



Asset Management and Reliability Program (AMRP)

GO Maximo Conference



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Presented by:
Neil Gibbs
Rick Marshall

 **inter** pipeline



Canadian Midstream O&G

- History of IPL & the Midstream Path Forward

Master Data

- Fundamentals of Master Data
- Location/Asset Hierarchy Conventions
- Location/Asset Hierarchy Development
- Asset Consolidation from Multiple Owners
- On-Hand Stores
- Rotating Items
- Attributes, Failure Codes, and Name Plate Data Collection

Maintenance Strategies

- Asset Criticality Ranking (ACR)
- Reliability Centered Maintenance (RCM)
- Failure Modes and Effects Analysis (FMEA's)
- Creating, Modifying, and Decommissioning Assets
- Work Order Life Cycle
- Obtaining Buy-in
- Distance as an Obstacle to Effective Scheduling
- Mobile Technology
- Organizational Restructuring



The Canadian Midstream O&G Business

- In Western Canada the oil and gas midstream business connects producers with refiners within Canada and the US market
 - Receiving facilities can be hundreds of kilometers away
- Typically producers and refiners avoid the pipeline business due the very different nature of the operation and logistics involved
 - Very remote and dispersed stations
 - Cost of construction
- Producers will enter into long term contracts, up to thirty years, to ensure market access



How IPL Came to be

- In 1997 IPL, Koch Pipeline at the time, consisted of a single pipeline system, operating over a relatively small area.
 - IPO value of \$375 million
- Through major acquisitions and organic growth, IPL now consists of the six pipeline systems we have today
 - Through acquisitions we ended up with support groups located geographically, rather than centralized
- IPL's organic growth program is set to more than double throughputs in the next two years
- Today's market capital of \$12 billion



Inter Pipelines Current Business

Conventional Pipelines

- Total Length of 3700 km
- 975,000 barrels of storage
- Average throughput 187,000 b/d
- 140 injection facilities

Oil Sands Pipelines

- Total length of 2600 km
- 3.8 MM barrels of storage
- Average throughput of 830,000 b/d
- 1.2 MM b/d of new pipelines





Why IPL Needs a Robust EAM

- In order for the pipeline industry to expand we need to assure the public and regulators we are managing our assets in a responsible manner
- We have grown too large to manage at the asset level without the use of Maximo
 - Ability to audit for internal compliance and regulatory oversight
- Pipeline capacity is so restricted that we are unable to make up lost production due to unplanned outages
 - Identify problematic assets
- Better understanding of where our maintenance dollars are being spent



IPL's Current Maximo Implementation

- Currently IPL's assets are identified in Maximo but not at a detailed enough level to gather the necessary KPI's
- Looking to standardize our use of purchase requisitions and route all requests through a centralized purchasing group
- We have inventory within Maximo which is associated to locations as spare parts, though this not consistently done through all operating areas
- We currently use Maximo for work management but our planning and scheduling are performed outside of the program
- We gather reasonable asset history but we lack asset specific failure codes



AMRP Objectives

- Asset Management & Reliability Program
- Optimize the financial and operational performance of Inter Pipeline's physical assets and work processes
- Reduce frequency and severity of loss events (spills, property damage)
- Improve reliability to meet and exceed customer expectations
- Implement standardized, scalable practices, processes, and technology for future growth
- Develop reporting and key performance indicators to provide sound decision-making in managing assets
- Ensure AMRP is developed by the business users



AMRP will build standardized processes and technology for Canadian assets from design to decommissioning

In Scope:

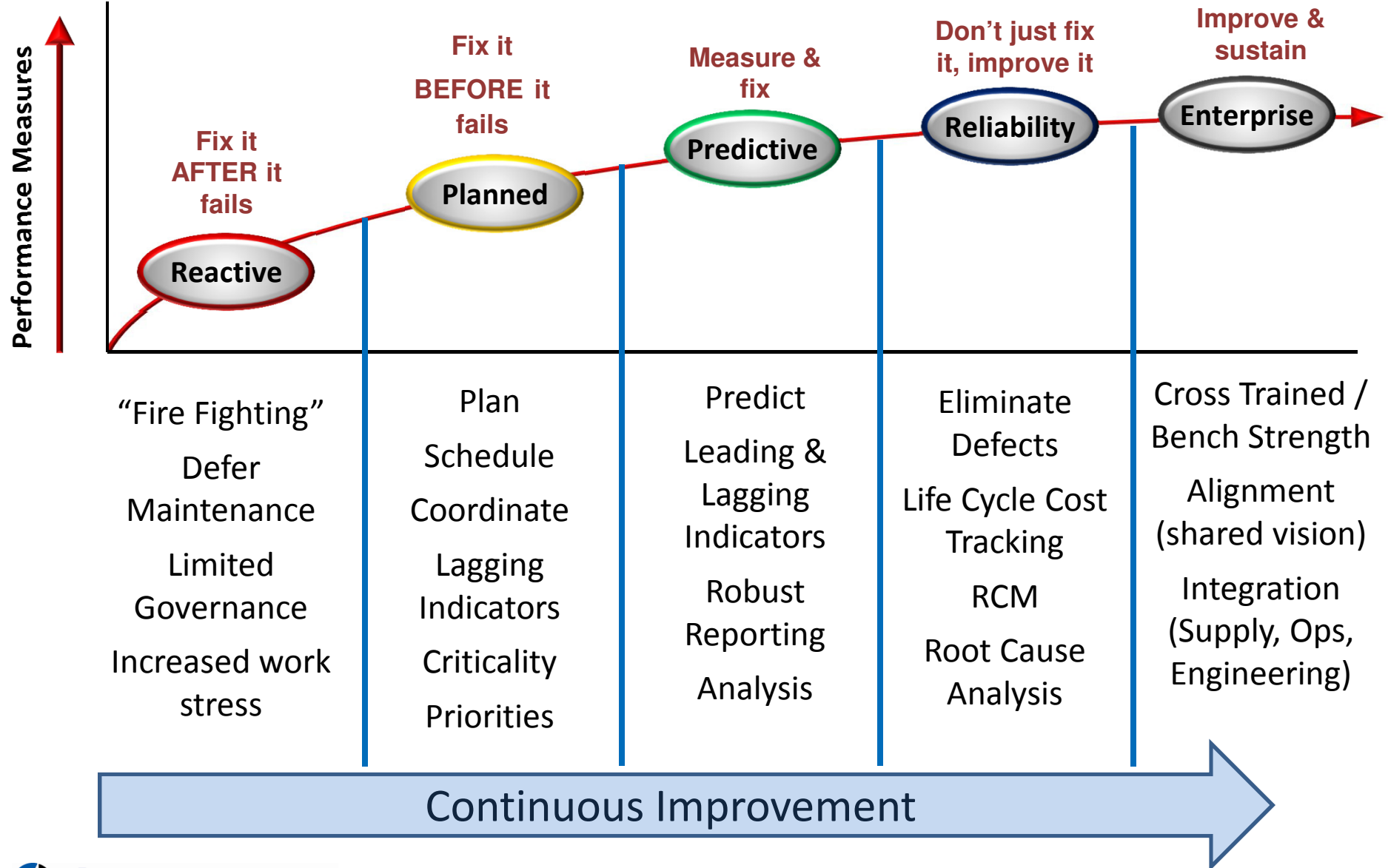
- Master Data
- Maintenance Strategies
- Supply Chain Management
- Reliability Centered Maintenance
- Reliability Analysis and Life Cycle Costing
- Management of Change
- Incident Management

Out of Scope:

- Assets outside of Canada
- Documents, drawings, and records management
- Risk-based integrity management of pipelines, tanks, and vessels



AMRP Maturity Levels





Summary

- Optimized project design (Life Cycle Costing)
- Efficiency gains in maintenance, planning/scheduling, and purchasing
- Accurate inventory of assets and locations
- Historical records of work performed
- Optimized inventory levels including critical spares
- Improved reputation with shippers, producers and regulators
- Reduce lost throughput, spills, and property damage
- Improved employee morale and less stress

“Managing Workload Stress”



Master Data



Fundamentals of Master Data

- Important component of any asset management program
- Must consider what is necessary from reliability, reporting and continuous improvement perspectives
- Should be the basis for phased/foundational development and implementation

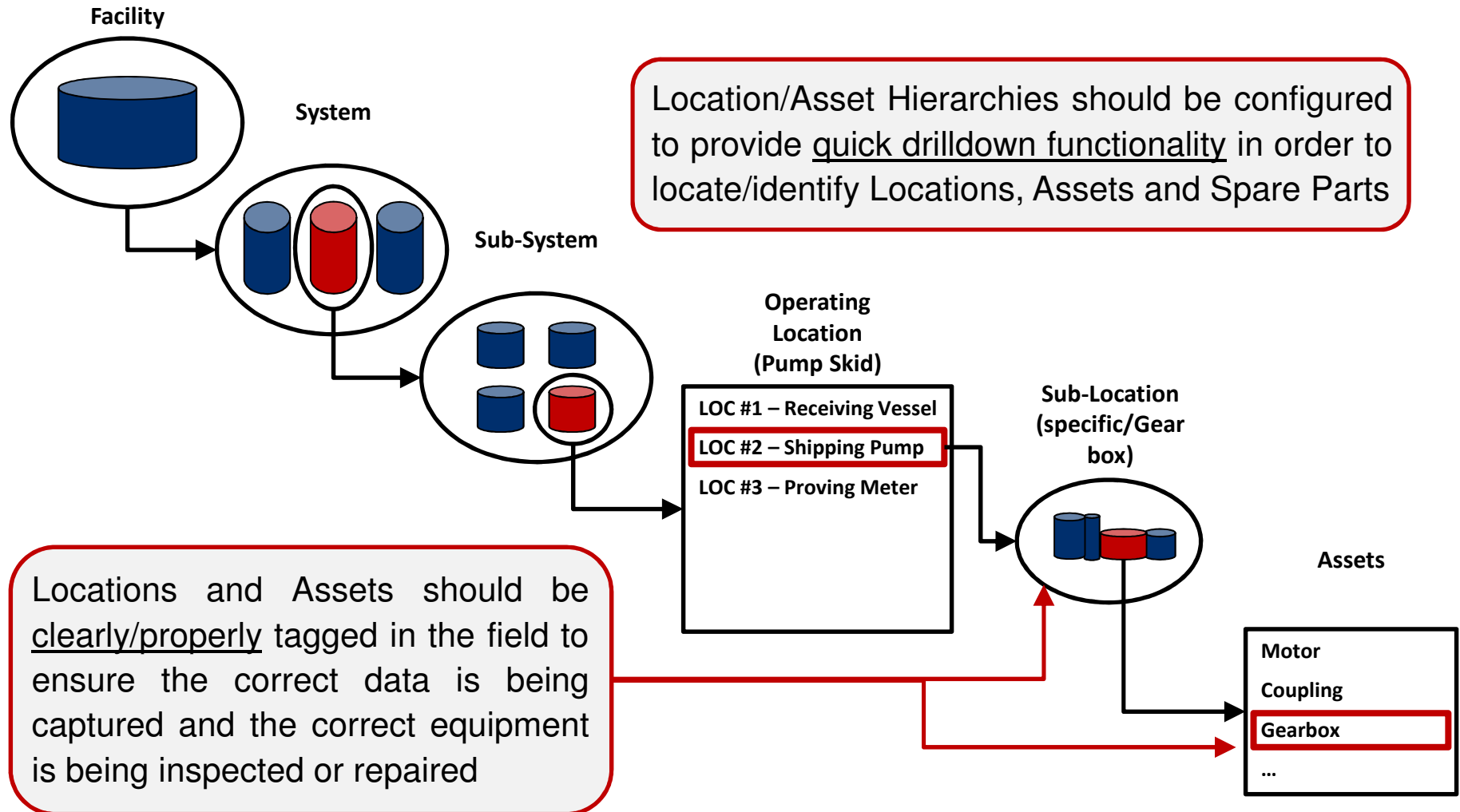


Location/Asset Hierarchy Conventions

- Needs to be established prior to reliability program kick-off
- Must consider current numbering and existing systems (DCS, PLC, procedures, drawings, etc.)
- Should include projects and standards
- Can also be implemented in a phased approach using legacy identifications



Location/Asset Hierarchy Development





Asset Consolidation from Multiple Owners

Addressing the Issue of Assets Consolidated from Multiple Owners into a Single Business Unit

- Assets assigned in the plant environment easily follow the previous system hierarchy.
- The linear pipeline requires a little more sophisticated hierarchy.
- The pipeline system adds an additional layer that isn't normally seen in the plant environment.
- Each plant/system and pumping location was originally identified by the numbering scheme provided by different engineering firms, different construction companies, and by the original operator.
- One of the most critical factors to overcome was the need for all assets to follow a common hierarchy and location numbering scheme.
- A great deal of time has been invested in creating a standard to be used throughout operations and projects.



Keep it Simple Where Possible

- Follow a system hierarchy.
- A system hierarchy supports work order scheduling.
- When an asset goes down, the scheduler needs to see immediately what other assets are available to be PM'd or repaired.
- Use the configuration in your hierarchy that is necessary.
- Don't try to find sub-assemblies and spare parts; the need will be obvious.
- There are years of success attached to this method.



Proper Identification of On-Hand Stores and Rotating Items

- Main items in storerooms will be critical spares and consumables.
- Your ACR/RCM Assessments will identify these.
- When selecting items that should be stored, use your expertise and system owners to identify the 1 off items.
- Lead times, cost and relationships with vendors can also drive the need to stock items.
- Rotating items are items to be taken off the shelf, put in service, the failed unit rebuilt and put back on the shelf. The need to track performance and traceability is also a driver.
- Maintenance needs to consider that production is king.
- Maintenance's job is to get the plant operating and then worry about rebuilding equipment. Your stores should reflect this with complete spares, not a group of parts.



- Maximo is very sophisticated in dealing with attributes, specifications, and failure codes.
- What all systems are lacking are details associated with equipment in the Mid-Stream Segment of Oil and Gas.
- These are very important to troubleshooting, reordering, life cycle analysis, and reliability analysis.
- Do not pass on an opportunity to set these up correctly.
- They are very labor intensive but the pay-off is huge.



- Scheduling asset name plate data collection and tagging equipment is critical to other initiative's success.
- The seasons play a significant role in accessing equipment to collect nameplate data and therefore has a major impact on overall project scheduling.
- The cold weather in Canada has ended up being the critical path for the project.
- Take this into consideration when developing project schedule.



Maintenance Strategies



What is Asset Criticality Ranking

- Asset Criticality Ranking (ACR) is a tool used to evaluate how asset failures impact organizational performance.
- Provides reliability leaders a detailed profile of characteristics that makes each asset critical.
- Provides focus to ensure that reliability improvements are made based on calculated risk rather than perception:
 - Safety and Environmental Impact
 - Operational Throughput
 - Maintenance Costs
 - Utilization Rate
- Allows for the systematic ranking of assets for prioritization of all efforts.



Benefits to ACR

- Primary mechanism needed to prioritize improvement activities when time and resource availability are limited
- This prioritization should be applied to Continuous Improvement efforts
 - PM Optimization (PM and PdM Development)
 - Bill of Material Development (to include Critical Spare Parts)
 - Capital Investments
- This prioritization should also be applied to Daily Management of the CMMS Workflow Process
 - Planning
 - Scheduling
 - Material Procurement



ACR Strategy Development

1. Determine the Components for ACR
2. Determine the Factors for each Component
3. Determine the Criteria and Scoring for each Factor
4. Determine the Weighting for each Factor
5. Determine the Scoring Calculation for each Component
6. Determine ACR Score groupings for bulk analysis



RCM and FMEA

- Reliability Centered Maintenance (RCM) is defined by the technical standard:
 - SAE JA1011 - Evaluation Criteria for RCM Processes
 - This standard sets out the minimum criteria that any process should meet before it can be called RCM.
- The initial part of the RCM process begins with Failure Modes and Effects Analysis (FMEA).
- The second part of the analysis is to apply the "RCM logic", which helps determine the appropriate maintenance tasks for the identified failure modes in the FMEA.
- Finally, RCM is kept live throughout the "in-service" life of equipment where the effectiveness of maintenance is kept under review and adjusted based on the experience gained.



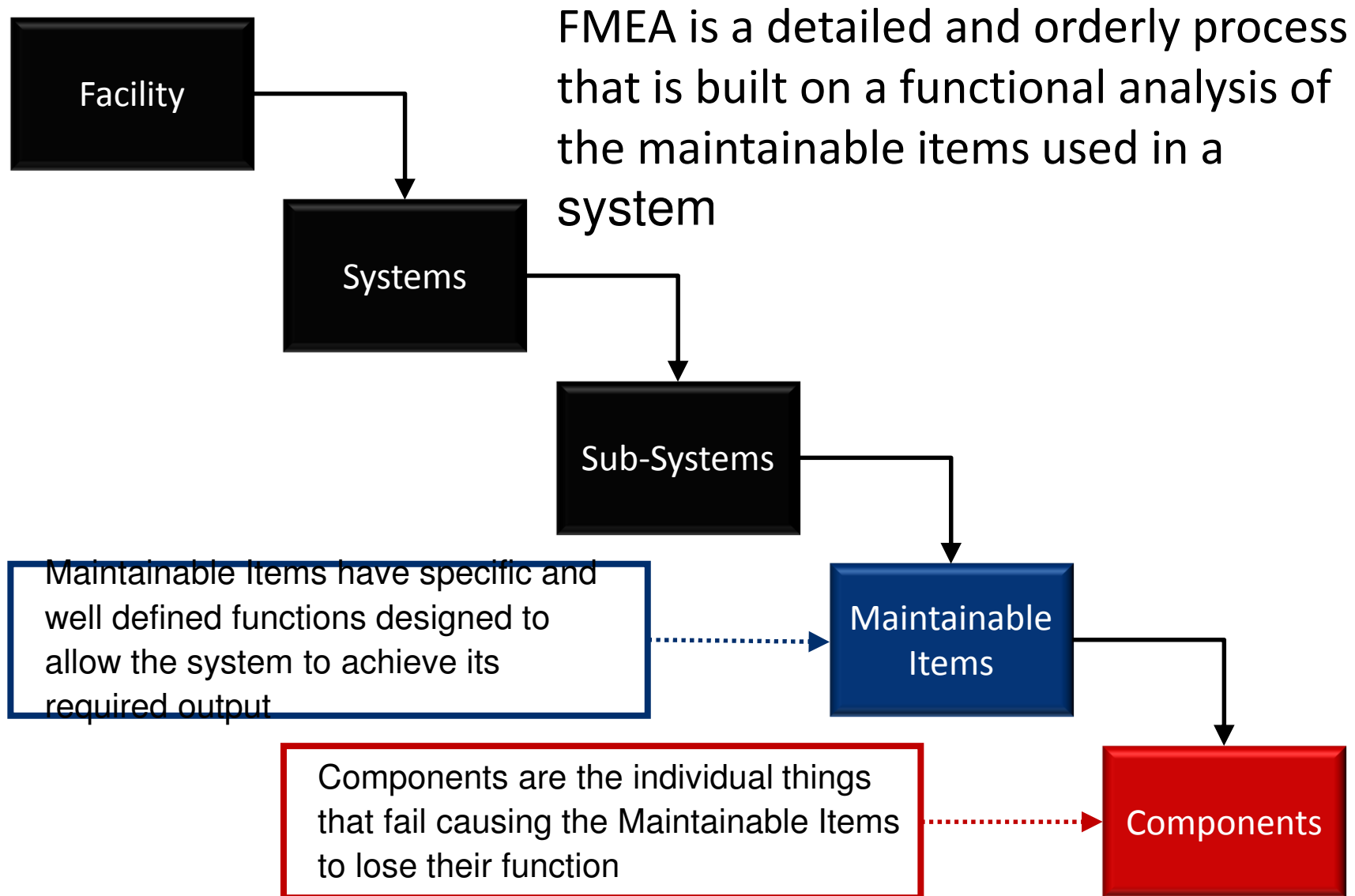
RCM Changing Perspectives

Paradigm Shifts inspired by RCM were:

- An understanding that the vast majority of failures are not necessarily linked to the age of the asset
- Changing from efforts to predict life expectancies to trying to manage the process of failure
- An understanding of the difference between the requirements of an asset from a user perspective, and the design reliability of the asset
- An understanding of the importance of managing assets on condition (often referred to as condition monitoring, condition based maintenance, and predictive maintenance)
- Linking levels of tolerable risk to maintenance strategy development



FMEA Functional Analysis System Hierarchies



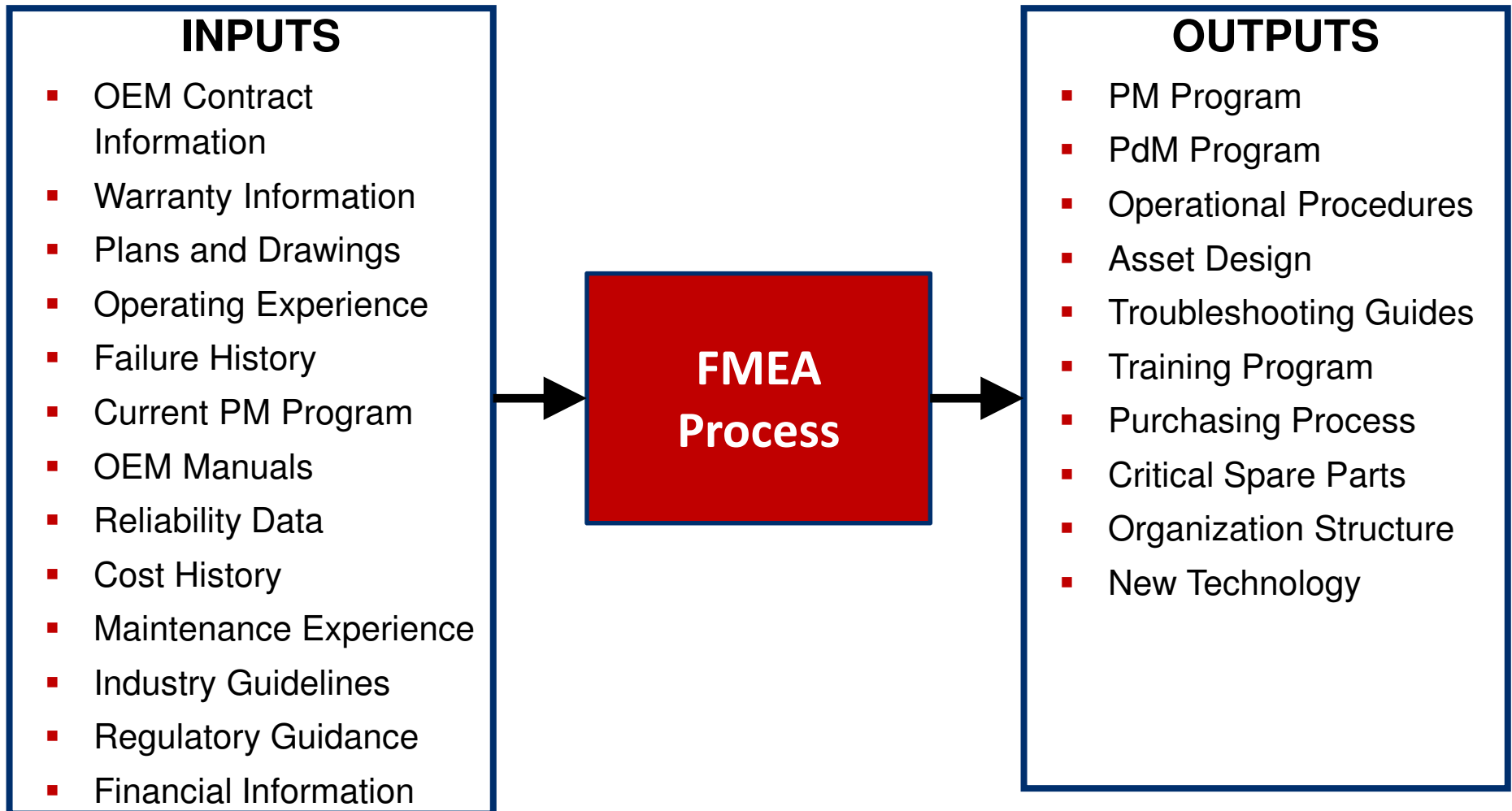


7 Basic Questions of FMEA

1. What are the functions and associated performance standards of the asset in its present operating context (**Functions**)?
2. In what ways does it fail to fulfill its functions (**Functional Failures**)?
3. What causes each functional failure (**Failure Modes**)?
4. What happens when each failure occurs (**Failure Effects**)?
5. In what way does each failure matter (**Failure Consequences**)?
6. What can be done to predict or prevent each failure (**Proactive Tasks**)?
7. What should be done if a suitable proactive task cannot be identified (**Default Actions**)?



FMEA Inputs and Outputs



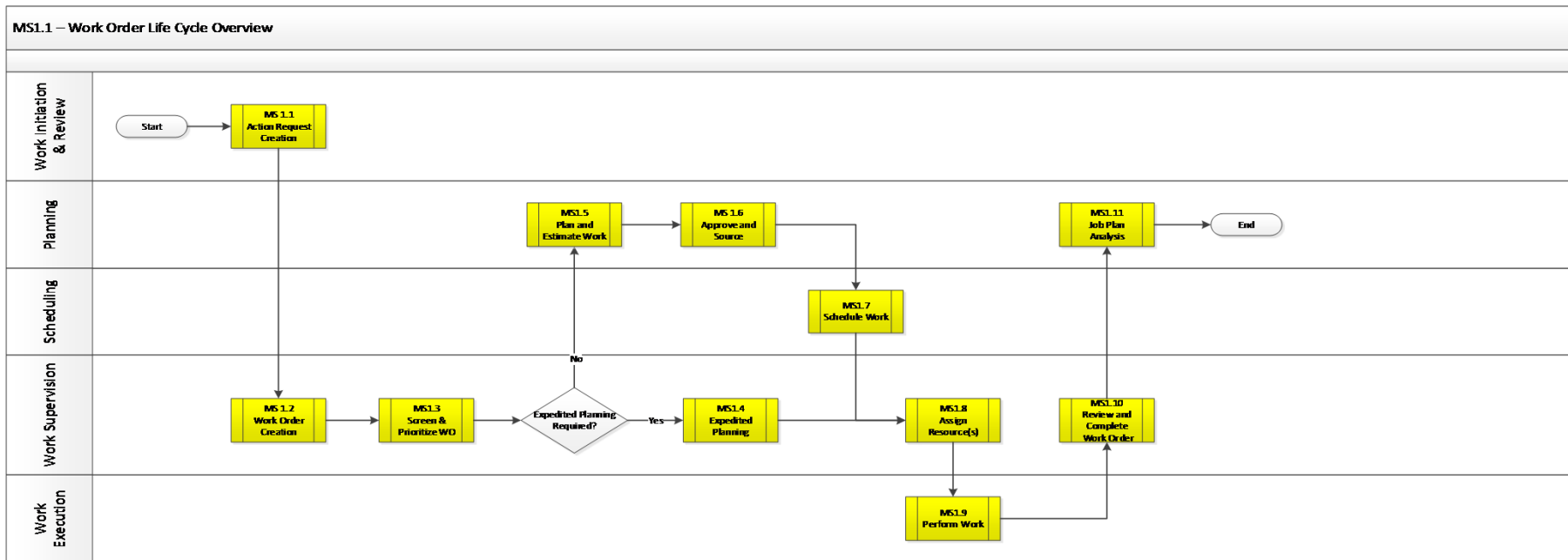


- This will be the continued success of your data or will ensure your data integrity is lost within 6 months.
- Make sure you have clear business processes and narratives that explain how this is to be performed and what data is to be maintained.
- Clearly define which functions are responsible for maintaining which data and in a specified timeframe.
- The importance of this cannot be over stressed.



Work Order Life Cycle Business Process Maps

Last Modified: 2014-09-21



* Project Management is performed outside of this process flow



Work Order Life Cycle Business Process Narrative

Example: The narrative should clearly define each step in the process map providing status changes, the responsible function and minimum requirements for the data that is to be contained at each step of the work order's progression through it's life cycle.

MS 1.1.3 Create or Modify AR

If an Action Request already exists, it may be necessary to add any additional information or to contact the original **requestor** if it is written to the wrong location or asset. If a new Action Request needs to be created, the following information should be included:

- Requestor Name and Contact Information**
- Location Number and Description or**
- Asset Number and Description**
- Description of Problem**
- Problem Code**
- Desired Priority**
- Desired Completion Date**



Obtaining buy-in from an Organization that Currently doesn't use Planning and Formalized Scheduling

- This is greatly misunderstood.
- It's not just someone in management stating that he supports the program.
- It's having a clear vision of what the company as a whole wants to get out of the program.
- It's communicating that vision to every staff member.
- It's being able to explain to the technician why his workload will be increasing and by doing it, what he/she's contributing back to the company's well being.
- You're basically asking technicians to stop having control over every minute of their day and to start following a strict schedule that will be reported on and their performance reviewed.



- Another issue with linear assets
- Issues sharing technicians' time between sites
- Issues sharing special tools
- Issues receiving materials for task
- Currently looking address this problem with mobile technology and remote storerooms
- This is yet to be fully resolved



Mobile Technology

- Proposed uses for Mobile Technology
 - Technicians retrieving tasks, recording actuals, completing work, looking up inventory and technical documents, reviewing schedules, creating work orders and communicating with supervision for approvals
 - Warehouse for receiving and issuing parts
 - Operators' rounds
 - Supervisors and system owners reviewing and approving work requests and work plans



Organizational Restructuring to Support Advanced Maintenance and Reliability Processes

- Ideally, existing staff will be redeployed to participate in more sophisticated roles
 - Technicians will be less involved in PM's and begin to participate in RCM assessments, PdM tasks and invest more time in aiding in planning and scheduling of routine activities and participating in projects.
 - One key component to effective scheduling is to have a clear delineation of responsibilities between operations and maintenance.
 - By the nature of each role, operators are positioned to respond to changing plant conditions and need to do so in a moment's notice.
 - Technicians need to be focused on the tasks they have been assigned to maintain schedule adherence expectations.
 - There will be a need for staff to support the EAM to ensure reporting is accurate and the data integrity is maintained.
 - Maintenance leads' and supervisors' roles will be changed from that of ordering parts and negotiating with operations for windows to perform tasks, and more to that of making sure techs are performing work when scheduled and work orders are being closed correctly.



Questions?

Contact Information

Neil Gibbs

Maintenance Coordinator

Neil.Gibbs@InterPipeline.com

(403) 620-4713

Rick Marshall

Principal Reliability Engineer

RMarshall@GenesisSolutions.com

(805) 320-9551

InterPipeline.com - GenesisSolutions.com