



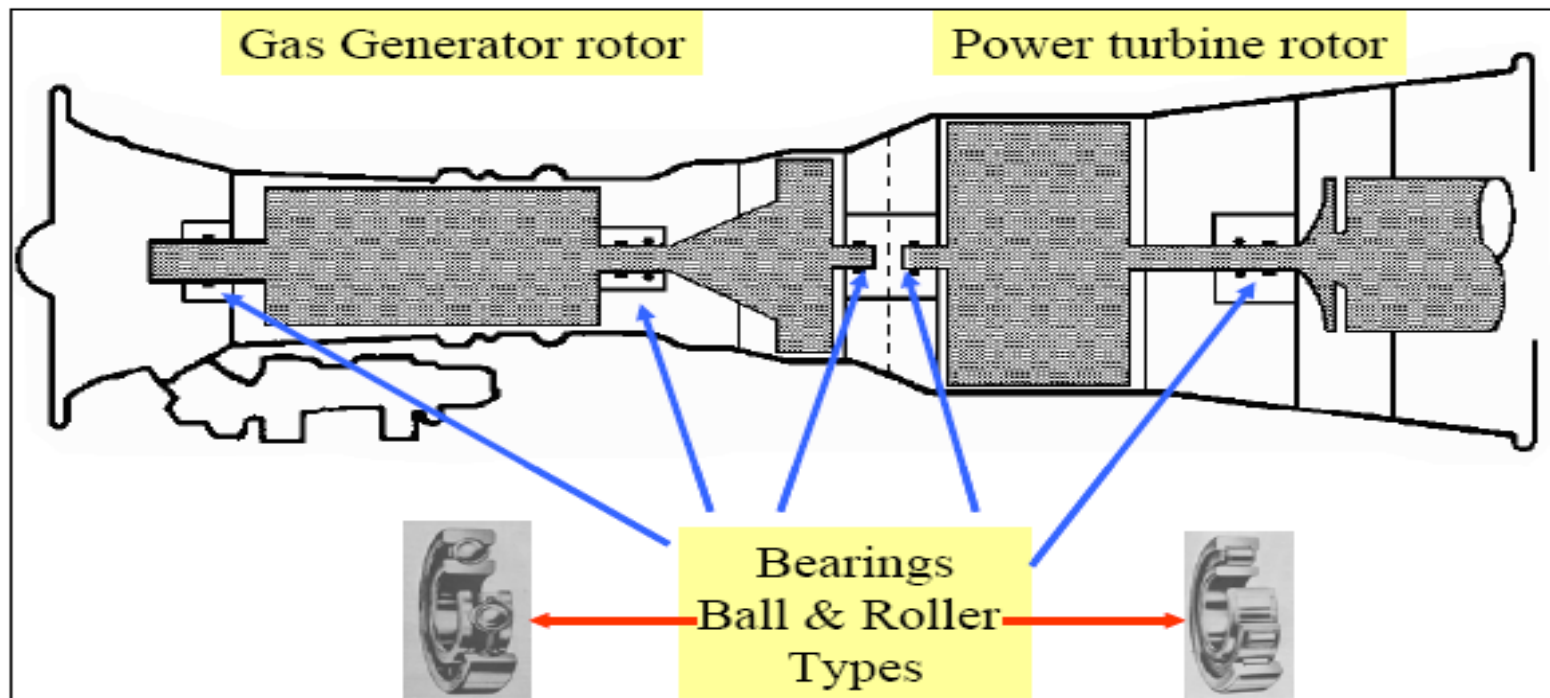
Content MetalSCAN LM2500 case study

1. Content MetalSCAN LM2500 case study
2. Ball & roller bearings in aero-derivative gas turbines
3. Possible consequences of bearing damage in gas turbines
4. Benefits of a reliable early detection of bearing damage
5. Requirements for effective early detection of bearing damage
6. MetalSCAN for aero-derivative gas turbines
7. GE LM2500 bearing damage case study
8. Wrap-up



2. Ball & roller bearings in aero-derivative gas turbines

Gas turbine main bearings serve the critical function of supporting and controlling the position of the shaft and the associated rotor.



Typical aero-derivative gas turbine main bearings



3. Possible consequences of bearing damage in gas turbines

Possible consequences of bearing damage in gas turbines are:

- Degraded shaft position control which can cause blades to contact the casing
- Risk of expensive secondary damage when this blade contact happens
- Unplanned engine stop
- Extra time required for problem analysis, repair decision and repair delivery
- Contaminated lube oil system which will require days of flushing
- Unplanned loss of production
- Unplanned loss of revenue



4. Benefits of a reliable early detection of bearing damage

Bearing damage happens to all aero-derivative gas turbines. Since bearing damage cannot be predicted in an effective way the best available option is to detect the damage at the very moment that it starts on a very small scale ...

Reliable early detection of bearing damage enables a gas turbine operator to:

- Make well-informed decisions about a necessary bearing replacement
- Keep the engine running while organizing a scheduled bearing repair stop
- Get the necessary spare parts and maintenance engineers on site
- Bring the engine to a scheduled bearing replacement stop
- Complete the repair and restart the engine as quickly as possible
- Optimize the production and revenue generation capacity of the engine
- Prevent expensive secondary damage to the engine



5. Requirements for effective early detection of bearing damage

The requirements for effective early detection of bearing damage are:

- Identification of the actual start of the damage (earliest detection possible)
- Continuous assessment of the degree and the progression of the damage
- Reliability of the damage detection (no false alarms, no missed alarms)



6. Gastops MetalSCAN for aero-derivative gas turbines

Gastops MetalSCAN for aero-derivative gas turbines provides a 24/7 assessment of all main bearings in a gas turbine.

When a bearing failure occurs it signals the very start of the damage and it provides trending information about the progression of the damage in the very early stages.

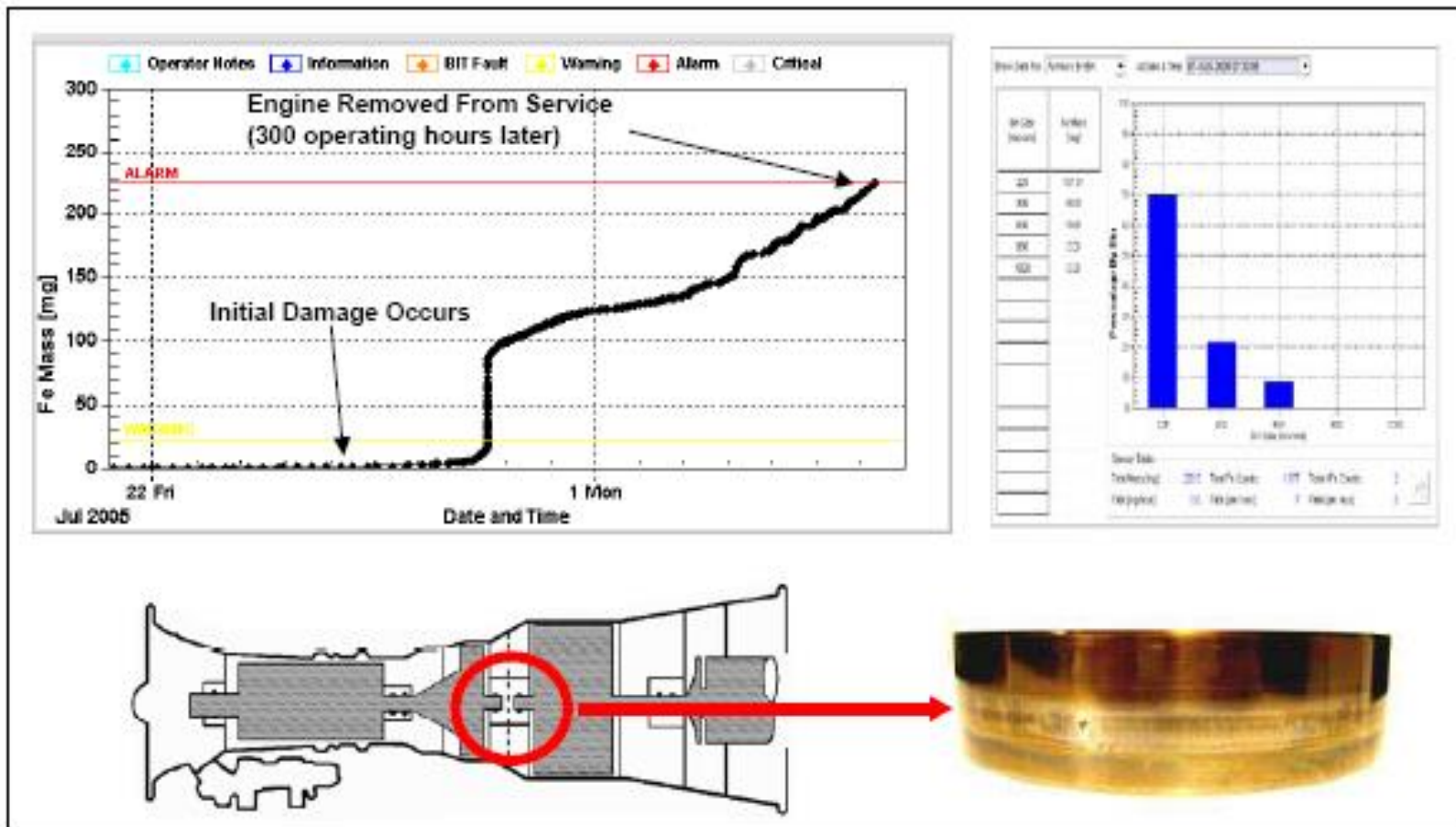
This information allows operators to undertake preventive and corrective actions while the engine is still running and to bring the engine to a scheduled stop before secondary damage has occurred.

MetalSCAN enables operators to act pro-actively and to plan necessary maintenance actions beforehand by ordering spare parts and by scheduling the bearing replacement at a convenient business moment to:

- minimize engine downtime
- minimize loss of production
- minimize loss of revenue.



7. GE LM2500 bearing damage case study (1)



LM2500 C-sump, bearing 5 & 6



7. GE LM2500 bearing damage case study (2)

Timeline of the bearing damage event in the GE LM2500 gas turbine:

- Engine ran for a significant period of time with virtually no debris being detected
- Once the initial damage occurred MetalSCAN immediately provided an indication
- MetalSCAN kept tracking the degree and the progression of the bearing damage
- After a rapid rise in debris the engine power was reduced to 80% to slow down the progression of the damage in order to reach a scheduled maintenance period
- Spare parts and maintenance engineers were on site when the MetalSCAN system passed the second alarm and the engine was brought to a scheduled stop
- Damaged bearings 5 & 6 in the C-sump between the gas generator turbine and the power turbine were replaced within the shortest possible turnaround time
- Secondary damage was avoided and the loss of production and loss of revenue was minimized
- At the moment of engine shutdown the vibration monitoring and oil scavenge temperature monitoring did not provide any indication of bearing damage



8. Wrap-up

In short: MetalSCAN for aero-derivative gas turbines ...

Fulfills the requirements for a reliable early detection of bearing damage:

- Identification of the actual start of the damage (earliest detection possible)
- Continuous assessment of the degree and the progression of the damage
- Reliability of the damage detection (no false alarms, no missed alarms)

Delivers the benefits of a reliable early detection of bearing damage:

- Improves the troubleshooting and problem-solving capacities of the operator
- Minimizes the risk of an unscheduled stop in case of bearing damage
- Minimizes engine down time in case of bearing damage.
- Minimizes loss of production and loss of revenue in case of bearing damage
- Minimizes the risk of expensive secondary damage in case of bearing damage

