

The slide features a white background with a large blue triangle on the right side and a smaller blue triangle on the left side, meeting at a point. The Materialise logo is positioned in the upper left area.

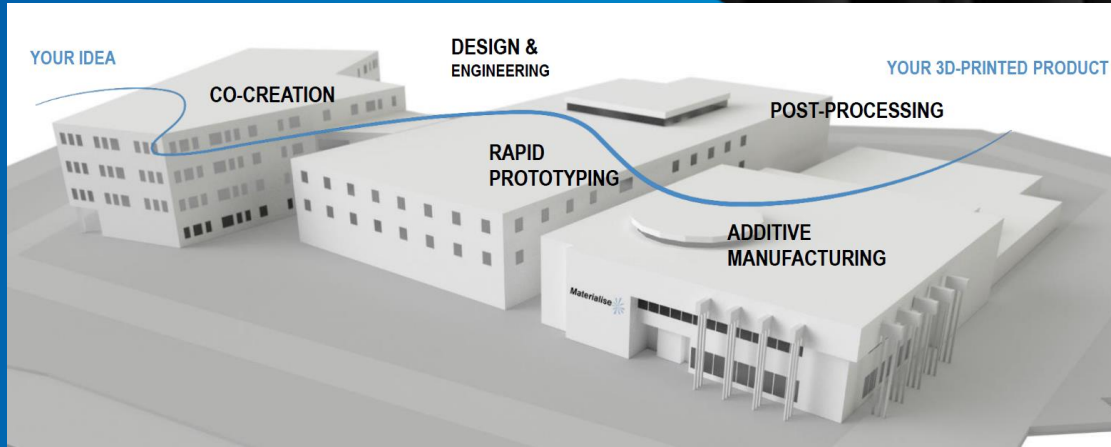
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How dedicated
Quality Management
is key for the industrialization of
Additive Manufacturing

A complete factory for Additive Manufacturing

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Agenda

1. Materialise NV today – Inhouse technologies
2. Why ‘Additive Manufacturing’?
3. Why a ‘Quality Management’ approach?
4. Co- Creation
5. Quality is all about.. – Business Cases
6. Quality Management summary

Materialise NV today



ROYAUME DE BELGIQUE - KONINKRIJK BELGIE

KINGDOM OF BELGIUM

Un État membre de l'Union européenne – Een lidstaat van de Europese Unie

A Member of the European Union

Service Public Fédéral Mobilité et Transports - Federale Overheidsdienst Mobiliteit en Vervoer

Federal Public Service Mobility and Transport

Direction générale Transport aérien - Directoraat-generaal Luchtvaart

Civil Aviation Authority

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**AGRÈMENT D'ORGANISME DE
PRODUCTION**

**CERTIFICAAT ERKENNING ALS
PRODUCTIEORGANISATIE**

PRODUCTION ORGANISATION APPROVAL CERTIFICATE

Référence / Referentie / Reference:

BE.21G.0009

Link on: www.materialise.com



Why Additive Manufacturing?

- To create technology innovation and competitive advantage across industries
 - Add added value to the design or product by incorporating functionalities
- To incorporate a different way of thinking
 - Supply Chain: Shorter lead times, less stock, reducing costs..
 - Design Creation: Design freedom, light weight structures, surface textures..
- To have material flexibility
- To minimize 'upfront' project investments



Repeatability



Accuracy



Repeatability and accuracy

Why a 'Quality Management' approach?

- To guarantee a qualified product out of a controlled process – Practical examples
- To comply with industry standards and customer requirements
 - Hence our ISO/ EN/ EC (Part21G) certifications
- To strive be the best in business by continuous improve processes
 - Push boundaries of the technology
 - Create 'Design' standards fit for additive manufacturing
- To Co-Create: Learn – Create – Find

Co-Creation



3DP ACADEMY

In a full-day program our experts inform you on the strengths and weaknesses of the most relevant technologies and materials. Furthermore we share best practices in design & engineering and analyze a number of groundbreaking AM cases.

GOAL:

Get your team up to date on all things AM

LEARN

CO-CREATION LAB

The Materialise CO-CREATION LAB is an interactive session in which experts from your company join forces with ours. The result is a multidisciplinary dream team that will unlock the hidden potential of 3D Printing in your company.

GOAL:

Create innovative concepts for your market

CREATE

3DP SCAN

The 3DP SCAN is an AM audit, held at your premises. A Materialise AM consultant will look for potential applications on the spot and provide you with a full report afterwards.

GOAL:

Spot parts that can benefit from AM

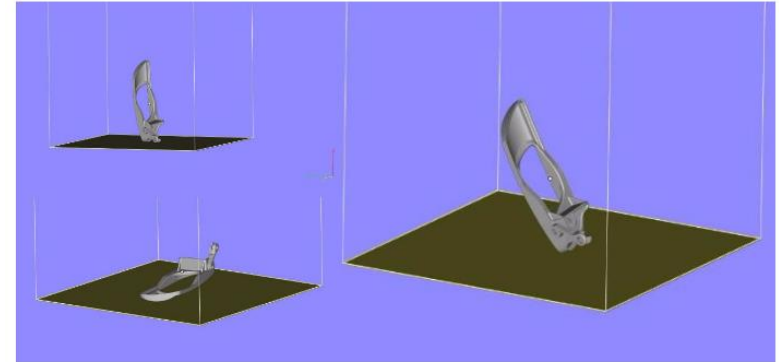
FIND

Quality is all about.. Limit Process Variations (1/3)

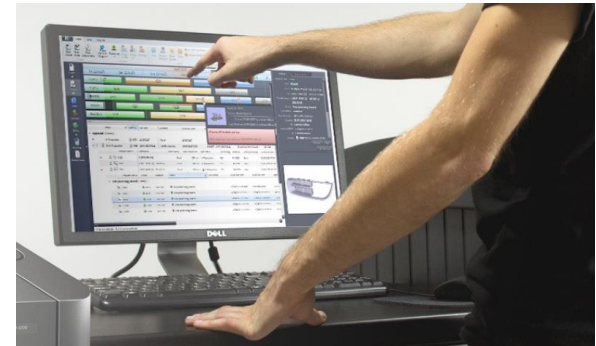
Process Quality approach

Process engineering: Challenges

- Impact on part properties & quality
 - Guarantee part positioning and orientation
 - Guarantee material specifications
 - Set machine and machine parameters



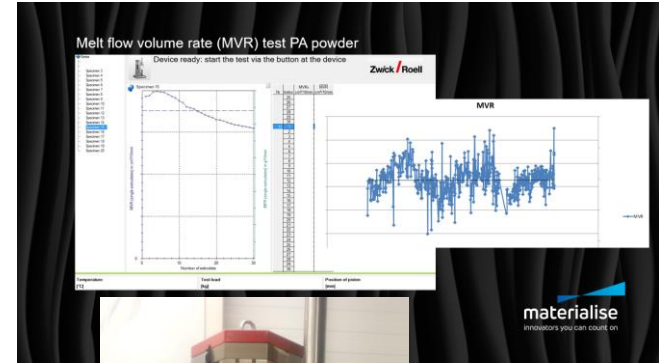
Example Materialise Streamics – Part orientation



Process Quality approach

Practical example LS technology

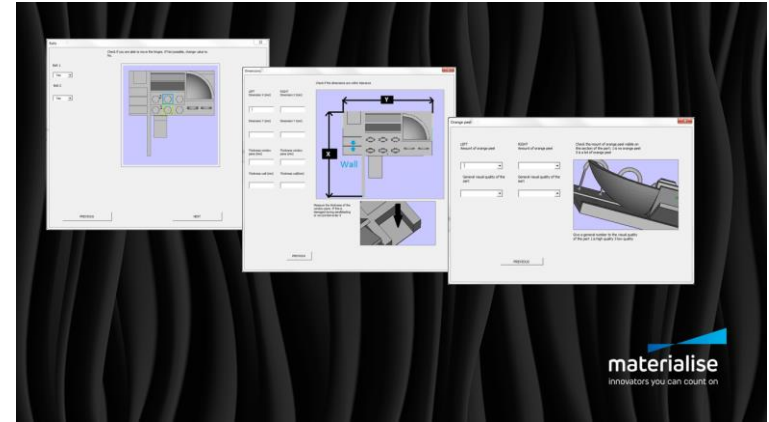
- Monitor quality PA powder (and control)
 - Ensure powder quality used in production by measuring upfront melt flow analysis per mixed batch
 - Limit variation – use agreed threshold values
 - Limit post-processing variation (upstream supply chain)
 - Guarantee mechanical properties



Zwick – Roell type A flow

Process Quality approach Practical example LS technology

- Machine maintenance traffic light system
 - Increase attention to build performance
 - Increase maintenance frequency if required
 - Keep variable parameters under control
 - Visualize in the organization – Fast communication with planning team



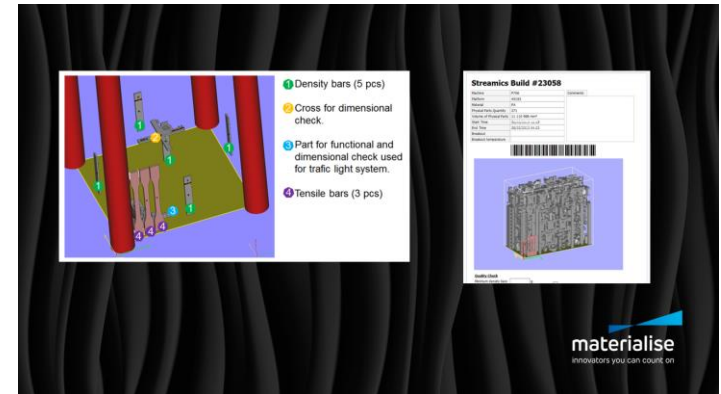
Machine	DTM1	DTM2	DTM3	DTM4	P100	P110	P380	P3951	P3952
Overall status	26-Mar	16-Mar	26-Mar	26-Mar	25-Mar	13-Mar	26-Mar	18-Feb	26-Mar
Bolts	0	0	0	0	0	0	0	0	0
Dimensions	0	0	0	0	0	0	0	0	0
Beam Offset	0	0	0	0	0	0	0	0	0
Surface Q	0	0	0	0	0	0	0	0	0
Mach Properties	0	0	0	0	0	0	0	0	0
Status	Free	Building	Building	Free	Free	Building	0-Jan	Building	Building
Start	09:43 (Thu 26 Mar)	13:17 (Thu 26 Mar)	11:28 (Thu 26 Mar)	09:15 (Thu 26 Mar)	09:00 (Thu 26 Mar)	09:27 (Thu 26 Mar)	0-Jan	11:19 (Wed 25 Mar)	12:00 (Thu 26 Mar)
End	01:00 (Thu 1 Jan)	13:47 (Sat 28 Mar)	11:28 (Fri 27 Mar)	01:00 (Thu 1 Jan)	01:00 (Thu 1 Jan)	01:00 (Thu 1 Jan)	0-Jan	17:19 (Thu 26 Mar)	01:00 (Thu 1 Jan)
Comment									

Machine	P701	P702	P703	P704	P706	P707	P708
Overall status	16-Mar	1-Jan	16-Mar	16-Mar	3-Dec	16-Mar	16-Mar
Bolts	0	0	0	0	0	0	0
Dimensions	0	0	0	0	0	0	0
Beam Offset	0	0	0	0	0	0	0
Surface Q	0	0	0	0	0	0	0
Mach Properties	0	0	0	0	0	0	0
Status	Free	Building	Free	Building	DailyMaintenance	Building	Building
Start	07:20 (Thu 26 Mar)	14:25 (Thu 26 Mar)	14:49 (Thu 26 Mar)	13:41 (Thu 26 Mar)	14:11 (Thu 26 Mar)	13:48 (Wed 25 Mar)	17:37 (Wed 25 Mar)
End	01:00 (Thu 1 Jan)	12:25 (Fri 27 Mar)	01:00 (Thu 1 Jan)	12:41 (Sat 28 Mar)	01:00 (Thu 1 Jan)	09:48 (Fri 27 Mar)	09:37 (Fri 27 Mar)
Comment							

Process Quality approach

Practical example LS technology

- Monitor build parameters by adding control parts
 - Immediate 'build succeed' information prior to breakout
 - Verification with non-destructive testing
 - Material mechanical property control
 - Density
 - Tensile strength – Elongation at break



Quality is all about.. Continuous Improvement (2/3)

Suction Gripper

A design evolution



Original part



- €€€+ assembly
- 237g



- €€ + assembly
- 87g



- €€ + no assembly
- 60g

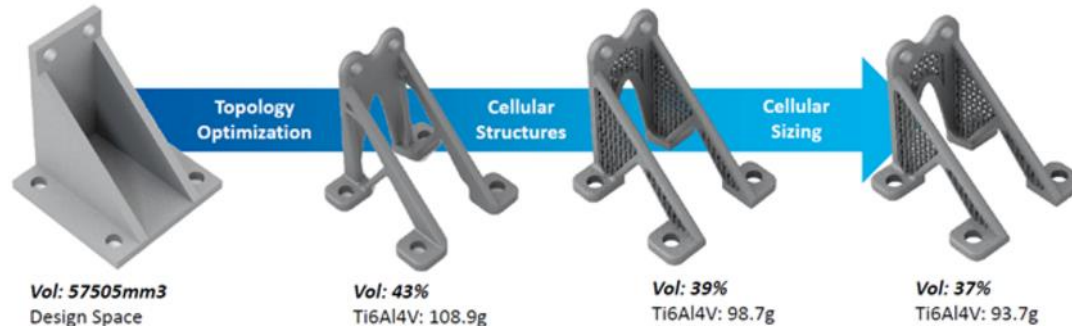


- Besides the parts cost reduction, saving weight and no assembly involved..
- The lifetime has increased by increased wear resistance
- Because complaints were taken into account from the start of the project

Bracket Topology optimization



Result topology optimization



In the end, only 37% of the original volume remained.

- Less material, maintaining required stiffness
- Using design software Materialise 3-matic, replacing by cellular structure
- Reduced thermal stress due to less bulk material and larger support areas

Business case – Redesign - lifetime increase

Lamp Holder/ Bracket Lifetime optimization

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Application part



Final solution application

- ▶ Less machine downtime of continuous cycle
- ▶ Incorporated additional functionality
- ▶ Part lifetime increase and very short production lead time

Quality is all about.. Monitoring (3/3)

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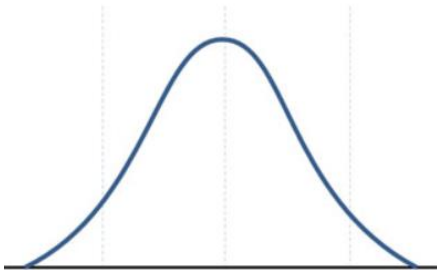
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- | | | | | | |
|---------------------------|--|-------------------|-----------------|--------------------------------|---------------------------|
| Stakeholders Requirements | M1 – Business Management | | | | Stakeholders Satisfaction |
| | M2 – Development & Improvement | | | M3 – Stakeholders Requirements | |
| | R1 – Business Cases Management | | | | |
| | R2 - Production | | | | |
| | R3 – Design & Industrialisation | | | | |
| | S1 – Procurement | S2 – Competencies | S3 – Facilities | S4 – Administration & Finance | |
| | S5 – Striving to ‘Excellence level’ IPSCA+ | | | | |



Quality Management summary

Limit process variation

Know the process by measuring



Continuous improvement

Find ways to do better



Monitoring

Keep an eye on Performance Indicators



A blurred background image showing two women in a meeting. One woman with blonde hair is in the foreground, looking down at a laptop. Another woman with dark hair is behind her, looking towards the camera. The setting appears to be a modern office or meeting room with other people and tables in the background.

Will you join us turning
future into present?

www.materialise.com

Sept 27th 2017 | Geert Appeltans