

NOVA WIRE INTEGRITY PROGRAM™
NOVA WIRE INTEGRITY PROGRAM™
NOVA WIRE INTEGRITY PROGRAM™
NOVA WIRE INTEGRITY PROGRAM™
NOVA WIRE INTEGRITY PROGRAM™
NOVA WIRE INTEGRITY PROGRAM™
NOVA WIRE INTEGRITY PROGRAM™

Overview of Nova - April 02

Agenda

- **Issues with aircraft wiring**
- **Overview of Nova**
- **Key features**
- **Nova benefits**

A demonstration of Nova is scheduled this afternoon



Nova Wire Integrity Program™ is an efficient, proactive & comprehensive Aircraft Wire Maintenance System

Issues with aircraft wiring

FAA emphasizing
wiring issues

The problem:

- **Aging equipment, environment, vibration & installation errors can take a toll on aircraft wire systems, which can result in:**
 - Aircraft down-time
 - Delays & cancellations
 - Unnecessary component removals
 - No fault found, no cause for rejection
 - Safety hazards
 - Shorts, sparks, open circuits, cabin smoke
- **Wire anomalies can occur during:**
 - Manufacture
 - Assembly / Integration
 - Operations
 - Maintenance



Probability of Aging Wire Anomalies Over Time

5 Years: 35%

10 Years: 52%

20 Years: 66%

Probability of Failure of the Worst Polyimide Insulated Wire in each USN P-3 "Aircraft Location vs Time" As of 5/7/95

Efficient mitigation
needed prior to flight

Need for a proactive & efficient system with state-of-the-art technologies!

The need for a wire integrity program

Factors Driving Aircraft Wiring Anomalies

Aging

- Changes in physical & chemical properties of insulation & conductors may affect:
 - Flexibility
 - Hardness
 - Tensile strength
 - Compressive & torsion strengths

Environment

- Effects due to geography and meteorology
 - Temperature
 - Humidity
 - Sun

Contamination

- Degradation of insulation with prolonged contact
 - Metal shavings from repairs
 - Exposure to fluids

Physical Abuse

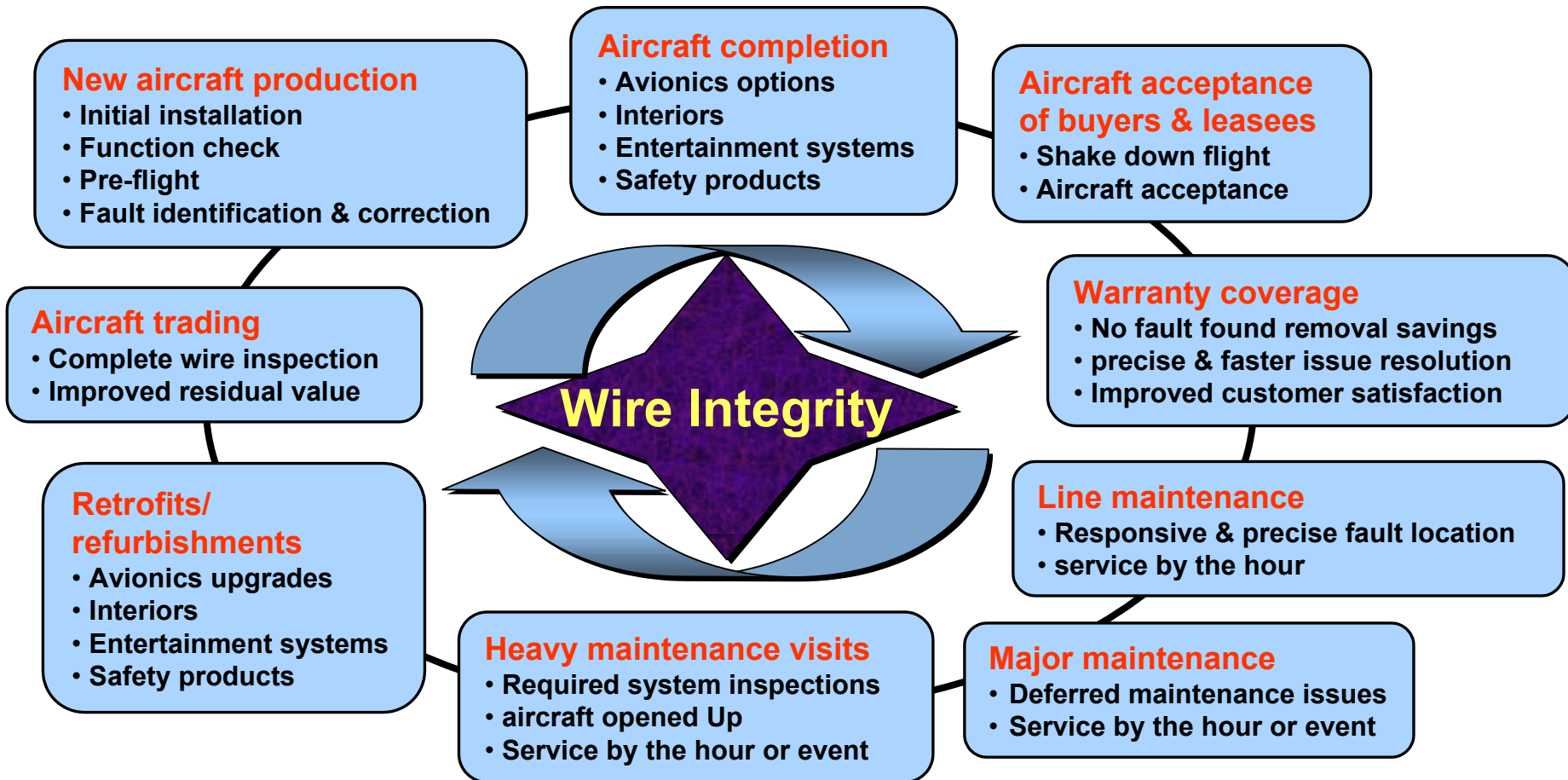
- Physical experience that degrade performance
 - Stepping on wires
 - Flexing or rubbing objects
 - Improper restraint

Cumulative Effects = Anomalies

Anomalies occur at all stages of the aircraft life cycle

Wire Integrity requirements during the aircraft's life-cycle

Aircraft life-cycle requirements



The magnitude of aircraft wiring issues is under estimated by the industry

Wire integrity is the next great frontier for the aviation industry!

Honeywell leads the team of industry experts who have developed the nose to tail Nova Wire Integrity Program™ (Nova). It includes hardware, software, and planning tools that perform intelligent wire testing and maintenance to save cost while improving aircraft safety and availability. The solution is ready today!

Industry leaders unite their expertise:

Honeywell



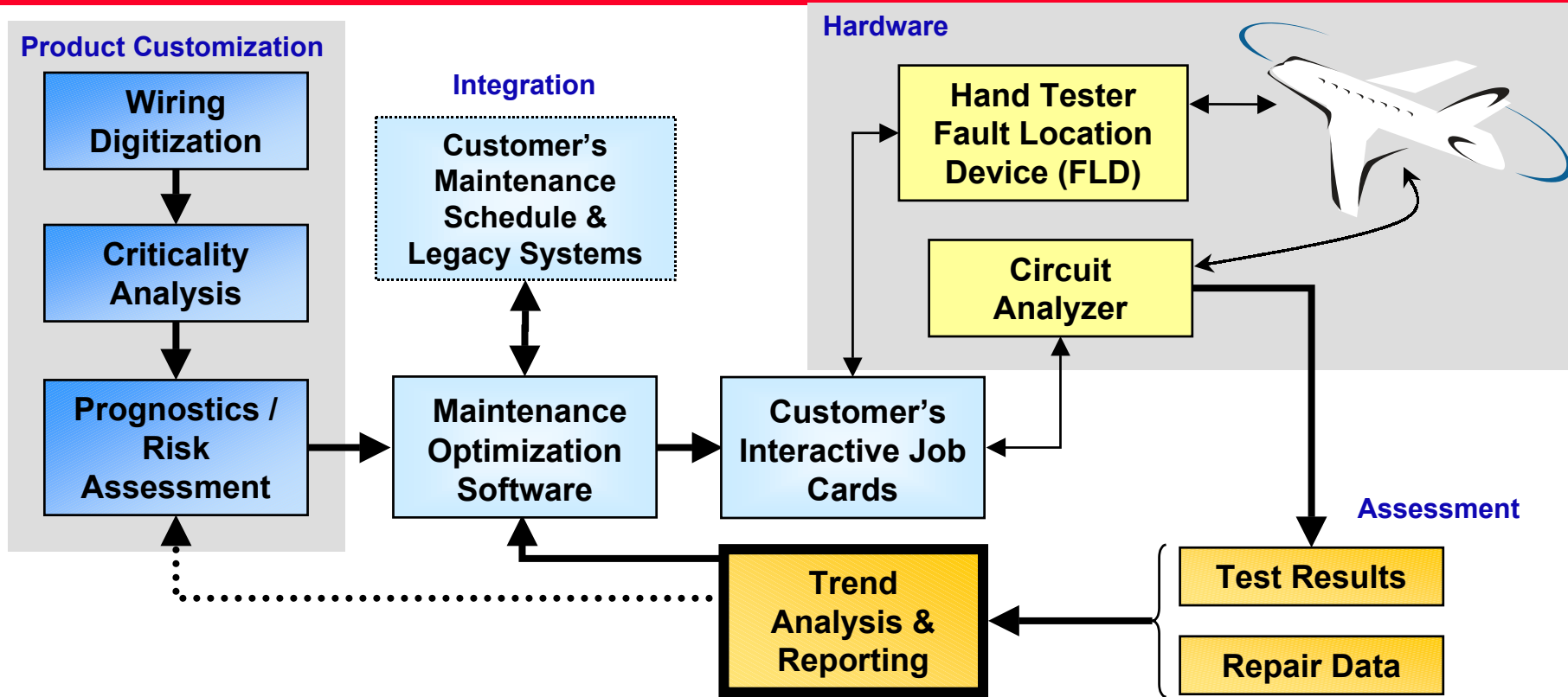
ITT-MCO International, Inc.



NORTHROP GRUMMAN

Nova Wire Integrity Program™ is an efficient, proactive & comprehensive Aircraft Wire Maintenance System

The need for a Wire integrity Program



- The software architecture enables Enhanced Zonal Analysis
- Initial parameters and attributes are loaded once (a matter of days only)
- Test planning automated and optimized in real time to account for schedule variations and availability of resources. Tests take only minutes.
- Trend Analysis, reporting, and prognostics are fully automated

Enables long-term wire management planning & scheduling

Implementing Nova takes only weeks!

Use of Honeywell's proven 6 σ approach: Define, Measure, Analyze, Implement and Control

- **Define** the scope of the program 1 ~ 2 days
 - ◆ AC type, locations...
- **Measure** the amplitude of the problem: 1 ~ 2 weeks
 - ◆ Data-mining maintenance records
 - ◆ Refine criteria based on operational profile
- **Analyze** the data 1 ~ 2 weeks
 - ◆ Most frequent systems isolated
 - ◆ Critical systems isolated
- **Implement** the solution 3 ~ 6 weeks
 - ◆ Model the systems in Nova's software <1 week
 - ◆ Design and order adapters <4 weeks ARO
 - ◆ Select, customize and order Nova HW/SW package <45 days ARO
 - ◆ Train users <1 week/group
- **Control** and monitor results by aircraft on-going
 - ◆ Reporting tools available within Nova



Zonal prognostication — a new era has begun!

Minimal data required from the user. The software automates most of the tasks

- Aircraft Type [Commercial, Military, Business...] & model
- Serial #, Instance name
- Date of Manufacture
- # of Flight Hours
- Target Zone
- Maintenance Activity in Zone [high, med, low]
- Harness revision, serial #, MFG date, installation date

- **Best Condition** – no action required
- **Good** – re-examine at next “C” check
- **Average** – continue to monitor
- **Below Average** – schedule action
- **Poor** – immediate attention needed

The FAA is working on EAPAS recommendations in that direction. A new ATA Sub-Chapter (97) will be created for wiring.

Why use advanced wiring analyzers?

Wiring analyzers perform multiple operations in a single test that are simply impossible to perform manually.

Wiring Analyzers Test More than Cables:

- Electrical harnesses
- Backpanels, backplanes
- Chassis & electrical racks
- Relay panels
- Control panels
- Products/assemblies with an interconnection network

Measuring, Recording
& Tracking the Health
of the Wiring System

The Nova Analyzers Can Perform:

- Circuit continuity test for open circuits
- Insulation resistance verification for short circuits
- Dielectric breakdown (hipot) tests
- Resistor, relay, diode and capacitor tests
- Switch & circuit breaker tests
- Precise fault location of wire problem
- Capture test results

15 lbs. & up

Portable

Integrated

The first totally integrated and customized industry solution using an open architecture to adapt and grow as required

Testing for anomalies

Comprehensive wire analysis:



Advanced Nova Test Capabilities

ANOMALIES

	Existing Visual Inspection	TDR	Continuity	Isolation	Hi-Pot (DWV)	Capacitance Measurement	Resistance Measurement	Conductive Fluid Scanning	WIDAS Test
Shorts	X		X			X			
Opens	X	X				X			
Damaged Insulation	S	S			X	X		X	
Damaged Conductor	S	S							
Damaged Shields	S	S							
Corroded Connector		S	S	S					
Fault Location/Interpretation	S	X				X	X	X	
Life Limit									X
Components/Configuration Check			X	X		X	X		

Available Q2/2002

Available Now

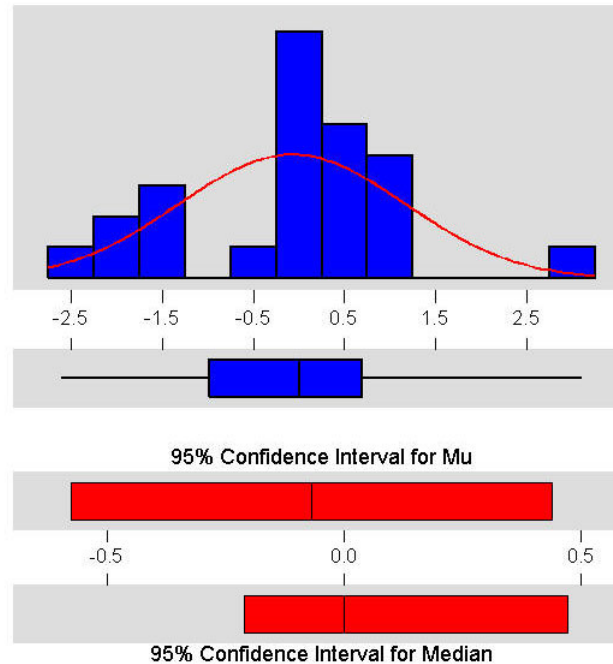
S = Some capabilities

No single piece of test equipment is capable of determining all potential anomalies

The accuracy of fault detection

- Honeywell chose a portable TDR based system after a thorough evaluation of 6 potential vendors and 2 technologies
- Our specifications are:
 - Opens and shorts
 - accurate within +/- 1 inch unloaded
 - accurate within +/- 3 ft loaded
- Most of the findings are within +/- 0.5ft loaded
- Digitized waveform can be captured and overlapped over time to detect trends (chaffing...)

Descriptive Statistics



Variable: Run 2 delta

Anderson-Darling Normality Test

A-Squared: 0.683
P-Value: 0.065

Mean -0.06920
StDev 1.23093
Variance 1.51518
N 25

Minimum -2.60000

Median 0.00000

Maximum 3.10000

95% Confidence Interval for Mu
-0.57730 0.43890

95% Confidence Interval for Sigma
0.96114 1.71241

95% Confidence Interval for Median
-0.21028 0.47208

Opens and shorts can be located with a high degree of probability from one end of the wire only without disconnecting the other end in most cases

Detail comparison of package offerings

Honeywell's Nova Packages

Wire Integrity Offerings

	Silver	Gold	Platinum (Turnkey)
Engineering Services			X
- Wiring Diagrams Digitization			X
- Test Program Engineering			X
Circuit Analyzer (capable of up to 5000 tests a minute/1000 points of switching)	X	X	X
- Circuit Analyzer connectors and cables	X	X	X
- Stand Alone Fault Location Device	X	na	na
- Integrated Fault Location Device		X	X
- Fault Location Device connectors and leads	X	X	X
Thin Server Client Based Architecture Including One Computer per Station		X	X
- Stand Alone Computer	X	na	na
- Local Area Network (LAN) Based Architecture		X	na
- Internet Ready Solution			X
Integrated Wheeled Cabinet (Including Storage for Baseline Connectors)	X	X	X
Digitization and Record Keeping Software	Stand Alone	Network	Web Based
Integrated Maintenance Management Software		X	X
Integrated Prognostics/Risk Assessment		X	X
- Basic Prognostics/Risk Assessment		X	na
- Interactive Prognostics/Risk Assessment		Option	X
Training	X	X	X
Warranty 1 Year	X	X	X
On-site / On-line Support	Limited	Limited	X
Maintenance Plan			X
Upgrade Software / Hardware for the Life of the Contract			X

Stand alone, network or web-based solutions customized to your needs

Key benefits of the Nova Wire Integrity Program™

1. Progressive & proactive maintenance concept

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

2. Enables accurate forecasting for wire inspections

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

3. Quickly performs multiple tests

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

4. Offers In-depth Wiring Prognostics

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

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

- Identifies the location of electrical faults within inches

6. Direct maintenance cost reductions



Offers significant efficiencies & comprehensive testing across miles/kilometers of wiring

Nova Wire Integrity Program™ benefits summary

Do You Know:

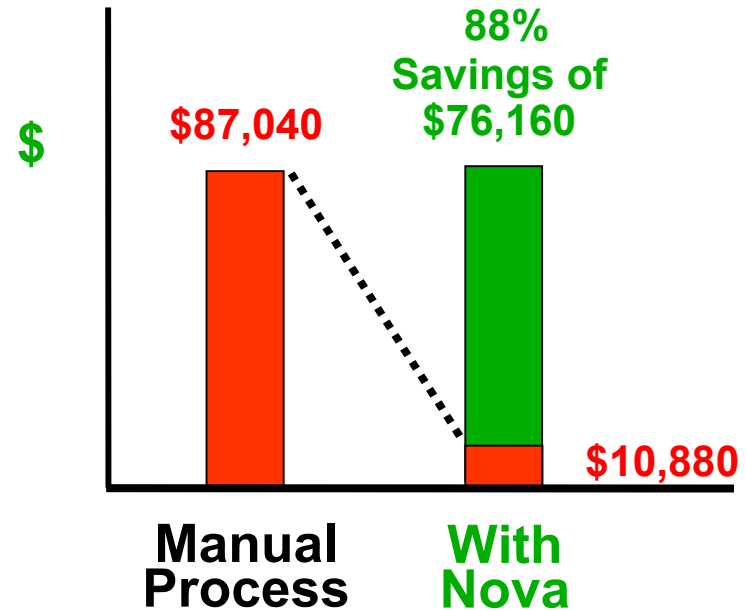
- Your current wiring maintenance costs?
- What savings can be expected?
- How this would all work?
- How much of an investment would be required?
- What is the ultimate value?

Savings means reduced...

- Inspection time
- Delays
- Cancellations
- MELs
- DMIs
- No Faults Found
- Unnecessary Repairs

Trouble Shooting Time Costs

For an Average Narrow Body Aircraft Over Four Years



Based Upon a Complete Aircraft Wire Inspection Every Four Years