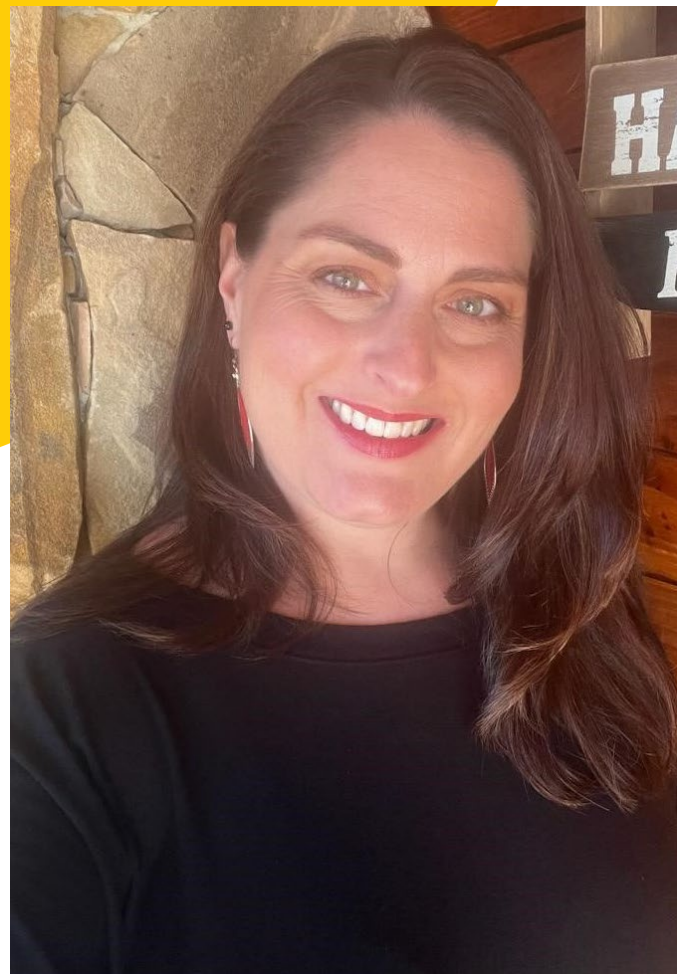
U.S. DEPARTMENT of ENERGY | Federal Energy Management Program

Operational Excellence:
O&M Beyond the Basics

T03-S01, August 5th, 2025

FEMP Summer CAMP (Courses Aligned with Mission Priorities)



Cassandra Johnson

Federal Energy Advisory Practice Lead

Jacobs

Agenda

- Session Learning Objectives
- Alternative O&M Strategies
- Reliability Centered Maintenance
- Conclusion and Q&A

Session Learning Outcomes

1. Identify potential O&M opportunities, including best practices and innovative approaches, that can be implemented in facilities.
2. Recognize condition-based (or predictive) maintenance strategies and how they differ from other O&M activities.
3. Identify useful O&M tools that facilities can use to maximize the effectiveness of current resources.
4. Identify the related benefits of O&M to overall life-cycle cost and reliability of assets.

What is Operational Excellence? And How Can We Achieve It?

REACTIVE

Repair it AFTER it breaks

- ☐ High Cost
- ☐ Overtime
- ☐ Unplanned
- ☐ Breakdown
- ☐ Outages

PREVENTATIVE

Repair it BEFORE it breaks

- ☐ Scheduled/Planned
- ☐ Coordinated
- ☐ Moderate Cost
- ☐ Improved Operations

PROACTIVE

Don't repair it! ELIMINATE the cause

- ☐ Predictive
- ☐ Life Extension
- ☐ Defect Elimination
- ☐ Precision
- ☐ Redesign
- ☐ Work Reduction
- ☐ Life Cycle Cost Effective

JoeDon Breda, PE

Managing Research Engineer

Research & Consulting | Advanced Energy

TRC

My Background

20 years in engineering

Design & operations roles:

- 14 years in design & consulting
- 6 years in facilities at OSU Medical Center (2018-2024)
- Joined TRC in 2024

Facilities highlights

Led BAS initiatives implementing:

- High-performance HVAC control sequences
- Controller-embedded AFDD
- New and retrofit applications

Format

Section 1: Traditional O&M

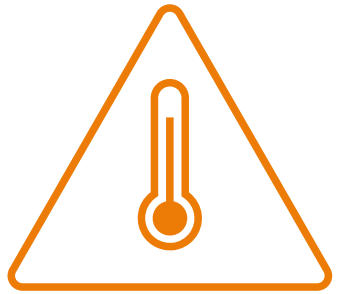
Section 2: Problems with Traditional O&M

Section 3: Alternative Solutions

1: Traditional O&M

Reactive

- Complaints
- Alarms & equipment failures



Outsourced

- Multi-year contracts
- Public bids
- Constrained staff resources

1: Traditional O&M

Documented?

- Computerized Maintenance Management System (CMMS)
- Manually logged on paper

Preventative maintenance?

- Task-oriented
- Scheduled

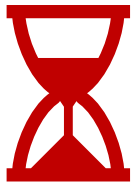
2: Problems with Traditional O&M

Unplanned repairs

- Equipment downtime
- Alarm fatigue from Building Automation System (BAS)

Limited staff resources

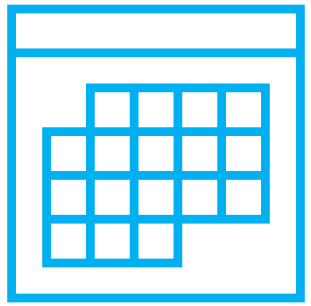
- Staff turnover
- Access to training & guidance
- Field investigation takes time

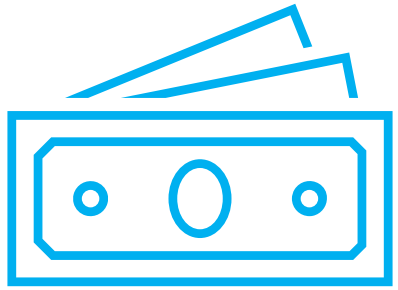


2: Problems with Traditional O&M

Insufficient documentation & preventative maintenance

- CMMS might be siloed
- Capital planning impacts





2: Problems with Traditional O&M

Safety is compromised

- Example: The desuperheater tech was on vacation

2: Problems with Traditional O&M

Efficiency is compromised

- Example of reheat valves not functioning properly
- Example of space heaters

2: Problems with Traditional O&M

Reliability is compromised

- Equipment fails prematurely
- Example of incorrect pump application w/ frequent, undocumented tear-downs

2: Problems with Traditional O&M

3: Alternative Solutions

Leverage Technology

- BAS are becoming increasingly powerful
- Advanced HVAC control strategies
- Automated Fault Detection & Diagnostics (AFDD)

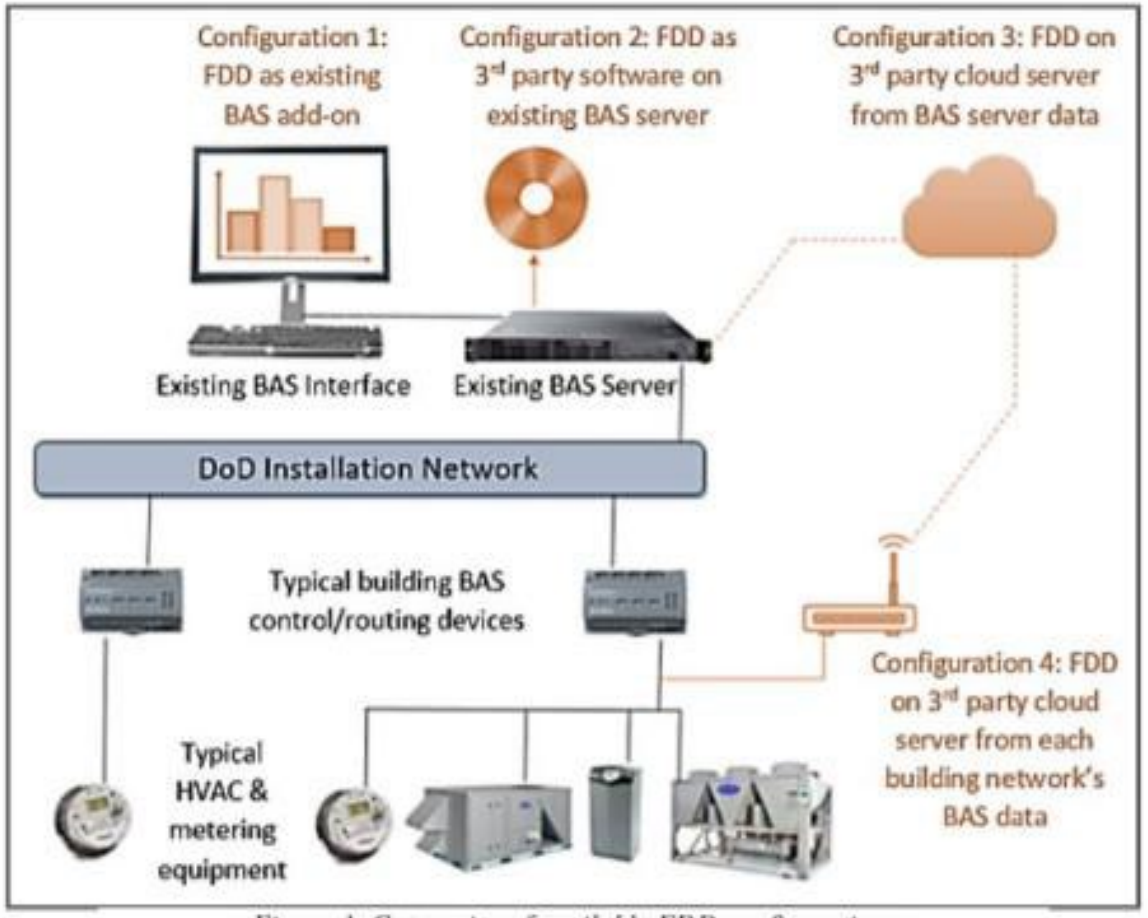


Figure 1. Categories of available FDD configurations

Image source: Brian Clark (Research Engineer at USACE CERL

3: Alternative Solutions

Standardize Rules for Alarming and Monitoring

- What conditions need to be alarmed immediately?
- What conditions can be deferred until demonstrating persistence?

3: Alternative Solutions

Alarm Log				
Date/Time	**Monitored Object**	**Clg Setpoint**	**High Limit**	**Present Value**
08/05 @ 6:01 am	Building 1 – 1st Floor – VAV-1 High Temp Alarm	74 °F	77 °F	77 °F
08/05 @ 6:01 am	Building 1 – 1st Floor – VAV-2 High Temp Alarm	73 °F	76 °F	77 °F
08/05 @ 6:02 am	Building 1 – 1st Floor – VAV-3 High Temp Alarm	74 °F	77 °F	78 °F
08/05 @ 6:02 am	Building 1 – 1st Floor – VAV-4 High Temp Alarm	75 °F	78 °F	78 °F
08/05 @ 6:02 am	Building 1 – 1st Floor – VAV-5 High Temp Alarm	73 °F	76 °F	77 °F
08/05 @ 6:02 am	Building 1 – 1st Floor – VAV-6 High Temp Alarm	74 °F	77 °F	78 °F
08/05 @ 6:02 am	Building 1 – 1st Floor – VAV-7 High Temp Alarm	75 °F	78 °F	79 °F
08/05 @ 6:02 am	Building 1 – 1st Floor – VAV-8 High Temp Alarm	73 °F	76 °F	77 °F
08/05 @ 6:02 am	Building 1 – 1st Floor – VAV-9 High Temp Alarm	73 °F	76 °F	78 °F
08/05 @ 6:02 am	Building 1 – 1st Floor – VAV-10 High Temp Alarm	74 °F	77 °F	77 °F

3: Alternative Solutions

"Cumulative % Hours" = Accumulated Zone Alarm Hours ÷ Run Hours

Alarm Log			
Date/Time	**Monitored Object**	**High Limit**	**Present Value**
08/05 @ 6:01 am	Building 1 – 1st Floor – VAV-1 High Temp Cumulative % Hours	50%	6%
08/05 @ 6:01 am	Building 1 – 1st Floor – VAV-2 High Temp Cumulative % Hours	50%	8%
08/05 @ 6:02 am	Building 1 – 1st Floor – VAV-3 High Temp Cumulative % Hours	50%	17%
08/05 @ 6:02 am	Building 1 – 1st Floor – VAV-4 High Temp Cumulative % Hours	50%	14%
08/05 @ 6:02 am	Building 1 – 1st Floor – VAV-5 High Temp Cumulative % Hours	50%	3%
08/05 @ 6:02 am	Building 1 – 1st Floor – VAV-6 High Temp Cumulative % Hours	50%	9%
08/05 @ 6:02 am	**Building 1 – 1st Floor – VAV-7 High Temp Cumulative % Hours**	**50%**	**80%**
08/05 @ 6:02 am	Building 1 – 1st Floor – VAV-8 High Temp Cumulative % Hours	50%	3%
08/05 @ 6:02 am	Building 1 – 1st Floor – VAV-9 High Temp Cumulative % Hours	50%	8%
08/05 @ 6:02 am	Building 1 – 1st Floor – VAV-10 High Temp Cumulative % Hours	50%	11%

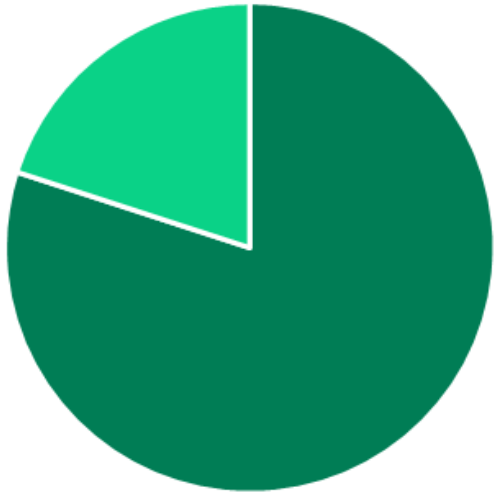
3: Alternative Solutions

Appoint at Least One O&M Champion

- Bridge operations, BAS shop, engineering, leadership
- Close feedback loops – clearly demonstrate challenges to leadership, make sure designer knows what didn't work
- Engage key stakeholders
- Hold contractors accountable
- Leverage data – track repeat problems

3: Alternative Solutions

The 80/20 Rule



- Make decisions – seek to move in the right direction
- Celebrate the wins
- Share the lessons

The “optimum” solution or strategy will always be a moving target, and that’s ok.

Rob Bucey

Director of Operations - Federal Advisory Solutions Practice

Jacobs

Reliability Centered and Condition Based Maintenance

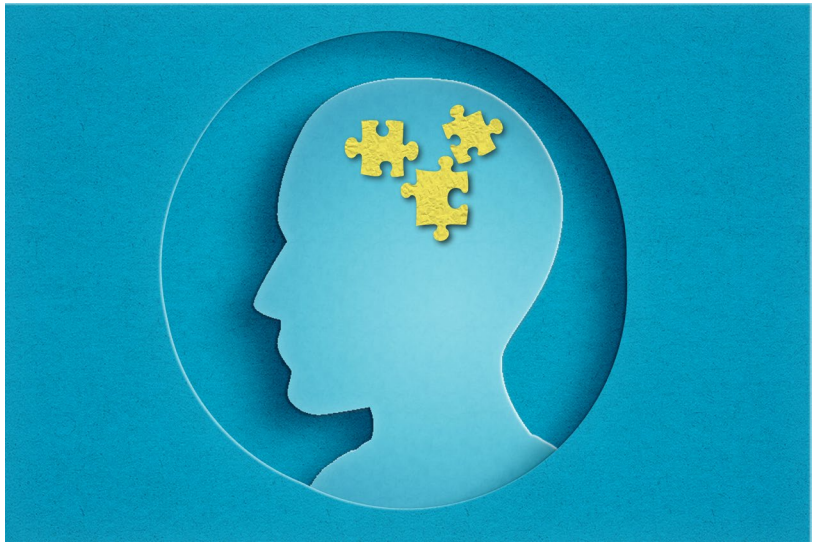
Logical, structured framework to sustain operational reliability

- ✓ Preserve system function
- ✓ Identify failure modes that can defeat the functions
- ✓ Prioritize function need (via failure modes)
- ✓ Select applicable and effective prioritized Preventive Maintenance (PM) tasks

Experience-centered approach utilized to deliver high value program that is practical to implement

Reliability Centered and Condition Based Maintenance

Summarized in 7 simple questions:



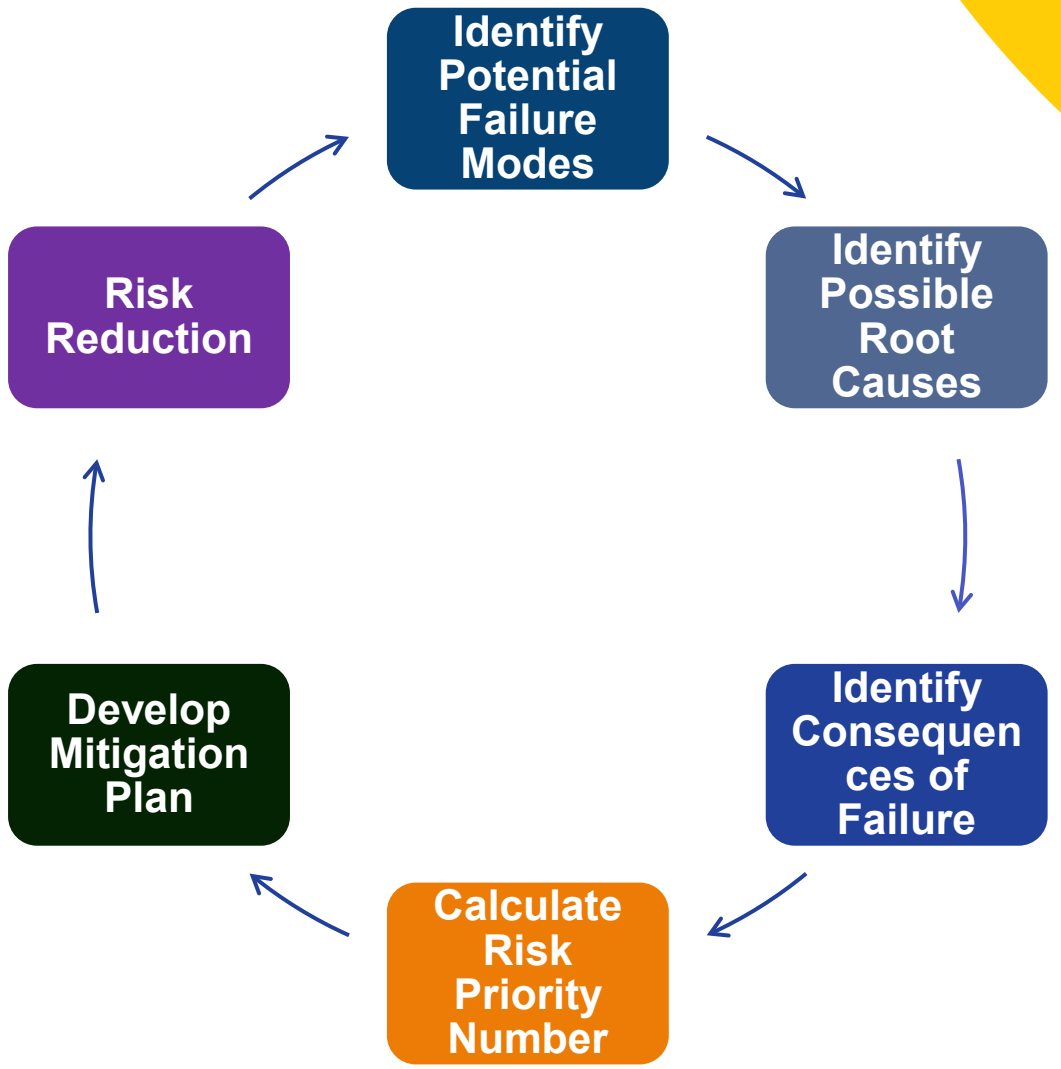
1. What are the functions of the asset?
2. In what ways can the asset fail to fulfill its functions?
3. What causes each functional failure?
4. What happens when each failure occurs?
5. What are the consequences of each failure?
6. What should be done to prevent or predict the failure?
7. What should be done if a suitable proactive task cannot be found?

Have you seen this before?



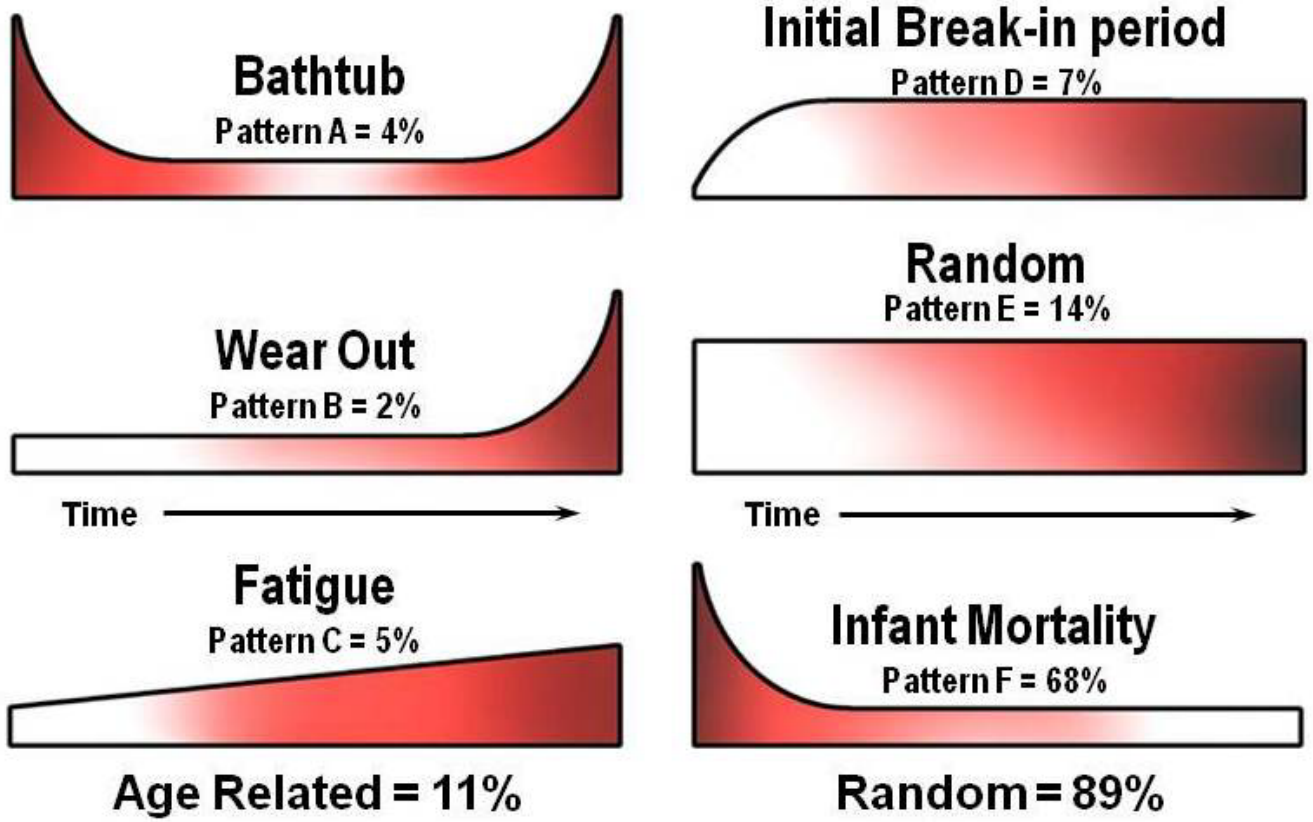

Managing Risk

- Assess Risk
- Clearly define mission requirements
- Identify failure modes
- O&M steps to address failure modes



Mitigating Risk Through Project Delivery

- ✓ Precision installation
- ✓ Maintainability
- ✓ Training
- ✓ Commissioning
- ✓ Turnover process



How do we get there?

Operations

- Define and implement maintenance strategy
- OEM vs. what meets your needs
- Run to fail
- Predictive techniques
- Root cause analysis
- Apply lessons learned over the lifecycle

SURVEY the situation.

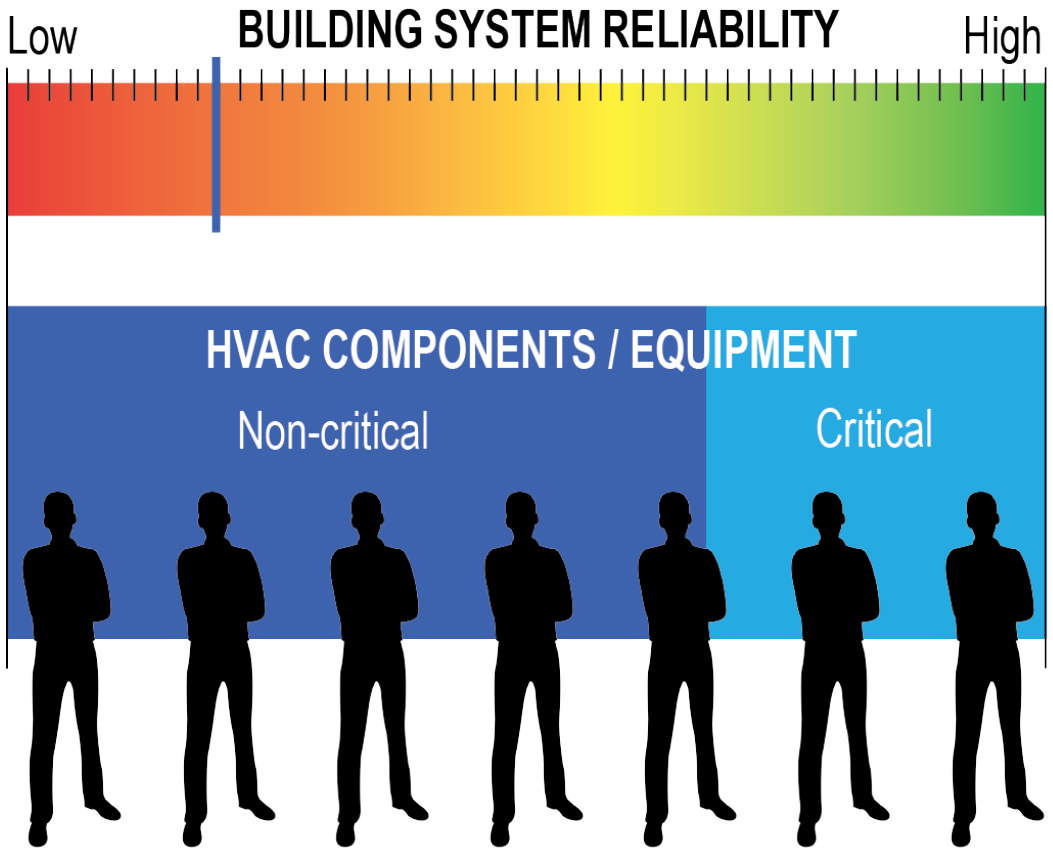
TAKE control, TALK to everyone that can help you understand the system and the problem and take accurate notes.

ORGANIZE your information and action plan.

PROCEED within approved procedures and processes.

Case Study: Marine Corps Base Hawaii

Pre-Pilot



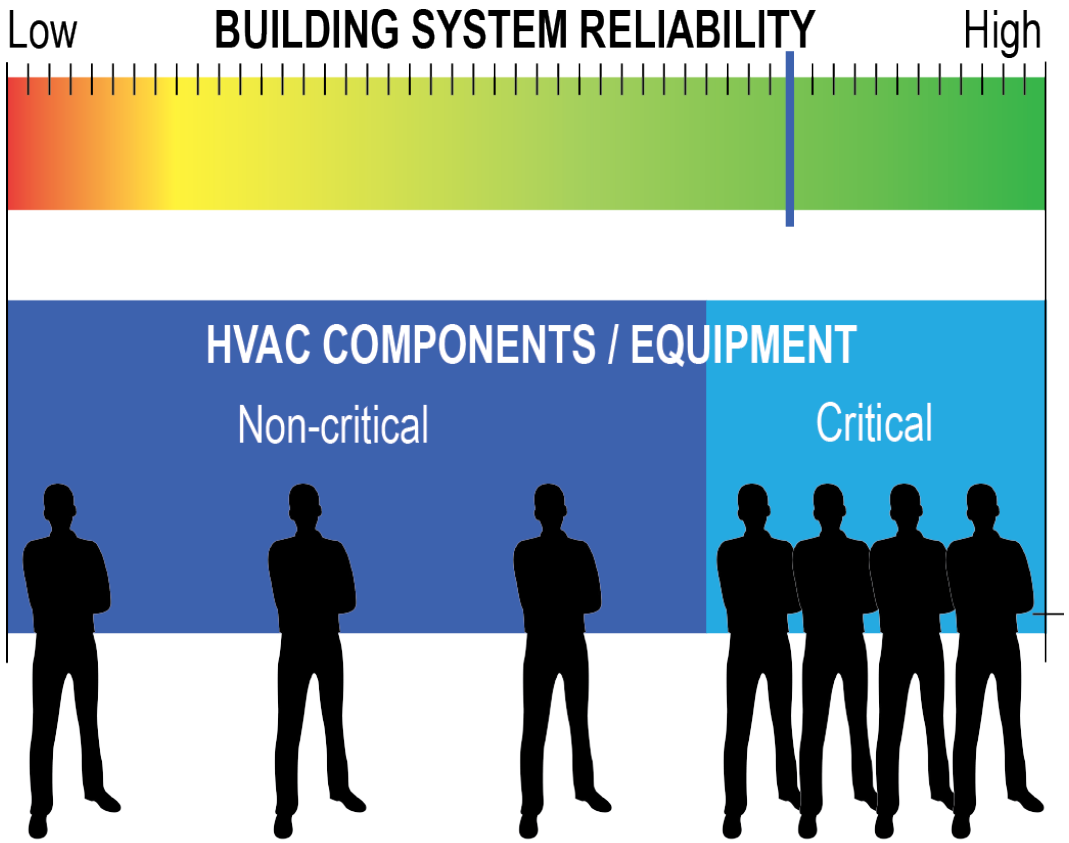
- Recurring building system outages
- Costly, undesirable urgent and emergency repairs
- Assets are treated as collection of equals
- Limited resources

Case Study: Marine Corps Base Hawaii

- Pilot included
  - 21 HVAC buildings
  - 20 critical power buildings
  - Shipyard compressed air plants
  - 1 Lift station
- Apply RCM principles
- Maximize effectiveness of current resources
- Rollout to entire FEC
- Deliver reliability at lowest total ownership cost

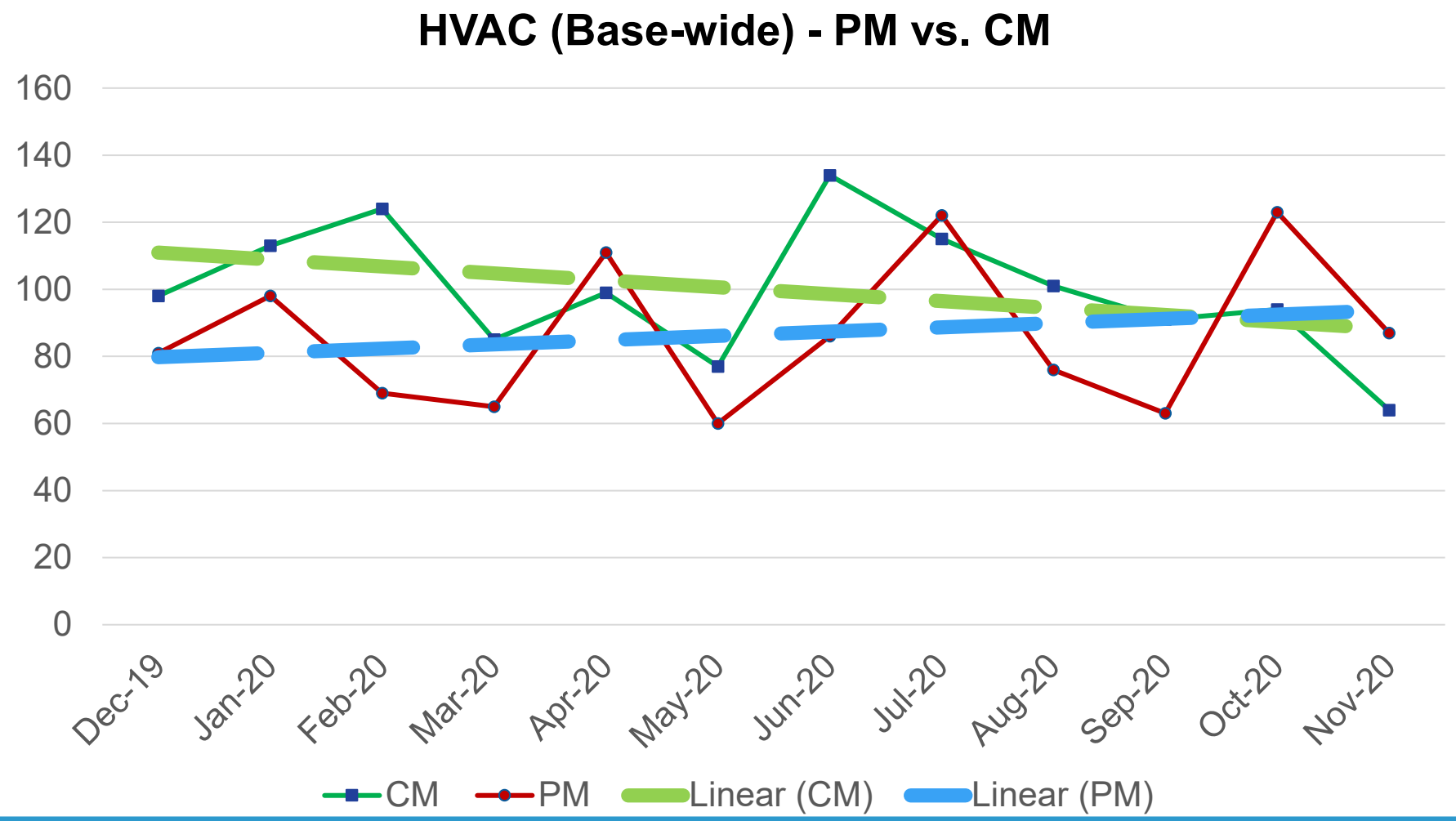
Case Study: Marine Corps Base Hawaii

Post-Pilot



- Analytical framework to support data driven decisions
- Optimized maintenance strategy – asset level
- Operations sequences developed resulting in energy savings
- Design and construction feedback for future improved performance
- Integrated Priority List
- Savings of $9.5M

Case Study: Marine Corps Base Hawaii



When Predictive & Preventive Maintenance activities increase, Corrective Maintenance issues decrease!

Benefits and Desired Outcomes

- Improved ability to meet mission requirements
- Engaged, productive workforce
- Ownership at all levels of organization
- Improved effectiveness and efficiency
- Reduced system/equipment down-time
- Extended Lifecycles
- Reduced Costs
- Inherent reliability in future designs

Questions?

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