

# **Advanced Diagnostics & Prognostics Systems**

**Pete Rendek**  
VP Sales and Marketing

**Scientific Monitoring, Inc.**

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- **Evolution of Diagnostics and Prognostics Tools for Condition Based Maintenance (CBM) and Monitoring**
- **State of the Art**
- **What you can expect**
- **Integration with Maintenance Tools**

# Early Days of Engine Monitoring



9 November 2005

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# We Still Do That, Don't We?

- **Preflight Check**
- **Overnight Visual Exam**
- **Borescope**



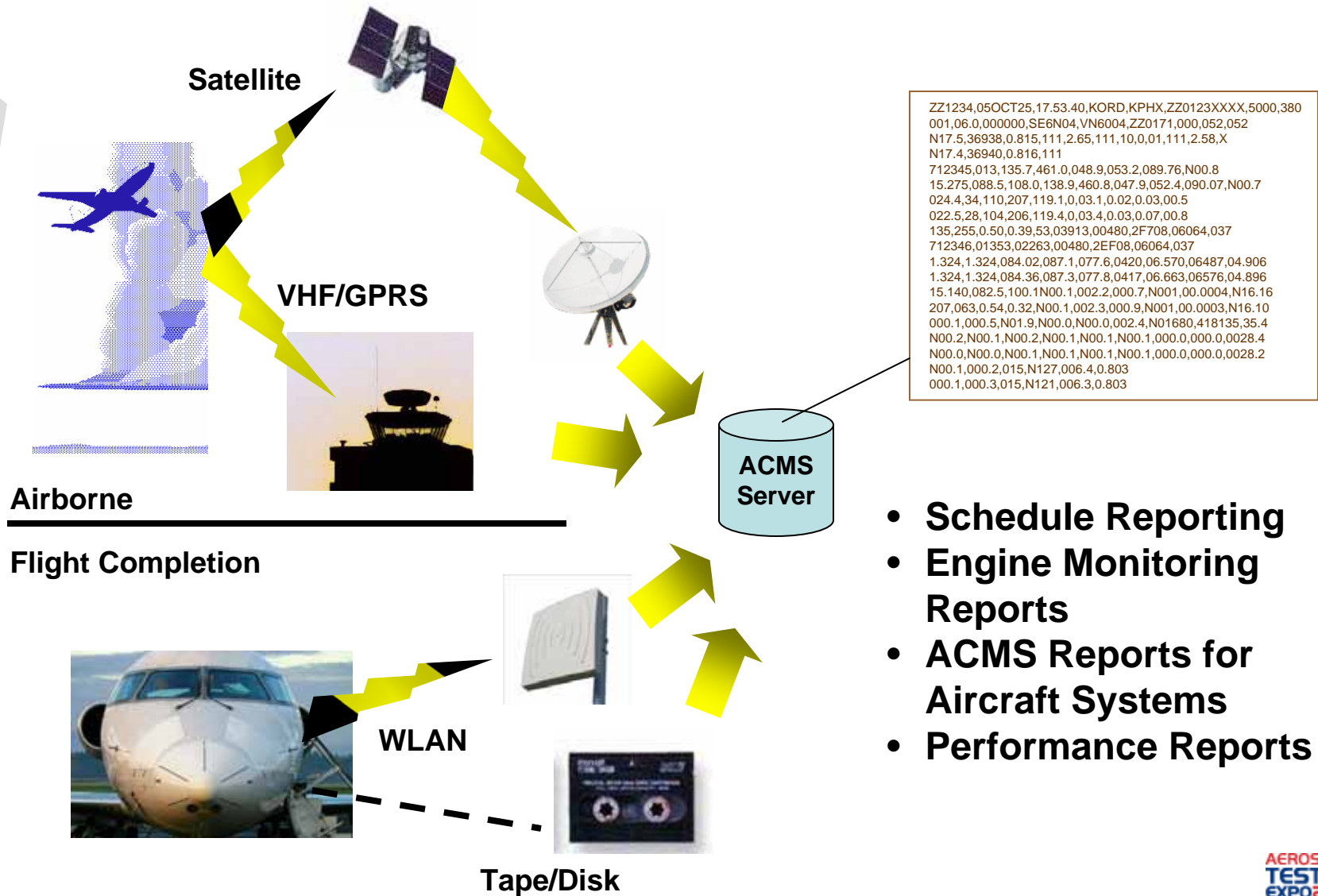
## Why?

- **Undetectable damage**
- **Leaks**
- **FOD – visually observable damage**

## The Goal is ...

- **Early detection of impending problems**
- **Effective corrective actions**
  
- **Can science & technology help?**

# Aircraft Data Acquisition Today



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- Schedule Reporting
- Engine Monitoring Reports
- ACMS Reports for Aircraft Systems
- Performance Reports

# CBM Tools For Processing Data

Logistics

Decision Support

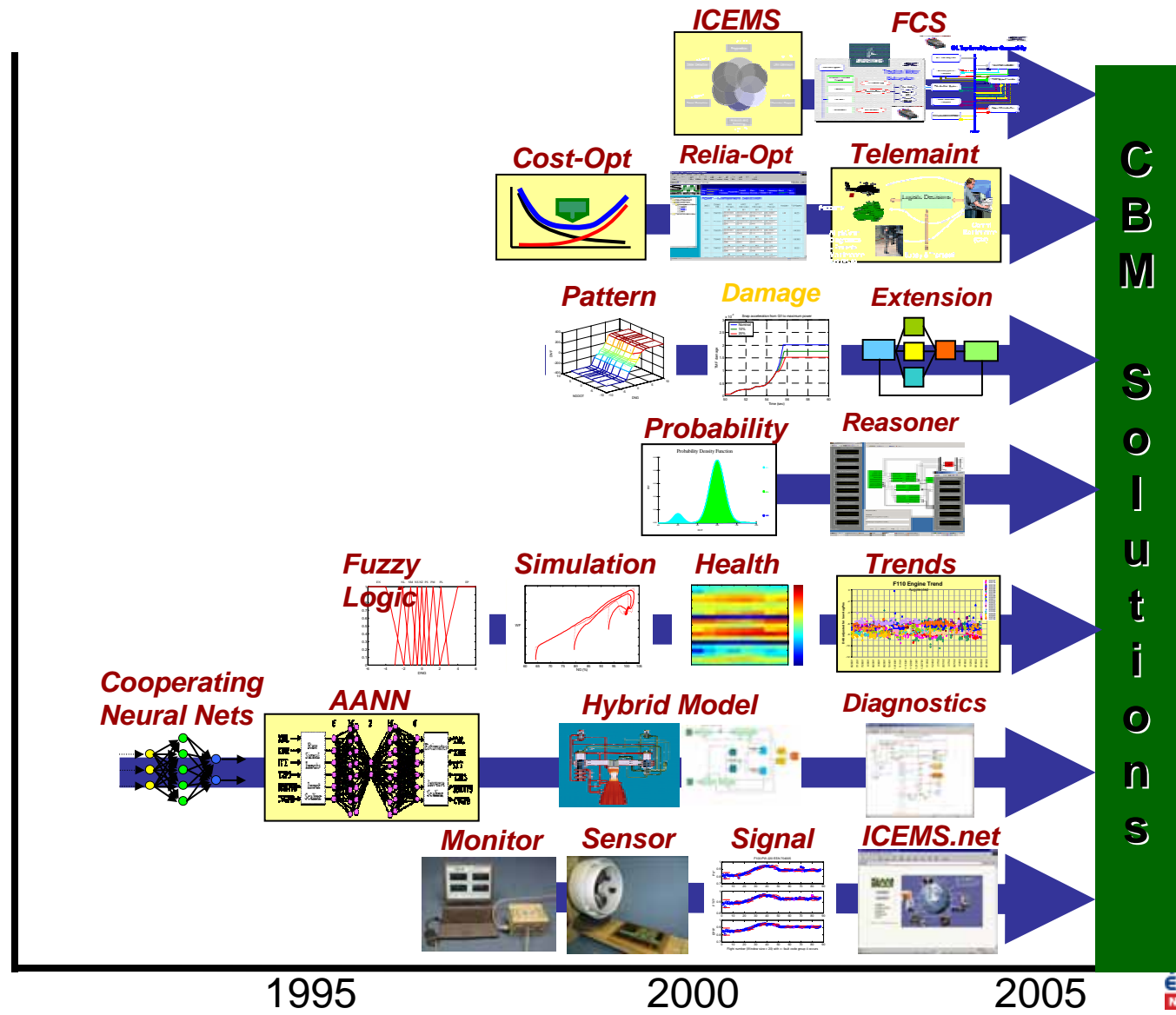
Life Extension

Prognostics

Assessment

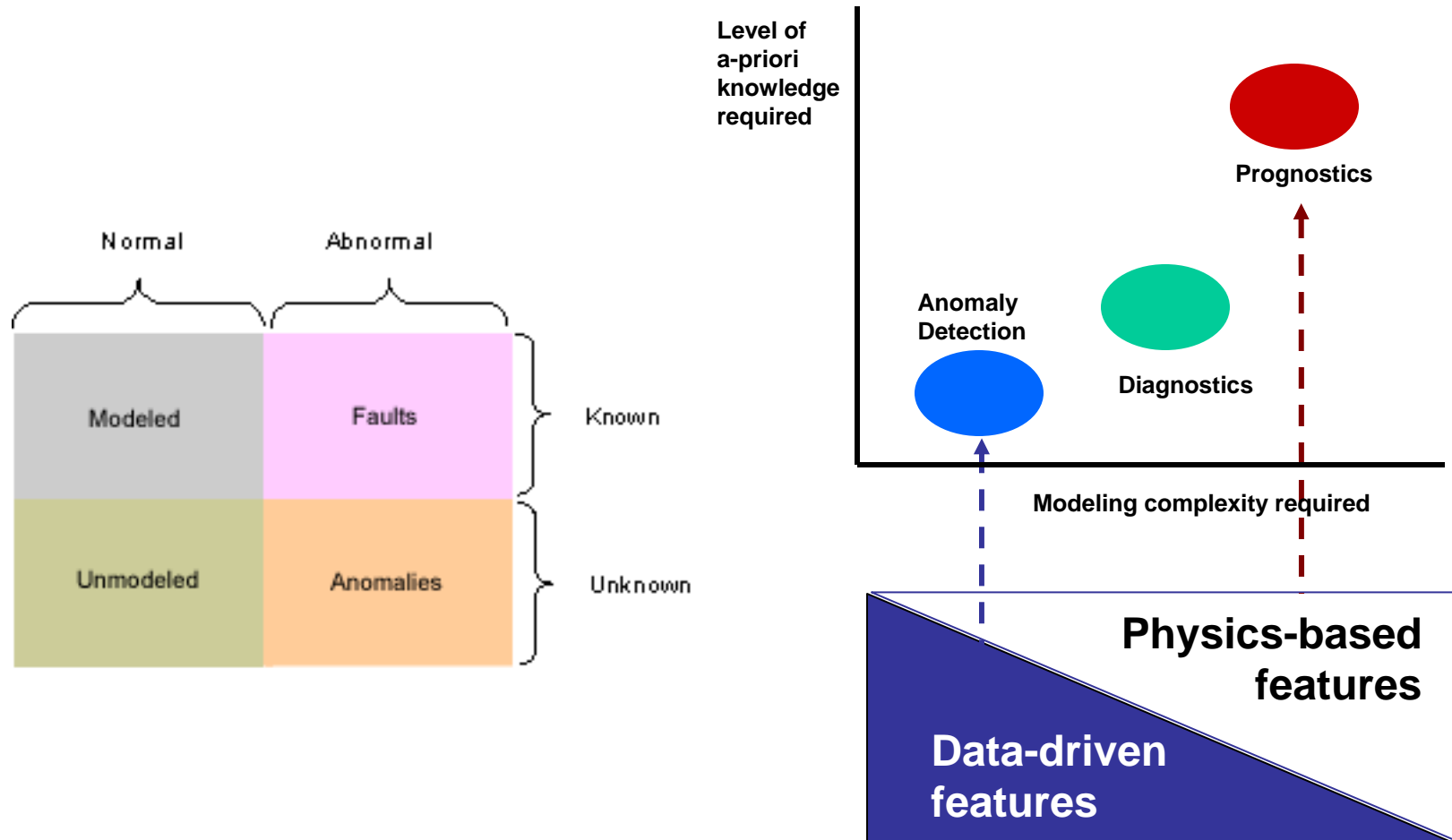
Detection

Data Management



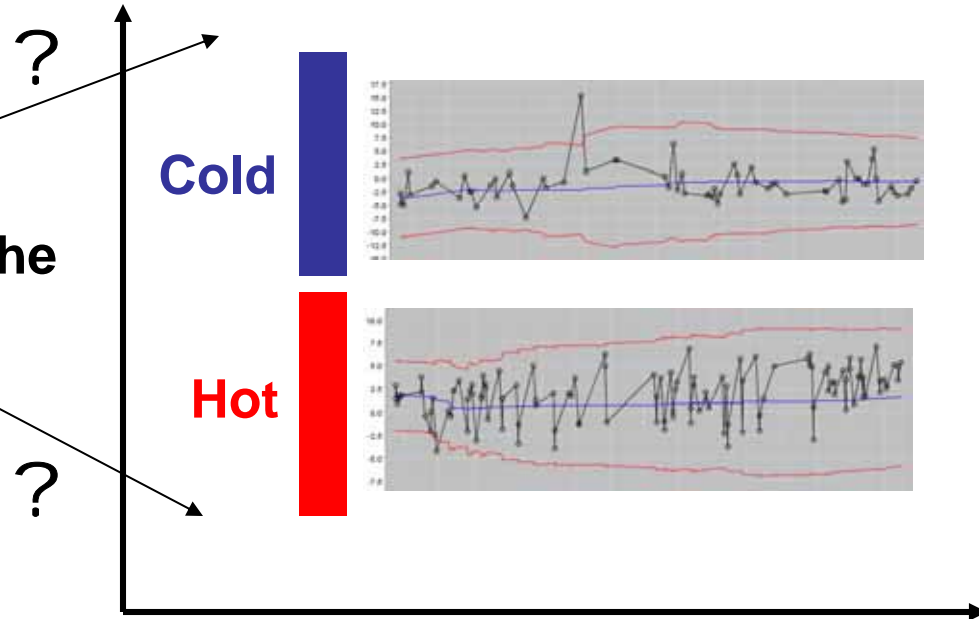


# Physics-based Modeling Approach Provides Superior Results



# A Hybrid CBM Modeling Approach...

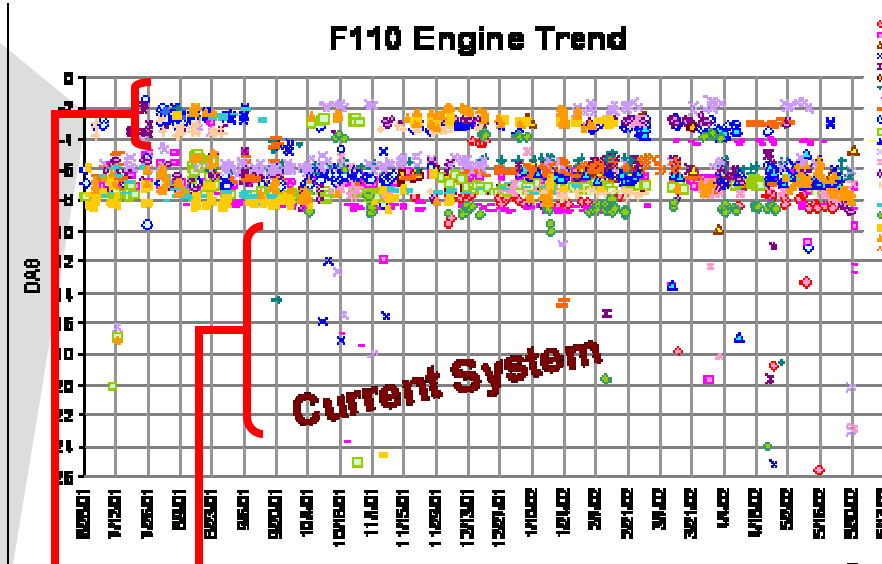
In an oil pressure system, where would you set the upper and lower warnings?  
 What about shaft speed?



- Rationalizes (normalizes) many outliers
- Improves 'signal to noise'
- Significantly better model fidelity
- Results in much higher alert confidence
- Only way to true prognostics



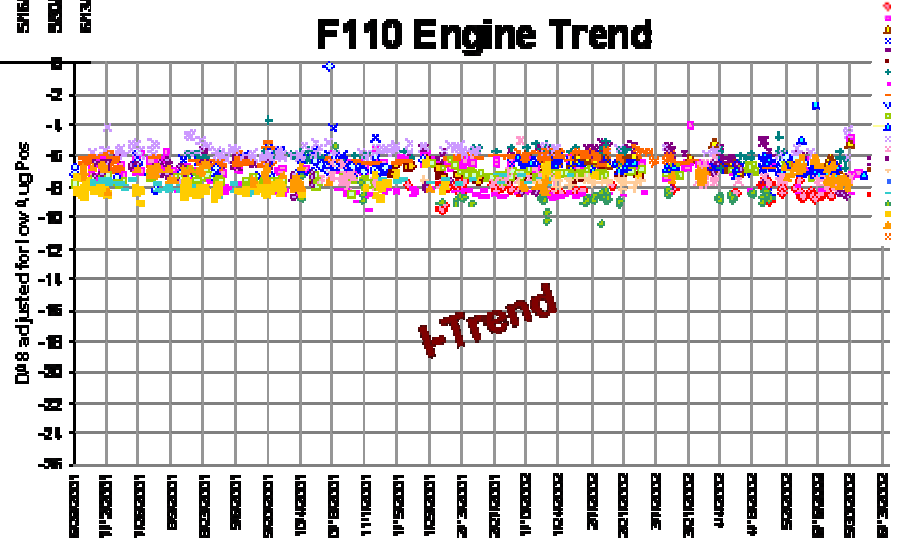
# Reduces Scatter & False Alarms



**'Outliers' – with valid reasons for variation**

**Valid alarms mixed in with outliers**

- SMI's approach & technology is unique and patented
- Proven on aircraft and engines
- #1 in the industry based on test results by Boeing and USAF



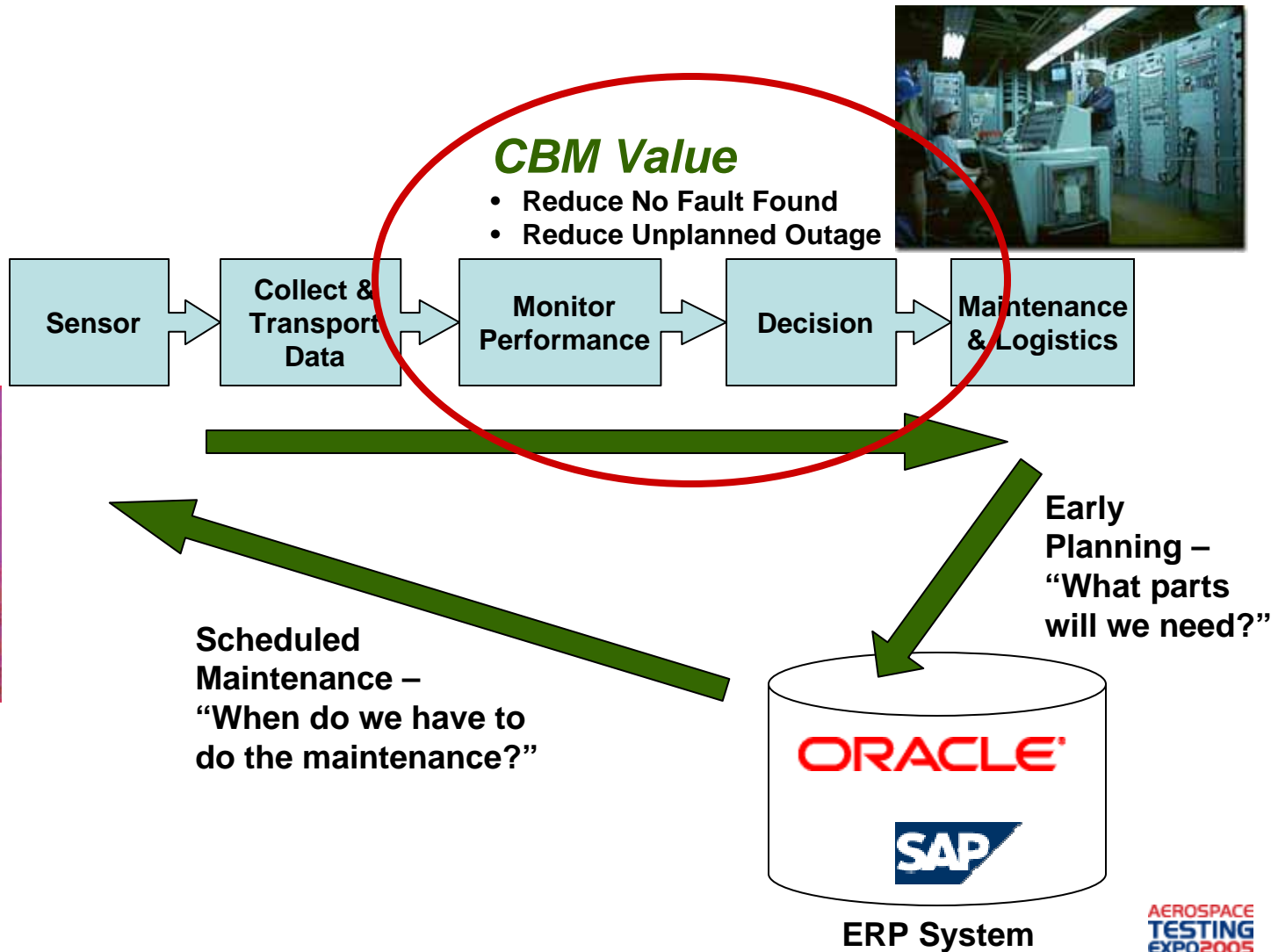
# A Suite of CBM Tools is Needed

- **Open system CBM (Condition Based Maintenance) architecture.**
- **Web-based, multi-layer, distributed platform.**
- **Modular, scalable analytical tools.**
- **Connectivity to back-office tools.**
- **Adaptable to existing monitoring system.**
- **Local or remotely hosted options.**



# CBM is Integral to Business Processes

## Application

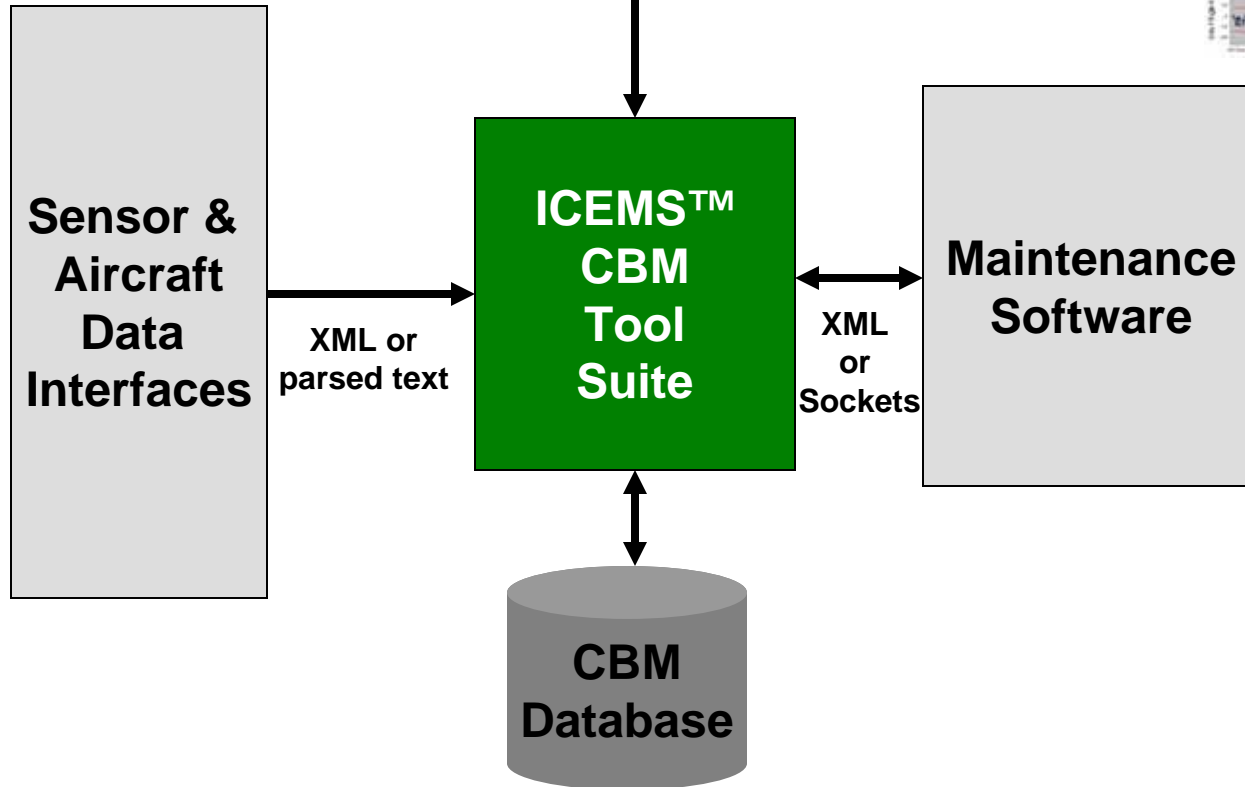
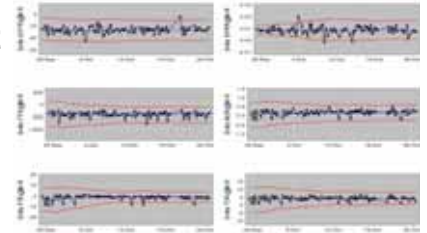


# CBM Requires a Flexible Architecture



**User Interface**  
*(Web, Existing Enterprise UI, Application interface)*

- Trending
- Alerting
- Watchlist



- **A physics based CBM modeling approach is the best way to ‘clean up’ your data and manage your assets**
- **It’s the only way to get to truly automated asset management processes**
- **A hybrid approach enables prognostics - the way of the future**