Getting Started with Spec2000 RFID

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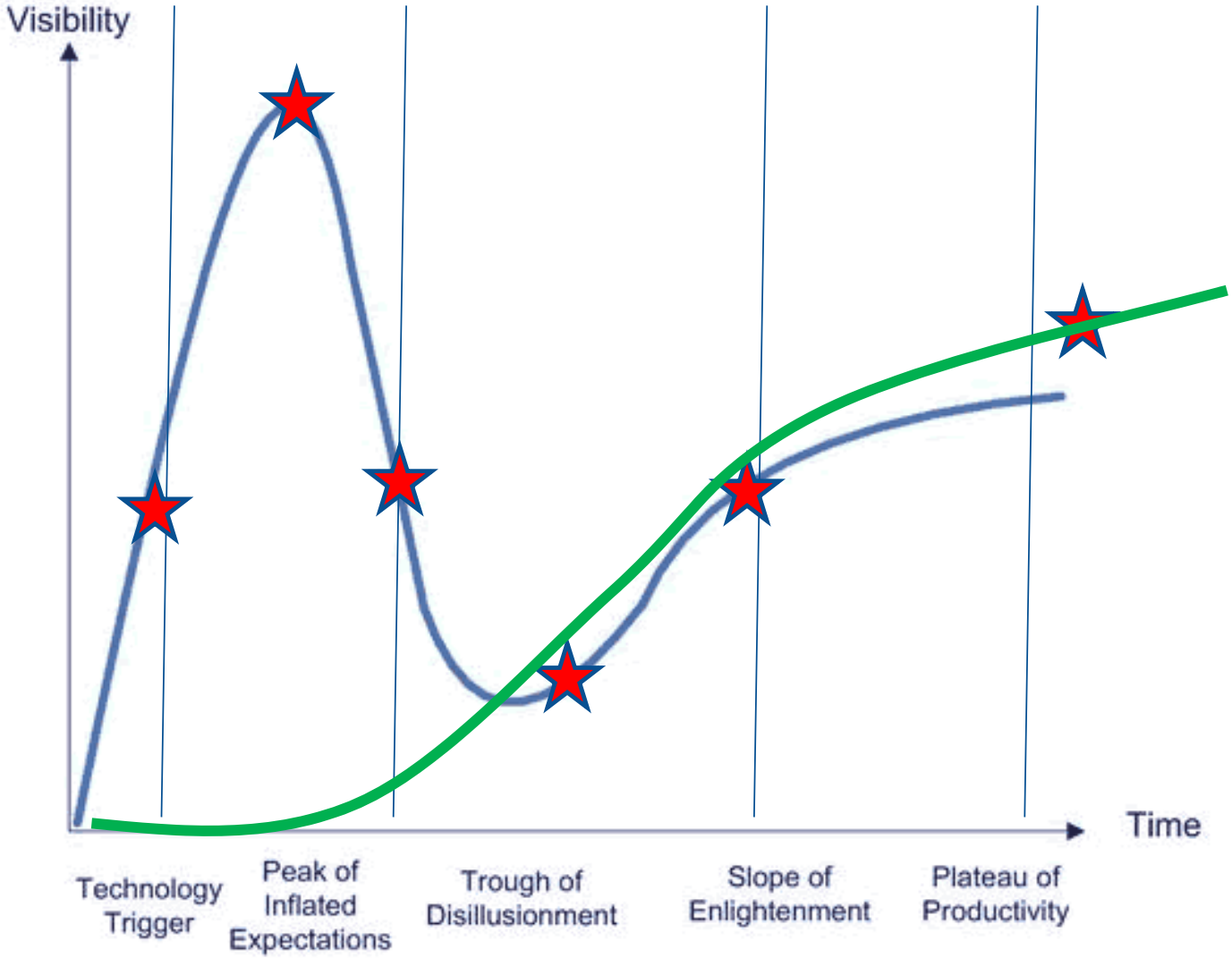
What happens if we don’t a good maintenance job….

If you are an engine manufacturer . . .

Where Is RFID Technology in Aviation?



RFID Sometimes it feels like this…

What Problem Are We Trying to Solve?

- Technology
- Business Data
- Business Solutions

RFID is Not All The Same!

✓**Passive Tags – used by EPC and Spec 2000**
- Tag powered by radio signal from reader
- Good Read Range (4 inches – 20+ feet)
- Approved for use on-aircraft,860 – 960 Mhz

Aviation standard

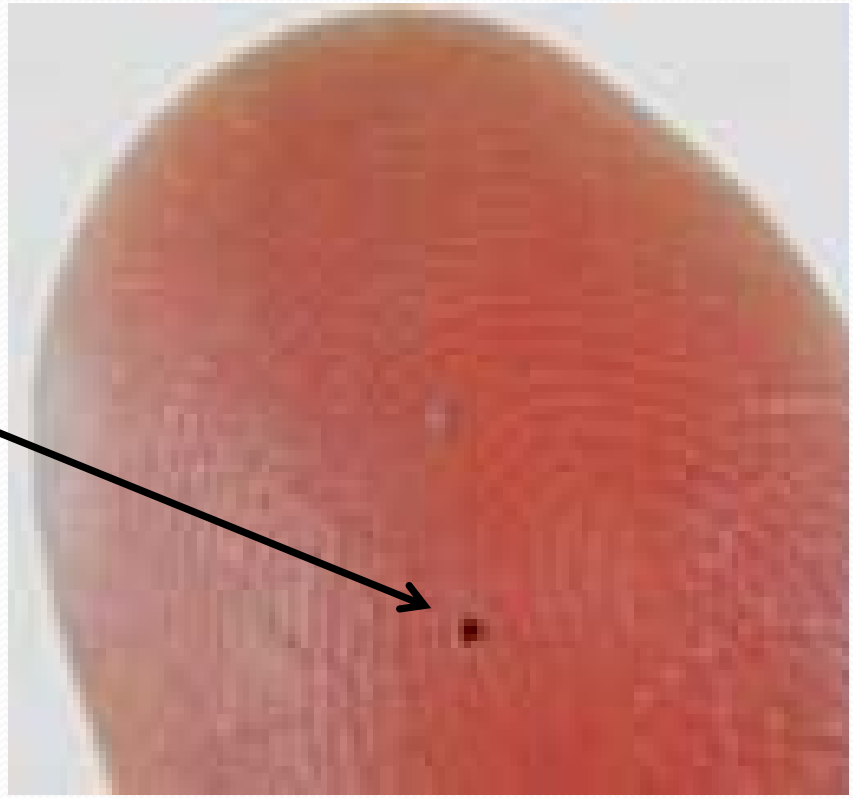
- **Battery-Assisted Passive Tags**
  - Tag powered by radio signal from reader
  - Battery only helps it listen for weaker signals
  - Good Read Range (4 inches - 20 feet)

- **Active Tags**
  - Tag transmits radio signal at regular rate (blink rate)
  - Battery powered memory, radio & circuitry
  - High Read Range (300 feet)
  - Not approved for on-aircraft use

- **But there's also WiFi tags, HF tags, LF tags, and GPS**

RFID Chip Size

This is it !



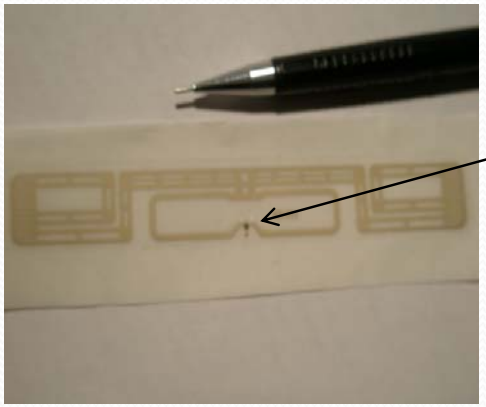
RFID Memory Sizes

512,000 bits

25 mm (2”)

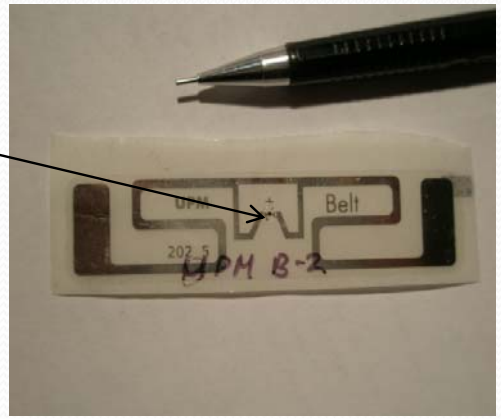
96 bits

12.5 mm (2”)

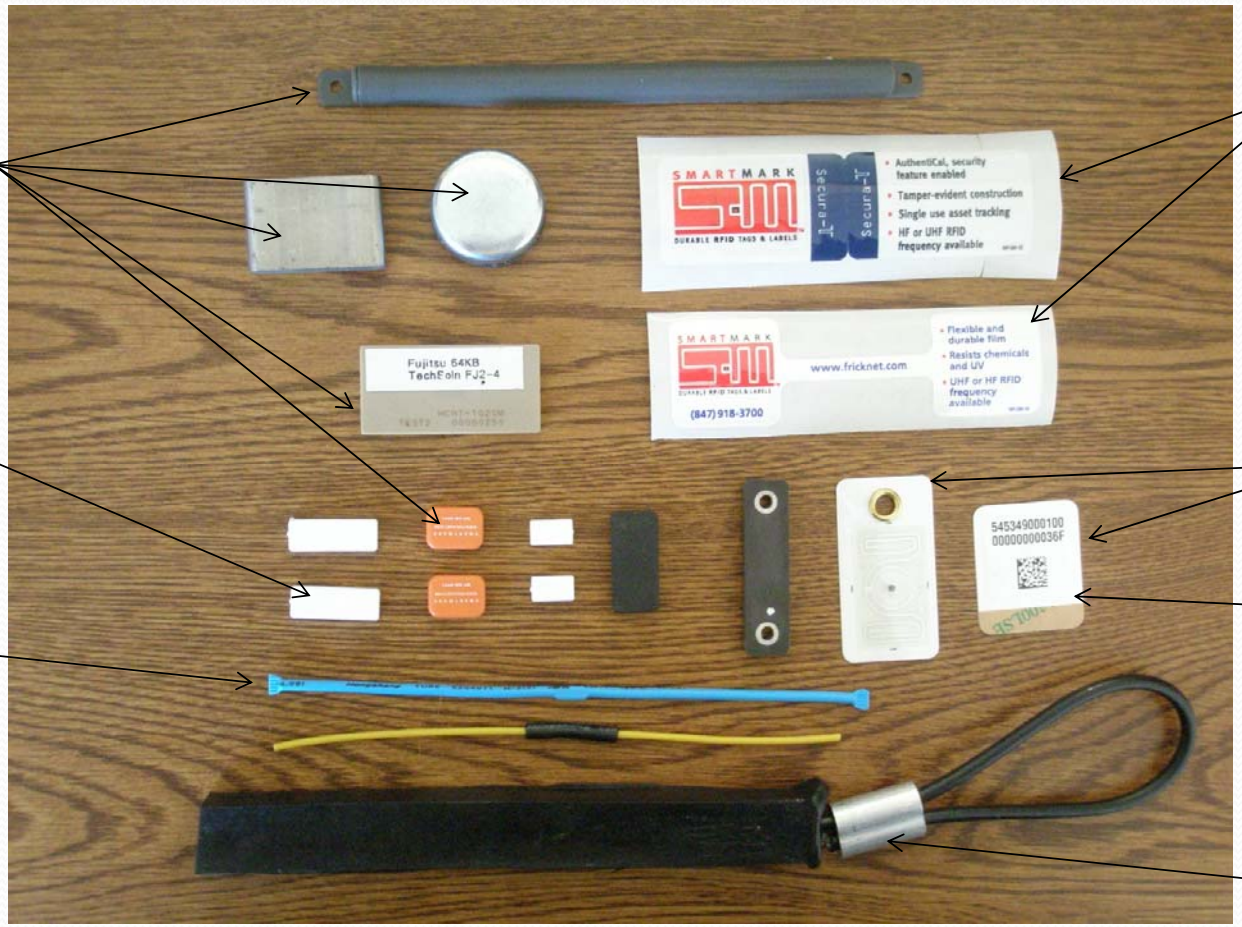


Here’s the RFID chip

512 bits



RFID Tag Shapes and Sizes



Metal-mount

Embed in fabric

Wire

Polyester

Plastic

IT Assets

Heavy Duty Rubber

RFID Tags for Aviation – 3 Sizes

- **Small**
  - Memory - 512 bits to 8k bits
  - ~83 characters to 1328 characters
  - Physical size: 0.5” x 3” → as big as you want it
  - Cost: $0.15 to $2.00 – quantity is important

- **Medium**
  - Size – 8kbits to 8KBytes
  - 1328 characters to 10,600 characters
  - Physical size: 1.0” x 4” → as big as you want it
  - Cost: $3.00 to $8.00 – quantity is important

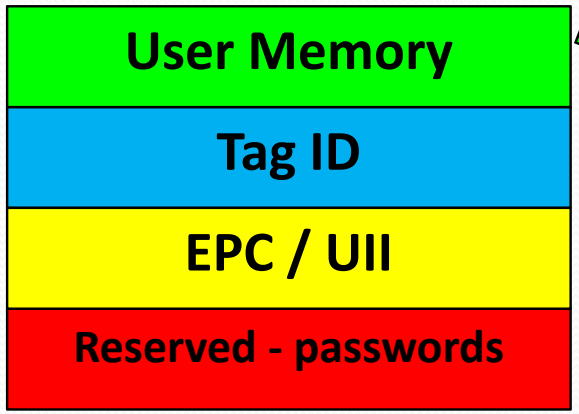
- **Large**
  - Size – 8 Kbytes → 64 KBytes
  - 10,600 characters to 85,000 characters
  - Physical size: 1” x 2”x 0.2” thick
  - Cost: $16 to $100 – quantity is important

Spec2000 RFID – standards-based

EPC C1G2 standard = ISO/IEC 18000-6C

→ Spec2000 Chapter 9 uses these standards

- standard readers
- standard tags



This is what Spec2000 is using that is different, but it is still part of the EPC standard!

- RFID “mindshare”
- cheap, 96-bit tags
- data is non-intelligible
- throwaway, shipping label for logistics

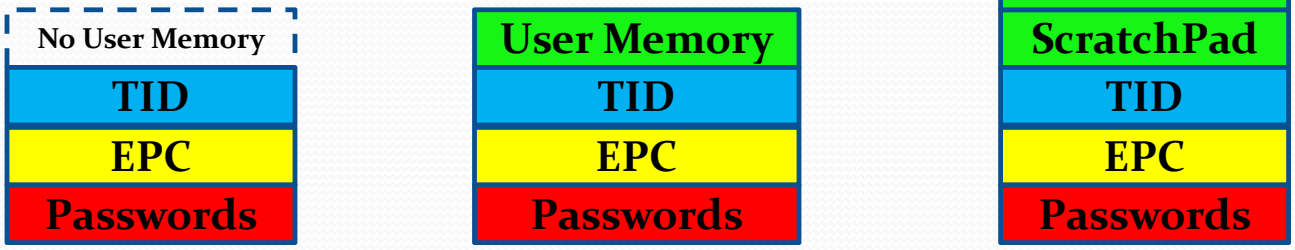
Old RFID vs. Aviation RFID

Aviation did this

The Standard

GS1/EPC Class 1 Gen 2
(=ISO 18000-6C)

Walmart did this



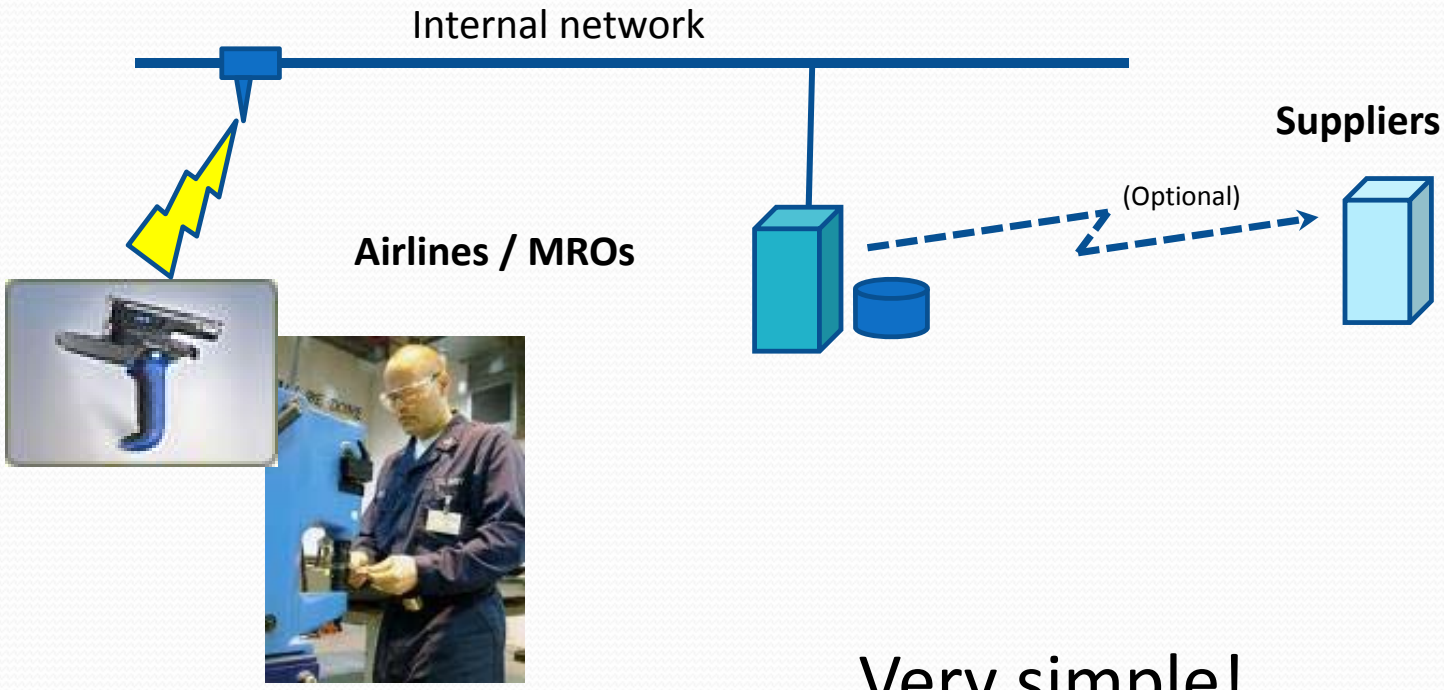
No-mem Tags
(e.g. shipping labels)

Low-mem Tags
(e.g. 512 bit User Memory)

High-mem Tags
(e.g. 8KB → 64KB)

Portable RFID Readers

ATA Spec2000 Infrastructure for Parts Marking



Very simple!

Low Memory Use Cases

- Generally used on expendable or consumable items:
  - Life vests
  - Oxygen bottles
  - Medical kits
  - Smoke masks
  - Flash lights
  - Seat covers
  - Anything that just needs a limited amount of data, like expiration date

What data goes in here?

- MFR = CAGE Code
- SER = Serial #
- PNR = Part #
- DMF = Date of mfgr.
- Other data important to you, e.g., EXP, LAC, etc.

Advantage of low-mem use cases:

- **Provides data where you had none before**
- **requires minimum changes to your business processes**

High Memory Tags

- Used on items that:
  - Are more expensive
  - Will have lots of maintenance history, e.g., rotables
  - Are more permanent and will last for a decade or more
  - Or, on items that you want more data about

Airbus has a requirement to RFID-tag parts on the A350 and RFID-tagged parts are being delivered to them currently

What data goes in here?

- **Birth Record** = 4 Mandatory data, 19 Conditional data elements
- **Current Data Record** = current Part # (PNR) plus short list of Conditional data
- **Part History Record** = 7 Mandatory actions (installed, removed, overhauled, etc.)
- **Mechanic Scratchpad** = freeform comments from airplane/bench mechanic

How to Get Started

- Hire a consultant short-term to get you jump-started
- Understand:
  - Common industry data definition found in the CSDD
  - Globally unique ID for every important part – a social security number for cradle to grave traceability (Chapter 9-4)
- Identify a business problem
  - Simple visibility of ‘when will my parts expire?’
- Buy a handheld RFID reader and some tags
  - Play with reader and different tags in different environments

Spec 2000
Functional and Data Architecture

The Foundation is there!

Legend:

Existing Standards

'In-Process' Standards

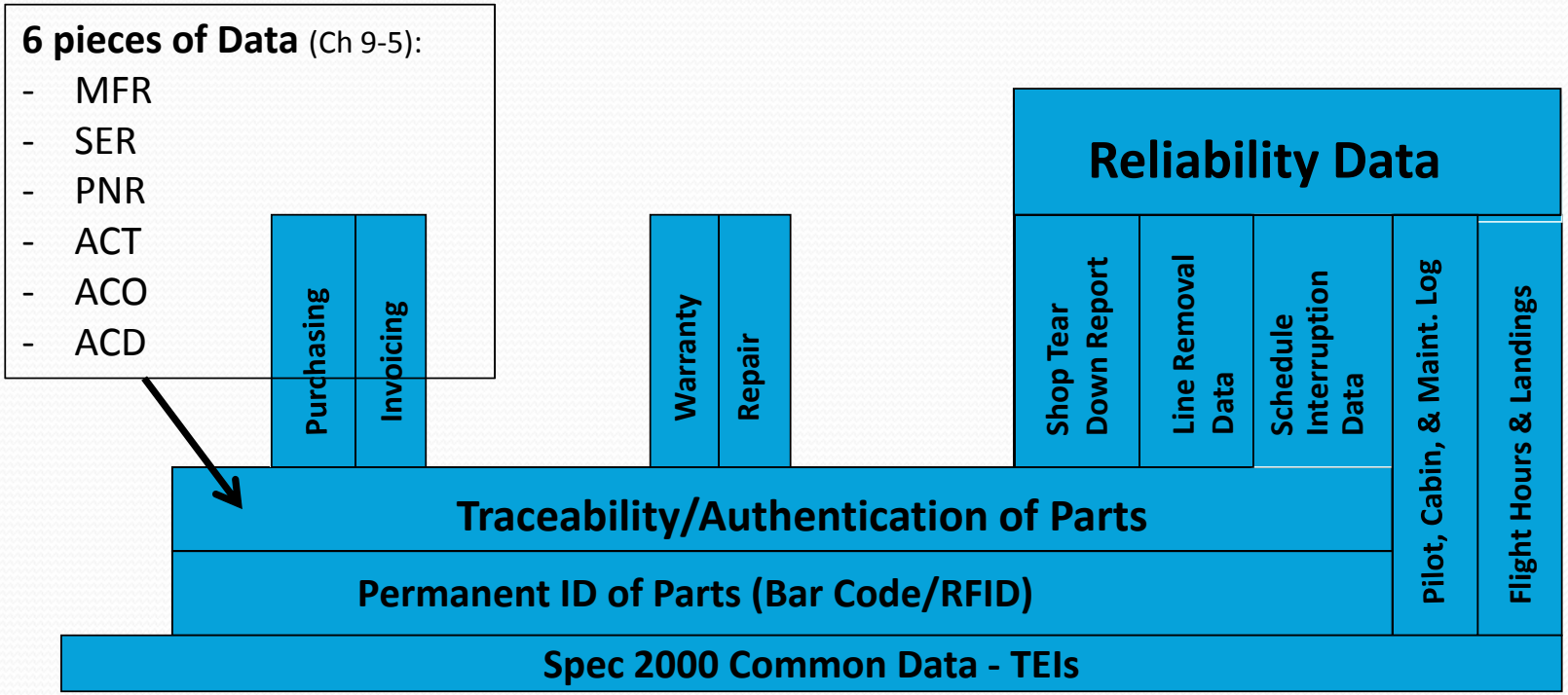
Future Standards

Jon Andresen, President

Rev: Mar 2009

Spec2000

Functional and Data Architecture



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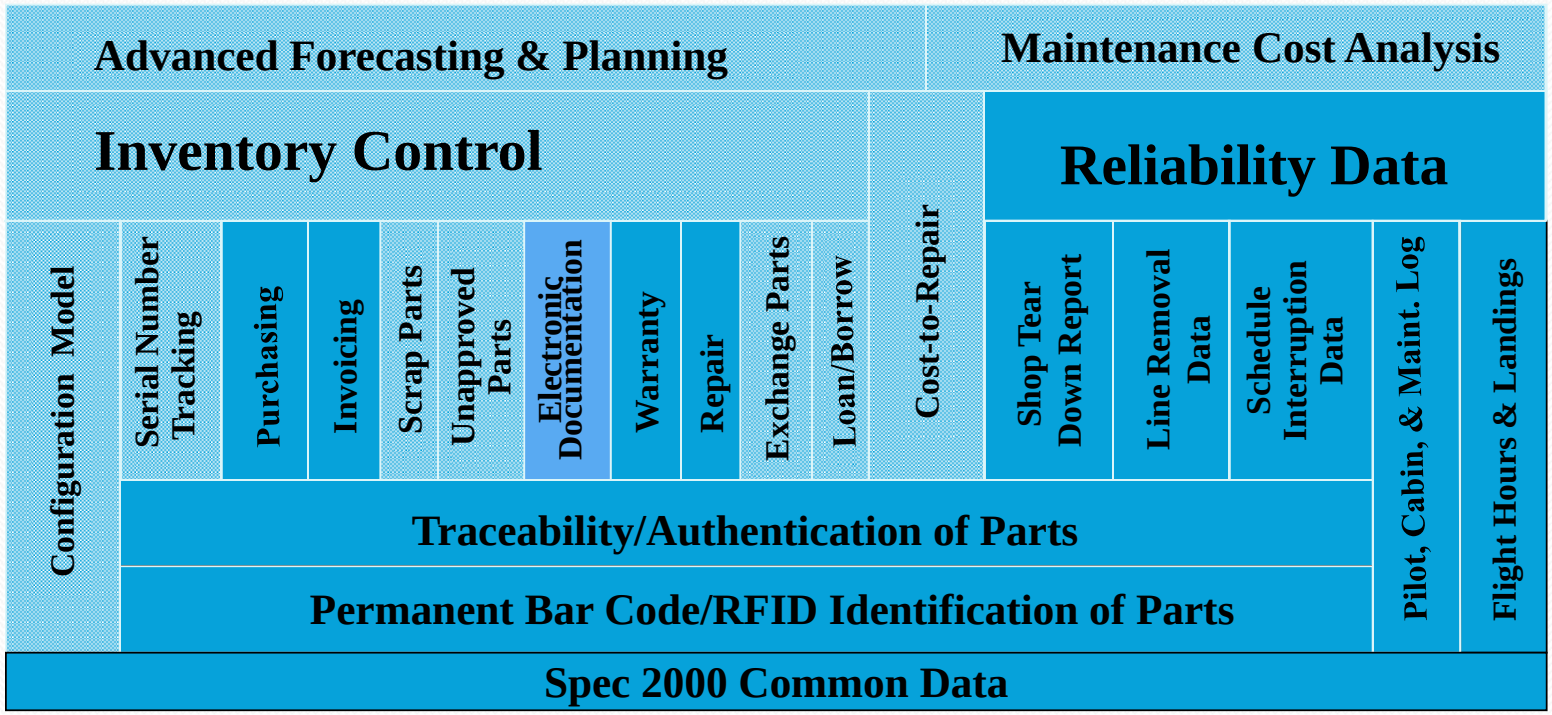
Jon Andresen, President

Rev: Jan 2009

Spec2000

Functional and Data Architecture



Legend:

Existing Standards

'In-Process' Standards

Future Standards

Jon Andresen, President

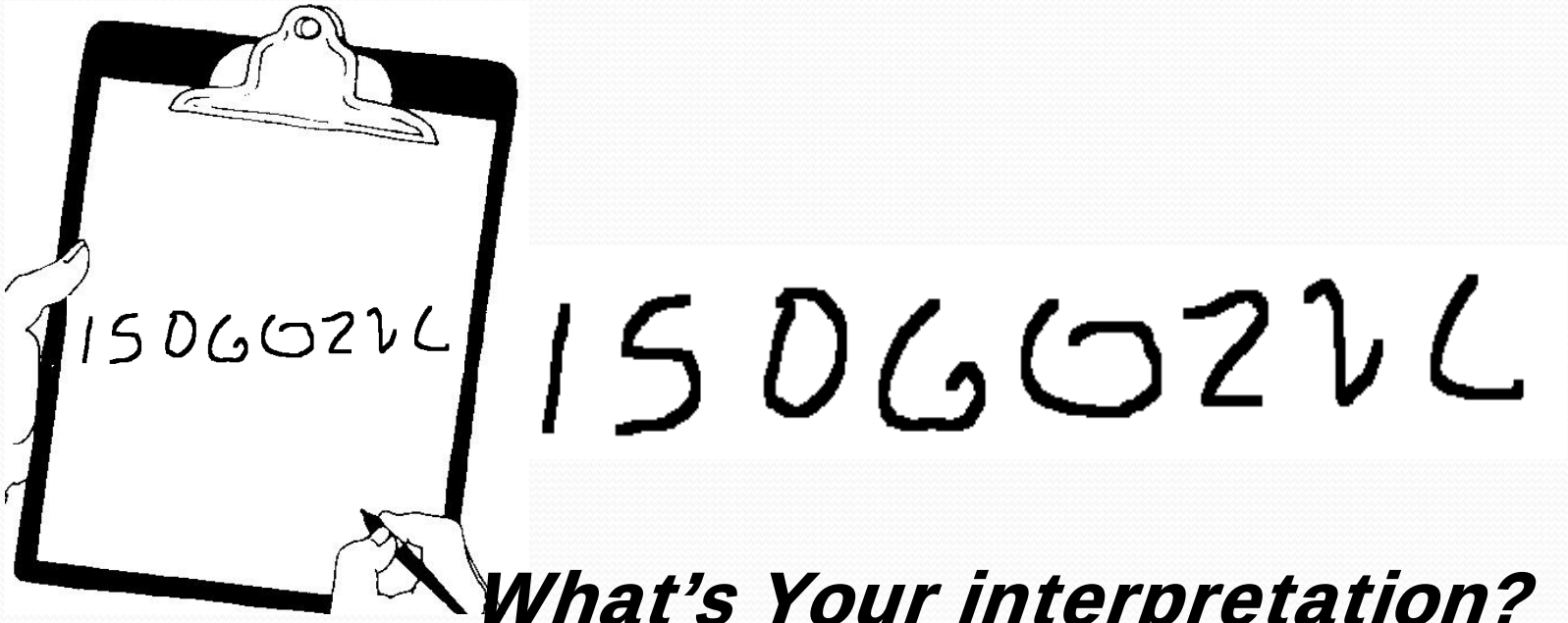
Rev: May 2004

Reality Check….

The World is Flat (and getting flatter!)

1. 11/9/89 – Berlin wall comes down
2. 8/9/95 – Netscape goes public
3. Work Flow – e.g., Windows, email, standards
4. Uploading – sharing what you created
5. Outsourcing – started with Y2K, core competencies
6. Off-shoring – better, faster, cheaper
7. Supply-chaining - practicing, sharing BCPractice
8. In-sourcing – using other experts inside company
9. In-forming – Google, the power to inform yourself
10. The Steroids – digital, mobile, personal, virtual

Ever seen characters like this?

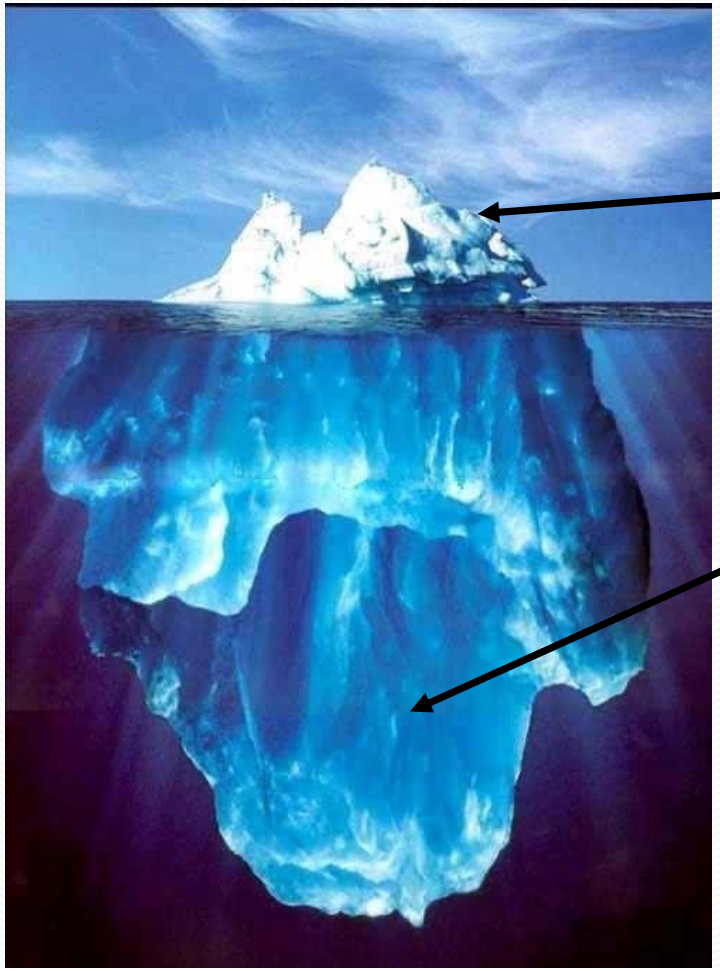


What's Your interpretation?

This has to STOP !

Gather data at the source in digital formats and leave it digital for re-use

Data Errors follow the Iceberg Principle



What you see

(= 10%)

What you don’t see !

(= 90% - this will hurt you)

What's data is this ?

26326593O

Part Number ?

Serial Number ?

Location ?

Employee Number ?

SSN without the dashes ?

Order Number ?

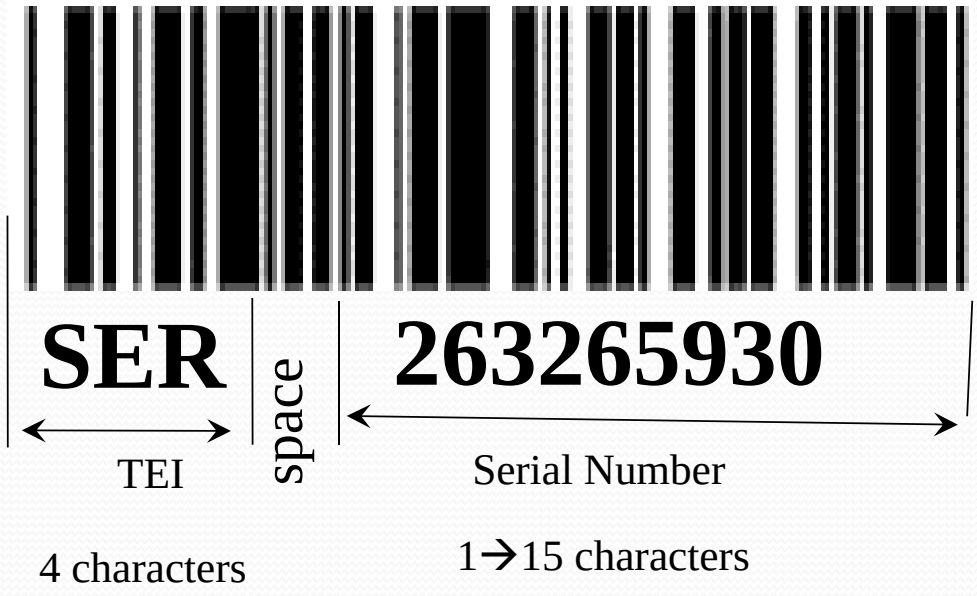
Who knows ???

This is a NAKED number with no intelligence whatsoever !

This may have worked on a paper form – it doesn't work from computer-to-computer

Example of an Intelligent Number

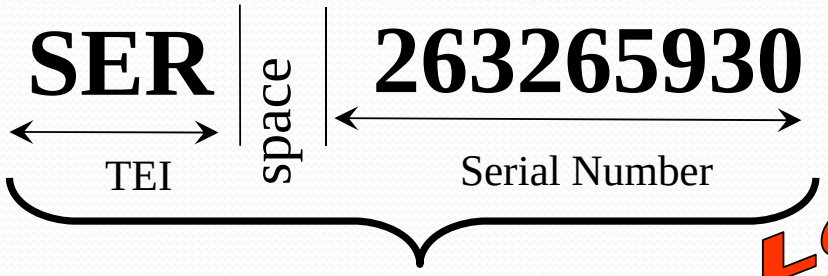
Serial Number showing Spec2000 Text Element Identifier (TEI)

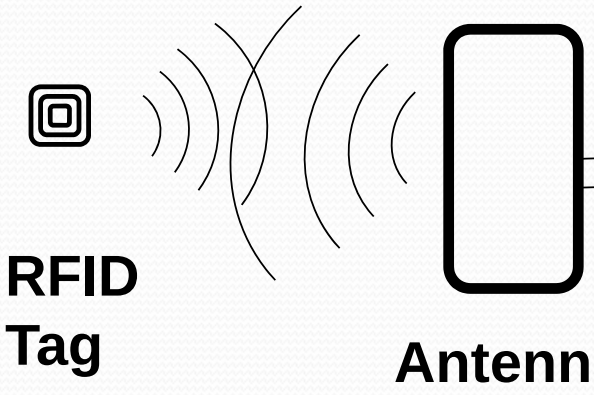


Simple, plain text, WYSIWYG, easy for people - easy for computers

Example of an Intelligent Number

Serial Number showing the Text Element Identifier (TEI)





Looks the same With RFID !

Simple, plain text, WYSIWYG, easy for people - easy for computers

Bar Code vs. RFID Technology

Barcode Advantages

- Cheap, quick, ubiquitous
- Standards-based, both technology and business
- Can use 1D or 2D

RFID Advantages

- Standards-based, both technology and business
- Does not have to be line-of-sight
- Can read through/around barriers
- Can read/write/change data
- Reads 100s of tags/second
- “transparent data collection”
- More data – same real estate

Barcode Disadvantages

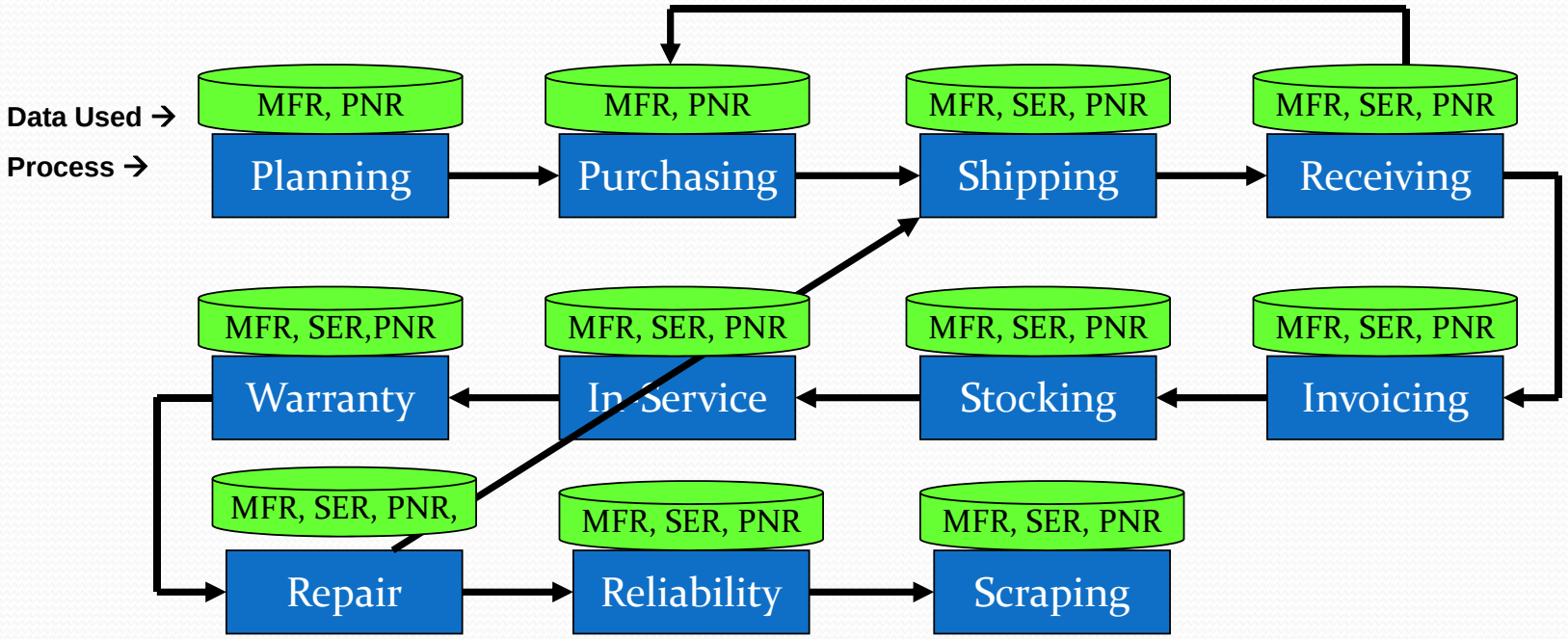
- Cannot add data to it
- Cannot change data
- Must be line-of-sight (i.e., you almost have to touch every part)
- More data requires more real estate

RFID Disadvantages

- Can read through walls (you did want to read stuff in the next room, didn’t you?)
- Cannot count things
- Our UHF variety doesn’t read thru liquids
- Read range typically shortened when on metal objects

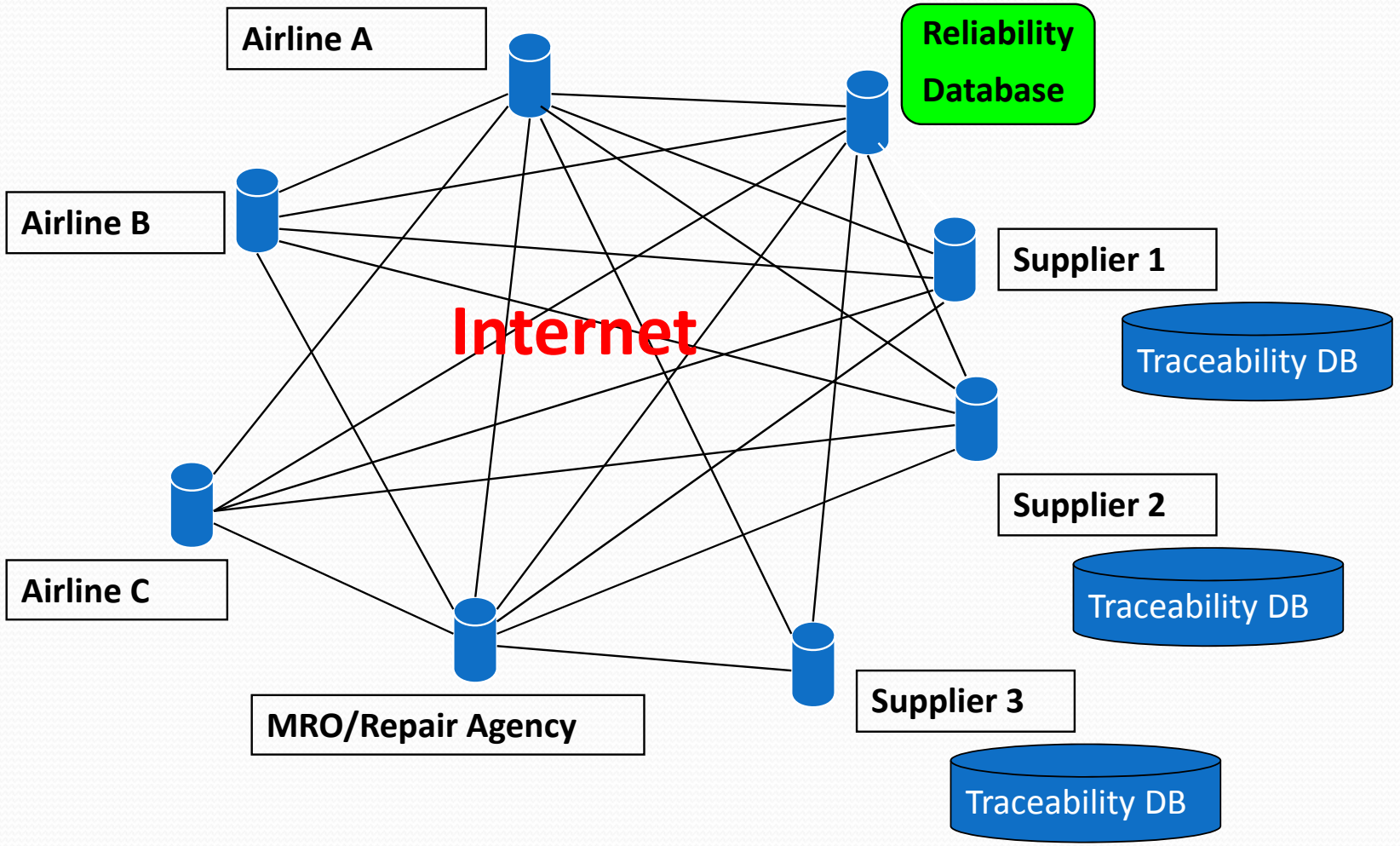
Intra-Company Traceability using TEIs

Planning - Purchasing - Shipping - Receiving - Invoicing - Stocking - Using - Warranty - Repair - Reliability - Scraping



Same data (no transformation) used on the part, the box, the computer screen, the paper, the database

Intra-Company Cradle-to-Grave Traceability



Suppliers RFID-tagging Parts

- "Chicken'n'egg" problem, supply and then demand, or vice versa? (think of Apple's iPad)
  - but several suppliers have seen the future and are now tagging new parts (e.g., Air Cruisers, Avox, EAM)
  - Also dozens of A350 suppliers, but only for A350 parts
- Systems are available for manufacturers
  - Must follow ATA Spec2000 requirements
  - Must uniquely serialize the parts within CAGE Code
  - Contact me for more information

Airline ROI ??

- If airlines don't engage with RFID, nobody wins!
- Airlines can't wait for decade-long ROI benefits
  - ROI business case – marking 1 million legacy parts and quickly getting benefits
  - Life-limited parts in cabin provide easy business case
- 2005 – development started on RFID legacy parts marking
- 2006 - Business case proven for legacy part marking
  - 99% labor savings shown for oxygen generators
  - 95% savings for life vest presence and expiration date check
  - 98% savings for TSA Security check
- 2008 – first airline RFID legacy part marking app available
- 2010 – first airline customer signed up, couldn't wait for suppliers so is paying to tag their own parts

Business Cost Models

- Primary problem – airlines have no data on expendables
  - Two business models across industry:
    - #1 - Airline would regularly check for expiration date on each item, but not save any data so when items did expire it was a surprise.
      - **Expensive labor costs**
      - **Expensive material costs** (AOGs, expedited shipping, etc.)
    - #2 – Airlines used earliest expiration date for any item on that aircraft and changed all the items to minimize maintenance costs
      - **Expensive material costs**

Major US Airline Implementation

- Their previous business model was the 'Surprise!' one
- Non-union environment; wanted to justify implementation without including any labor savings
  - Found substantial benefit solely with material savings
- Focused on oxygen generators first
  - Study showed discarding 12% of assets' life on average
  - Wasted asset cost more than justified new system
  - ROI measured in weeks – not years!
- Many other assets will be tagged to generate more savings in the future

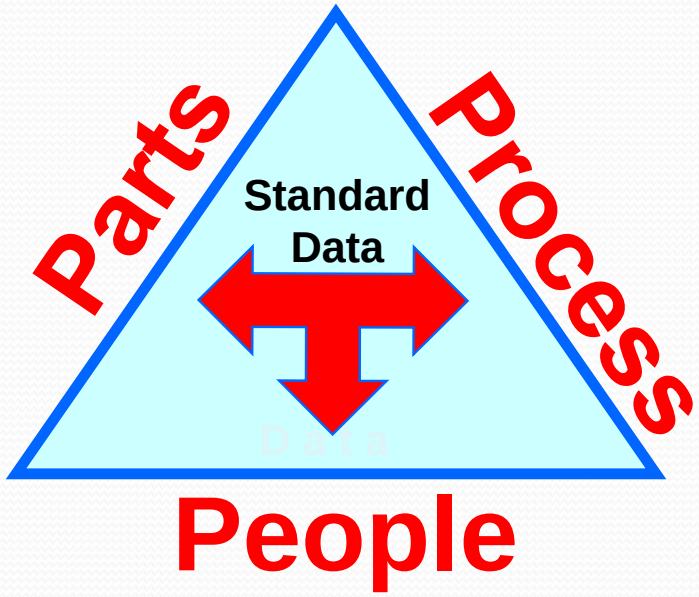
Costs and Savings

- A 757 plane can have all O2 gens RFID tagged and entered in database in about 2/3 man-hour (cost = $50 USD?)
- Cost of special, certified tags is under $2.00 USD (1.4€, 0.6 £)
  - Entire plane-set costs $175 USD
  - Tags meet SAE AS5678 certification
- After tagging, plane can be re-checked anytime in 30 secs.
  - As fast as you can walk from cockpit to rear galley
- Reports show exact locations by Tail #, Part #, Expiration Date
- Summary reports show how many of each Part # by month
  - Greatly improves both maintenance and purchase planning
    - More savings here then doing the maintenance itself

ROI Examples

- Airline has 144 aircraft
  - Annual savings on life vest checks/assets = $724,000
  - Annual savings on O2 Generator checks/assets = $56,000
  - Annual savings on security checks = $1,627,000
  - Total annual savings for 2 assets + security checks =$2,407,000
  - = Annual savings of $16,700/airplane → do the math…

RFID may or may not be the right answer for you, but business solutions are what Spec2000 is trying to deliver.



Spec2000 RFID is neither as hard as you imagined nor as easy as you hoped, but engage with us and we can select the right business problem for you to address.

Thanks for Listening!

Jon Andresen

President

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