Government Funded SBIR and STTR Initiatives

Integrated Sensor System for Load and Condition Assessment, Phase II

Sponsor: NSWCCD

Start: December 2001 Complete: November 2003

Develop prototype wireless Smart Bearing sensor systems in cooperation with a bearing manufacturer. The sensor is to be a low-cost component, integrated directly with a bearing. The sensor system is to be intelligent and open to interface to existing monitoring systems. This will provide an open published standard for integration of this intelligent system with any diagnostic system (i.e., ICAS). Thus, the sensor system will be a value-added adjunct to an otherwise standard bearing. Prognostic algorithms, that are characteristic of the application, will be developed and validated in conjunction with the bearing manufacturer, and predictions of Remaining Useful Life will be correlated with results of bearing tests-to-failure. Power harvesting capability based on rotation will also be developed and integrated with the ICHM application. Having this capability will cause the sensor system to be essentially maintenance-free, as well as remove the need for a separate power source, which is not always available.

Wireless Integrated Sensor System for Load and Condition Assessment

It is believed that the application of smart sensor systems will provide more timely monitoring and maintenance. Sensors in the forms of a deflection pin and a stress pin were developed and tested. Two bearing test rigs: a portable, or light-duty version, and a heavy-duty model were designed. A light-duty rig was fabricated and used for Phase I testing of the sensors. For this Phase II of the project the assembly of a heavy-duty test rig was finished and used for the Phase II experiments.. The conceptual incorporation of either sensor into an integrated system with Wireless Data Transmission via the ICHM® that was considered for the Phase I of this contract was realized during the Phase II and was a substantial effort that resulted in a demonstration of the power-scavenging module and an ICHM® Data Acquisition electronics module capable of interfacing to the stress-pin, deflectometer or an accelerometer.

The Smart Bearing Sensor System, as can be seen in this block diagram, the sensing element or stress-pin, power scavenging module and the electronics module, called WHALM (Wireless Health and Load Monitor), were parts of this contract. The host platform, or system health monitor, was not a part of this contract. The different parts of the smart bearing sensor system are described in more detail in the final report.

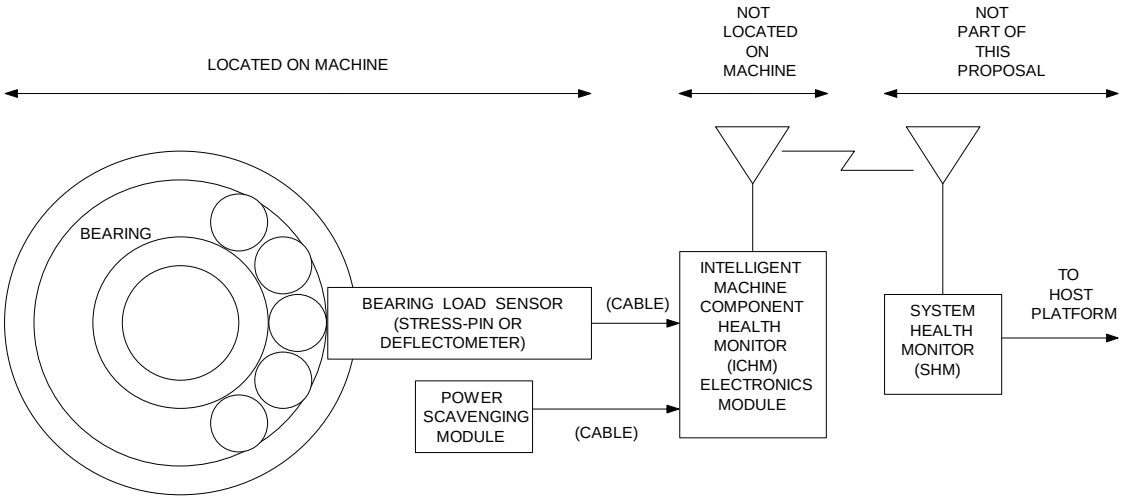

Figure ***Error! No text of specified style in document.****.1: Smart Bearing Sensor System block diagram*

System Components

- Sensor
  - Transduction element
  - Pre-amp
- Power Harvester
  - Rotor with magnets
  - Stators
- WHALM
  - Signal Conditioning
  - Data Acquisition
  - Pre-processing
  - Power Conditioning
  - Wireless Communication
- Host
  - Post-processing
  - GUI

Ambient Powered Wireless Sensors
Sponsor: NIST SBIR Phase I

Start: Oct. 2002 Complete: Mar. 2003

Successful demonstrated the feasibility of developing the technology to produce a thermally powered wireless sensor from advanced thermoelectric and commercial wireless technology for health monitoring applications.

Fault Location In An Intelligent Open Sensor Network SBIR

Sponsor: NAVSEA

Start: May 2001 Complete: November 2001

Define a set of self-test practices that will be incorporated into an intelligent sensor network to enable it to assess its own "system health". OST identified a model intelligent sensor network that is representative of a typical machine health monitoring application to serve as the target development system. The intelligent sensor network self-test capabilities and specifications were defined within the framework of the IEEE 1451 family of intelligent sensor network standards. A functional simulation of the intelligent sensor network was created and coded.

AAAV (Advanced Amphibious Assult Vehicle) STTR

Sponsor: US Marine Corps

Start: June 1999 Complete: July 2002

Developed wireless prognostics and maintenance decision support system for the drive train of the AAAV. Developed the core of the ICHM 20/20 product. Embedded wavelet advanced feature extraction algorithms and maintenance decision support intelligent agent in the system. Demonstrated the capability of wireless to function successfully on the vehicle.