



Nevada Test Site
North Las Vegas



Wrench Time Study

Wrench Time study Review

- A unique opportunity to explore how planning, communication, work process, and environment can affect a “fair” day’s work.

Scope

Between May 22 and July 27, 2007, Management Resource Group (MRG), under the direction of Bruce Norris at NSTec, conducted a study to show how maintenance used the available work time.

The vast area of the Nevada Test Site (NTS) required scheduling alternate weeks in **Zone 1** (Area 23) and **Zone 2** (the forward Areas served out of Area 6).

On July 26, 2007, the scope of this study was modified to include the North Las Vegas facility, **Zone 3** (NLV).

Sampling and Work Order Classification

Sampling Criteria

Five major time groupings:

- | | |
|------------------------------|------|
| 1. wrench time | WT |
| 2. productive time | PT |
| 3. non-productive time | NPT |
| 4. Other Non-Productive Time | ONPT |
| 5. unaccountable time | UA |

The work day was cataloged in 15 minute segments into NSTec's web-based tool along with work observations.

Work Order Classification

- Corrective Maintenance CM
- Life Cycle Maintenance Replacement LCMR
- Preventative Maintenance PM
- Other work order type OTHER
- Service Work type SERV

Distribution of Craft

Distribution of Craft Observed

Below is the average distribution of craft in Zone 1 and 2 observed during the study.

EMERGENCY URGENT CREW	6
PM CREW	8
LOCKSMITH	2
ASBESTOS WORKER:	3
CARPENTERS:	16
CEMENT MASONS:	2
HEAVY EQUIPMENT	43
INSPECTORS:	2
LABORERS:	52
MACHINE SHOP:	13
MINERS:	16
OPERATORS:	31
PAINTERS:	20
PIPEFITTERS:	18
REEFER MECH:	4
REIN IRONWORKERS:	1
SHEETMETAL:	13
STRU IRONWORKERS:	22
SURVEYORS:	2
TEAMSTERS:	27
WIREMEN:	67
O&M CRAFTS:	13
TOTAL CRAFTS	388

Craft Model

- NTS - The union's responsibilities were clearly defined by craft and restricted by contract.
- NLV - The contract allowed the craft to work across disciplines.

Summary by zone

Wrench Time Summary

ZONE	Wrench Time (WT)	TIME AVAILABLE	PERCENTAGE
→ 1	8360	31920	26%
2	9365	29105	32%
3	990	3000	33%
ALL	18715	64025	29%

Zone 1 – Area 23

- Bargaining unit are contractually bound to perform only the duties within its discipline.
- There was sharing of Craft to other areas that where extensive travel was required.
- High Percentage of corrective maintenance.

Wrench Time Summary

ZONE	Wrench Time (WT)	TIME AVAILABLE	PERCENTAGE
1	8360	31920	26%
→ 2	9365	29105	32%
3	990	3000	33%
ALL	18715	64025	29%

Zone 2

- Craft more productive in an atmosphere where the work package had a clear scope and higher level of detail as exhibited at U1A and BEEF.
- Limited construction projects available during the study.

Wrench Time Summary

ZONE	Wrench Time (WT)	TIME AVAILABLE	PERCENTAGE
1	8360	31920	26%
2	9365	29105	32%
→ 3	990	3000	33%
ALL	18715	64025	29%

Zone 3 North Las Vegas

- NLV, was an abbreviated study and did not include construction projects. This skewed the wrenchtime performance.
- The compact campus and close availability of commercial resources makes NLV a different model than NTS.
- Cross-discipline model tended to be more efficient on projects.
- The interactive use of the energy management systems and access to building drawings added to the job quality at NLV.

Productive Time Summary

ZONE	Wrench Time (WT)	TIME AVAILABLE	PERCENTAGE
1	8185	31920	26%
2	7160	29105	25%
3	990	3000	33%
ALL	16335	64025	26%

Non Productive Time Summary

ZONE	Non Productive Time (PT)	TIME AVAILABLE	PERCENTAGE
1	7310	31920	23%
2	7150	29105	25%
3	600	3000	20%
ALL	15060	64025	24%

Other Non Productive Time Summary

ZONE	Wrench Time (WT)	TIME AVAILABLE	PERCENTAGE
1	5300	31920	17%
2	3165	29105	11%
3	330	3000	11%
ALL	8795	64025	14%

Unaccountable Time Summary

ZONE	Wrench Time (WT)	TIME AVAILABLE	PERCENTAGE
1	2765	31920	9%
2	2265	29105	8%
3	90	3000	8%
ALL	5120	64025	8%

Observations

Maintenance Approaches

Reactive



Proactive

- Breakdown Maintenance
- Corrective Maintenance
- Preventive Maintenance

- Predictive Maintenance
- Proactive Maintenance
- Reliability Centered Maintenance

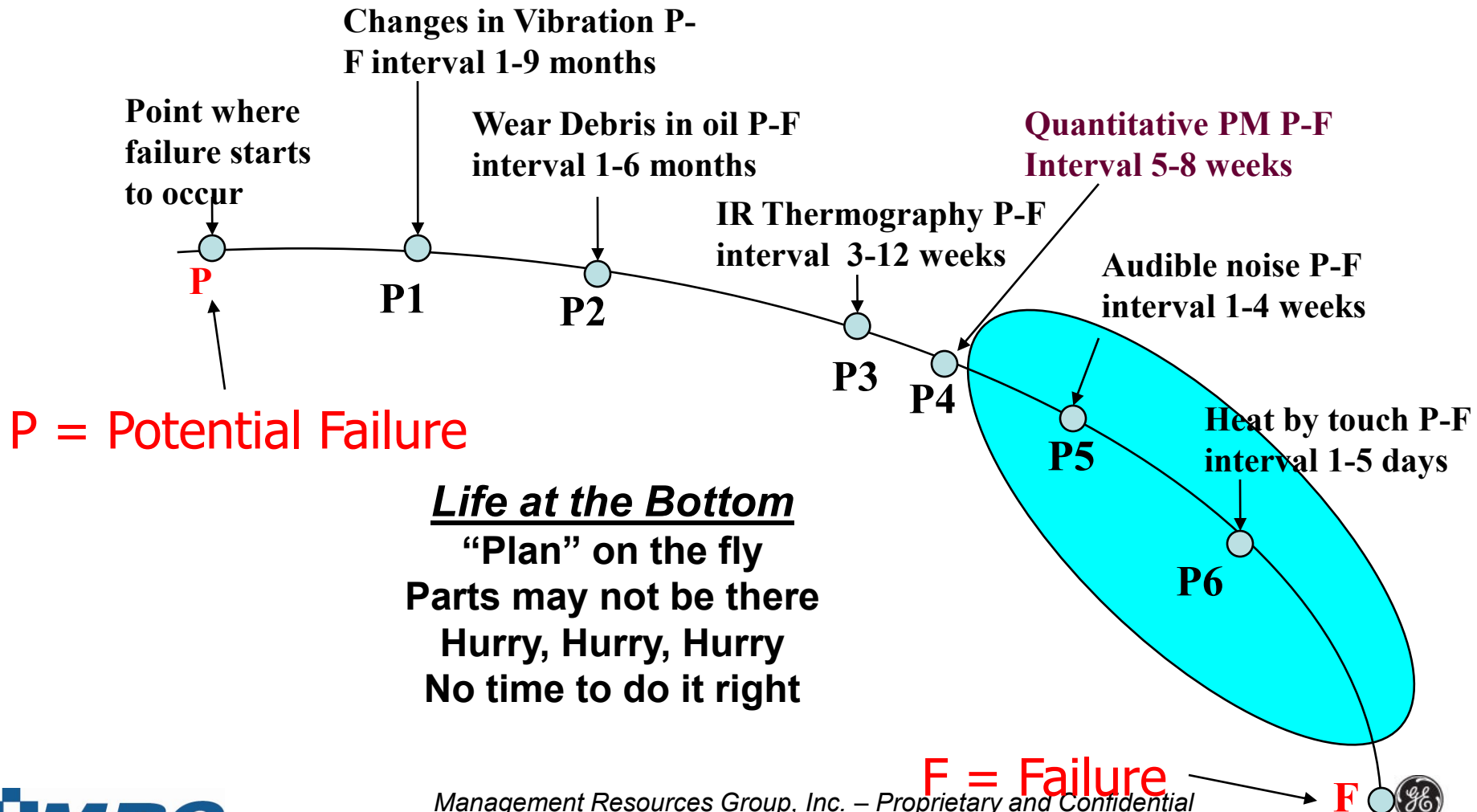
Breakdown Maintenance

- Frequent downtime due to failures
 - Loss of production/service/output
 - Inability to meet commitments to customers
 - Exposure to safety/environmental risks
- Poor equipment performance
- High direct maintenance costs
 - Large amount of time spent locating parts



Life in the Reactive Model

(The P to F Curve)



Life at the Bottom

“Plan” on the fly

Parts may not be there

Hurry, Hurry, Hurry

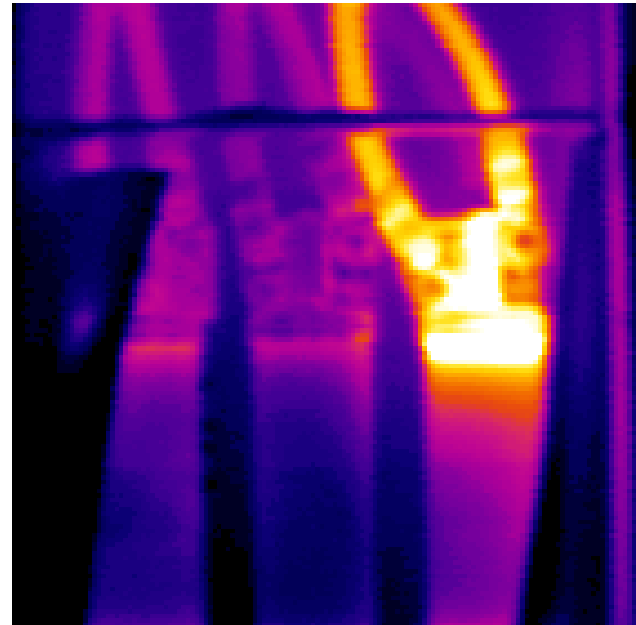
No time to do it right

Reliability Centered Maintenance (RCM) Analysis is a highly structured review of a system that focuses on preserving system functions, rather than preserving equipment.

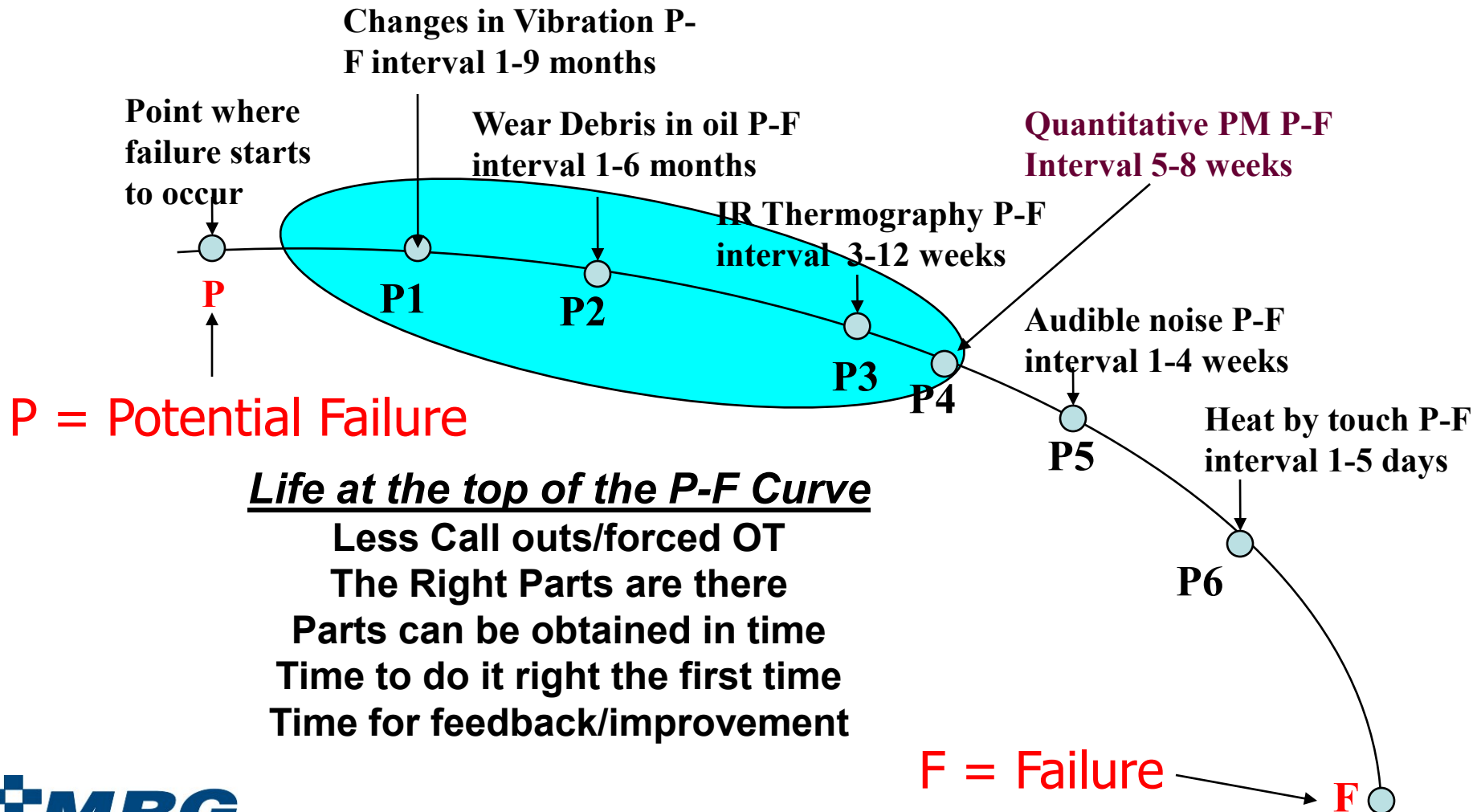
This approach is used to develop focused, effective, and cost-efficient PM/PdM programs.

Predictive Techniques

- How cost effective is thermography?
 - The average cost savings is \$4 for every dollar spent on thermography



Life in the Pro-active Model





VS.

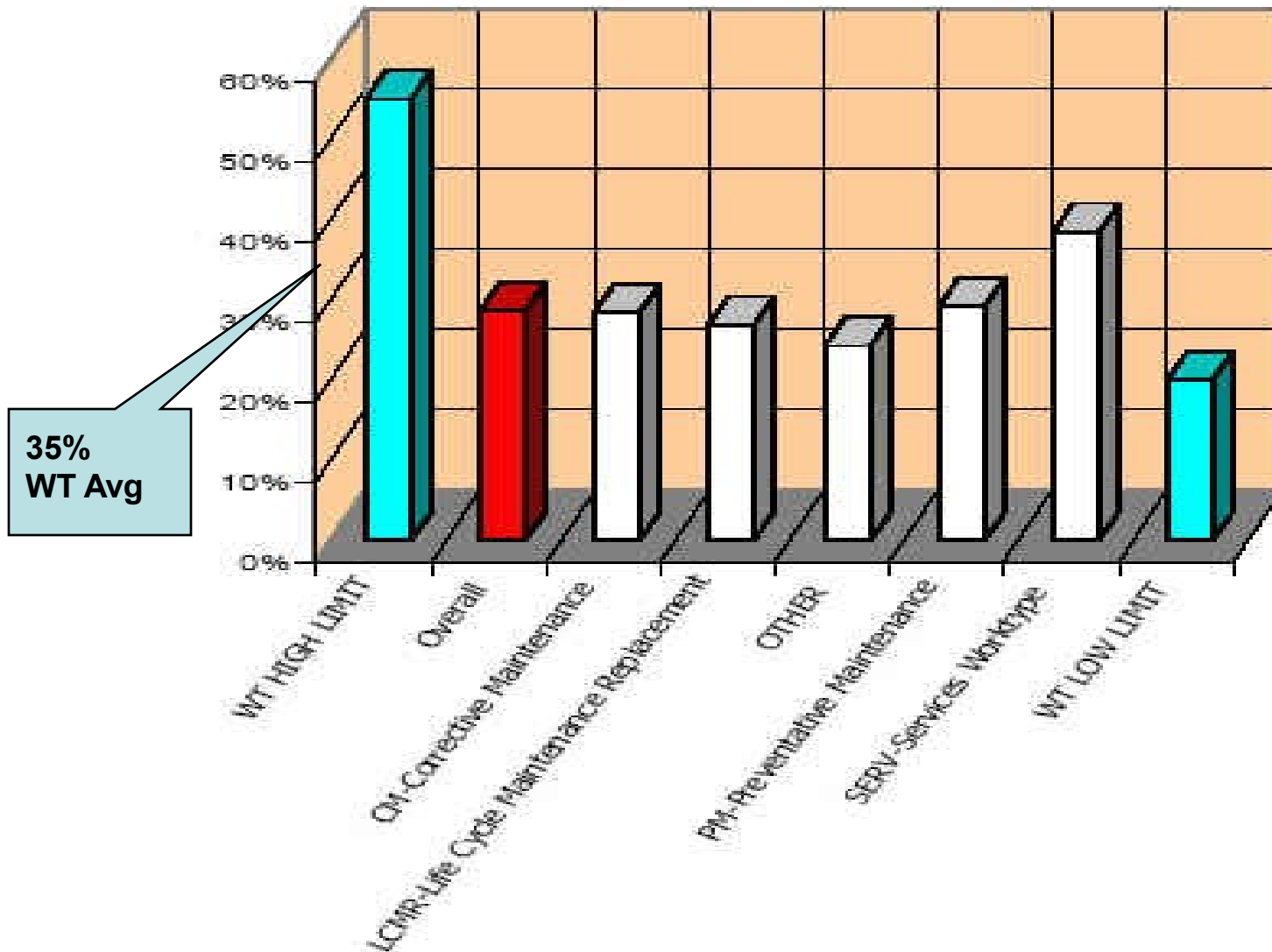
World Class

NTS Wrenchtime vs. World average

	Wrenchtime	% of study
<u>Wrenchtime HIGH LIMIT (World Class)</u>	<u>55.00%</u>	
Overall	28.69%	
CM-Corrective Maintenance	28.43%	45.31%
LCMR-Life Cycle Maintenance Replacement	26.72%	17.56%
OTHER	24.22%	16.09%
PM-Preventative Maintenance	29.18%	9.40%
SERV-Services Work type	38.47%	11.64%
<u>Wrenchtime LOW LIMIT (Worst case)</u>	<u>20.00%</u>	

Industry Average = 35%

NTS Wrenchtime vs. World average

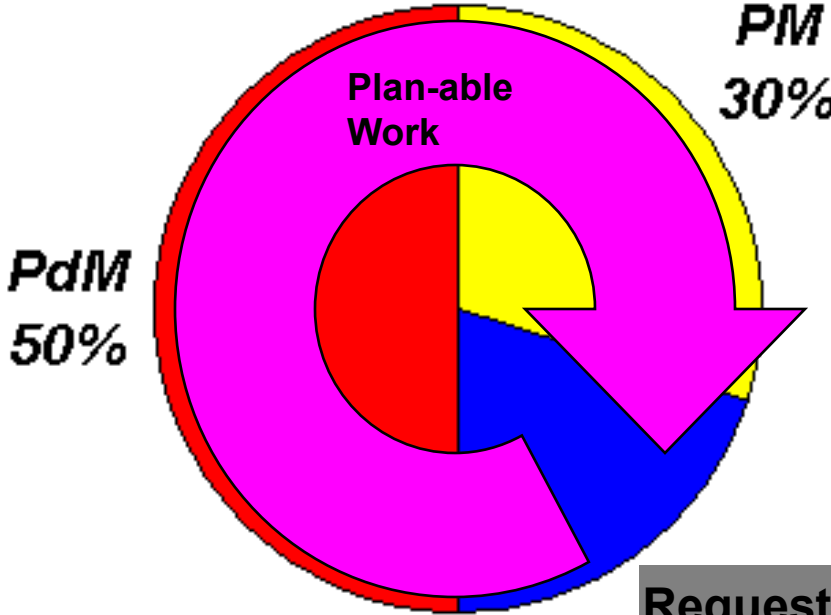


Do the Right Work

PdM 50%
 15% PdM
 35% Results

PM 30%
 15% PM
 15% Results

Desired Mix of Work



ntial

Distribution

Time Distribution

Sorted by percentage

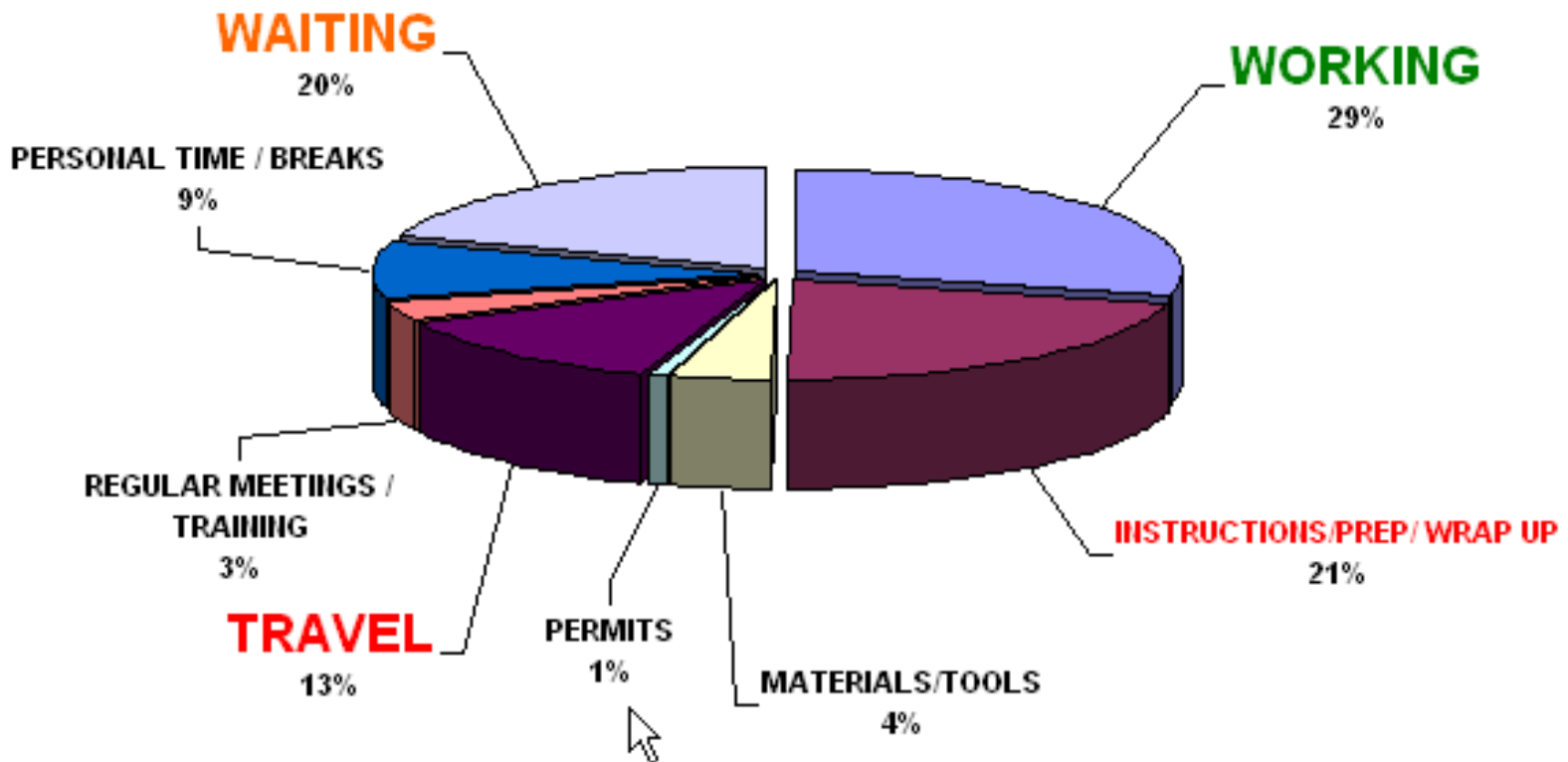
Descending

CODE	DESCRIPTION	PERCENTAGE
WT	Wrench Time	28.69%
T	Work Travel	12.22%
OB	On Break	8.15%
CJS	Clean up Job Site	7.25%
WA	Work Assignment / preJB / postJB	6.51%
WOO	Wait On Others	5.50%
UA	Un-Accountable	5.05%
SM	Site Meeting	4.52%
WBJ	Wait Between Jobs	3.92%
WFI	Wait For Information	3.69%
TRA	Training	2.89%
IDLE	Idle	2.19%
WFT	Wait For Tool	2.19%
WFM	Wait For Material	2.14%
WEA	Weather	1.63%
WFO	Wait For Operator	1.08%
RR	Rest Room	0.69%
WOP	Wait On Permit	0.67%
OW	Other Wait	0.50%
PER	Personal	0.50%
	TOTAL	100.00%

Wrench Time Summary PIE chart



TIME PERCENTAGE (NTS)



Opportunity

The return on investment (ROI) in time, quality of finished product and, dollars can be significant.

- Wait Times and Breaks = 33%
- Travel = 12%

Wait Times

Largest opportunity is locked up in “waiting” activities.
Waiting accounts for 24% of the time at NTS and NLV.
Include 9% personal and break time, this goes up to 33%

- If NSTec could capture just half of this time, it would put the facility in the **enviable 46%** wrench time status.

The return on investment (ROI) in time, quality of finished product and, dollars can be significant.

- Wait Times and Breaks = 33%
- Travel = 12%

Travel

- The next largest single block of activity is tied up in travel where there is a cause and effect tie between travel and waiting.
- Capture just 3% of travel time and adding it to reduced wait time would raise “wrench time performance” to **world class** status.



Capture Half

Saving potential

Equating to full time equivalents (FTE) and financial savings

1868 hours / year (allowing for holidays and vacations)

388 Craft X 1868 hours = 724,784 available regular hours

16.5% X 724,784 = 119,590 hours saved or **64 FTE**

Assuming

\$50,000 straight rate = \$3,201,000 savings

\$76,663 loaded rate = \$4,907,947



Recommendations

Reliability Services Suggested

The data foundation can be used to:

- Reliability Gap Analysis
- CMMS Audit
- Workflow Development – Roles and Responsibilities
- PM/PdM Optimization Services
- Materials Management Solutions

NEXT

Reliability Gap Analysis

Using the evaluation of maintenance and reliability practices, tools and techniques

- *Determine the financial benefit*
- *Develop a detailed improvement plan that is linked to the business goals, NSTec culture, and resource availability*
- *Identify opportunity for improvement*
- *Define the best path forward to capturing improvement benefits*

[recommendations](#)

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CMMS Audit

A well-implemented Computerized Maintenance Management System (CMMS) is essential to successful work management and reliability.

A CMMS audit is the first step required when repairing your system.

[recommendations](#)

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Workflow Development

The Workflow Development “best practices” will efficiently manage all aspects of maintenance assets proactively:

- Increase consistency and efficiency of work performance within a work group or across an entire organization
- Clarify and document each contributor’s responsibilities
- Expedite training the workforce on the new processes
- Maximize your return from your CMMS investment by explicitly documenting the use of software in the work processes

[recommendations](#)

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PM/PdM Optimization Services

- *The quality of preventative maintenance plan can make or break a reliability program. **Unfortunately**, most PM programs are burdensome and may do more harm than good.*
- *Proven quantitative techniques can be used for PM development and failure-based techniques and integrating PdM technologies.*

[recommendations](#)

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Materials Management Solution

Materials management provides the control for Maintenance, Repair and Operational (MRO) inventory by helping NSTec answer the Five W's.

- | | |
|-----------------|----------------------------|
| 1. Who | used the part? |
| 2. What | is the part named? |
| 3. When | should I order more parts? |
| 4. Where | can I find the part? |
| 5. Why | is that part needed? |

design and implementation services that let you manage, store, and track inventory.

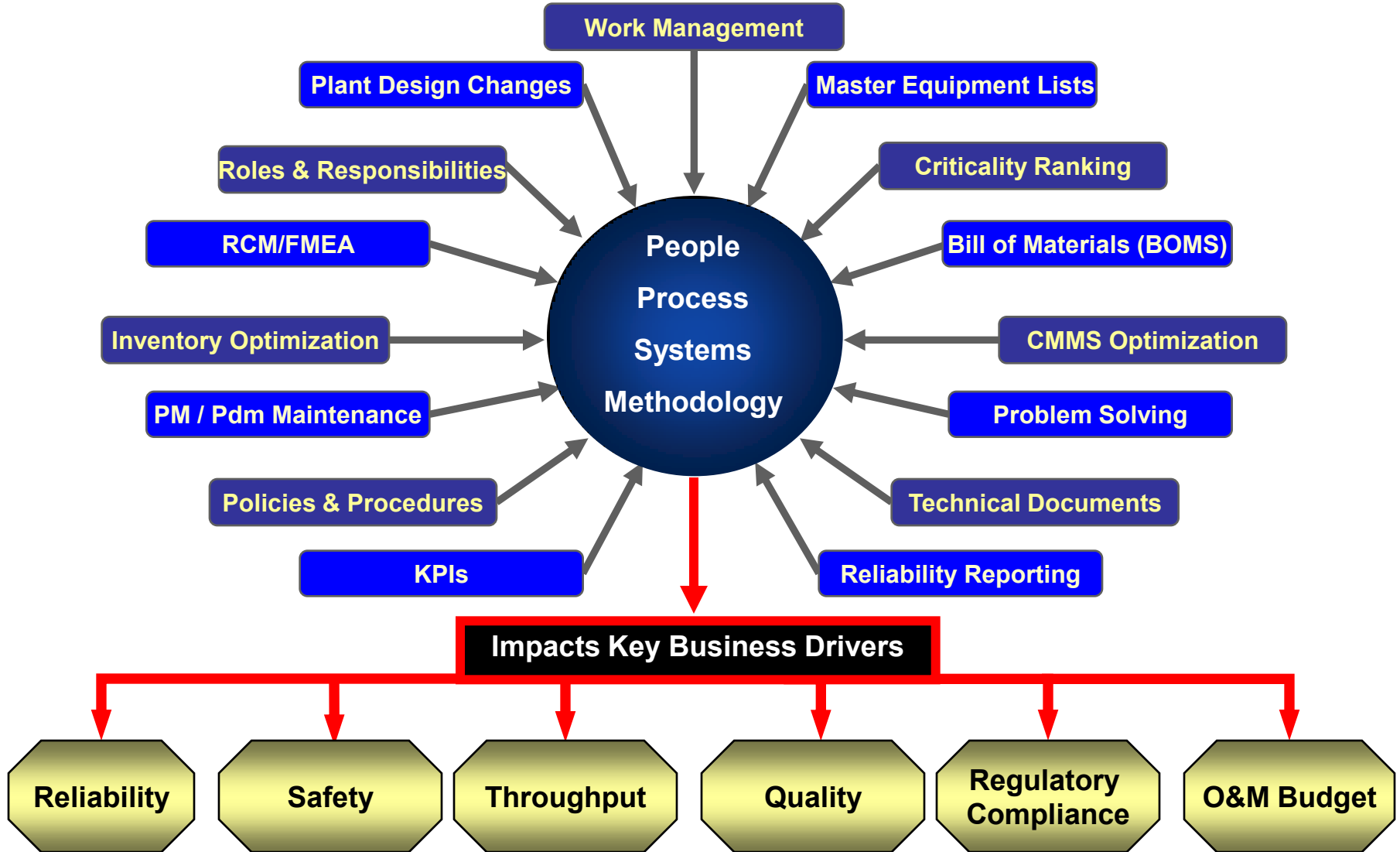
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- *PM/PdM Optimization Services*
- *Materials Management Solutions*

Reliability is...





Questions

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