

Confidential

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*reaching new frontiers*



## ***CM0006 MINI-OVERHAUL PROJECT***

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<b><i>Designation:</i></b>	<i>Candidate Engineer</i>
<b><i>Section:</i></b>	<i>Middelbult Main Shaft (Sasol Mining)</i>
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<b><i>Coach:</i></b>	<i>WA De Beer</i>

**Note!!!**

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All questions will be addressed at the end of presentation



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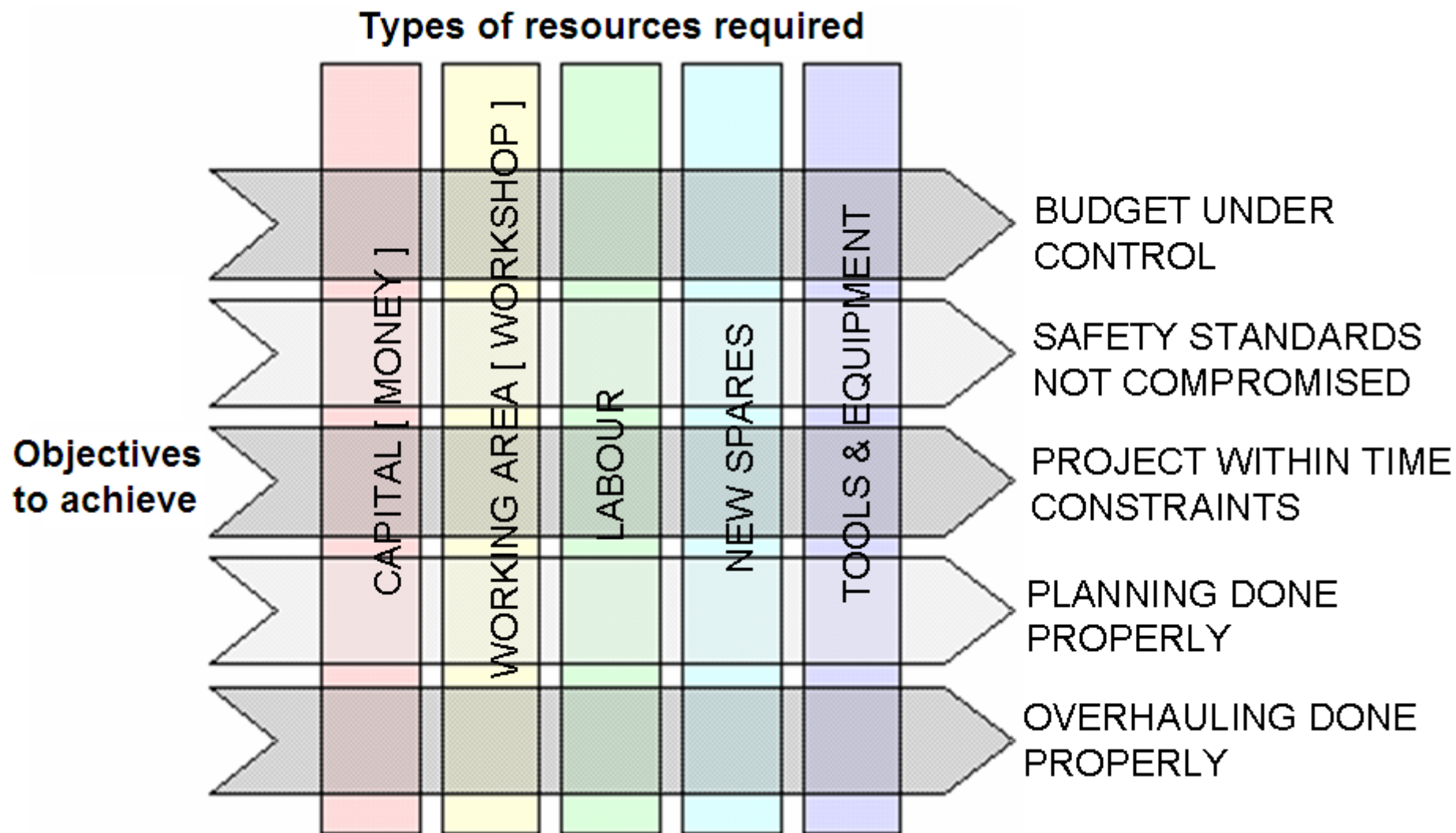
## Background

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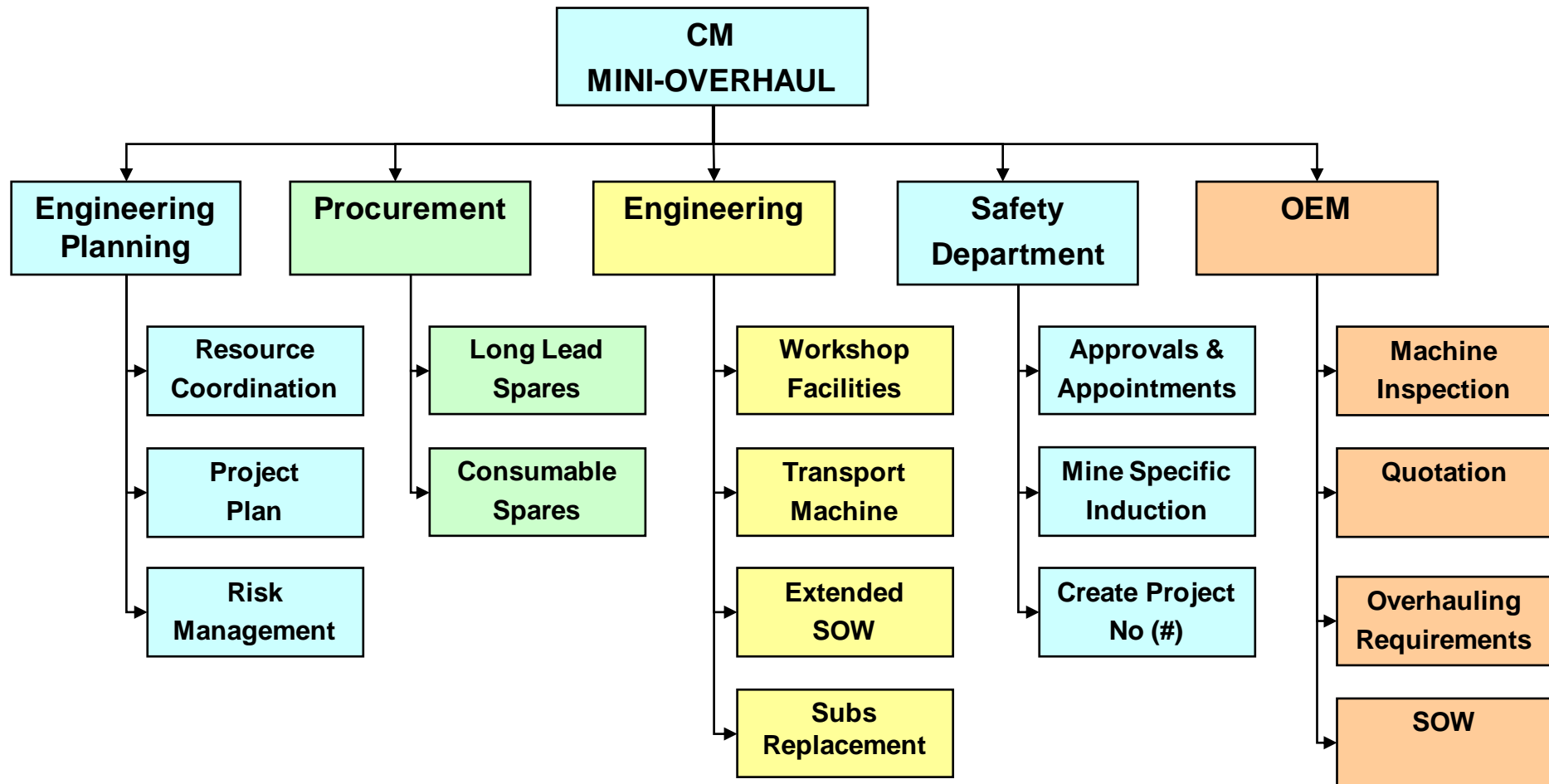
- Full overhaul on CM machines was done every 2 years in Joy workshops.
- As from June 2007, mini-overhaul maintenance strategy was introduced.
- Mini-overhaul is done in the respective mine workshop a year before a full overhaul which now occurs every three years.
- Mini-overhaul costs a quarter of a full overhaul.
- The strategy aims at postponing capital spent on the CM overhaul program.
- With the new approach, one third of the 54 machines is fully overhauled a year as compared to half.



# Objectives



# Work Breakdown Structure





## Overhauling Requirements

WORKSHOP (M/bult)	LABOR	EQUIPMENT	MACHINE SOW
Space (25m x 10m)	Cleaners (Apprentice x 2) (M/bult)	Welding machine CO2, 600A (M/bult)	Machine condition assessment (M/bult)
Overhead crane (15 ton)	Artisans (x2) (M/bult)	Cutting torch & cylinders (M/bult)	Safety requirements (M/bult)
Crane chain (15 ton, 4 legged, adjustable hooks)	Project Leader (M/bult)	Change house & lockers (M/bult)	Spares requirements (M/bult & Joy)
Crane chain (3 ton, 2 legged, adjustable hooks)	Project Supervisor (Joy)	PPE (Gloves, earplugs & goggles, M/Bult)	Plan list & time frames (M/bult)
1000V supply (machine testing) (150A or 200A)	Site Supervisor (Joy)	Basic Tools (Joy)	Task list & time frames (Joy)

## Overhauling Requirements (Cont)

WORKSHOP (M/bult)	LABOR	EQUIPMENT	MACHINE SOW
380V supply, 80A breaker (more than 1 point, separate breaker)	Electrician ( <b>Joy</b> ) Helper (x2, <b>Joy</b> )	Specialised welding ( <b>Joy</b> )	Risk Analysis ( <b>M/bult</b> )
Tramming cable	Fitter ( <b>Joy</b> )	Line boring ( <b>Joy</b> )	
Storage area (spares)	Boiler maker ( <b>Joy</b> )	Hydraulic hoses ( <b>Joy</b> )	



## *Project Approach*

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- Risk management.
- Transportation of the machine.
- Preparation of project facilities (e.g. workshop).
- Preliminary work on the machine (e.g. six monthly inspection, testing of subassemblies, procuring spares, etc).
- Approvals (tools, safety files and appointment).



## ***Project Risk Management***

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- List of expected outcomes.
- Identification of threads to the intended outcomes.
- Impact of the risk and likelihood of the risk.
- Developing of a comprehensive risk management plan.
- Execution of risk control plan.

# Risk Management Plan

LIKELYHOOD		IMPACT			
	LEVEL	1	2	3	4
LEVEL	Description	Minor	Moderate	Major	Catastrophic
<b>A</b>	Almost certain	<ul style="list-style-type: none"> <li>• Joy employees could not attend induction on a weekend.</li> <li>• Some spares could be ordered on daily basis.</li> </ul>	<ul style="list-style-type: none"> <li>• Unavailability of 15 ton crane.</li> <li>• Unavailability of 80A breakers.</li> </ul>		<ul style="list-style-type: none"> <li>• Joy tools might be stolen.</li> <li>• Machine transportation may be delayed due to strike.</li> </ul>
<b>B</b>	Likely	<ul style="list-style-type: none"> <li>• Unavailability of mine artisans/apprentice.</li> </ul>	<ul style="list-style-type: none"> <li>• Components may fail before the norm.</li> </ul>	<ul style="list-style-type: none"> <li>• Budget might be inadequate.</li> <li>• Spares may not be available on time.</li> </ul>	<ul style="list-style-type: none"> <li>• Safety might be compromised.</li> <li>• Breakdowns might occur after overhaul.</li> </ul>
<b>C</b>	Possible	<ul style="list-style-type: none"> <li>• M/bult artisans may not be treated appropriately.</li> <li>• Cutter boom motor spigot might be small for the hole.</li> <li>• Gap between C.L.A and spade frame more than 100 mm.</li> </ul>		<ul style="list-style-type: none"> <li>• Joy may sacrifice some tasks.</li> </ul>	<ul style="list-style-type: none"> <li>• Planning time may be inadequate.</li> <li>• Machine may under perform after overhaul.</li> </ul>

## Risk Management Plan (Cont)

LIKELYHOOD		IMPACT			
	LEVEL	1	2	3	4
LEVEL	Description	Minor	Moderate	Major	Catastrophic
D	Unlikely	• Excess vibration on hydraulic pump.			
E	Rare	• Inexperience leadership skills.			
Minor - Can be resolved within 24 hours, low financial impact. Moderate - More than 24 hrs downtime, medium financial impact. Major - Less than 72 hrs downtime, high financial impact. Catastrophic - More than 72 hrs downtime, huge financial impact.			Almost certain - Expected to happen in most circumstances. Likely – Will probably occur in most circumstances. Possible - Might occur at some time. Unlikely – Could occur at some time. Rare – May only occur in exceptional cases.		

# Risk Control Plan



QUALITATIVE RISK FORESEEABLE	CONTROL ACTION
<ul style="list-style-type: none"> <li>• Joy employees could not attend induction on a weekend.</li> </ul>	<ul style="list-style-type: none"> <li>• Arranged induction during the week.</li> </ul>
<ul style="list-style-type: none"> <li>• Some spares were ordered on daily basis.</li> </ul>	<ul style="list-style-type: none"> <li>• EMS was ready to release purchase requisition.</li> </ul>
<ul style="list-style-type: none"> <li>• Unavailability of 15 ton crane.</li> </ul>	<ul style="list-style-type: none"> <li>• A fork lift was arranged to assist the available crane.</li> </ul>
<ul style="list-style-type: none"> <li>• Unavailability of 80A breakers.</li> </ul>	<ul style="list-style-type: none"> <li>• The breakers were ordered and installed urgently.</li> </ul>
<ul style="list-style-type: none"> <li>• Joy tools might be stolen.</li> </ul>	<ul style="list-style-type: none"> <li>• The workshop were locked all the time.</li> </ul>
<ul style="list-style-type: none"> <li>• Unavailability of mine artisans/apprentice.</li> </ul>	<ul style="list-style-type: none"> <li>• Section engineer responsible for the CM made a plan.</li> </ul>
<ul style="list-style-type: none"> <li>• Components might fail before the norm.</li> </ul>	<ul style="list-style-type: none"> <li>• Testing and six monthly inspection was done.</li> </ul>
<ul style="list-style-type: none"> <li>• Budget might be inadequate.</li> </ul>	<ul style="list-style-type: none"> <li>• Attention to critical spares first, keep track of budget, delayed repair</li> </ul>
<ul style="list-style-type: none"> <li>• Spares might not be available on time.</li> </ul>	<ul style="list-style-type: none"> <li>• Order as early as possible, Repair/change later, PSM must have long lead spares ready.</li> </ul>
<ul style="list-style-type: none"> <li>• Safety might be compromised.</li> </ul>	<ul style="list-style-type: none"> <li>• Safety files were approved, Joy tools were checked, Joy employees attended induction, appoint safety supervisors.</li> </ul>
<ul style="list-style-type: none"> <li>• Breakdowns might occur after overhaul.</li> </ul>	<ul style="list-style-type: none"> <li>• Review Current maintenance plan and adjust properly.</li> </ul>
<ul style="list-style-type: none"> <li>• Machine may under perform after overhaul.</li> </ul>	
<ul style="list-style-type: none"> <li>• M/bult artisans may not be treated appropriately.</li> </ul>	<ul style="list-style-type: none"> <li>• Expectation meeting was arranged with Joy supervisors.</li> </ul>



## Safety Requirements

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- Basic PPE for overhauling team:
  - *Gloves*
  - *Earplugs*
  - *Goggles*
- Joy safety files:
  - *Were taken to the mine safety department for approval.*
  - *Included task procedures.*
  - *Included certification of equipment.*
- Equipment & Tools:
  - *Mine project leader visually inspected the condition of Joy equipment.*
  - *Mine safety department checked the record of equipment in the safety files.*
- Induction:
  - *Joy employees (x8) attended the mine specific induction.*
- Appointment:
  - *Two Joy supervisors were legally appointed.*

# Spares

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- Spares were categorized into four groups:
  - *Standard spares (Joy).*
  - *Sub-assemblies (M/bult).*
  - *Consumables (M/bult).*
  - *Electrical panel spares (M/bult).*
- Sub-assemblies and standard spares are long lead spares.
- Spares were repaired or replaced based on machine condition assessment.
- Never mix non-Joy spares with Joy spares.



## Standard Spares

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- Joy was responsible for the condition of standard spares:
  - *Machine frames:*
    - *Main frame – checked for cracks and welded.*
    - *Spade (gathering head) – replaced.*
    - *Conveyor boom – replaced.*
    - *Cutter head – checked for cracks and welded.*
  - *Pipes and fittings – replaced.*
  - *Guards – replaced.*



## Machine Condition Assessment

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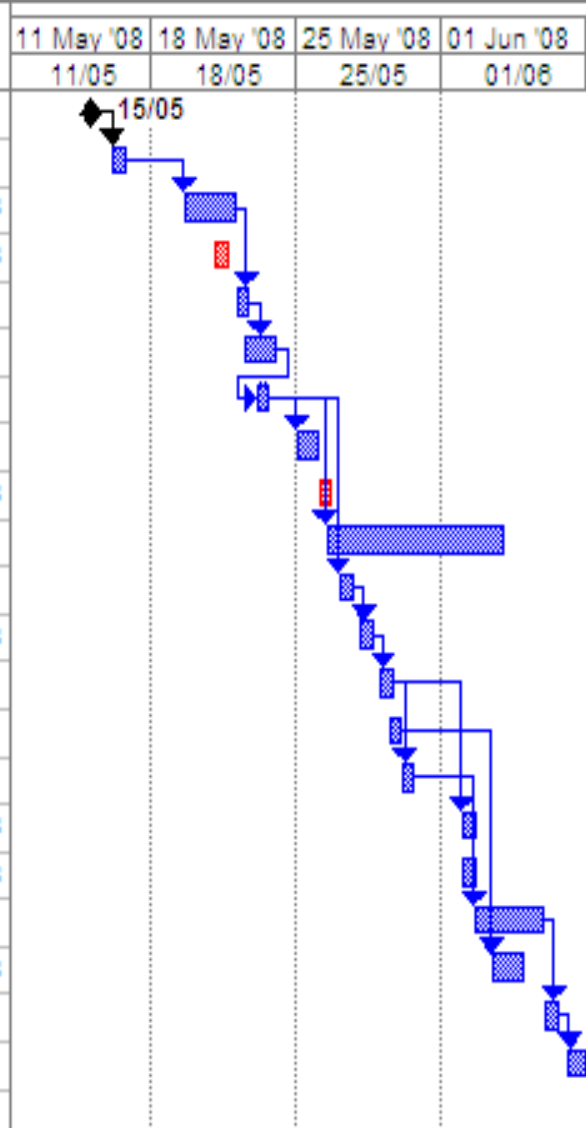
- Helped in identifying and procuring of required spares.
- Discard/repair criteria was based on:
  - *Machine components history.*
  - *Machine six monthly inspection – most consumables and some subs.*
  - *Central workshop tests (electrical, vibration & oil analysis) – gearboxes and motors.*
  - *M/bult COMMON – vibration on hydraulic pump.*
- The components history was reviewed in conjunction with other discard/repair criteria.
- Transportation of the machine affected the life of crawlers.

## Sub-assemblies Repaired/Replaced

SUBASSEMBLIES	TEST	ACTION	REASON FOR ACTION
Cutter motor R/H	COMMON	Replaced	Bearing failure
Cutter motor L/H	Central workshop	Ok, repaired	
Gathering motor R/H	Insulation test	Replaced	Down to earth, done 1.8 Mt
Gathering motor L/H	Insulation test	Replaced	Down to earth, done 1.8 Mt
Gathering gear case L/H	6-monthly inspection	Replaced	Leaking oil on seals, done 1.8 Mt
Gathering gear case R/H	6-monthly inspection	Replaced	Leaking oil on seals, done 1.8 Mt
Gathering head cylinders	6-monthly inspection	Replaced	Leaking and clevis damaged
Pump motor	Central workshop	Water jacket to be replaced	Worn, done 1.8 Mt
Stab cylinders	6-monthly inspection	Ok, only bushes were replaced	Loose
Stab shoe	6-monthly inspection	Replaced with a spare	cracks
Foot shaft roller	6-monthly inspection	Replaced	worn
CLA	6-monthly inspection	Replaced	Both $\pm 725$ mm
Secondary conveyor reducer	Visual inspection	Replaced	Gears worn, done 1.8 Mt
Traction motor L/H	Central workshop	Ok, washed and baked	To make it dry, done 1.8 Mt
Traction motor R/H	Central workshop	Ok, repaired	
Traction gear case L/H	Central workshop	Repaired	
Traction gear case R/H	Central workshop	Repaired	

# Middelbult Time Management Plan

ID	Task Name	Start	Finish	11 May '08	18 May '08	25 May '08	01 Jun '08
				11/05	18/05	25/05	01/06
1	Project scope	Thu 15/05/08	Thu 15/05/08	15/05			
2	Risk analysis meeting	Fri 16/05/08	Fri 16/05/08				
3	Organise workshop & tram machine (CM)	Mon 19/05/08	Wed 21/05/08				
4	Risk analysis & overhaul requirements meeting	Wed 21/05/08	Wed 21/05/08				
5	Machine on surface	Thu 22/05/08	Thu 22/05/08				
6	Wash machine	Thu 22/05/08	Fri 23/05/08				
7	Tram machine to workshop	Fri 23/05/08	Fri 23/05/08				
8	Six monthly inspection (main frame)	Sun 25/05/08	Sun 25/05/08				
9	Progress meeting in Middelbult main shaft	Mon 26/05/08	Mon 26/05/08				
10	Strip machine	Mon 26/05/08	Tue 03/06/08				
11	Organise change house, mine specific induction & LHD's	Tue 27/05/08	Tue 27/05/08				
12	Transport cutter boom, conveyor boom & spade to surface	Wed 28/05/08	Wed 28/05/08				
13	Wash cutter boom, conveyor boom, spade & tram to the workshop &	Thu 29/05/08	Thu 29/05/08				
14	New conveyor boom delivered	Thu 29/05/08	Thu 29/05/08				
15	Six monthly inspection on cutter boom and conveyor boom	Fri 30/05/08	Fri 30/05/08				
16	Transport traction motors & gearboxes, pump motor & cutter motor fo	Mon 02/06/08	Mon 02/06/08				
17	Safety appointments and safety file	Mon 02/06/08	Mon 02/06/08				
18	Induction for line boring team & start of line boring	Mon 02/06/08	Thu 05/06/08				
19	Assemble conveyor boom	Tue 03/06/08	Wed 04/06/08				
20	Lifting up the machine	Fri 06/06/08	Fri 06/06/08				
21	Liners delivered & installed	Sat 07/06/08	Sat 07/06/08				
22	Spade delivered	Tue 10/06/08	Tue 10/06/08				



# Joy Time Management Plan

ID	Task Name	Start	Finish	01 Jun '08 01/06	08 Jun '08 08/06	15 Jun '08 15/06	22 Jun '08 22/06	29 Jun '08 29/06
1	Clean machine and tram to workshop	Mon 02/06/08	Mon 02/06/08	02/06				
2	Remove conveyor chain	Mon 02/06/08	Mon 02/06/08					
3	Remove gathering head chain	Mon 02/06/08	Mon 02/06/08					
4	Remove conveyor boom	Mon 02/06/08	Mon 02/06/08					
5	Remove both planetaries	Mon 02/06/08	Mon 02/06/08					
6	Strip conveyor boom	Mon 02/06/08	Mon 02/06/08					
7	Strip gathering head	Mon 02/06/08	Tue 03/06/08					
8	Remove stab shoe	Wed 04/06/08	Wed 04/06/08					
9	Prepare machine and do line boring	Tue 03/06/08	Sat 07/06/08					
10	Prepare cutter boom for line boring (strip & test cracks)	Mon 09/06/08	Tue 10/06/08					
11	Prepare machine for welding (crawler liners)	Fri 06/06/08	Fri 06/06/08					
12	Remove and fit new base liners (weekend only)	Sat 07/06/08	Sun 08/06/08					
13	Replace and re-route hydraulic hoses	Tue 10/06/08	Fri 13/06/08					
14	Re-routing of cables (replacement)	Tue 10/06/08	Fri 13/06/08					
15	Repair cutterboom and cracks on frame (welding)	Sat 14/06/08	Sun 15/06/08					
16	Assemble gathering head (only to receive 13/6/08)	Sat 14/06/08	Sun 15/06/08					
17	Assemble conveyor boom (only to receive 13/4/08)	Tue 17/06/08	Wed 18/06/08					
18	Install stab shoe	Wed 11/06/08	Wed 11/06/08					
19	Install both palnetaries	Fri 13/06/08	Sat 14/06/08					
20	Install crawler chains (lower machine)	Sat 14/06/08	Sun 15/06/08					
21	Install gathering head frame	Tue 17/06/08	Wed 18/06/08					
22	Install cutter boom	Wed 18/06/08	Thu 19/06/08					
23	Install conveyor boom	Thu 19/06/08	Fri 20/06/08					
24	Install conveyor chain	Fri 20/06/08	Mon 23/06/08					
25	Install methane system	Mon 23/06/08	Tue 24/06/08					
26	Test machine	Tue 24/06/08	Wed 25/06/08					
27	Paint machine	Wed 25/06/08	Fri 27/06/08					
28	Delivery	Fri 27/06/08	Fri 27/06/08					27/06

# Cost Management

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- Project costs were 20% above allocated budget:
  - *Some sub-assemblies repaired/replaced were not included in the original scope of work.*
  - *COMMON advised that those sub-assemblies should be replaced before failure.*



## ***Project Success***

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- Machine completed on time.
- Completed with zero harm.
- Reduction in life cycle operating costs (NPV).
- Machine availability is not less than 90%.



## ***Conclusion and Recommendations***

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- Long lead spares must be procured at least 3 months in advance.
- One project coordinator or leader responsible for all mini-overhauls must be elected for the new proposed workshop.
- Governing rules with service provider to be formalised.



## *Learning outcomes*

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- Exposure to the real engineering world.
- Project ownership.
- Concurrent engineering.
- It is recommended that all Candidate Engineers in other mining houses be given such projects - great learning curve.



## ***Acknowledgements***

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- Mr. A De Beer (M/bult Engineering Manager Services)
- Mr. J De Beer (M/bult head technical services )
- Mr. J Van Vuuren (Foreman)

# Questions???

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