CURTISS - WRIGHT

# Electric Motor Bearings

## *Motor and gearbox health*

A critical radar antenna at Miami International Airport is driven by a redundant motor and gearbox configuration. Standard vibration measurements indicated no mechanical problems with either motor or gearbox. A Stress Wave Analysis, (SWAN™), immediately indicated abnormally high Stress Wave Energy (SWE) from one of the motors. SWAN's Spectral Analysis indicated a significant spectral line at the bearing outer race defect frequency. SWE readings from a replacement motor, taken from the overhaul depot, read within five percent of the healthy motor. A tear down and inspection of the discrepant motor confirmed significant spalling on the outer race as indicated by SWAN.

The primary reason for the implementation of Stress Wave Analysis (SWAN) is that vibration analysis has several undesirable characteristics that continually plague its effectiveness. These characteristics include difficulty in interpretation of data, late indications of anomalies, a high likelihood of false alarm, and the need for custom setup from machine to machine.

The nature of vibration analysis is that all of the dynamic motion of a machine is considered, resulting in a very complex spectral signature. Thus highly skilled and specially trained personnel are required for data analysis and interpretation.

The illustration below demonstrates the ease of interpreting SWAN data as compared to traditional vibration analysis techniques. Both motors were in service in a critical airport radar application. The top comparison of complex vibration spectra shows no apparent damage to either motor. The much simpler Stress Wave Pulse Train (SWPT) spectra in the middle plots below, clearly show a defect spectral frequency line 20 db above background levels for the discrepant motor, and no spectral lines for the healthy motor (unlike vibration analysis).

Even more dramatic, is the comparison of Stress Wave Energy levels over a 100 hour operating period. The good motor SWE levels are steady and remain in a narrow range, while the discrepant motor's SWE levels are erratic, increasing, and at times were more than 10 times as high as the good motor's SWE readings. When the discrepant motor was replaced, the replacement motor demonstrated SWE readings the same as the good motor. Disassembly of the discrepant motor confirmed the early stages of bearing fatigue damage.

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