Optimizing printer productivity by pro-active use of field data

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ABOUT CANON

One of the world's most recognized brands

Since 1937, Canon has been manufacturing products that enable people to do amazing things in their lives and in their businesses.

Over the years, Canon has built a reputation for quality, reliability and innovation that has been rewarded in the strong, meaningful relationship with our customers.

Key facts Canon

Products & solutions

- Cameras
- Video equipment
- Network cameras
- Medical equipment
- Semiconductor-manufacturing equipment
- Printers for home and office
- Digital production printers

Leader in consumer & professional imaging

181,897 employees worldwide in 2020

2020 revenues $30.39 billion

Ranked 3rd among U.S. patents in 2020

About Canon Production Printing

Develops and manufactures high-tech printing products and workflow software for the commercial printing market.

Large Format Graphics

Continuous Feed

Imaging Supplies

Technical Document Systems

Sheetfed Presses

Workflow

Packaging

High productivity requires high reliability

- Facilitate 24/7 use by our customer
- Reduce maintenance time by
  - achieving high quality & reliability
  - be ahead of issues

This can be achieved in several ways

- Adapt instruction to users
- Change maintenance strategy
- Find opportunities for improvements product design

The challenge of the printhead

Develop inkjet products for high quality and reliability demands

- >1000 nozzles per engine
- Millions of dots per print
- Placed with micrometer accuracy
- Reproduced for millions of prints

Built-in technology:

- PAINT technology for nozzle compensation
- Automatic maintenance system to restore nozzle function

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Field data

USAGE

Engine

SERVICE CALLS

PHYSICAL SENSOR

PERFORMANCE

Print Quality KPIs

Cases of field data usage

Reactive use of logging data: case

Case

- One of the first successes of using field data (2013)
- Lifetime of printheads shorter than expected
- Physical analysis of returned printheads did not lead to an obvious root cause

Question to solve with data analysis:

Is it possible to find the major parameter(s), affecting this lifetime problem, in the logging data?

characteristics	Usage data engine / print heads
engine	Last date printing
customer	Warm hours
Printer model	Printed m/m2
printheads	Used ink
Install date	

Reactive use of logging data: results & solution

- cumulative failure (Weibull) distributions for many possible relevant parameters
- For example:
  - Ink –> random failure
  - Warmhours → clear influence on Beta

- Additional observation in field data: customers leave engine on after printing
- Solution: reduce warm hours by improving customer instructions and software adaptation

Early detection and prediction

Case:
New Product introduction (2018), controlled roll out
Small number of failing heads in the field

Question to solve with data analysis:
Estimate the severity to set priority

Results and solution:
Weibull analysis

- Use both “good” and “failed”
- Prediction: unacceptable failure level

Prevent field defect: repair in the field and stock, redesign production process

By early detection and prediction, we were able to repair and prevent field defect. Escallation prevented by design change before mass production roll out.

Field data as experimental data

Case
The time between production and installation might be of influence for the quality of the printhead
Shelf life of a printhead was determined within R&D, based on limited number of samples

Question
Can we confirm shelf life by using field data?

Results:
Perfomance indicator: “position accuracy KPI”

Analyzed as a function of actual shelf life .

Conclusion: No influence of shelf life on quality.

Proactive FMEA driven monitoring

Case:
Diffusion of ink through a seal to the electrodes might damage them.

Look for leakage currents.
This is measured on a daily base and stored for all machines

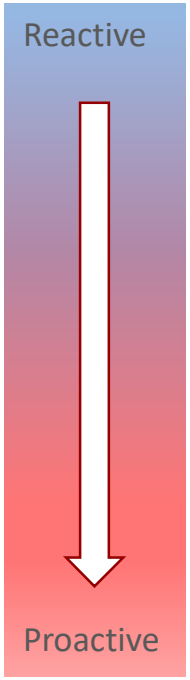
Not seen in R&D reliability tests.

Question:
Confirm the absence of ink diffusion failure mechanism by studying the leakage currents in the field

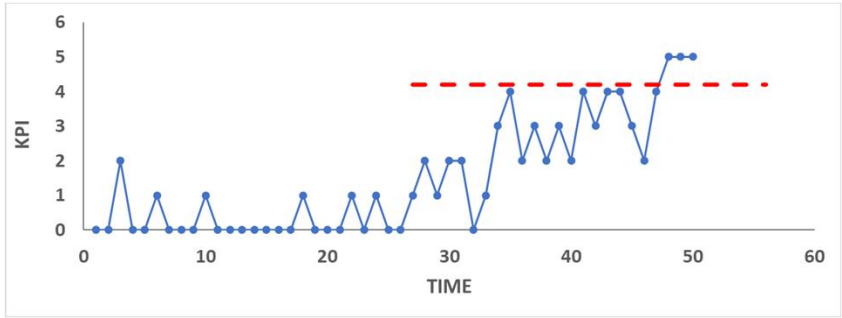
Results and solution:
- lead back to 3 different failure mechanisms, but not to ink diffusion

Wrap up

From reactive to pro-active field data use



- reactive data analysis@ failure: quick and preventive solutions
- for life time prediction
- as extension of R&D reliability tests
- FMEA driven: sensor available in logging.
  - for fast feed back and predictive maintenance
- Performance Monitoring:
  - follow KPI's for engine performance and print quality



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Needs when improving productivity by field data use

Improving productivity using field data requires more than just data analysis:

- Define perfor phase
- Domain know
- Infra structure
- Balance logging-frequency and storage-size
- Predictive maintenance implemented in service organization.

Start now!

Learn & Benefit!

- And don’t forget: Proactive reliability testing in an early development phase is still needed!


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