IMS Predictive Technologies for Self-Maintenance Industrial Systems

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The IMS Center

Drivers and Transformation Technologies 2001

Unexpected Breakdowns

Common Issues

Costly Downtime and Constrained Productivity

Reactive Approach to Service (Ad Hoc and Firefighting)

Excessive Warranty Costs

Too Much or Incomplete Data or Not in Useful Format

Common Attributes & Needs

Multi-Sensor Data Fusion

Degradation Assessment and Prediction

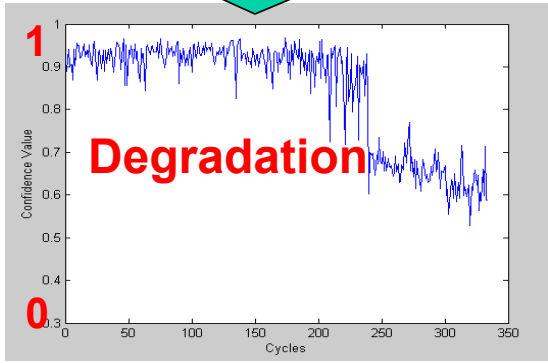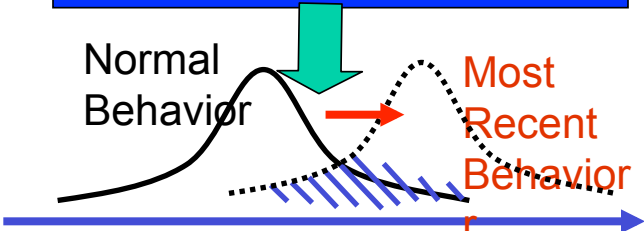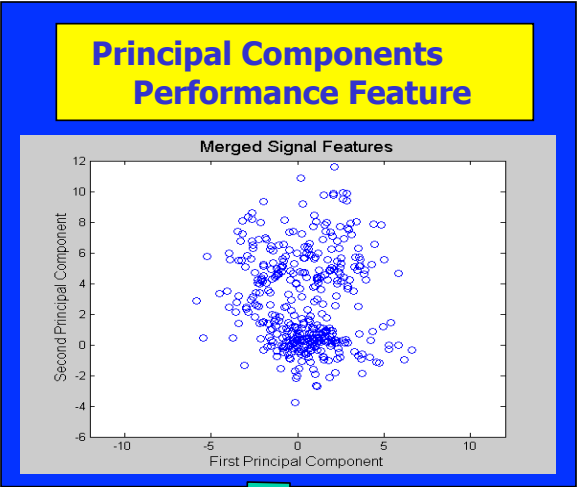**Retrievable Information from Anywhere at Anytime**

IMS Focus

Degradation Modeling

Predictive Informatics Tools (PHM)

Maintenance Analytics & Decision Support Tools

Fail & Fix (FAF) → Predict & Prevent (

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Predictive Analytics and Instrumentation

Principal Components Performance Feature

Merged Signal Features
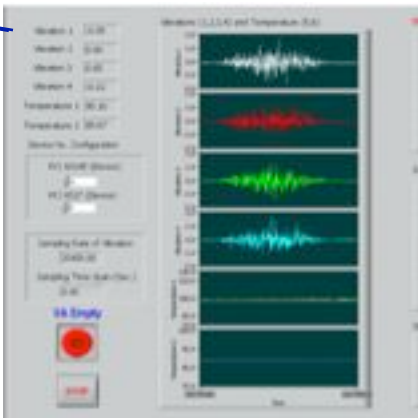
Prediction of Machine Performance Life

Normal Behavior

Most Recent Behavior
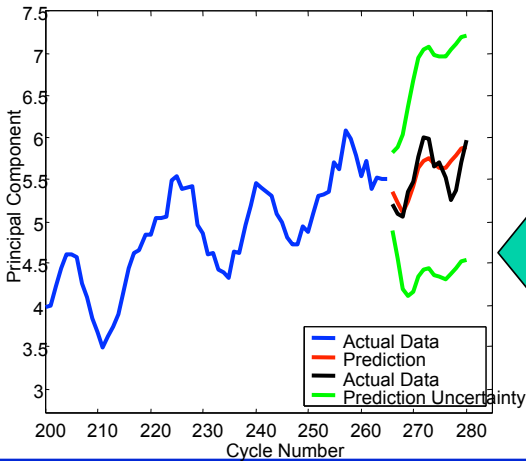
Health Feature Radar Chart

Bearing
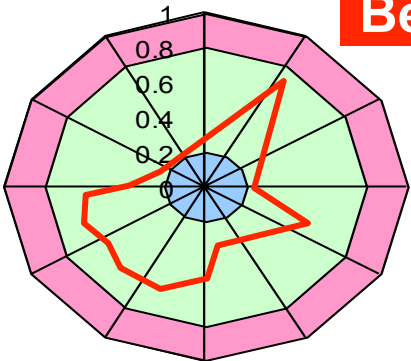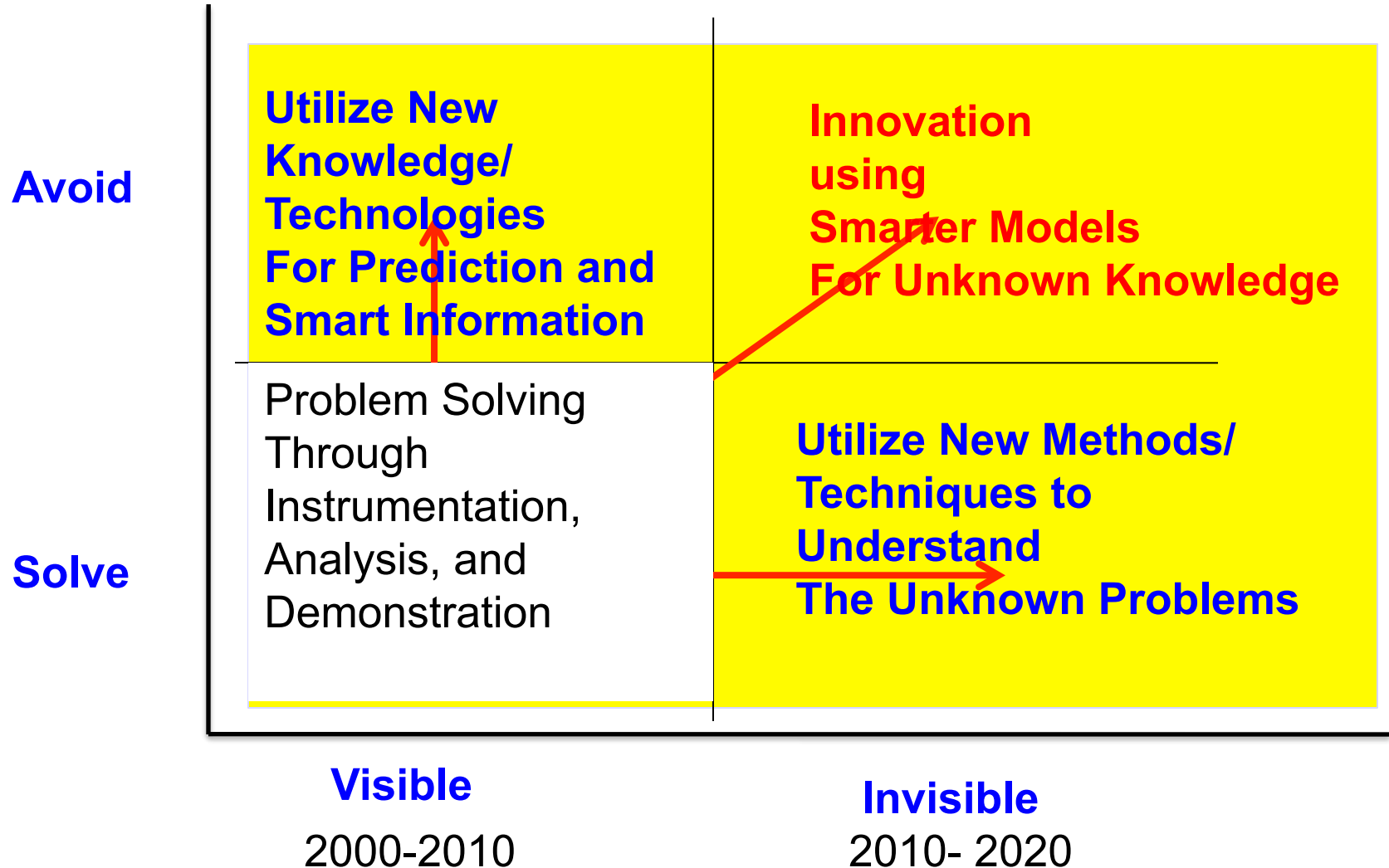
Degradation

Actual Data
Prediction
Actual Data
Prediction Uncertainty

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IMS Research Transformation Strategy

Avoid

Utilize New Knowledge/ Technologies For Prediction and Smart Information

Innovation using Smarter Models For Unknown Knowledge

Problem Solving Through Instrumentation, Analysis, and Demonstration

Utilize New Methods/ Techniques to Understand The Unknown Problems

Solve

Visible 2000-2010

Invisible 2010- 2020

NI LabVIEW Watchdog Agent® Toolkit
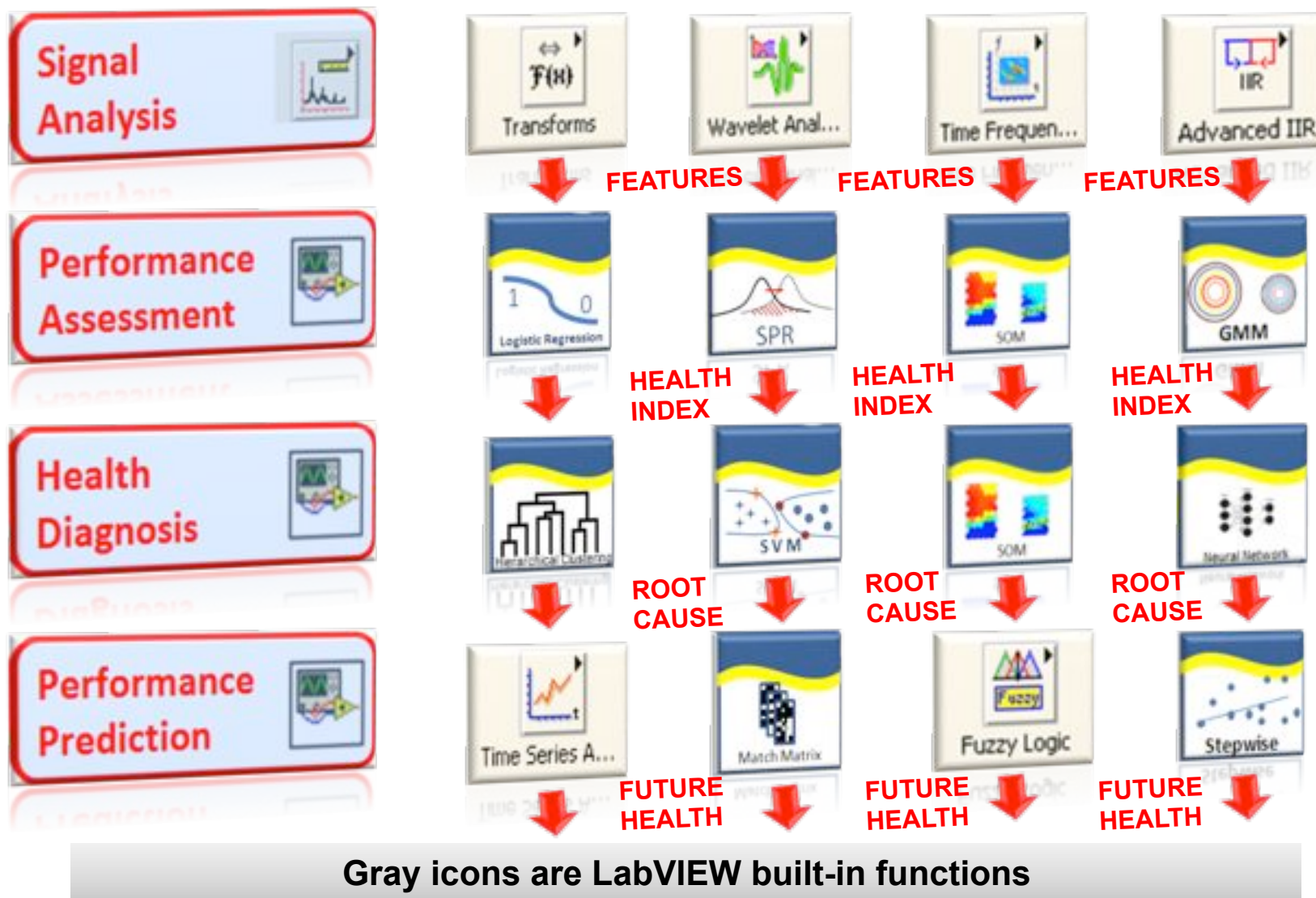
Gray icons are LabVIEW built-in functions

Global Industry Partners (80)

IMS — CENTER FOR INTELLIGENT MAINTENANCE SYSTEMS

CANADA
• Syncrude

GERMANY
• FORCAM
• Siemens

BELGIUM
• FMTC

FINLAND
• Kone

KOREA
• Samsung Semiconductor
• Samsung (Electro-Mechanics

JAPAN
• Omron Corporation
• Nissan
• Hitachi
• Komatsu
• Mitsubishi Heavy Industry
• Toshiba Corporation

USA
• P&G
• NI
• Parker
• Goodyear
• Boeing
• GE
• Woodward
• API
• GCWW
• TechSolve
• Applied Materials (2)
• LAM
• TI
• Micron
• Canrig
• Raytheon
• Emerson
• Idaho Nat. Lab
• Ingersoll Rand
• Spirit Aerosystems
• 21st Century Systems
• Avetec
• Eaton
• Kistler

FRANCE
• Alstom

SPAIN
• Tekniker

TAIWAN
• HIWIN
• III
• PMC
• MIRDC
• Psi
• ITRI
• Delta Electronics
• Tongtai Machine Too

HONGKONG
• Metron Hongkong Ltd.

• SCK
• HRL
• Ford
• Intel
• Caterpillar
• BorgWarner
• Montronix
• Daimler-Chrysler
• Harley-Davidson
• Johnson Controls

BRAZIL
• CETA/ SENAI

• Chevron
• ETAS
• USPS
• Festo
• Cisco
• Coherix
• EDAptive

• Genex
• Toyota
• Inteligistics
• Prometec
• Rockwell

• Siemens TTB
• Bosch
• McKinsey & Co.
• United Technologies
• We Energies

CHINA
• CEPREI
• CEI
• Sinovel
• Beijing Shenzhou Software
• AITRI Shanghai
• Sany Heavy Industry

CHINA
• China State Ship Co.
• Dongling Tech
• Haier
• Shanghai Electric
• Bao Stell
• Saanxi Heavy Truck

IMS Major Impacts

1. Won PHM (Prognostics and Health Mgt) Data Challenges Competition for 2008 (1st and 3rd) ,2009 (1st, 2nd, 3rd), 2010 (3rd), 2011 (1st and 3rd), 2012 (3rd), 2013 (3rd, 4th, 5th).

2. Ranked the highest Economic Impacts (1:270) by NSF Economic Impact Study Report in 2012.

3. NSF ICorps Award (2012) for New Company Spin Off-Predictronics

4. NI for IMS License Trials started in Oct. 2011—NI Toolkit Official Global Licensing Will Start 2014.

5. 85% of IMS students joined IMS member companies (including GM, Boeing, GE, Siemens, Cummins, Caterpillar, Parker, Eaton, Goodyear, FORCAM, UTRC, Bosch, etc.)

Agility

Business Model

Contagiousness

Delivery

Excellence (Education, Execution, Energy, Entrepreneurship, etc.)

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