



Asset Reliability at the San Juan Mine

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Manager Maintenance
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Agenda

- **San Juan at a Glance**
- **Organizing for Reliability**
- **Reliability Processes**
- **Results**
- **Questions**

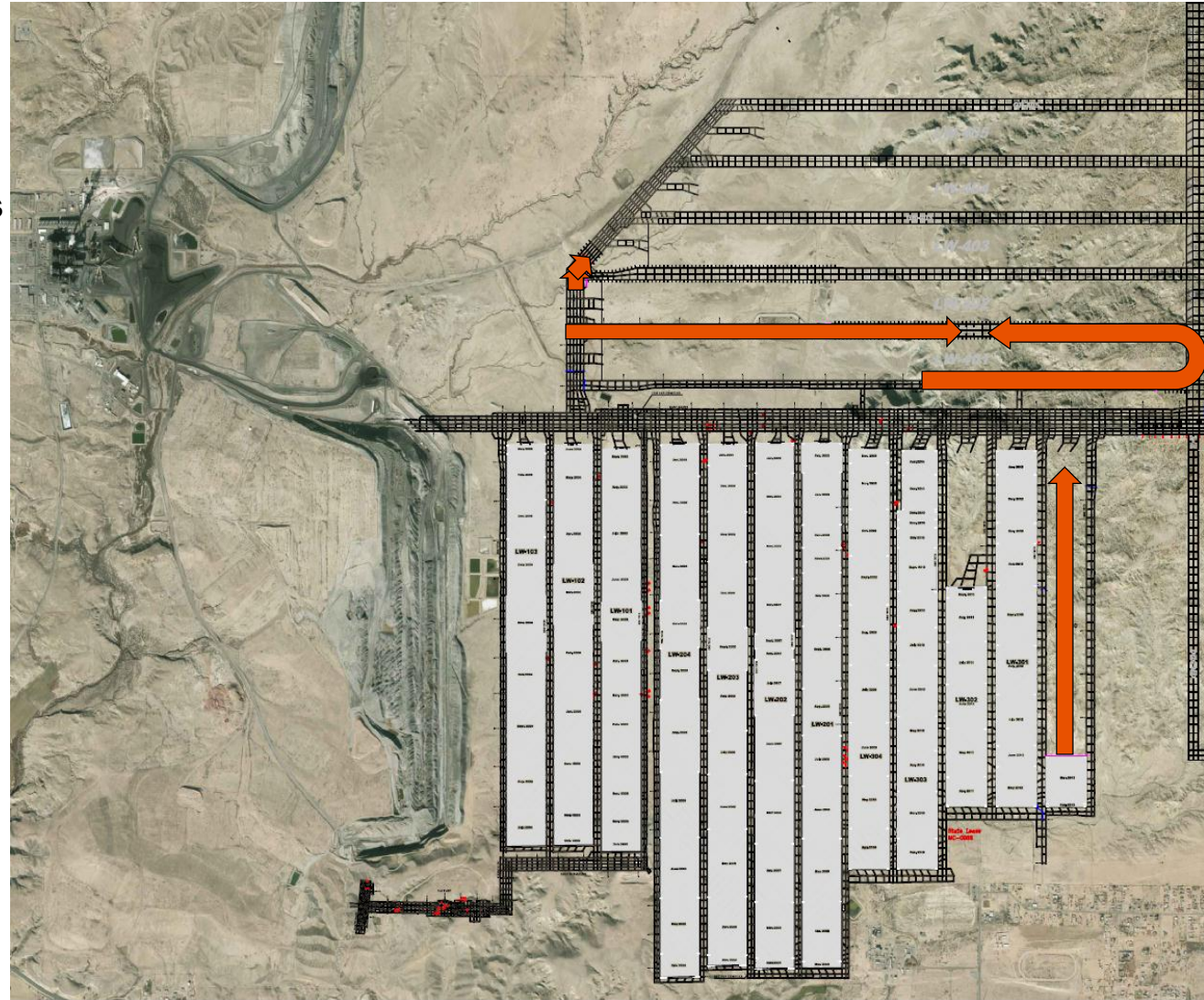
San Juan at a Glance

Longwall

- Joy Face
- 11'-13' Seam Height
- 1000' wide
- 10,000' – 15,000' panels

Development

- 2- 12CM12 Units
- 12ED25 Miner/Bolter



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Conveyance

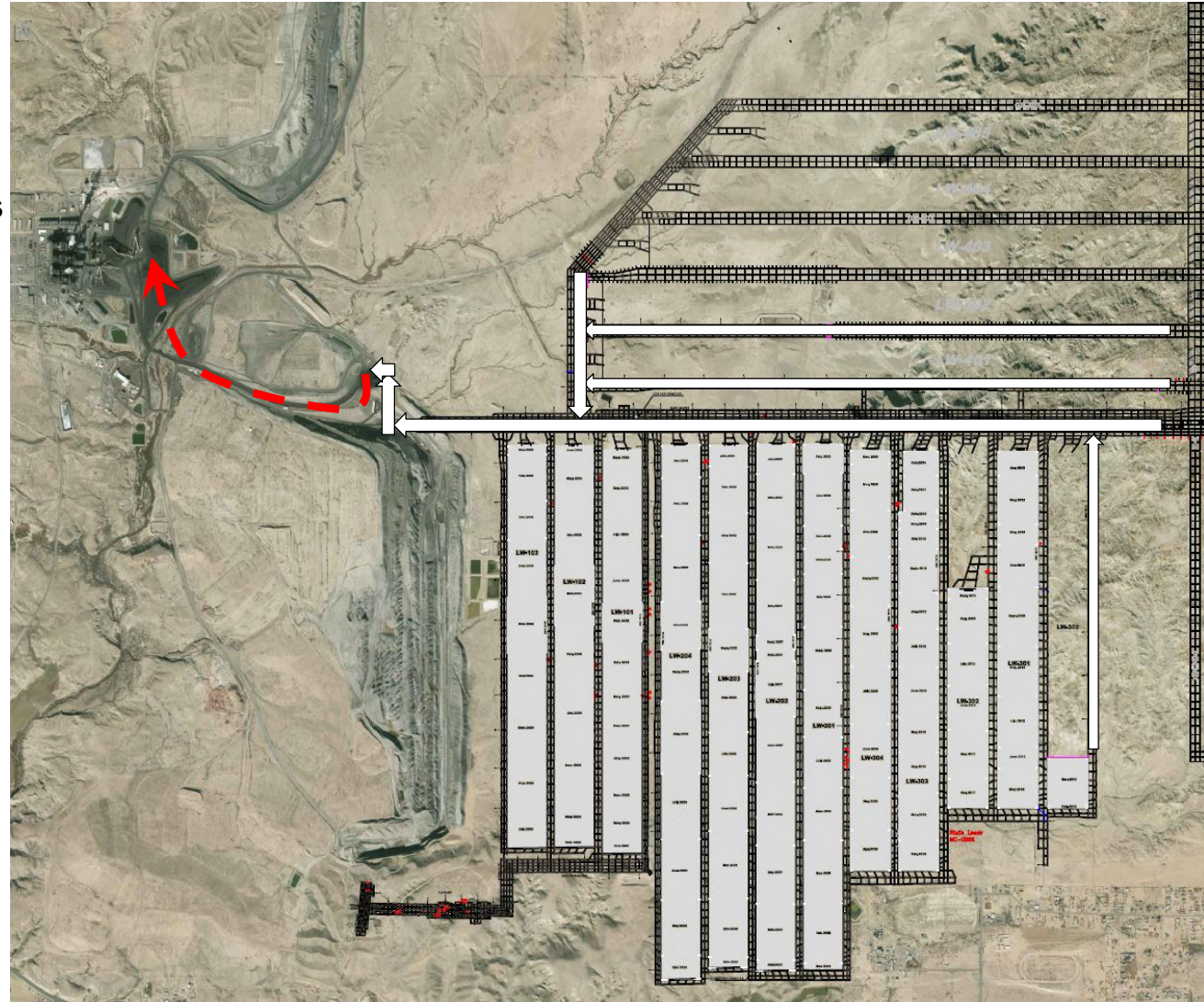
- 60" Gates
- 72" Mains/Sub-Mains

Haulage

- Loader/150T Truck
- 2 Mile Haul

Coal Plant

- Sizing – 1-1/2" Minus
- 4,000 Tons/Hour
- 225kTons storage w/
60kTons Live Feed to
Generating Station



Definition

- Asset –
 - Something valuable belonging to a person or organization that can be used for the payment of debts¹
 - A resource with economic value that an individual, corporation or country owns or controls with the expectation that it will provide future benefit.²
- Reliability -
 - The ability of a person or system to perform and maintain its functions in routine circumstances, as well as hostile or unexpected circumstances.³
 - Something or someone that is reliable can be trusted or believed because they work or behave well in the way you expect.⁴

Asset Reliability is a state where equipment or system performs as expected.

¹Cambridge Dictionary, dictionary.cambridge.com

² Investopedia, www.investopedia.com

³Wikipedia, www.wikipedia.com

⁴Cambridge Dictionary, dictionary.cambridge.com

Planning

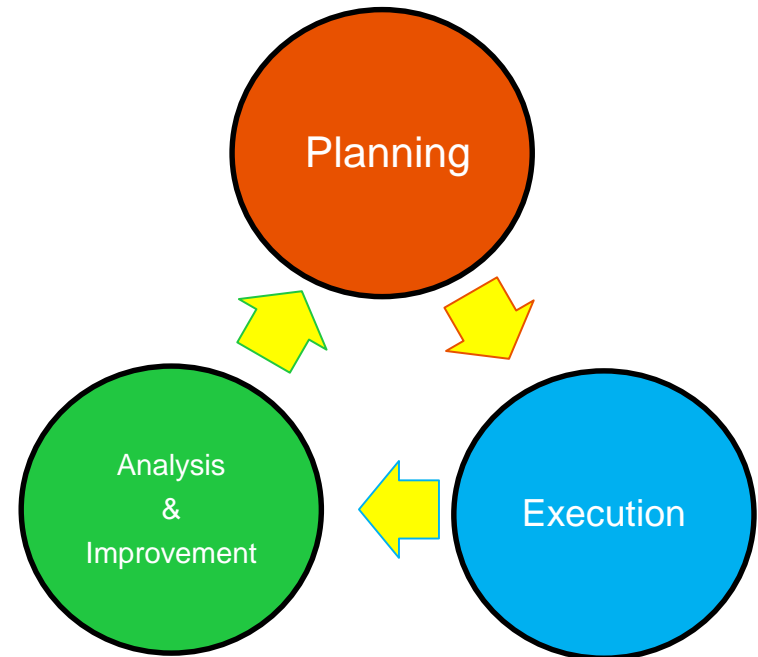
- Uses Thorough Tasklists
- Plans +1 to +12 weeks out
- Must have Field Presence

Execution

- Only Performs Work with Tasklist
- Formally SLAMs every Job
- Plans & Executes Emergent Work
- Confirms Time and Enters Work History

Analysis & Improvement

- Reviews all Completed Work
- Creates and Updates Tasklists based on Reviews
- Performs all MTAs/RCAs
- Strong Engineering Skills



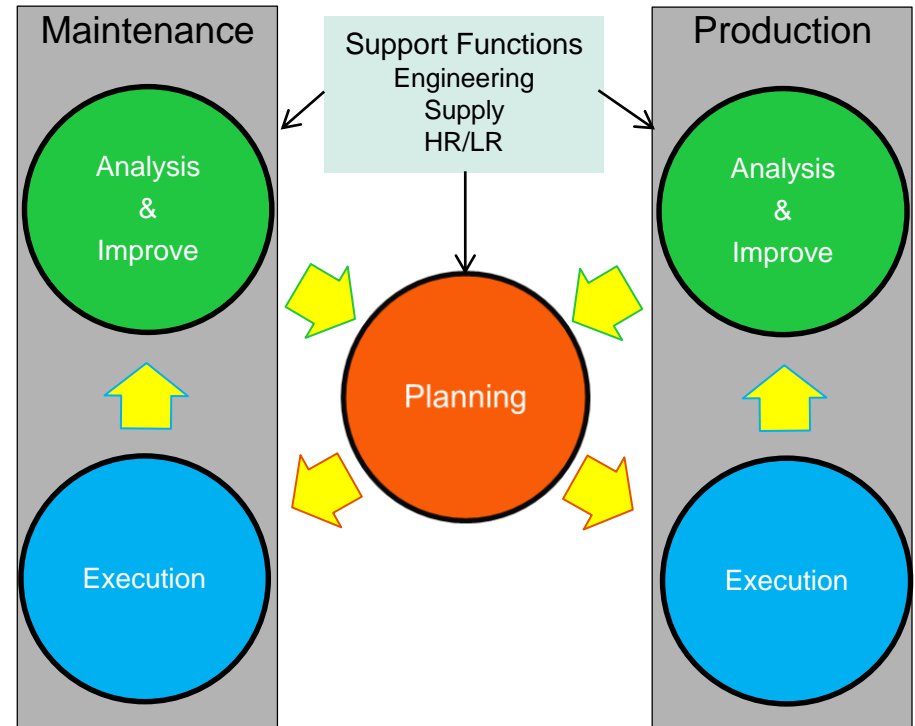
Organization

Collaboration

- **Must Occur on a Daily Basis**
- **Between Functions and Departments**
- **Must have Common and Achievable Goals**

Support Functions

- **Heavily Involved with Planning**
- **Change Management Agents**
- **Standards Owner**



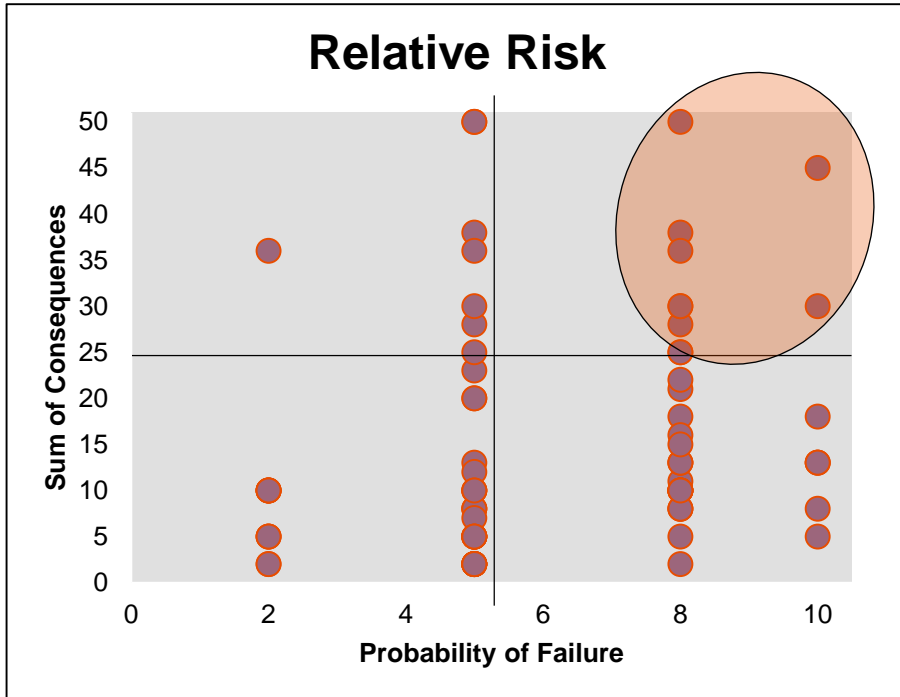
Organization – Maintenance Ratios

Total Maintenance Personnel – 171

Maintenance Ratios

- Salary to Trades – 1:3
- Superintendents to Trades – 1:18
- Supervisors to Trades – 1:8
- Planner to Trades – 1:16
- Manager to Superintendents – 1:7

Process – Prioritize Assets



Asset Prioritization

- Each Asset is Evaluated based on Relative Risk to the Business.
- All Functional Stakeholders involved in the RA
- Highest Relative Risk Number is given priority to determine how to prevent and predict their failures.

| Asset Name | | Sum of Consequences | Probability of a Failure | Relative Risk |
|-----------------|-------------------------------|---------------------|--|---------------|
| SJM-UNG-LWM-LPC | Longwall Pump Car Fleet | 50 | 08 - Failures occur monthly | 400 |
| SJM-UNG-CME-RBE | Cm Roof Bolters | 38 | 10 - Failures occur once a week or more frequently | 380 |
| SJM-UNG-OTB-GRD | Graders For Sjug Outby | 28 | 10 - Failures occur once a week or more frequently | 280 |
| SJM-USF-VNT-BCS | Final Balance Chamber Seals | 50 | 05 - Failures occur once or twice a year | 250 |
| SJM-ROS-GRD-16G | 16G Motor Graders At San Juan | 30 | 08 - Failures occur monthly | 240 |
| SJM-ROS-TRK-TKW | Water Trucks | 30 | 08 - Failures occur monthly | 240 |
| SJM-UNG-LWM-MON | Monorail | 28 | 08 - Failures occur monthly | 224 |

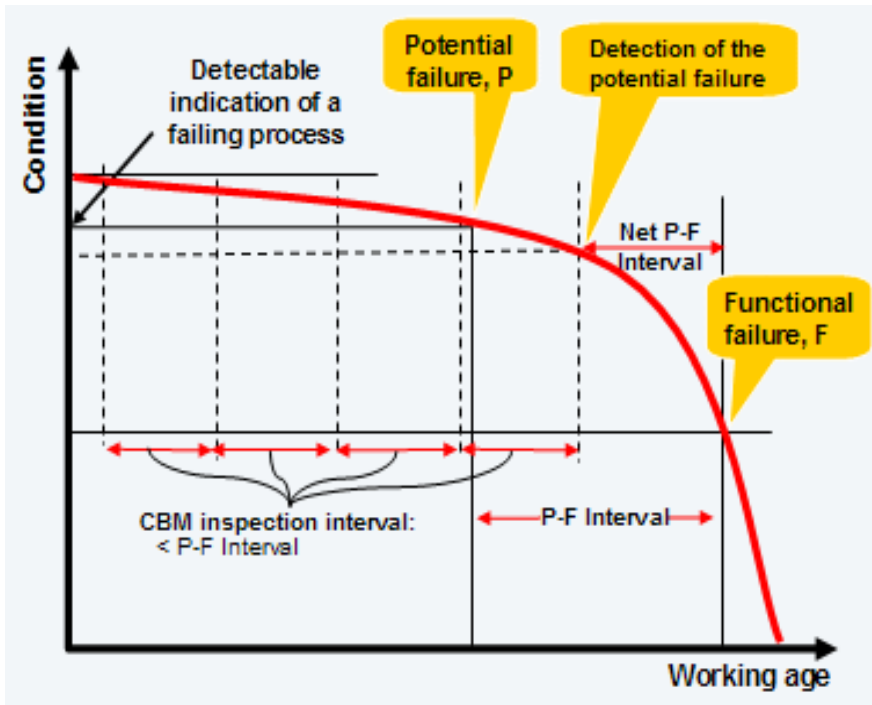
Process - Determine Asset Strategies

Strategies

- Run to Failure
 - Zero Risk to the Business if Failure Occurs
 - Typically Low Dollar Value
- Preventative
 - Consistent Lifecycle
 - Difficult to increase Lifecycle due to location
- Predictive
 - Opportunities for Lifecycle increase
 - Deference of CAPEX
 - Lower cost/unit (\$, ton, hour, foot)

Process – Maintenance Task Analysis

P – F Curve

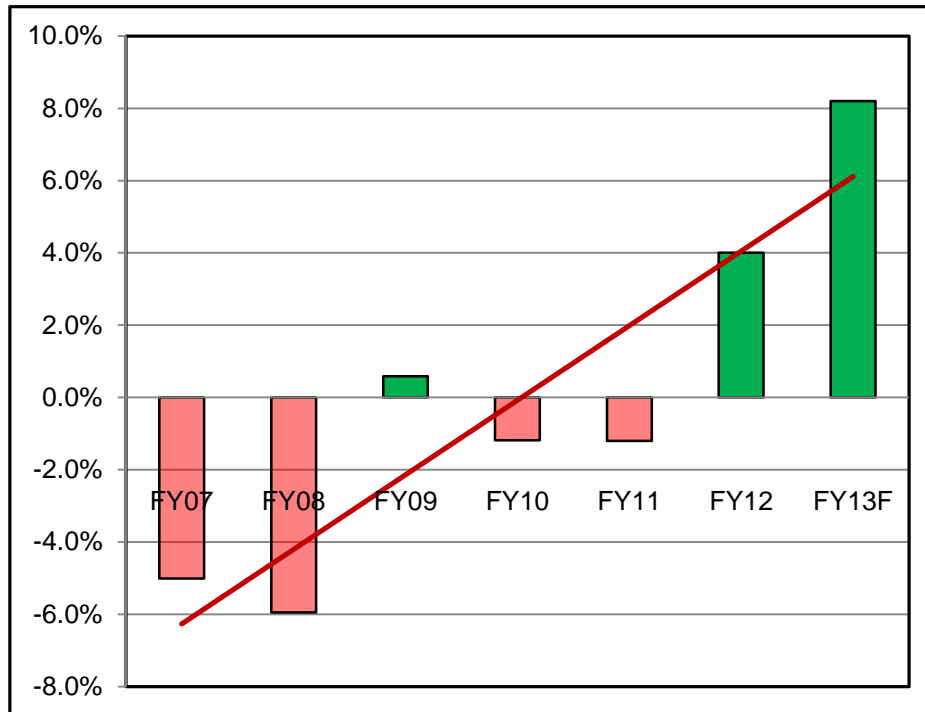


MTAs

- Maintainers and Operators Involvement are Critical to this Process
- Applied to Assets with Predictive Strategies
- Dissect Equipment down to Component Level
- Utilize FMEA / FMECA to Determine Failure Modes
- Correlate Failure Modes to P-F Curve
- Assign Maintenance Tasks to position on P-F Curve.

Results – Variance to Budget

Variance to Budget (%)

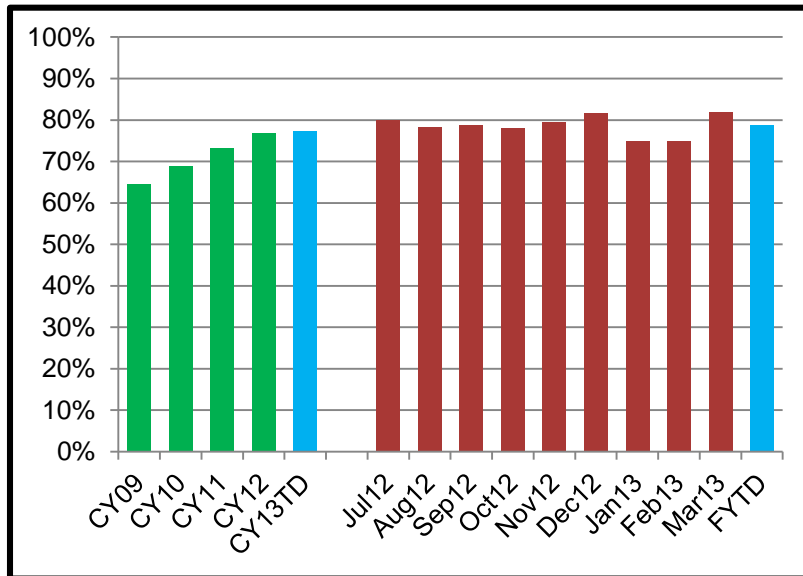


Notable Gains

- Increased Engine Life on Haul Trucks by 16%
- Extend Rolling Stock Oil Drains by 18%
- Moved CM rebuilds from 1.5 Mt to 2.0 Mt
- Real Time Oil Analysis on Conveyance Gearboxes & CAT 785 – 3512 Engines

Results – Planned Work

Planned Work (%)

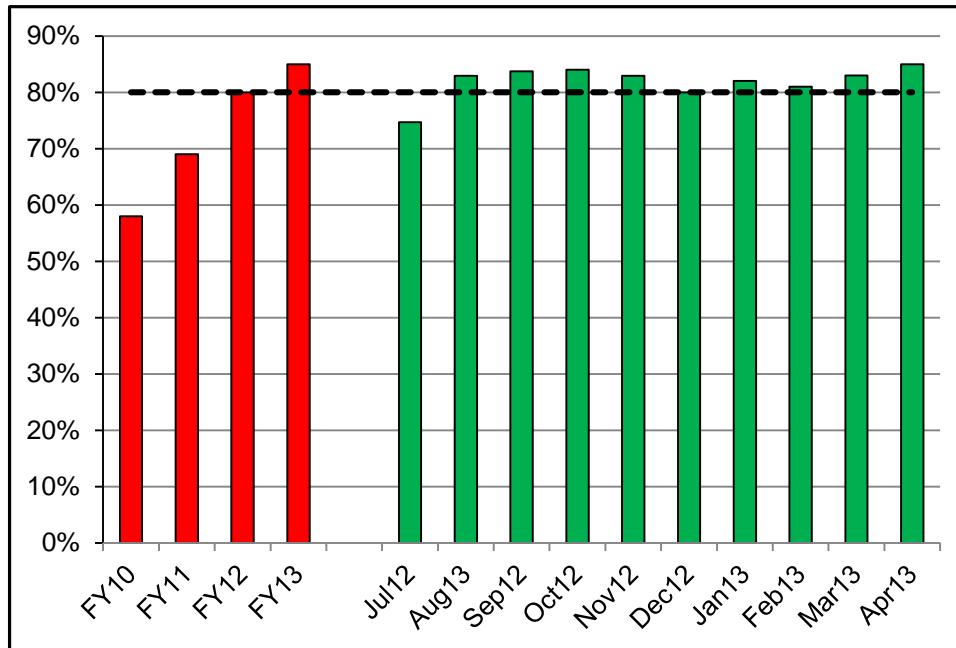


Notable Gains

- 20% increase since CY09
- Fiscal year trending to a 80% level
- Difficulty maintaining levels during LW move

Results – Adherence to Schedule

FY2010 to Date (%)

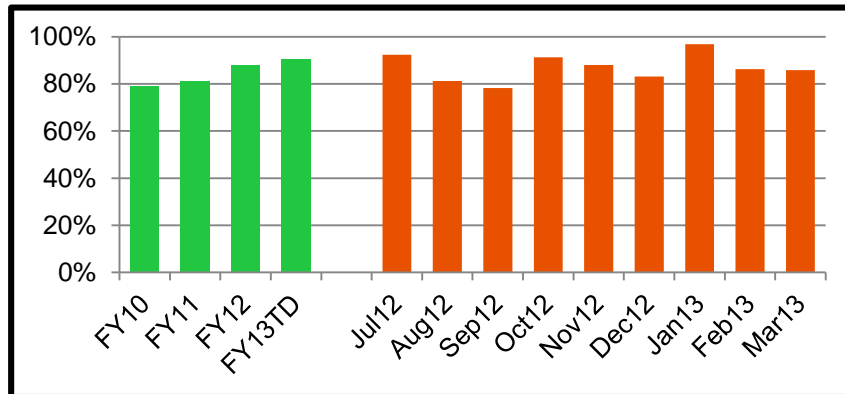


ATS

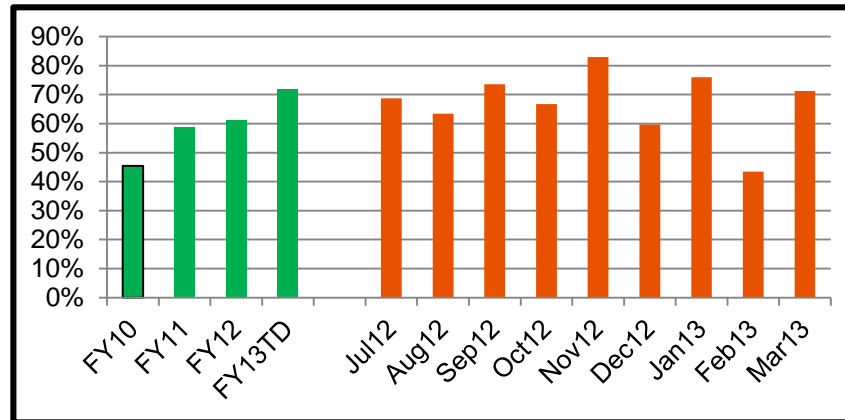
- Definition – Work that is Performed on the Day Scheduled
- Schedule is Locked the Thursday prior to the Scheduling Week
- A Measure of Effective Scheduling
- Requires a High Process Discipline amongst Functions

Results – Availability

Development

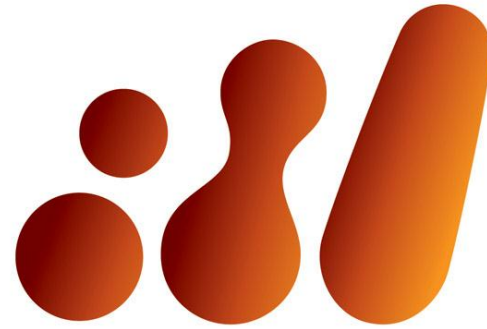


Longwall



Effective Maintenance Availability

- $A_{EM} = \frac{MTBF}{MTBF+MTTR}$
- Favorable trending on a per year basis
- Require a increasing trend on a monthly basis



bhpbilliton

resourcing the future