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Industrialize Additive Manufacturing

Design and print useful parts at scale

History of Atlas 3D and Siemens Acquisition

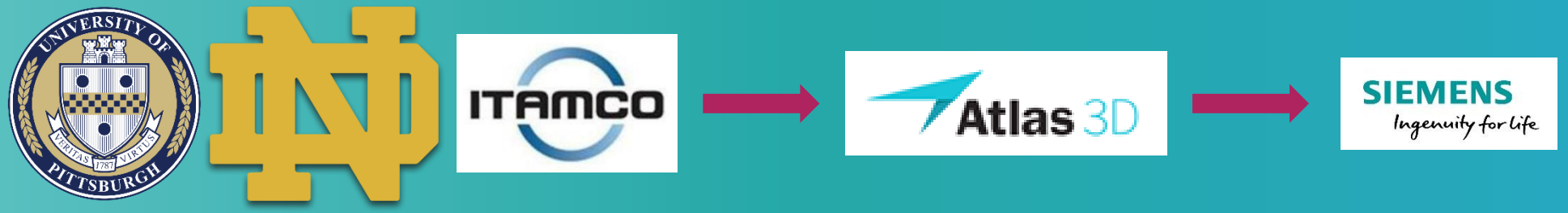
Initial product and company was 2015 National Winner of $1.6M Grant from America Makes Project #4047

Atlas 3D spun-out April 2017 in Plymouth, Indiana to Commercialize Software

Mission: To take the “Black Art” out of metal additive printing, by providing answers to the critical questions surrounding orientation and support structure generation, for successful first time prints . . . Every time!

Software Known as Sunata™, Launched November 2017

Atlas 3D acquired by Siemens in November 2019



Conventional thinking

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Disadvantages:

Complex supply system

High manufacturing cost

Long lead time

Complex assembly

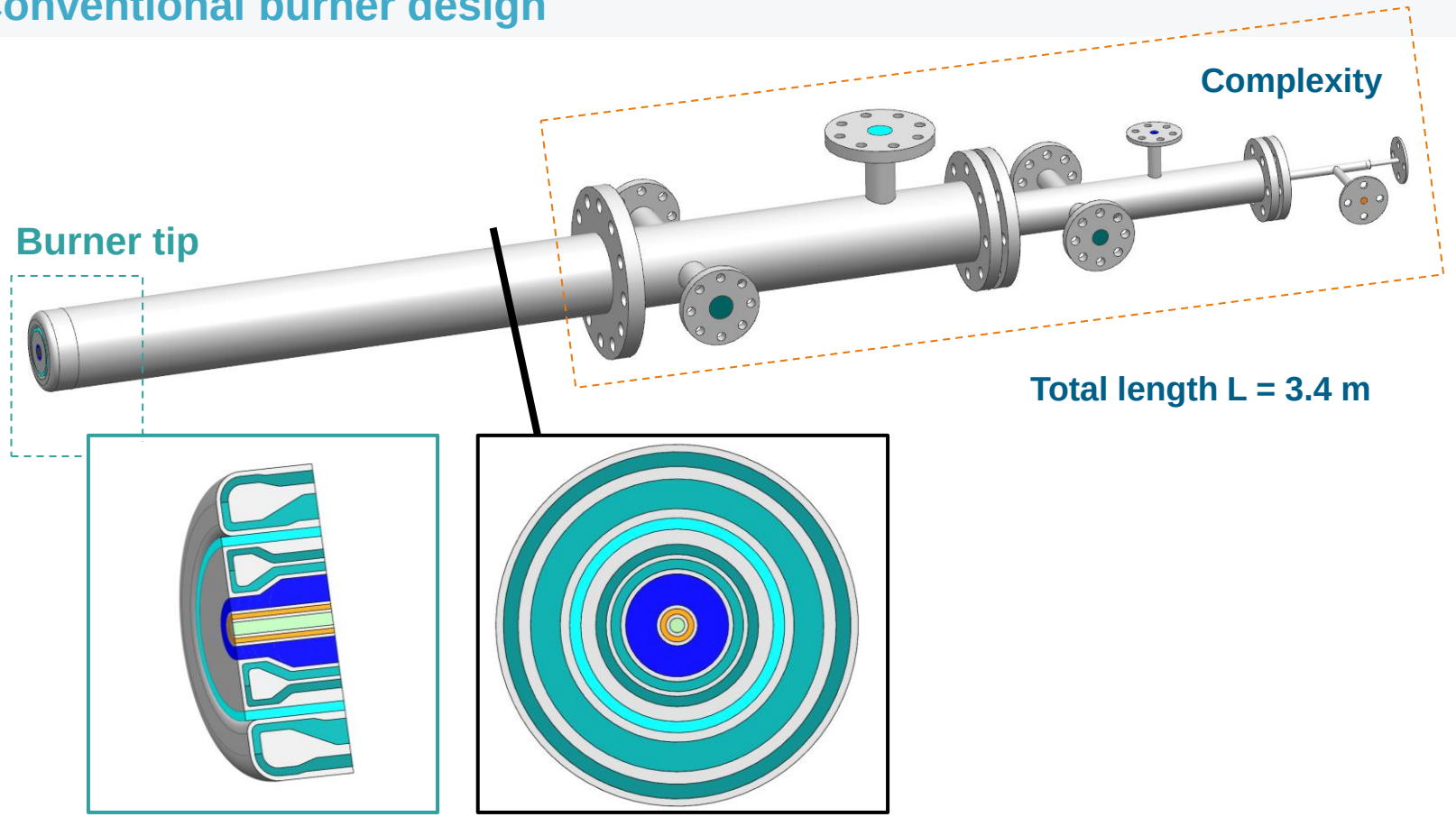
Costly maintenance, repair

Excessive size

Many parts, flanges, welds

Nested, ring-shaped fluid channels

Conventional burner design



Inspiration

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Simulation-driven generative design

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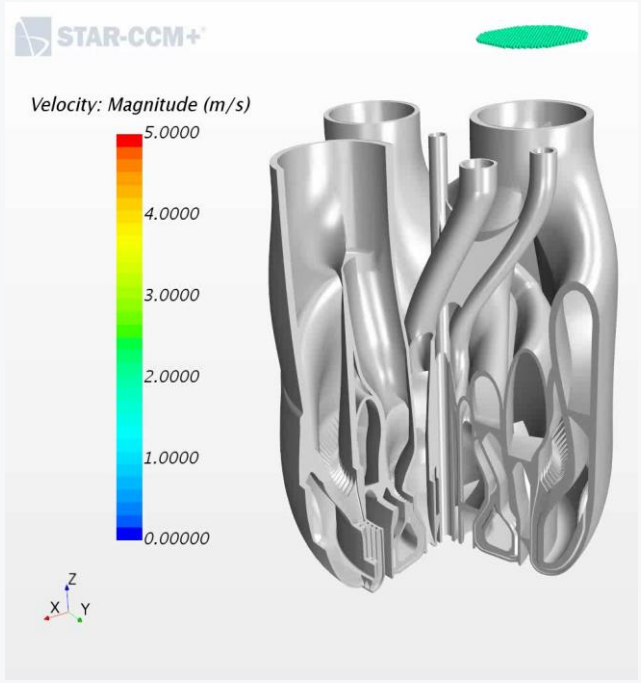
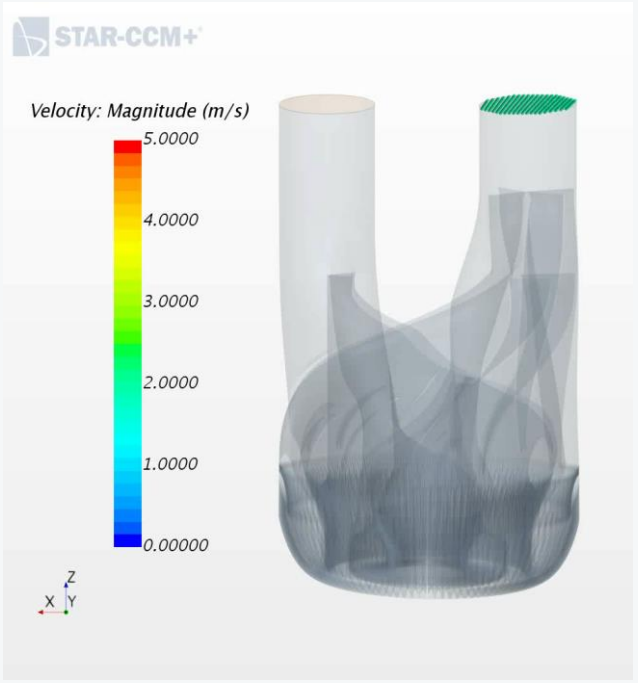
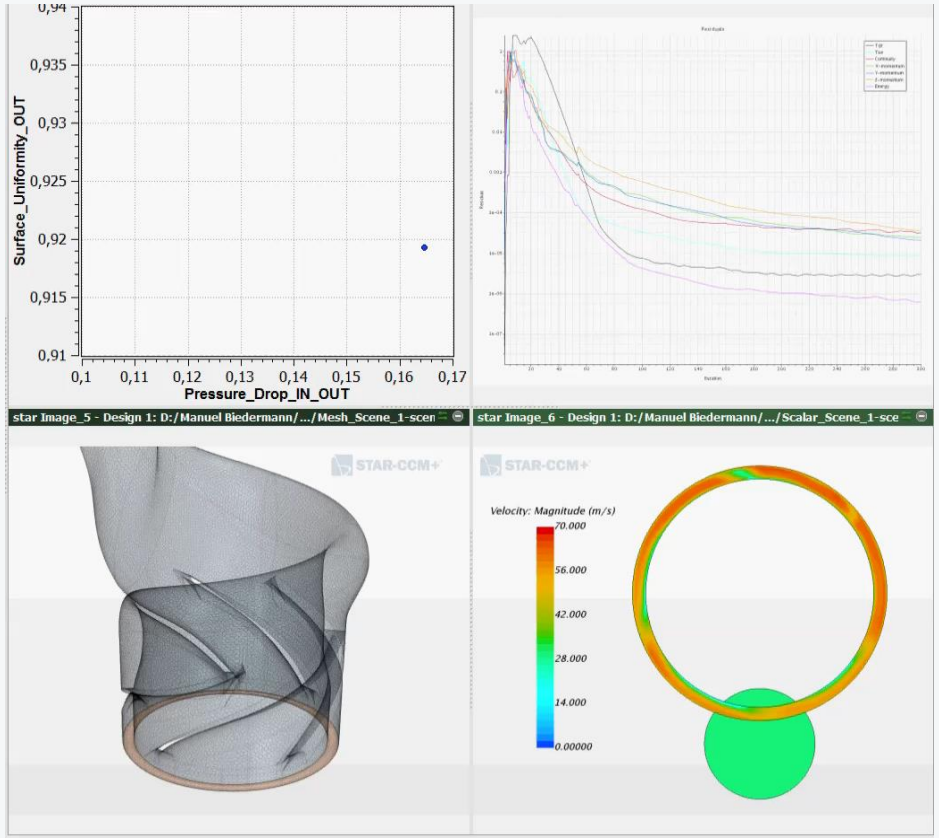
Computational fluid dynamics (STAR-CCM+)





Design space exploration (HEEDS)



Result: Reimagined system

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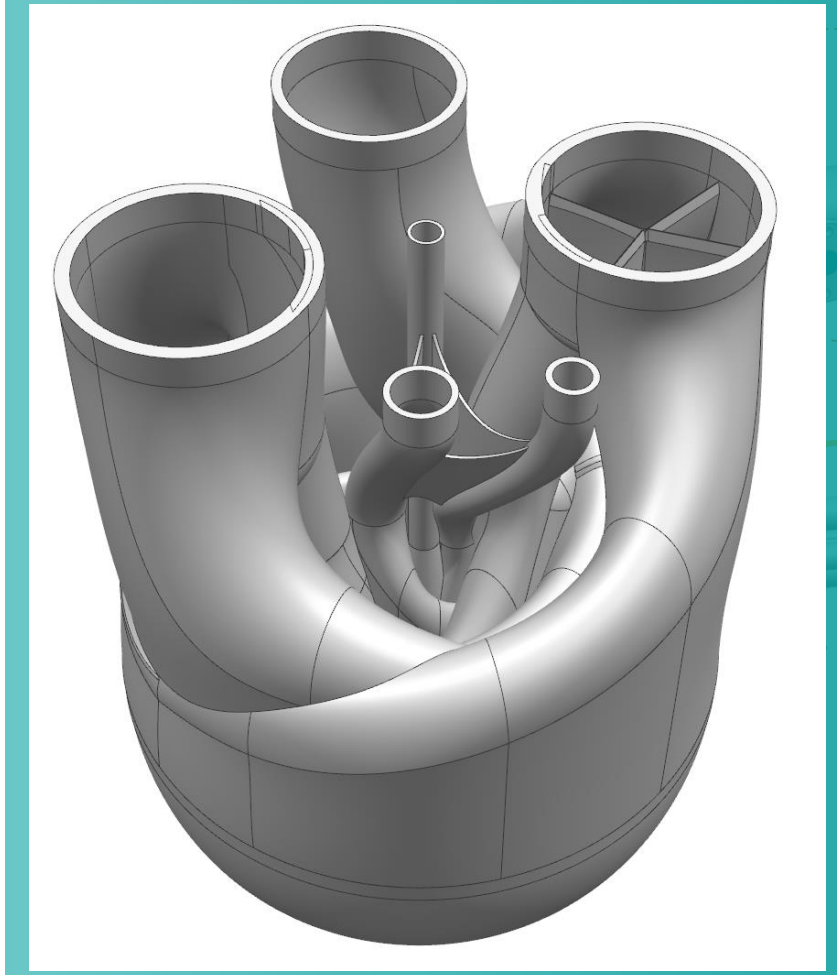
AM Thinking:

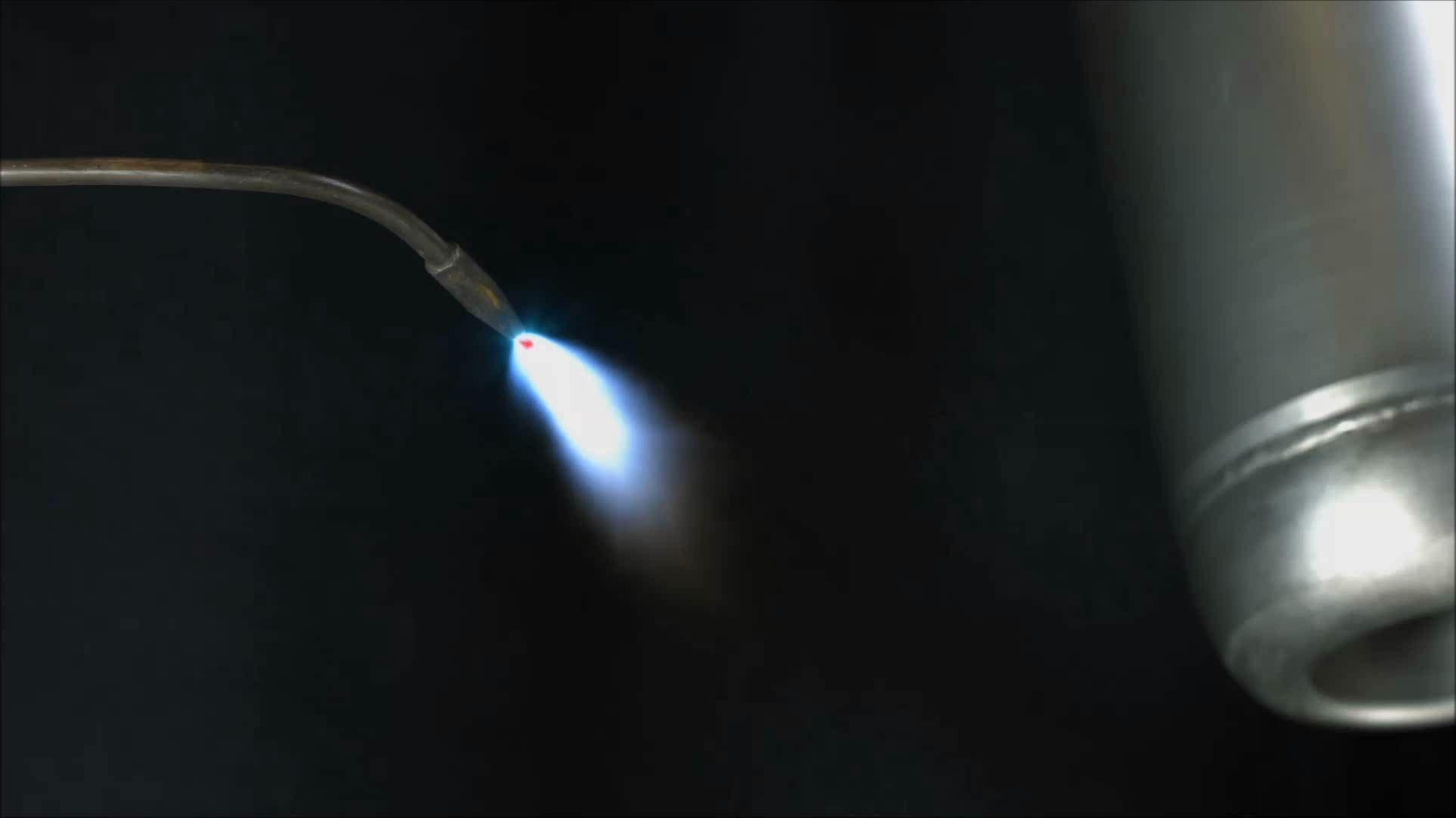
Vast improvement opportunities in every area of design, manufacturing and business



Product:
Simplified, standardized mounting assembly
Reduced size
Reduced mounting effort

Manufacturing:
Reduced lead time, faster assembly
Reduced parts by over 50%
Reduced welds by approx. 50%
Reduced assembly complexity, steps

Business:
Accelerated speed to market
Adjustable design for customer-specific combustion requirements
Simplified repair



Additive Manufacturing is driving Innovation: Incremental progress isn't competitive enough

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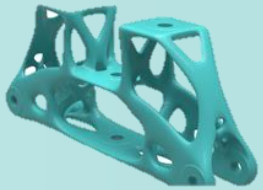
Reimagine products

- Reduce weight, material
- Scan-to-product
- Expand performance
- Accelerate innovation cycles

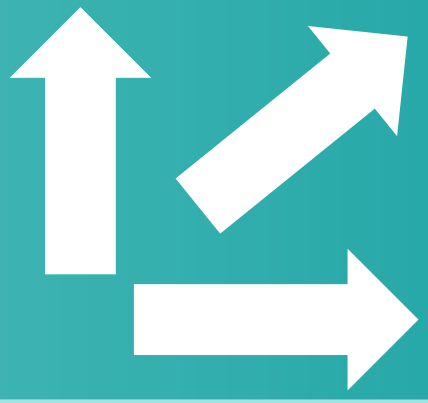


Rethink business

- Individualization, personalization
- Zero inventory – on demand printing
- Design anywhere. Print anywhere.
- Increase competitiveness

Reinvent manufacturing

- Eliminate molding/castings/tooling
- Eliminate/simplify assembly process
- Reduce supply chains
- Affordable low volume production



STATUS QUO

Product transformation
Shift from conventional design to innovative DFAM

Manufacturing transformation
Shift from prototyping / experimentation to mainstream industrial production

Economics drives the adoption of Additive Manufacturing

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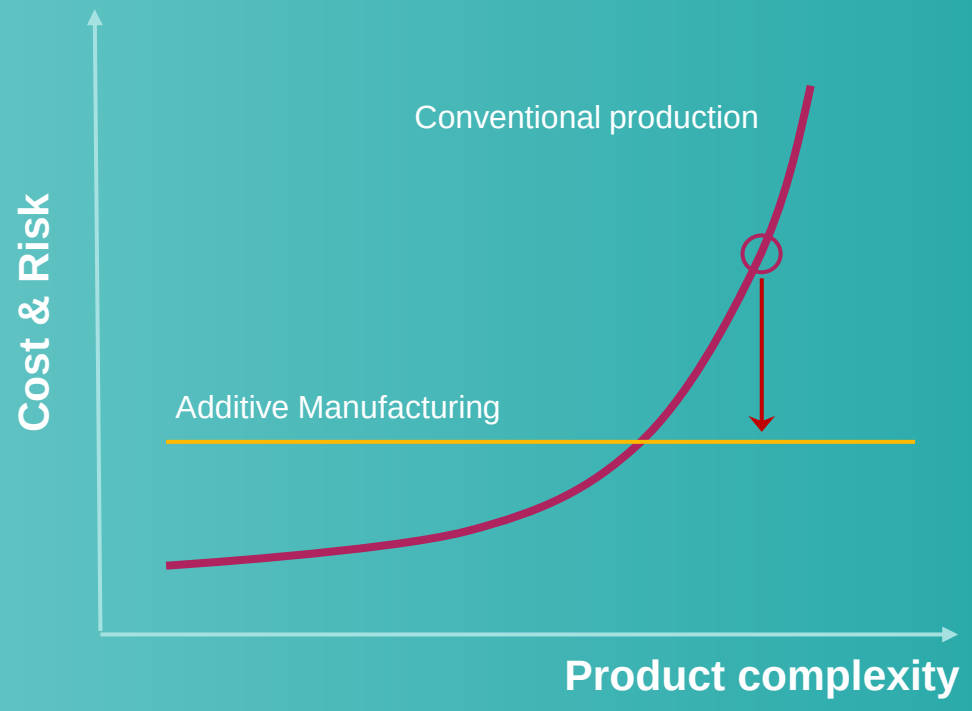
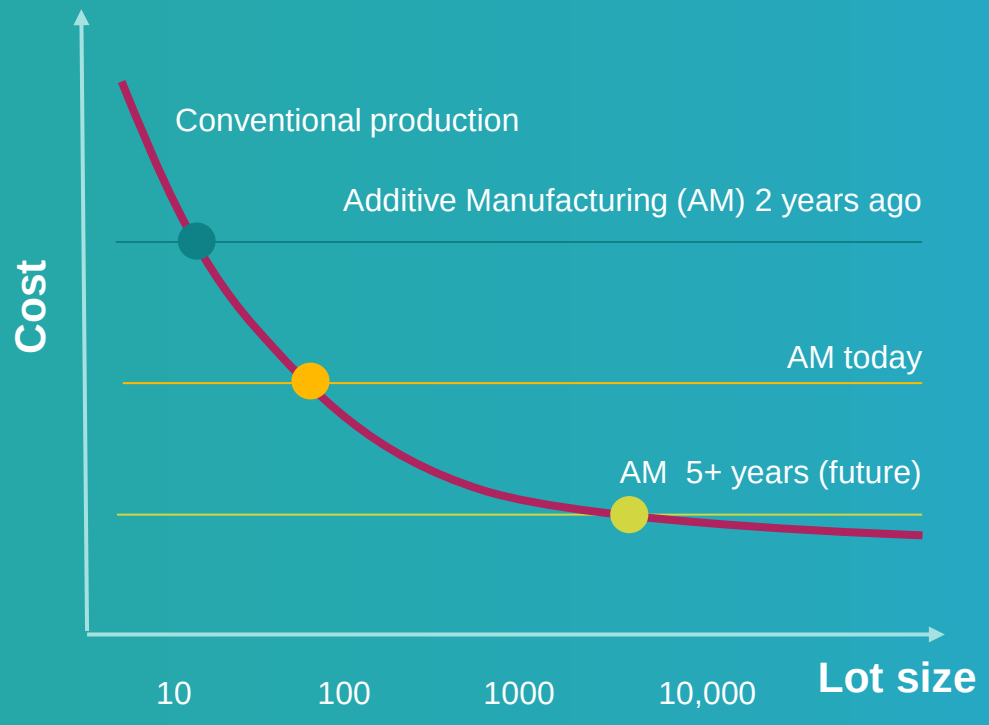
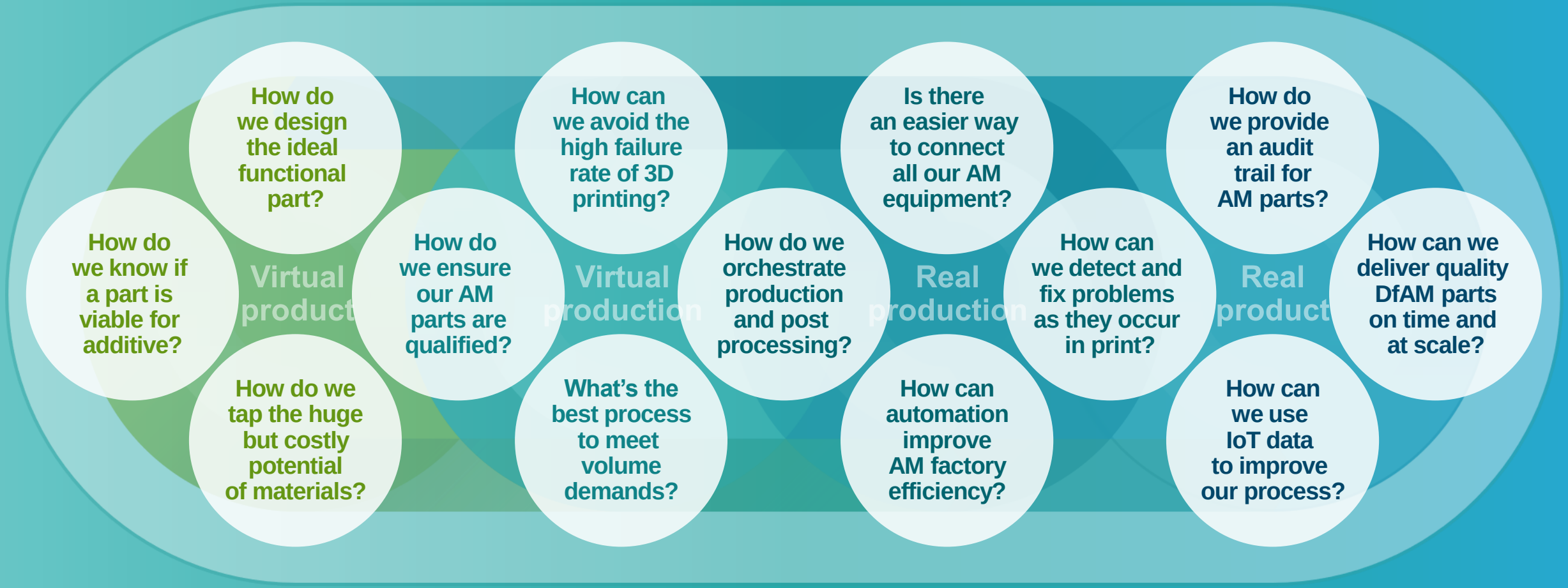


Complexity for Less



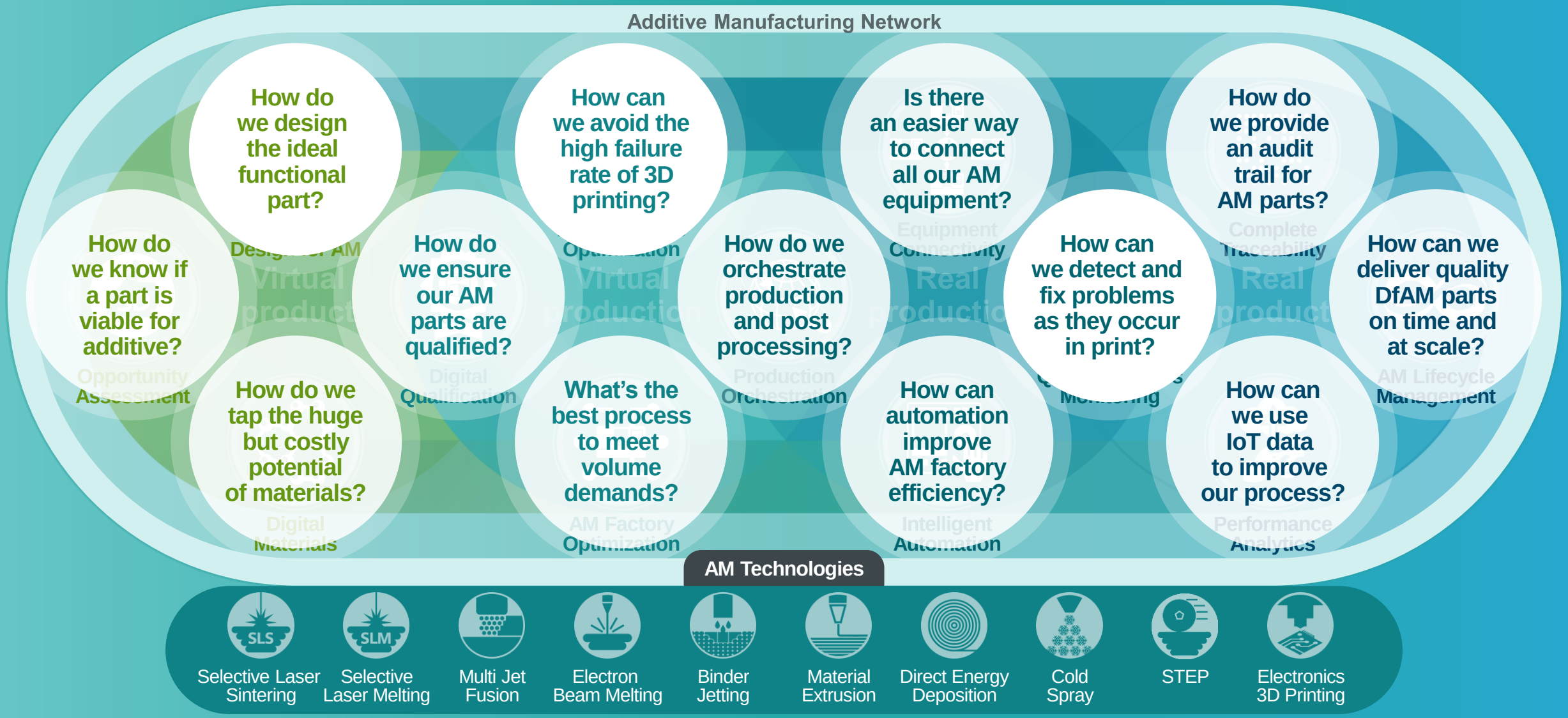
Small Series for Less

CUSTOMER CHALLENGES



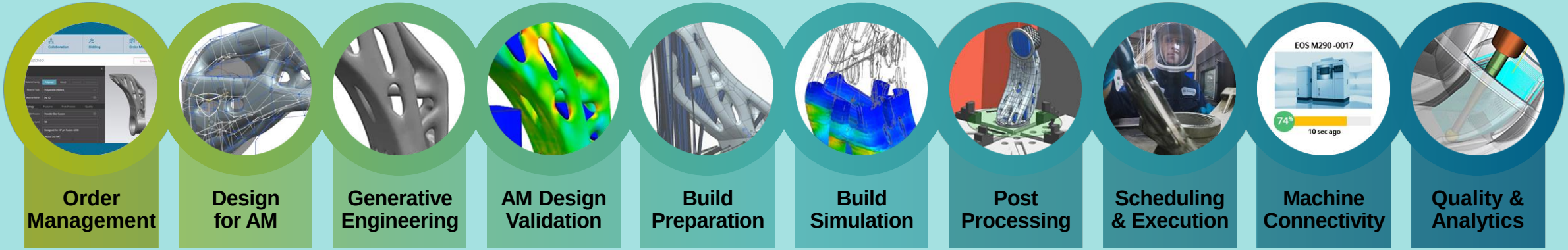
ACROSS THE DIGITAL ENTERPRISE

SIEMENS XCELERATOR AM VISION



SIEMENS INDUSTRIAL ADDITIVE MANUFACTURING SOLUTION

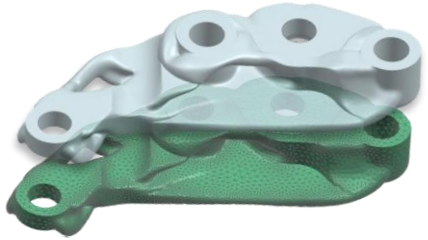
Procurement | Product Development | Manufacturing Planning | Production



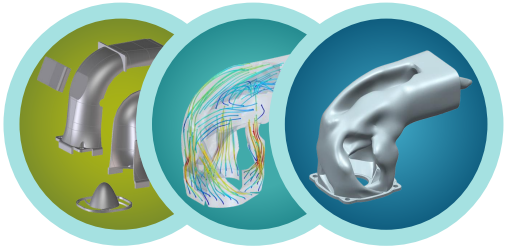
Order Management | **Design for AM** | **Generative Engineering** | **AM Design Validation** | **Build Preparation** | **Build Simulation** | **Post Processing** | **Scheduling & Execution** | **Machine Connectivity** | **Quality & Analytics**

Key Capabilities

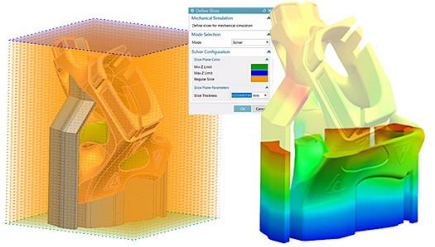
A unified solution for AM idea-to-part



Multi-disciplinary generative engineering



Simulation-driven “right-first-time” printing

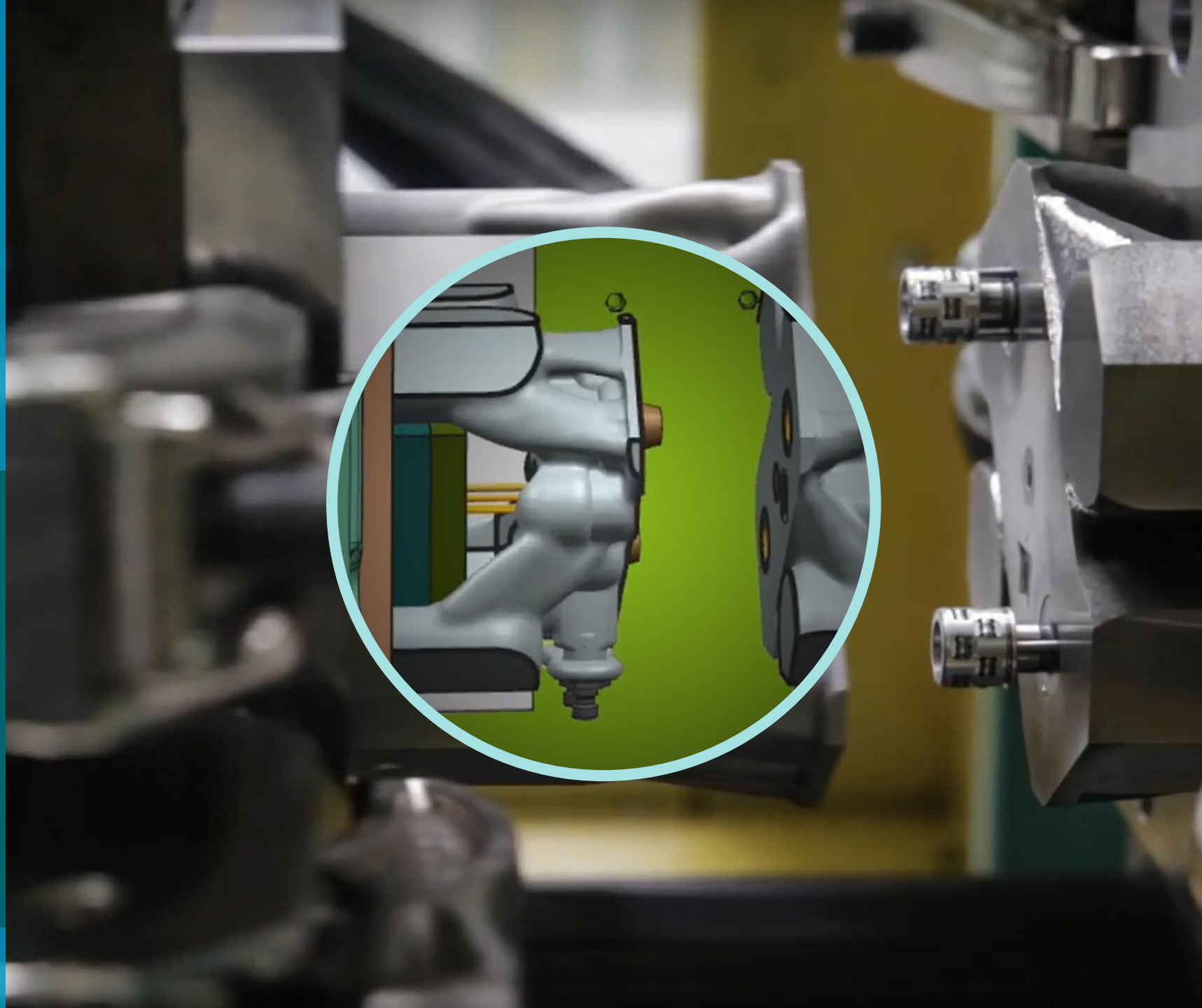


Managed environment from order-to-service

toolcraft

CHALLENGE

Streamline the process for optimizing a customer mold tool using additive manufacturing.



SOLUTION

Work in one environment for AM process, from design and validation, through build prep and simulation, to traceability.

50% REDUCTION IN TOOL WEIGHT

30% REDUCTION IN CYCLE TIME

LESS ENERGY CONSUMPTION

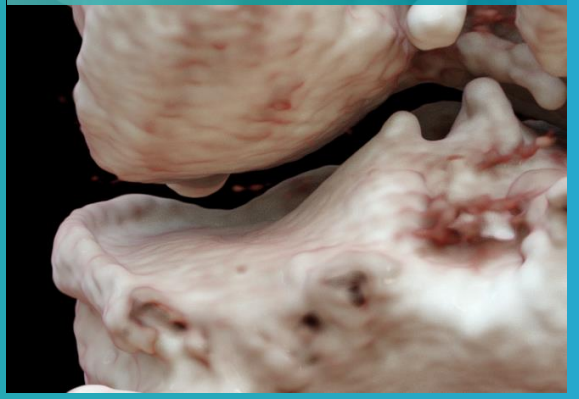
Siemens is industrializing additive manufacturing

Power Generation

Power Services

Mobility

Healthineers

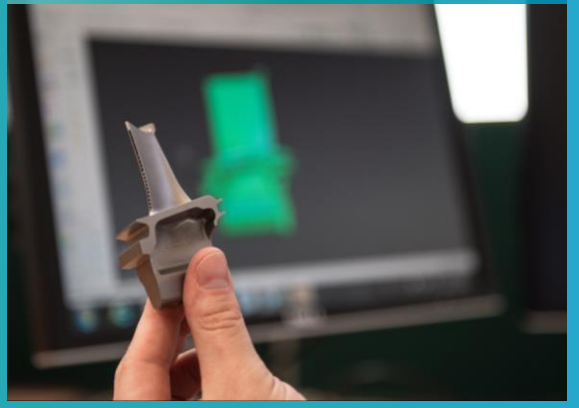


PLM Software

Motion Control

Corporate Technology

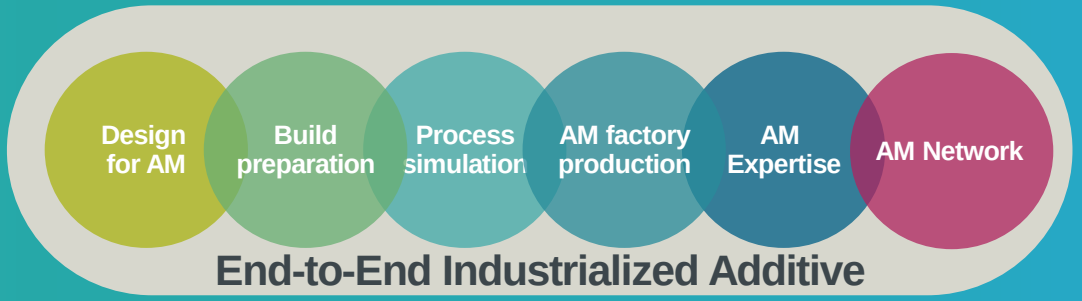
Materials Solutions



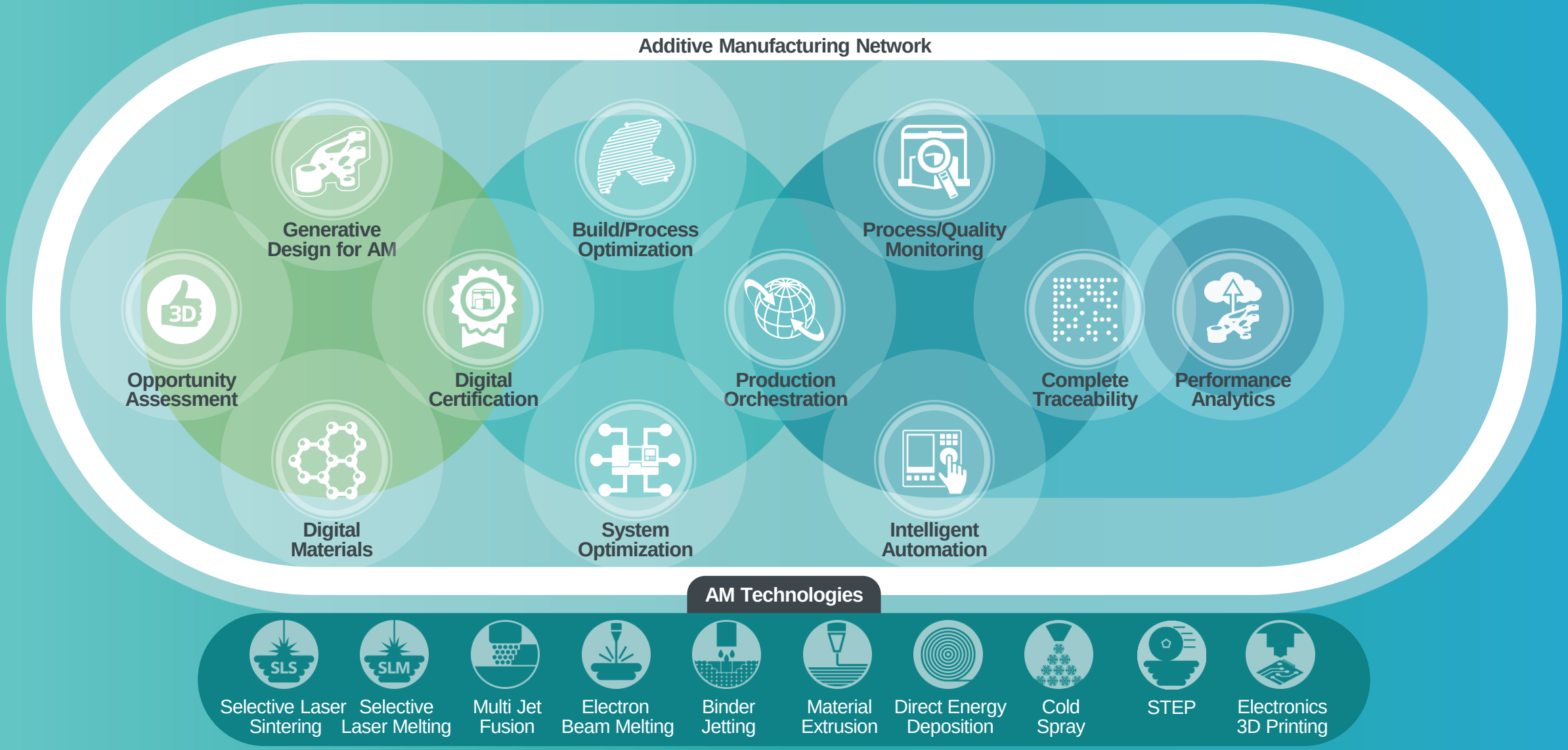
End-to-end industrialized additive

“Siemens is providing us with the most complete, fully associative end-to-end process chain from design to 3D printing of parts including finishing and quality assurance allowing us to transform Additive Manufacturing into an industrial production technology.”

Christoph Hauck
CEO of MBFZ toolcraft GmbH



Siemens End-to-End Additive Manufacturing Solutions



Thank you.

Use Case: Scan-to-part for additive manufacturing

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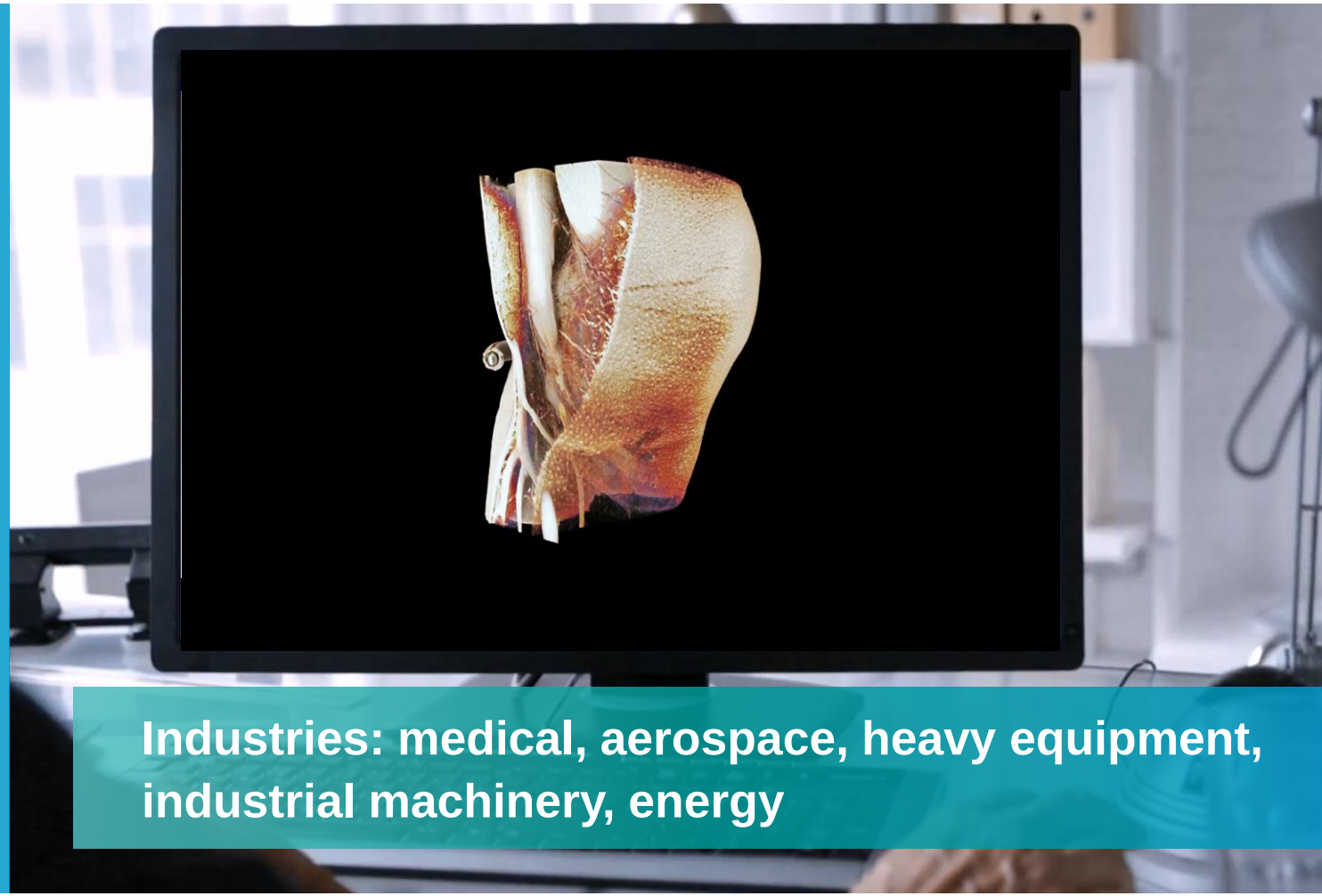
Utilize scans of physical objects to engineer and 3D print individualized products

Value:

- Personalize products
- Economically produce lot sizes of one part
- Expedite reverse engineering of parts

Key capabilities:

- Convergent Modeling™ – standard CAD tools work with mixed facet and precise geometry
- Linked, smart model-driven process from scan to printed part



Industries: medical, aerospace, heavy equipment, industrial machinery, energy

Use Case: Lightweighting with bionic / organic designs

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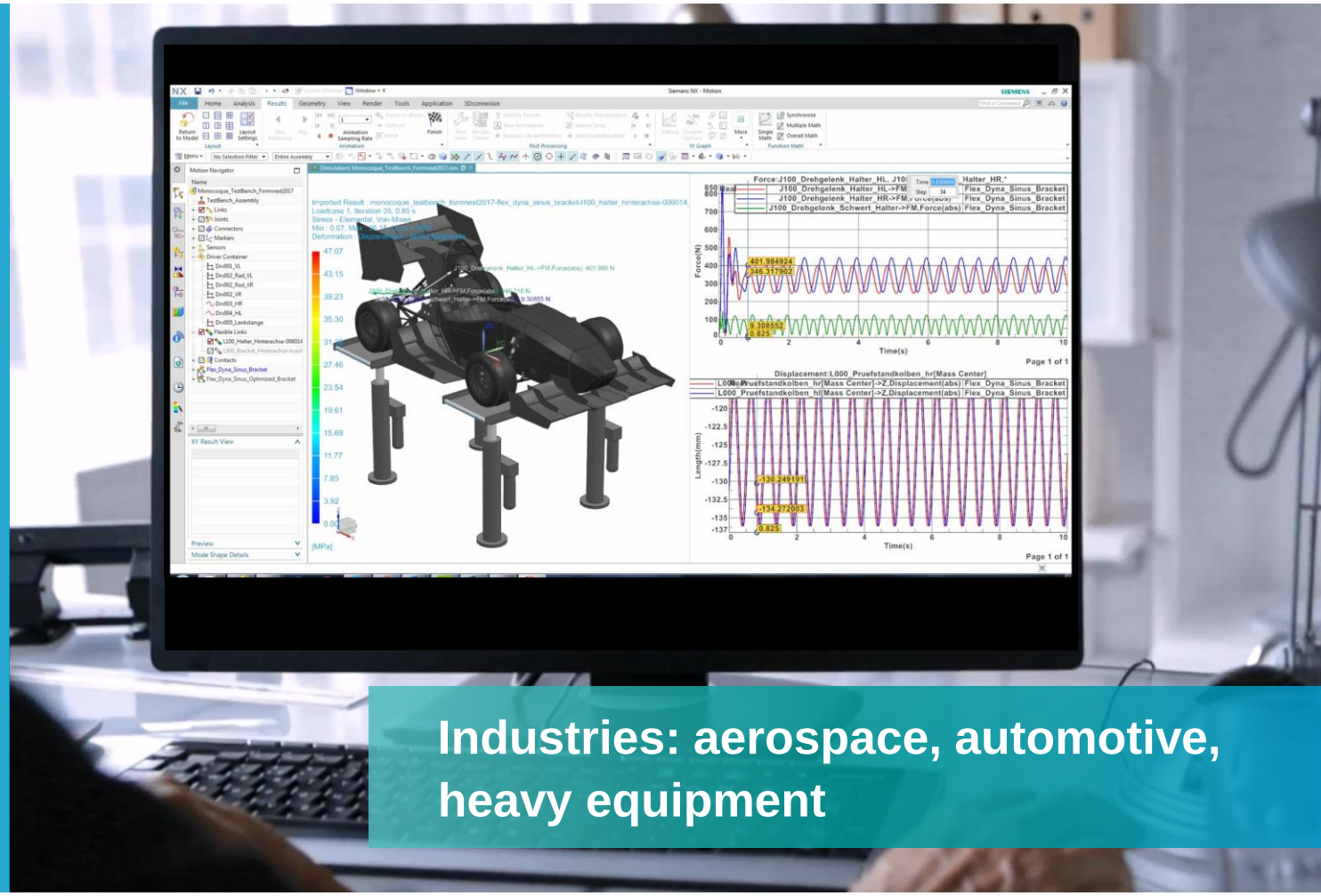
Generate lighter weight and stronger parts with topology optimization

Value:

- Reduce product weight, material
- Maximize strength
- Automatically generate optimized shapes suitable for 3D printing

Key capabilities:

- Convergent Modeling™ – standard CAD tools work with mixed facet and precise geometry
- Integrated generative design, topology optimization eliminates data conversion / transfer
- Integrated design rules for 3D printing
- Linked process from concept to print



Industries: aerospace, automotive, heavy equipment

Use Case: Eliminate castings and forgings

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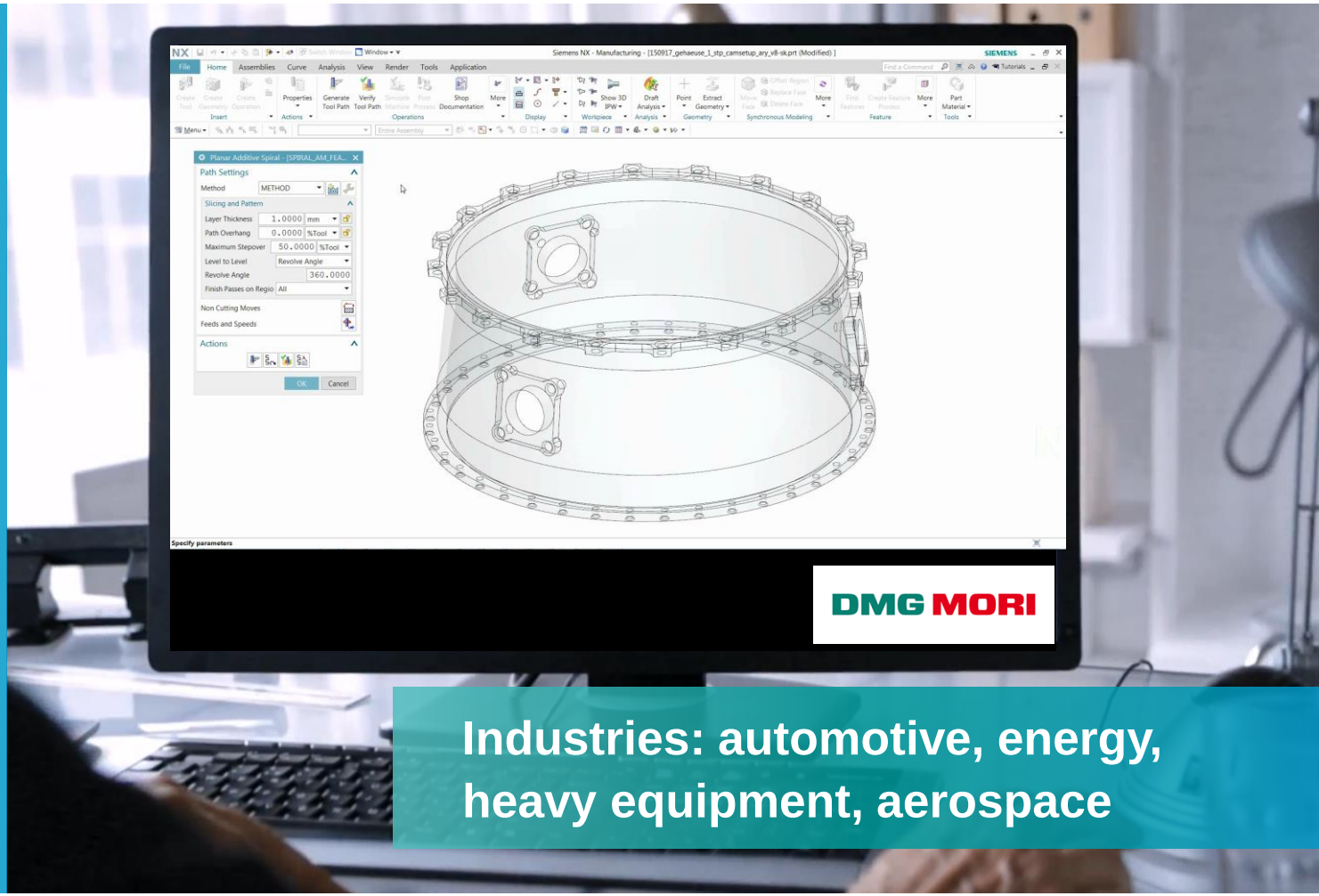
Produce parts using 3D printing instead of with castings

Value:

- Make parts in weeks instead of months
- Produce parts with complex internal geometry for greater performance
- Economically produce small lot sizes
- Accelerate innovation cycles

Key capabilities:

- Linked process from design to print eliminates data conversion, enables associativity
- Integrated print preparation and post-print finishing in NX
- Ability to drive multi-axis FDM and fixed-axis DED printing technologies with one system



Industries: automotive, energy, heavy equipment, aerospace

Use case: Automate composite lay-up [technology demonstrator / future vision]

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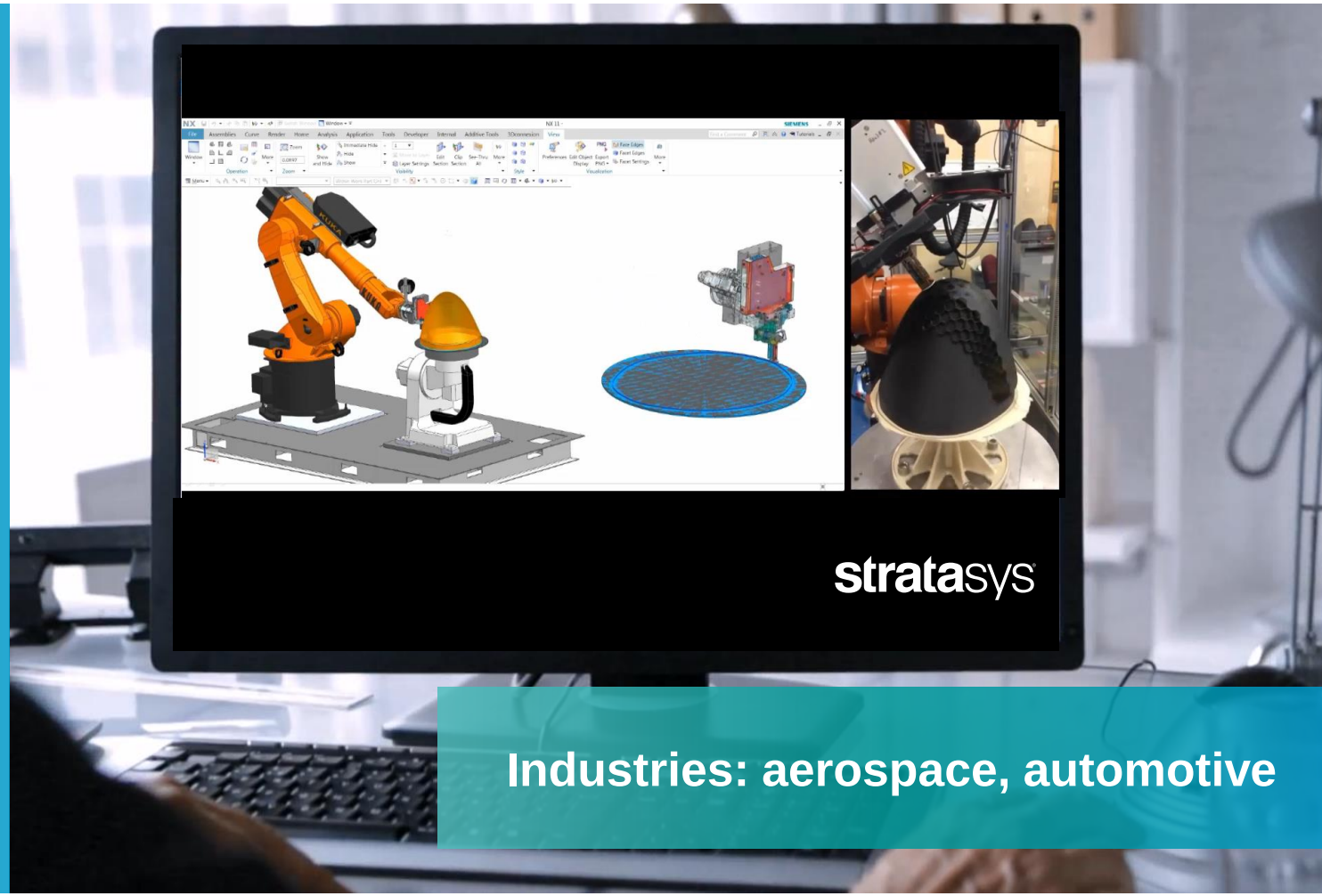
Produce large scale production and composite parts using robots

Value:

- Automate production to make parts in days instead of months
- Eliminate part size constraints
- Lightweight parts
- Economically produce small lot sizes

Key capabilities:

- Multi-axis programming and control for FDM
- Siemens Sinumerik controlled multi-axis robot
- Integrated and linked process from design to print – all in NX



Industries: aerospace, automotive

Use Case: Consolidate parts and eliminate injection mold tooling

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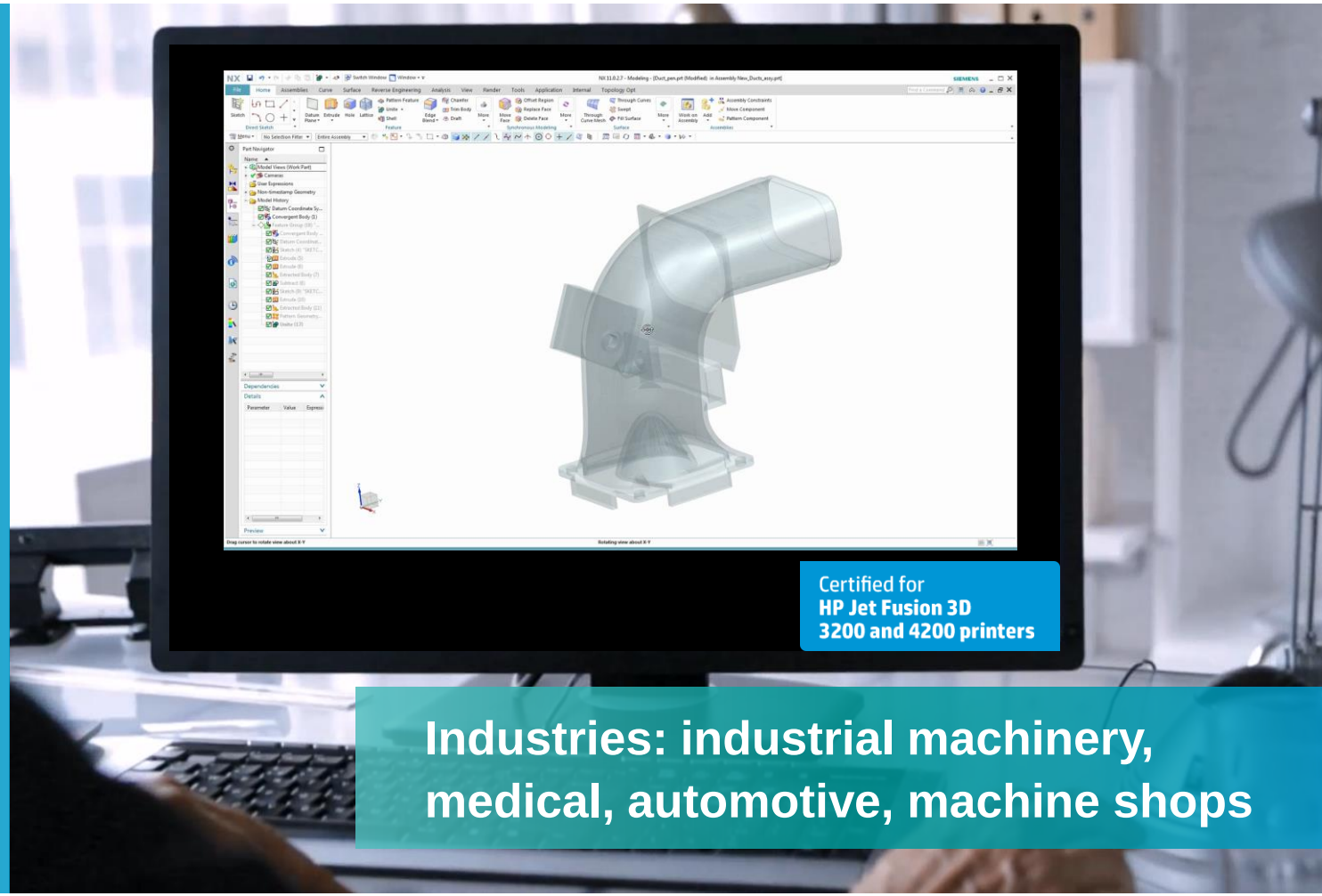
Produce plastic parts using 3D printing instead of mold tooling for low / mid-level production volumes

Value:

- Consolidate parts, increase complexity
- Make parts in days instead of weeks, economically product small lot sizes
- Accelerate market penetration

Key capabilities:

- Convergent Modeling™ – standard CAD tools work with mixed facet and precise geometry
- Linked process from design to print eliminates data conversion, enables associativity
- Integrated print preparation (powered by Materialise) for HP Multi Jet Fusion
- 3D nesting for optimally packed build volume



Industries: industrial machinery, medical, automotive, machine shops

Reshaping the business of power generation

Conventional thinking

Additive Manufacturing thinking

13 → 1 parts
system simplification

26 → 3 weeks
lead time reduction

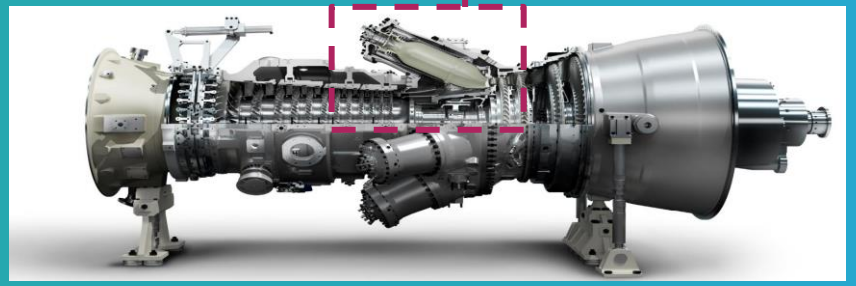
22%
weight reduction

In serial production

Function & performance improvement

Designed in NX

Combustion System
Burner
Swirler/Nozzle/Filter/Mixer



CHALLENGE

Use 3D printing
to improve efficiency
of its own 3D printers
to prove the viability
of MJF for production.

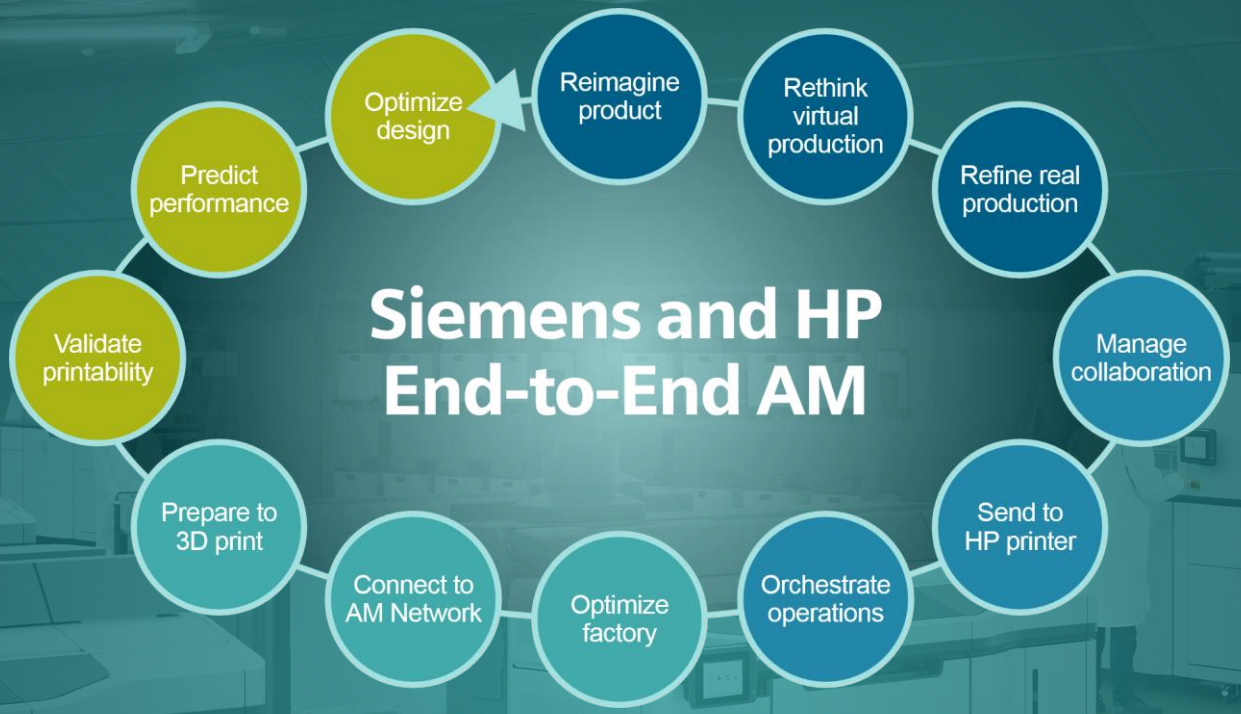
SOLUTION

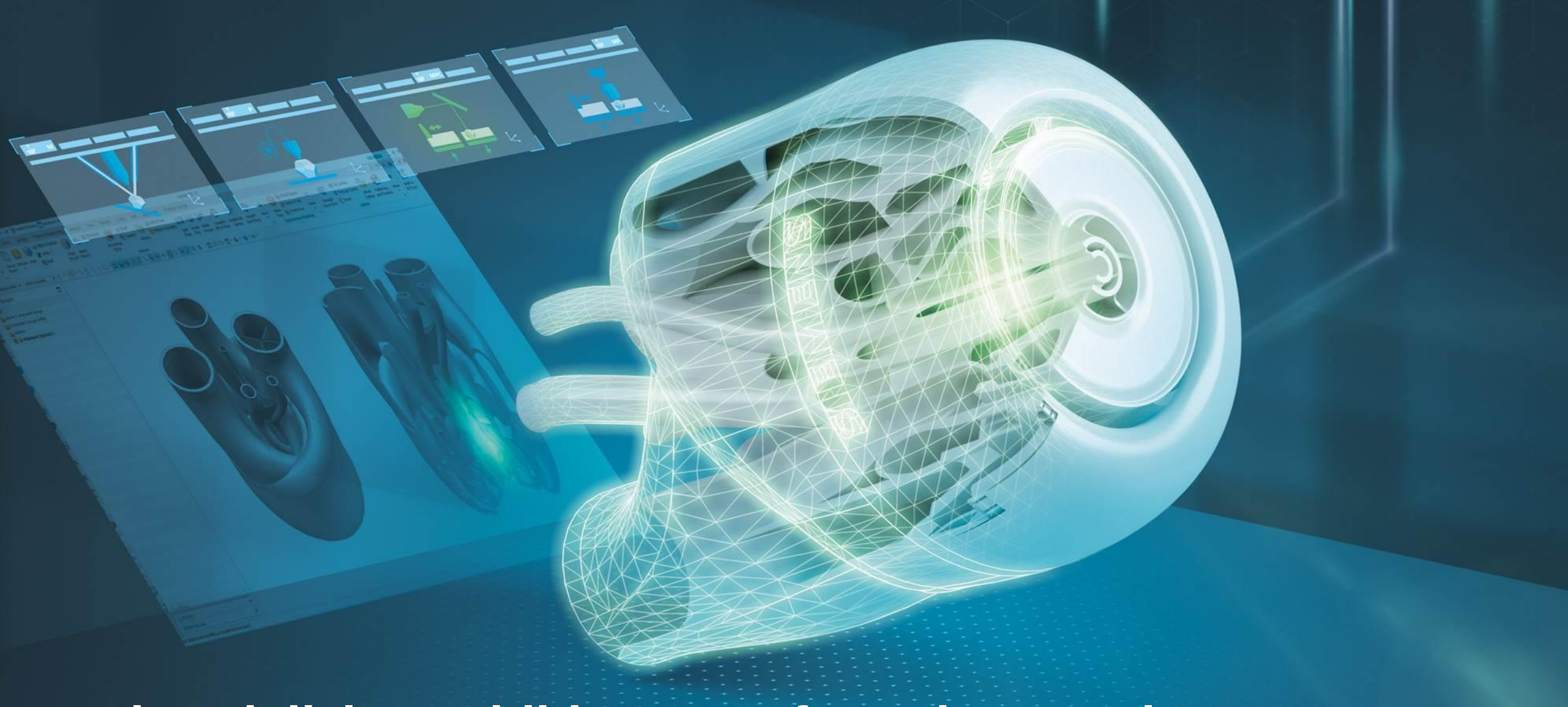
Leverage entire digital thread for AM design, simulation, 3D printing & performance analytics of HP cooling duct.

34.3% PART COST REDUCTION

22.3% FLOW CONTROL IMPROVEMENT

75.0% FASTER DEVELOPMENT





Industrializing Additive Manufacturing requires a change in mindset and digitalization