AIAG
2004 AUTO-ID SHOWCASE

The Need for Traceability

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Traceability May Be Best Defined
By What It Is Not

Logistics  Inventory  Tracking
Control  Movement

Product ID  Networks  Databases

Authentication  Reports  Auto ID
Technologies

But These Are Enablers in the
Environment Through Which a
Product Progresses
A Better Way To Look at Traceability Is:

As Two Words:

Trace Ability:

....or having the ability to determine the quality, quantity, characteristic, and course or development history of something...to its point of origin if required....*IT’S PEDIGREE*
Traceability of Critical Parts
Automotive and Aerospace

The Automotive Industry and Aerospace Do Things Differently at Times and the Same Sometimes

The Automotive Industry and Aerospace Each Have Their Own Sets of Problems and Probably Would Not Want To Trade

But the Automotive Industry and Aerospace Make an Interesting Comparison

And It Was a Fun Story To Put Together

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# Traceability of Critical Parts  
**Automotive and Aerospace**

<table>
<thead>
<tr>
<th>Things in Common</th>
<th>Things Not in Common</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Transportation</td>
<td>● Acceleration and speed</td>
</tr>
<tr>
<td>● Six Passengers</td>
<td>● Cost</td>
</tr>
<tr>
<td>● Aerodynamic Styling</td>
<td>● Production Rate</td>
</tr>
<tr>
<td>● Destination Oriented</td>
<td>● Size</td>
</tr>
<tr>
<td>● Engines and motors</td>
<td>● President’s Vision</td>
</tr>
<tr>
<td>● Quality</td>
<td>● The Detail of Traceability of Critical Parts</td>
</tr>
<tr>
<td>● Traceability of Critical Parts</td>
<td></td>
</tr>
</tbody>
</table>

All Traceability Requirements Are Not Created Equal

But All Must Be Satisfied...For the Good of the Customer

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Traceability of Critical Parts
Automotive and Aerospace

Be Happy with the TREAD Act
It Could Be Worse

Using Aerospace Traceability Requirements, A New Pickup Truck:

Would take a month to build
Would cost millions
Could not carry the paper trail of traceability

UNIMAGINABLE!!!

But for NASA to survive in the Automotive Industry environment:

Could not start to deal with configuration management issues after vehicle delivery, shade tree mechanics, aftermarket suppliers, counterfeiters, knockoffs, junk yards.

UNIMAGINABLE!!!
Traceability of Critical Parts
It Could Be Worse

The Automotive Industry Could...

But...it isn't true is it?

You Already Have
Cassini Sent to Investigate
Automotive Industry Exploring New Markets
Traceability of Critical Parts
It Could Be Worse

The Aerospace Industry Could

Built-in Identifiers...

We Already Have

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New Delivery System Was Required
New SUV Was Produced
Revolutionary New Brake System

Revolutionary New Shocks, Too

Use Once and Discard

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Catchy Name—Mars Rover
"Land Rover" Already Used

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Traceability Requirements

Anyway, Welcome to the Club

Aerospace Had Traceability Requirements Since 1960

Traceability for Every Piece of One Vehicle
Every Few Years Has One Set of Problems

Automotive Had Traceability Requirements Since 2000

Traceability for Several Pieces of Thousands of Vehicles
Every Day Has Another Set of Problems

Each New Technology Will Make It Easier

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TREAD Act
Components/Systems to Report

- Steering
- Suspension
- Service brakes
- Parking brakes
- Engine and cooling system
- Fuel system integrity
- Power train
- Electrical system
- Lighting
- Visual systems
- Climate control including defroster
- Airbags and related components
- Seatbelts and related components
- Seat
- Engine speed control
- Integrated child restraints
- Latches
- Tires
- Wheels
- Trailer hitches

Can you imagine these systems and their components all serialized, tracked for life, configuration maintained when parts were replaced. When the system or component design life expired, the vehicle on which it resided would be held until the system or part was replaced.

Well, that’s Aerospace

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November 1, 2000
Transportation Recall Enhancement, Accountability, and Documentation Act (TREAD Act)

Ford Aware of Venezuela Tire Defect in 1998

- Safety: The auto maker and Bridgestone Firestone also are under siege from the Florida attorney general.

From Times Wire and Staff Report

CARACAS, Venezuela — Ford Motor Co. and Tuesday that its first report of problems with Firestone tires on Explorer sport-utility vehicles in Venezuela came in 1998, two years before it began replacing

Ford Had Data On Tire Safety, Records Show

By Kenneth R. Pollack

WASHINGTON — Ford Motor Co. documents indicate that company officials had data that Firestone tires installed on Explorer sport-utility vehicles had little or no margin for safety at high speed driving or the tire pressures Ford recommended.

The reports were part of a collection of documents that congressional investigators released late yesterday ahead of an

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Traceability of Critical Parts
Tragedy and Response

- Law Maker Response.... Legislate TREAD
- Auto Industry Response.... Use AIAG
- AIAG Sponsors AutoTech and Showcases
- Implementers of TREAD Attend Today
How Far Can You Go Nowadays Without Traceability

Not To The Moon Or Mars

Not Even Off The Launch Pad

Not Out Of Detroit

Not Even Off The Assembly Line
A NASA Lesson Learned

Trouble Starts

Where Traceability Stops

Or Was Never Started

Or Had Gaps

Or Records Were Lost

Or Parts Were Not Marked

Or ... Or ... Or...
Reasons for Traceability

Life Cycle Design and Testing
Service and Test Results Feedback
Items of Interest in Broad Use
Required Replacement of Bad Parts
Reliability
Safety
Or ... Or ... Or
Recall or Litigation

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Traceability of Critical Parts
Why It Is Important To NASA

• Design Safety Factor of 1.4+

• Continued Testing to Validate Safety Factor

• Fleet Leader Condition (What Is Failing)

• Where Are All the Parts Like the Failed One

• How Do Only the Bad Ones Get Replaced

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Traceability of Critical Parts Test for Life Extension

Learn to Test
Test to Learn
Failures Provide
Recall Information

This and other RSRM information compliments of:

ATK THIOKOL PROPULSION

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Elements of Traceability

As-Designed Database
As-Built Database
As-Maintained Database
Communication Network
Participant Dedication
New Part Identification
In-Service Part Identification
Part Authentication

Everything Working Together
Traceability of Critical Parts Requires a Reliable Database

- Prime Contractors Required To Keep Engineering and Configuration Databases NASA Has Complete Access
- Engineering Tracks Life and Condition of All Parts
- Configuration Tracks Location and Status of All Parts
- Pieces Are Traceable to Parts to Assemblies to Components --- And All to the Vehicle
Traceability of Critical Parts

Reusable Solid Rocket Motor
Traceability of Critical Parts
Traceability of Critical Parts

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Traceability of Critical Parts
Traceability of Critical Parts
Traceability of Critical Parts Starts with Identification

Part Numbers and Serial Numbers Identify One Part From the Other

CAGE Numbers Identify One Supplier from the Other

More Technology Is Needed To Identify A Genuine Part from A Counterfeit

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Automatic Identification Used at Many Levels

Bar Coded Labels That Are Adhered to or Printed on the Product

Direct Part Marked Visible Permanent Identification

Direct Part Marked Hidden Permanent Identification

RFID

Intrinsic Identification

All Technologies Must Work Together In the IT World.... Traceability Depends On Automatic Identification Working With Automatic Communication For The Right Results
Automatic Identification Choices

Bar Code Labels Are Cheap... Mature... Reliable... Widely Available Technology

Use Bar Code Labels Where You Can

But If There Is Not Room for a Bar Code Label... Use 2D

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Product ID Problems That Inhibited Traceability

- Direct Part Mark 2D Symbols
- No Contrast Marks
- Curved and Shiny Surfaces
- Distance Reads
- Symbols Covered with Paint
- Chemical Tags Not Used as Codes
So We Quit Complaining and Started Developing Solutions

Someone Has To Be First
Direct Part Marking
Direct Part Marking

NASA’s Primary Emphasis
....Item-Level Traceability
....Track the Piece

Left: 10x10 matrix symbol on the head of a straight pin

Below: 10x10 matrix symbol on the side of a turbine blade

Know the Pedigree
....Know who made it
....Know who marked it
....Know who stands behind it

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Automatic Identification Starting Points

All ID Must Work Together

Fuel Injector

Data Matrix

Human Readable

Turbine Blade

Space Shuttle
Main Engine

Bar Code

100796553

2500
Direct Part Marking Enables Life Cycle Tracking

Data Matrix Codes Marked On The Parts Provide The IT Link

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Additional Technology Enables Life Cycle Integrity

- Counterfeits Make a Look Alike
- Knock Offs May Not Even Look Alike
- Customer Blames OEM If Something Breaks
- Traceability Stops Where Cheating Starts
- Insurance Companies Should Love Traceability
Additional Technology Enables Life Cycle Integrity

Use the Technology Available to You

Cheat

Cheaters

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**Product ID and Authentication Family Picture**

**Read Through Paint**

**Magnetic**

**Intrinsic Identification Using X-ray Fluorescence**

**NASA Optical Scanner**

- For Visible Marks
- No contrast mark on smooth aluminum
- Shiny screwdriver

**Standard X-ray fluorescent detection range Titanium**

**XRF detection range using vacuum adds Aluminum alloys**

**Ultrasonic**

**Software converts to ASCII and code of choice**

**Detects silicon contamination**

**Detects elements used in Pharmaceuticals**

**New market leader for XRF**
Authentication Technologies

Intrinsic Identification

How does an OEM prove that the part that failed was not made by the OEM?

XRF authenticates the product

CAGE Code.....5 Element Tag

XRF converts formats and ties to bar and matrix codes

XRF converted format is transparent to IT systems

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Product Validation and Authentication

Automatic Identification Fully Integrated
(temporary to permanent to intrinsic marks for routine to the most secure product ID and validation matching)

Direct Mark

Magnetic

Ultrasonic

RFID

Five Levels of Auto ID Work Together Transparent to IT System
Blessed are the flexible—for they shall not be bent out of shape

Bar Codes... Visible 2D symbols... Hidden symbols...

XRF authentication... RFID...

If all you need is a piece of technology to make things work...
Find the right supplier and complete your mission

If you are just starting and need a lot of help......
Consider hiring a company that offers SOLUTIONS...
Integrates the pieces that make sense for you...
And holds your hand until it works
Traceability Summary
Automotive and Aerospace

● Traceability Enables TREAD Responses

● Reliable Databases Required

● Reliable Product ID Required

● Reliable Communication Networks Required

Life is NOT like a box of chocolates.
Life is like a jar of jalapenos.
What you do today
May burn your tail tomorrow!
Time to Load Up
and
Get Off the Stage
Thank You for the Detroit Hospitality