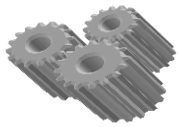
HORSBURGH & SCOTT

‘Sentry’ Solutions

Problem/Solution Cost/Benefit ‘Case’ study;

√ Grind, Regrind Mills: Multi-Mill Complex interactive damage.



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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)

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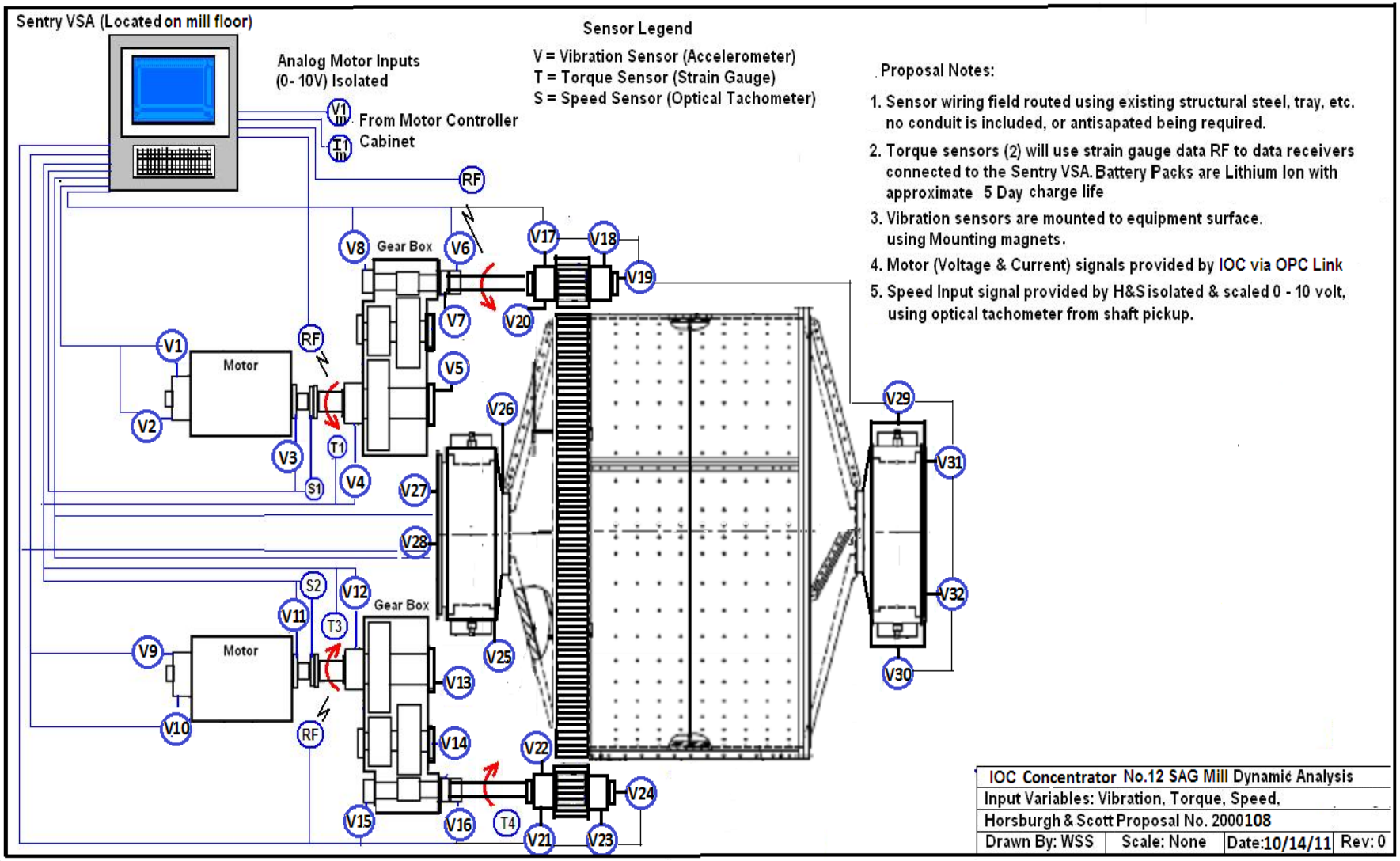
Problem: Grind, Regrind Mills. Multi-Mill Complex interactive damage.



Overview of Sentry hardware and Sensor layout

"Snapshot" from 3-D "Movie" Animation provided insight to Forces.

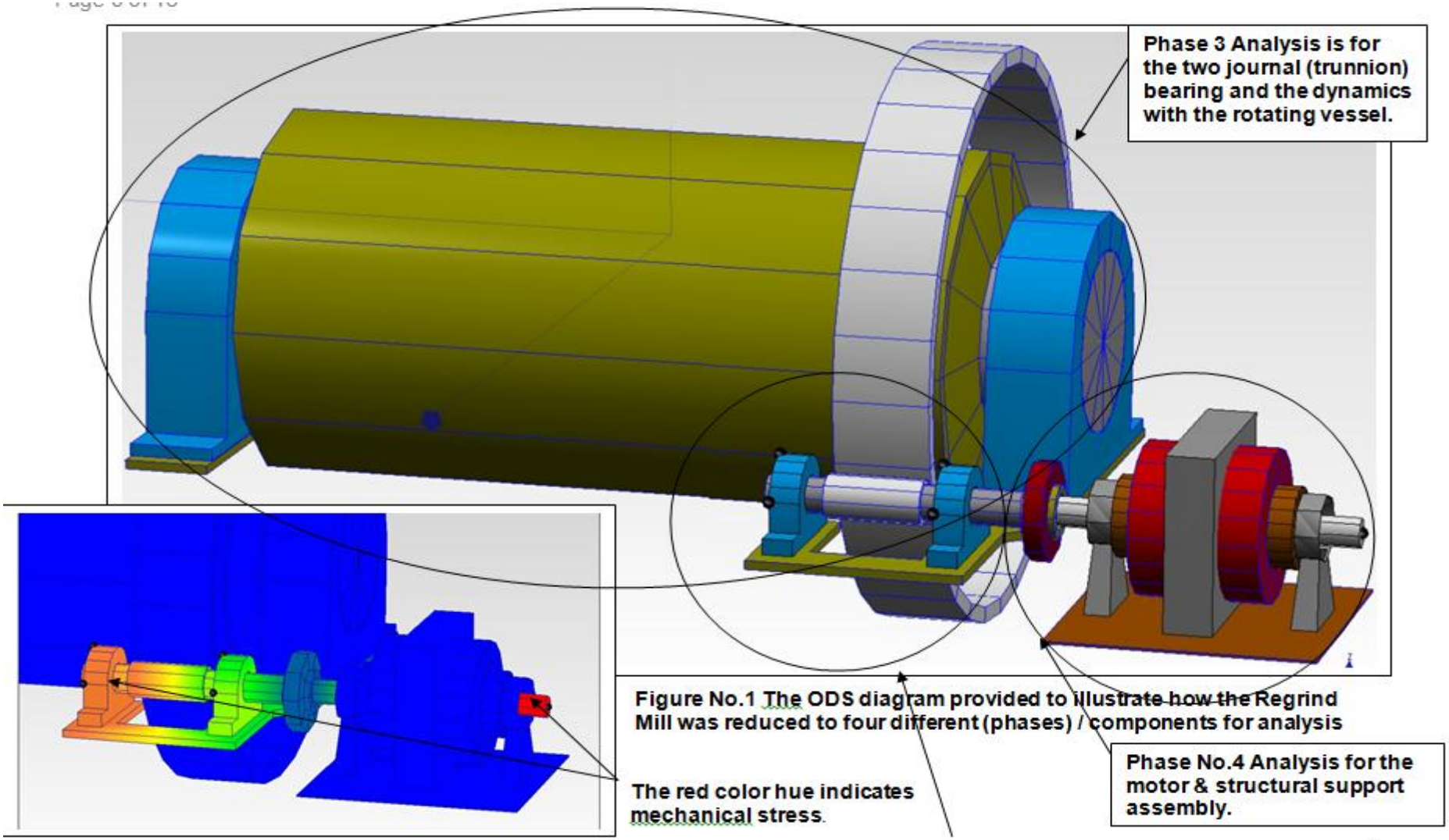


Figure No.1 The ODS diagram provided to illustrate how the Regrind Mill was reduced to four different (phases) / components for analysis

Figure No. 1A The ODS model depicts the how the bent shaft effects the OB Bearing

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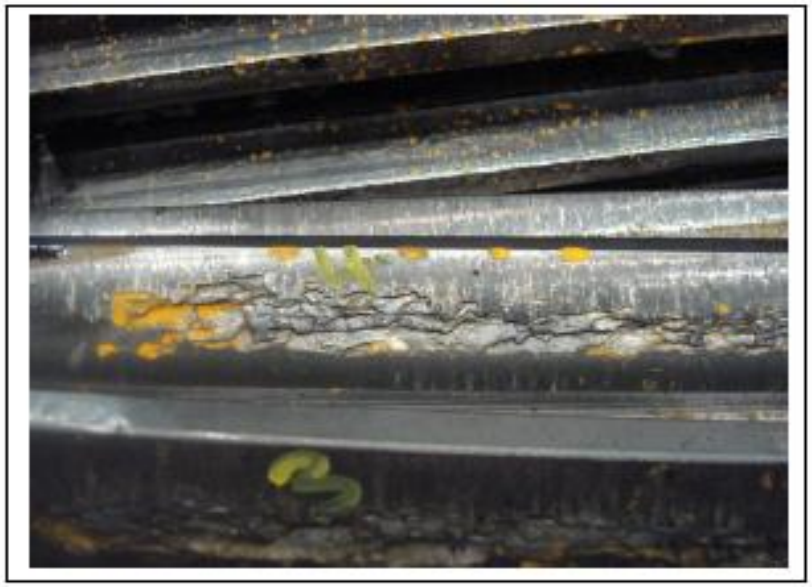
Solution Conclusion. ‘Root’ cause of vibration: Gear Alignment needed. (Note: this is one example of many solutions)

Findings

The Pinion was found to be in such a condition that catastrophic failure is imminent due to cracking and lack of existing base metal at the pitch line. The alignment of the pinion to the ring gear was such that there was approximately only 60% contact. The pinion was also found to be out of alignment with the motor shaft. Our inspection of the ring gear split line with a feeler showed a gap of between .002 -.005 between the mating halves. The backlash and root checks confirm the misalignment between the pinion and the ring gear. Florescent Mag Particle inspection has detected two minor indications on the ring gear and multiple linear indications on the pinion.



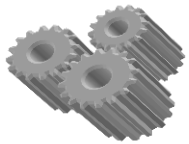


Figure 1: Pinion teeth in comparison the Ring Gear teeth

In figure 1 above the picture on the left shows the extent of damage of the pinion compared with the ring gear working flank on the right. Although a certain amount of gear mesh can be expected with the running of an old gear set the extent of the damage on the pinion seen here will certainly compromise the tooth geometry of the ring gear over time.

Investments, Cost/Benefit analysis

- $2M investment: Condition Assessment (material and Engineering Services Labor), new/re-mfg. components and labor. (Total investment for multiple Mills).

- ROI: Much higher reliability >> $20 M/year of increased Uptime ($1 invested >>10$ of Return)