Best practices on Predictive Maintenance (PdM)

Fleet Management Optimization Strategies - OPex

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Talking Points

- Lets Optimize – cost + efficiency + quality
- One size does not fit all – Generalize and Personalize
- Technology is an enabler – Lets use it – never a better time
- Lets not re-invent the wheel – learn from other industries – integration is the key
- Embed Accountability to solution provider

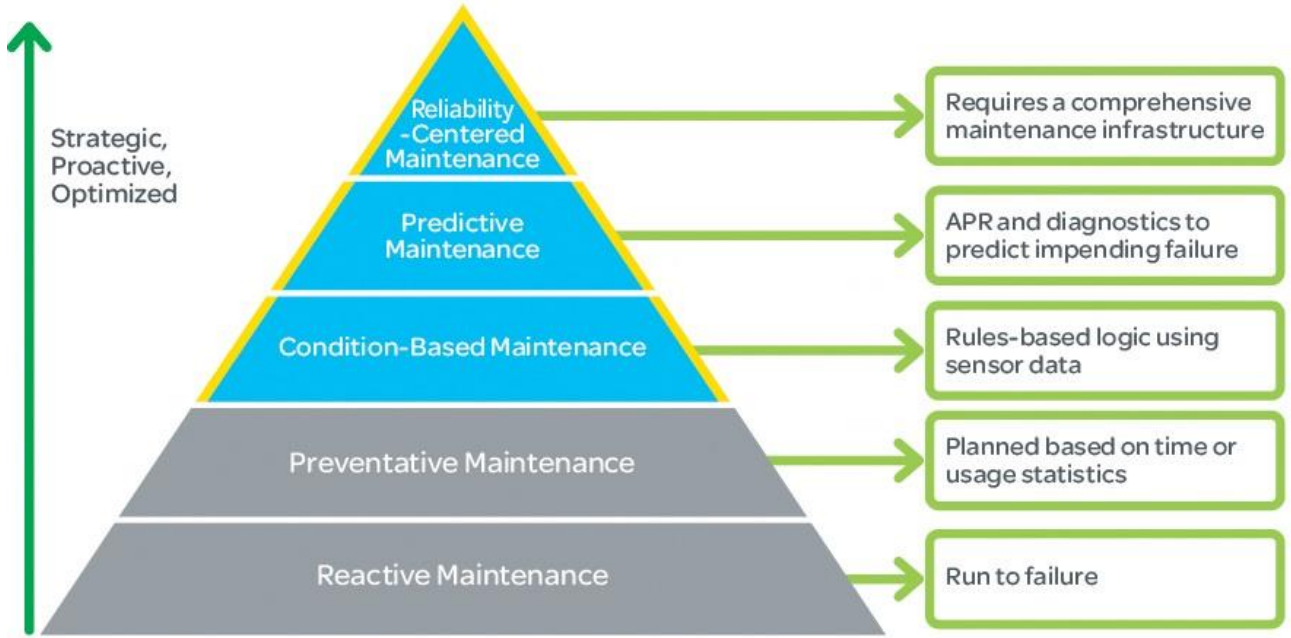
Background - OPex

Maintenance & Spares is OPex – Budgeted ($150k +- annual – accrued monthly : varies / ~ 12-15%)

- Spare parts
- Repairs (shore labor or riding teams)
- Survey and classification fees
- Dry-dockings

How do you currently manage?
Digital solutions? CMMS (computerized maintenance management system)
Ship – Shore management controls?

Background - Maintenance



	Benefits	Challenges
Reactive	• Maximum utilization and production value from asset	• Unplanned downtime • Potential for further damage to the asset • Higher maintenance costs
Preventive	• Lower maintenance costs • Less equipment malfunction and unplanned downtime	• Need for spare part and inventory management • Increased planned downtime • Maintenance on seemingly perfect assets
Predictive	• Connected technologies provide a holistic view of asset health • Improved analytics options • Removes the necessity to run-to-failure or replace a part while it still has life	• Increased upfront infrastructure setup (sensors, systems, etc) • Complex system implementation requirements including data management, technology and user adoption.

Best Practices – Predictive Maintenance

#1: IDENTIFY KEY MACHINES - critical machinery and equipment with the most significant losses

#2: GATHER DATA
- Maintenance records and machine histories
- Procurement
- Benchmark
- Machine Sensor Data

#3: ANALYZE, CORRELATE - MACHINE PERFORMANCE
- uptime, performance, output quality.
- key parts and components
- correlate machine data to other business information (Shipment delays/Parts quality)

#4: ACT ON EVIDENCE AND RECORD THE OUTCOME
Document for ROI on key metrics - downtime, failure rates, costs

#5: EXTEND & REFINE
Connect another machine or a group of machines

Recommendations Challenges & Opportunities

- Develop a Maintenance Strategy – Balanced (what is yours?)
  75%-85% PM vs. 15%-25% RTF maintenance
  75%-85% PM vs. 5%-10% PdM vs. 10%-15% RTF maintenance
- Maintain Metrics
  Mean time to repair (MTTR)
  overall equipment effectiveness (OEE)
- Find the Right Technology Partner (Tools + Process + Knowledge)
  Adopt a digital program that has inbuild quality checks – Data Quality Matters and related to skills and training.
- Where and how to deploy? Full Cycle?
- Link to the OPex Optimization and include incentives
- Revenue Opportunities?