CINTEG AG
Produkte digital entwickeln

Stratasys AM solutions for Mass Transportation

- Rail -

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Leitung 3D Druck, CINTEG AG

stratasys

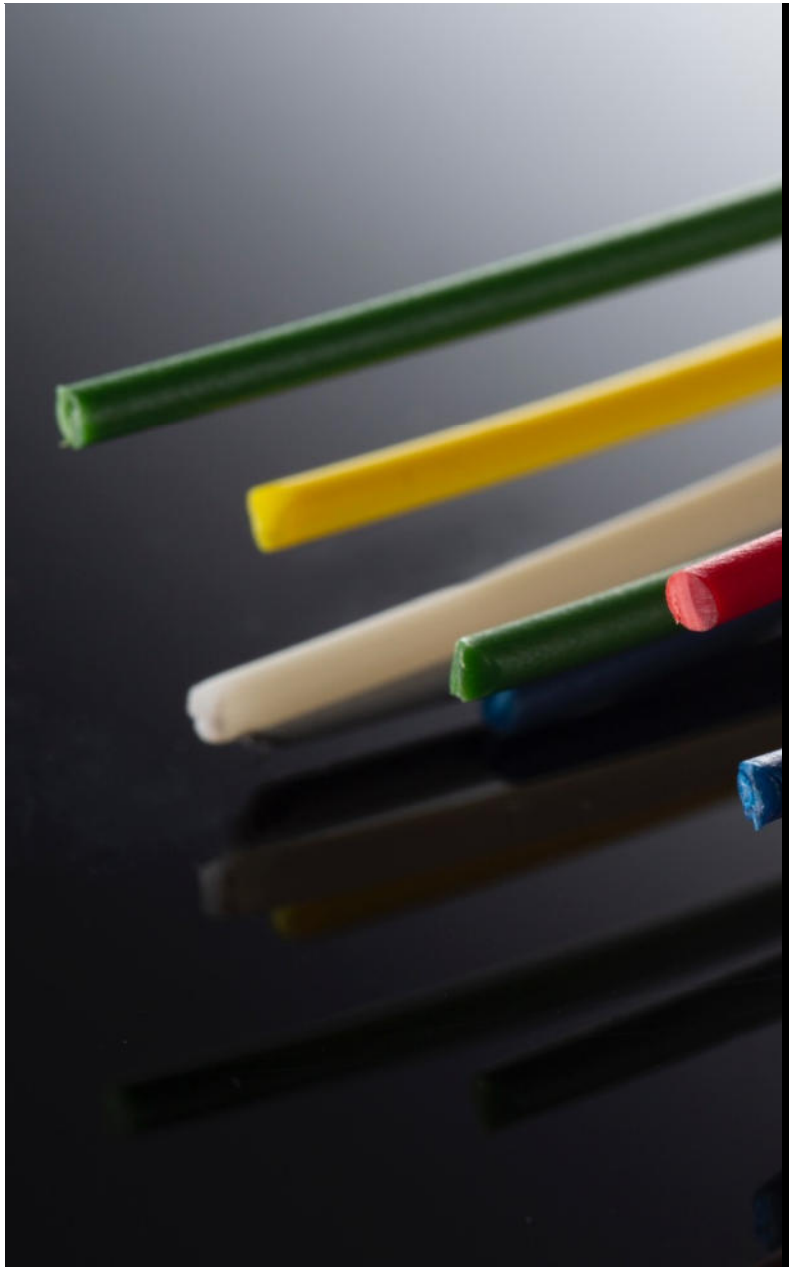
Additive Manufacturing

Process control

- Heated chamber
- Dried air
- Temperature control
- Moisture control
- Logfile after print job
- Connectivity through MTConnect
- Camera control

Traceability

- Batch Number on Cardridge
- Datasheet of material properities of lot number
- Sealed and dried
- Certificate of Conformance



Material Certification for Rail

EN45545-2 covers…

Hazard Level Classification

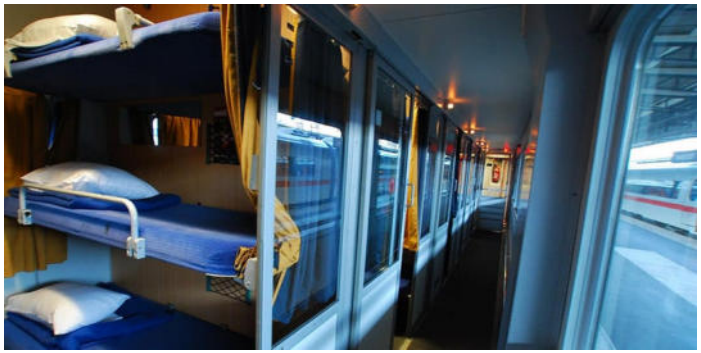
HL1

No underground sections

HL2

Tunnel >= 5 km

HL3



No side evacuation

HL3 fulfills HL2 and HL1 requirements

EN45545-2 explained…

26 Materials Requirement Sets

http://www.crepim.fr/

4 different
requirement sets
for a seat assembly !!!

https://akro-plastic.com/plastic-solutions/transportation/

Product Classification

- Interiors
- Exteriors
- Furniture
- Mechanical Equipment
- Electro Technical

EN 45545 REQUIREMENT SET	LISTED PRODUCT NO.
R1 - Interiors Primary	IN1A, IN1B, IN1D, IN1E, IN15, IN4, IN7, IN12A, IN12B, IN14
R2 - Interiors Limited Use	IN2, IN9A, IN10
R3 - Interiors Strips	IN3A
R7 - External Features	IN12C, EX1A, EX1C, EX3, EX4, EX5, EX6A, EX8, EL3C
R8 - External Roof Features	EX2, EX6B
R9 - Bogie Rubber Elements	M1
R10 - Flooring Components	IN1C, IN15
R18 - Full Seat	F1
R19 - Staff Seats	F2
R21 - Seat Components	F1A, F1B, F1E, F3
R22 - Interior Seals	IN16
R23 - Exterior Seals	EX12

How to choose an FDM material for rail components

< 100 g
for interior grouped products

< 400 g
for exterior grouped products

ALL
FDM Materials

> 100 g
for interior grouped products

> 400 g
for exterior grouped products

EN45545-2
Certified
FDM
Materials

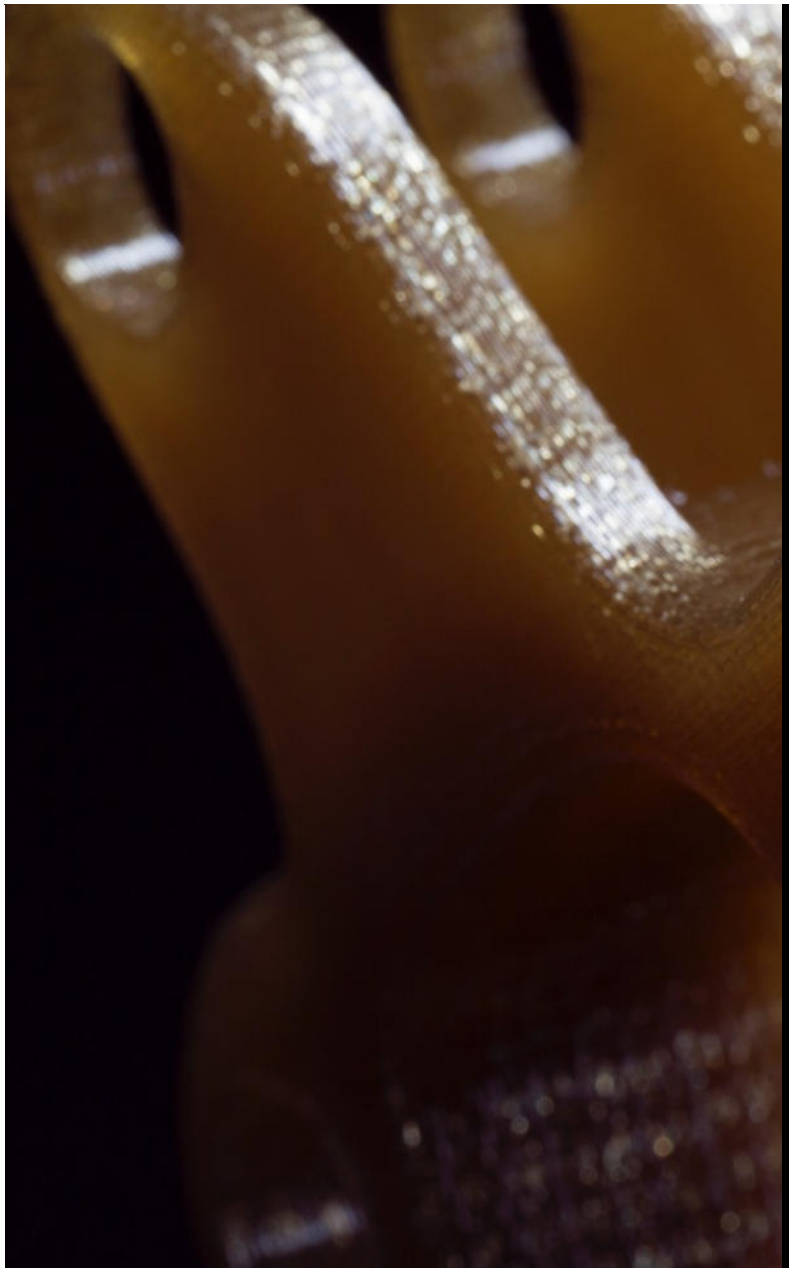
Fire Safety for Rail EN45545-2

⚠ Please note that products printed with different machines, with different print settings (orientation/ filling/ tip size) and with different wall thicknesses may perform differently.

Stratasys FDM materials **ULTEM™ 9085 resin** and **Antero 800NA** (PEKK based thermoplastic) **have both passed EN 45545-2 on all hazard levels HL1/2/3** - fully demonstrating that they are suitable for use in production for the rolling stock industry.

Antero 800NA material was chosen for this air duct part due to its fuel resistance and light weight.

An ULTEM™ 9085 resin environmental control duct



Proven Applications in Rail

ROLLING STOCK INTERIOR

Cable clips / Connectors / Brackets

ULTEM™ 9085 resin

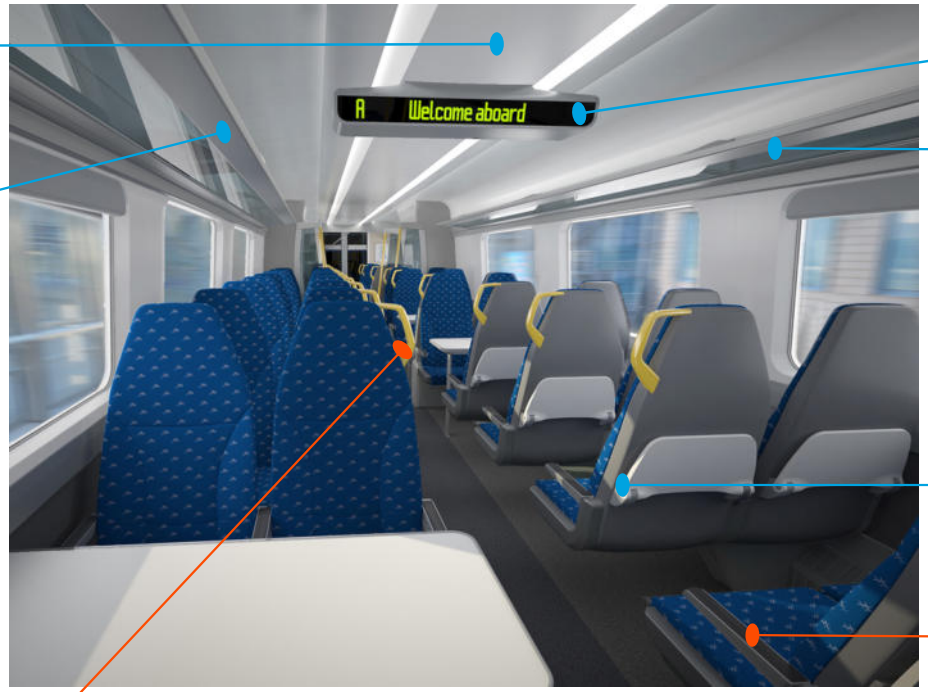
HVAC (Air Duct)

ULTEM™ 9085 resin

FST Requirement

Handle/Safety

ULTEM™ 9085 resin wrapped with Glass Fibber



Information/ TV Screen Housing

ULTEM™ 9085 resin

FST requirement

Plugs/Electric Cable Holder

ULTEM™ 9085 resin

Individual table

ULTEM™ 9085 resin

FST requirement

Seat arm rest

ULTEM™ 9085 resin wrapped with Glass Fibber

Potential Structural with Composite Sandwich

Direct Production Parts

ROLLING STOCK EXTERIOR

Lighting / Sensor Housing

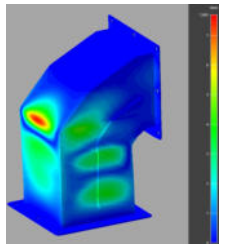
ASA / Nylon 12 CF

Large Covers F900

ULTEM™ 9085 resin / Nylon 12 CF
Optionally wrapped with Glass Fibber

Front Skirt / Bumper

ULTEM™ 9085 resin



Air vent system parts

ULTEM™ 9085 resin

Information Display Housing

ASA / Nylon 12 CF

Head lamps housing

ASA /ABS/PC- ABS/Nylon 12 CF

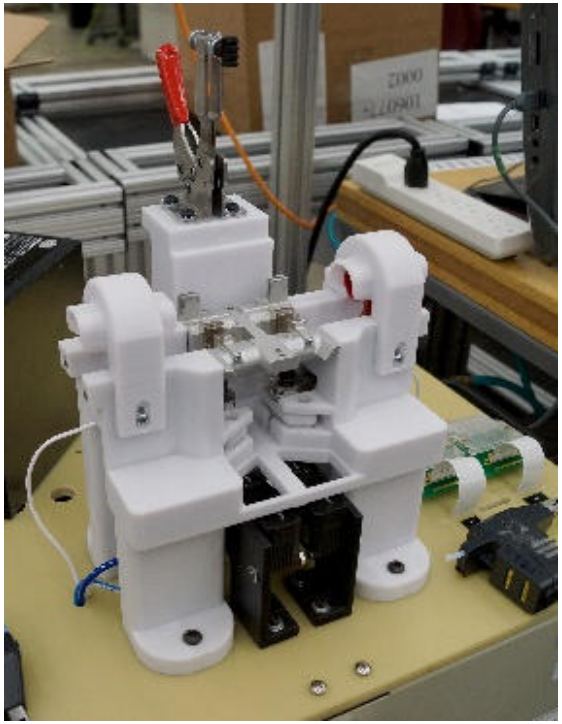
Potential Structural with Composite Sandwich for reinforced impact resistance

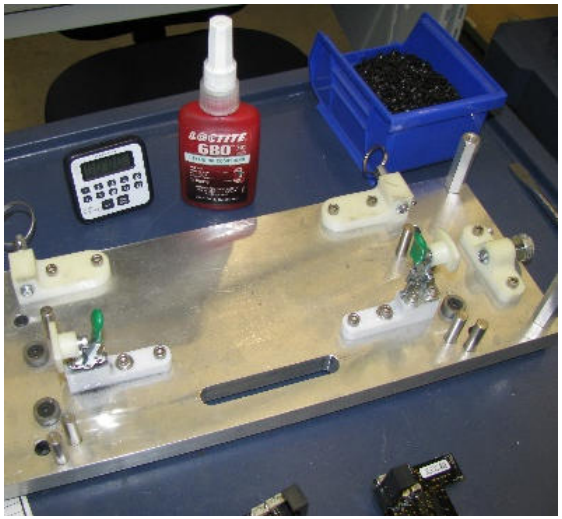
Direct Production Parts

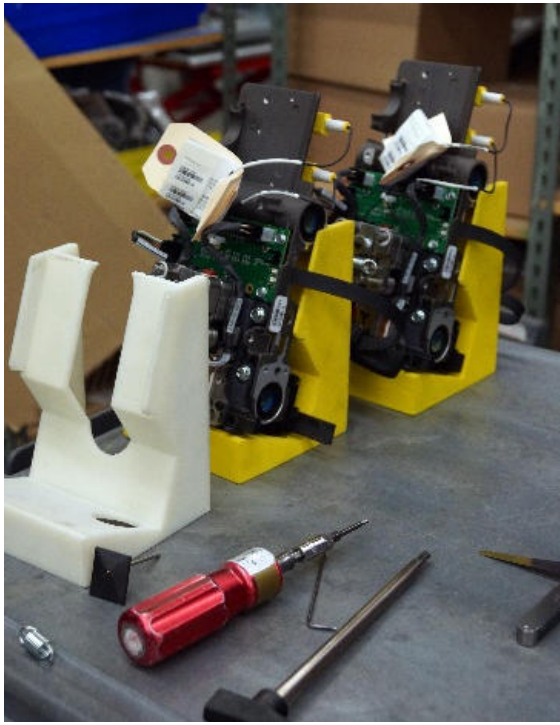
Rolling Stock / Manufacturing aids

Jigs and fixtures and more…

- 3D printing can cut lead time by 60-90%, with tooling often going from concept to production in less than a day
- Custom jigs and fixtures improve ergonomics and productivity
- Digital inventory eliminates the need for physical storage
- 3D print injection molds for test runs or small quantities







Angel Trains & ESG RAIL

First 3D printed parts on British passenger trains

"An obsolete replacement part can be 3D **printed on-demand** and installed immediately, enabling **operators to better maintain its trains** and get vehicles **back into service more quickly**, thus **improving the quality of service** for passengers. "

James Brown, Data and Performance Engineer, Angel Trains

3D printed arm rest, grab handle, table tray

Red Grad handle 3D printed in ULTEM™ 9085 resin after 3 months trial

Material Cost Savings

50%

Lead Time Savings

94%

Installation of 3D printed front bumper

Siemens Mobility

Customized Solutions

SIEMENS

"**Customizing** low volume production parts using FDM 3D printing has been **transformational for our customer service offering,** as well as our **supply chain**. Not only are we taking orders on-demand, **3D printing** has also given us the flexibility to **meet customer requirements faster** with no obsolete parts created in the process."

Michael Kuczmik, Head of Additive Manufacturing, Siemens Mobility GmbH, Customer Service

Lead Time Savings

From weeks to days

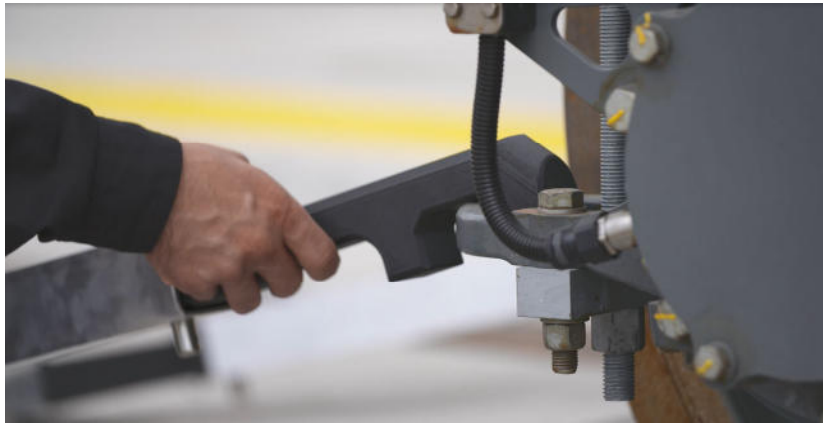
Siemens Mobility

Streamlined supply chain

SIEMENS

"The ability to 3D print **customized tools** and **spare parts whenever** we **need** them, with no minimum quantity, has transformed our supply chain.

Michael Kuczmik, Head of Additive Manufacturing, Siemens Mobility GmbH, Customer Service

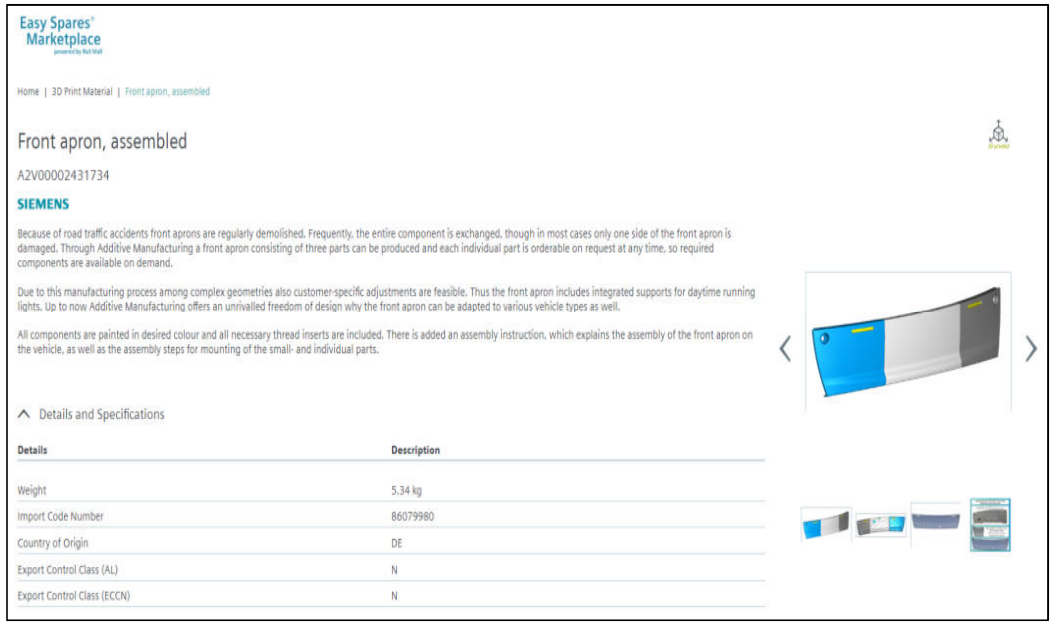


Lead Time Savings

95%

Service & Maintenance

SIEMENS



https://easysparesmarketplace.siemens.com/de

Retrofitting

USB chargers

Displays

Digitalization devices

Bombardier Transportation

Speed up development process

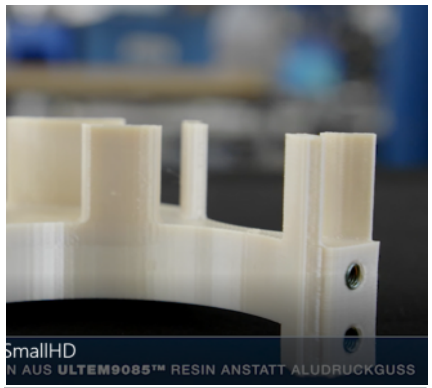
BOMBARDIER

Door Lock printed in ASA

Airduct lacquered printed in ULTEM™ 9085 resin

Lamp Holder in ABS instead of sheet metal

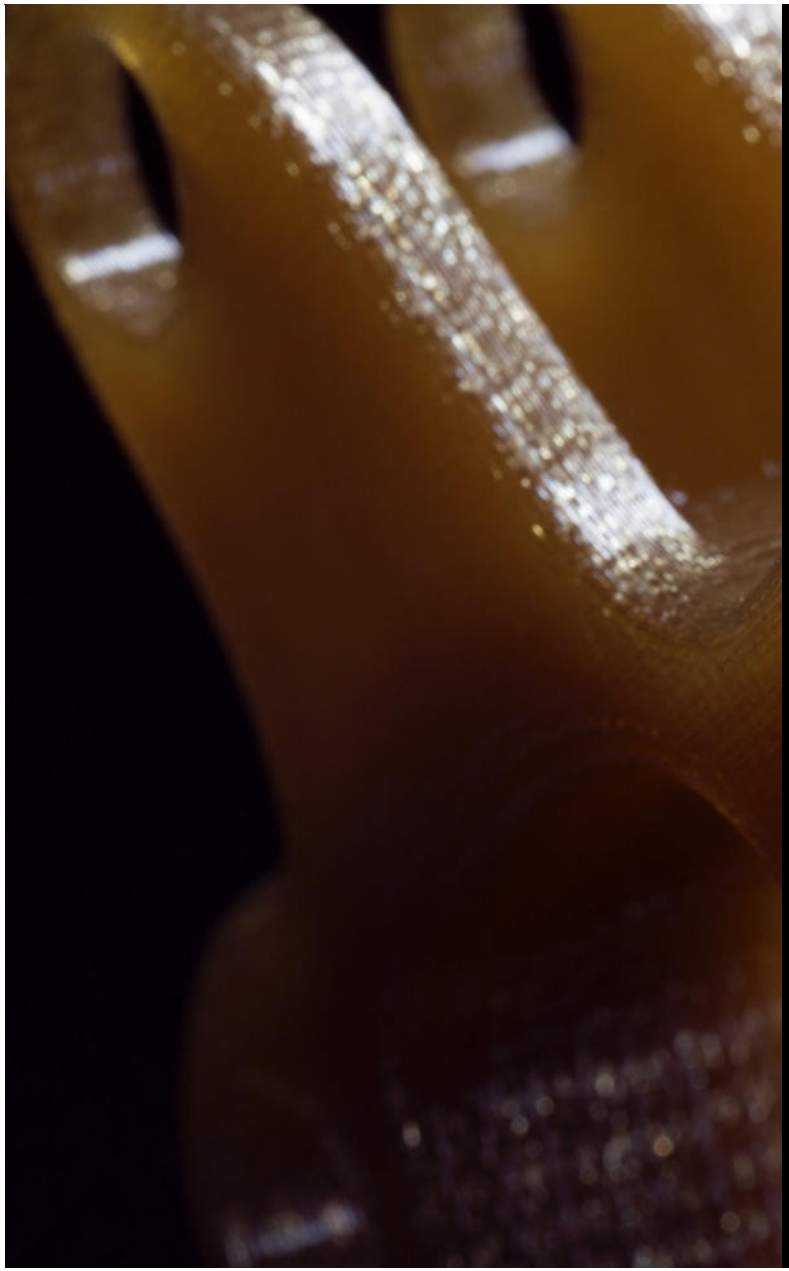
External Duct in ULTEM™ 9085 resin



Capacitor in ULTEM™ 9085 resin instead of Die-Cast Aluminium

Light mounting bracket printer in ULTEM™ 9085 resin instead of Die-cast Aluminum

Connector Holder printed in ULTEM™ 9085 resin instead of PA12

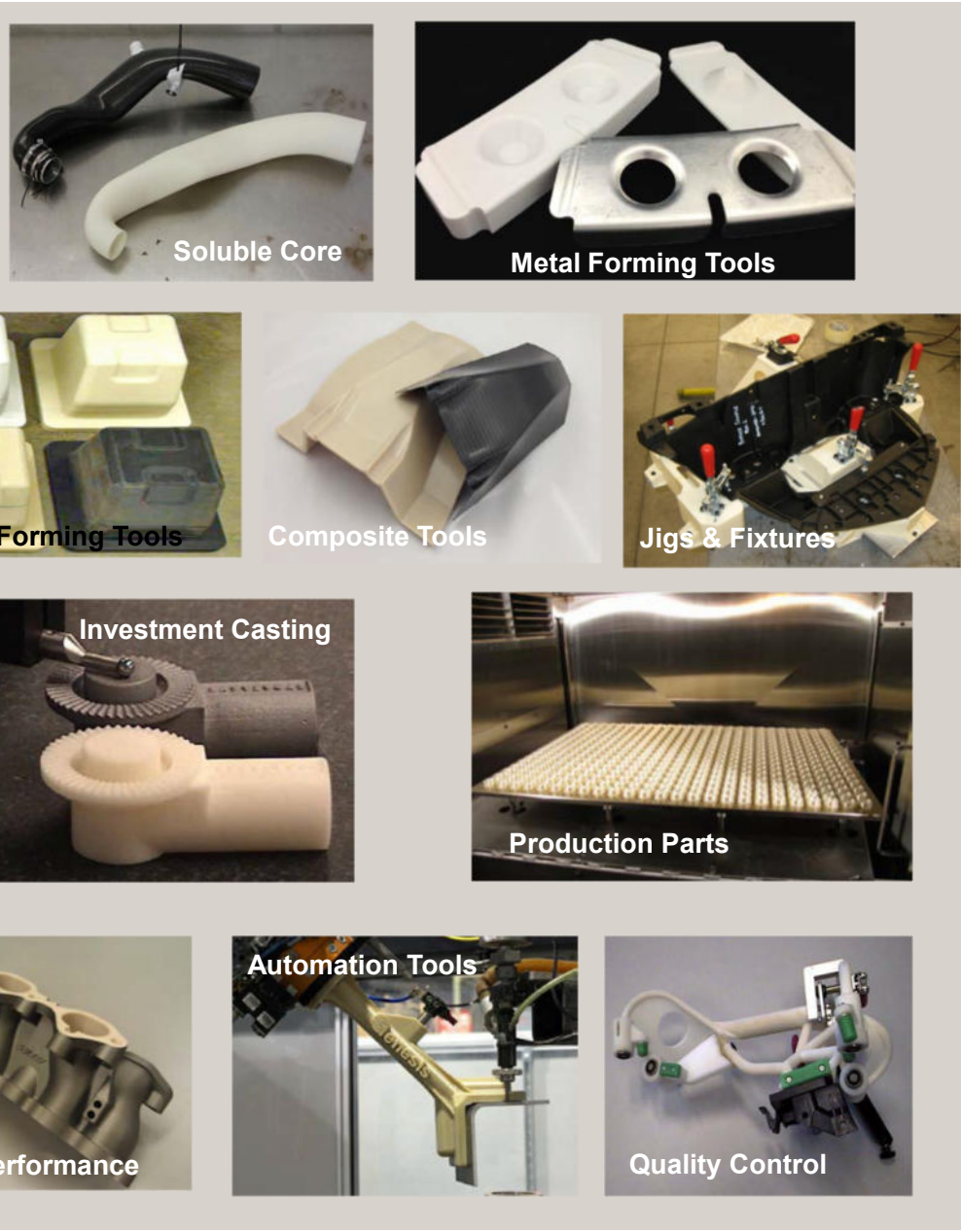


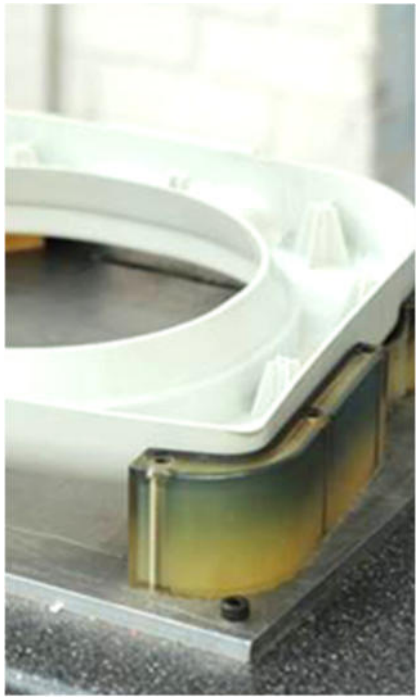
Industrial Applications Overview

Industrial Applications Overview

Approximately **80%** of FDM system owners in the U.S. are using the technology for a jigs, fixtures and end use parts application.

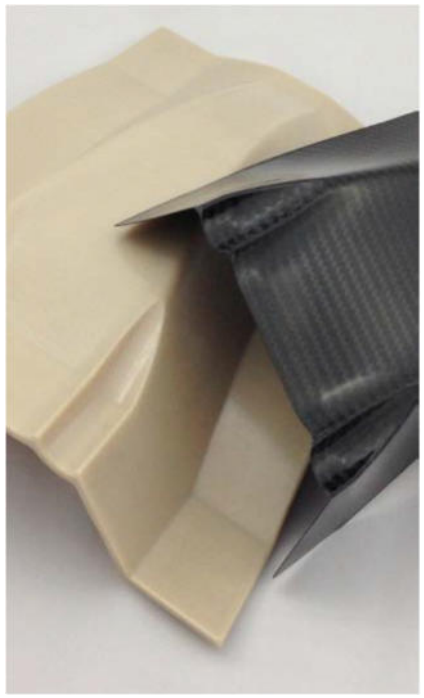
Organizations can realize **40 to 90% reductions** in **lead-times** and **70 to 90% cost savings**

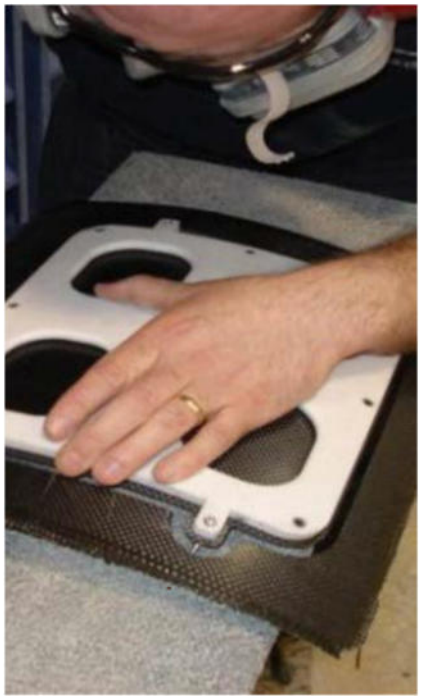



Jigs and Fixtures: Drill Guides, Assembly Jigs, Measurement Jigs…

- FDM: ASA, PC, TPU, Nylon 12 Carbon-Fiber
- PolyJet: VeryClear+Agilus
- Complexity at NO EXTRA COST

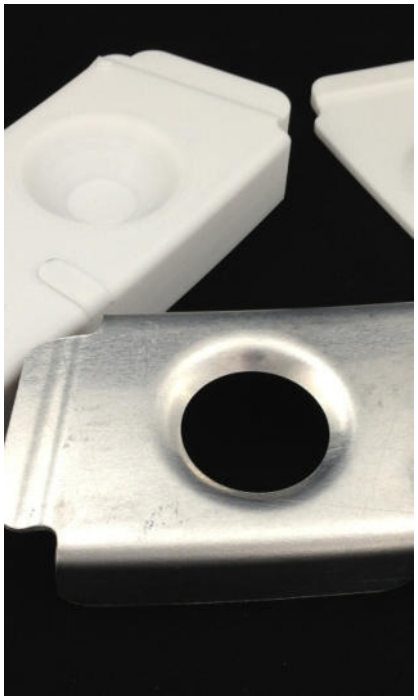




Composite Tooling

FDM: ULTEM™ 1010 resin (HDT 213C), ST 130

- Cheaper and Lighter Tools
- Autoclavable Material



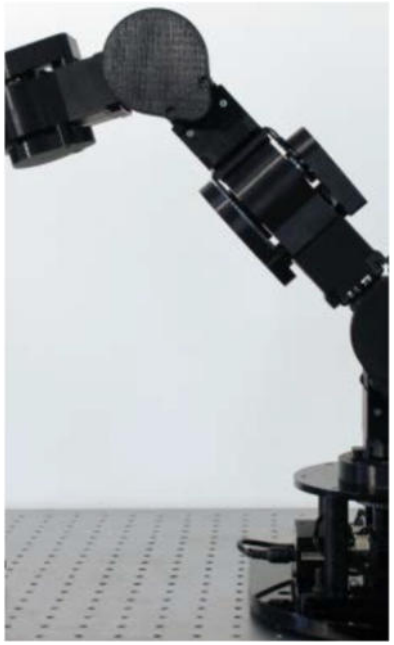


Metal Forming

FDM Materials: PC (7,000PSi), ULTEM™ 9085 resin (10,000PSi,) Nylon 12 CF (15,000PSi)

- ➢Sheet metal forming tools in hours
- ➢Tool design validation
- ➢Short Production Runs



Automation Tools

FDM Materials: ASA, PC, ULTEM™ 9085 resin, Nylon 12 CF…

- Grippers with complex shape
- Vacuum channels inside the tools
- Weight and Cost Saving up to 70%

Thank You

CINTEG AG
Produkte digital entwickeln

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stratasys