



“DFTPM: Design for Total Productive Maintenance”

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The Genesis of This Topic

- ✦ Sustainable E2E Engineering Design
- ✦ Jeep Cherokee bulb replacement



Words of Wisdom

*“You can not inspect quality into
a product.”*

Harold S. Dodge

Agenda

- ✱ The Evolution of Maintenance
- ✱ Design Considerations
- ✱ Case Study – Health Care
- ✱ Summary and Q&A

Breakdown Maintenance

- ✱ An antiquated approach that neglects to perform maintenance activities until the equipment fails
- ✱ Ex: engine throws a rod
- ✱ Unplanned downtime costs more than planned downtime
- ✱ Degradation in product before failure

Scheduled Maintenance

- ✦ A pre-set schedule of maintenance activities, perhaps based on MTBF
- ✦ Ex: LOF service every 3 months
- ✦ Neglects to consider usage

Predictive Maintenance

- ✱ Planning maintenance activities based on usage
- ✱ Ex: LOF every 5,000 miles
- ✱ Neglects to consider conditions

Preventive Maintenance

- ✦ Considers both usage and conditions
- ✦ Ex: LOF service based on driving conditions, season of year, city v. highway driving, etc.

Total Productive Maintenance

- ✦ Continuous monitoring based on a multitude of factors
 - ✦ Usage
 - ✦ Equipment
 - ✦ Environment
 - ✦ Sensors
 - ✦ Operator
- ✦ Ex: sensing of viscosity breakdown

Maintenance-free Products

- ✦ Robust design negates the need for maintenance activities
- ✦ Ex: porous media air bearings
- ✦ Ex: sealed batteries
- ✦ Ex: frost-free freezer units
- ✦ Ex: electronic fuel injection
- ✦ Ex: ignition coil packs

Potential conflict w/new product sales

- ★ GE/Sylvania, others – forced obsolescence of light bulbs
- ★ “The Man in the White Suit”



Words of Wisdom

“There are no solutions. There are only tradeoffs.”

Dr. Thomas Sowell

Design Considerations

- ✦ Ergonomics
- ✦ Spare parts availability
- ✦ Skills required
- ✦ Tools required
- ✦ MTTR
- ✦ Instructions

Operator Responsibility

- ✦ Highly skilled in operation & service
- ✦ Continuous monitoring
- ✦ Workstation housekeeping (5S)
- ✦ CI actions (kaizen blitz)

Health Care Example

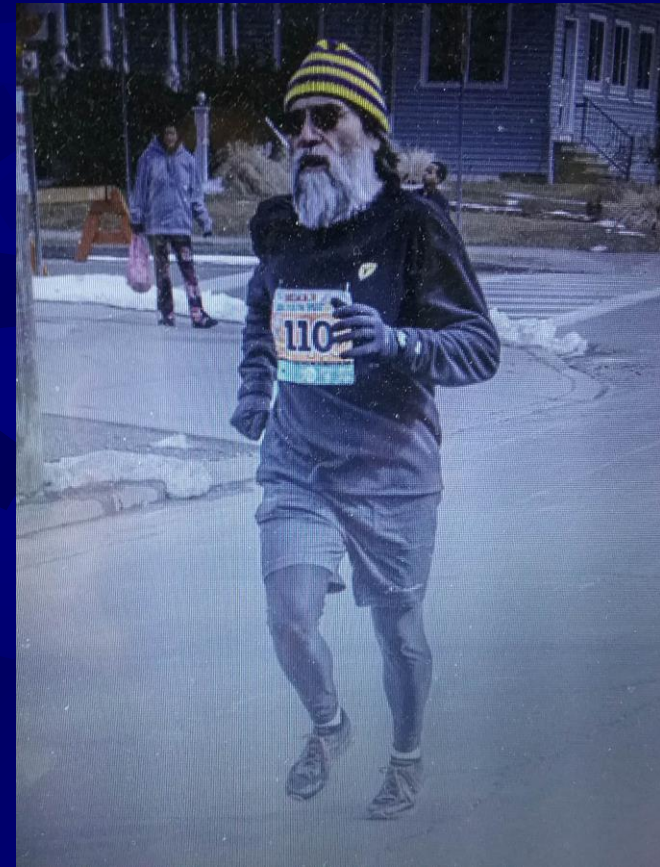
✦ The overwhelming majority of health care cost in the USA are driven by individual lifestyle choices:

- ✦ Diet
- ✦ Exercise
- ✦ Stress management

✦ Mainly breakdown maintenance

Design of the Human Body

- ✦ A machine that repairs itself
- ✦ Adding stress makes it stronger
- ✦ Adapts to environmental conditions



Design of Natural Food

- ☀ RM preferred to FG
- ☀ Nuts, grains, produce (colors!)
- ☀ Java man didn't eat McD's



Summary

- ✦ The Evolution of Maintenance
- ✦ Design Considerations
- ✦ Case Study – Health Care
- ✦ Questions or comments?

Any Comments/Questions?

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Training that is “edu-taining”!