IMAPS event:
Hi-Rel Products traceability: from Production to End Customer
Status of the Art and Industry 4.0 plan impact
24th November 2016, Milano

MICROTTELGROUP
Electronic Manufacturing Service & Ceramic Sensors

CASE STUDY: development of a multifunctional traceability system in a Automotive EMS environment

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CHAPTER 1

INTRODUCTION
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International ELECTRONIC MANUFACTURING SERVICES and SENSOR Manufacturer (since 1982)

• EMS PCBA
• EMS Ceramic
• EMS Modules
• SENSORS

WE DO BOTH DESIGN PRODUCTS AND PROCESSES!!!
Where are we?
PROFILE

- Location: Inzago-Mi
- Foundation: 1982
- Area: two manufacturing sites
  Inzago and Vimercate
- 5,400 sqm
- Employees: 140
- Tot Group: 360
QMS Certifications:

ISO 9001:2008 (900X, since long ago...)
ISO/TS 16949:2009 (since 2015, so almost «yesterday»)

BOTH CUSTOMERS AND MARKETS ARE DRIVING CHANGES!!!
IT’S A STRUGGLE FOR EXHISTENCE!!!
What we suppose to do???
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Which kind of dimensions we are dealing with (typically)?

Sensors: from 1 to 3 cm (round/square). From 1 to 6 mm thick

PCBA: from 1.5 to 30 cm (square). From 0,2 to 2,5 mm thick

And so?

Very often dimension is a constraint!!!
Very often substrate nature (ceramic) makes things slightly difficult!!!

ARE WE IN CONDITION TO SERIALIZE PARTS?
(GIVING PARTS A NAME IS QUITE FUNDAMENTAL )
FOR ACHIEVE A VERY DEEP TRACEABILITY LEVEL
WHICH KIND OF NATURE OUR PROCESSES BELONG TO?

USUALLY WE «ADD» COMPONENTS/MATERIALS TO A SUBSTRATE

FEW EXAMPLES

SMT: SOLDERING OF COMPONENTS ON A FLAT SUBSTRATE
SENSORS (THICK FILM TECH.): SELECTIVE DEPOSITION OF INKS ON A CERAMIC SUBSTRATE

HOW?
WE HAVE THERMAL PROCESSES (TO JOIN THINGS TOGETHER)

ENOUGH? OF COURSE NO!
INDIRECT PROCESSES: FUNCTIONAL TEST, PARTS PACKAGING
AND SO? WHAT A TRACEABILITY SYSTEM SHOULD DEAL WITH?

OUR PROCESSES:
INFORMATION RELATED TO PROCUREMENT (PO#, SUPPLIER, DELIVERY NOTE)
IN PROCESS: 4M (MACHINE, METHOD, MANPOWER, MATERIAL + SETUP VERIFICATION)
PARTS FUNCTIONALITY DATA
PACKING DATA + LOGISTICS
CHAPTER 2

REASONS FOR A TRACEABILITY SYSTEM

(otherwise «the one without data, he is simply defending himself with opinions)
WHY «TRACEABILITY»?

1) TRACEABILITY IS «COOL»? (What the others think about us?)
2) Because our Customers buyers always tell us that our Competitors are so far ahead (and cheaper) compare > we are always running some kind of endurance race*
3) Because of Automotive. It’s a TS 16949 QMS requirement but mainly it’s a direct Customer one (even though no one is willing to pay for this precious service).
4) It’s PARAMOUNT in failure analysis > we do have many examples available
5) Because «protect» us from external attacks (to say Customers Claims)
WHO DO YOU NEED FOR IMPLEMENTING A TRACEABILITY SYSTEM (in a small/medium enterprise)?

1) A sponsor (to say Management)
2) A project Manager (someone that has a general overview)
3) A very very (very!) motivate IT Team (including outsource)
4) A very very (very!) motivate IT Team
5) Someone else slightly passionate in his job
WHAT WE KNEW ABOUT TRACEABILITY BEFORE STARTING?
WE KNEW THAT TRACEABILITY:
  1) WAS LIKE A «MIRAGE»
  2) WAS VERY DIFFICULT TO IMPLEMENT
  3) WAS A SUBJECT BOTH FOOD/PHARMACEUTICAL INDUSTRY AND FORWARDING SERVICE WERE VERY STRONG
  4) WAS SOMETHING THAT OUR COMPETITORS WERE DOING BETTER THAN US (SEE ABOVE)

WHAT WE KNOW NOW AFTER THE TRACABILITY PROJECT
  1) «FULL» TRACEABILITY IS STILL A MIRAGE (COSTS VS BENEFITS)
  2) IT’S SOMETHING THAT IS QUITE DIFFICULT TO IMPLEMENT
  3) IT’S SUBJECT BOTH FOOD/PHARMACEUTICAL INDUSTRY AND FORWARDING SERVICE ARE STILL VERY STRONG
  4) ???

SOONER DEVICES ARE MARKED DEEPER TRACEABILITY DATA AVAILABLE!!!
CHAPTER 3

MICROTTEL SPA

MTS > MULTIFUNCTIONAL

TRACEABILITY SYSTEM
EVERYTHING STARTS/ENDS WITH
«LOGISTICS»

CUSTOMER CONTRACT

DELIVERY TO CUSTOMER

PROCESSES
WHAT IS «MTS» COMPOSED BY?

1) A CUSTOM MADE DATA STORAGE/TREATMENT/RECOVERY SYSTEM THAT INTERACTS WITH:
   2) SAP (ERP)
   3) QUALITY SW (GALILEO)
   4) MANY DATA INSERTION/VERIFICATION STATIONS (MATERIALS INCOMING, MANUFACTURING LINES, DELIVERY AREA, ETC.)

WHAT ABOUT HARDWARE?
A LOT OF:
   5) COMPUTERS
   6) HANDHELD/FIXED DATAMATRIX SCANNERS
   7) INDUSTRIAL PRINTERS (LABELS)
   8) DEVICES MARKING SYSTEMS (CO2 LASER, INKJET, YAG LASER)
   9) (PERSONS INSERTING DATA IN A COMPUTER)
WHICH ARE «MTS» MAIN FEATURES?

4M: MATERIAL/METHOD/MANPOWER/MACHINE
DATA COLLECTION AND RETRIEVAL
PROCESSES SETUP VERIFICATION AID:
ARE WE USING RIGHT MATERIAL? (RISK ANALYSIS:
FAILURE PREVENTION METHOD).

FOREWORD: MANUFACTURING SESSIONS ARE SORTED IN «LOTS». DEVICE
PN AND «LOT» ARE PRIMARY KEYS FOR TRACEABILITY DATA
MANAGEMENT
3.1: MTS **INPUT**: MATERIALS INCOMING

- **CUSTOMER CONTRACT**
- **MATERIAL PLANNING AND PROCUREMENT**
- **SUPPLIER**
- **WAREHOUSE: INCOMING CONTROL (AIDED) + LABELLING**

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**3.1: MTS **OUTPUT**: MATERIALS INCOMING**

1) **ELECTRONIC COMPONENTS: EACH MATERIAL PACKAGE IS UNIQUE (QUALITY STATUS MANAGEMENT)**

2) **LINK BETWEEN PURCHASE ORDER INFORMATION AND MATERIAL**

3) **AIDED INCOMING CONTROL (WHAT WE HAVE vs WHAT WE WERE EXPECTING – COMPONENTS MANUFACTURER PN AIDED COMPARISON)**

4) **MATERIAL Q.TY MANAGEMENT (FOR EACH PACKAGE)**

5) **SUPPLIER DOCUMENTS STORAGE**

6) **QUALITY CONTROL DATA RESULTS**
3.1: DEVICES «MARKING» (LASER, INKJET, PRINT, SW, LABEL)

**HIGH** TRAC. = MARKING PERFORMED IN THE VERY BEGINNING

**LOW** TRAC. = CLOSE TO THE END OF MANUF. CYCLE
MIXING OF BOTH HIGH AND LOW TRACEABILITY LEVELS MARKING RELATED INFORMATION GRANTS A FULL DATA CHAIN!!!
3.2: MTS 4M: MATERIALS USED
CASE 1: ELECTRONIC COMPONENTS
LINE AUTOMATIC DATA COLLECTION
IF SUBSTRATE IS MARKED «FULL COMPONENTS TRACEABILITY» IS GRANTED (THOUSAND OF COMPONENTS EACH BOARD)
AIDED MACHINE SETUP: WE ARE CONFIDENT TO MOUNT THE WRIGHT COMPONENT. OTHERWISE AN ALARM SWITCH ON!!!
EVERY PROCESS ANOMALY IS RECORDED
CASE 1: ELECTRONIC COMPONENTS
ADDITIONAL FEATURES:
1) QUALITY STATUS (E.G. BLOCKED COMPONENTS) RELATED TO MANUFACTURER/DATACODE/LOT
2) COMPONENTS AGE MANAGEMENT
3) CHEMICALS (SOLDER PASTES) INCLUDED
4) TOOLS VERIFICATION INCLUDED

WHAT’S NEXT?
MANAGEMENT OF «MOISTURE SENSITIVE DEVICES»
FLOOR LIFE
CASE 2: CERAMICS MATERIALS (INCLUDING SENSORS) NO (HIGH LEVEL) SINGLE IDENTIFICATION IS POSSIBLE SO COMPONENTS «LOT LEVEL» TRACEABILITY ONLY IS POSSIBLE.
3.3: MTS **4M**: MANPOWER/MACHINE

COMPLETE INFORMATION BATCH RELATED TO BOTH RESOURCES (MAN/MACHINE) AND MANUFACTURING DATA (YIELD/STATUS) ARE RECORDED WITHIN SAP (BEAS)
3.3: MTS 4M: MANPOWER/MACHINE/METHODS IN PROCESS CONTROLS RECORDS
ALL DATA MANAGED BY GALILEO PLATFORM
SYSTEM SPREADED ALL AROUND FACTORY (VALUE ADDED PROCESS)

OUTPUT: COMPLETE DATA SET RELATED TO IN-PROCESS CONTROLS (GALILEO)
3.3: MTS 4M: MANPOWER/MACHINE/METHODS

ADDITIONAL MANUFACTURING DATA AVAILABLE:

1) MANUFACTURING STATUS MONITORING/MANAGEMENT
2) ELECTRONIC ASSEMBLY: AUTOMATIC OPTICAL INSPECTION (AOI) RESULTS FULL TRACEABILITY
3) ELECTRONIC COMPONENTS REWORK FULL REPORT (100% TRACEABILITY)
4) MACHINE MAINTENANCE STATUS (GALILEO)
5) MEASURING SYSTEMS CALIBRATION STATUS (GALILEO)
6) PROCESS YIELD CALCULATION
7) PROCESS EFFICIENCY CALCULATION
8) MACHINE DOWNTIME
9) DEVICES FUNCTIONAL DATA

I TOLD YOU ALREADY: TRACEABILITY'S COOL!!!
3.4: GOODS DELIVERY > MANAGED BY LOGISTICS
FINAL GOODS WAREHOUSE IS MANAGED ON TRACEABILITY DATA (PN, LOT)
AIDED PACKAGES PREPARATION PROCESS: PARTS VERIFICATION + TRACEABILITY SYSTEM
3.4: GOODS DELIVERY > MANAGED BY LOGISTICS

MAIN TOPICS:
1) WAREHOUSE IS MANAGED UNDER TRACEABILITY DATA (PN/LOT)
2) EACH BOX HAS A UNIQUE ID
3) PREPARATION FOR SHIPPING PROCESS IS AIDED (COMPARING PLANNED INFORMATION WITH ACTUAL ONE; SCANNING OF BOXES LABELS).
4) DELIVERY NOTES (TO CUSTOMER) CONTENTS CUSTOMIZABLE
CHAPTER 4

MICROTEL «MTS» TRACEABILITY APPLICATION AT ITS BEST: AN ANGRY CUSTOMER CLAIM!
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A valuable Customer called us (very very worried) claiming some components all around the world were detacching from PCBs!

Traceability chain (backward):
1) From delivery notes to list of carton boxes
2) Every single delivery box has a unique ID
3) Each tray within a box is labelled
4) Content of each tray is traced (list of device SN)
5) Test and manufacturing data: when, how, materials, who
6) Sub-suppliers procurement info
7) List of other already delivered boxes of the same manufacturing batch

What we discovered?
Parts were manufactured in the same manufacturing session (including test), in the same process condition, using same material batches and delivered on the same day to Customer.

So final root cause? Sorry, it cannot be revealed...but we were declared as INNOCENT (and it’s enough from our side!)
CHAPTER 5

FINAL REMARKS

(Courage! We have almost done it!)
OK MICROTEL, EVERYTHING SEEMS FANTASTIC, BUT WHAT ABOUT **COSTS**?
WE SHOULD OBVIOUSLY BALANCE PURE COSTS WITH BENEFITS

**COSTS** (to achieve what described above)
24 months/man
Direct (sw/hw): few dozens K€
Indirect: traceability system slightly add weight to process timecycle (for data insertion)
BENEFITS

- DECREASING OF PROCESS FAILURES NUMBER (INTERNAL/EXTERNAL - CONTROL SKIP AND WRONG MATERIALS USED)
- FAILURE ANALYSIS EFFECTIVENESS
- INCREASED REPUTATION TO CUSTOMER
- NEW CUSTOMER (?)

AND SO? DURING NEXT YEARS WE ARE TRYING TO PERFORM SYSTEMATIC BENEFITS CALCULATION
HINTS FOR CREATING A TRACEABILITY SYSTEM (BASED ON PURE EXPERIENCE):

- CREATE A TRACEABILITY CORE (SCALABLE/CUSTOMIZABLE STEP BY STEP) > EVERY CUSTOMER HAS ITS OWN REQUIREMENT, MARKET CHANGES VERY FAST
- KEEP KNOWHOW IN-HOUSE
- MAINTAIN IT: DISPOSE DATA NOT NEEDED!
- NEVER STOP IMPROVING IT
- ALWAYS LISTEN TO THE VOICE OF CUSTOMER
OUR NEXT CHALLENGES?
- MANAGEMENT OF MOISTURE SENSITIVE COMPONENTS FLOOR LIFE
- INTEGRATION OF AUTOMOTIVE SENSORS MANUFACTURING DATA IN A SINGLE PANEL
- INCREASE DATA INTEGRATION (DATA COMING FROM DIFFERENT SOURCES)
THANKS FOR THE ATTENTION!
ANY TOUCH QUESTION?

For additional information and other funny things related to EMS
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