

Condition Based Maintenance(CBM) and its Significance

Md Ali Gauhar Shahriar

MEO Class One, MBA

Senior Fleet Superintendent

MSI Ship Management Pte. Ltd.

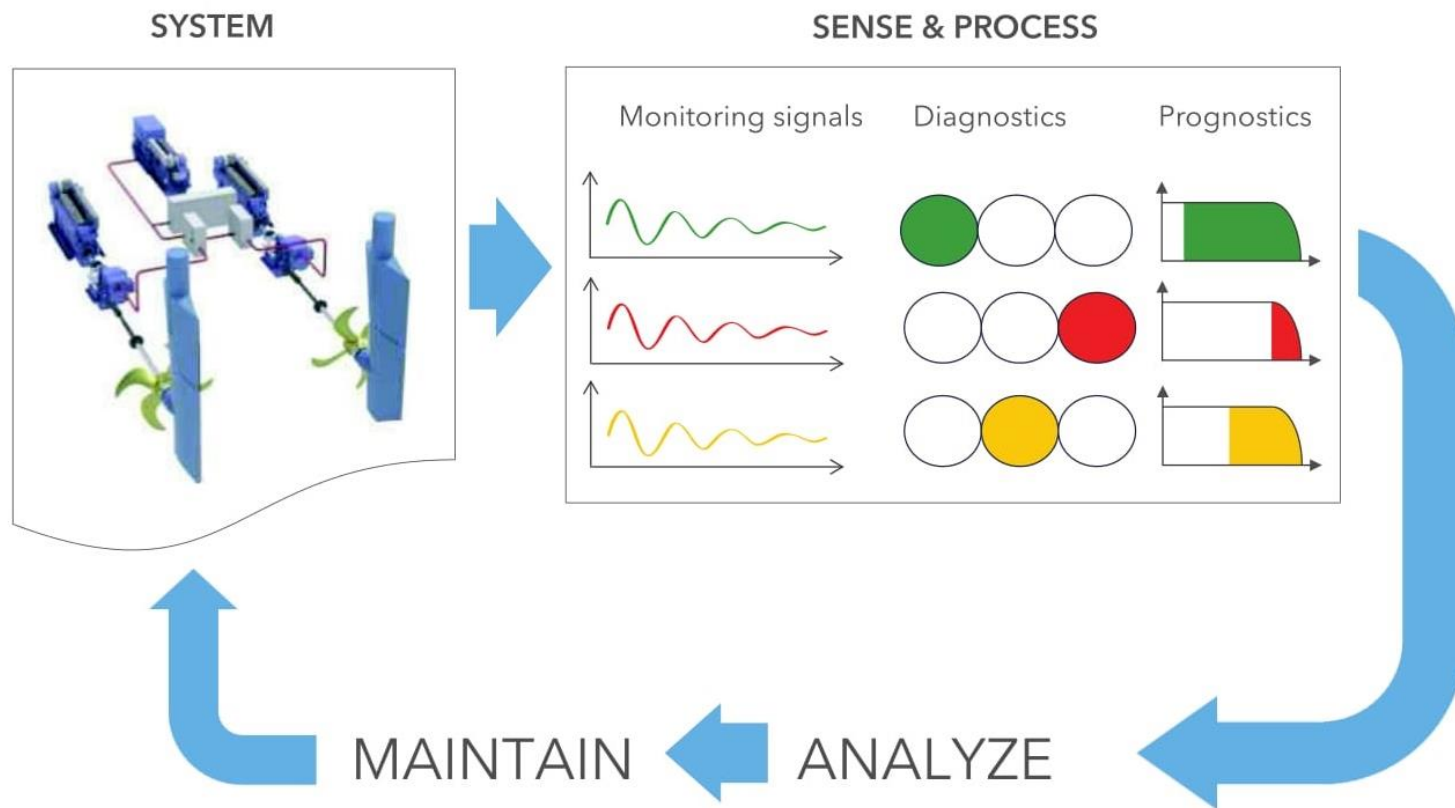
What will I be talking about?

- What is CBM?
- Why CBM at this point of time?
- Why it is not yet popular in Shipping?
- What are the challenges?

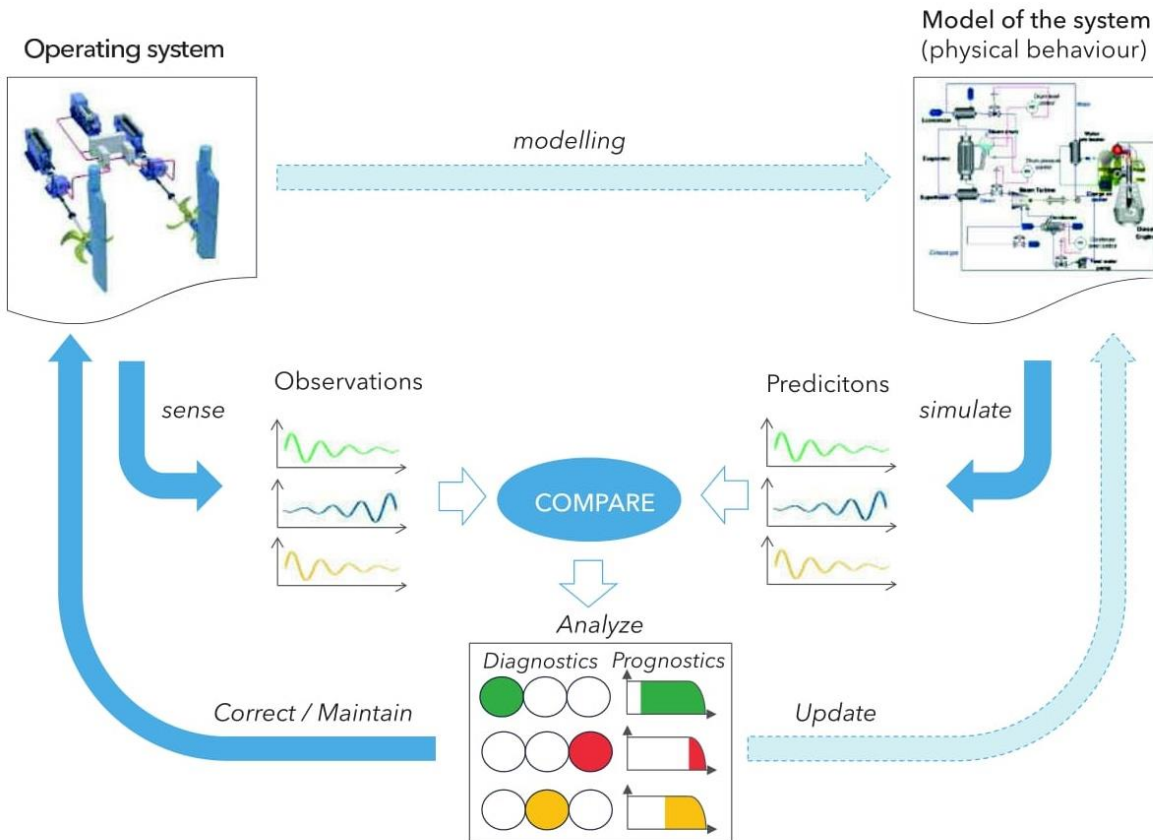
Types of Maintenance

- Breakdown maintenance (Run to Failure)
- Continuous Survey of Machinery
- Planned Maintenance System (Preventive)
- Approved Machinery Planned Maintenance
- Condition Monitoring (Predictive)
- Condition Based Maintenance (Predictive):
Monitoring, forecasting, diagnosis, prognosis (RUL), decision making

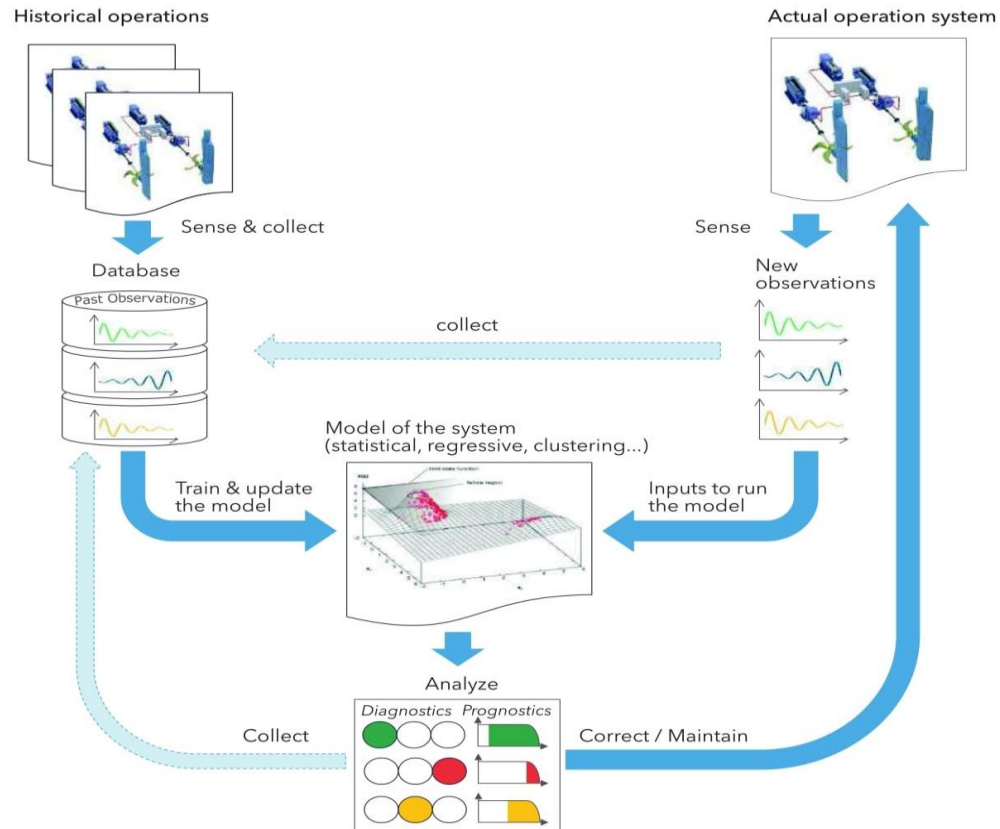
CBM Framework



Model Based CBM Framework



Data Driven CBM Framework





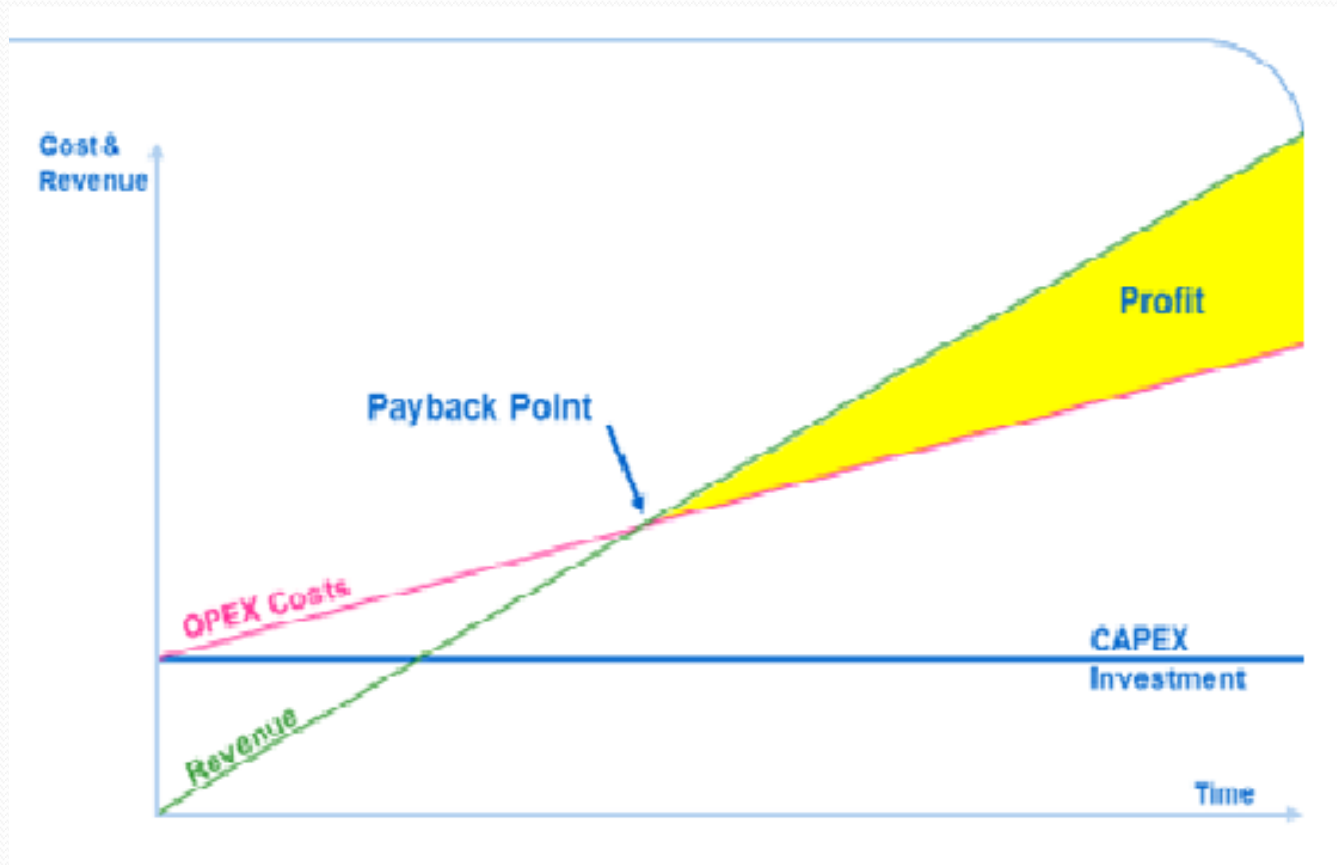
If we do not follow PMS , what percentage of machinery failure we may expect??

Why CBM?

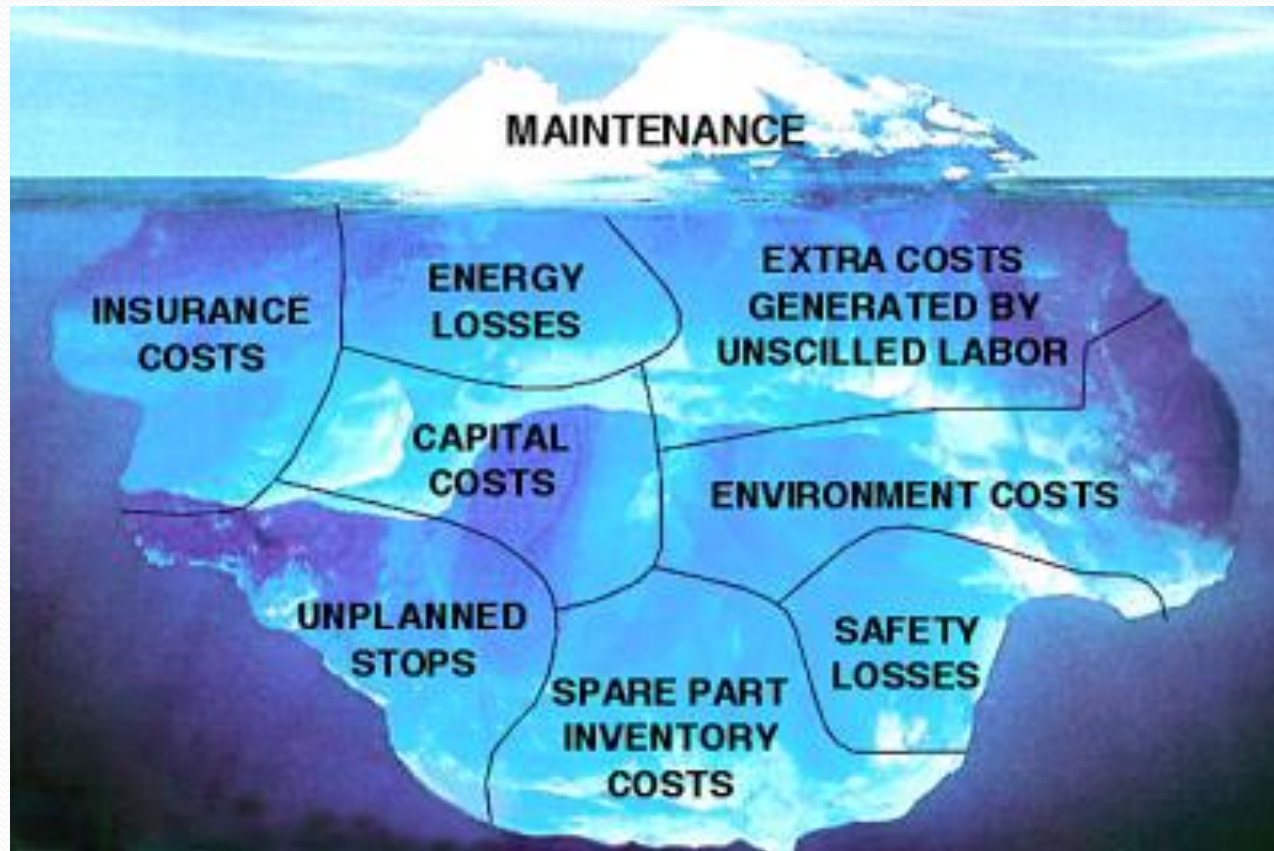
- Age related failures :20-30%, Random Failures: 70-80%
- Optimize maintenance interval.
- Consumption of spares is minimized.
- Reduce Maintenance error.
- Downtime is avoided by taking proactive measures.
- Root cause problem solving.



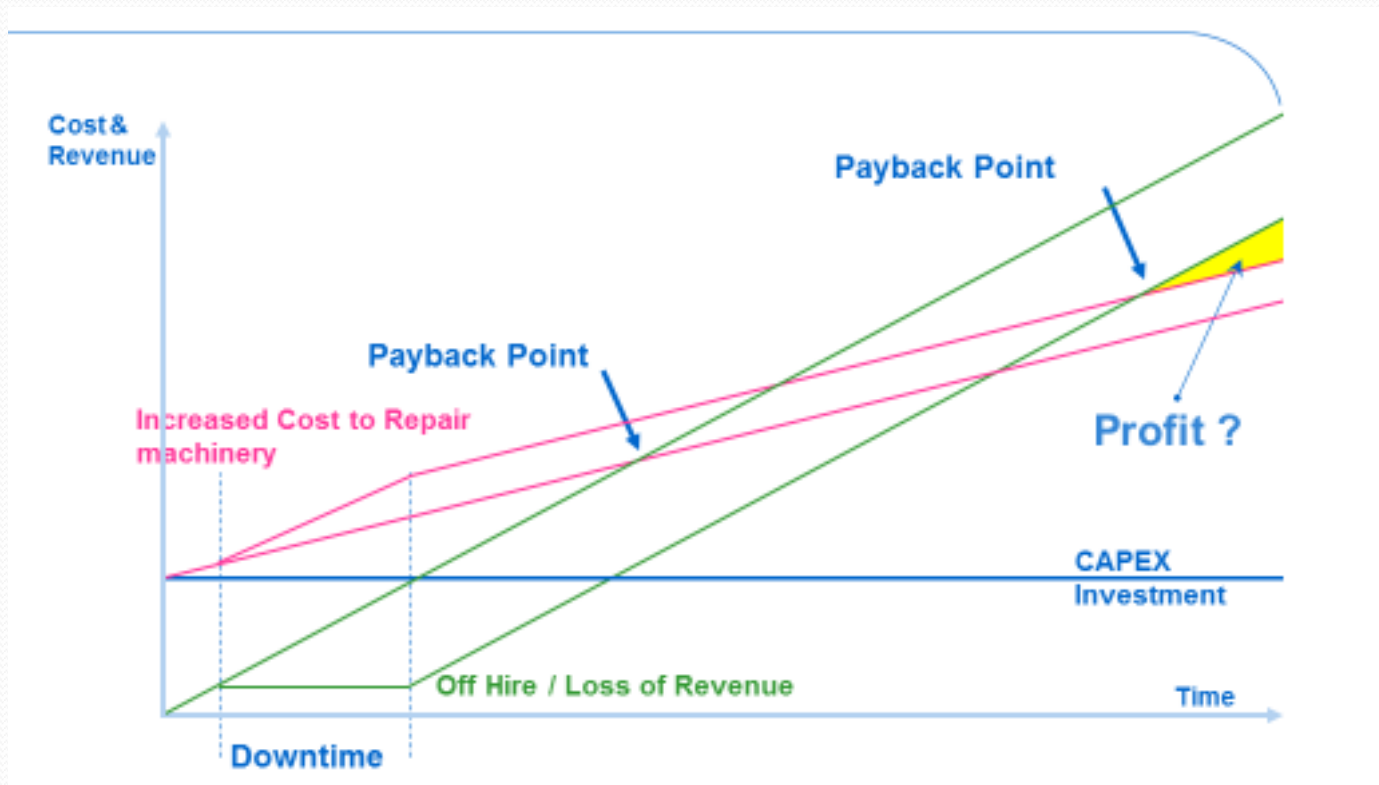
The Basic Business Model



Cost of Maintenance Vs Other Costs



Why Conduct Maintenance?



Why now?

- Availability of Simple Sensors
- More intelligent software programs
- Availability of Internet, Bandwidth and Big Data
- Maker's Involvement and improvement of design
- Initiation of Class Survey procedure

Method of CBM

- Vibration Analysis



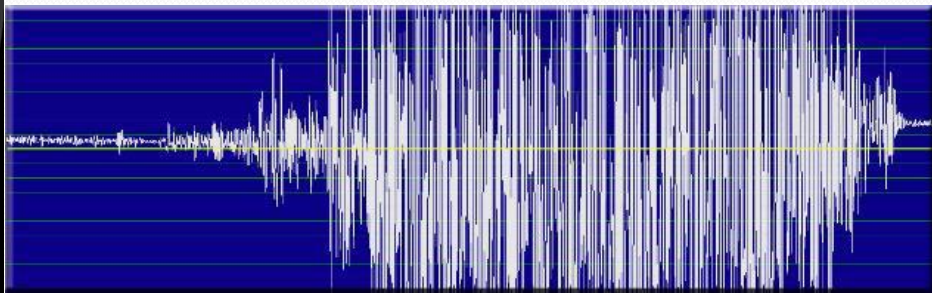
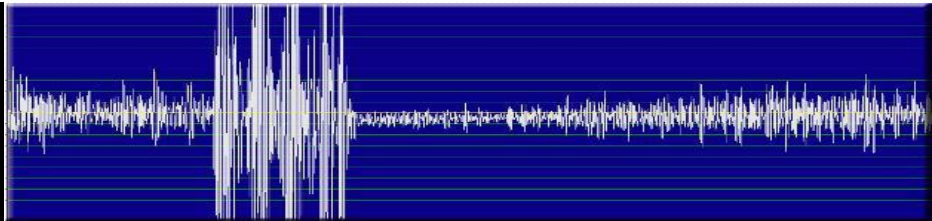
Method of CBM

- Infrared Temp detection



Method of CBM

- Ultrasonic Technology: detect leaks, under/over lubrication



CBM Equipment and process

Portable

Fixed

Intelligent Online System

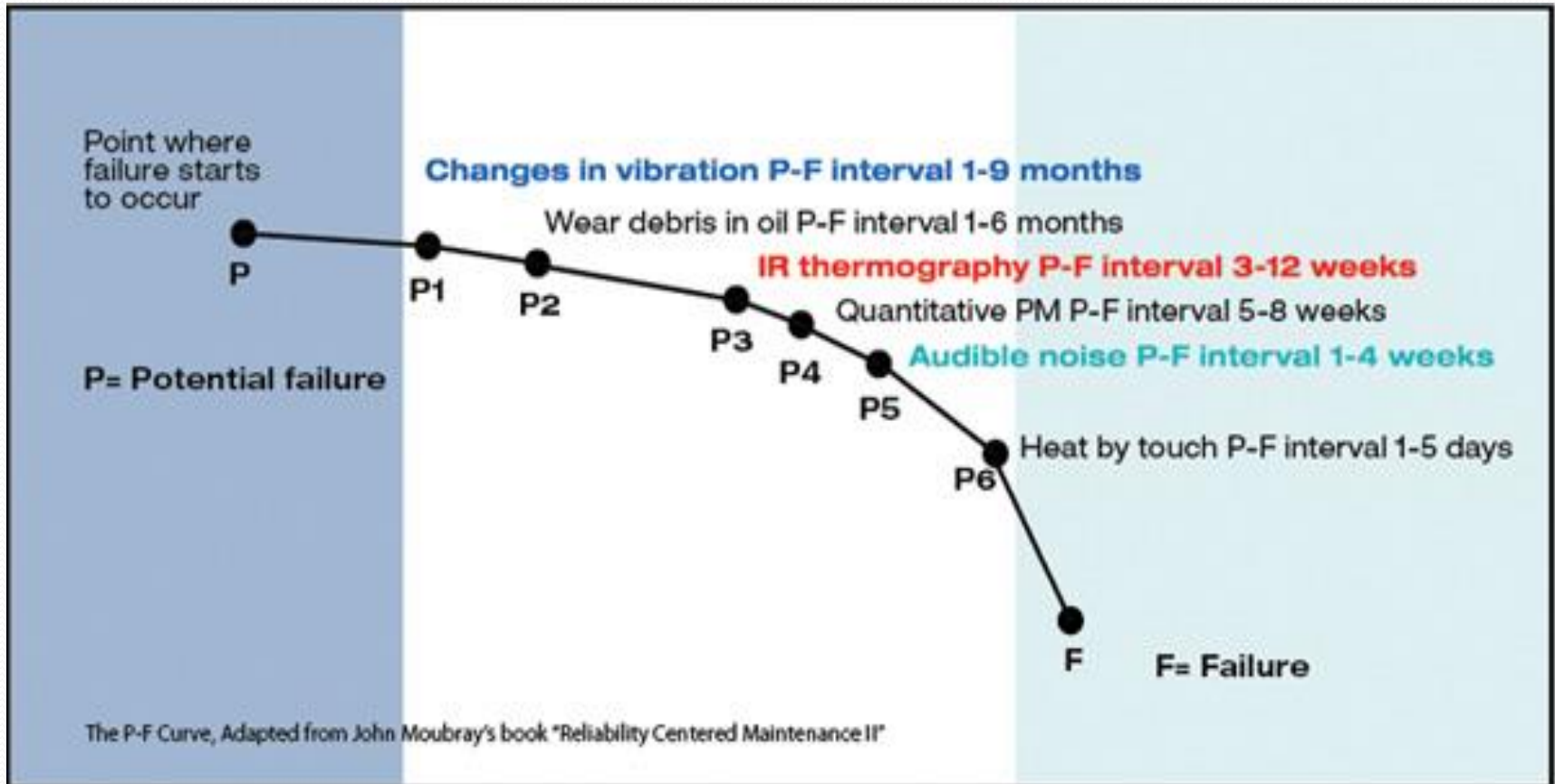
Fleet CBM service using remote monitoring
Specialist CM services where a Marine CM
specialist go onboard.



Use of Five Senses.

Is it relevant at this point of time??

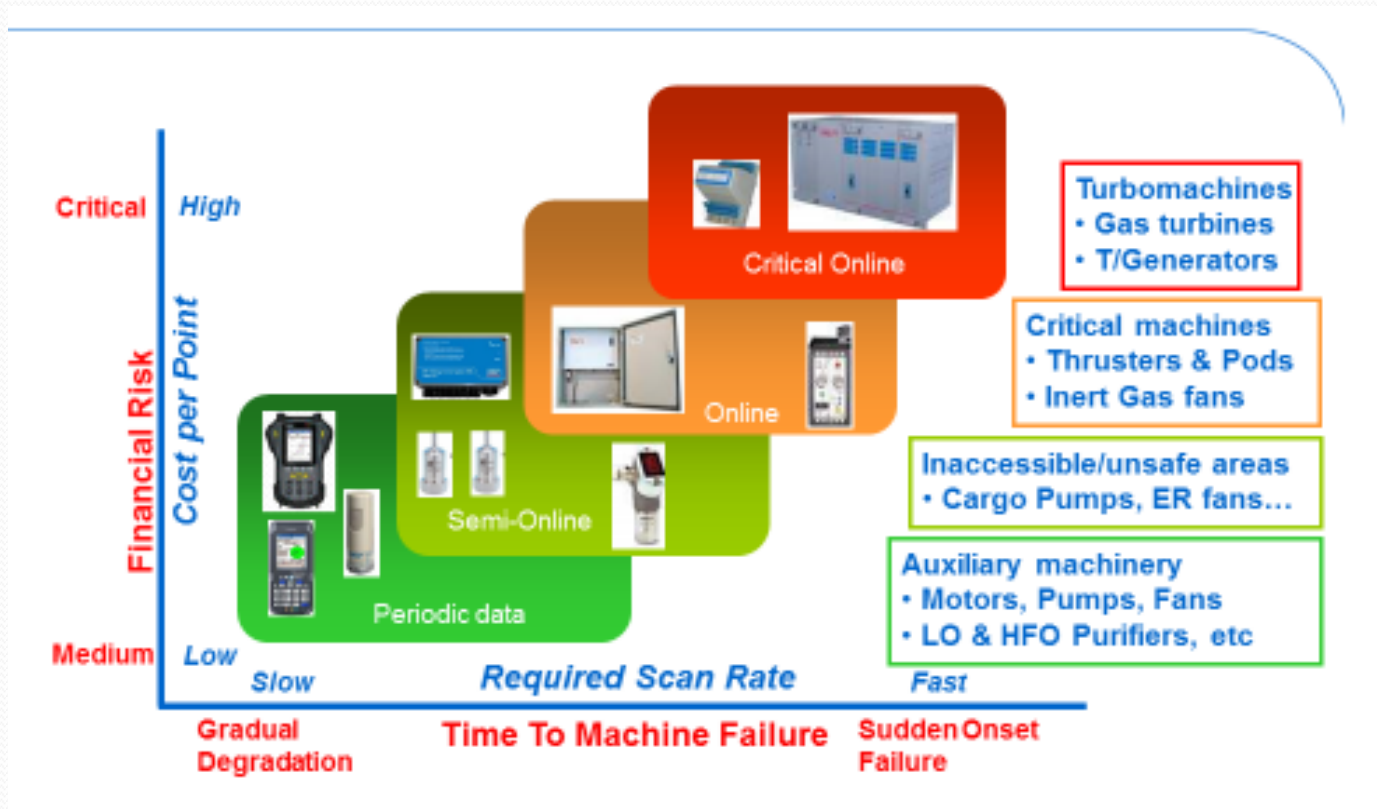
The P-F Curve



6 steps to CBM

- Strategy
- System Set Up
- Data Collection
- Remote Analysis
- Corrective Action
- Reliability Improvement

Marine Condition Monitor Strategy



Does CBM Increase Reliability?

- The only way to improve reliability of an equipment is to change the design of the equipment, or the methods used to install, operate, and maintain it.
- Design error, Faulty material, Improper Fabrication and construction, improper operation, Inadequate maintenance and maintenance error can affect reliability.
- Reliability of the services can be improved by predictive maintenance or CBM on the equipment.

Are we Resistance to change?

- PMS is easy, need only a calendar
- Tradition: do maintenance the way we do always. (Cultural Resistance)
- Redundancy of the equipment

- Technology for CBM is too costly
- Additional cost and time to maintain various sensors.

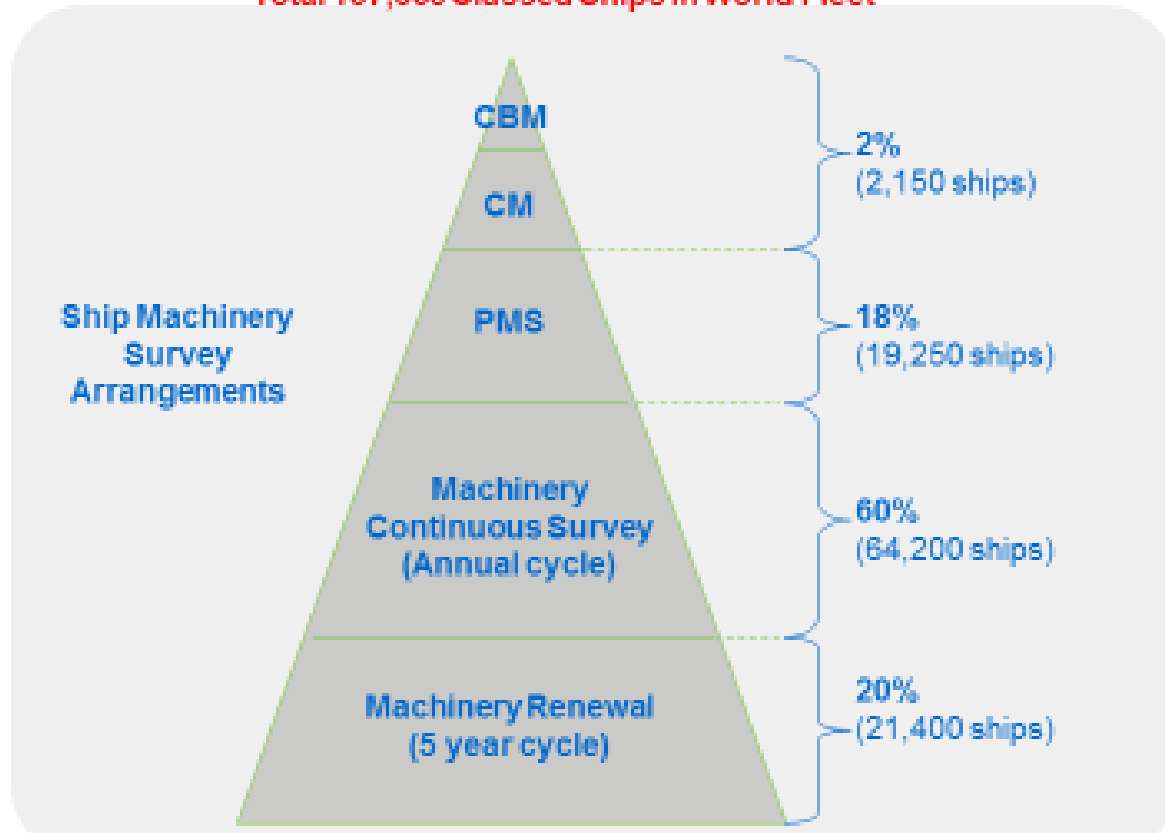
- Need capable crew who can analyze data and override maker's maintenance schedule.



What is the percentage of Classed Ships in World Fleet using CBM or Condition Monitoring??

Marine CBM and Ship Machinery Surveys

Total 107,000 Classed Ships in World Fleet



Challenges?

- **Maker's Warranty; Design and Maintainability at component level.**
- **Appropriate Software and new standard must be developed.**
- **Ship's are purpose designed and Unique. Needs more time to build useful data.**
- **Sharing proprietary data.**
- **Ship Shore data transfer capability.**
- **Class Approval/Notation**
- **Acceptance by H&M Insurance**
- **Oil Major Acceptance**

Do owner have a choice?

- Cost of the ship
- Depends on the shipyard
- Cost of Equipment
- Trading life of a ship
- Reliability of equipment

Do the Maker has any responsibility?

- Agrees on CBM rather calendar based maintenance.
- Design the product to accept various sensors
- Equipment manufacturer to provide CBM service with a fee. Framo as an example.
- They can also benefit by using product usage information to improve product design

Incentives to CBM!

- H&M Insurance company—financial incentives
- Warranty on Monitoring equipments.
- Extended warranty if CBM equipments are installed.
- As more people buy, the cost of CBM equipments will drop.



Thank You