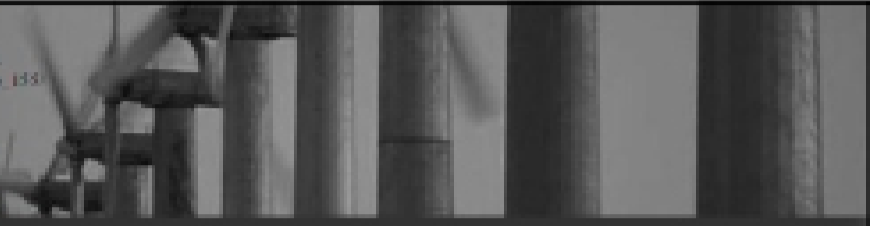


Adapted for  
Wind Power Management class  
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**GASTOPS**

**Oil Debris Condition Monitoring  
For Wind Turbine Gearboxes**

**Presented by : Richard Dupuis**

**AWEA Wind Power Asset Management Workshop  
January 2008, San Diego, CA**

*Making Machinery More Effective*

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## Corporate Profile





- Advanced products and services for Machinery Condition Assessment and Control
- Supplier of **MetalSCAN** Oil Debris Monitoring technology since 1995
- Aviation, Defense, Energy and Marine sectors
- Founded in 1979
- Four locations:
  - Ottawa, Ontario (head office)
  - Halifax, Nova Scotia (field office)
  - Victoria, British Columbia (field office)
  - Pensacola, Florida (GasTOPS, Inc.)

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## What's the Problem ?



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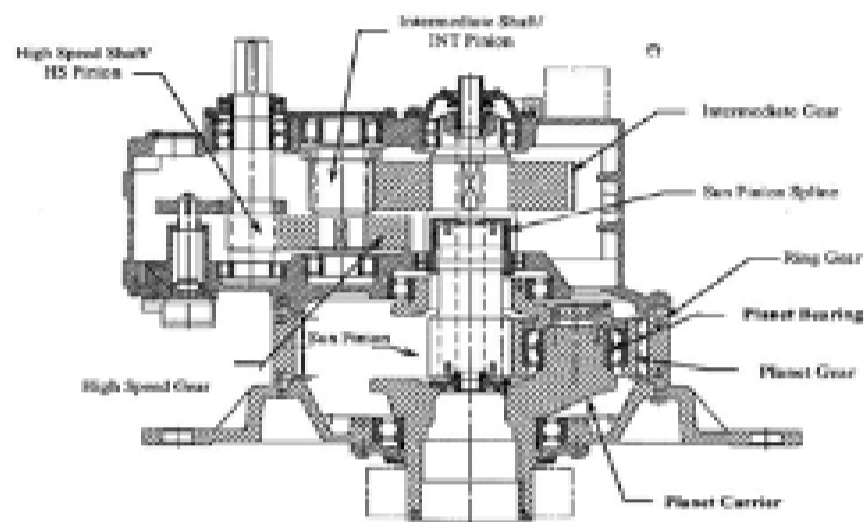
## Gearbox Failures




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## Typical Wind Turbine Gearbox Arrangement



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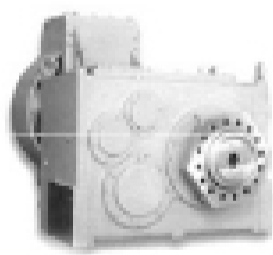
## Overview

- How can the problem be managed
- Condition Monitoring Theory & Feasibility
- Oil Debris Monitoring (ODM) method - principle of operation
- Why Bearings & Gears Fail
- Validation of ODM method for condition monitoring

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## How to deal with the problem ?



- Conduct root cause investigations of gearbox problems
- Continue to make design modifications to gearboxes and their system interfaces
- Operators/owners must seek solutions to manage the problem

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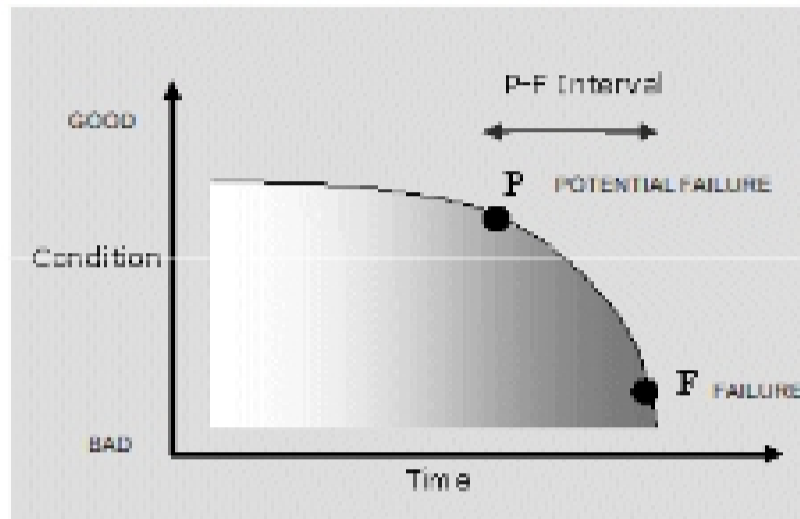
## How can the problem be managed ?

- **Adopt Condition Monitoring (CM)**
- **Avoid "Failure" Event**
  - Contain the damage
  - Reduce repair time & costs significantly
- **Minimize Business Interruption**
  - Schedule repair support on-site before shutdown
  - Minimize lost revenue & penalties

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## Condition Monitoring Theory : P-F Curve



- Need to have a: "Condition Indicator" (CI)

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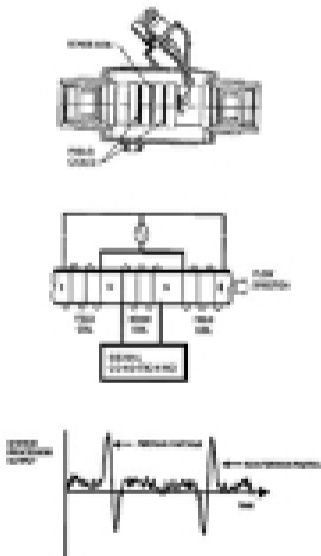
## CM Technical Feasibility Criteria

- CI must detect the potential failure (P)
- CI must identify the degree of damage towards failure (F)
- P-F interval must provide adequate time for the organization to proactively plan
- P-F curve must be consistent for the failure mode

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## Oil Debris Monitoring (ODM) - Principle of Operation



- Sensor includes 3-coil assembly
- Metallic debris from bearing or gearbox sump flows past the field coils creating a disturbance signal in the sense coil
- Signal characteristics define:
  - particle size based upon signal amplitude
  - type (Fe or NFe) based upon signal direction

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How does ODM satisfy  
the CM criteria ?

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