Massachusetts Bay Transportation Authority

Bus Maintenance Re-engineering

Cabot, Charlestown, and Everett Updates

December 18, 2017

Overview

- Maintenance Operations Professionalized

- Focus on Team
  - Invest in workforce
  - Provide training
  - Shop equipment
  - Workplace safety

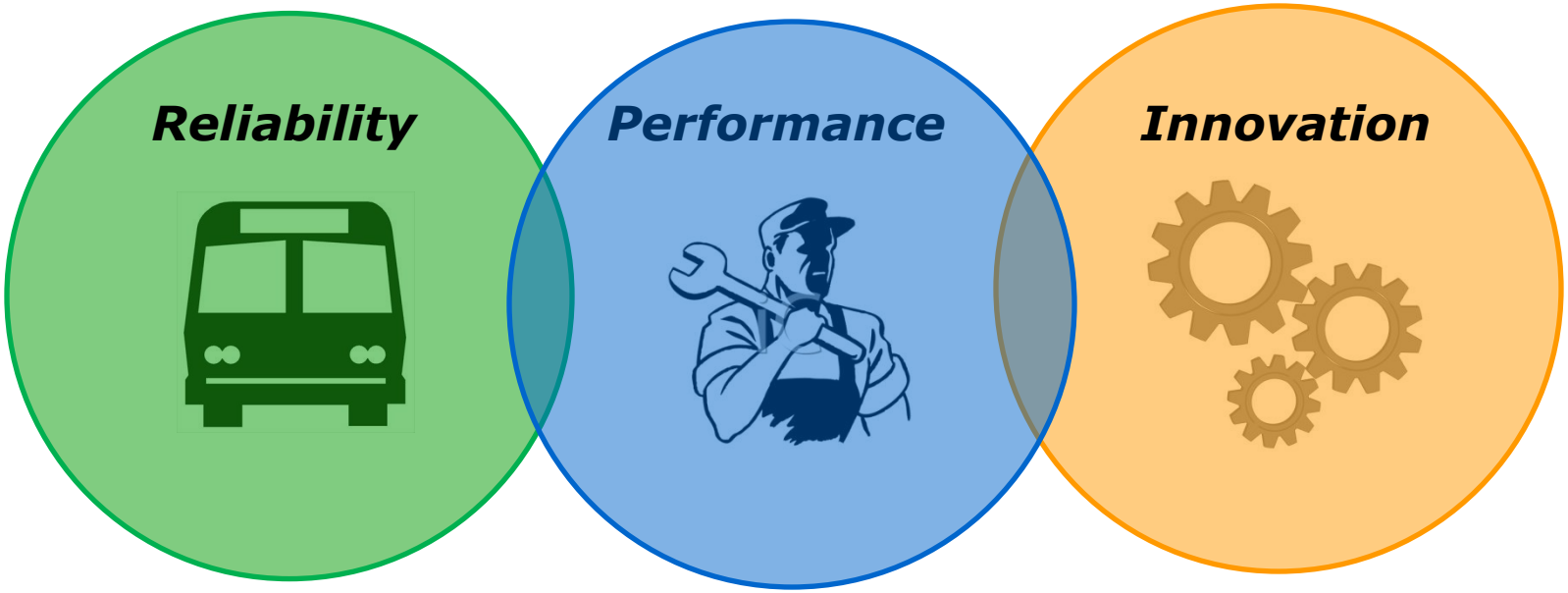
- Cost Effective
  - Ensure accurate inventory control
  - Performance management

- Service Delivery
  - Maintain safe, clean, reliable buses
  - Quality repairs

Today's Presentation

- Bus Maintenance Strategy
- Bus Maintenance Strategic Objectives
- Cabot Progress
- Performance Measures
- Charlestown Pilot
- Everett Lean Maintenance Study Update

Bus Maintenance Strategy

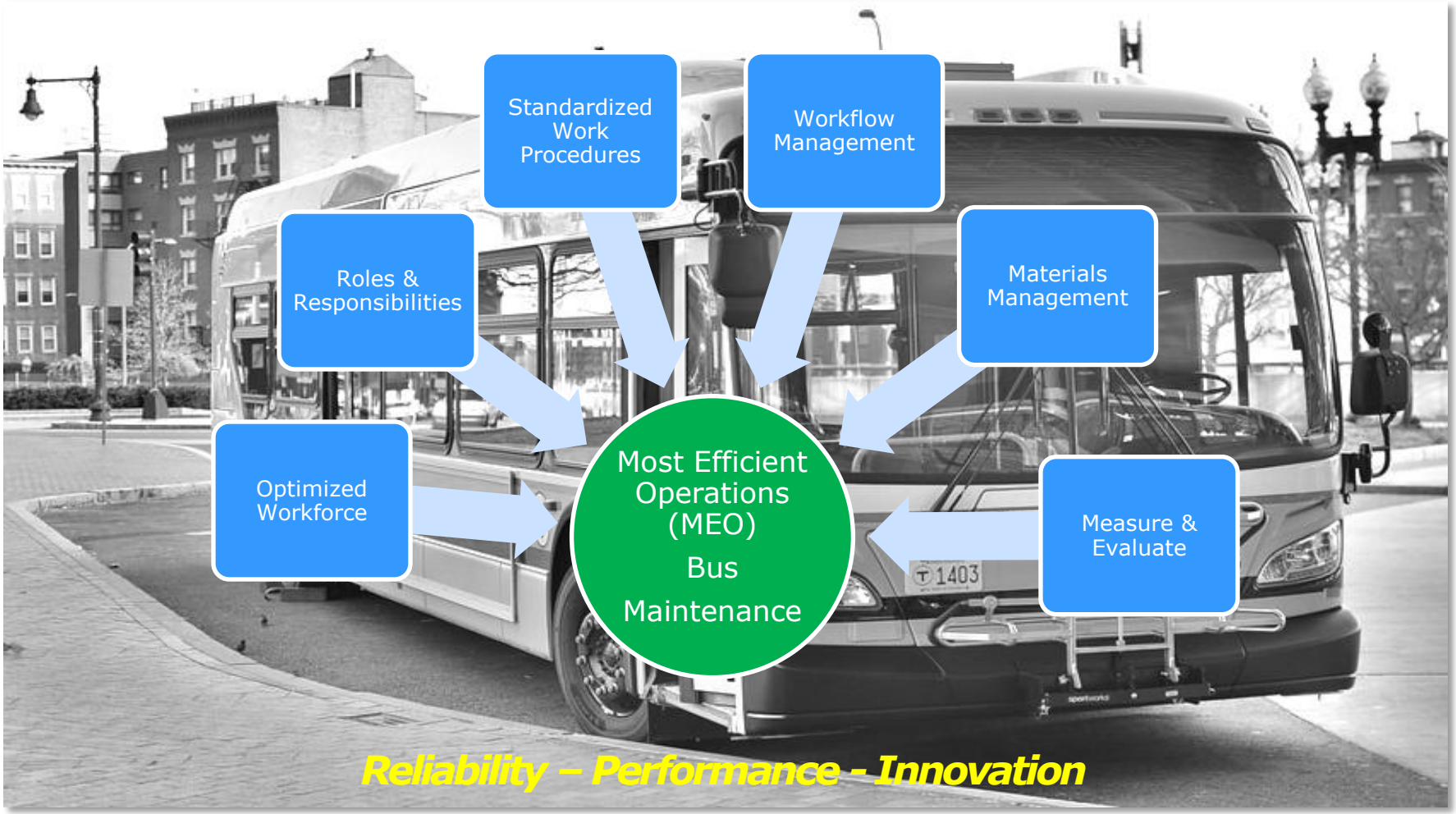


- Back to Basics
- Quality Repairs
- Increased MMBF
- Reduced Downtime

- Optimized Staffing
- Standard Repair Times
- Cost Effective
- Performance Management

- Data Driven
- Optimized CMMS
- RCM Maintenance
- Web Based Tools

Bus Maintenance Strategic Objectives



Cabot Pilot Goals

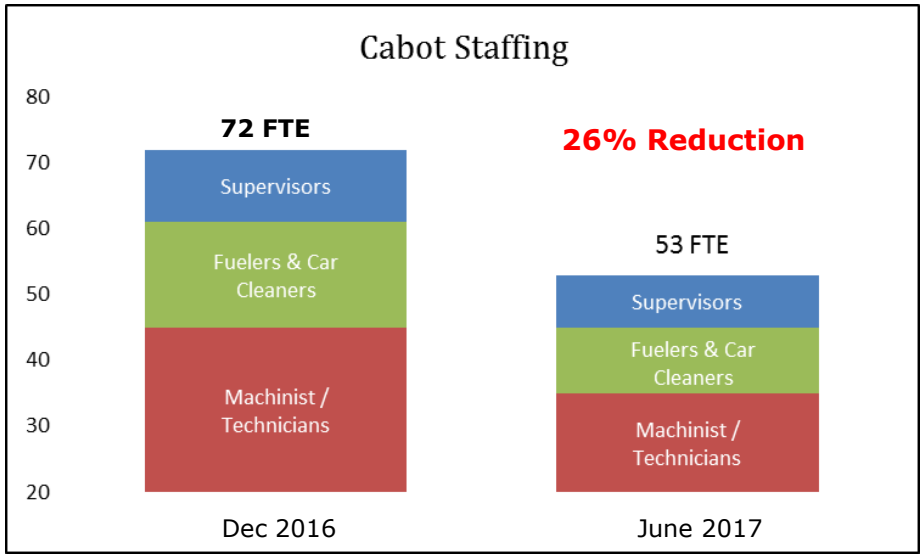
- Optimized Workforce
  - Match staffing to maintenance requirements
- Reduce Cost
  - Target $27 Cost per Revenue Hour (CRH)
  - Reduce Overtime
- Improve Maintenance Operations
  - Implement Standard Repair Times (SRT)
  - Improve Workflow Management
  - Machinists entering work tasks
  - Working Forepersons
  - Improve shop equipment
- Performance Management
- Implement Warranty Program

Cabot Initiatives – Started July 2017

- 204 New Buses in Service
- Warranty Policy & Process
- Overtime Review Committee
- Trainers Deployed to Depot
- Quality Assurance Inspections
  - In-house & 3rd Party
- Standard Repair Times (SRT) for core tasks
- Upgraded Shop Equipment
- UST Replacement
- Performance Work Books
- Optimized Staffing

Cabot Pilot – Key Initiatives

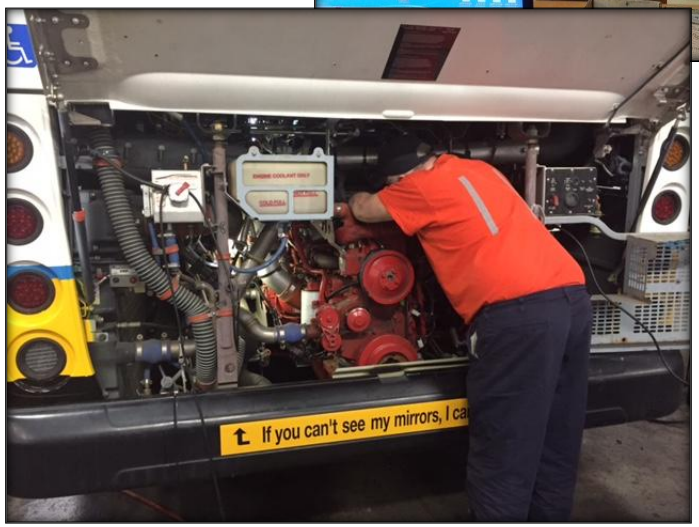
- Optimized Staffing Levels
  - Maintenance Based Staffing Model
  - Defined Roles & Responsibilities



1- Cost figures tabulated from Peoplesoft avg of first quarter FY17 vs FY18.

Cabot Pilot – Key Initiatives

- Technician Training
  - Standard Repair Times
  - Work Order Entry

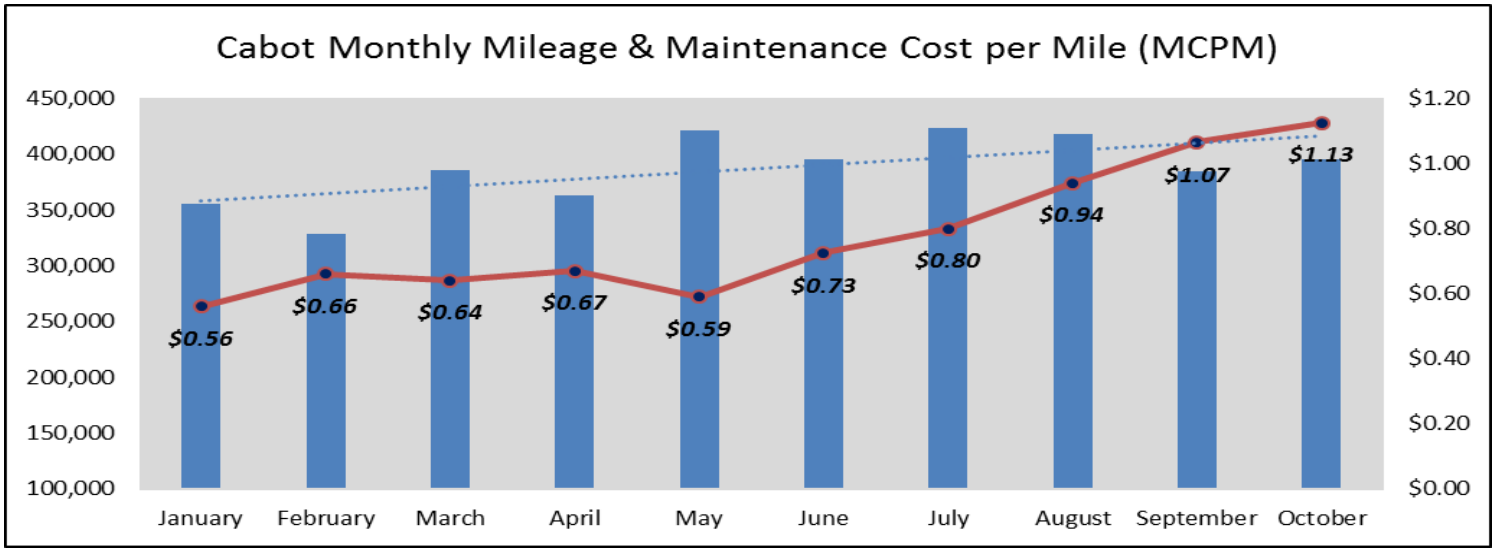


93%

Compliance
Standard Repair Times[1]

1- Data Tabulated from MCRS2 and SRT Core Tasks

Cabot Pilot – Maintenance Costs

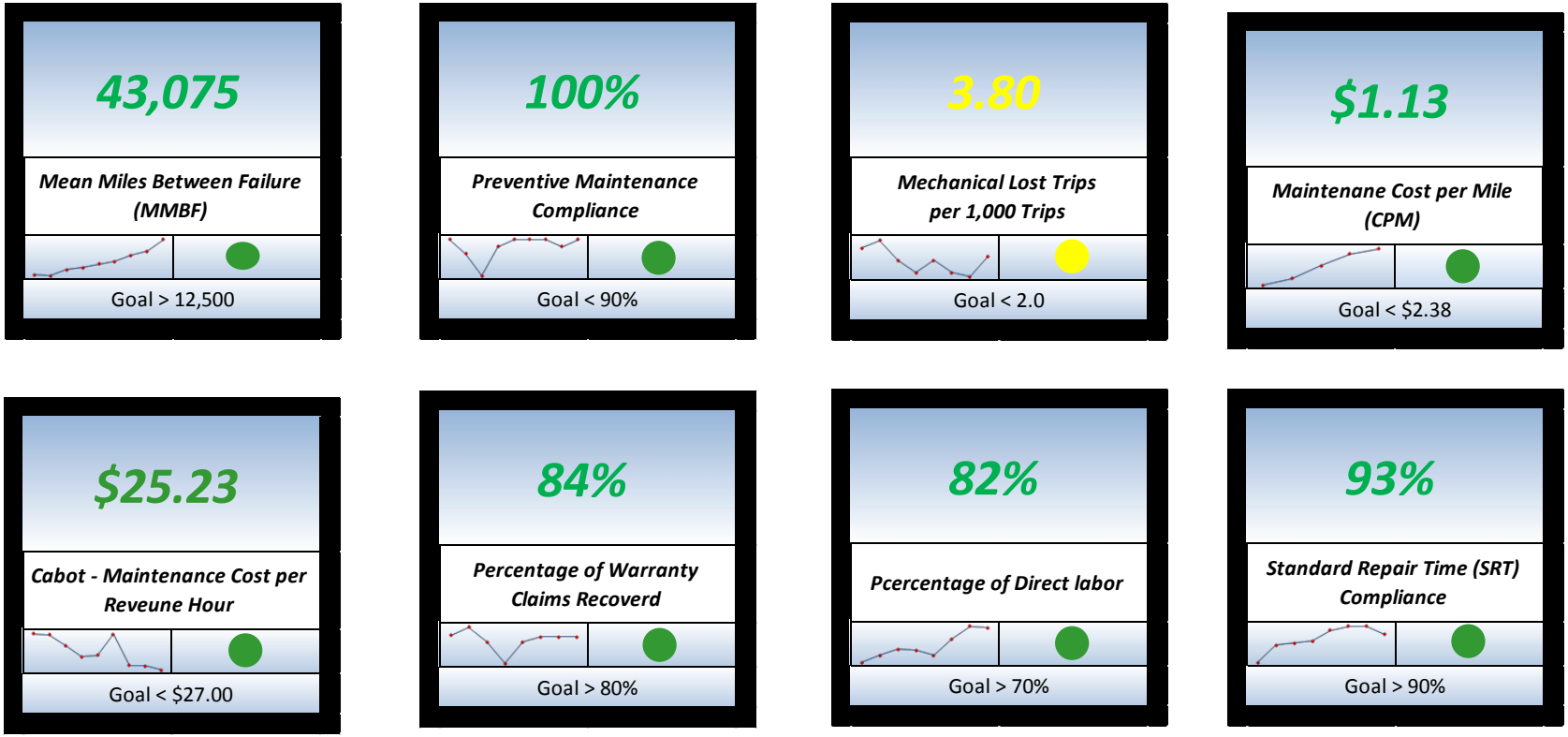


- Bus fleet transitioning from first year full coverage warranty – Oct 2017
- Garage Avg – 410K Miles per Month – 23% increase from FY16
- PM represents 20% of the Cabot Workload – 80% Warranty
- 708 PM Intervals Required Annually –Buses Avg 4 PM Intervals Annually
- PM Intervals Range 6K thru 66K – Buses avg 26K miles annually
- ***Data is critical*** - Failure trend analysis is key to identifying cost

New Executive Dashboard – July 2017

Cabot Bus Maintenance Key Performance Dashboard

October 2017

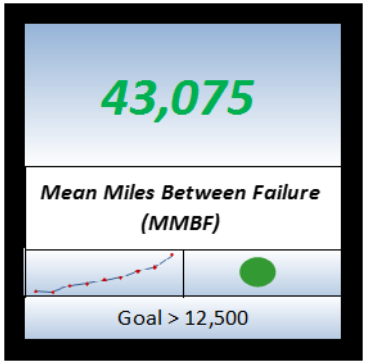


Reliability * Performance * Innovation

Executive Dashboard - New July 2017

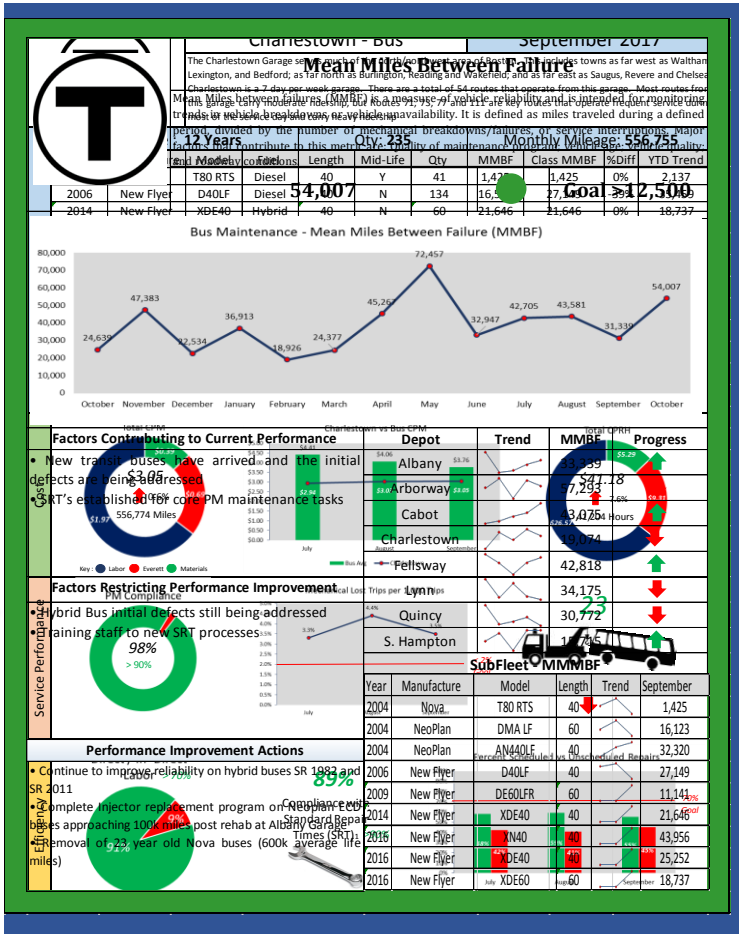
Key Performance Measures

- Reliability
- Cost
- Warranty
- Technician Efficiency
- Quality Repairs



KPI Summary

Performance Factors & Trends



KPI Details

Cabot Pilot Success

$255K

Avg Monthly Savings[3]

- Optimized Staffing
- Reduction of materials
- Warranty Recovery

$25.23

Cost per Revenue Hour

- ***37%*** Reduction in 12 months[1]

59%

Reduction in OT last 6 Months[2]

- Overtime Review Committee
- Workflow Management
- Standard Repair Times

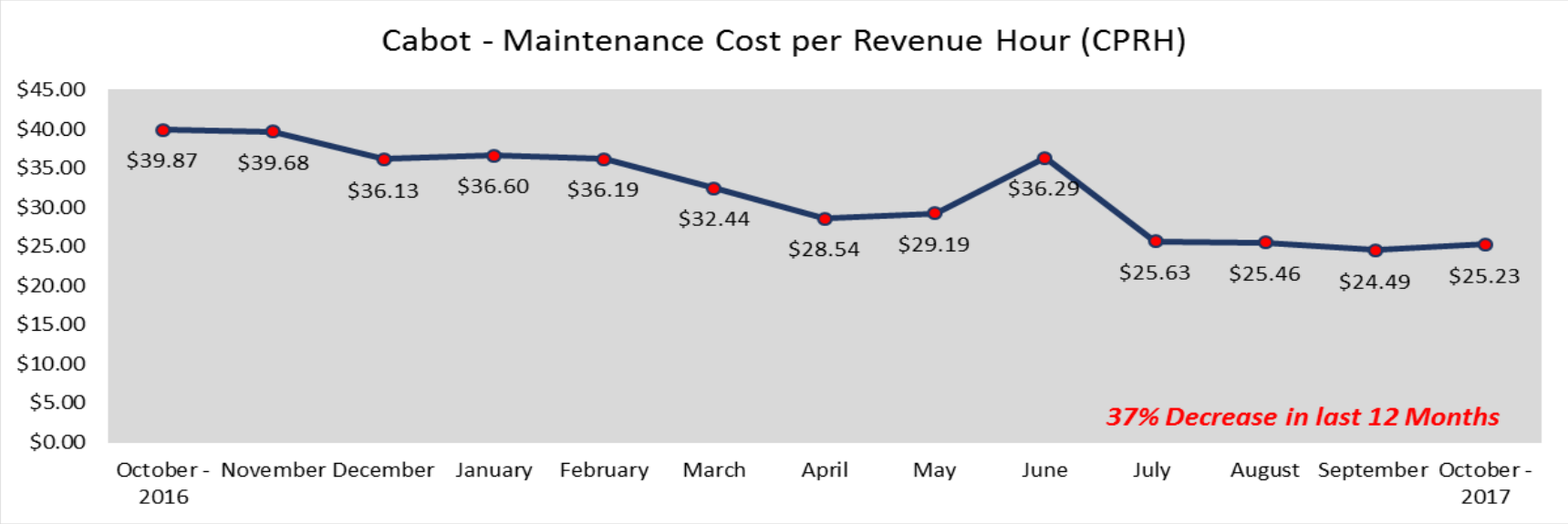
$2.79

Total Cost per Mile (TCPM)

- ***50%*** reduction in 12 months[1]
- 3% Increase in monthly mileage
- 19 additional PM Inspections

1- Cost figures tabulated from October 2017 data from Peoplesoft
2- OT calculated avg October 2017 through May 2018 vs April 2017 through December 2016.
3 -Avg saving calculated from FY17 actuals and projected FY18 run rate

Cabot Pilot Success



- 37% cost decrease in the last 12 months
- Optimized Staffing Levels
- Standard Repair Times (SRT)
- Workflow Management
- Delivery of new buses October 2016 – September 2017
- Outstanding staff engagement and teamwork

1- Cost figures tabulated from October 2017 from Peoplesoft.

Charlestown Pilot

Charlestown Pilot – Started November 2017

Current Fleet – 237 Buses (Avg Age 11.3 Yrs)

134 – 2006 New Flyer 40 ft Diesel

60 – 2016 New Flyer XDE 40 ft Diesel Hybrids

41 – 1995 Nova RTS 40 ft Diesel

1 – 2015 El Dorado 40 ft Fuel Cell

$41.46

Cost per Revenue Hour[1]

$3.02

Total Cost per Mile (TCPM)[1]

Mileage and Maintenance

583K Miles per Month

7.05M Miles Annually – 26% of MBTA Mileage

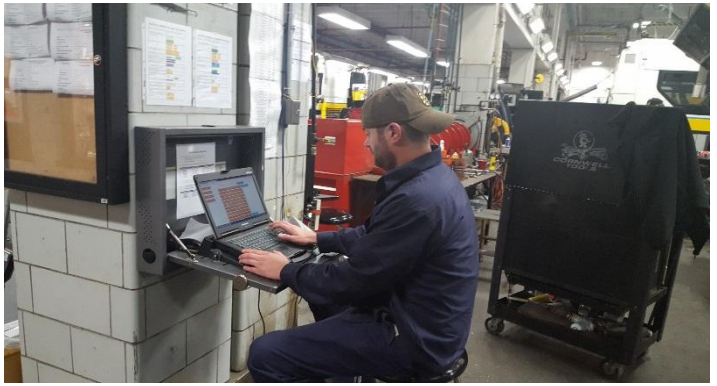
30K Miles per Bus Annually – Highest in MBTA System

1.2K PM Intervals Annually

1- FY18 avg Cost figures tabulated from Peoplesoft and are not finalized. Cost include Everett Allocation

Charlestown Pilot Program Initiatives

- Optimize Staffing –
  - Maintenance Based Staffing Model
  - 14% reduction (81 to 71 FTE)
- Remove Nova Buses From Service
  - Scrap contract awarded
  - Completed by December 31st
- Implement Standard Repair Times (SRT)
  - Mechanic Kiosk
  - Machinist data entry
- Torque Tire Indicator Program
  - 2 pilots underway
  - Fully in place January 1st



Machinist work order entry

Torque Indicators

Charlestown Pilot Program Initiatives

Key Maintenance Programs & Goals

- New Flyer retarder software update
  - 40% reduction in brake & axle work
- New Flyer Battery Management System
  - 25% reduction in road calls
  - 15% reduction in battery costs
- Hybrid Training for Machinists
  - Improved diagnostics & troubleshooting

Shop Safety Assessment

- 4 Corrective Actions
  - 2 open, 2 closed
- 16 Safety Recommendations

Machinist completing brake job

Charlestown Wrecker

Charlestown – Challenges

Fluid Dispensing System

Oil Storage Tanks

- Shop Fluid Dispensing Systems Broken and Inoperative
- Fuel Alley Fluid Dispensing Systems inoperative
- Oil Storage Tank Pump Inoperative
- Chassis Wash lift Broken
- Bus Lifts Broken
- House Keeping

Chassis Wash lift

Charlestown Pilot Goals

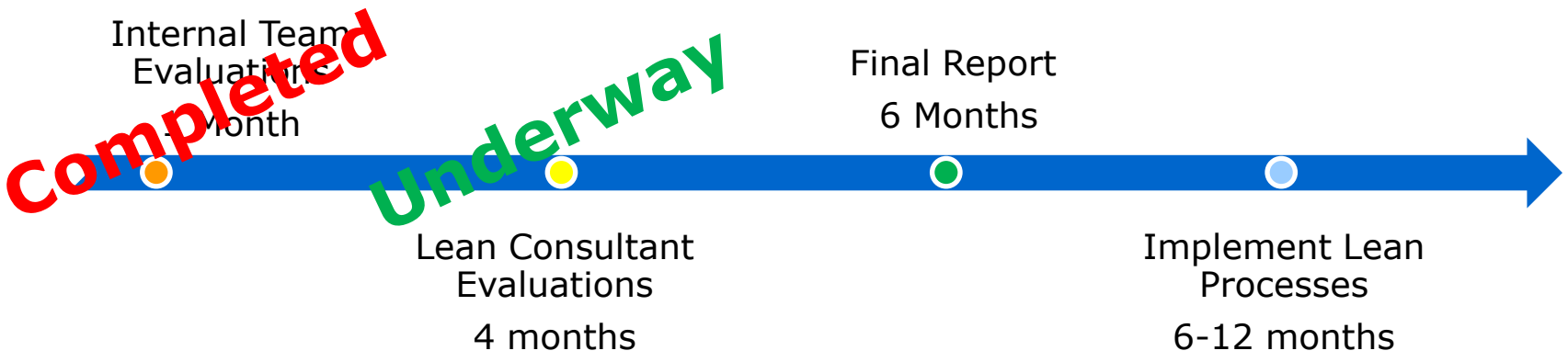
- Implement Bus Maintenance strategic objectives
  - Optimize staffing
  - Workflow management
- Implement Standard Repair Times (SRT)
- Implement key maintenance programs
- Remove Nova buses from service
- Invest in the workforce
- Upgrade maintenance equipment
- Reduce cost
  - $35 Cost per Revenue Hour

Everett Lean Maintenance Study

Everett – Lean Maintenance Study

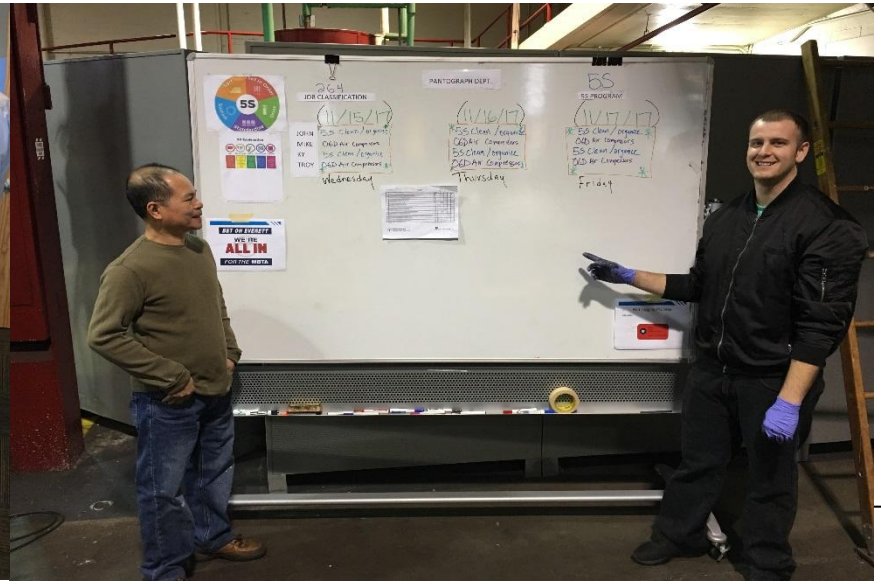
Hamilton Cornell Associates & CH2M Hill

- Industrial Engineering review of component manufacturing / rebuild Process
- Activity based cost review and analysis
- Cost Benefits and business Modeling
- Component technology Integration
- **Task Underway – 9/11/2017**



Everett Shops Lean Maintenance Initiative

- 5S process implemented - Lean council established
- Full labor and staffing utilization review
- Workflow analysis completed – Foreperson training & certification
- Review of component manufacturing process, demand, efficiencies
- Key Performance indicators created and measured



5 Lean Transformation Objectives

1. Engage Workforce
2. Workplace Organization
3. Workflow Simplification
4. Manage Schedule and Reliability
5. Improve Productivity

Employee Engagement

- 5s organized in every department – communicated throughout facility -- all departments involved
- Cross-functional 'Lean Council' consists of members of 7 bargaining units (717, Alliance, 589, Local 35, Local 17, 264, and 453)
- Working cooperatively on initiatives: **"The Lean Council is working to make the Everett Shops a leading example of teamwork, efficiency, and responsiveness for the MBTA."**
- Facility wide lunch and learn sessions: Lean management overview

Strengthening Frontline Management Skills

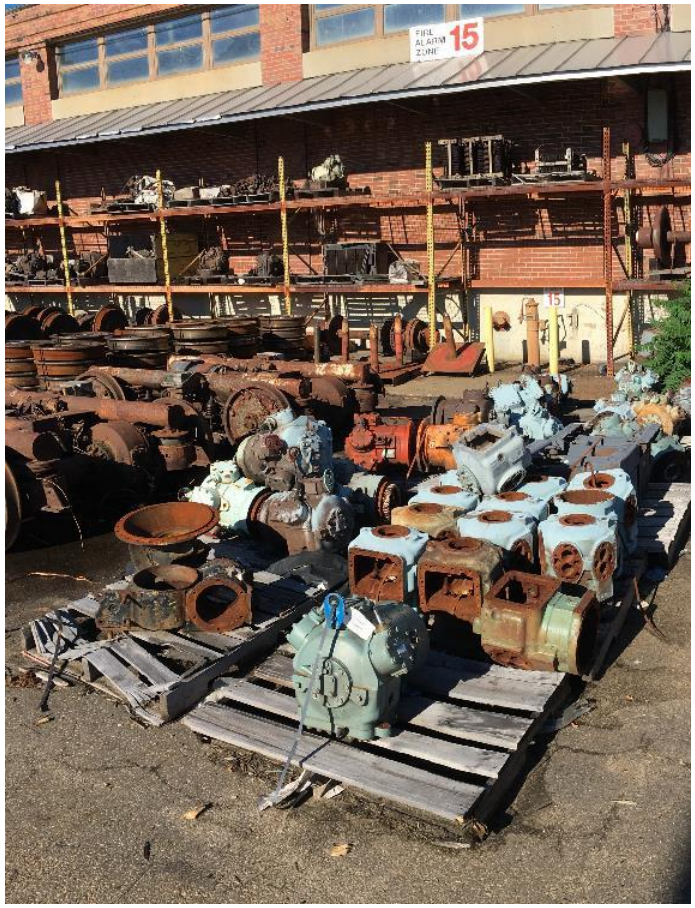
- Certification program for MCRS2
- Building a culture of data fluency & accountability
- Foreperson and Supervisors actively involved in and responsible for 5s objectives

Workplace Organization and 5S

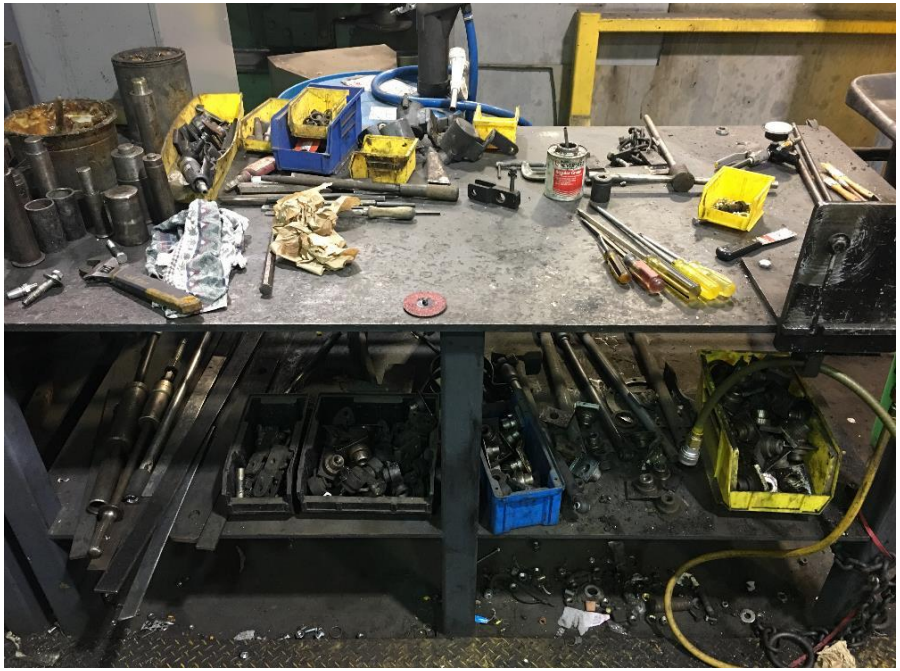
- 20 Zones for improvement covering all outside and inside areas at Everett. Notable improvements
- Internal peer reviews on 5s and Safety factors
- 220 Tons of obsolete and unnecessary material removed from property
- Bus and Subway enhancements in component exchange for improved inventory accuracy
- Striping and safety zones established
- Pilot Vendor Managed Inventory (VMI) for hardware and better point of use storage

Blowout Room Storage – Before & After

Gear Set Storage – Before & After



Pantograph – Before & After



Key Takeaways

- Optimized Staffing Levels
- Standard Repair Times (SRT)
- Workflow Management
- Performance Management
  - Building a data fluent culture
  - Trend analysis
  - Accountability
- 5 S Process
- Outstanding staff engagement and teamwork