fail or need service. In this session, we will explore the methodology to implement a predictive maintenance program within mining operation.&lt;br&gt;&lt;br&gt;By: A. Mullan, HATCH</td>
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<td>09h00–</td>
<td><strong>Mine-to-Heap Leaching Optimisation</strong>&lt;br&gt;Synopsis: Across the globe, grades of ore bodies have declined resulting in heap leaching becoming more and more prominent in our industry today. Optimising particle-size distribution, loading plans, and leaching plans on heap-leach operations have become paramount for maximising NPV on operations where heap leaching is dominating or substantially representing a significant portion of a mining operation. This is mine-to-heap optimisation, treating our heap-leach operations with increased analysis and monitoring as we do with milling operations. Utilising dynamic systems to model heap-leach performance on the basis of first principles in leaching kinetics and hydrodynamics has resulted in substantial increases in heap-leaching operational performance. Collectively, through metallurgical analysis, comminution analysis, and utilising dynamic simulation (modelling) of heap-leach operations, increased value to operations has been demonstrated, both in current operations and in evaluating and maximizing feasibility of new operations.&lt;br&gt;&lt;br&gt;By: I. Mullany, Global Director, Mining and Metals</td>
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<td>09h30–</td>
<td><strong>Connected Worker</strong>&lt;br&gt;Synopsis: To improve productivity, allow the connected worker to visualise their assigned activities in context with other relevant information (e.g. equipment manuals, standard operating procedures, evacuation procedures, and worker locations with specific skills).&lt;br&gt;&lt;br&gt;By: A. Raman, HATCH</td>
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<td>09h00–</td>
<td><strong>Bulk Ore Sorting</strong>&lt;br&gt;Synopsis: Bulk sorting of ore offers an opportunity to exploit the heterogeneity of an ore body to selectively reject low-grade and waste material from the mined ore, thereby increasing ore grades to processing plants. Realising the opportunity requires the use of emerging technology in real-time ore sensors and analytics. These are capable of rapidly measuring key bulk-ore characteristics and efficiently, reliably, and selectively rejecting the low-grade or waste material. In this presentation, Hatch will discuss the application of this technology to conveyer systems, the range of sensor technologies available, the diversion systems we have developed, and the significant value that could be delivered from this technology.&lt;br&gt;&lt;br&gt;By: D. Harding, Global Director-Innovation, HATCH</td>
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<td>09h30–</td>
<td><strong>Autonomous Mining Introduction</strong>&lt;br&gt;Synopsis: The application of new technology can significantly reduce unplanned outages of equipment as well as human exposure to hazards. In this session, we will discuss how the application of new technology can reduce the number of required shutdowns for inspection as well as help proactively manage the digital mine.&lt;br&gt;&lt;br&gt;By: L. Moller, HATCH &amp; F. Button, Red Button</td>
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Synopsis: As water becomes a more scarce and costly commodity for both new and existing mining operations, an integrated and holistic approach to water sourcing, management, and treatment is crucial to a successful operation. By combining years of experience in both management and treatment of water in mining, partnerships with innovative technology companies, and the ability to deploy water testing equipment for real-time process troubleshooting and optimisation, Hatch is taking an integrated approach to solving our clients’ water challenges at various sites globally.

By: A. Kasza, Lead, Water & the Natural Environment., HATCH

Underground Operational Management System (Short Interval Control)

Synopsis: People are at the centre of everything we do. Those people need the right information, at the right time, to make the right decisions. The major difference between an underground mine and any other business is accurate, timely workplace status information. We simply cannot “see” what is happening. This has forced a dependence on paper and verbal-based communications that are prone to error, even in the best circumstances.

The manufacturing, auto, and oil & gas industries are well down the road on a digital journey that has completely transformed these industries over the past two decades. Digital platforms have been developed and installed. All equipment and people are sensored, connected, and enhanced by mobile devices to provide operations with real-time, accurate, integrated information that is essential to running an efficient operation. However, when we come to work in our mining operation, it is like going back in time. Many of our operations have not yet started on the digital journey, and those that have are not yet far enough down the road to realise the full benefits.

There are three important attributes of data specific to mining:
1. Information completeness
2. Information accuracy
3. Information timeliness

There is strong evidence to support the conclusion that reducing variation at the process level can increase productivity by as much as 25 percent in most underground mines. Now, there is readily available technology to completely digitize the mining operation so the data collection process can be reliably automated.

The focus is real-time information to drive decisions targeting “in shift performance” (SIC) and continuous improvement.

By: I. Mullany, Global Director, Mining and Metals

Technology Partnership

Synopsis: The mining industry needs to innovate to address challenges in productivity associated with lower grade and more complex ore bodies. Successful development and implementation of innovation requires a range of different disciplines, technologies and business processes that need to be efficiently and effectively integrated. Hatch has formed a technology partnership with a tier-one mining organisation to achieve this. Through these partnerships, mining organisations will have access to Hatch’s proven technology-commercialization experience, deep mining-domain expertise in business process design, operational performance, engineering, and digital systems, and the ability to effectively integrate these into holistic solutions.

By: D. Harding, Global Director, Innovation, HATCH

Online Coal Quality Analysis and Stacking-Reclaiming Modelling Using an X-Ray Fluorescence (XRF) Analyser

Synopsis: The Sasol Coal Value Chain is a complex system consisting of blending, stacking, and reclaiming no fewer than six different coal sources with vastly different coal qualities. The performance of the coal gasification facility depends crucially on the quality—both the average and standard deviation—of the coal reclaimed from the coal stacking yards. Therefore, it is critical for the business to not only know the quality of the coal being stacked and reclaimed in real time, but also to optimise the stacking-reclaiming process in order to reduce the variability in the coal quality over time. Sasol Coal Supply has acquired an online x-ray fluorescence (XRF) analyser for real-time coal quality analysis. This paper discusses the integration of the real-time data with various off-line data sources from the coal supply facility to create a centralised and standardised data framework for input to a stacking reclaiming simulation model. The simulation of a heap profile of the coal quality for each heap stacked, together with the quality of the reclaimed coal, is used in the development of a reclaiming strategy and optimisation of the stacking-reclaiming process. Furthermore, the real-time coal quality data, modelling, and results are all made available on an easy-to-use web-based GUI for proactive decision making, diagnostic analyses, and optimisation across the value chain.

By: Dr. Roelof LJ Coetzer, PhD, Pr.Sci.Nat., Sasol Group Technology

Employee of the Future

Synopsis: The role of the human factor has gained immense prominence in the risk management environment over the last two decades. Early pioneers in health and safety like Heinrich and Reason commented on the impact of at-risk behaviour of employees and the causal link to workplace incidents. The importance of this management area has, however, been elevated through the inclusion of human factor analyses in incident investigation methodologies as well as a more holistic focus on human fitness to perform work. In managing these, risk organisations have started to look at the role of fatigue, psychosocial wellness, incentives, communication, and leadership behaviour in shaping the human context in the workplace.

By: Leigh McMaster, Specialist in Behavioural Change, South African Chamber of Mines
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| 13h00–15h00 | Round Table Discussion 3: An Integrated Approach to Water in Mining  
By: A. Kasza, Process Engineering, HATCH |
| 13h00–15h30 | Round Table Discussion 4: Integrated Operation Centres  
By: D. Harding, Global Director, Innovation, HATCH |
| 15h00–15h30 | Closing Note  
Arne Weissenberger  
Regional Director, Mining and Metals  
HATCH |