3D Printing – Market Status and Opportunities

July 2019

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Prepared for ISS R&D Conference 2019

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3D PRINTING

Overview of technology

Description:

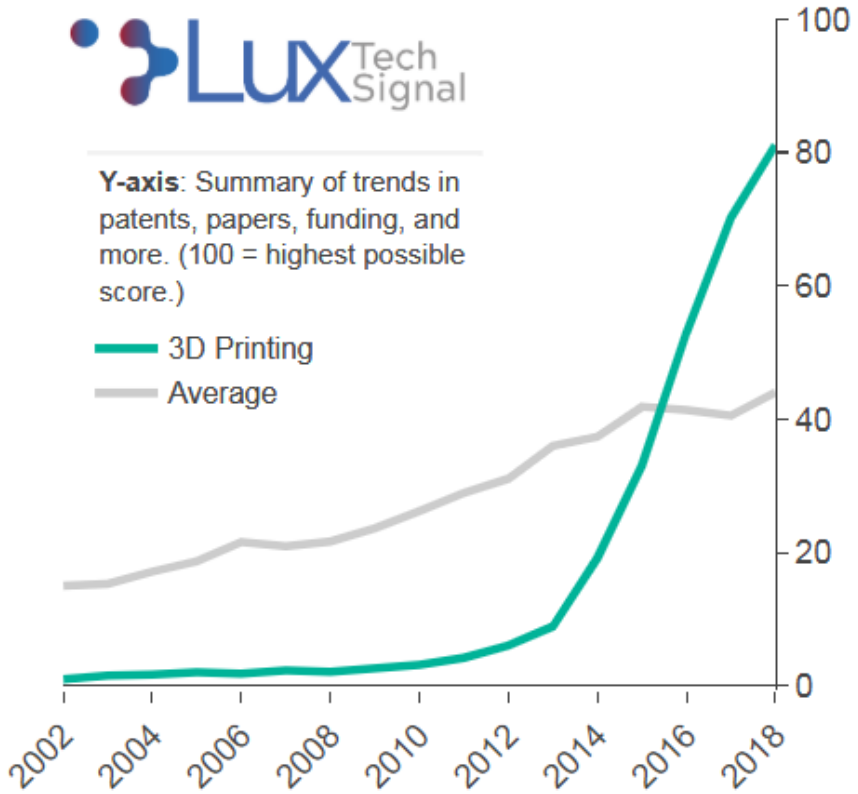
Additive manufacturing of objects layer by layer, based on digital design data

Key Benefits:

Novel geometries and compositions enable better performance and operational efficiencies

Higher materials utilization saves costs

Distributed manufacturing simplifies supply chains and reduces distribution costs



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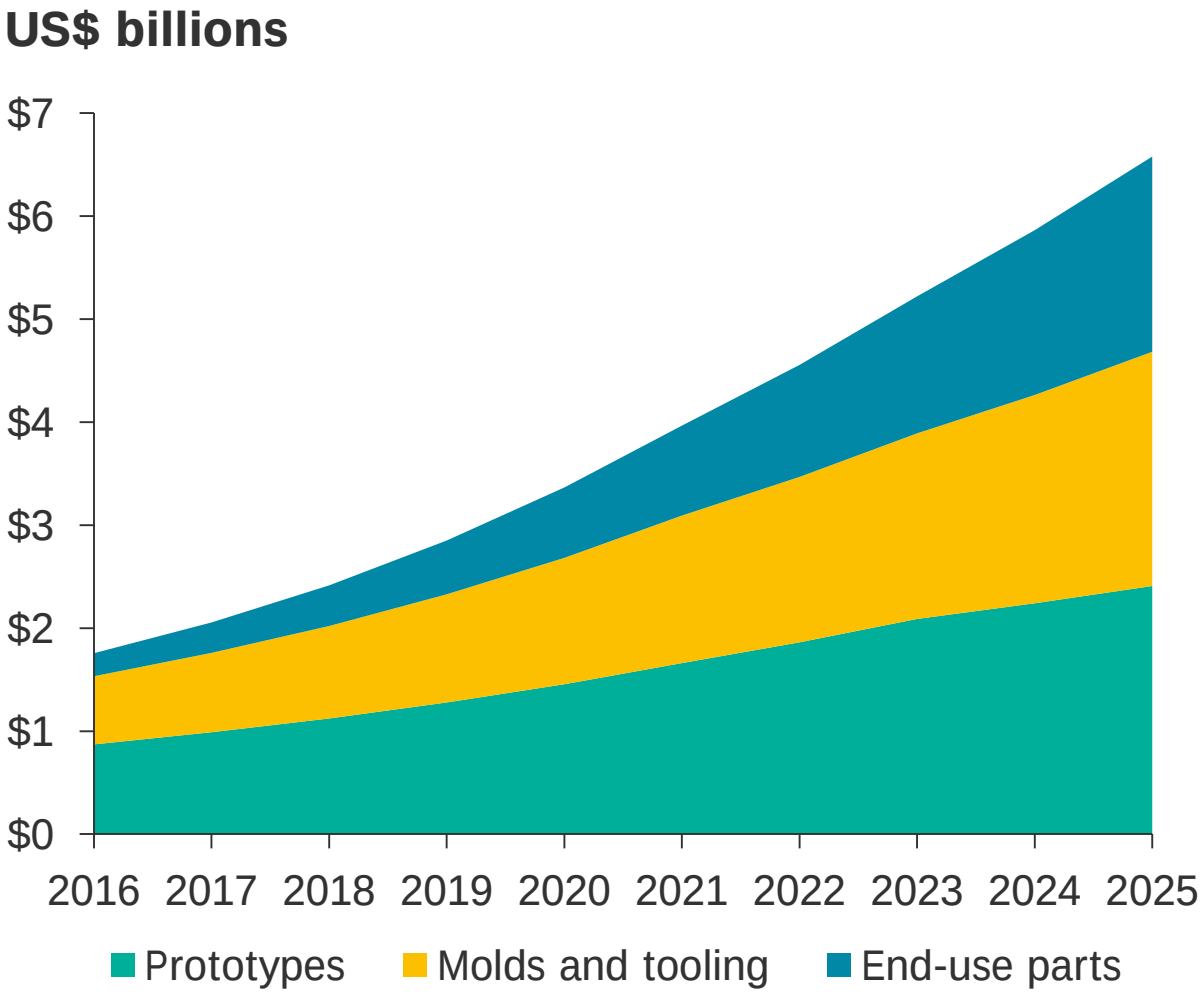
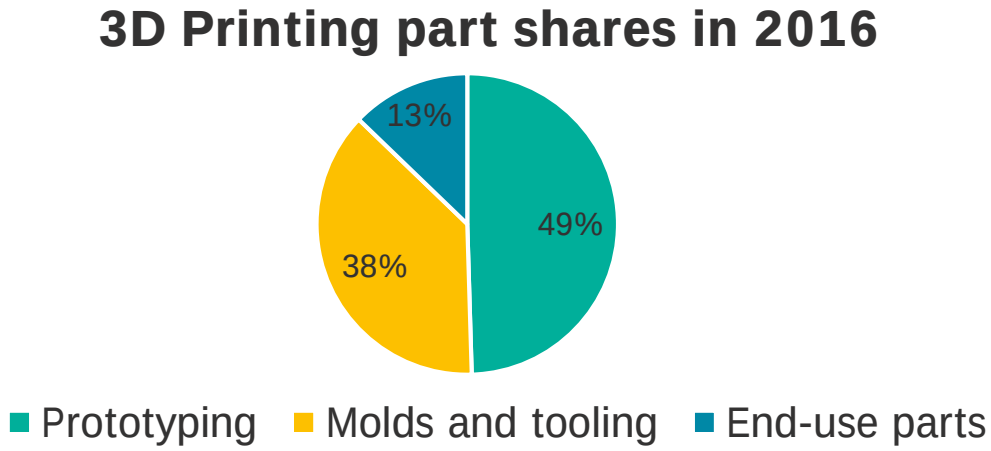
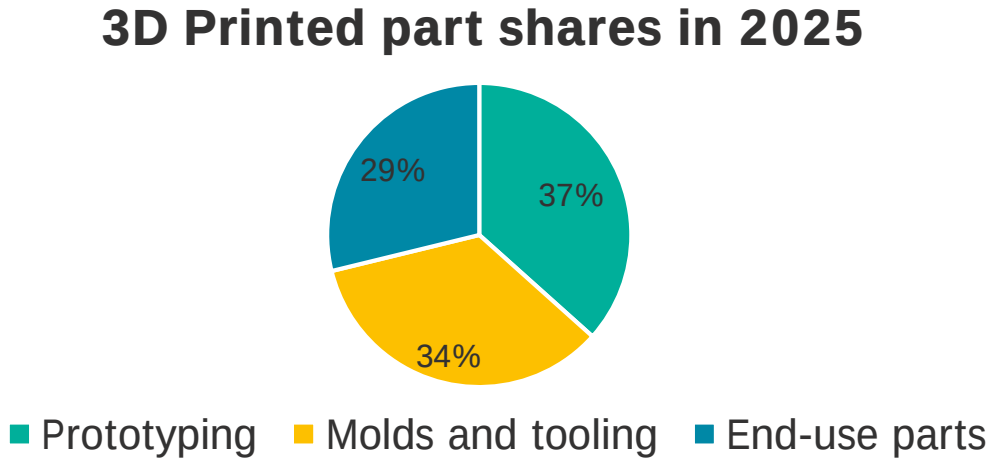
3DP market: printed parts grow to $6.6 billion in 2025, with share of end-use parts rising fastest







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3D PRINTING

Aerospace case study

Using Norsk Titanium's RPD process, Boeing achieved;

- **10% less time spent** compared to traditional manufacturing
- **Cost reduction** by up to 70%
- $2 million to $3 million material cost saving per plane

As Norsk Titanium's RPD process received FAA approval, **printing additional components became easier for others in the field** without having to go through the same extensive testing process each time

Sources: Norsk Titanium and Boeing

3D PRINTING

The opportunity for aerospace

Engine printing can **improve performance** & dramatically **lower cost**

3D PRINTING

Wire based systems are emerging for low-cost metal printing

NORSK TITANIUM

LUX TAKE: Positive

Positive

Relativity

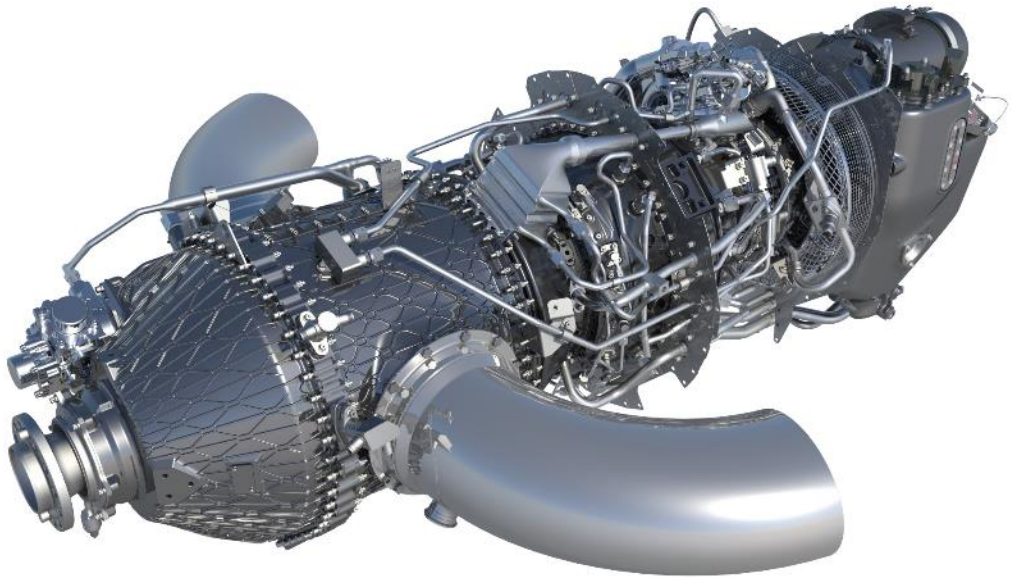
LUX TAKE: Wait And See

Wait And See

3D PRINTING

Developing printable engines creates opportunities in terrestrial power & mobility

GE Aviation



SIEMENS

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3D PRINTING

Systems for fabrication in space are coming online as well

MADE IN SPACE

3D PRINTING

Materials development is an enabler for the shift to end-part production

Higher maturity process trend

formlabs

Lux Take: Positive

Developed **high performance materials** for its **low-cost SLA-based 3D printers** for specific use cases in dental, jewelry, and functional prototyping

Offers hardware, software, materials, and services

cubicure

Lux Take: Wait and See

Developed a **SLA**-based technology that can process **highly viscous resins with temperature control**

Has developed three materials for specific applications – printability demonstrated

Carbon

Lux Take: Positive

Develops **CDLP** system

Developed **high-performance materials for targeted applications**

Offers complete solution (hardware, materials and software)

Can fundamental materials research on ISS help boost this trend?

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The promise and potential for 3D printing

3D printing is increasing being used to print production parts – especially where it can offer performance or materials reduction benefits	Aerospace should continue to be a lead user of 3D printing & to explore how to extend its use to more and larger parts
3D printing can allow customization and on-site production in remote areas	Printing parts in space (and on moon and Mars) will be a critical tool
Innovations in materials, hardware, software, and ease-of-use are needed for 3D printing to reach its commercial potential	Research on ISS could help enable some of these advances by looking at automation, robustness, and fundamental materials

Thank you!

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