



## Automated Diagnostics and Prognostics for Aging Aircraft Structures and Wiring Systems

SAE DoD Conference – Reno, NV – October 2002

# Agenda

- **Issues with Aging Aircraft  
(Wiring and Structural Systems)**
- **Aging Starts at Delivery**
- **The Enablers for Life Cycle VHM**
- **The Benefits**

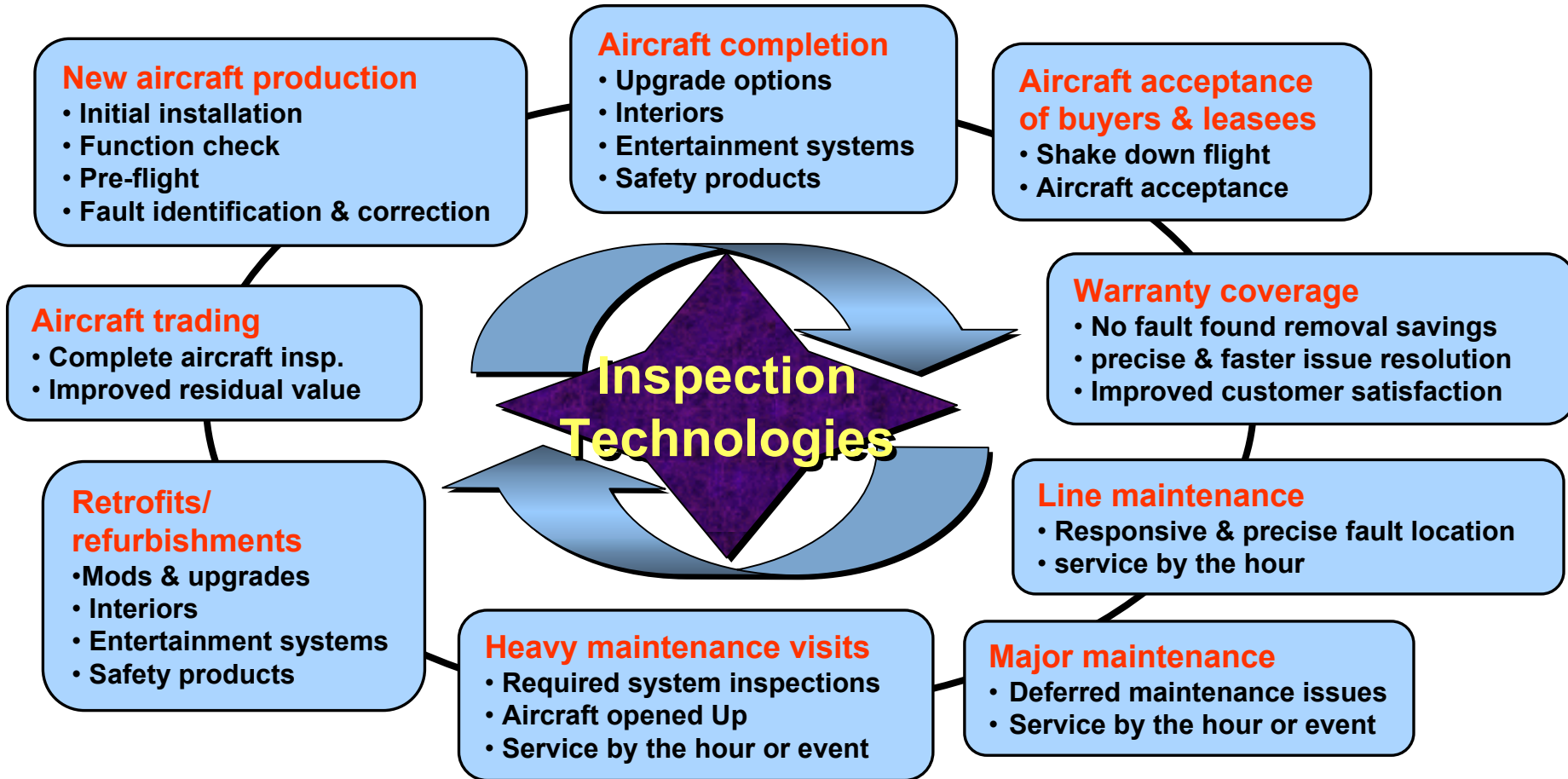


# Economic Drivers for Predictive and Automated Inspection Technologies

- **Aging Wiring is a concern:**
  - High priority at FAA
  - High priority at DoD JCAA
- **TWA 800 and SR 111 investigation reports by NTSB strongly suggested actions by FAA**
- **FAA created a working group (ATSRAC) in 1999**
- **NPRM due April 03**
- **AC/SFARs... due 2005**
- **ATA created sub chapter 97 to log wiring defects**
- **More than 1,000 smoke in cabin incidents reported in 2000**
- **Wiring related costs estimated to be 10% of airframe maintenance**
- **Structural testing is a growing concern with new and aging fleet:**
  - High priority at US Navy (Corrosion)
  - High priority at USAF (Composite)
  - Concern at FAA (Composite)
- **DoD/FAA created the Joint Council on Aging Aircraft to combine efforts on R&D toward automation, prediction...**
- **Drive to:**
  - Reduce human factor of inspections
  - Reduce inspection requirements
  - Enhance composite detection capabilities
- **Inspection costs estimated to be 20% of airframe maintenance**

# Not Just an “Aging” Issue

## Aircraft life-cycle requirements



*Aircraft are aging the day they enter service – Technology based tools can be implemented to monitor their health, predict failure modes, and plan for maintenance more effectively*

# Honeywell Advanced Diagnostics & Prognostics Services

## Nova Wire Integrity Program™

**The Problem:** Aging takes a toll on aircraft **wiring systems**, causing aircraft down-time, no-fault-found component removals, and safety hazards.

### The Solution:

- Prognostics & diagnostics software
- Portable testers that can plug into one end of the cable and diagnose faults location with high accuracy.
- Saves on direct maintenance costs & Improves safety



**In Production - Awarded a program with USAF/FAA started 5/1/02**



## SAM™ - Structural Anomaly Mapping

**The Problem:** Aging takes a toll on **airframes**, causing aircraft down-time, not easily discerned structural defects in metal & composites, and safety hazards

### The Solution:

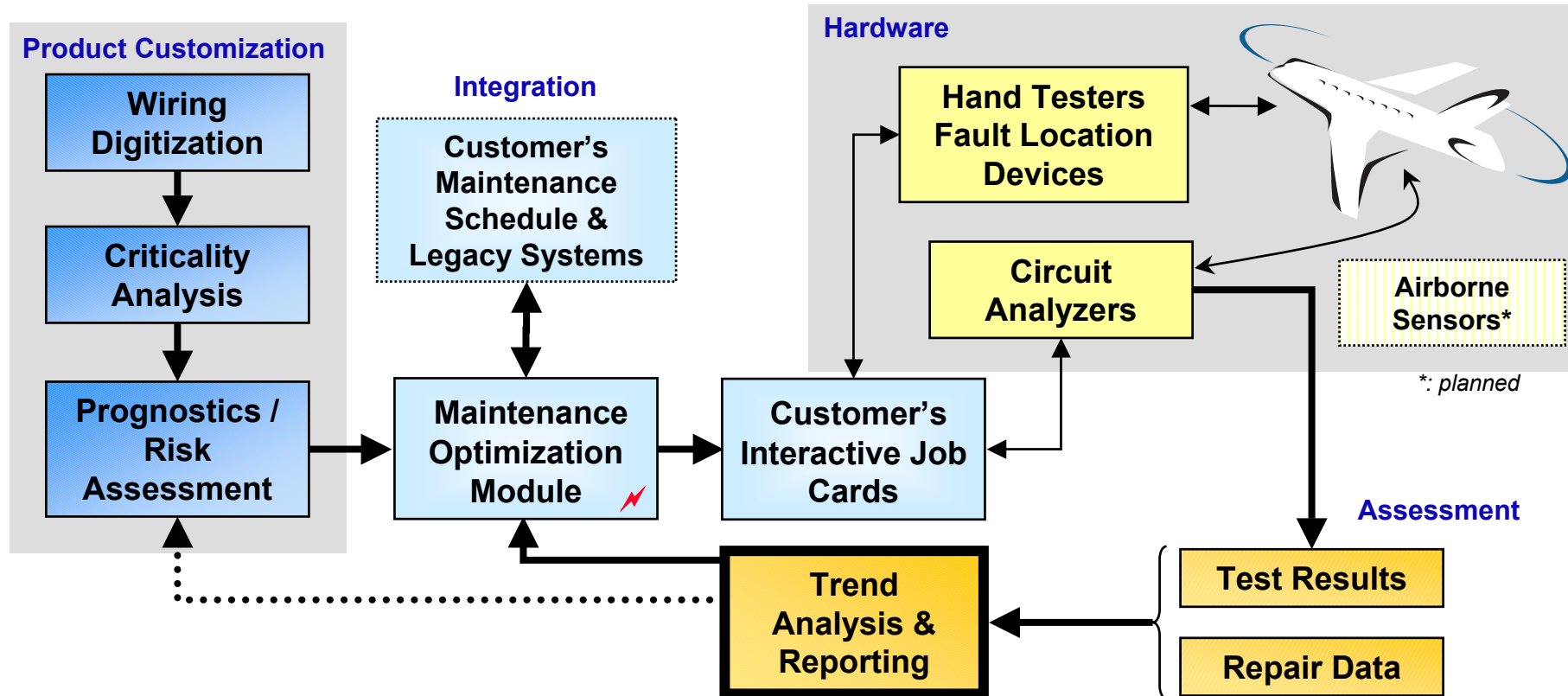
- Integrated suite of prognostics & diagnostics software
- Robot driven technology
- Replaces labor-intensive, outdated NDT techniques
- Repeatable, High Accuracy
- Saves on direct maintenance costs & Improves safety



**In Development Stage – Working Prototype located in DC area**

**Available technologies using open architecture designs and COTS components**

# Synopsis of the Nova Wire integrity Program™



- Initial one time loading of parameters and attributes
- Tests take only minutes
- Fully automated
- Enables Enhanced Zonal Analysis ⚡

⚡ **Real-time criticality assessment and maintenance optimization through prognostics**

**Enables Entire Life Cycle Wire Integrity Management**

# Synopsis of the SAM™ System Architecture

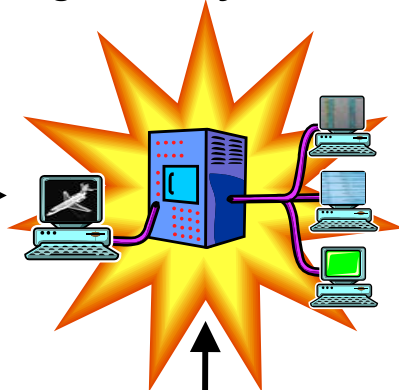
## Existing Maintenance Data

- Maintenance manuals
- Maintenance schedules



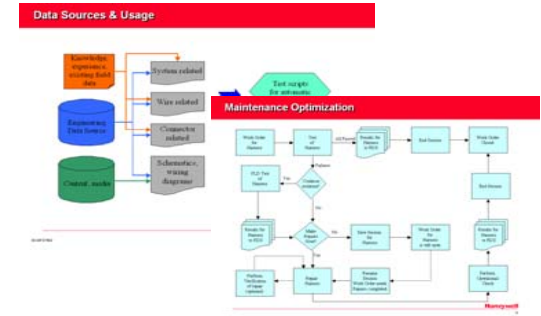
## SAM™ Database

- Location of measurement
- Comparison to expected and previous measurements on same and other aircraft in fleet
- Knowledge Management / Sharing with Supply Chain Management System



## Vehicle Health Monitoring

- In-flight sensor data
- Use/abuse data



## SAM™ Sensor Delivery Vehicle

- Operates autonomously based on SAM™ database model
- Operates sensors required by maintenance optimization module
- Acoustic, Eddy Current, etc.

## Maintenance Optimization Module (Shared with WIP)

- Analysis of trends
- Prognostics / Risk assessment
- Based on existing system approved by NASA, FAA, and DoD

***Enables Entire Life Cycle Structural Integrity Management***

# Key benefits of Advanced Diagnostics and Prognostics Technologies such as Nova Wire Integrity Program™ and SAM™

## 1. Progressive & proactive maintenance concept

- Determines probability of defects
- Enables preventive maintenance versus on-condition failures or delays

## 2. Enables accurate forecasting for inspections

- A predictable inspection process
- Minimizes the unknown element of inspection time

## 3. Quickly performs multiple tests

- Across multiple aircraft zones, multiple systems
- Performs highly technical tests not currently performed!

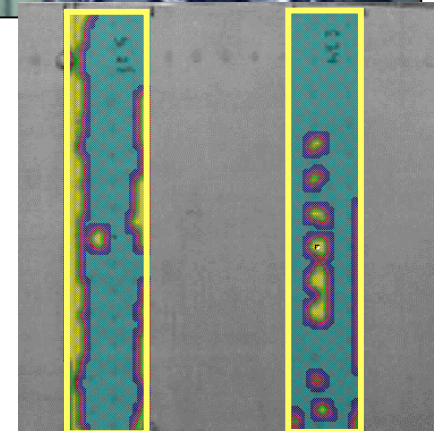
## 4. Offers In-depth Prognostics

- Advises of probability failures
- Archives data
- Generates fault reports
- Allows Trend Analysis

## 5. Fault location and state-of-the-art technology

- Identifies the location of defects accurately

## 6. Up to 20% direct maintenance cost reductions



# Questions & Contact Information

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