

IPAMC - DataTrak Systems Inc

Maintenance Planning & Scheduling
Focus on Best Practices
November 2017

Ben Stevens --- Stevensb@kingston.net

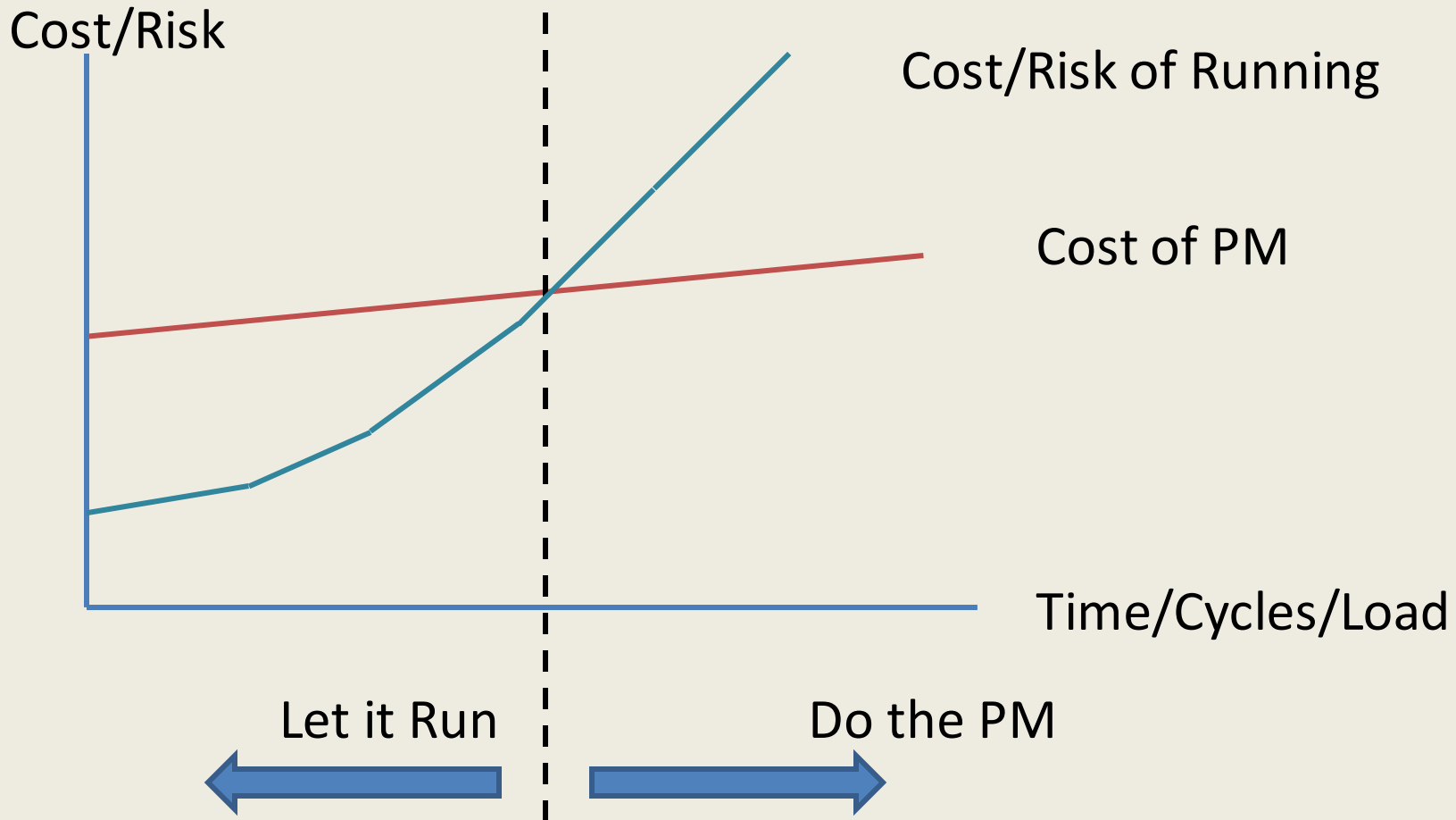
What's the purpose of maintenance Planning and Scheduling?

1. To get the timing right for the delivery of a Maintenance Job (Maintenance Plan, Annual Schedule)
2. To ensure that all necessary information is available to the Maintenance Team to safely and cost-effectively carry out a required task (Work Order or Job Plan)
3. To ensure that all necessary resources are available to the Maintenance Team to safely and cost-effectively carry out a required task (Job Scheduling)

Maintenance Job - PM

1. Equipment Function?
 1. Functional Failure (performance level)
 2. Potential Failure (performance level)
2. Does the Measurement of Condition impact the Delivery of the Function?
3. Track Degradation of the Function?
4. Prediction of when the Functional Failure will occur?
5. Do we have enough Lead Time?
6. Does the measurement of the condition allow us to prevent the Functional Failure?

Timing the PM



Cost-Effective Maintenance

Basic Rules:

1. If the cost of Prevention (the PM) is less than the Cost/Risk of Failure, then perform the PM
2. If the Cost/Risk of Failure is less than the Cost of the PM, then continue to run
3. Remember that the Risk of Failure and the Cost of the PM will change with time and usage

$$\text{Risk} = \text{Cost of Failure} \times \text{Probability of Failure}$$

Cost-Effective Maintenance: Balancing Risk against PM Cost

Probability of Failure

- %
- Time Frame (= current operating cycle)
- Confidence level

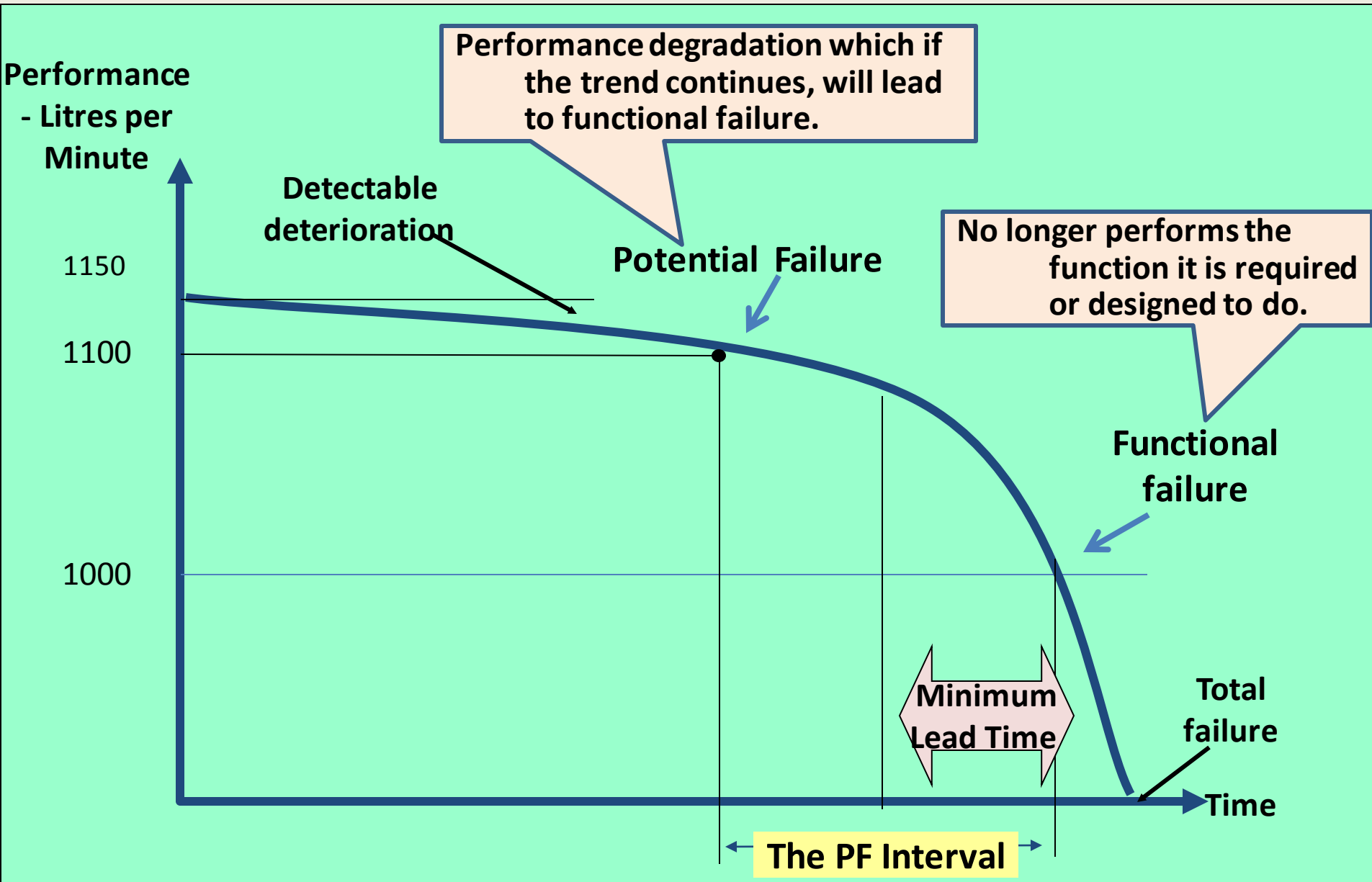
X

**Cost of Failure =
Cost of Emergency Repair +
Cost of Lost Revenue +
Penalty Costs, Reputation
Costs, Fines and Reparations**

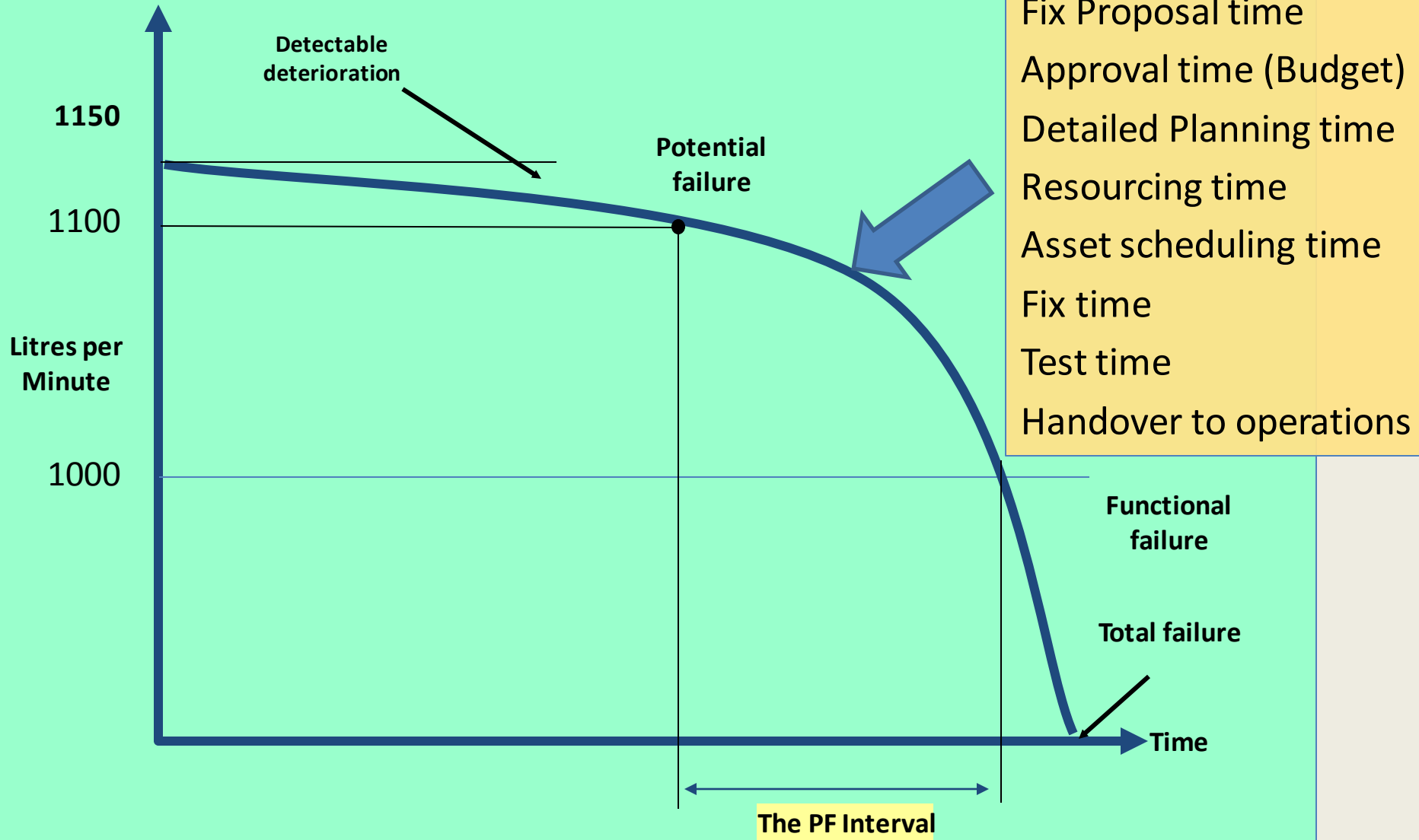
**Cost of PM =
Cost of PM Work +
Cost of Lost Revenue +
Penalty Costs, Reputation
Costs, Fines and Reparations**



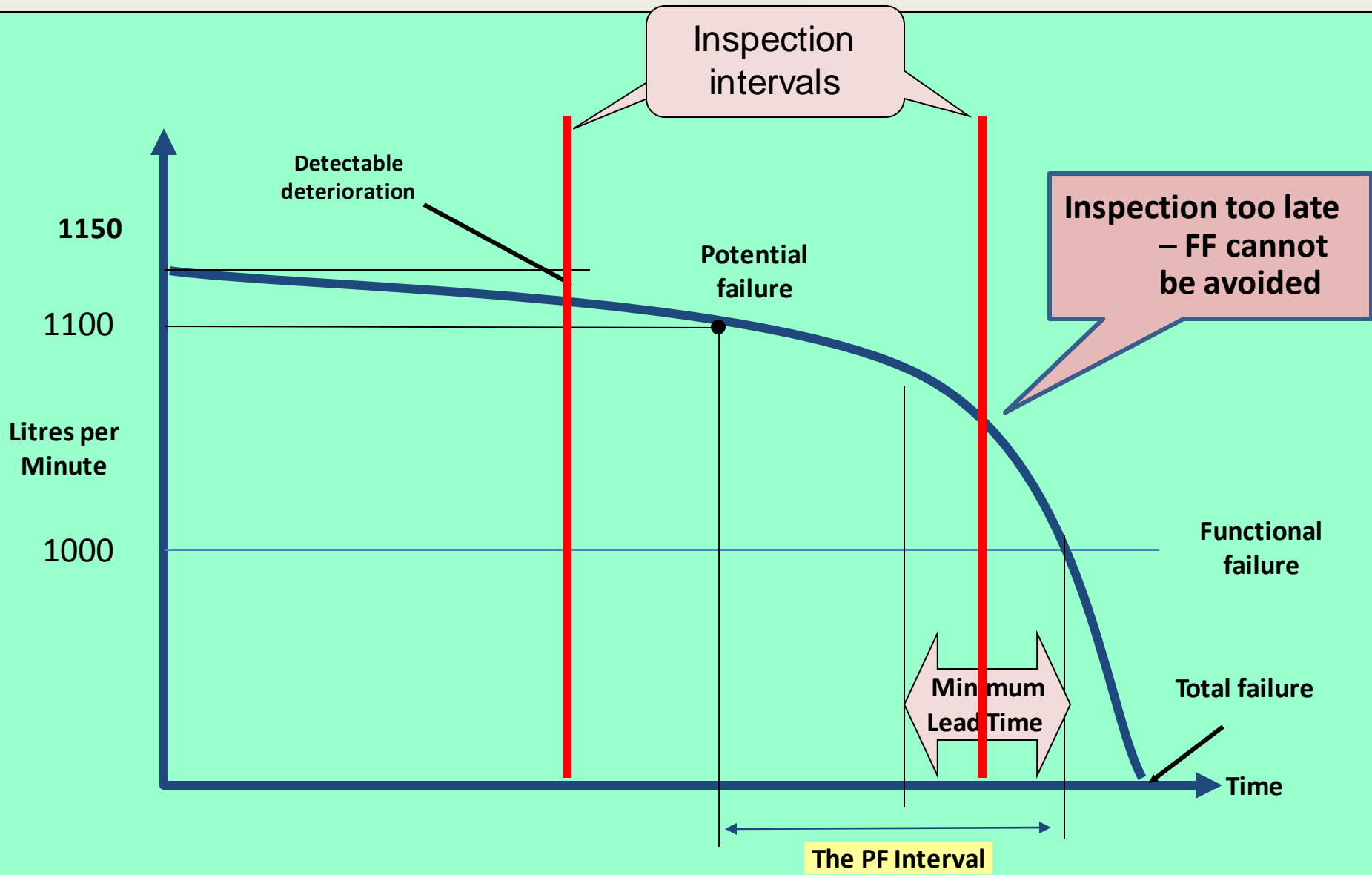
Failure -- Potential and Functional Failures



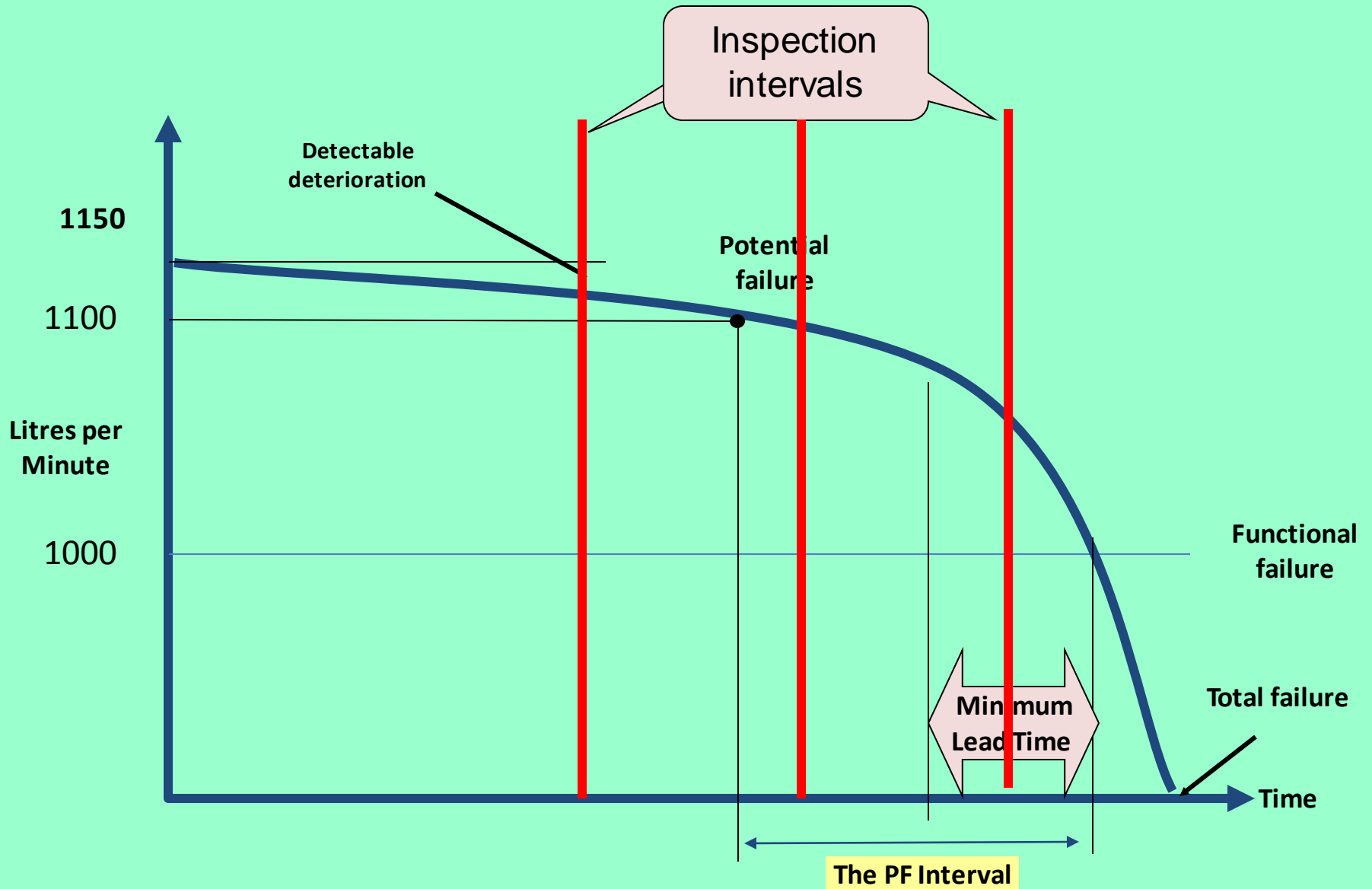
Looking at Lead Time..



How do we Gain Knowledge of Performance?



The Inspection Interval must allow time for the Lead Time



Planning “Golden Rule”

PF Interval \geq Lead time

PF interval – Inspection time = Warning Interval

Warning Interval \geq Lead Time

What if...??

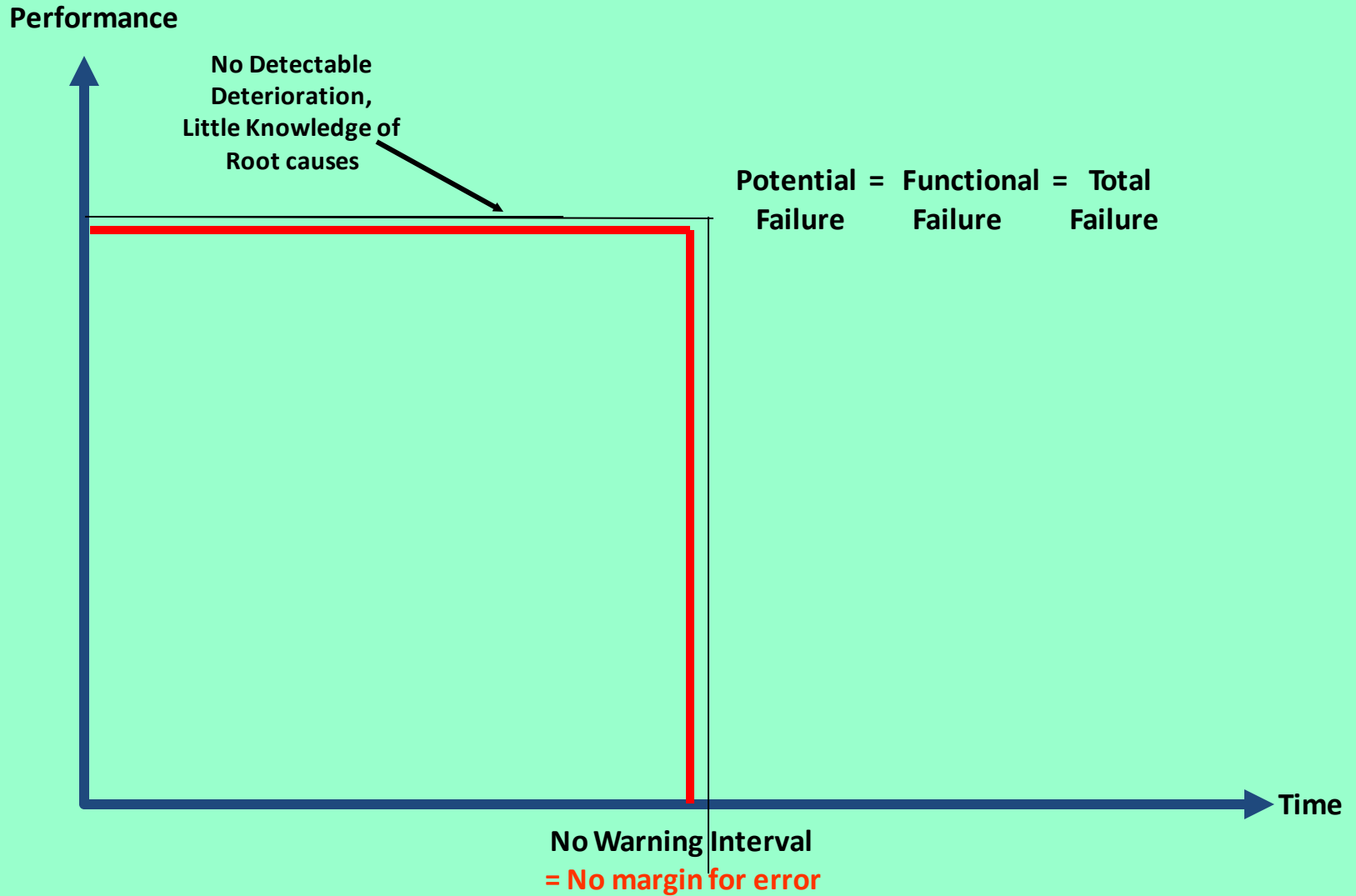
Lead time > PF interval

Lead time > Warning interval

What are your options???

Maintenance Job - Corrective

CBM cannot work here?

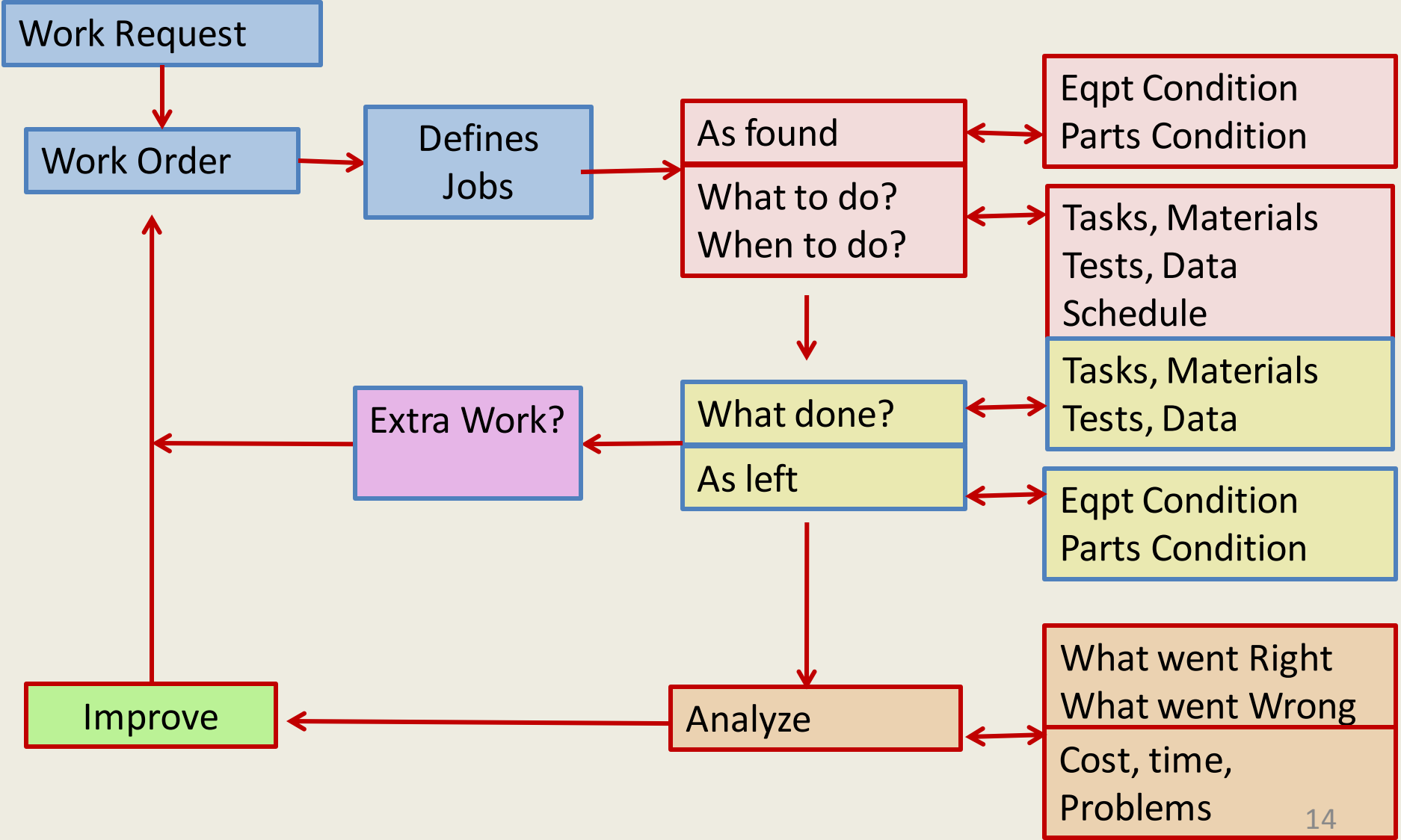


Work Order – Job Plan

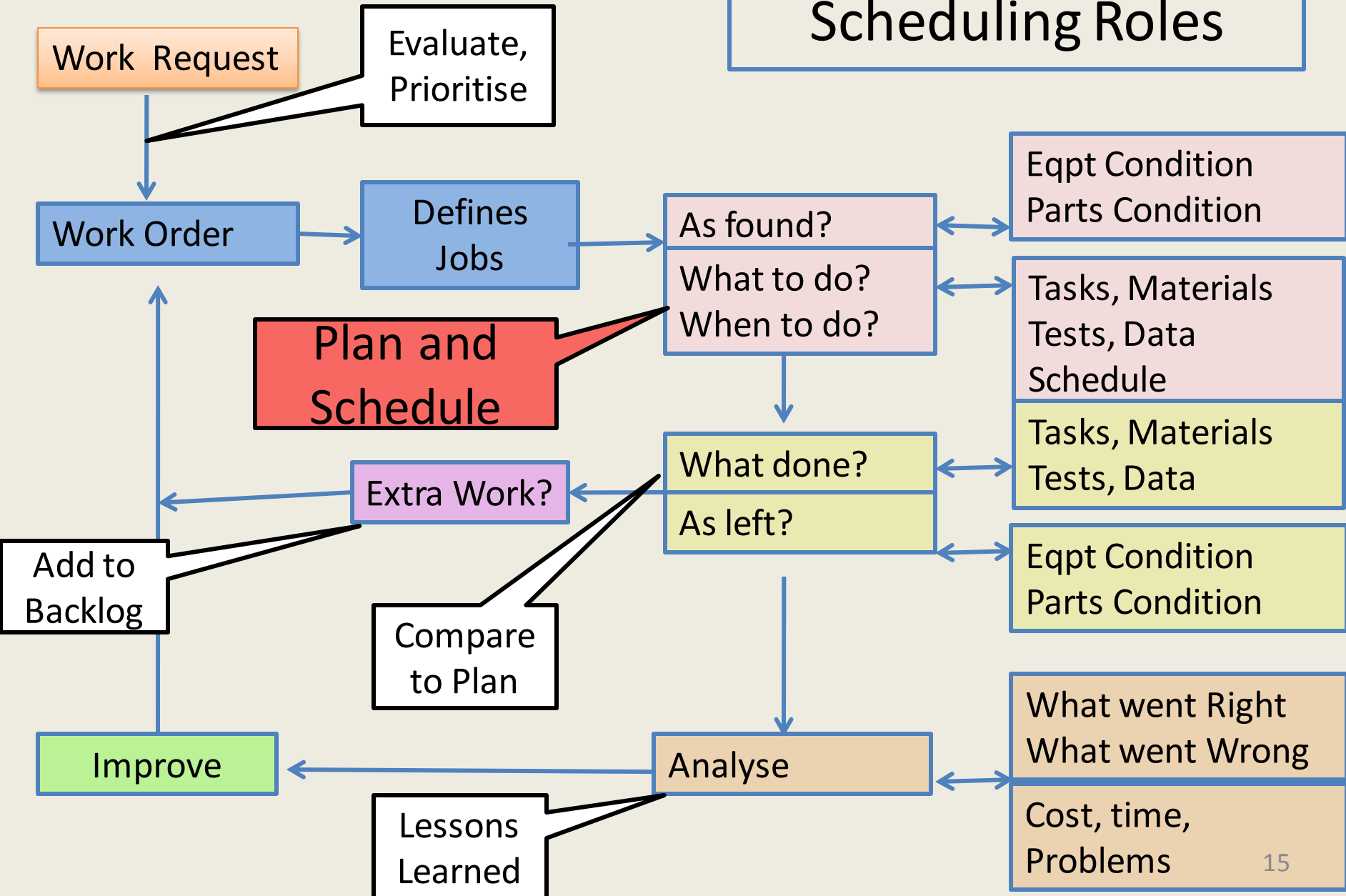
Types of Work Orders

- a. **Inspections** – designed to record the condition of the equipment – establish if there is an impending problem
- b. **Preventive maintenance** work – designed to prevent a specific failure – Condition or time based
- c. **Corrective**– to remedy a known fault
- d. **Investigative work** - to detect and identify an unknown fault
- e. **Emergency** – an immediate response to an unexpected failure
- f. **Redesign** – to eliminate a critical or hidden failure
- g. **Projects** – to extend capacity, improve a process
- h. **Analytical** – to interpret data in order to draw a conclusion
- i. **Sub contract and external repair work** – to match your internal work processes
- j. **Admin, research, budgeting, KPI** preparation and display

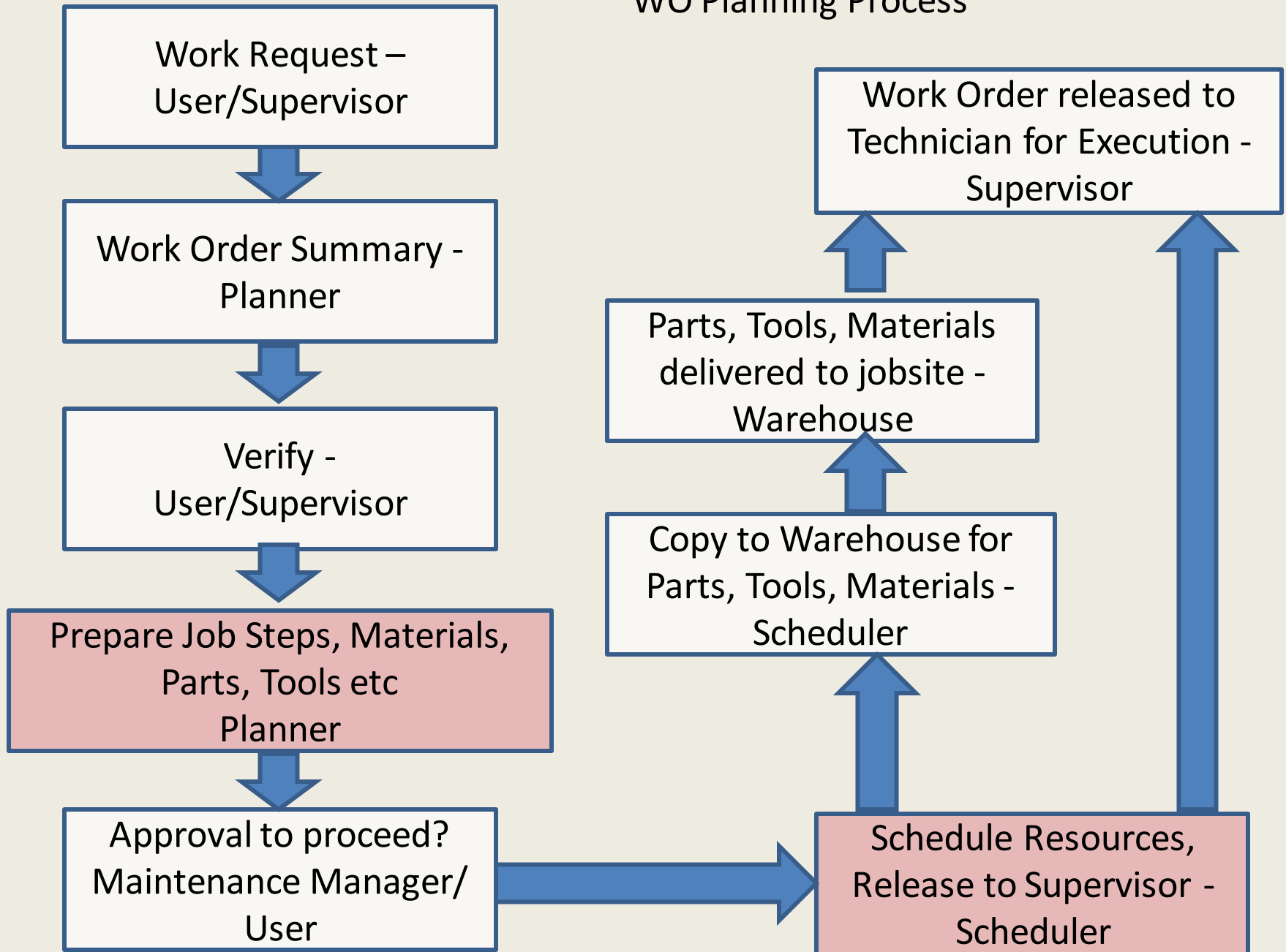
The Work Order Cycle



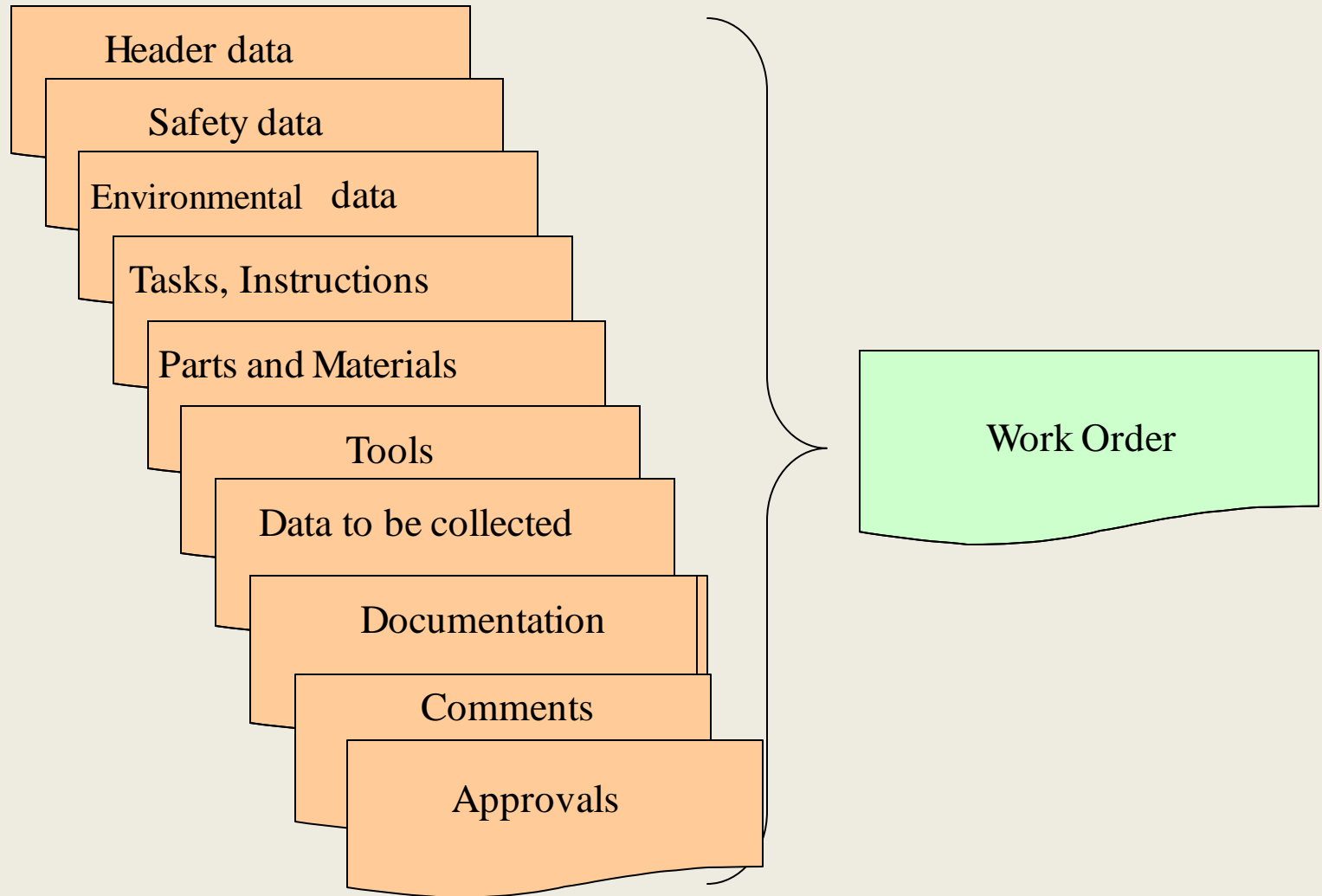
Planning & Scheduling Roles



WO Planning Process



Work Order Contents



Need a Word copy of a suggested work order format? -- Email me!

Focus on Planning and Scheduling

Plan – define the equipment, the job and the resources;
Prepare the Work Order - Planner

Schedule – make sure the resources are available when needed
- Scheduler

Assign – Decide who is to do the work
- Supervisor

Complete on time – Carry out the tasks
- Technician and Manager

Verify – that the work has been done to standards –
QA or Supervisor

Manage – track the costs, verify versus budgets –
Cost Analyst and Manager

Improve – the quality of the planning for next time
- Planner or Reliability Specialist

Control
(not in our
agenda)

Planning –

Focus on the “What & How”

- **What** future work is to be done
- **How** is it to be done
 - Make sure the job is properly defined (ALL tasks and resources)
 - Reduce the potential for delays and extra costs caused by lack of knowledge of the work
- Job plans are the basis for a company’s Best Maintenance Practice
- Job Plans should be frequently reviewed and upgraded
- Planners
 - Prior experience of having done the work – job experience is key
 - Knowledgeable of O&M conditions
 - Knows what is not feasible
 - Comfortable with the task details

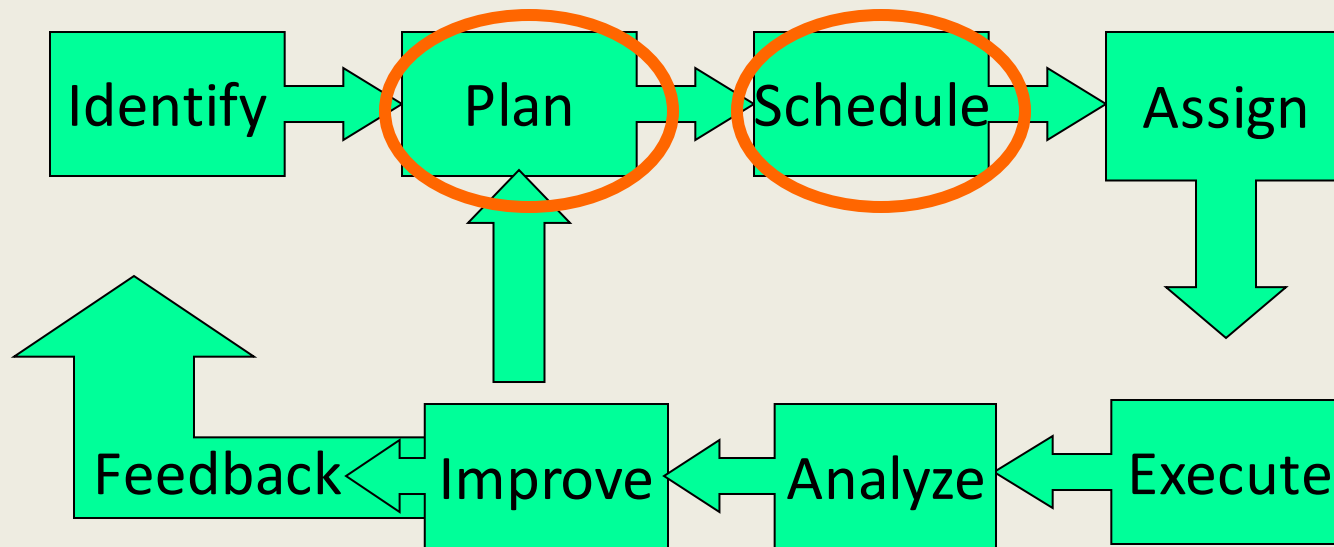
Scheduling –

Focus on the Who and When

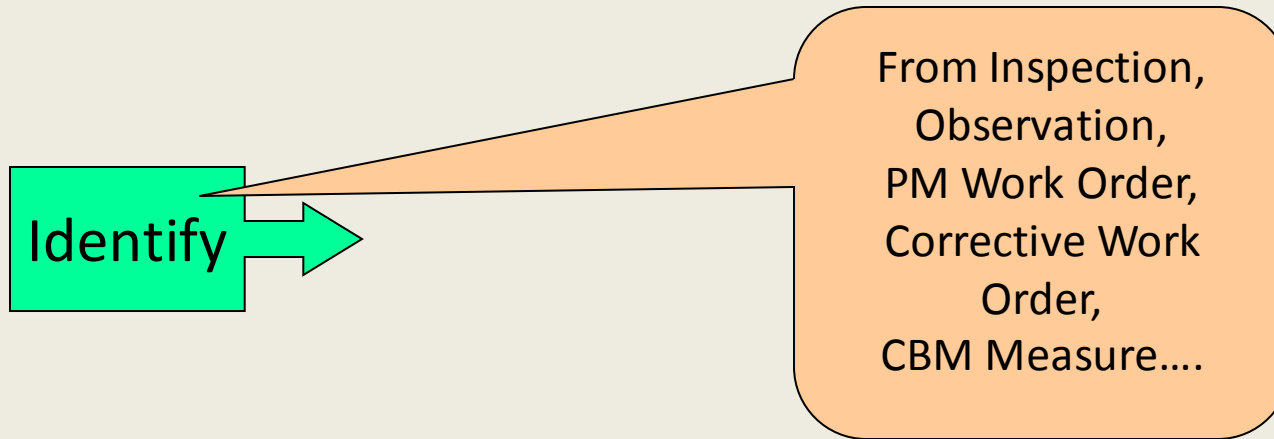
- **When** is the work to be done
- **Who** is to do the work
 - Make sure all the resources are available for the job
 - Reduce the potential for delays and extra costs caused by resources not being available
- Job schedules are the basis for a company's daily, weekly, monthly work completion
- They should be frequently reviewed and upgraded
- Schedulers
 - Experts in multi-tasking
 - Close contact with resource availability
 - Does not need to know details of job (but it helps!)
 - Understand expediting

Best Practices – Planning, Scheduling & Control

- Eight key steps

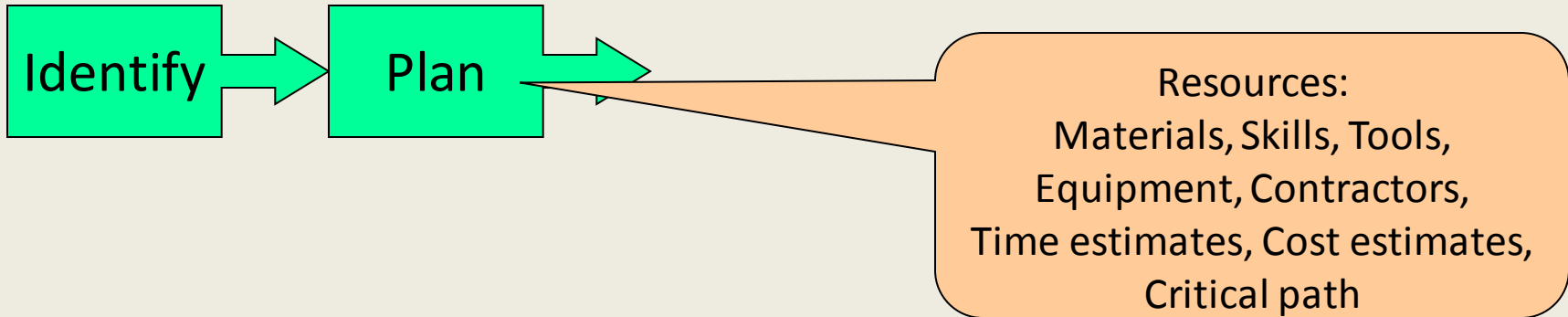


Planning, Scheduling & Control - Step 1



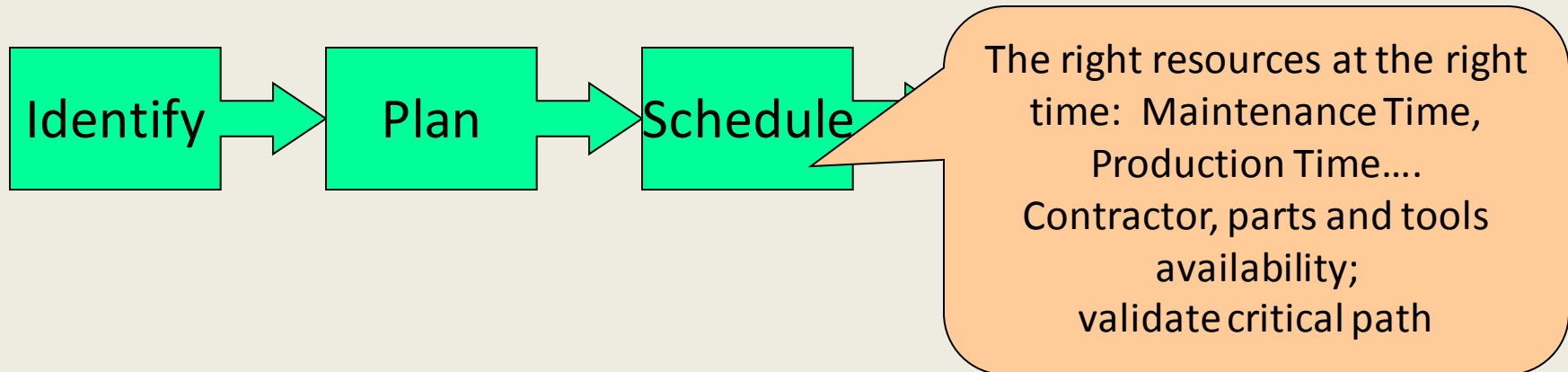
- 1. Strive for quality improvement in the work request – better observation, better problem definition, more training**
- 2. Use smarter condition monitoring to define thresholds for work requests**
- 3. Ensure Conditions being monitored are predictors of functional failures**
- 4. Insert approval process between Work Request and Work Order – duplication, budgetary, functional, technical, priority.**

Planning, Scheduling & Control - Step 2



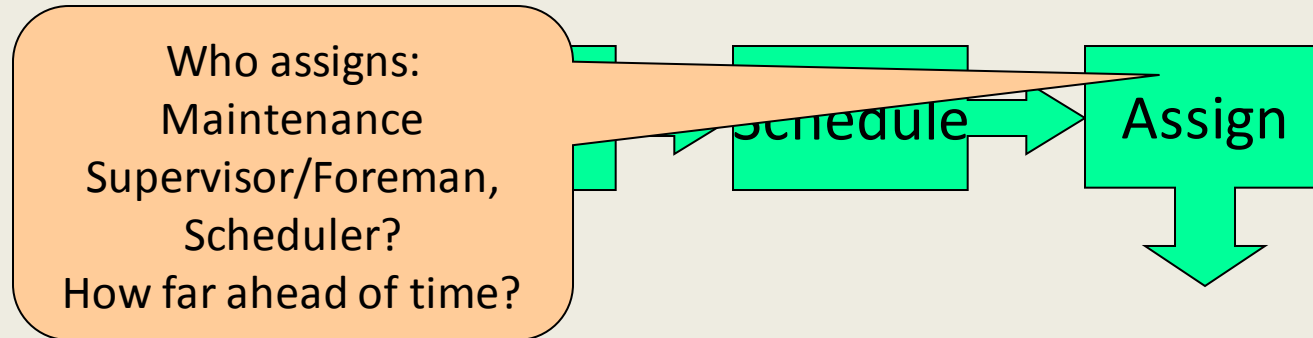
- 1. Always work from a template wherever possible – update previous work order version**
- 2. Use Company’s internal Best Practice and Best Knowledge – which should be continuously updated from experience**
- 3. Ensure that all work elements are included – Equipment, Tasks, Resources, Permits, Supervision, Data to be Collected, Analysis**
- 4. For complex jobs, ensure job sequence will facilitate scheduling by stages**
- 5. Plan Critical Path**
- 6. Review for budget, quality, timeliness, priority and need before releasing to scheduling**
- 7. Weekly Planning meeting to review work load, priorities etc**
- 8. Attend at Weekly Backlog meeting**

Planning, Scheduling & Control - Step 3



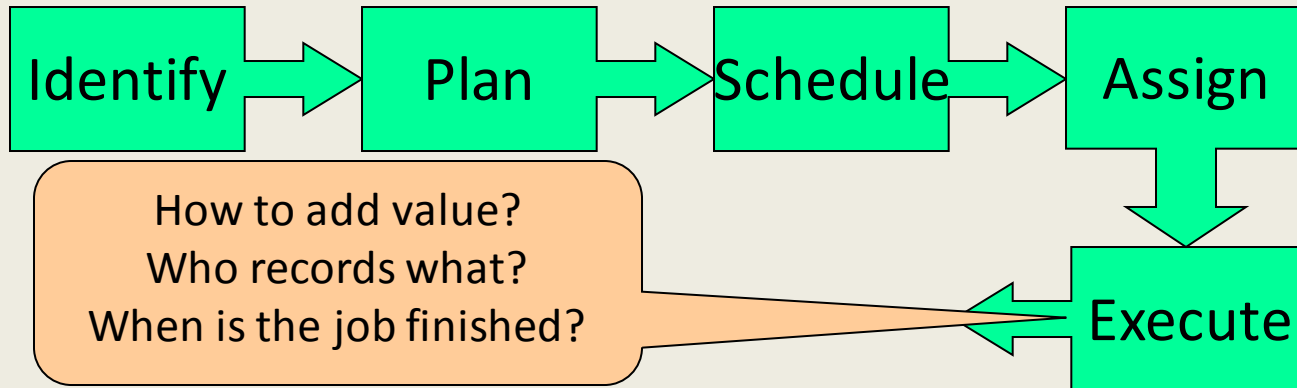
1. Ensure all Work Order elements are in place before issuing
2. Integrate with related maintenance and operational schedules to optimize resource use, equipment downtime, production schedule
3. Pay attention to Resource leveling
4. Where job staging is required, ensure resources for stage 2 are available JIT before releasing after stage 1
5. Ensure adequate time is scheduled for each job step
6. Validate Critical Path
7. Adjust for reliability of Contractors re on-time job start and job finish, suppliers for materials lead times etc
8. Weekly Schedule meeting (also Daily??), Weekly Backlog Mtg

Planning, Scheduling & Control - Step 4



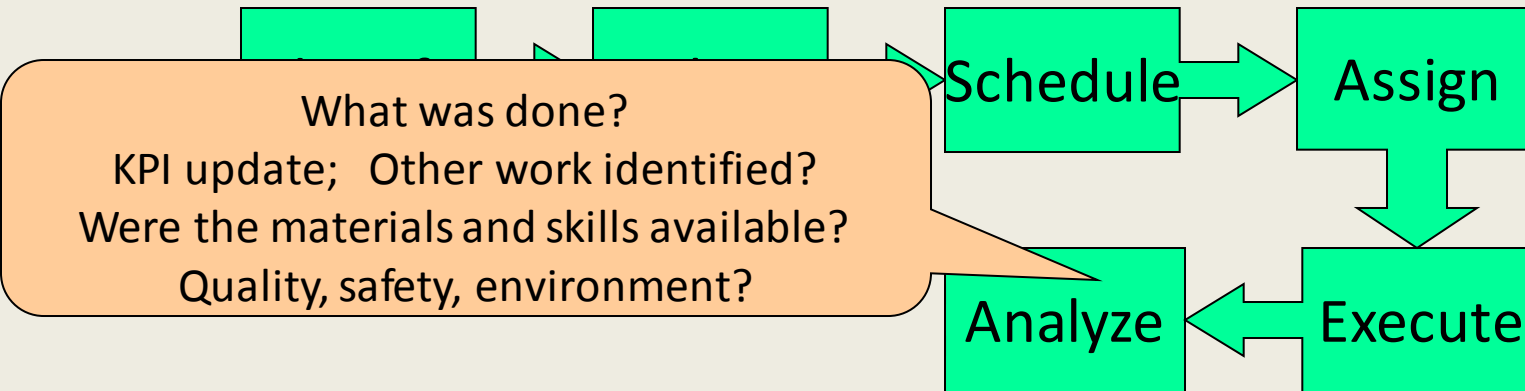
- 1. Decide whether assignment is Scheduling task or Work Team Leader task - ie assign to individual or to crew/contractor**
- 2. Make sure required priority and skill level are supported**
- 3. Check availability (vacations eg)**
- 4. Depending on job, experience (and confidence), assign work to be completed in a block (eg one week or one month) versus single day**
- 5. Decide on level of details provided based on experience level of crew.**

Planning, Scheduling & Control - Step 5



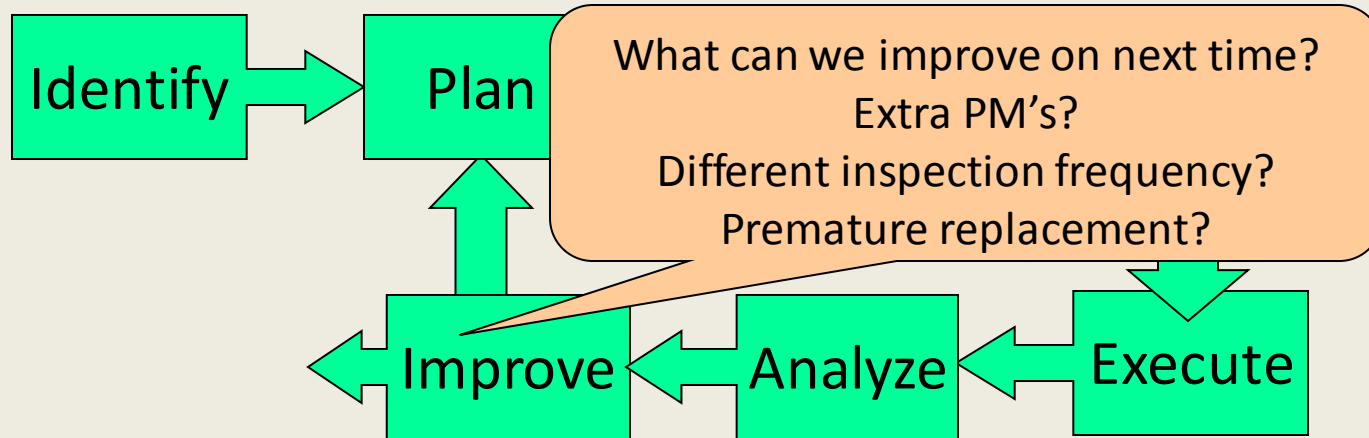
1. **Set rules for time definitions within “Execute”** - travel time, wait time, wrench time etc
2. **Ditto for materials consumption/disposal**
3. **Train for data collection – consistency, accuracy, completeness**
4. **Encourage feedback re all job elements**
5. **Validate quality and completeness of work and reporting – accountability must be clear**

Planning, Scheduling & Control - Step 6



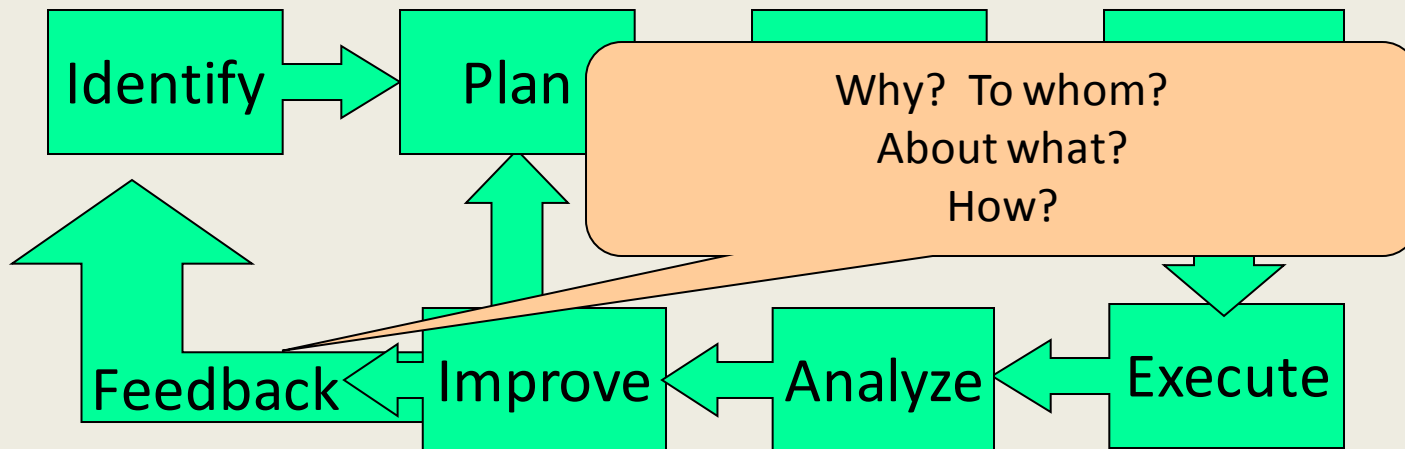
1. Review details and feedback -- What can be done better next time?
2. Cross reference to RCM??
3. New knowledge gained re jobs, equipment?
4. Test correlation between Condition Measurement and Failure
5. Change in frequency?
6. KPI's updated and published
7. Make sure Analysis task in on a work order

Planning, Scheduling & Control - Step 7



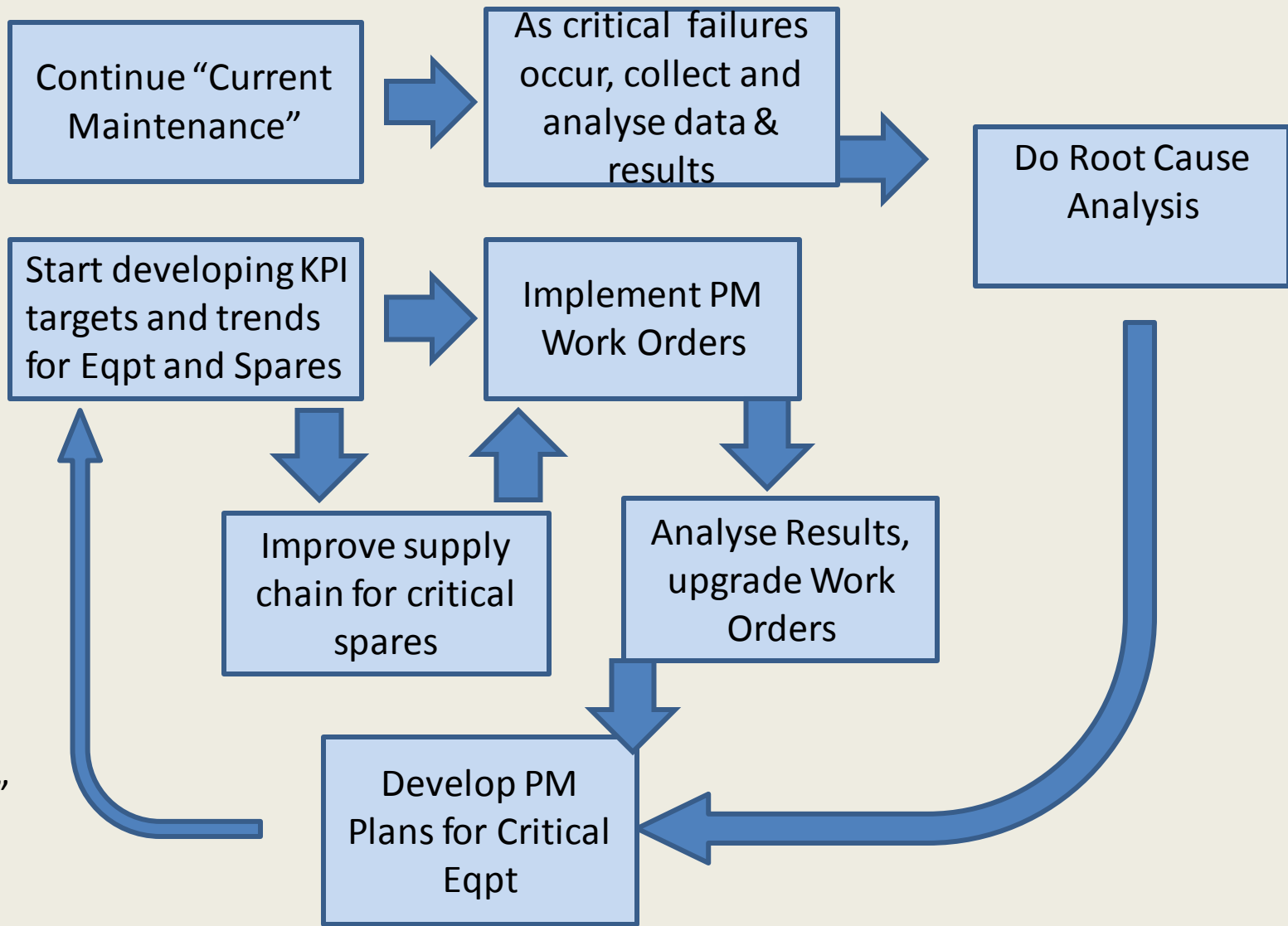
1. Ensure proposed improvements are integrated into Maintenance Plan - contents, frequency, priority.
2. If failure is on critical RCM'd equipment, check RCM logic and adjust in maintenance plan for similar equipment.
3. Use KPI's to drive changes in behaviour
4. Set new KPI targets
5. Introduce new procedures and tools
6. Train and retrain

Planning, Scheduling & Control - Step 8



1. Ensure Feedback is provided to Technicians, Operators, Supervisors and Management
2. Broadcast successes, acknowledge failures
3. Announce new goals
4. Encourage future participation and feedback
5. Emphasize Continuous Improvement added value

From Unplanned to Planned Working Mode



Update Plans and Discontinue unnecessary "Current Maintenance" as it is replaced by Planned Maintenance

Some Suggested KPI's

- % Wrench time – 60%
- % Work planned – 80+%
- % Work Scheduled – 90+%
- % Schedule Compliance – 95+%
- Work Order Quality – 95%
- Planners + Schedulers to Technicians ratio – 1:10
- Planned to Unplanned cost ratio –1:3
- Work Backlog ~ 1 to 2 weeks
- # WO's completed within +/- 10% of estimate
- % of overtime < 10%

Thank you

Email me!

Stevensb@kingston.net