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AM als Treiber der Transformation zur digitalen Produktion

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Lemgo, November 10, 2017

EOS is the market leader for Additive Manufacturing

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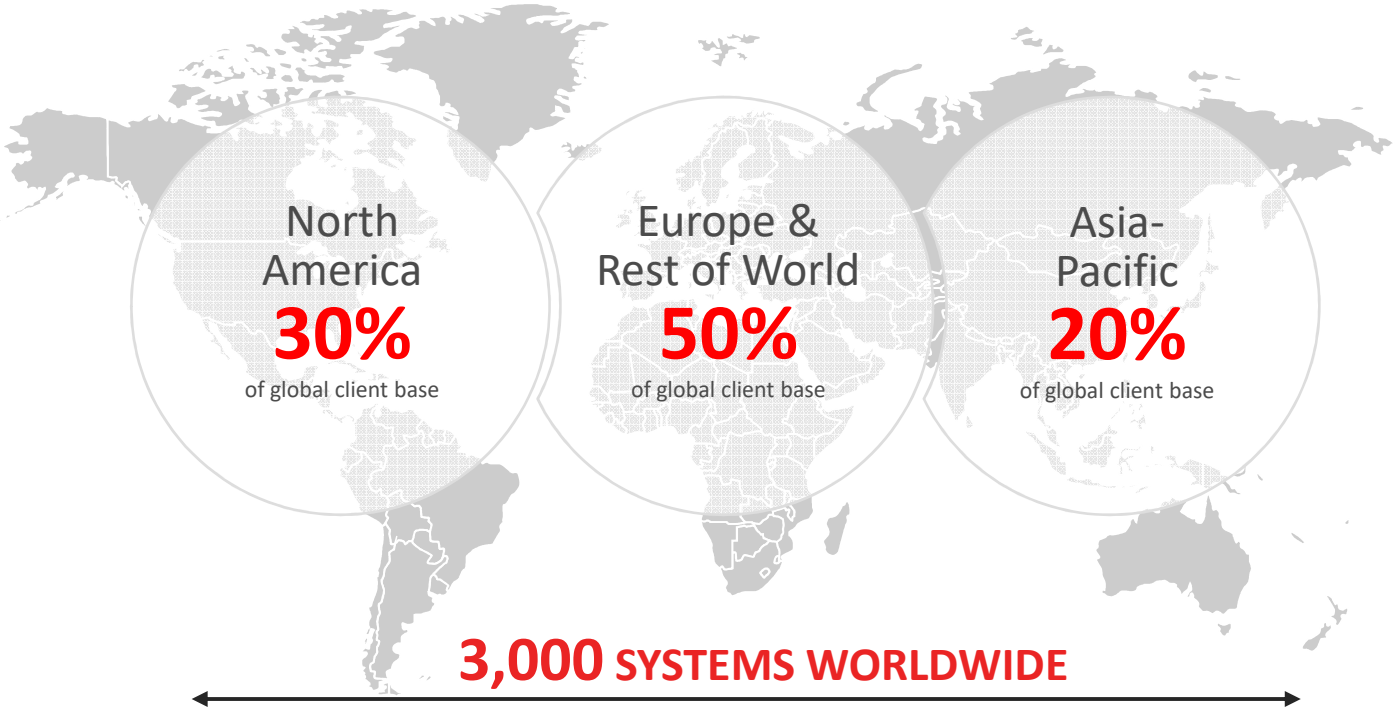
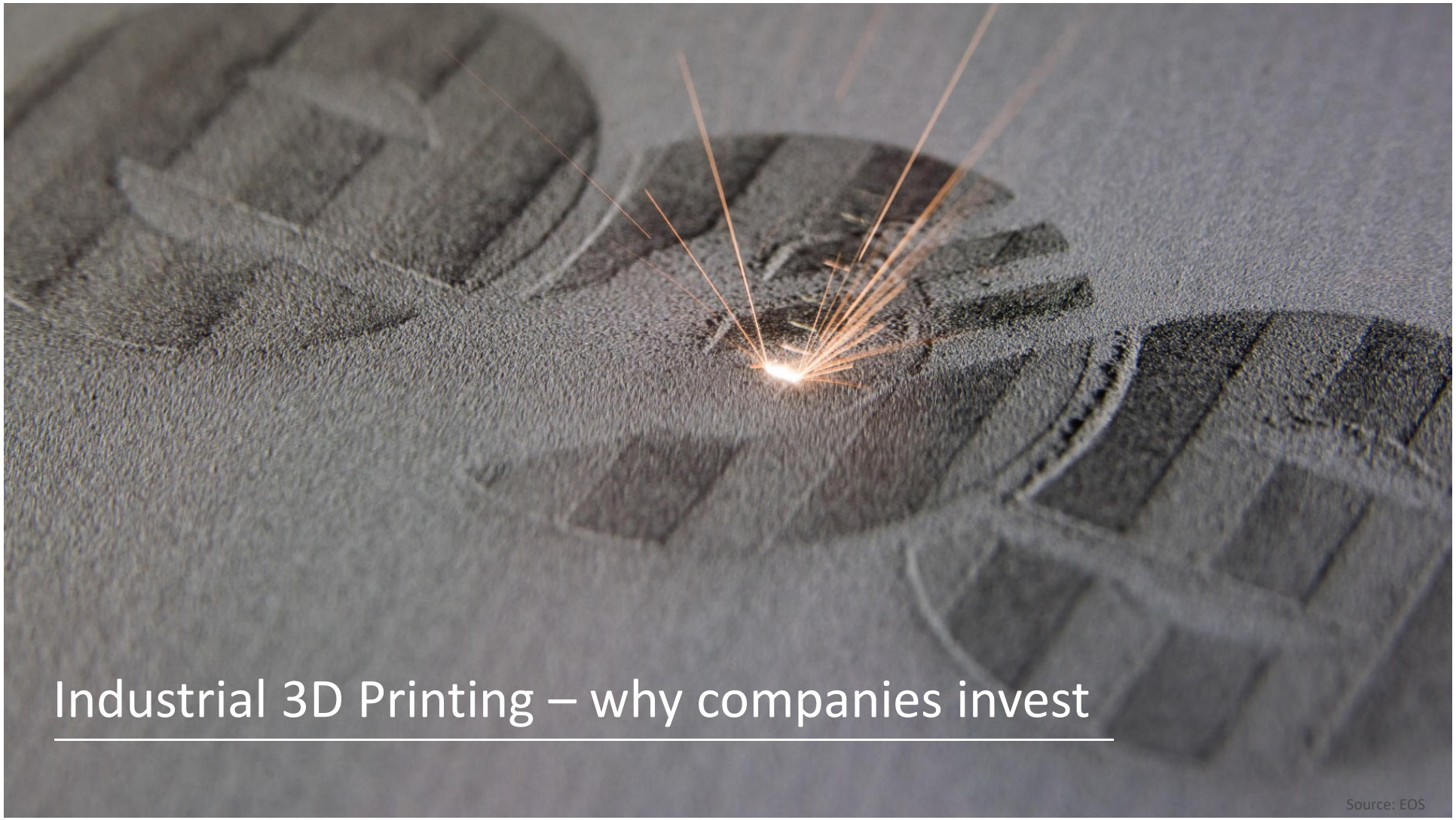


Source: EOS


Production capacity >1,000 systems per year


Industrial 3D Printing – why companies invest
Source: EOS

Example control hydraulic component

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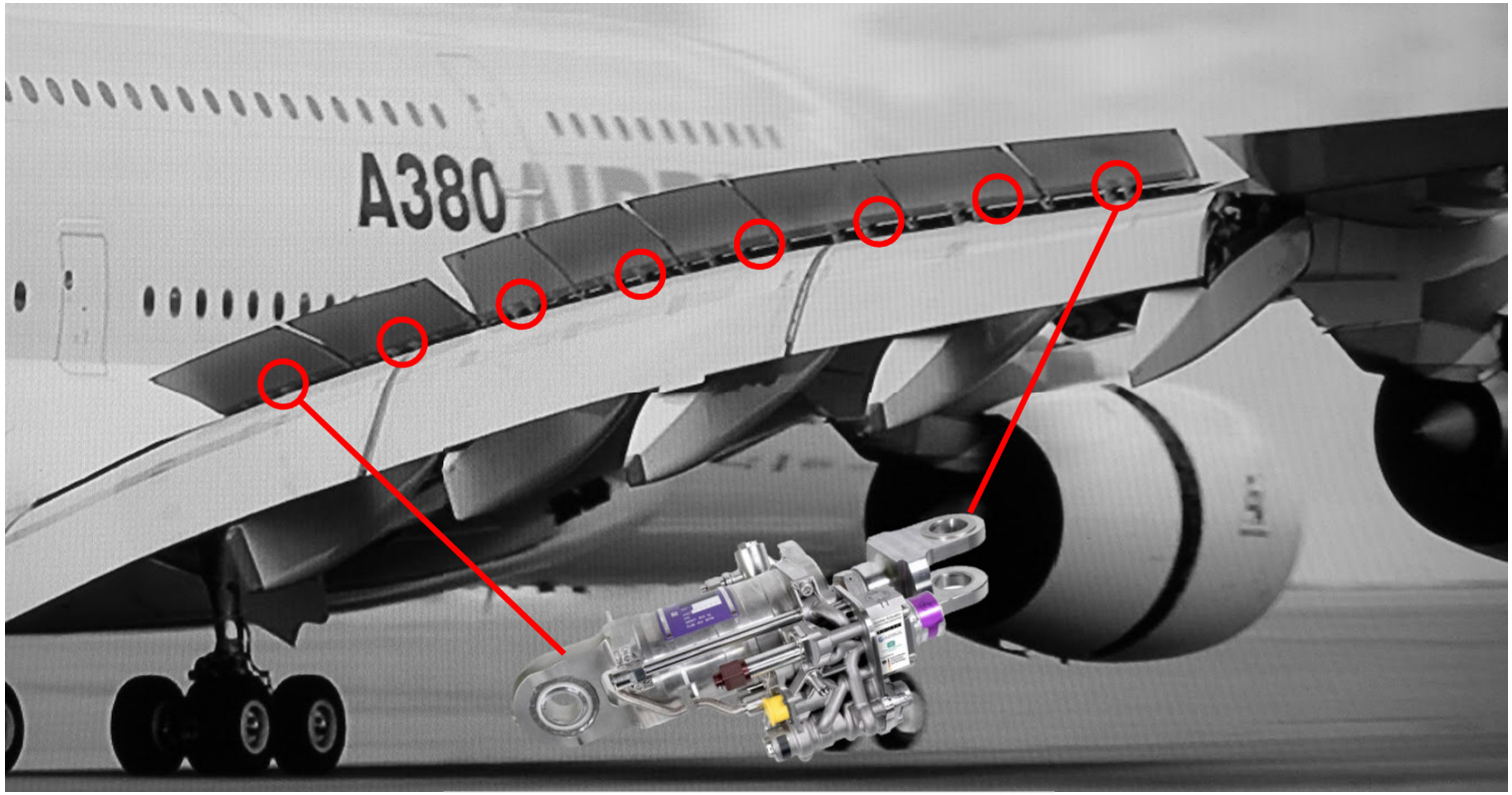

Source: Airbus, Liebherr Aerospace

Example control hydraulic component

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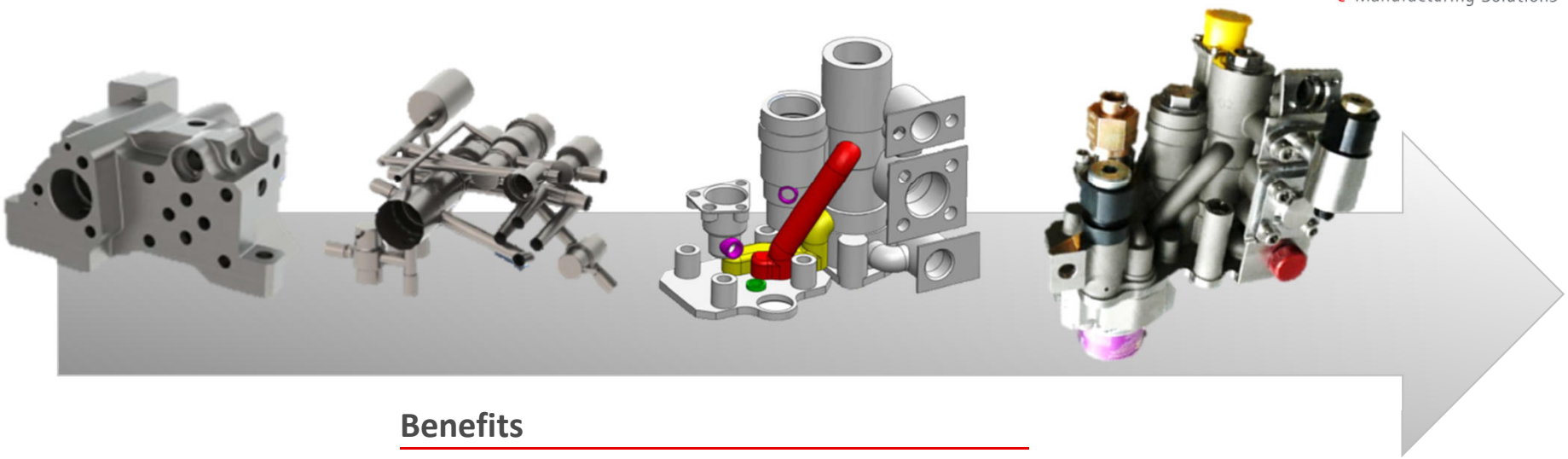
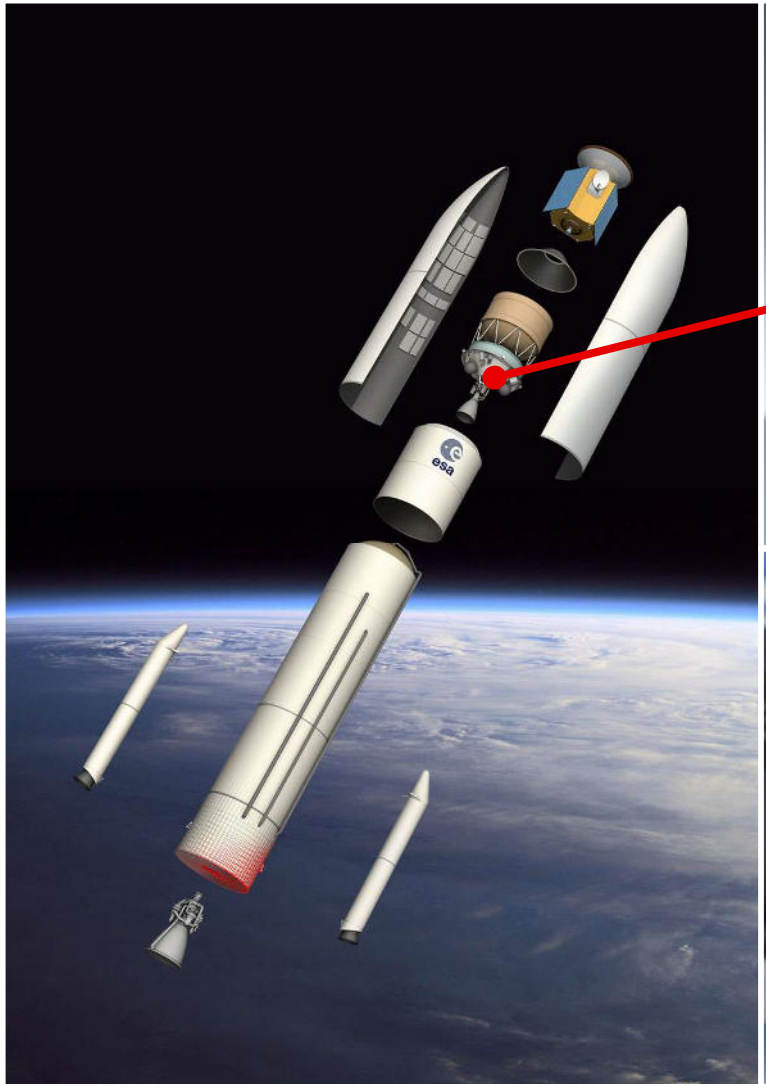


Benefits

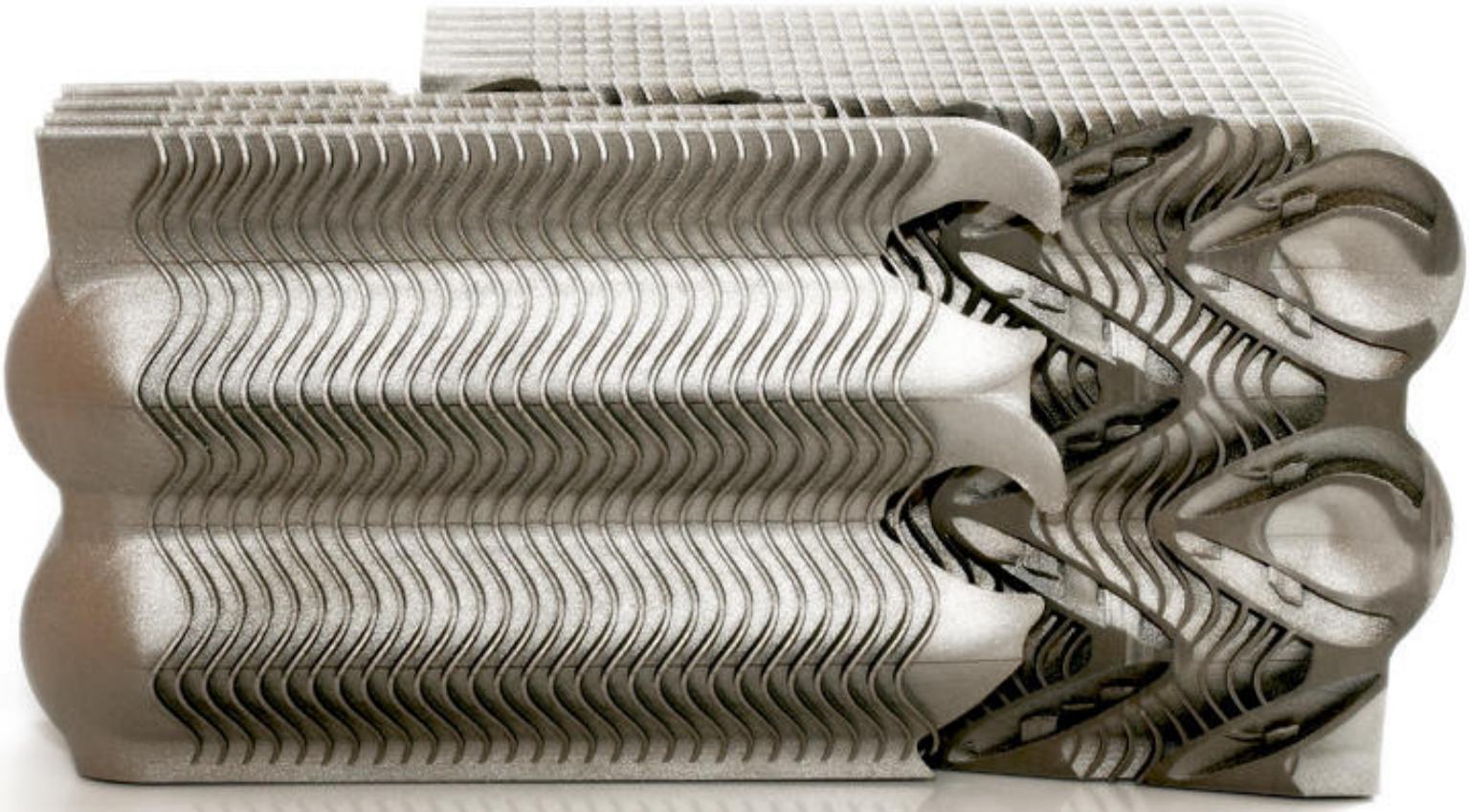
- Identical functionality as conventional part
- Fulfilling all certifications requirements for flight
- 10 parts eliminated
- 35% less weight

Source: Liebherr Aerospace

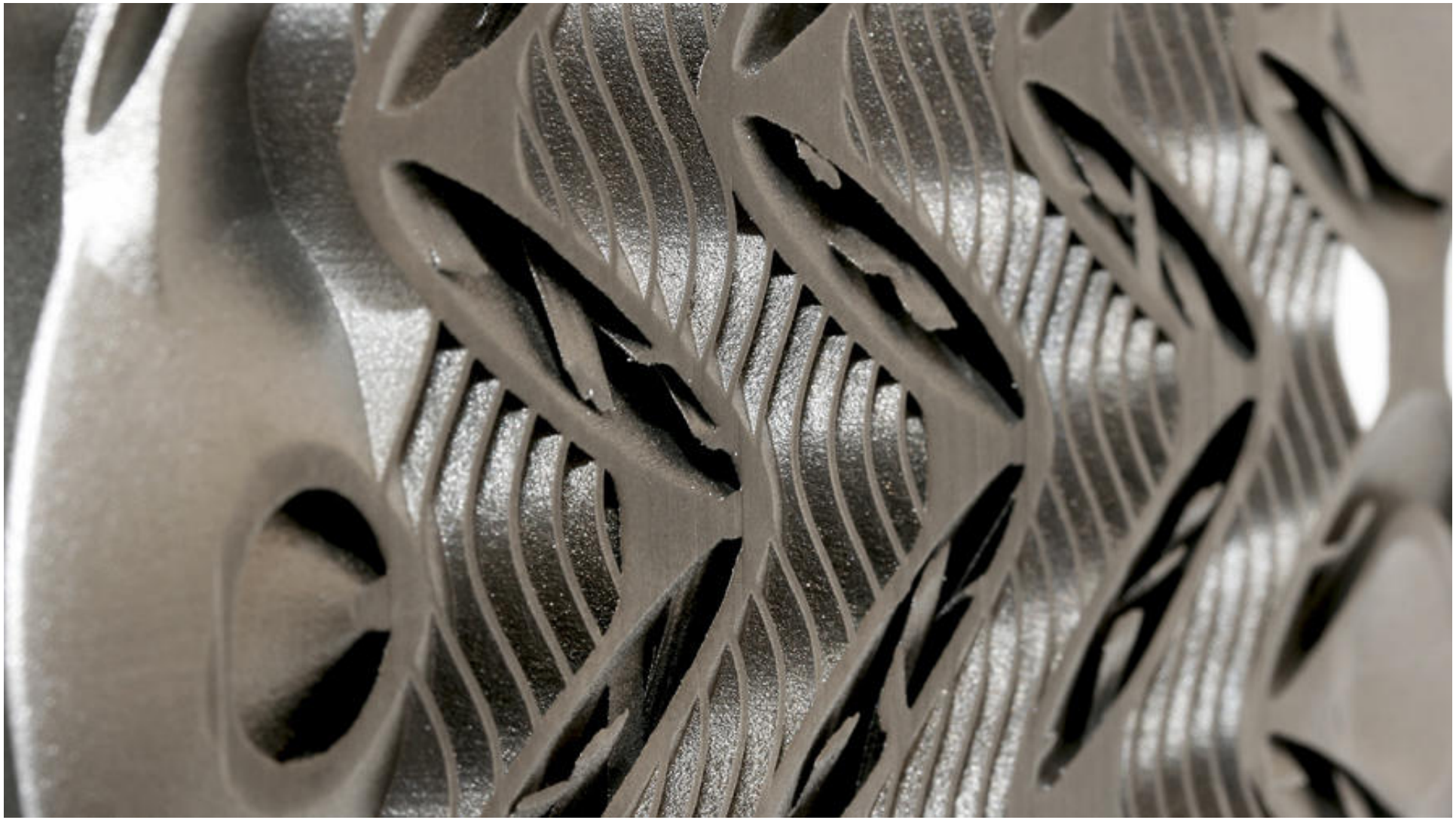


Ariane 6 – Vinci Engine injector

- 248 single parts
- More than 8000 holes
- No finishing necessary
- Cost reduction < 60%
- Lead time reduction < 80%



Source: Autodesk Within



Additive Manufactured molding is used in tire production

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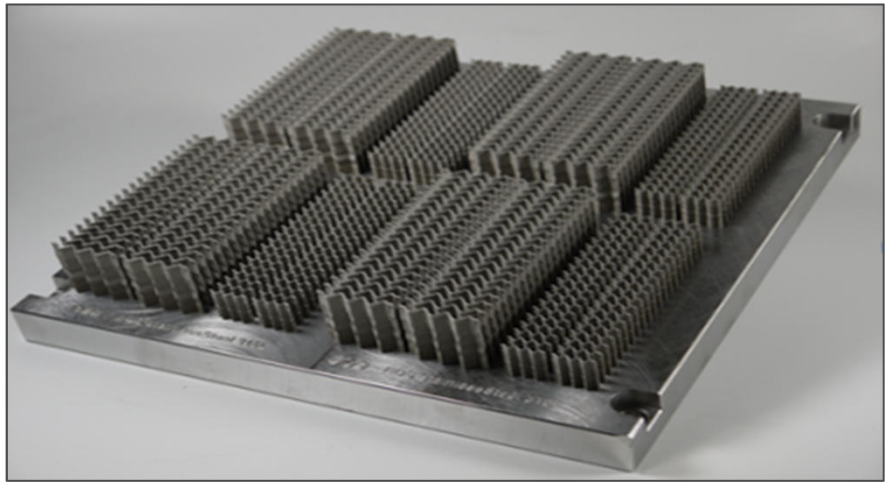
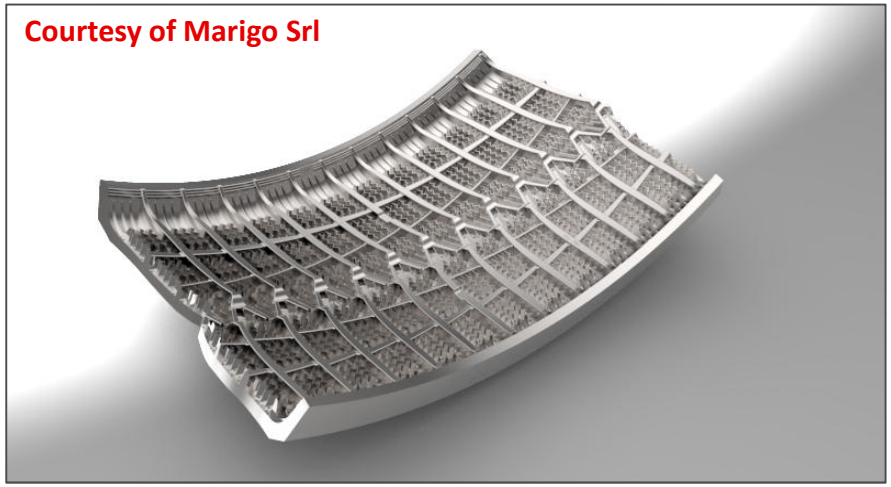
3D sipes

- Freedom of design for 3D sipes
- Shape complexity is not a cost-driver
- Fast innovation implementation



Tire winter mold segment

- Manufacturing of complex profile directly, 3D sipes integrated
- Customized parameters possible



Source: EOS, Marigo

Electric drive trains provide a huge potential for AM

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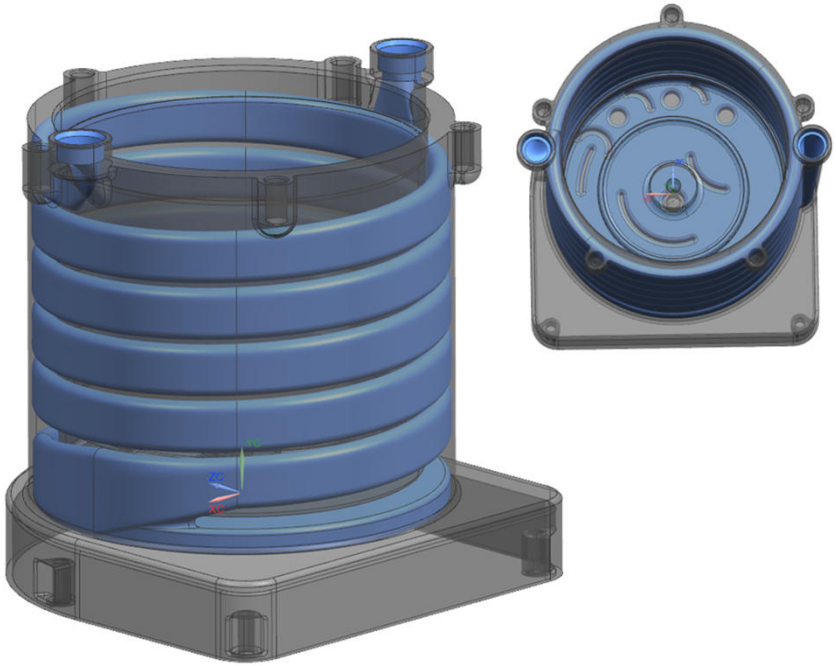

Example e-motor housing

- **Integrated cooling channels** in the motor housing
- **Weight reduced** by 25%
- **Components reduced** from five to one
- **No sealing** necessary (reduction of failures)
- **Optimized flow** resulting into better cooling performance and less pressure losses

Source: Pankl Racing Systems

With Electrified Transmissions and Drivetrains, NVH becomes a comfort issue

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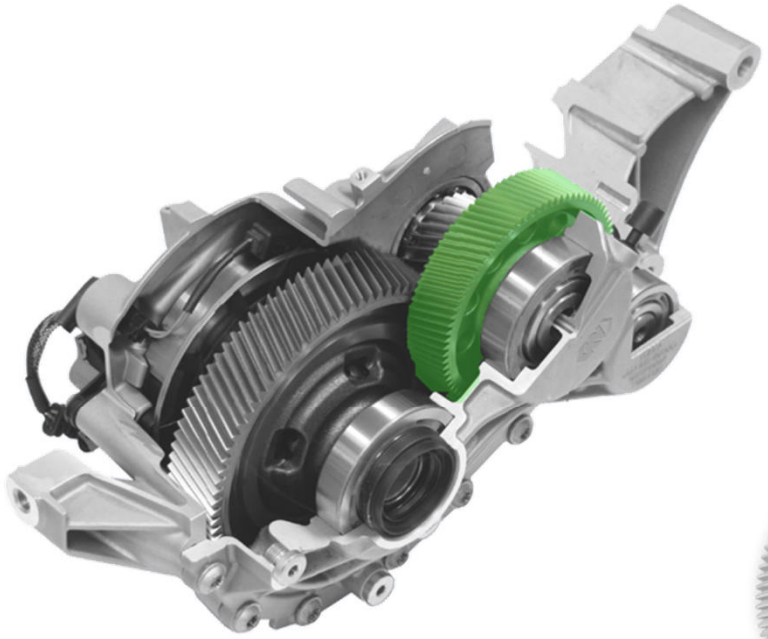

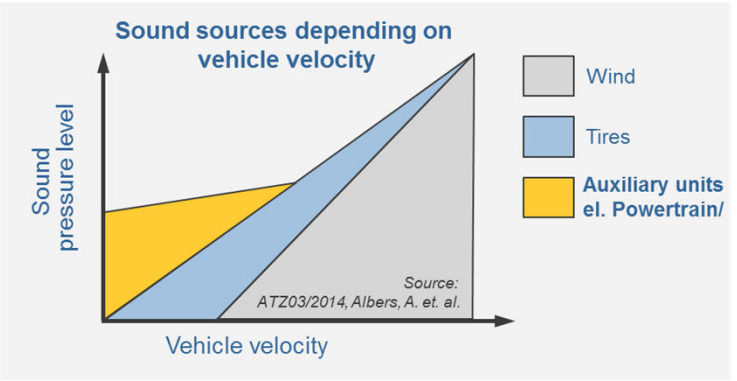

Gear body with densified teeth

Damping

Resulting sound level

Source: GKN Driveline, GKN Sinter Metals

Additive Manufacturing can help to reduce weight and noise

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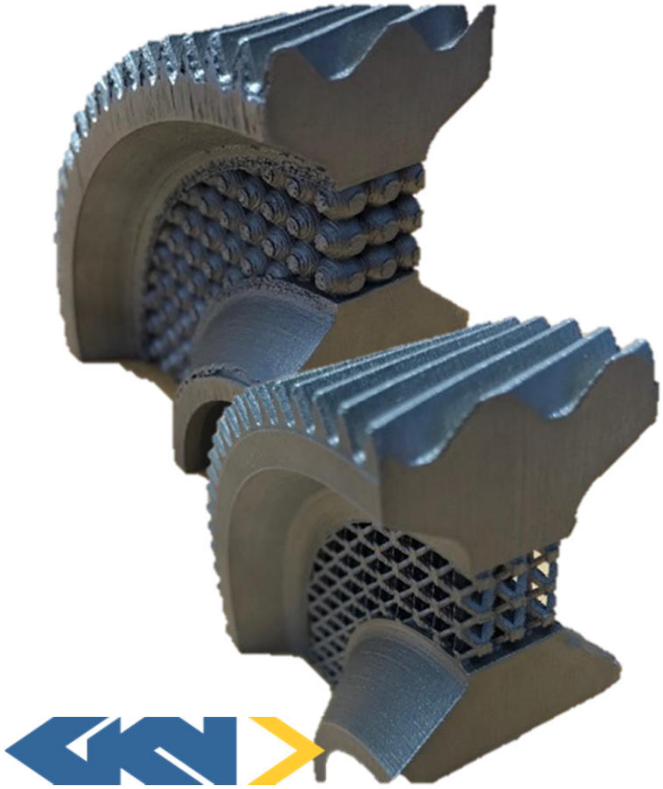

Source: GKN Driveline, GKN Sinter Metals

Example Helical Transmission Gears

- Conventional, add-on hybrid and battery electric vehicle (BEV) transmission
- Finishing quality of gear teeth is main driver to reduce Noise Vibration Harshness (NVH) today
- Printed lattice structures can be adapted to transmission load situation
- Additive Manufacturing can help to reduce weight and NVH impact of electrified drivetrains

Digitization happens since quite some time

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1995+

- Music
- Photography
- Video rental
- …

2010+

- Print media
- TV
- Travel
- HR
- …

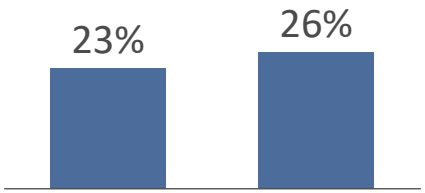
2015+

- Banking
- Healthcare
- Automotive
- Retail
- Education
- Telco
- …

2020+

All businesses will be subject to digital disruption

80%
of companies expect Industry 4.0 to impact their business model



48%
manufacturers only feel well prepared

Digitalization can generate an additional potential of
490 bln. € in Germany

Source: McKinsey Global Institute

Factory of the Future – how will it look like?

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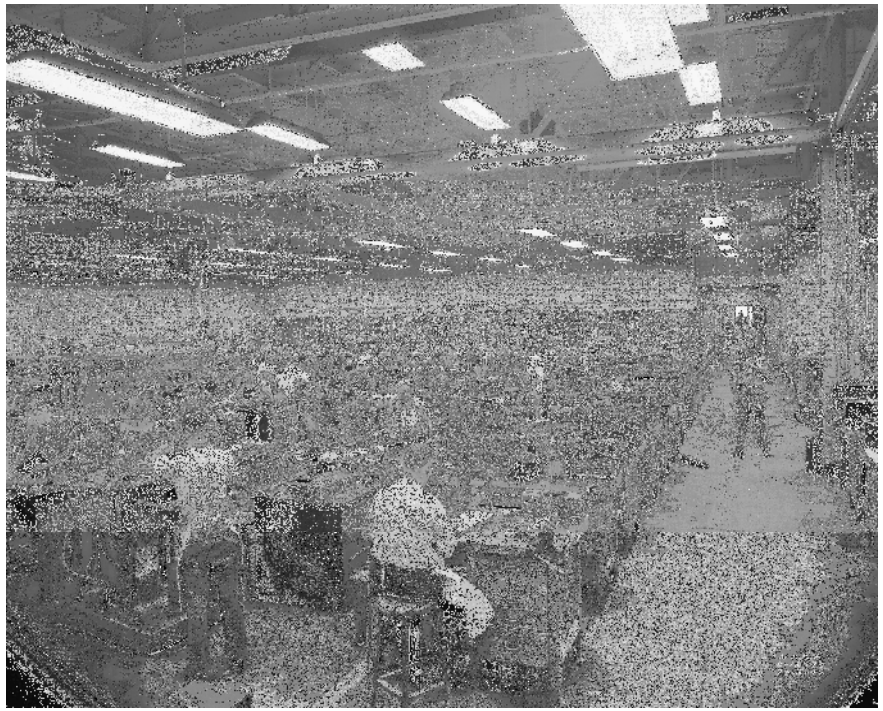
Manual production in the 40’s



Source: http://nasaimages.lunaimaging.com/luna/servlet/detail/nasaNAS~5~5~21951~126643:Machine-Shop-Men-Working-at-Machine

Semi-automated production in the 80’s

Source: https://arcadeblogger.com/2016/05/13/arcade-factory/

Factory of the Future – how will it look like?

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Semi-automated production in the 2000s

Source: http://www.lyngroup.ca/

AM production in the 2010s

Source: Siemens

AM influences almost all life cycle phases of a product

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Today's product life cycle

Configure → Design → Produce → Sell → Service

- Personal configuration
- Mass customization

- Bionic design
- Lightweight
- Integrated functions

- Lot size one

- New business models
- New distribution channels

- Spare parts on demand

Influence of AM

Source: EOS

EOS Vision

Additive Manufacturing technology is an established and efficient way of industrial production.

Siemens invested €21.4 m into its AM facility

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Image Courtesy of Siemens

Depending on batch size, printing of direct parts or injection molding tools makes sense

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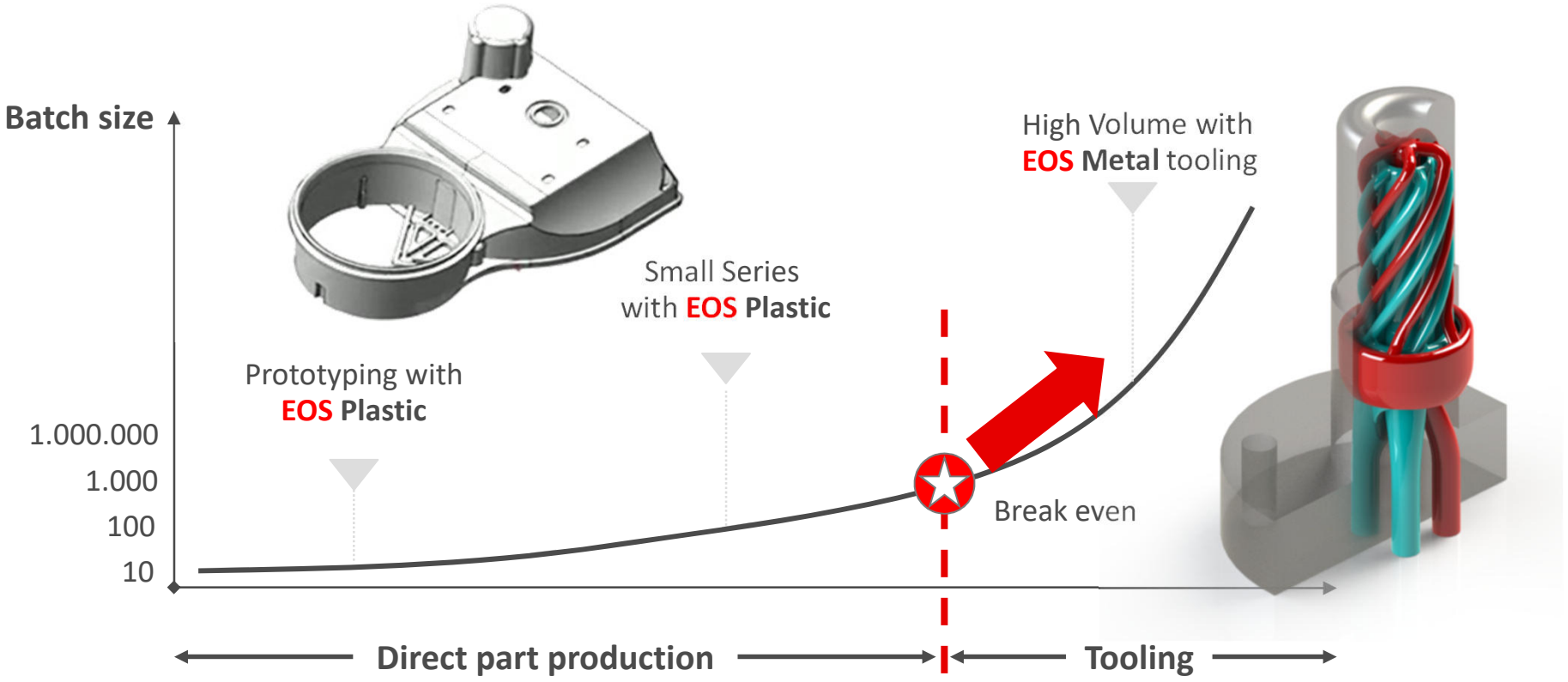
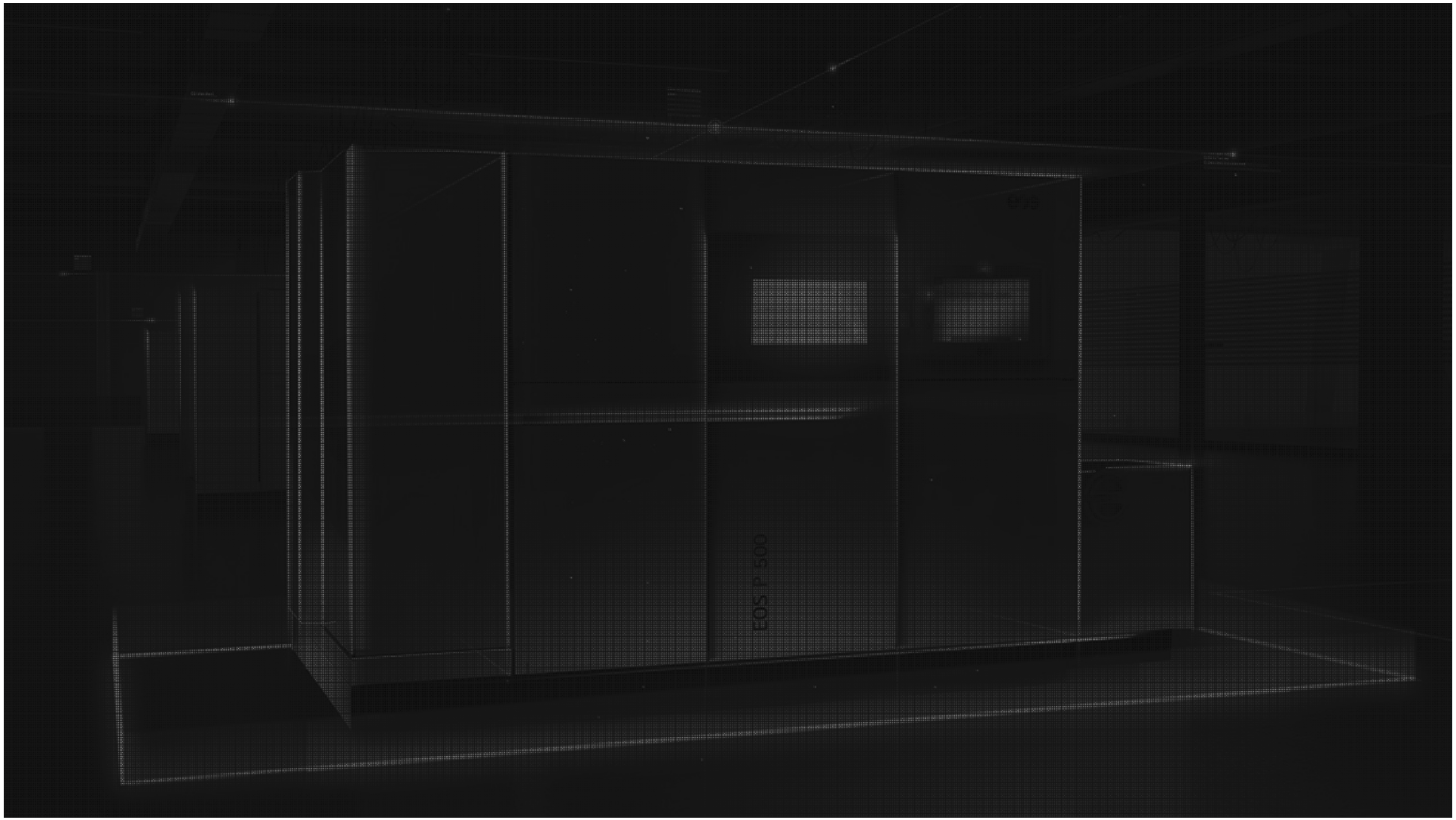


Source: EOS, Fado, PEP


EOS 1D C

Goal: Integrated production system for a cost-efficient production of aluminum parts in Aerospace and Automotive

Additive Manufacturing is a key transformation driver towards a digital factory

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Summary

- **Additive Manufacturing** will radically **change** the way, engineers **design products**
- In addition to the digital transformation, **the technology adds complexity and speed** in the way products are sold, serviced and has the potential to disrupt business models
- The technology matures to be **'automotive ready'** in polymer and metal applications
- **The digital factory is no fiction** – large OEMs start ramping up AM capacity

Source: EOS