

BHP

BofA SmartMine Conference

Presentation & Speech

29 June 2022



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Innovation at the world's largest mining company

**Bank of America
SmartMine Conference**

Laura Tyler Chief Technical Officer

I want to say thank you once again to Bank of America for the chance to talk about the technology and innovation that is driving performance at BHP and how we seek to differentiate and position ourselves for the future. Before we begin, I would like to just acknowledge that I am speaking from the custodial land of the Kurna people of the Adelaide Plains here in South Australia. I pay my respects to all the traditional owners on whose lands BHP operates around the globe, including their elders past and present, and I just want to acknowledge and recognise their unique culture, resilience and enduring spiritual connection to their land.

It is also great to be speaking to an audience of our peers, valued investors, supply chain partners, maybe even future supply chain partners, who knows? But all of you are aware of the incredible opportunity that we have in the resources industry to transform what we do through innovation and technology.

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This presentation contains forward-looking statements, including statements regarding: trends in commodity prices and currency exchange rates; demand for commodities; production forecasts; plans, strategies and objectives of management; assumed long-term scenarios; potential global responses to climate change; the potential effect of possible future events on the value of the BHP portfolio; closure or divestment of certain assets, operations or facilities (including associated costs); anticipated production or construction commencement dates; capital costs and scheduling; operating costs and shortages of materials and skilled employees; anticipated productive lives of projects, mines and facilities; provisions and contingent liabilities; and tax and regulatory developments.

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Other factors that may affect the actual construction or production commencement dates, costs or production output and anticipated lives of assets, mines or facilities include our ability to profitably produce and transport the minerals, petroleum and/or metals extracted to applicable markets; the impact of foreign currency exchange rates on the market prices of the minerals, petroleum or metals we produce; activities of government authorities in the countries where we sell our products and in the countries where we are exploring or developing projects, facilities or mines, including increases in taxes; changes in environmental and other regulations; the duration and severity of the COVID-19 pandemic and its impact on our business; political uncertainty, labour unrest, and other factors identified in the risk factors discussed in BHP's filings with the U.S. Securities and Exchange Commission (the 'SEC') (including in Annual Reports on Form 20-F) which are available on the SEC's website at www.sec.gov.

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BHP also holds interests in assets that are owned as a joint venture but not operated by BHP (referred to in this release as 'non-operated joint ventures' or 'non-operated assets'). Our non-operated assets include Antamina, Cerrejón, Samarco, Atlantis, Mad Dog, Bass Strait and North West Shelf. Notwithstanding that this presentation may include production, financial and other information from non-operated assets, non-operated assets are not included in the Group and, as a result, statements regarding our operations, assets and values apply only to our operated assets unless otherwise stated. References in this presentation to a 'joint venture' are used for convenience to collectively describe assets that are not wholly owned by BHP. Such references are not intended to characterise the legal relationship between the owners of the asset.

Technology and innovation embedded in BHP

Underpins delivery of reliable operational outcomes, disciplined growth and sustainability leadership across our value chain



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At BHP, our purpose is to bring people and resources together to build a better world. To do this, we need a portfolio that is future-fit and positioned to generate value for decades to come. Our assets are sector-leading. We aim to operate them to maximise value for all of our shareholders and the power of data, innovation and technology, together with the BHP Operating System have enabled and accelerated continuous improvement right across our value chain, from exploration right the way through to marketing and delivery of our products to our customers.

These strategic levers – data, innovation, technology and the BHP Operating System – set us apart and help us deliver outcomes across four key areas. Firstly, we seek to maintain safe, predictive and productive operations through stable systems, application of operating discipline and improvement. This feeds through to our strong margins and consistent cash flows. Secondly, we are driving productivity improvements with emphasis on automation, real-time data-driven insights and decision making where we can automate it. Thirdly, the power of data and innovation helps us to unlock the next stage of value growth at BHP, both from realising greater margins in our existing assets but also, and importantly, how we seek to find new assets for the future.

Finally, we are seeking improved sustainability and social value outcomes through innovation. I am focused in my role on how we decarbonise faster, take energy out of systems as efficiently and effectively as possible, cut down on water use and really seek to reduce our footprint size. Under Mike Henry, we have seen an increased focus on technology and innovation, and BHP has become more agile in how we work. We believe this is how we will continue to differentiate ourselves from our competitors.

BOS drives significant value

BHP Operating System (BOS) has been operating since 2017 and empowers the front line to help design Standardised Work

An operating model based on a common set of systems and processes

Builds on the work of last decade including 1SAP implementation

Tool for incremental initiatives to be originated from front line operations

Technology and innovation provides the tools to enable BOS

Delivered **~US\$1.3bn** across FY22 in cost out, revenue uplift



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I want to start by talking about our existing assets and how innovation in the way we operate, coupled with digital data, has driven improvement and changed the way we work every day. This is a major contributor to our consistent operational performance that you will have seen over the last few years. We have been working on the BHP Operating system, or BOS for short, since 2017. Our goal was to create a way of working that makes improvement central to everyone's role in the pursuit of operational excellence, taking inspiration from the leading carmakers such as Toyota and the Toyota method.

It builds on foundations that we have built over the previous decades, including 1SAP implementation, which many of you will remember us going through, increasing digitisation, implementation of centres of excellence and, of course, our move to the cloud more recently. It marks a fundamental shift in leadership, organisational capability and employee empowerment, and it is our most important lever to build organisational resilience and grow value.

Together with the power of data and technology, it is making us safer, more reliable and more productive. BOS has helped us carve out about US\$1.3 billion in cost savings and revenue uplift in the last year alone. This is a result of the BOS principles and practices, focused on our target to deliver our production commitments and increase margins on every single tonne. This includes more efficient maintenance practices and higher productivity across the business.

These improvements were owned by an empowered front line across our Minerals Americas and Minerals Australia assets through the BOS routines that we have put in place. I was recently at Escondida, where the passion of the teams to deliver improvement, to be safer, to add value, was really inspiring and to be part of those meetings and part of those routines was really quite powerful. Embedding those BOS routines has given their improvement ideas a real voice, made it really powerful and showed how they can bring what they know and what they understand to the workplace every day. But how does it happen in practice?

Leaner, innovative and more standardised

A way of working that creates ~80,000 potential problem solvers, solutions accelerated by technology

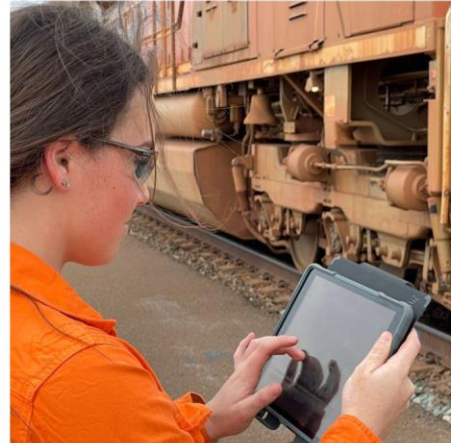
Underwritten by in-house innovation and applications

Provides an interface to the people on the ground via apps

Front line can input improvement suggestions in real time

About **12,000** maintenance activities completed via the app each month

More than **2,000** improvement ideas submitted each month



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We have approached it in two ways. We look at it top-down, where we build a digital twin for each of our assets to model improvement along the value chain – where are our bottlenecks? How do we truly understand them? And bottom-up, where the BHP Operating System effectively creates 80,000 problem solvers across our business globally to improve safety and productivity, but it is underwritten by in-house innovations and applications that provide the interface for people on the ground to execute and improve their work.

Many ideas on the front line start on the front line with people who operate our assets every day. They are the ones that are often best-placed to work out how to standardise the work processes and how to share the innovative ways of working. A great example is the standardised work tools that we have rolled out on any repetitive tasks across all of our Australian and South American operations. We started in maintenance because of the sheer significant spend there and the opportunity to put it into the already structured nature of work that maintenance is. This benefits equipment availability and reliability, or mean time between failures, both of which are material factors to achieve our production targets.

Through a strategy to build a fully integrated BOS, right the way across the system, we have deployed a global toolkit that leverages innovative market solutions and builds on those existing pockets that we see of digital maturity across the business. This app then provides the frontline maintainers and operators with an interface to follow the work instructions on how to do the activity, for example a truck maintenance activity, where they can upload the detailed equipment information as they execute the work, including examples such as photos or notes or whatever that is going to be required for future work. They can raise a maintenance notification for follow-up and, importantly, input improvement and suggestions in real time, while they are doing the task. These are fed back to site improvement teams and has meant we have increased the velocity of continuous improvement, right across our operations.

BHP asset data is wired together through our 1SAP system, so we can directly compare data and process improvement between, for example, the BMA, the Escondida and the WAIO fleets in real time, so that best practice can be analysed and spread quickly between the assets. Through the in-field app, about 12,000 maintenance activities are completed every month and more than 2,000 improvement ideas are raised. The standardised work app picks up those ideas and those ways of working, and improves the future ways of working. This approach, we believe, all wired through 1SAP, is a competitive advantage for BHP, driven by technology, making our front line work safer and more productive.

Safety, diversity and productivity benefits

Strong safety record in Standardised Work initiatives, tasks designed for a more diverse workforce



Use of Standardised Work is on the rise across our global footprint

So far yielded a significant reduction in effort where deployed

Brings improvements in labour flexibility across maintenance roles

~US\$200m reduced maintenance costs, increased equipment availability

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Through standardising processes enabled by digital solutions, standardised work activities have yielded significant reduction in effort by driving consistent, quality outcomes. We have also delivered about US\$200 million in value to BHP over the past two years, through reductions in maintenance costs and increases in production brought by increased equipment availability and mean time between failures. For example, the introduction of standardised work on one of our Hitachi excavators has reduced labour hours allocated to a 16-week service by over 25%, from 90 hours to 65 hours.

Redesigning and improving how the work is done also means we can be more flexible and diverse in hiring for these operational maintainer roles and as we eliminate or redesign tasks that have historically relied upon physical strength, we can change the way that we work. Given the safety, diversity and productivity benefits delivered so far, we are deploying the standardised work apps across all maintenance areas and we are trialling it at our iron ore rail operations to see how we can implement it through production as well.

We are also using innovation with our data and systems in what we call total equipment strategies for our critical operating systems. Initially applied to mobile fleets, we have now successfully extended it to our fixed plants. Total equipment strategies, or TEs for short – I do not suppose it would be BHP without yet another acronym – revisits the maintenance and asset integrity strategies for the critical pieces of equipment in our operations. Based on a mathematical analysis of the breakdowns, the maintenance patterns, the OEM recommendations, it delivers a recalibration of the maintenance strategies, resets the work orders in the systems and assesses the critical parts listing with the intent to increase availability and reliability, and reduce maintenance and inventory holding costs.

As another example, at our Newman iron operation in Western Australia, the mobile TES project for excavators helped to extend the average equipment life by 40% and delivered an availability uplift of 2%. The outcome was 3.5 years of extra life for the equipment, which may not actually seem like a lot but helped to achieve capital productivity by deferral of US\$80 million over five years.

Looking at what we have learned, we will also roll out these innovations and learnings at all of our new assets and major projects. This will differentiate us as it will allow us to capture these benefits from day one of production. The next phase of these will be on our world-class Jansen potash project that Jason referred to earlier on, up in Saskatchewan, where we are looking at the potential to accelerate first production to 2026. I just spent some quality time on the ground up there and it is exciting to see it coming along, and we are really excited by the great progress that they have made in completing the shafts or getting the shafts accelerated so that they can bring the project forward.

I want to take some time now to speak on that project and the work that we have completed there.

Innovation to deliver advantages at Jansen

Approach at US\$5.7 billion potash project drives sustainable cost, safety and sustainability benefits

Low water footprint and emissions embedded in design

~60% less fleet creates ~10% operating cost saving

Larger sized borers, continuous conveyance and automation

A new benchmark for equipment and decision automation in the industry

Continuous high-speed loading systems to maximise rail efficiency



Dotted line indicates typical conventional borer height

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Jansen will be the most advanced and sustainable potash mine ever built. As a new operation, we do not have to retrofit technology and we can install at design. It will be difficult, if not impossible, for existing potash miners to retrofit and recreate the operational advantages that we are seeking to capture over the next couple of years. For example, during design we wanted to provide a proven alternative to the conventional active borer technology, so we partnered with Sandvik to look at the options. The result is the photo on the slide, where you can see the big red machine. We will introduce a high degree of automation, integrated design and eventually a remote operation centre like we see at WAIO, BMA and Escondida to drive the borers of the future. We will be connected to it from surface, potentially even from Saskatoon.

Jansen Stage 1 will have just four mining systems, capable of producing the equivalent of 10 to 14 typical systems, able to monitor the ground ahead and adjust its mining height to match the ore body. This is a sustainable advantage, with around 60% less fleet creating around a 10% operating cost saving as well as fewer active mine faces, so therefore increasing stability, and a smaller environmental footprint. Jansen, we believe, will set a new benchmark for equipment and decision automation in the potash industry. We will have three times the number of process sensors and 10 times the number of machine health monitoring sensors compared to the next largest producer in Saskatchewan.

This, married together with the latest processing technology, means we expect to achieve an industry-leading recovery rate of around 92%, which I think is pretty awesome, and Jansen Stage 1 will have approximately 50% less carbon emissions per tonne than the average in the basin and approximately 60% less fresh water consumed on the same basis. We are actively continuing to take steps to further lower those emissions and water usage at start-up and continuing through as we ramp up. So we have developed a lot of technology in-house at Jansen but we have also partnered externally where we needed to solve the big challenges. We see the value in making sure we bring everybody along on the journey.

Unlocking future potential value growth

Taking an innovative approach across our organic projects and levers for growth

Leaching technology

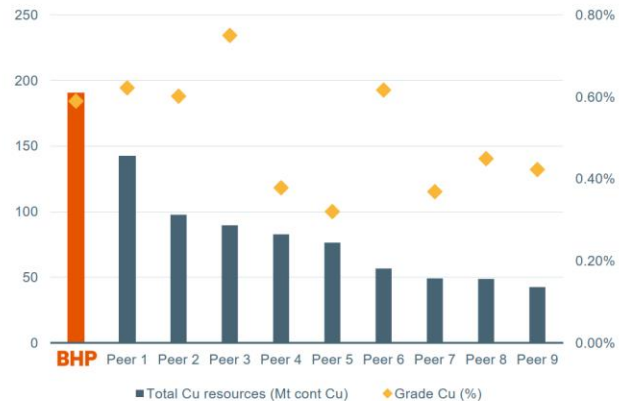
- Chalcopyrite leaching projects at all MinAms copper assets
- Potential to double recoveries in primary sulphides
- Chloride leach at Spence could be expanded to Escondida

Exploration technology

- Using 3D machine learning to deliver new search spaces
- Promoting the fusion of data science into exploration
- Leveraging decades of legacy data to develop new targets

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Largest copper endowment with comparatively high average grade
(Total copper resources, contained metal copper Mt) (Copper grade %)



Peers include: Anglo American, Antofagasta, Codelco, First Quantum Minerals, Freeport, Glencore, Rio Tinto, Southern Copper and Teck.
Source peers: Wood Mackenzie Ltd, Q1 2022.
Source BHP data: FY2021 BHP Annual Report.
Note: Based on ownership interest. Refer to detailed table for BHP's Copper Mineral Resources in the Appendix slide 12.

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Looking beyond Jansen, in my introduction I highlighted that technology and innovation is not just about the existing assets but also about applying innovation and technology to the future and to increase future value. One example that is exciting is working on efficiency-increasing technology, such as the primary sulphide leaching at our copper assets in South America. Chalcopyrite leach projects are progressing at all our copper assets in South America. While it is early days, we are really encouraged by the results to date and will provide a bit more detail soon, so I am not going to give you lots of detail today but watch this space. Chalcopyrite leach has the potential to increase copper recoveries in primary sulphide ore and significantly reduce the cycle times. Our work in this space has demonstrated that our leaching technology has the potential to double copper recoveries in primary sulphides from the current mid-30s percentile.

We are also looking at chloride leaching technology. We have had success at Spence implementing this - we saw recoveries increase by 10% over 2017 levels and we are hoping for similar increases at Escondida as we replicate the process there over the next year or two. If successful, given the volume of throughput at Escondida, this should drive significant increases in value through to the bottom line. Beyond the in-house development in leaching, we are also working with external partners, specifically Jeti Resources, who I think you have coming up later on in the programme, where we will be investing in trials of their technology.

Copper discoveries have decreased in frequency as the resources are more remote. They may be deeper, lower-grade, under cover, or in countries with more challenging operating conditions. That makes the resource we already control in copper, which for BHP is the largest in the world, and nickel, even more valuable and technology's role in helping to unlock this potential even more critical. But I do believe that the endowment that we hold is not just in terms of the resource in the ground, it is also in the legacy data that has been gathered throughout the 150-year history of BHP, Billiton and all the other companies that have formed today's group, and there are quite a lot of them when you start looking. We have created new tools and a data lake to view this legacy data in a different way. Significant amounts of data, much of which was previously paper copy, is now digitised and available for our geoscientists to access.

As Jason noted, I was a Chief Geoscientist for a while there. One of my big pushes was to get that data digitised and ready for use. Now we are using the dataset in association with machine learning technologies to develop new exploration targets globally. Some of these new targets are in our current and in our future drill schedules. This requires both scientific and technological innovation. The global metals exploration team at BHP works with technology, our ventures group and external partners on solutions that can be applied to our data and global endowment models to open new search bases for exploration, or maybe I should say for discovery. An example of this is using 3D machine learning in Australia with SensOre and KoBold, and in Chile with SRK and DeepIQ. We are working in partnership with these guys to deliver a new generation of search spaces under cover that were not previously recognised.

Digital and data drives real time insights

Innovations that start small can be rolled out and accelerated across BHP



Delivering more, and better, data to our people's fingertips in real time

Decision automation, machine learning initiatives from our digital factories

Digital factories initiatives subject to minimum **10x NPV over cost**

Using these across our mines, in our logistics, products and marketing

Rolling out innovations across assets and commodities creates value

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Finally, I look to where technology could deliver the most transformational change across the business, and I would say this has to be in digital. Digital is quite a broad term, but I want to deliver more and better-quality data to the operations in real time, so that decisions can be automated with confidence and to make sure people can provide calculated intervention and see the intended outcomes. This is just such an incredible, powerful opportunity for how we truly democratise data and get it into people's hands. But it is a multi-year journey and we are investing to make sure we get this right through foundations in data ownership, cloud, digital ways of working, cybersecurity and the digital capability build across the business.

This investment, coupled with the digital factories at every major asset, all directly enable BHP's digital future. We are seeing the start of this transformation, coupled with the continued automation I talked about last year, and the future is both exciting and bright. Our digital factories are hothouses of performance. Based on agile methodologies, they seek out and they solve the business problems around data performance. They chase value and with every project, we set a minimum return of 10 times NPV over cost, so no project gets through just because it looks good, and they are delivering. In a company the size of BHP, even the smallest innovations that can be rolled out quickly will have significant global impact.

In closing, over time, we are confident that our investment in digital technology and innovation, linked with the automation we are putting in place, will follow a path of increasing returns, with reuse, scaling and adaption to new applications, some of which we just do not know about yet. BHP is a safe, sustainable and future-focused place to work. We deliver quality products to our customers and strong returns to our shareholders, while focusing on decarbonising our footprint and improving our social value. As our purpose states, we bring people and resources together to build a better world, but we do it with technical excellence and improvement at the heart of everything we do.

With that, I will pass back to Jason and James.