‘Sentry’ Solutions

Problem/Solution Cost/Benefit ‘Case’ study:

√ Raymond Mill: Complex forces created Shaft damage.
The ‘Sentry’ Concept

Predicts the future “health” of equipment to proactively ensure maximum Uptime, Prevent Downtime and Protect your investment.

Provides 24/7 “At a Glance” equipment condition (of vibration, strain, temperature) using intuitive Red/Yellow/Green “Traffic Light” system.

Creates 3-D “movies” to rapidly identify the TRUE Root Cause of equipment “hot spots”.

Enhances Predictive Maintenance (PdM) and Process optimization.

H&S takes full ownership for detailed Corrective Actions specific to the unique Needs of the Customer. (Extension of Customer Reliability Group)
Problem: Raymond Mill Complex forces created Shaft damage.

Overview of Sentry hardware and Sensor layout
"Snapshot" from 3-D "Movie" Animation provided insight to Forces.

Vertical "wobble" motion of Mill is the result of loose bolting, unstable foundation and damage to "Farbrica" pads on base supports.

"Red" color indicates mechanical stress on the gearing and shaft assembly. Brightest "red" indicates highest stress. Maximum stress at the 4 inch transition pinion shaft validates assessment model as it is the same as the actual 'twist' breakage.

Axial Thrust from pinion shaft misalignment and thermal growth of the pinion shaft is toward the bevel gear.
Solution Conclusions. ‘Root’ Causes of Reliability Issues:

- Pinion Shaft Misalignment
- Mill Base and Mounting Instability
- Bull Gear “Wobble” Vertical Motion
- Torque Cycle Fatigue
- Thermally Induced Stress via nearby Furnace that radiated damaging Heat
- High Bending Moment from Gear Mesh Distortion
- Foundation Deterioration
Long Term Solution. Generated improved Procedures, Drawings and Specifications to enhance future Reliability.
Example: Pinion drawing update with Shim addition (corrected mounting distance).
Compared ‘Before’ and ‘After’ to ensure Corrective Action repair Success. (Significantly lowered the vibration).

Before Rebuild:
Vibration at Pinion Out Board Bearing in Horizontal Direction

After Rebuild:
Vibration at Pinion Out Board Bearing in Horizontal Direction

Vibration Trends AFTER Rebuild: Low & Stable
Investments, Cost/Benefit analysis

• $150K investment: Condition Assessment efforts (Engineering Services Labor).

• $700K investment: new/re-mfg. components and labor.

• ROI: Much higher reliability >> $5 M/year of increased Uptime ($1 invested >>5$ of Return)

• Previous $22.5 M of Downtime NOT repeated.