Asset Utilization

November 2002
Asset Utilization

What Is Asset Utilization Project? (AUP)

• AUP is a comprehensive system developed by Rio Tinto to improve maintenance practices through Maintenance Practice Assessment, Benchmarking and Improvement Initiatives.
• AUP employs a cross sectional team comprised of both salaried and hourly employees tasked to seek opportunities for process improvement (value).
• AUP seeks to develop and apply “BEST PRACTICES” among Rio Tinto operations.
The Theory

- Asset utilization is a function of:
  - Reliability
  - Throughput
  - Quality
  - Demand
- The objective is increasing the Return on Assets Employed by minimising the “hidden plant”
Stage 1

Data Collection and Diagnosis

• Best Practices Gap Analysis
• Delay/Loss Analysis
• “Stake in the Ground” Metrics
• Identify Improvement Opportunities
## Asset utilization Improvement Process

### 4. Work Flow

<table>
<thead>
<tr>
<th>Work Order Types</th>
<th>Period 1</th>
<th>Period 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.01 Number of PM and PdM Work Orders generated</td>
<td>1,232</td>
<td>920</td>
</tr>
<tr>
<td>4.02 Number of PM and PdM Work Orders completed</td>
<td>1,106</td>
<td>544</td>
</tr>
<tr>
<td>4.03 Labour hours charged to PM and PdM W.O.s</td>
<td>16,504</td>
<td>22,901</td>
</tr>
<tr>
<td>4.04 Number of Corrective Work Orders generated</td>
<td>2,244</td>
<td>4,932</td>
</tr>
<tr>
<td>4.05 Number of Corrective Work Orders completed</td>
<td>2,290</td>
<td>2,779</td>
</tr>
<tr>
<td>4.06 Labour hours charged to Corrective W.O.s</td>
<td>33,653</td>
<td>22,448</td>
</tr>
<tr>
<td>4.07 Number of Breakdown/Emergency Work Orders generated</td>
<td>689</td>
<td>253</td>
</tr>
<tr>
<td>4.08 Number of Breakdown/Emergency Work Orders completed</td>
<td>665</td>
<td>256</td>
</tr>
<tr>
<td>4.09 Labour hours charged to Breakdown W.O.s</td>
<td>7,386</td>
<td>2,404</td>
</tr>
<tr>
<td>4.10 Labour hours charged to Standing W.O.s</td>
<td>21,077</td>
<td>9,439</td>
</tr>
<tr>
<td>4.11 Number of Standing Work Orders in use</td>
<td>56</td>
<td>59</td>
</tr>
<tr>
<td>4.12 Do you have any other Work Order types?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>4.13 Number of &quot;Other&quot; Work Orders completed</td>
<td>4,825</td>
<td></td>
</tr>
<tr>
<td>4.14 Labour hours charged to &quot;Other&quot; W.O.s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.15 Total Number of Work Orders generated</td>
<td>6,161</td>
<td>3,638</td>
</tr>
<tr>
<td>4.16 Total Number of Work Orders completed</td>
<td>6,097</td>
<td>3,219</td>
</tr>
<tr>
<td>4.17 Total labour hours charged to work orders</td>
<td>109,138</td>
<td>51,040</td>
</tr>
<tr>
<td>4.18 Labour Hours not charged to a Work Order</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.19 Total Labour hours</td>
<td>109,138</td>
<td>51,040</td>
</tr>
</tbody>
</table>
Asset utilization Improvement Process

Dragline #153

Top 10 Losses

Average hours lost per unit

- Travelling/Walking
- Mechanical Breakdowns
- Scheduled Mechanical Maint.
- Inspections/PM's
- Electrical Breakdowns
- Wait on Dozer
- Operations Other
- Power Cable Changes/No Power
- No Labour
- Weather/Rain/Fog
Stage 2

Plan Development

• Developing a Business Case
• Align Ideas with Business & Prioritize
• Select Projects to Proceed
• Scope & Plan Projects
AUP Overview

Team Involvement:

• The AUP process employs a cross section across skills and departments.

• Teams are critical in this process. The basic structure includes a core team supported by four focus teams.

<table>
<thead>
<tr>
<th>Core Team</th>
<th>DDS Team</th>
<th>RS Team</th>
<th>Plant Team</th>
<th>Electrical Team</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ken Wooley</td>
<td>Marc Ostrem</td>
<td>RS Planner</td>
<td>Bruce A. Miller</td>
<td>Steve Arriger</td>
</tr>
<tr>
<td><strong>ROS</strong></td>
<td>DDS Scheduler</td>
<td>RS Scheduler</td>
<td>Leslie Thorn</td>
<td>Aaron Spielman</td>
</tr>
<tr>
<td>Rene Edwards</td>
<td>Kathy Bryan</td>
<td>Dave Gauntner</td>
<td>Jerry Hutchinson</td>
<td>Tom Shepherd</td>
</tr>
<tr>
<td>Bill Cromer</td>
<td>Steve Cowan</td>
<td>Pam Halbert</td>
<td><strong>Plant Operator</strong></td>
<td>Wade Hart</td>
</tr>
<tr>
<td>Travis Todd</td>
<td>Kelvin Kennedy</td>
<td><strong>Dozer Operator</strong></td>
<td>Plant Lead</td>
<td></td>
</tr>
<tr>
<td>Lenny Altenburg</td>
<td>Dragline Operator</td>
<td><strong>Maintenance Lead</strong></td>
<td>Clint Cooper</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Electrician</strong></td>
<td><strong>Truck Mechanic</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>DDS Mechanic</strong></td>
<td><strong>Haulage Operator</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maintenance Lead</td>
<td><strong>Dozer Mechanic</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Asset utilization Improvement Process

Stage 3

Plan Implementation

- Site Commitment
- Funding & Resources
- Measure & Track Progress
- Sustainable Change
<table>
<thead>
<tr>
<th>Ref No</th>
<th>Issue / Improvement Opportunity</th>
<th>Aligned with Business Plan?</th>
<th>Risks Boundaries and Constraints</th>
<th>Combine with?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Leadership Commitment and Accountability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Planning and Scheduling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9a</td>
<td><em>Truck planning and scheduling program is not being used for draglines and shovels:</em> Clearly define the work processes that are utilized for trucks and will be utilized for draglines and shovels in the execution of planned maintenance tasks. In particular,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9b</td>
<td><em>Planning and scheduling compliance is not being fed back to planning department:</em> The effectiveness of planning and scheduling processes needs to be fed back from the tradespersons to the planning and scheduling department. The feedback could be parts comp</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9c</td>
<td>A <em>disconnection between operations and maintenance functions appears to have developed:</em> Establish formalized weekly planning and scheduling meetings involving maintenance, production, supply and contractors. Formal meetings will include a scheduling meet</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Prize

Return on Assets Employed = Production Revenues - Production Expenses

Net Asset Value

Outcomes through improved reliability & throughput of plant and equipment:

• Increase/Protect operating revenues
• Decrease/Control operating expenses
• Reduce/Eliminate assets and inventories
AUP Initiatives

• Started July 2001

• Focused on three Initial projects
  – Maintenance Planning and Scheduling
  – Warehouse Stores Accuracy and Partnership
  – 830E Hauler Planning and Scheduling
Planning And Scheduling Problems

• Planners were unable to plan due to:
  – Spending too much time on daily activities
  – Tasked with all employee management issues
  – Tasked with front line manager responsibilities
  – Maintenance practices were purely reactive
What ??
Planned Maintenance ??

Production Department Reaction !
Warehouse/Shop Changes

Overview:

• Revise physical layout of parts stores. Provide areas for parts staging.

• Relocate 95%+ stock to South Side.

• Man Warehouse 6-days per week.

• Provide kitting for over 90% of parts used on planned jobs.

• Partner With Suppliers to Supply Parts for AUP Kits.
Positive Results:

• Reduced Double Orders.

• Has ultimately lead to better communication and inventory reduction.

• Has provided better rebuild and warranty follow up.
Unplanned Outage!
AUP 830E Implementation

Goals For Haul Trucks
Focused On Three Primary Improvement Areas

1. Equipment Inspections & Parts Management
2. Equipment Delivery and Scheduling Procedures
3. Manpower Management
Why It Works – The Top 10

1. Teamwork and Support at All Levels
2. PM’s performed on a 28-day interval instead of an hourly basis
3. Inspection / Audits Done 10 Days in Advance
4. AUP Mechanic Ensures the Scheduled Truck is Delivered
5. Correct Parts Delivered on Time
6. Adequate Manpower Assigned to Job and Kept on Job
7. Addition of Dedicated Truck Electrician to truck crew.
8. Planned Maintenance Given Priority over Breakdowns
9. Operators Provide Good Write-Ups & participate in 250-HR PM’s
10. Measure and Report Project Results
Asset Utilisation Project

Maintenance Best Practices Gap Analysis
Cordero Rojo
Period 1 & 2 Comparison
Elements of Maintenance Best Practice

1 LEADERSHIP, COMMITMENT AND ACCOUNTABILITY
2 SAFETY, ENVIRONMENTAL AND REGULATORY MANAGEMENT
3 ORGANISATION AND HUMAN RESOURCE MANAGEMENT
4 MAINTENANCE MEASUREMENT & REPORTING SYSTEMS
5 COST MANAGEMENT AND REPORTING
6 CONTRACTOR AND SUPPLY MANAGEMENT
7 MATERIALS MANAGEMENT
8 RELIABILITY ENGINEERING
9 PLANNING AND SCHEDULING
10 PREVENTIVE & PREDICTIVE MAINTENANCE
Cordero Rojo Maintenance - Best Practice Gap Analysis

**Period 1 vs Period 2 Compliance**

1. Leadership, Commitment & Accountability
2. HSE & Regulatory Management
3. Organisation & HR Management
5. Cost Management & Reporting
6. Contractor & Supply Management
7. Materials Management
8. Reliability Engineering
9. Planning & Scheduling
10. Preventive & Predictive Maintenance

Period 1

Period 2
The Bottom Line

A Bad Lie At WMEA
## AUP Initiatives
### 2002 Jan-June Average

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2001</th>
<th>2002YTD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draglines</td>
<td>84.5</td>
<td>85.2</td>
<td>91.1%</td>
</tr>
<tr>
<td>P&amp;H Shovels</td>
<td>85.8</td>
<td>89.4</td>
<td>92.2%</td>
</tr>
<tr>
<td>830 Trucks</td>
<td>86.0</td>
<td>87.6</td>
<td>91.4%</td>
</tr>
<tr>
<td>Dozers</td>
<td>86.7</td>
<td>91.9</td>
<td>91.3%</td>
</tr>
</tbody>
</table>

### Warehouse accuracy
- 2000: 80%
- 2002YTD: 89%

### Maintenance Cost Per Unit
- **2001 actual**: $0.197
- **2002 YTD**: $0.164

- 17% reduction
A four percent increase in available operating hours equates to:

- 18 trucks are operated in the fleet.
- 7000 Hour average operating time per year / per truck.
- 7000 X 18 equals 126,000 operating hours possible.
- 4% increase in available hours equates to 5040 hours of additional operating time.
- This equates to a no cost truck!
AUP Initiatives Going Forward

– Fall Reassessment

– Electrical Project / Work Flow Study

– Production Planning Project

– Dragline Refocus

– Reliability Engineer
Shift the Focus

From the **State** of Equipment

- “*Present levels of performance are OK. Occasional breakdown and loss of reliability cannot be prevented.*”

To the **Function** of the Equipment

- “*It’s the responsibility of both maintenance and operation to not only determine levels of performance, but eliminate the root cause of problems. Poor reliability is a controllable problem, not a statistical fact.*”
Asleep on the job!
Me? What Presentation?

You Wake up in the morning and your Hard Drive is Empty
What Does Rio Tinto Bring To the Process?

• Upper management buy in for initiatives.

• Allows time for “PAUSE”, to look at the business objectively.

• Provides the manpower to dig into the numbers.

• Provides the benchmarking data used to measure progress.
Goals of the Project

• Achieve a greater percentage of planned maintenance activities.

• Increase availability of equipment

• Maintenance cost reduction

• Reduce contractor hours by using in house labor

• Increase return on assets employed
• Identify the most significant opportunities for improvement.
  – In our case, we identified the need to provide reliable transportation of the coal from the dig face to the hopper as being the top priority and the key to operational success.

• Don’t take on too many initiatives at one time, stay focused.

• Celebrate successes.
Cordero Rojo Maintenance - Best Practice Gap Analysis

**Element 7 - Materials Management**

**Rating Assigned**

```
<table>
<thead>
<tr>
<th>Period 1</th>
<th>Period 2</th>
</tr>
</thead>
</table>
```

- **Sub Element 7.01**
- **Sub Element 7.02**
- **Sub Element 7.03**
- **Sub Element 7.04**
- **Sub Element 7.05**
- **Sub Element 7.06**